Planning and Environmental Consultants

Environmental Impact Assessment Report Remedial

Derrybrien Wind Farm Development Decommissioning Project – Retained Development

Volume 1b: Main Report Chapters 8-17

8. SOILS, GEOLOGY AND LAND

8.1 Introduction

8.1.1 Chapter Scope

This chapter presents an assessment of effect on soils, geology and land for the Derrybrien Wind Farm Development – Retained Development as described in Chapter 4 of this rEIAR.

Effects on the receiving soils, geology and land for all elements of the wind farm, grid connection and ancillary works have been assessed over the following stages of the project:

- Impacts that have occurred:
  - Construction Phase (2003-2006).
  - Operation and Maintenance Phase (2006-2022).
- Impacts that are occurring:
  - Ceased Operations Phase (2022-Present).
- Impacts that are likely to occur:
  - Decommissioning Phase.
  - Post-Decommissioning Phase (for the Retained Development).

The purpose of this assessment is to give context to the post-decommissioning impacts that are likely to occur on soils, geology and land from elements of the wind farm, grid connection and ancillary works that will be left in place after decommissioning (the Retained Development).

Impacts on soils, geology and land during the Prospective Development are addressed in more detail in Chapter 8 of the Environmental Impact Assessment Report (EIAR) that has been prepared for the Derrybrien Windfarm Development Decommissioning Project – Perspective Development that accompanies this application.

The baseline sensitivity of the receiving soils, geology and land for this report has been assessed based on the site conditions in 1998, prior to the construction of the wind farm.

In terms of both site stability and environmental protection it is considered that minimal decommissioning works is the best approach for the site. Therefore, the decommissioning plan will entail the following:

- De-energising the site by initially disconnecting the high voltage (HV) lines at the substation, followed by low voltage (LV) disconnection at each of the turbines as well as the 110kV OHL for the grid connection.
- Temporary widening of the narrow sections of the site access tracks in the turbary area and at selected junctions to provide safe access for mobile cranes to the turbines.
- Controlled dismantling of the turbine blades, nacelle and masts. The decommissioned components will be removed from the site for re-cycling, disposal or re-use elsewhere.
- Removal of the sub-station and associated buildings-including removal of all the electrical transmission components, capacitors, transformer, concrete plinths, and control building.
- Controlled dismantling and removal of the steel lattice tower and timber twin polesets for the 110kV Overhead Line (OHL).
- Dismantling of the steel lattice towers for the anemometers.

- Removal of the Agannygal sub-station and associated buildings-including removal of all the electrical transmission components, capacitors, transformer, concrete plinths, control building and foundations.
- Reinstatement of the Ennis-Shannonbridge 110kV overhead line

The features of the Retained Development, to remain *in situ in* perpetuity after the Prospective Development has been completed are listed below:

- **At-ground and below-ground structures/features associated with the Derrybrien Wind Farm Development, including**:

  Derrybrien Windfarm including the Derrybrien 110kV Substation
  - Reinforced concrete foundations for 70no. wind turbines.
  - Reinforced concrete foundations of structures within the Derrybrien Substation compound.
  - Reinforced concrete foundations of 2no. Anemometer masts.
  - Approximately 17.5km of access tracks and 70no. hardstand areas.
  - Direct buried underground electrical and communications cabling.
  - 3no. Borrow Pits / Quarries.
  - Naturalised Peat Repository areas.
  - Onsite Drainage Infrastructure.

  Derrybrien to Agannygal 110 kV OHL and Agannygal 110kV Substation
  - Below ground elements of 34no. double wooden pole sets.
  - Reinforced concrete foundations for 2no. end masts.
  - Reinforced concrete foundations for 5no. angle masts.
  - Reinforced concrete foundations for 1no. intermediate mast.
    Reinforced concrete foundations of structures within the Agannygal Substation compound.

- **Offsite development constructed in response to the peat slide in 2003, including**:
  - Barrage 1 and Coillte Access Track.
  - Barrage 2, Access Track and Repository Area.
  - Barrage 3 and Repository Area.
  - Barrage 4.
  - Repository Area at the Black Road Bridge.
  - Drainage Diversion Works.

Repairs to Black Road Bridge, Flaggy Bridge and Unnamed Bridge C and Crooked Bridge. Specific consideration has been given to the peat failures that occurred on the wind farm site during construction, particularly the large peat slide that occurred in October 2003.

Remedial mitigation and monitoring measures that were implemented on the site during construction and during the operation and maintenance phase of the project are summarised in this chapter. It also includes the mitigation measures that will be implemented for decommissioning the wind farm, grid connection and ancillary works, and for the Retained Development post-decommissioning.

Cumulative impacts from other projects or activities in the area are also assessed along with the likely long-term residual impacts of the Retained Development after decommissioning.

8.1.2 Statement of Authority

Derrybrien Wind Farm Site – AGL Consulting

The assessment of the impacts related to the Derrybrien Wind Farm elements of the project was carried out by Mr. Conor O'Donnell (BA, BAI, MS, FGS, CEng, MIEI, FConsEI), Managing Director at AGL Consulting. Mr. O'Donnell is a Chartered Engineer with over 25 years' experience as a geotechnical engineer in Ireland and the United States. He has an Honours Bachelor's Degree in Civil, Structural and Environmental Engineering from Trinity College Dublin, and a Master's Degree in Geotechnical Engineering and Structural Mechanics from Cornell University, Ithaca, New York.

Mr. O'Donnell has extensive experience with civil and earthworks design for wind farms in Ireland and the UK and has developed a particular area of expertise in assessing and managing the risk of peat stability for wind farms on upland blanket bogs at planning, detailed design and construction stage. He has carried out peat stability risk assessments and provided expert advice on geotechnical risk mitigation for several windfarms on upland blanket bogs in Ireland including the Grousemount Wind Farm in Co. Kerry, the Garvagh Glebe and Tullynahaw Wind Farms in Co. Leitrim and the Crockagarran Wind Farm in Co. Tyrone.

Mr. O'Donnell was the lead project geotechnical engineer responsible for managing the risk of peat stability for the completion of the civil works on the Derrybrien Wind Farm site after the peat slide in October 2003. He also prepared the chapter on soils, geology and land for the 2020 remedial Environmental Impact Assessment Report (rEIAR) for the Derrybrien Wind Farm.

Mr. O'Donnell was the geotechnical advisor to An Bord Pleanála on peat stability and ground movement for the Oral Hearing into the 2009 application for the Corrib Onshore Gas Pipeline. He was also geotechnical consultant to Sligo County Council on spoil management for excess peat and mineral soil for the EIS and 2014 Oral Hearing for the N4 Collooney to Castlebaldwin Road Improvement Scheme. He has also provided expert advice and forensic investigation services to the Health and Safety Authority and Liberty Insurance in relation to peat slides that occurred on wind farm sites in Ireland.

Derrybrien to Agannygal 110 kV OHL and Agannygal 110kV Substation – Fehily Timoney

The assessment of the impacts related to the Derrybrien Wind Farm Overhead Line (OHL) elements of the project was carried out by Mr Ian Higgins (BSc, MSc, FGS, MIEI). Ian is a Principal Geotechnical Engineer with over 25 years' geotechnical consultancy experience in Ireland and the UK. Ian has completed numerous geotechnical & geological impact assessments for wind farm developments in Ireland. In addition, he has significant experience in the geotechnical/civil design of wind energy projects at construction stage. He holds an Honours Bachelor's Degree in Engineering Geology from the University of Sunderland and a Master's Degree in Geotechnical Engineering from Heriot-Watt University, Edinburgh.

8.1.3 Relevant Legislation

This chapter of the rEIAR is prepared in accordance with the requirements of European Union Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment (the 'EIA Directive') as amended by Directive 2014/52/EU. The requirements of the following legislation are complied with:

- European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2001 – 2018.
- Directives 2011/92/EU and 2014/52/EU on the assessment of the effects of certain public and private projects on the environment, including Circular Letter PL

1/2017: Implementation of Directive 2014/52/EU on the effects of certain public and private projects on the environment (EIA Directive).

- S.I. No. 349 of 1989: European Communities (Environmental Impact Assessment) regulations and subsequent amendments (S.I. No. 84 of 1995, S.I. No. 352 of 1998, S.I. No. 93 of 1999; S.I. No. 450 of 2000; S.I No. 538 of 2001); S.I. No. 30 of 2000 the Planning and Development Act, 2000; and S.I 600 of 2001 Planning and Development Regulations and subsequent amendments, on the assessment of the effects of certain public and private projects on the environment.
- Planning and Development Act, 2000, as amended.
- S.I. No 296 of 2018: S.I. No. 296 of 2018: European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018 which transposes the provisions of Directive 2014/52/EU into Irish law.
- The Heritage Act 1995, as amended.

8.1.4 Relevant Guidance

The soils, geology and land chapter of this rEIAR was prepared having regard, where relevant, to guidance contained in the following documents:

- Environmental Protection Agency (2022): Guidelines on the Information to be contained in Environmental Impact Assessment Reports.
- Environmental Protection Agency (2015): Draft - Advice Notes on Current Practice (in the preparation of Environmental Impact Statements).
- Environmental Protection Agency (2003): Advice Notes on Current Practice (in the Preparation of Environmental Impact Statements).
- European Commission (2017) Guidance on Screening.
- European Commission (2017) Guidance on Scoping.
- European Commission (2017) Guidance on the preparation of the Environmental Impact Assessment Report.
- Institute of Geologists Ireland (2013): Guidelines for the Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements.
- National Roads Authority (2009): Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes.
- Department of Housing, Planning and Local Government, Government of Ireland (2018), Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment.

8.1.5 Peat Slide of 16th October 2003

The peat slide that occurred on the site on the 16th October 2003, during the first phase of construction on the wind farm, had a significant effect on soils, geology and land in the area. Therefore, it forms an integral part of the impact assessment for the project and specifically in this Chapter of the report.

This section gives an overview of the characteristics of the peat slide as well as the likely cause of the slide, possible failure mechanism and contributory factors that were interpreted based on site inspections and investigations carried out at the time.

Section 8.1.5.2 then describes how the impact of the peat slide and the issue of peat stability in general are necessarily assessed to current best practice guidelines in this Chapter for the project within the context and scope of the rEIAR.

8.1.5.1 Overview of the Peat Slide, Likely Cause and Possible Failure Mechanism

Over 450,000 m^3 of blanket bog was disturbed in the slide over an area of approximately 25 Hectares on the forested slopes on the south side of the wind farm. Approximately 250,000 m^3 of the disturbed peat moved downslope from the slide area, broke up and entered the natural drainage channel for the watercourse in sub catchment SC7(b) (as defined in Chapter 9 – Hydrology and Hydrogeology) as a viscous flow of fluidised remoulded peat material. Some of this material was deposited in lobes on flatter ground to either side of the channel upslope from the Black Road Bridge. A proportion of the material moved further downslope along the stream channel below the bridge ultimately reaching the Owendalulleagh River, approximately 5.25 km downstream from the site.

The movement of the material along the stream channel occurred in pulses in the days and weeks following the slide in response to subsequent rainfall events, which remobilised the peat in the upper reaches of the stream when surface runoff entered the channel. Immediately following the peat slide, a number of barrages were constructed across the stream channel and slide area in an effort to contain the downstream movement of the material.

The material that remained within the failure scar on the upper slopes and wind farm site was typically comprised of detached rafts of intact peat, remoulded peat and a thin cover of intact basal peat over the underlying mineral soil and rock. Sections of the site access tracks on the south side of the wind farm were also damaged in the slide and had to be re-constructed. Over time, surface runoff and groundwater has become concentrated along natural drainage channels within the slide area, increasing the level of drainage to the blanket bog on the surrounding slopes.

Applied Ground Engineering Consultants, Ltd. (AGEC) carried out an inspection and supplemental investigations on the site at the time of the slide to provide an opinion on the likely cause of the failure. A copy of their report - "*Derrybrien Windfarm – Final Report on Landslide of October 2003*" - is included in Appendix 8-1 of this Chapter.

The peat slide was initially reported to have occurred immediately downslope of Turbine T68 on the southern slopes of the wind farm, and AGEC have identified this as the likely initiation point for the slide. At the time of the failure, peat was being excavated from the site of the turbine and the arisings were being placed or "sidecast" onto the intact peat slopes on the downslope side of the turbine and floating road. Other drainage works were being carried out along the floating road within the slide area approximately 300 m downslope from T68.

AGEC concluded that the construction activity, and particularly the placing of arisings onto the intact peat slopes, most likely triggered the slide. The failure mechanism that they proposed is shown schematically in Figure 8-1. The additional surcharge load on the intact peat slopes could have initially caused a localised shear failure in the underlying intact peat, which would have reduced its shear resistance and resulted in a redistribution or transfer of lateral load to the adjacent peat downslope. Additional transfer of lateral loading as more material was placed on the slopes could have led to a progressive shear failure and reduction in shear resistance along the base of the peat further downslope. Ultimately, this could have led to the large planar or translational peat slide that occurred on the inclined slopes.

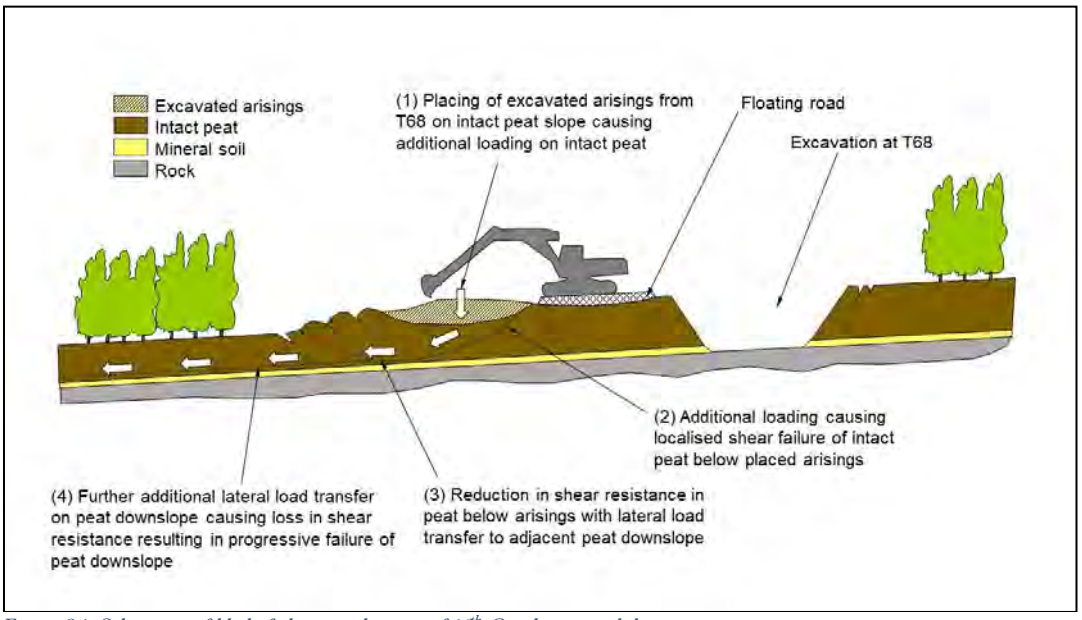


Figure 8-1: Schematic of likely failure mechanism of 16th October peat slide

The magnitude of the load on the intact peat slopes from the arisings was low relative to the scale of the peat slide. Furthermore, excavated arisings from the turbine foundations had already been sidecast on the intact peat slopes in a number of other locations on the site without causing a failure in the peat. Therefore, on its own it does not fully explain why the slide occurred at Turbine T68.

Based on their investigations into the failure, AGEC have identified additional contributory factors that would have made the slope predisposed to failure in that area including, *inter alia*:

- Its location within a shallow valley along a natural drainage line where there would likely have been a concentration of both surface and sub-surface water flow.
- A zone of weaker peat at depth within the centre of the drainage line.
- The additional surcharge load from the floating road at the top of the slide, which was constructed directly on the intact peat slopes.
- The drainage works that were being carried out within the slide area approximately 300 m downslope from the turbine.
- The existing furrows and drainage lines within the conifer forests which would have dissected the vegetative upper layers of the peat creating lines of weakness within the peat mass.

This is consistent with additional investigations carried out subsequently on the site, and also with current best practice guidelines for assessing the risk of peat instability for wind farm developments on upland blanket bogs, which are based on assessing a range of similar contributory risk factors related to site characteristics to identify areas where there is an elevated risk of peat instability, as will be discussed in this Chapter.

8.1.5.2 Treatment of the October 2003 Peat Slide in the rEIAR

Section 8.2.1 gives a detailed description of the methodology that was used for the assessment of the impact of the project on the receiving soils, geology and land. This section describes how the impact of the peat slide and the issue of peat stability in general have been necessarily assessed for the project within the context and scope of the rEIAR.

- In Section 8.4 direct impacts of project activities that have an effect on peat stability have been assessed separately as stability impacts over the full project life cycle,

from construction through to decommissioning, including impacts of the Retained Development after decommissioning.

- The methodology for assessing the effect of stability impacts reflects the risk of a peat slide occurring for each activity based on the characteristics of the activity (e.g. the magnitude, extent, frequency and duration of loading on the peat), the probability of a peat failure occurring as a result of that activity, and the possible nature and extent of the peat failure.
- The probability of a peat failure occurring has been assessed based on the site characteristics and relevant contributory factors that increase the risk of a peat slide in accordance with current best practice guidelines for peat landslide hazard and risk assessments for wind farm developments on upland blanket bogs (e.g. Scottish Government – Energy Consent Unit, 2017).
- The possible nature and extent of a peat failure has been calibrated by the characteristics and scale of the peat slide that occurred on the site in October 2003, which has been assessed as the worst-case scenario for this project.
- In determining the significance of the effect of stability impacts, the sensitivity of the receiving environment has been assessed based on the characteristics of the soils, geology and land that could be impacted by a peat failure in the worst-case scenario.
- In Section 8.4.1.1.2 the October 2003 peat slide has been identified as an "impact that has occurred" during the construction stage of the wind farm, specifically in the assessment of the impact of side casting materials excavated from the turbine foundations on the intact peat slopes, which has been attributed to triggering the slide at Turbine T68.
- The monitoring and mitigation measures that were implemented on the site in response to the slide to successfully prevent any further peat failures during the remaining construction phase of the project, and over the operation and maintenance period of the wind farm to date are presented in Section 8.6.2.2.
- Given the significance of the peat slide on this project, the impact of the slide and related response works on the receiving soils, geology and land in the area have been assessed separately over the full project life cycle in Section 8.4. The baseline sensitivity of the receiving environment within the area impacted by the slide has been assessed in Section 8.3.1.4 and residual impacts of the slide after decommissioning are assessed in Section 8.7.3.
- The peat slide has been treated as a single event that occurred on the 16th October 2003 and includes the pulses of peat material movement that occurred down the channel of stream SC7(b) in the days and weeks after the slide.

This represents a comprehensive assessment of the direct impacts that the project had on the receiving soils, geology and land with regard to peat stability, including an assessment of the direct impact of the peat slide itself. The impact assessment has necessarily been carried out in accordance with the current EPA Guidelines (EPA, 2022) as well as current best practice guidelines for peat landslide hazard and risk assessments for wind farm developments on upland blanket bogs (Scottish Government – Energy Consent Unit, 2017). However, it does not reflect the state of practice and understanding of the risk of peat slope failures in the construction industry at the time of the slide. Therefore, to put the assessment in context:

- At the time of the peat slide at the Derrybrien Wind Farm in 2003 the construction industry's general knowledge of failures on peat slopes was very limited. While there had been some failures previously, these generally remained largely unreported, and none were of the scale or impact of the slide that occurred at Derrybrien. The Derrybrien peat slide was an unprecedented event and is still the largest peat slide to have occurred in Ireland or the UK.
- The peat slide at Derrybrien stimulated numerous investigations, research projects and publications into peat slope failures in Ireland and the UK which have greatly increased our knowledge of the behaviour of peat and of peat failures on upland blanket bogs.

- The best practice guidelines for peat landslide and risk assessments for electricity generation developments on upland blanket bogs (Scottish Government - Energy Consent Unit, 2017) were developed as a result of the peat slide at Derrybrien. The first version of the guidelines was published in the UK in December 2006 (Scottish Executive, 2006). In Ireland they were first referenced for assessing the impact of wind farms on peat soils in the 2008 version of the Best Practice Guidelines for the Irish Wind Energy Industry (IWEA, 2008).
- The mitigation and monitoring measures that were implemented on the Derrybrien Wind Farm site in response to the peat slide were successful at preventing any further peat slides on the site during the remaining construction and operation phases of the project. Although many of these measures have become standard practice in the industry, they would not have reflected standard practice at the time that the slide occurred in 2003.

In general, the most significant effects of the project on soils, geology and land occurred during the construction stage of the project, particularly up to and including the peat slide at the wind farm site in October 2003.

As will be shown in this Chapter, the impact of site activities on the peat and the significance of the effects with regard to peat stability reduces considerably over the project life cycle from the second phase of construction after the peat slide (2004-2006), through the operation and maintenance phase of the project (2006-2022), to decommissioning in 2025 and post decommissioning - particularly on the wind farm site. This is due to changes in the characteristics of the site activities as well as changes to the probability of occurrence of a peat slide as a result of:

- Implementation of effective design mitigation measures and alternative construction methods (e.g. alternative methods of spoil management).
- Additional geotechnical investigations, stability analyses, testing, monitoring and geotechnical supervision (e.g. geotechnical assessment and full-scale proof testing of floating roads).
- Changes to the site characteristics due to improved drainage and an increase in the strength of the peat under sustained dead load surcharges (i.e. the floating roads, peat repositories and material sidecast areas).

8.2 Methodology

8.2.1 Impact Assessment Methodology

The baseline date for the site conditions used in the impact assessment is 1998, prior to the construction of the wind farm.

All available information was used to establish the baseline conditions for the soils, geology and land on the project and in areas off-site that could be impacted by a peat slide. This included a comprehensive desk study of available information from published sources as well as a review of all the relevant ground investigation information.

The desk study included a review of historical aerial photographs, LiDAR topographical survey data, and relevant information on ground conditions, bedrock geology and Geological Heritage Sites from the Geological Survey of Ireland (GSI) the Environmental Protection Agency (EPA) and the Ordnance Survey of Ireland (OSI).

Additional ground investigations were carried out during the construction stage of the wind farm in 2004/2005, after the peat slide, to supplement the original investigations for the wind farm prior to construction, which were completed in 2001. The majority of the information from the construction

stage investigations would also be representative of the conditions on the wind farm site prior to construction, particularly outside the slide area and where the ground conditions were not impacted by the project. Therefore, all of the relevant information from these investigations was used to establish the baseline site conditions.

The baseline sensitivity of the receiving soils, geology and land impacted by the project has been assessed on a 7-point scale from **Negligible** to **High** based on a combination of a number of factors including the characteristics of the materials (i.e. peat, glacial till or rock), the ecological importance of the blanket bog, carbon storage potential (peat), geological heritage (glacial till/rock), and land use characteristics. In assessing the impact of a peat slide related to project activities, consideration has also been given to the characteristics of the receiving soils, geology and land outside the site that could be directly impacted by a slide.

In this Chapter:

- An 'Impact' is defined as an action from a site activity that results in a change to the receiving soils, geology and land e.g. for construction of the turbine foundations the impact on the receiving soils, geology and land is the excavation of the peat and glacial till to construct the foundation on the underlying rock.
- The 'Effect is defined as the change or changes resulting from that impact, e.g., the changes to the characteristics of the peat and glacial till that occur after they are excavated.

Impacts of the project on soils, geology and land have been assessed over the full project life cycle under three categories:

- Impacts that have occurred.
- Impacts that are occurring.
- Impacts that are likely to occur.

The first category relates to impacts that occurred during the construction phase of the Project between 2003 and 2006, and during the operation and maintenance phase between 2006 and Q1 2022. The assessment of impacts over this period is based on a comprehensive record of project activities that were carried out and any related impacts that occurred, including the peat slide that occurred on the site during construction in October 2003.

The second category relates to impacts from the construction, operation and maintenance phases of the Project between 2003 and 2022, and from the ceased operations phase (2022-Present Day) that are still occurring at the end of 2024. These are typically ongoing long-term impacts such as groundwater lowering due to improved drainage, or permanent and sustained surcharge loads on the intact peat slopes from site access tracks or material deposition areas that were left in place at the end of construction.

The third category relates to impacts that are likely to occur on the site during the decommissioning phase of the Project, and for the Retained Development post-decommissioning. This includes an assessment of the impact of project activities that are likely to be carried out during decommissioning based on the proposed decommissioning plan, as well as an assessment of the impact of elements of the wind farm, grid connection and ancillary works that will be left in place after decommissioning (the "Retained Development"). Long-term impacts related to the Retained Development after mitigation are assessed as residual impacts.

The methodology that was used to assess the impact of the various project activities on the receiving soils, geology and land on the site is based on the recommendations in Section 3.7 of the 2022 EPA Guidelines on Information to be Contained in Environmental Impact Assessment Reports (Environmental Protection Agency, 2022).

Given the history of peat instability on the site, for each phase of the project the impacts of site activities have been assessed separately as **Direct Impacts** and as **Site Stability Impacts**, as shown in the flow chart on Figure 8-2.

Direct Impacts: Direct Impacts of project activities are those that are assessed based on the direct physical impact on the receiving soils, geology and land use. For example - excavation of peat and glacial till for the construction of the turbine foundations has a direct impact on the peat habitat that is disturbed at the turbine site, and the physical characteristics of the excavated materials.

The **Effects** of direct impacts are assessed on a 7-point scale from **Negligible** to **High** based on the nature, extent, duration and frequency of the effects. Many of the impacts for different project activities have the same effect at different locations across the site. Therefore, the combined effect of these impacts has been assessed to determine the significance of the effect. For example, there are 70 No. turbines on the wind farm, all of which involved excavation of peat for the turbine foundations. Peat excavation was also required for the borrow pits, substation, site compound and anemometer masts. Therefore, the combined volume of peat excavated from these sites and the total area of disturbed habitat on the blanket bog have been calculated to assess the significance of the effect on the receiving soils, geology and land. In assessing the combined effect for the whole project, consideration has also been given to the volume of peat that was disturbed in the peat slide that occurred at the site in October 2003. Where appropriate, impacts that are specific to a particular activity or location have been assessed independently.

For impacts that have occurred (e.g. during the construction, operation and maintenance phases of the windfarm), the assessment is based on comprehensive records of project activities and the works that were carried out for the project. However, for impacts that are likely to occur during and after decommissioning, the probability of occurrence of the impact is also considered.

The **Significance** of the effects of direct impacts have then been determined as a function of the sensitivity of the receiving soils, geology and land directly impacted by the project activity using the matrix in Figure 8-3, which has been adapted from the chart in Figure 3.4 of the 2022 EPA Guidelines.

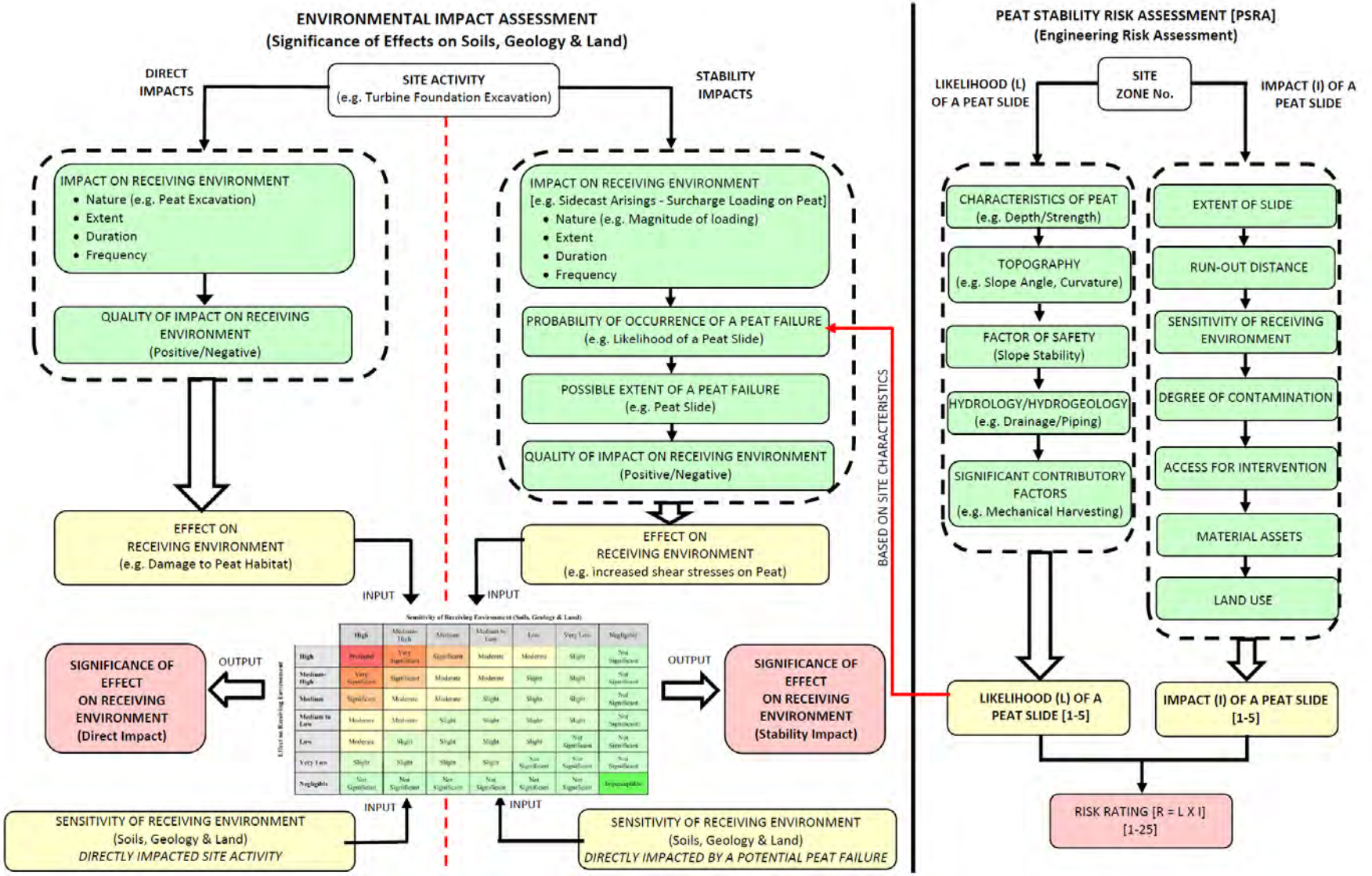


Figure 8-2: Flow chart for assessment of direct impacts on soils & geology and impacts on site stability

Effect on Receiving Environment \ Sensitivity of Receiving Environment (Soils, Geology & Land)	**High**	Medium-High	Medium	Medium to Low	Low	Very Low	Negligible
High	Profound	Very Significant	Significant	Moderate	Moderate	Slight	Not Significant
Medium-High	Very Significant	Significant	Moderate	Moderate	Slight	Slight	Not Significant
Medium	Significant	Moderate	Moderate	Slight	Slight	Slight	Not Significant
Medium to Low	Moderate	Moderate	Slight	Slight	Slight	Slight	Not Significant
Low	Moderate	Slight	Slight	Slight	Slight	Not Significant	Not Significant
Very Low	Slight	Slight	Slight	Slight	Not Significant	Not Significant	Not Significant
Negligible	Not Significant	Not Significant	Not Significant	Not Significant	Not Significant	Not Significant	Imperceptible

Figure 8-3: Significance of Effect on Receiving Soils, Geology & Land

Stability Impacts: Stability impacts are direct impacts where the effect on the receiving soils, geology and land increases or decreases the risk of instability, typically in the peat, potentially triggering a large peat slide as a worst-case scenario.

For example, where peat and glacial till excavated from the turbine foundations are placed on the intact peat slopes adjacent to the excavations (i.e. sidecast), covering the peat habitat with the excavated material is the **direct impact** on the receiving soils, geology and land. However, the dead load surcharge that is applied on the surface of the peat due to the weight of the materials is the **stability impact**. In this case the primary effect of the stability impact is the increase in shear stress in the underlying peat, which increases the risk of a peat failure, potentially triggering a peat slide on sloping ground where the magnitude of loading is such that the downslope shear stresses exceed the strength of the peat.

Therefore, to identify site activities that have a higher risk of triggering a peat slide, the effects of site stability impacts have been qualitatively assessed on a 7-point scale from **Negligible** to **High** as a function of:

- The characteristics of the site activity and stability impact (e.g. the magnitude, extent, frequency and duration of loading on the peat).
- The quality of the effect on the receiving soils, geology and land with respect to site stability [i.e. adverse (increases risk of peat instability), or positive (reduces risk)].
- The probability of a peat failure occurring as a result of the effect.
- The possible nature and extent of a peat failure.

Characteristics of Stability Impacts: In the majority of cases the stability impact of project activities involves a dead or live load surcharge on the intact peat slopes. The magnitude, extent and frequency of loading is a function of the characteristics of the project activities, which have been assessed based on the comprehensive site records from the construction stage of the project and from the initial operating phase of the wind farm to date. For impacts that are likely to occur during and after decommissioning, the probability of occurrence of the impact is also considered.

Where appropriate, stability impacts of different site activities in the same part of the site have been assessed in-combination to determine the significance of the effect. For example, the effect of the live load surcharge from construction traffic on the floating roads has been assessed in combination with the dead load surcharge from the road itself, which was constructed directly on the peat. Also, in assessing the impact of material sidecasting on the intact peat slopes, consideration has also been given to the fact that the material was typically placed adjacent to the floating roads with the excavators operating on the roads, which would have led to a concentrated combined surcharge loading and activity on the peat in those areas at the time.

In some cases, it was not appropriate to assess stability impacts in combination. For example, while consideration has been given to the magnitude, frequency and duration of construction traffic loading on the floating roads for each activity, the live load surcharges from different site activities have not been combined because they do not lead to a cumulative loading on the road, i.e. the roads were not wide enough to accommodate two-way traffic. Furthermore, not all of the activities were carried out in the same part of the site or at the same time. For example, while excavations for some of the turbine foundations were active, the construction of the floating roads was being completed, they were typically being carried out in different parts of the site due to logistical constraints and traffic control. The heavy surcharge loading on the floating roads from the mobile cranes that were used to erect the turbines would also have occurred after the turbines and crane hardstanding's had been completed. Site activities related to the 110 kV overhead line and Agannygal Substation were remote to the wind farm site.

Fundamentally, site activities that were carried out in different parts of the site or at different times did not have a combined stability impact on the peat. However, where activities that were carried out in the same area and at the same time did have a combined stability impact then this has been considered in the assessment.

Quality of Impact: The direct physical effect of surcharge loads on the peat slopes involves an increase in shear stresses in the peat, which increases the risk of a peat failure, potentially triggering a large peat slide as a worst-case scenario. Therefore, surcharge loading has an adverse impact on the peat with respect to site stability.

Project activities that have a **positive impact** on the peat with respect to site stability are those which reduce the risk of peat failure – for example drainage improvements that reduce groundwater pressures within and below the peat, and increase the strength of the peat due to consolidation under increased vertical effective stresses where the groundwater table is lowered.

Probability of Occurrence (Peat Failure): The probability of a peat failure occurring has been assessed for each project activity based on the characteristics of the stability impact (e.g. the magnitude, extent, duration and frequency of loading) as well as the physical characteristics of the site such as the topography, peat depth, peat strength and groundwater conditions. This is consistent with the EPA Guidelines (EPA, 2022) as well as current best practice guidelines for peat landslide hazard and risk assessments in *"Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Projects,* 2nd Edition, April 2017 (Scottish Government – Energy Consent Unit, 2017).

On this project a peat stability risk assessment has been carried out for the various components of the project in accordance with the 2017 best-practice guidelines from the Scottish Government Energy Consent Unit to assess the likelihood of a peat slide in zones across the site based on the site characteristics and other contributory factors that are known to lead to a higher risk of peat instability. As illustrated in Figure 8-2, the results have been used to assess the probability of occurrence of a peat failure for the assessment of stability impacts in this chapter.

The baseline peat stability risk assessments for the wind farm site, the peat slide response works, and the grid connection are presented in Section 8.3.4.

The probability of occurrence of a peat failure is expressed as a range (e.g. Low to Possible) to characterise the range in conditions across the site. The probability is also assessed at each stage in the project life cycle to take account of any changes to the characteristics of the site activities - for example by alternative design or method of construction - or any changes in site conditions that could change the likelihood of a peat slide, such as the increase in strength that occurs in peat over time as it consolidates under sustained surcharge loads left in place on the slopes.

For this project, the possible **Extent** of a peat slide and the **Sensitivity of the receiving soils, geology and land** have been calibrated by the scale of the very large peat slide that occurred on the site on the 16th October 2003, and by the land that that was directly impacted by the slide. The slide covered an area of approximately 25 ha. The characteristics of the land use, topography, ground and groundwater conditions within the slide area are also representative of the general conditions that could be impacted by the project in other areas around the site where there is a risk of a large peat slide. Therefore, it has reasonably been considered as the worst-case scenario in assessing stability impacts on this project.

To accurately characterise the possible extent of a slide for each project activity, consideration has also been given to the scale and characteristics of smaller, more localised peat failures that occurred on the site during construction – for example the localised shear failure or small scale peat slides that occurred around the perimeter of some of the open excavations in peat for the turbine foundations, which had a significantly lower impact on the receiving environment on the wind farm site.

The **Significance** of the effects of stability impacts was then determined using the matrix in Figure 8-3 as a function of the **Effect** that the impacts had on the peat with respect to site stability (which reflects the likelihood and possible extent of a peat failure), and the baseline **Sensitivity** of the receiving soils, geology and land potentially impacted by the peat failure, including land downslope and off-site from the wind farm in the case of a large peat slide.

This chapter identifies where peat failures actually occurred during construction as a result of project activities. Although the probability of a peat failure occurring has been assessed as Very Possible or Likely for some site activities that were carried out extensively across the site, only a small number of peat failures actually occurred, and all but one of these were localised or small-scale failures within the site where the effect on the peat was Low and only Slightly Significant. This is because there are usually a number of other natural and anthropogenic factors that contribute to peat failures occurring in any area of the site in addition to the stability impact of the site activities.

To ensure that methodology for assessing stability impacts of project activities on the receiving soils, geology and land, is representative and consistent with the direct impact of peat failures that can occur as a result of those activities:

- The worst-case scenario for the possible extent of a peat failure has been used to assess the significance of the effect of stability impacts on the receiving environment.
- Where there is a high probability of a peat failure occurring as a result of a site activity (i.e. very possible to likely), the significance of the effect of the stability impact of that activity on the receiving environment is the same as the significance of the effect of the direct impact of the peat failure that could occur in the worst case scenario as a result of that activity.

In this way, the methodology identifies stability impacts that have significant effects whether or not a failure occurs so that appropriate design and construction mitigation measures can be implemented as a preventative measure.

Cumulative impacts: Cumulative impacts from other projects on site or in the area are assessed in Section 8.5 of this chapter. Most of the other projects in the area are remote to the project and will not have any cumulative impacts on soils, geology and land in the project area. Therefore, the

assessment of cumulative impacts is limited to any significant impacts from other wind farms within close proximity to the project, and from commercial forestry and peat extraction in turbary plots on or adjacent to the wind farm site.

Remedial (Mitigation) Measures and Monitoring: Section 8.6 gives a comprehensive record of the mitigation measures that were implemented during construction of the project, particularly after the peat slide, and during the operation and maintenance phase up to the end of 2022. Section 8.6.2.2.2 gives details of the monitoring that was carried out to monitor peat movement and changes to ground water levels in selected areas across the wind farm site after the peat slide in October 2003.

The majority of the mitigation and monitoring measures that were implemented on the project were used to successfully manage the risk of peat instability and prevent another peat slide on the site. Apart from some changes to the layout and extent of the floating roads, or to the number of turbines that were constructed on the site, there were no significant changes to the design of the project. The mitigation measures were generally related to spoil management, management of site activities on the peat slopes (e.g. drainage, tree felling etc) and to the evaluation, testing and use of the floating roads. Many of the measures that were adopted were developed from first principles and are included in this chapter to give context to the assessment of stability impacts on soils, geology and land.

At this stage the mitigation measures that were relevant to the construction, operation and maintenance of the wind farm have been incorporated into the standard operating procedures on the site. They will continue to be implemented for the comparable construction/demolition activities during decommissioning. Section 8.6.2.5 also includes additional specific mitigation measures that will be implemented for decommissioning, which are consistent with the measures that have been successfully implemented on site to date.

Residual impacts: Residual impacts that are likely to occur after the decommissioning of the project are addressed in Section 8.7. These are based on the proposed decommissioning plan for the project and include long-term impacts related to the Retained Development that are occurring and are likely to continue to occur after mitigation.

8.2.2 Limitations/Difficulties Encountered

No significant difficulties were encountered that prevented a comprehensive assessment of impacts of the project on the receiving soils, geology and land.

This section presents a summary of the difficulties that were encountered during the assessment and the actions that were taken to overcome those difficulties, where possible.

8.2.2.1 Wind Farm Site

The main difficulties that were encountered in the assessment of the impact of the wind farm on soils, geology and land on the site were related to the limited information that was available for the ground and groundwater conditions on the site prior to construction, and for some of the construction activities prior to the peat slide on October 2003, i.e.:

- There was very limited ground investigation information available for the site prior to construction to establish the baseline conditions for the ground and groundwater conditions on the site in 1998.
- There are limited records for some of the construction activities that were completed prior to the 2003 peat slide, particularly the management and disposal of spoil excavated from the site compound, borrow pits and 39 No. turbine foundation excavations that were completed prior to the slide.
- There is also limited information on the remedial measures and monitoring procedures that were implemented to mitigate the impact of the project on soils, geology and land.

Due to access restrictions on the wind farm site the pre-construction ground investigation that was carried out in 2002 was limited to a small number of trial pits and light dynamic probes in the peat with limited laboratory classification testing of disturbed samples, which did not provide full coverage of the site.

However, this was compensated for by the extensive ground investigations, topographical surveys and laboratory testing that were carried out on the wind farm site during the second phase of construction after the slide, which provided comprehensive coverage of the site topography; the extent, depth and strength of the peat, and the material characteristics of the mineral subsoil and bedrock across the project area. This information was reasonably considered representative of the baseline conditions on the site, prior to construction, particularly where the information was not affected by the works that had been completed on the site.

Prior to the peat slide in October 2003 peat, mineral soil and, in some cases, weathered rock were excavated from the site of the borrow pits, site compound and 44 No. turbine foundations that had been completed or excavated. There is limited information on the volume of the different materials that were excavated from these areas, and the records of where the materials were disposed of are incomplete, particularly for the site compound and borrow pits. However, the majority of the materials were excavated from the sites of the turbine foundations, and it is known that these were sidecast on the peat slopes adjacent to or within close proximity of the excavation. Although there are limited records of the volume of the materials that were excavated from each turbine, a detailed survey of the material sidecast areas was completed by Applied Ground Engineering Consultants (AGEC) immediately after the peat slide. The survey provides sufficient information on the location, extent, characteristics and depth of the materials deposited in each area to carry out the assessment of the impacts on the receiving soils, geology and land. AGEC also recorded details of observed peat instability in the sidecast areas which has facilitated the assessment of the site stability impacts. The results of their survey are included in their report "Final Report on Derrybrien Windfarm Post-Landslide Site Appraisal", dated 4th February 2004 (Ref. 378_099), which is included in Appendix 8-1.

Although, there are limited records for the materials excavated from the sites of the borrow pits and site compound, it has been assumed that the same construction methodology was used for disposing of the excavated materials so that it had a similar impact on the receiving soils, geology and land on the wind farm site.

There was also limited information on the groundwater levels in the peat across the wind farm site. This made it difficult to quantitatively establish the baseline conditions on the site, prior to construction, and also to assess the impact of drainage on the peat and subsoils during and after construction. For example:

- No piezometers were installed on the site during the original ground investigation in 2002, prior to construction, or during the initial phase of construction before the peat slide in October 2003;
- After the slide, a combination of manual standpipe piezometers and automated electronic piezometers were installed in selected areas across the site to monitor groundwater levels during and after construction. However, there was an insufficient number of piezometers to give a comprehensive record of groundwater levels for the diverse range of topography, ground conditions, surface hydrology and drainage conditions across the entire project area.
- The electronic piezometers were monitored continuously over a period of over 6 years after construction, up to January 2012. However:
    - As noted above, there was an insufficient number of piezometers to characterise the full range of conditions that would be expected across the site.
    - There were no manual backup readings to confirm that the piezometers were functioning correctly over such an extended period of time.

- Monitoring of the piezometers were discontinued before the groundwater levels had stabilised at the monitoring locations.

Although there is limited quantitative information on groundwater levels across the wind farm site, it is considered that there is still enough information on the topography, hydrology, drainage, soil, rock and groundwater conditions across the site to carry out a sufficiently detailed and conservative qualitative assessment of the likely impact of drainage on the receiving soils, geology and land based on experience and sound engineering judgement. In assessing the impact, some judgement has necessarily been applied to interpreting the limited piezometer data that is available and how representative it is for the range of conditions that would be expected across the site given the location of the piezometers and the reliability of the data.

8.2.2.2 Peat Slide: Temporary Barrages and Run-Out Distance of Slide Material

Some difficulty was also encountered in determining details of temporary barrages. Following the peat slide event, a number of temporary barrages were constructed a distance downstream to intercept the flow path of the peat slide material. These temporary barrages were constructed immediately following the peat slide and were subsequently removed within an estimated year or so following the peat slide. Details of the extent of these temporary barrages is not known, and inspection (in 2020) of the location of these temporary barrages showed no evidence of the barrage. For impact assessment purposes, an estimate of the construction and extent of temporary barrages has been included below based on reasonable estimates.

The extent of the run-out distance of the peat slide is difficult to estimate with certainty and has been estimated based on the presence of peat on the stream/river banks based on records following the slide event. The peat slide would have initially comprised dominantly a remobilised peat flow, but as the material entered a stream/river channel the materialwould have become more fluidised due to the presence of water. The channelised flow would have eventually become sufficiently degraded and saturated that it would act as a suspension in water, which in the context of the impact on Soil, Geology and Land would have effectively marked the end of the peat flow.

8.3 Receiving Environment

This section gives an interpretation of the baseline conditions for soils, geology and land use for the project in 1998, prior to construction of the project.

8.3.1 Baseline Environment – Wind Farm Site

8.3.1.1 Introduction

All available information was used to establish the baseline conditions on the wind farm site, and in areas off-site that could be impacted by a peat slide. This included a comprehensive review of relevant information from the ground investigations that were carried out on the site, and a desk study review of historical aerial photographs, LiDAR topographical survey data, and relevant information on ground and groundwater conditions, bedrock, and geological heritage sites from online sources including the Geological Survey of Ireland (GSI), the Environmental Protection Agency (EPA) and the Ordnance Survey of Ireland (OSI).

Section 8.3.1.2 gives a summary of the ground investigations that were carried out on the wind farm site in 2001, prior to construction, and in 2004/2005 during the construction stage of the project. The majority of the information from the construction stage investigations would also be considered representative of the baseline conditions on the wind farm site, particularly outside the slide area and

where the ground conditions were not impacted by the project or peat slide. Therefore, all of the relevant information from these investigations was used to establish the baseline site conditions.

Section 8.3.1.3 gives a summary of the baseline conditions for the topography and land use on the site, as well as the geotechnical characterisation of the peat and glacial till, and the geological classification of the bedrock geology.

The Geological Survey of Ireland (GSI) Landslide Susceptibility Classification for the wind farm site and surrounding area is shown on the GSI Landslide Susceptibility Map in Section 8.3.1.3.2.

The characteristics and sensitivity of any Geological Heritage Sites (GHS) within the wind farm site are assessed in Section 8.3.1.3.4 based on the information that is included in the GSI database.

Sections 8.3.1.3.5 and 8.3.1.3.6 give a summary of the groundwater conditions on the site and an overview of the surface hydrology and hydrogeology in the peat, which are relevant to the assessment of the impacts on soils, particularly in relation to the peat and site stability.

The baseline sensitivity of the receiving soils, geology and land impacted by the project has been assessed in Section 8.3.1.4 based on a number of factors including the characteristics of the materials that were impacted (i.e. peat, glacial till or rock), the ecological importance of the blanket bog, carbon storage (peat), geological heritage (glacial till/rock), and land use characteristics. In assessing the impact of a peat slide related to activities on site for the project, consideration has also been given to the characteristics of the receiving soils and geology outside the wind farm site that could be directly impacted by a slide, downslope from the wind farm.

The results of the baseline peat stability risk assessment for the wind farm site are presented in Section 8.3.4.1 to characterise the likelihood of a peat slide across the site based on baseline site characteristics related to topography, peat and subsoil conditions, hydrology, hydrogeology and other known contributory risk factors related to peat instability. The assessment identifies areas on the site where there were compounding risk factors with regard to peat stability that could lead to an elevated risk of a peat failure prior to the implementation of appropriate risk mitigation measures.

8.3.1.2 Geotechnical Investigations

8.3.1.2.1 *Introduction*

Extensive ground investigations have been carried out across the site to date at different phases of the project, primarily at detailed design and construction stage. Drawing No. 003 by AGEC Ltd. in Appendix A of the "*Derrybrien Windfarm - Geotechnical Stability Report & Assessment of Stability Impacts of On-Site Activities*" by AGL Consulting (Report No. 11-147-R04), which is included as Appendix 8-2 of this Chapter, shows a consolidated layout plan of the majority of the investigation points, which illustrates the high level of site coverage that has been achieved. The investigations have largely been comprised of:

- A comprehensive desk study of available information on soils, geology and groundwater conditions.
- An aerial LiDAR survey of the wind farm and surrounding area to obtain an accurate model of ground levels and topography across the site.
- Trial pits to determine the depth and characteristics of peat and subsoils, and the depth to bedrock at shallow depths up to 3.0-4.0 m.
- Extensive peat probing to establish a profile of the depth of peat across the site.
- In-situ vane shear testing to establish the undrained shear strength of the peat.
- In-situ undisturbed piston sampling of the peat to obtain high-quality undisturbed samples for laboratory testing and inspection.

- Disturbed gouge-auger core samples of the peat and subsoil to inspect the characteristics of the peat at the interface with the underlying mineral soil.
- Rotary coreholes to establish the depth to rock and the rock mass characteristics at a number of turbine locations.

The following is an outline summary of the different phases of site investigations that were carried out on the wind farm site. Further details on the investigations and related factual reports are included in AGL Report No. 11-147-R04 in Appendix 8-2.

8.3.1.2.2 *Pre-Construction Ground Investigation - IGSL Site Investigation (2002)*

IGSL Ltd. carried out the pre-construction ground investigation on the site in December 2001. Access to the turbine locations was not possible for conventional ground investigation equipment to carry out trial pits, boreholes or rotary coreholes because of the poor ground conditions and extensive forestry coverage on the site. Therefore, the works was comprised of the following:

- 8 No. trial pits to depths of 2.5-3.3 m with a wide-track hydraulic excavator.
- 58 No. dynamic probes using a light hand-held Mackintosh Probe – primarily located at Turbines T1-T46, with 12 No. additional probes at selected locations over the rest of the site.
- 24 No. auger samples of the peat at depths of 1.5 m across the site.
- Laboratory testing of the disturbed samples of the peat, which included 12 No. water contents and 6 No. chemical tests (SO3 & pH).

8.3.1.2.3 *AGL/BAM Supplemental Site Investigations – Construction Stage (Post-Slide – 2004/2005)*

Extensive supplemental ground investigations were carried out on the site by AGL Consulting and the main civil works contractor, Ascon Ltd. (now BAM Civil) during the second phase of construction in 2004/2005, after the peat slide, to accurately characterise the topography and the depth, strength and characteristics of the peat and underlying glacial till across the site so that the risk of peat instability could be adequately assessed and managed for the completion of the wind farm.

The investigations were primarily concentrated along the site access tracks and at proposed peat deposition areas on the intact peat slopes. The fieldwork consisted of:

- Peat depth probing and sampling with a hand-operated 20 mm diameter steel probe with the 1.0 m long 20 mm diameter gouge-auger core sampler.
- Slope angle measurements on the surface of the peat by GPS, optical survey and hand-held Abney Level.
- In situ vane-shear tests to determine the undrained shear strength of the peat using a Geonor H-10 65/130 mm penetration vane.
- Rotary coreholes by Irish Drilling Ltd. at 27 No. turbine bases to determine the depth to rock and rock mass characteristics, with Standard Penetration Tests (SPT) in the overburden to assess the in-situ undrained shear strength of the glacial till.
- Installation of 10 No. 19 mm diameter push-in piezometers to record groundwater levels in the peat across the site.
- Collection of high-quality undisturbed samples of the peat with 75 & 100 mm thin wall Geonor piston samplers and by block sampling in trial pits.
- Specialist laboratory testing of undisturbed samples to classify the strength and material characteristics of the peat.

8.3.1.2.4 AGEC Ground Investigation (2003)

AGEC carried out a ground investigation on the site after the peat slide in 2003. The investigation was comprised of:

- In-situ shear vane tests using hand-held vanes. AGEC carried out shear vane tests using the hand held Geonor H-60, 25.4 mrn diameter vane.
- In-situ shear vane tests by Fugro Ltd. to determine the undrained shear strength of the peat using a Geonor H-10 55/110 mm penetration vane mounted on a 3-tonne mini crawler rig.
- Detailed walkover survey inspections and geotechnical mapping of site characteristics and material sidecast areas at turbine locations.

The investigations that were carried out by AGEC are included in their report titled "Final Report on Derrybrien Windfarm Post-Landslide Site Appraisal" dated 04/02/2004 (Report no. 378_099)", which is included in Appendix 8.1. Their investigations formed part of an initial preliminary investigation of peat stability across the site after the peat slide in October 2003. Therefore, they are located along the floating roads and near the turbine foundations that had been completed prior to the slide, where excavated material had been sidecast on the intact peat slopes.

8.3.1.2.5 ESBIE Ground Investigation (2004)

Extensive supplemental geotechnical investigations were also carried out on the site by ESB International Engineering (ESBIE) between June 2004 and December 2004 to assess the stability of the site for the planned tree felling operations following the peat slide in October 2003. The fieldwork provided comprehensive coverage of the site between the floating roads and turbines and was comprised of:

- Slope angle measurements with a hand-held Abney level at 15-25 m intervals along 219 No. profiles at representative locations across the site.
- 3162 No. peat depth probes with a hand-operated 20 mm diameter steel probe to establish the variation in peat depth and the slope at the interface with the underlying mineral soil or rock along the survey profiles.
- Peat sampling at 222 No. locations with the 1.0 m long 20 mm diameter steel gouge-auger core sampler to provide visual classification of the peat.
- 1179 No. in-situ vane shear tests in the peat at representative locations with the Geotech AB 140 mm x 280 mm automated vane.
- Installation of piezometers in the peat at selected locations around the site in February 2004.

8.3.1.3 Baseline Conditions (1998) – Soils, Geology & Land Use

8.3.1.3.1 Land Use and Topography

The Derrybrien Wind Farm Development site is located on the upper slopes of the Cashlaundrumlahan Mountain in the Slieve Aughty Mountains in Co. Galway. The site is primarily characterised by upland blanket bog which has historically been used for commercial conifer forestry over the central and western parts of the site, and turf cutting in turbary plots on the east side. An aerial photograph of the site taken in 2000 is shown on Figure 8-4. The wind farm site is identified on the photo. The photograph identifies the main features that were on the site prior to construction of the wind farm, including:

- The extent of existing forestry access roads on the site prior to construction.
- The extent of the conifer plantations and firebreaks within the wind farm site.
- The turbary plots in the open blanket bog at the east end of the site.

- The existing access roads to the turbary plots which were constructed as floating roads.
- Patches of poor tree growth across the site – generally associated with deep peat and high water table.
- Existing watercourses and drainage channels.
- Potential subsurface drainage channels along lines of vegetation.
- The zone of young trees in an area that may have been damaged by fire.

The pattern of tree furrows and the surface drainage network can be identified on the aerial photograph. In the area of peat harvesting on the east side of the site the network of surface drains is defined by the boundaries of the turbary plots. On the west side of the site there is a large area where the tree growth is smaller than the surrounding area – as indicated by the lighter shade of green, possibly indicating where there was a historic fire that damaged the trees in the area. The area has been re-planted and the strips of darker vegetation within this area are possibly indicative of subsurface drainage paths or concentrated subsurface flow.

Figure 8-5 and Figure 8-6 show the general topography of the site following completion of construction (i.e. post 2005). However, with the exception of the borrow pits, the slide area at Turbines T68 and T70, and along the site access tracks, the ground surface elevations and slope angles across the site would generally also be relevant to the original conditions on the site in 1998, prior to construction.

The peak of Cashlaundrumlahan Mountain is at Elev. +365 mOD near Turbine T10 near the centre of the site. Within the site the ground level drops away gently to between approximately Elev. +325 mOD and +345 mOD along the perimeter of the wind farm site over a distance of approximately 700 m to the north and south, and 1.2 km to the west. At the east end of the site the ground surface is lower and drops down to Elev. +290 mOD and +298 mOD at Turbines T46 and T44, respectively, which are approximately 2.6 km from the peak.

There is a broad zone that runs across the full width of the site for a distance of approximately 250-300 m to the north and south of the peak of the mountain where the ground surface slopes gently away from the peak at slope angles typically <3°. This is within the central three rows of turbines on the site layout in Figure 8-5.

To the south of this zone the slope is convex in profile with slopes generally increasing up 4-5° degrees and locally 5.0-7.5° within the wind farm site, particularly between Turbines T21 and T41. Downslope from the site in this area the slopes increase more consistently typically up to 7.5° and locally up to 10.0°.

The northern upper slopes of the mountain within the wind farm site are characterised by a terraced profile with broad flat areas where the slope angles are <3°, separated by benches where the slopes are locally steeper at up to approximately 5.0-7.5°, locally up to 10°. This reflects a stepped profile to the underlying bedrock, which has sub-horizontal bedding. There are areas of deeper peat and ponded surface water on the flat terraces, as identified on the aerial photograph in Figure 8-4. These are characterised by the change in colour to the darker natural vegetation on the blanket bog, or by pools of surface water, like the area near Turbine T61.

North of the wind farm site there is a convex break in slope to steeper more uniformly graded slopes up to 7.5-15.0°. Turbines T47 to T52 are located along the convex break in slope on this side of the site.

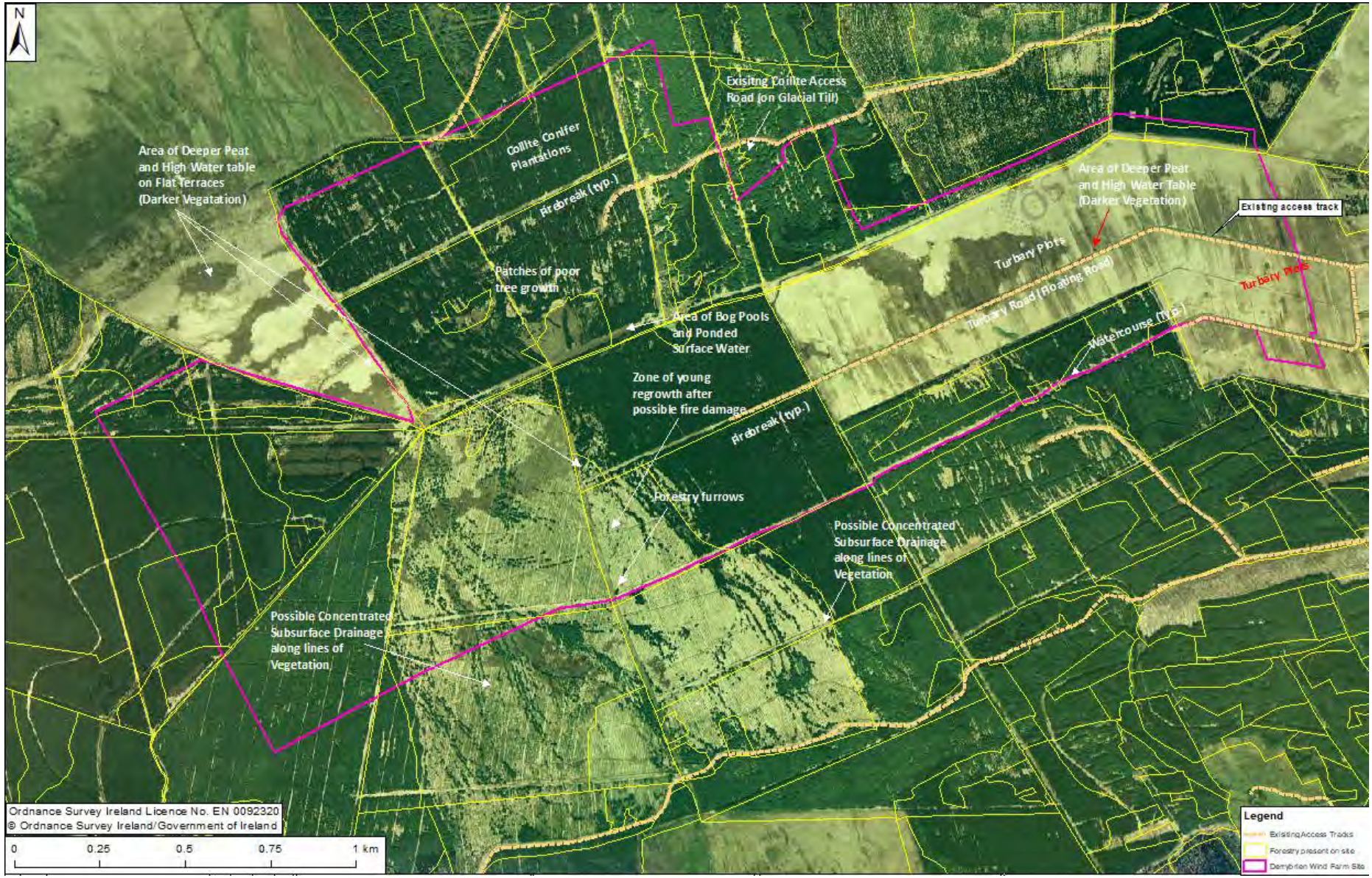


Figure 8-4: Aerial Photograph of the project area prior to construction (2000)

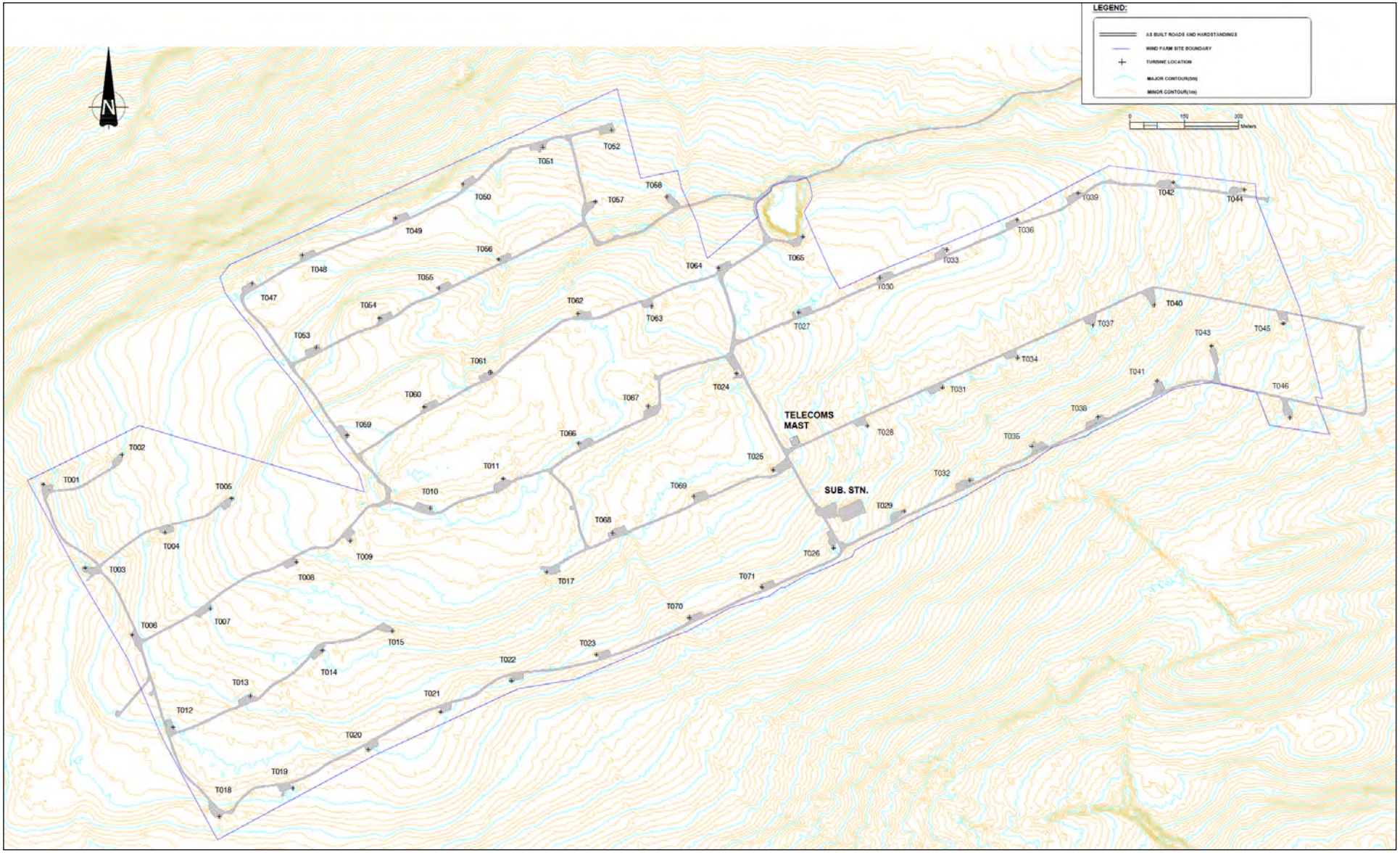


Figure 8-5: LiDAR Survey of the Site (Post-Construction)

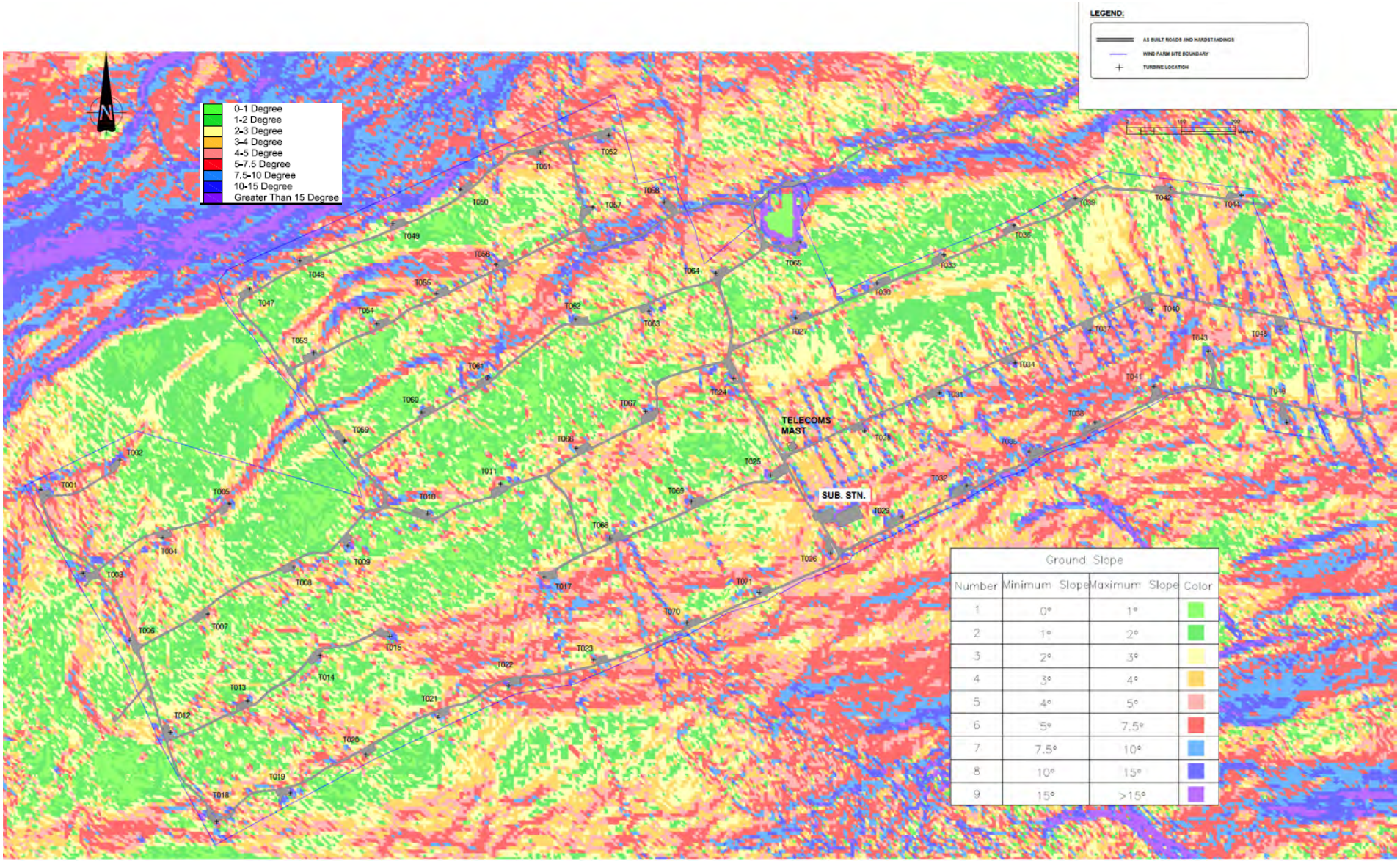


Figure 8-6: Ground surface slope angles based on post-construction LiDAR survey

8.3.1.3.2 Landslide Susceptibility Mapping

Figure 8-7 shows the Landslide Susceptibility Map for the Project area from the Geological Survey of Ireland (GSI) superimposed on the OSI 1:50,000 Discovery Series map. This map provides information on areas which are pre-disposed to landslides using a classification system based on slope angle, soil type and a parameter referred to as the Topographic Flow Index (TFI), which is a measure of how overland flow of landslide debris is concentrated or dispersed by the terrain, also taking into account flow velocity.

The slope angle is derived from the 20 m Digital Elevation Model (DEM) and values can range from 0 to 90 degrees. Soil types are generalised into 5 main groupings based on their grain size distribution (i.e. fine or coarse-grained), and/or particular characteristic, including Peat, which is particularly relevant for the Derrybrien Wind Farm. The TFI is also derived from the 20 m DEM and is calculated using factors related to slope angle, flow direction and flow accumulation. The classification model is weighted by applying a known inventory of landslide events to particular combinations of factors that have a higher incidence of landslides. The results are banded into four categories of landslide susceptibility ranging in classification from Low to High. The resolution of the mapping is on a local to regional level based on the accuracy of the DEM (20 m) and the scale of the base mapping (1:50,000).

The landslide susceptibility map for the Project area shows that much of the wind farm site would be classified as being of Low susceptibility to landslides. There is a broad area on the steeper slopes on the south side of the wind farm and across the turbary plots on the east side of the wind farm where the susceptibility is classified as Moderately Low. This includes the area where the peat slide occurred at Turbine T68 in October 2003, during construction of the wind farm. The location and extent of the peat slide are recorded on the GSI database.

On the north side of the wind farm site there are locally steeper sections of ground between terraces that have a Moderately Low susceptibility to landslides. The steeper slopes to the north of the site boundary between turbines T49 and T51 have been classified as having a Moderately High landslide susceptibility.

The Landslide Susceptibility Map indicates that conditions on the windfarm site are suitable for the project with appropriate design and mitigation measures for working in peat, particularly in the areas of Low or Moderately Low susceptibility. The areas of Moderately High and High susceptibility are generally limited to the steeper slopes outside the site boundary to the north and south of the wind farm, particularly to the north.

The GSI National Landslide Susceptibility Map was developed as part of a mapping project that was completed between 2007 and 2016. Therefore, it was not available for characterising the baseline conditions in the project area in 1998, prior to construction.

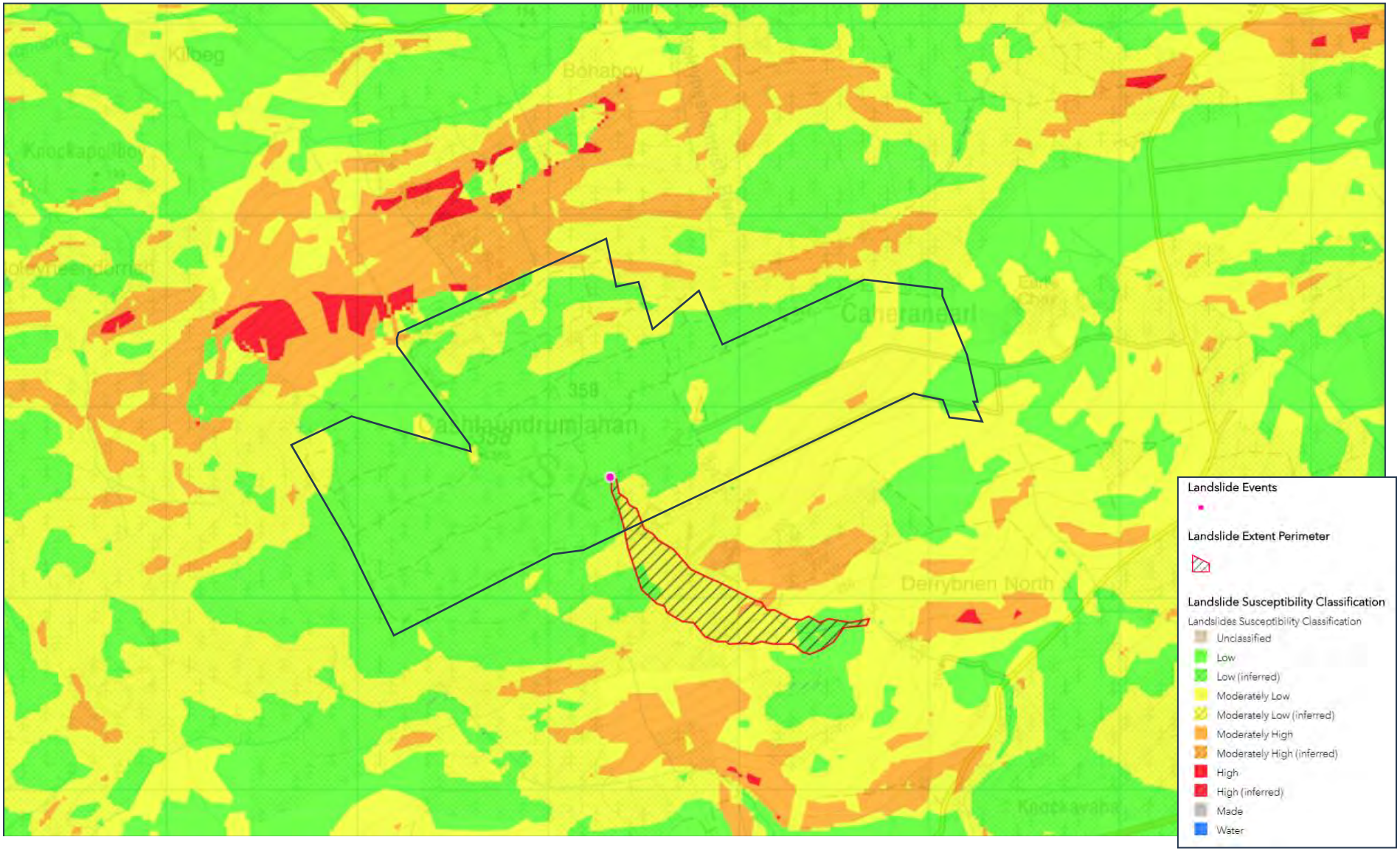


Figure 8-7: GSI Landslide Susceptibility Map for Project Area (Geological Survey of Ireland – online mapping, 2020)

8.3.1.3.3 Geotechnical characterisation of baseline site conditions

Quaternary Geology & Subsoils Map - GSI

Figure 8-8 shows a map of the Quaternary Geology for the wind farm site and local area which was generated from the Geological Survey of Ireland online database. The wind farm site is covered by upland blanket peat (BkPt). Exposures of glacial till derived from Devonian Sandstones (TDSs) are identified on the steep slopes on the north side of the site and on the lower slopes downslope from the wind farm.

There are many exposures of outcropping bedrock (Rck), particularly along the banks of streams and watercourses and on the lower slopes downslope from the wind farm.

Peat

The majority of the wind farm site is covered by blanket peat. Figure 8-9 shows the depth of peat across the wind farm superimposed on the LiDAR survey. The depth of peat has been interpreted from the extensive number of peat probes that have been carried out on the site.

In general, the depth of peat is proportional to the slope angles. The areas of deep peat up to 3-6 m deep, and locally >6.0 m, correspond to the broad flat or gently sloping ground across the central and western sections of the wind farm, and on the flat terraces on the north side. The slope angles in these areas are typically <2-3° (see Figure 8-6).

Peat depths <2 m are generally confined to the areas of steeper slopes up to 5.0-7.5°, with shallow peat <1.0 m on slopes typically up to 7.5-10.0° along the benches at the edge of the terraces on the north side of the wind farm, and on the steep slopes along the perimeter of the wind farm between Turbines T47 and T50 to the north, and between Turbines T32 to T41 to the south. Peat depths of 2-3 m typically occur on the intermediate slopes of 3-5°.

In the trial pits carried out pre-construction by IGSL Ltd. the peat is described as soft brown fibrous organic PEAT. In general, the degree of decomposition (humification) of the peat varies with depth – typically ranging from fibrous in the upper vegetated layer (the acrotelm) where there is still living plant matter (Von Post H4-H6), to slightly fibrous, amorphous or clayey with depth in the underlying catotelm peat, which is comprised of dead plant matter generally below the water table (Von Post H7-H10). There is a more significant variability in the characteristics of the peat in the areas of deeper peat >2-3 m.

Water contents recorded by IGSL in the peat ranged from 150-450%, which are very low for peat. Water contents recorded by AGL during the construction stages of the project were typically in the range of 800-1250%, which is more representative (Figure 8-10). The water content is expressed as the ratio between the mass of water to the mass of solids in the soil. Therefore, for water contents >1000%, over 90% of the peat mass is comprised of water, which is representative for blanket peat. Lower water contents of 20-75% were recorded in the clayey peat and organic clay layers at the base of the peat.

Mass loss on ignition tests carried out on samples of the peat indicated that the organic content is generally >95% (Figure 8-11). Lower values of 20-75% were recorded in the clayey peat and organic clay layers at the base of the peat. The bulk density of the peat samples tested by AGL ranged from 0.98 to 1.03 Mg/m^3 (Figure 8-12), increasing to 1.35-1.40 Mg/m^3 in the clayey peat and organic clay layers at the base.

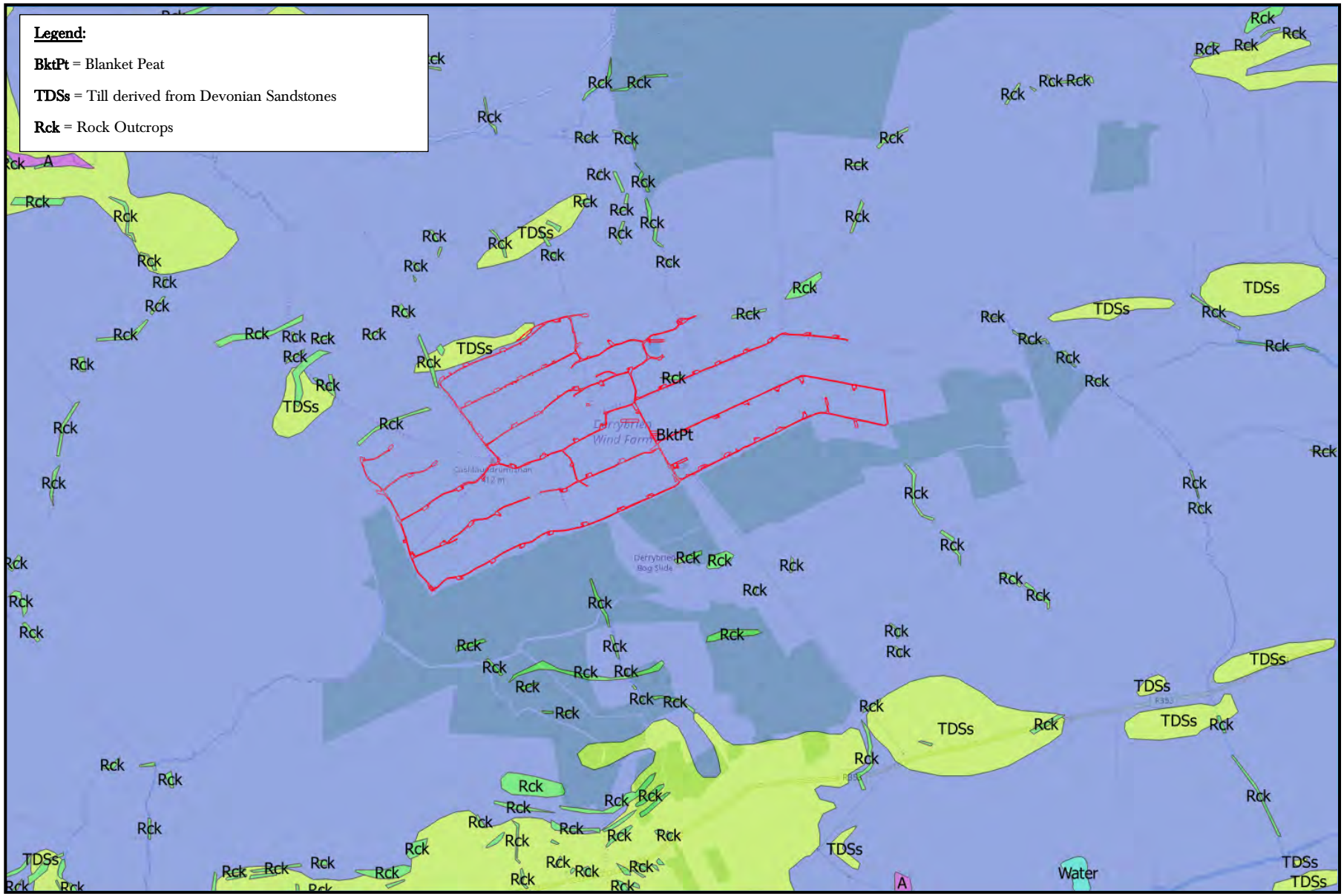


Figure 8-8: Quaternary Geology Map (Geological Survey of Ireland)

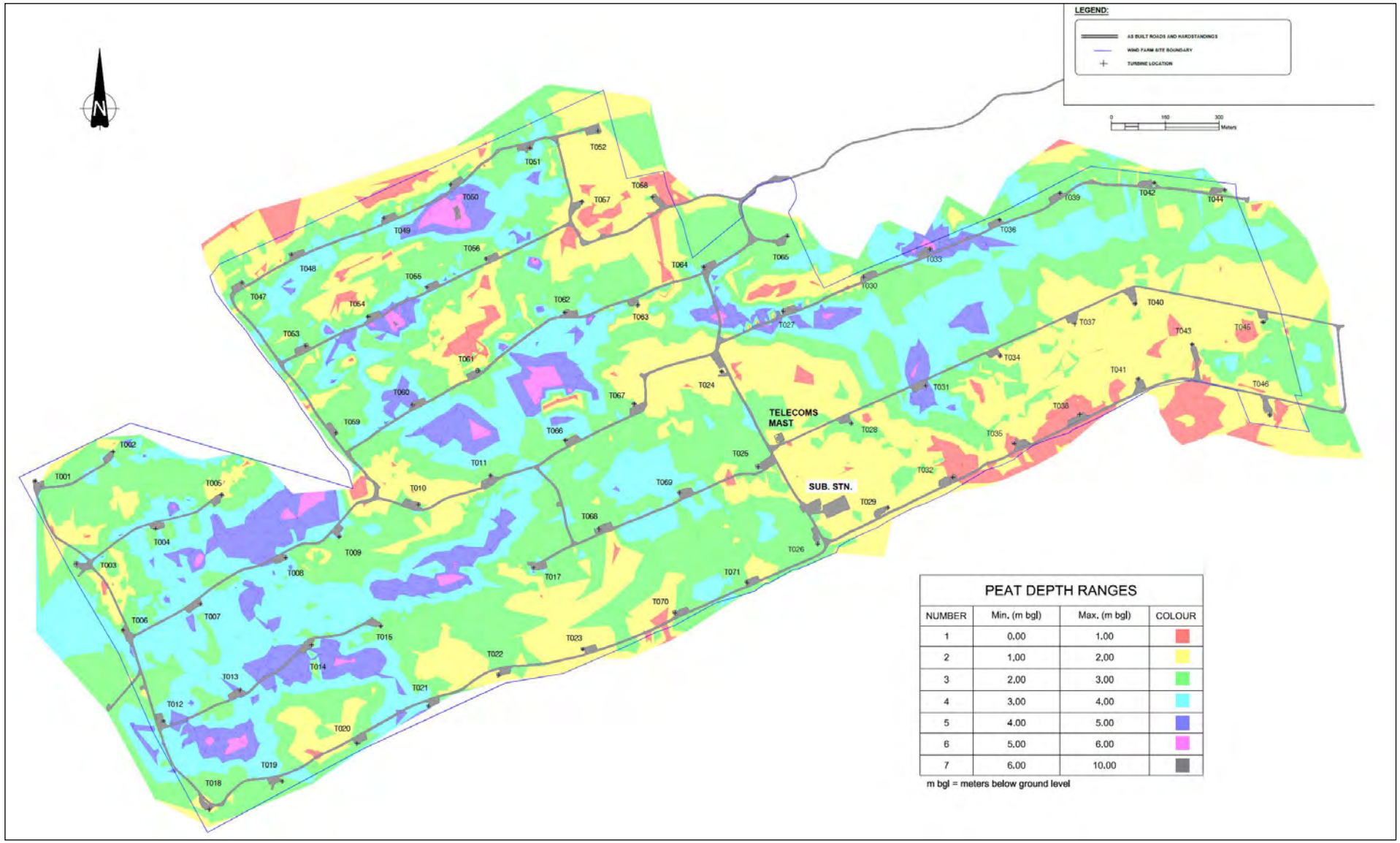


Figure 8-9: Peat depths across the site

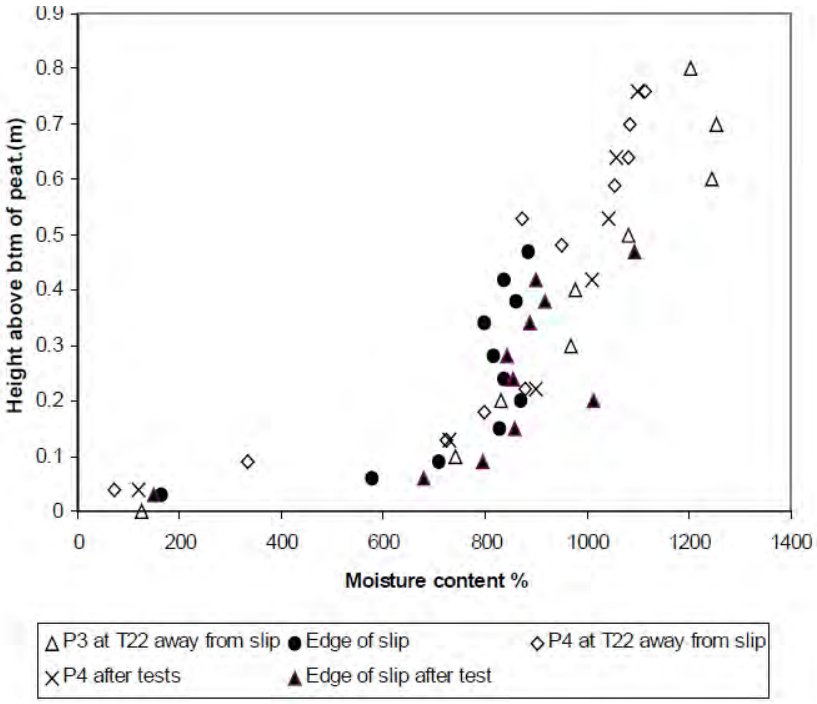


Figure 8-10: Water content of peat

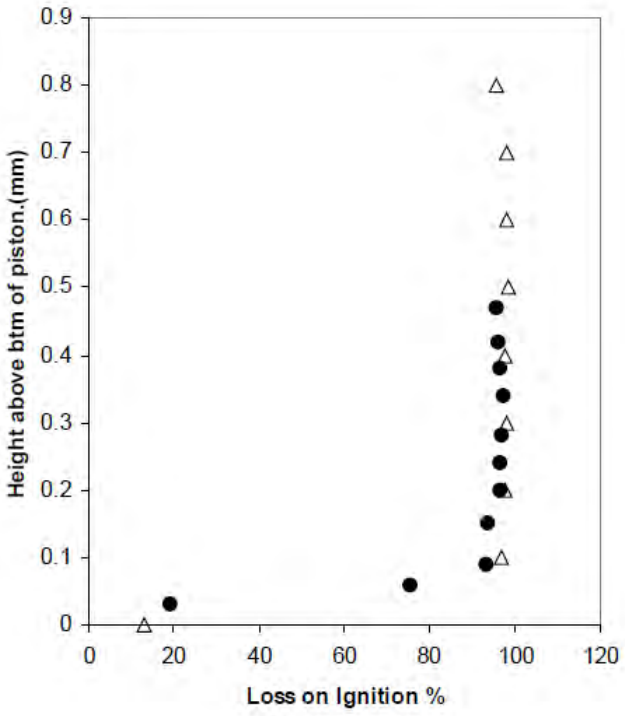


Figure 8-11: Organic content of peat by Mass Loss on Ignition

Figure 8-13 shows typical profiles of unfactored undrained shear strength recorded in the peat by AGL/BAM with the Geonor H-10 in-situ penetration vane during the construction stage of the project. In accordance with BS5930:2015 – BS Code of Practice for Site Investigations, the peat would be classified as Extremely Low Strength with an undrained shear strength <10 kN/m^2. The results were generally in the range of 5-10 kN/m^2, with a few locally lower values of 3.5-4.0 kN/m^2. The unfactored shear strengths recorded with the Geonor H-10 vane were validated on site by proof load testing on a test section of floating road during construction.

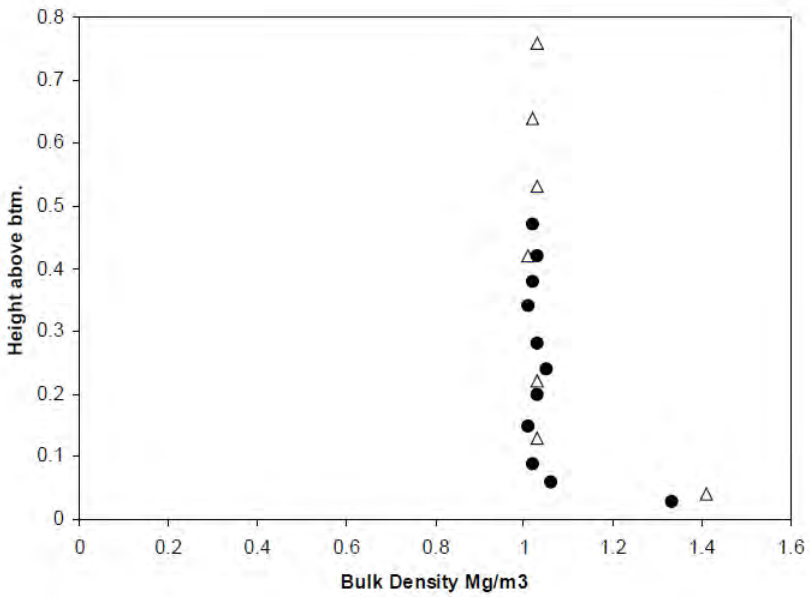


Figure 8-12: Bulk Density of Peat

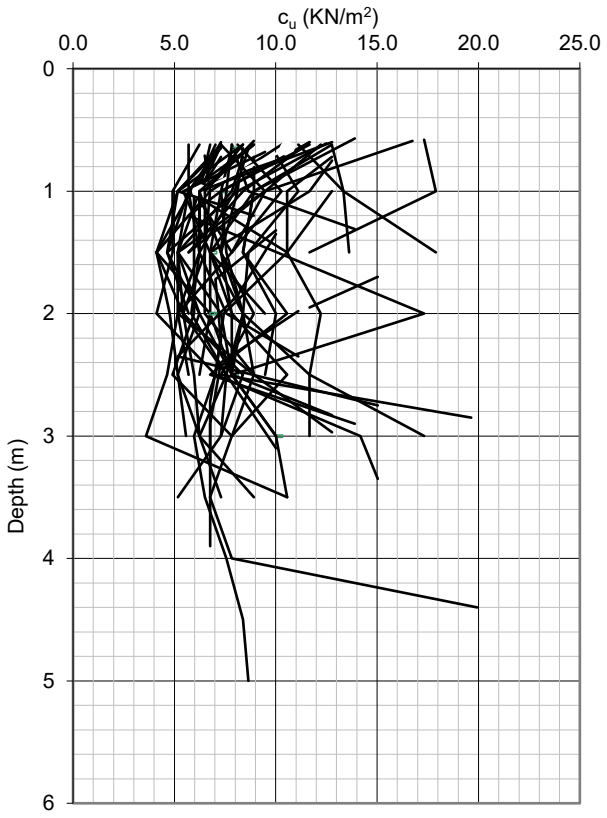


Figure 8-13: Profile of undrained shear strength (c_u) with depth in peat recorded with the Geonor H-10 in-site vane

Figure 8-14 shows the results of laboratory tests carried out on undisturbed samples of peat collected from the site by AGL. The tests were carried out at the soils laboratory of Trinity College Dublin for AGL/BAM and they included results of direct simple shear tests on samples collected adjacent to the slide. The results indicated that the undrained shear strength of the samples of peat tested in direct simple shear was generally greater than 4.5-6.0 kPa. However, some very low strengths on the order

of 2.0-4.5 kPa were recorded on samples near the base of the peat in the vicinity of the slide (average = 3.5 kPa).

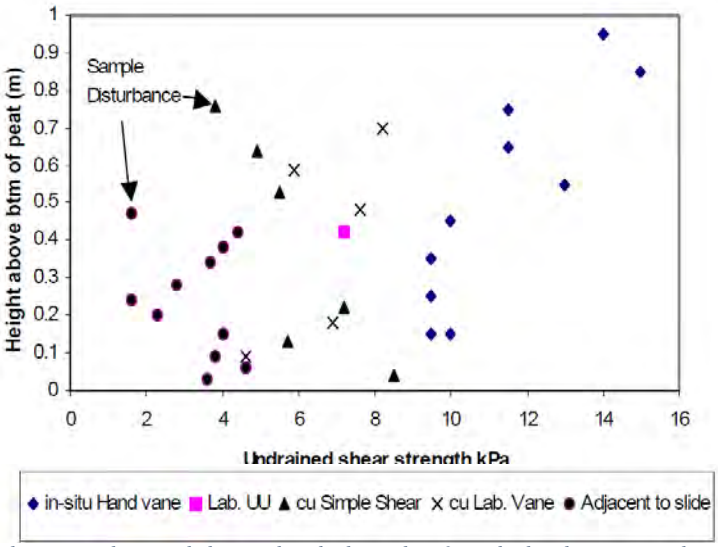


Figure 8-14: Undrained shear strengths recorded on undisturbed samples of peat by hand vane, triaxial tests and direct simple shear tests

Mineral Subsoil & Glacial Till

Where the full depth of peat was penetrated in 4No. of the trial pits carried out by IGSL Ltd. it is shown to be underlain by a 0.1-0.6 m thick layer of soft grey-white sandy SILT over glacial till described as Firm purple sandy gravelly CLAY. In areas of shallow rock, the peat may also be directly underlain by rock, although this was not generally the case.

Based on the rotary coreholes carried out by Irish Drilling Ltd. (IDL) at 27 No. of the turbines across the site (Turbines T6 – T8, T30, T33, T34, T36, T39, T47-T62, T64 & T70-T71), the glacial till layer ranges in thickness from 0.6 m to 7.6 m (typically between 0.6 m and 3.5 m) and is underlain by a weathered rock or rock. IDL generally describe the till as slightly sandy gravelly SILT, although samples recovered by conventional rotary coring may not be representative of the in-situ conditions.

Standard Penetration Tests (SPT) were carried out in the glacial till by IDL in some of the rotary coreholes. The SPT N-Values generally ranged from 10-33, which would correspond to an undrained shear strength (c_u) of 50 to 165 kPa using the approximate empirical correlation $c_u \approx 5 \times N_{SPT}$. In accordance with BS 5930 the strength of the till would be classified as Medium (40-75 kPa) to High (75-150 kPa) or Very High Strength (150-300 kPa).

Some lower SPT N-Values of 6-9 were recorded in the glacial till at depths of 3.5-4.5 m in the coreholes at Turbines T31, T33 and T64. These would locally correspond to undrained shear strengths of 30-45 kPa, which would be classified as Low (20-40 kPa) to Medium Strength in accordance with BS5930.

Rock

Figure 8-15 shows the bedrock geology on the site of the Derrybrien Wind Farm Development and in the surrounding area from the 1:100,000 Geological Map from the Geological Survey of Ireland (GSI).

The site lies in a zone of bedrock from the Ayle River Formation which is described as a Mudstones, Siltstones and Conglomerates. The lower part of the formation is characterised by red Siltstones,

Mudstones with carbonate concretions, Sandstones and Conglomerates. Sandstones are generally large-scale trough and planar bedded. Conglomerates are large-scale cross-bedded.

Figure 8-8 and Figure 8-15 identify where rock outcrops have been mapped in the area, generally on the steeper slopes downslope from the perimeter of the wind farm site, particularly to the north of the site. The geological map also shows the dip angle and dip direction of the bedding in the rock. It is typically sub-horizontal (0-10º) and dipping to the NE/NW on the north side of the mountain, and to the south and southeast on the south side of the mountain.

On the steeper slopes to the north of the wind farm there is a zone of bedrock from the Derryfadda Formation, which is comprised of Greywackes, Siltstone and Mudstone. The Formation is dominated by grey-green, medium to thickly bedded (<3 m), fine to coarse grained Greywacke, commonly containing conspicuous and diagnostic basal units of granule grade conglomerate.

Bedrock was cored by Irish Drilling Ltd. (IDL) at 27 No. turbines across the wind farm site (Turbines T6 – T8, T30, T33, T34, T36, T39, T47-T62, T64 & T70-T71). Bedrock at these turbines was generally comprised of slightly weathered, strong to very strong, thinly to medium bedded, locally thinly laminated, purple fine to medium-grained SANDSTONE.

At Turbines T8, T53 and T60 the rock within the depth of the corehole was locally comprised of moderately strong or strong, slightly weathered purple thinly laminated slightly sandy SILTSTONE. Siltstone layers were also encountered within the Sandstone elsewhere on the site.

Along the north side of the site, the rock encountered in the coreholes at Turbines T47 to T51 was generally comprised of slightly weathered, strong to very strong, thinly to thickly bedded and massive cream fine to coarse-grained CONGLOMERATE.

The depth to the top of competent rock was variable but typically ranged from 3.0 m to 6.2 m. Shallower rock was encountered at a depth of 1.3-1.7 m at Turbines T47 and T49 at the north end of the site, and at a depth of 2.5 m at Turbine T58, near the site entrance.

Competent rock at Turbines T51 and T64 was initially at a depth of 8.0-10.3 m. However, additional coreholes carried out at the turbines indicated that the depth to rock was variable and rose to a depth of 5.5-5.6 m in places.

The Total Core Recovery (TCR) of the rock was generally 90-100%. The Rock Quality Designation (RQD) was variable and generally ranged from 0% to 57%, partially due to the thickness of the bedding in the rock. Higher RQD values of 78% and 100% were recorded in more competent Sandstone layers with thicker bedding. Bedding in the rock was generally sub-horizontal (0-10°) to gently dipping (10-20°).

There are sections of highly weathered rock noted at the transition from the overburden to rock. The weathered rock is described in the logs as a:

- Weak to moderately strong highly (locally completely) weathered green, purple white medium grained thinly to medium bedded SANDSTONE with residual soil horizons.
- Gravel and cobble sized fragments of strong highly weathered purple thinly laminated SILTSTONE.
- Weak to moderately weak, highly to completely weathered orange, brown medium grained thinly to very thinly bedded SANDSTONE.

The weathered rock was encountered predominantly in the north and northwest part of the wind farm; however, it was locally identified in T71 at the south end of the site and in T7 at the west end of the site. The weathered rock is noted above the bedrock at depths from 2.9 m to 6.3 mBGL, and it ranges

in thickness from 0.8 m to 3.4 m. The Total Core Recovery (TCR) of the weathered rock ranged from 67% to 100% and the RQD was generally zero in the non-intact rock.

8.3.1.3.4 Geological Heritage Sites

There are no audited or unaudited geological heritage sites identified on the wind farm site on the Geological Survey of Ireland Spatial Resources interactive map viewer.

8.3.1.3.5 Groundwater

The wind farm site is predominantly covered in Blanket Peat and there are areas of ponded water and small streams across the site. The aerial photograph in Figure 8-4 identifies areas of high groundwater level on the flat terraces or gently sloping ground across the site including:

- An area of ponded surface water with bog pools adjacent to Turbine T61 on the flat ground near the peak of the mountain.
- Areas of high groundwater level on the flat terraces associated with the change to the darker natural surface vegetation on the blanket bog.

In the pre-construction ground investigation carried out by IGSL Ltd. water strikes were recorded in the trial pits at depths of 1.0 m to 1.5 m and were described as seepage.

During construction, standpipes were installed by AGL at 6 No. locations along a north-south axis from the centre to the south of the wind farm in the vicinity of the peat slide to get a profile of the depth of groundwater down the slope. The readings that were taken from 17th November 2003 to 4th December 2003 indicated that the depth to groundwater ranged from 0.1 m to 1.1 mBGL.

12 No. electronic vibrating-wire piezometers were also installed in clusters at 4 No. locations around the perimeter of the site to get continuous readings of water levels in the peat. The piezometers were installed adjacent to turbines T2, T18, T34 and T49/T40. The piezometers indicated that the depth to groundwater generally fluctuated between 0.3 and 1.1 mBGL at the end of construction in 2005.

Groundwater on the wind farm site would be expected to flow downslope through a network of natural open pipes within the peat as well as possibly through an open joint network in the underlying bedrock. Several springs have been identified on site, particularly within scarp faces on the northern slopes. The linear pattern of trees identified on the aerial photograph in Figure 8-4 is possibly indicative of concentrated subsurface drainage in the peat.

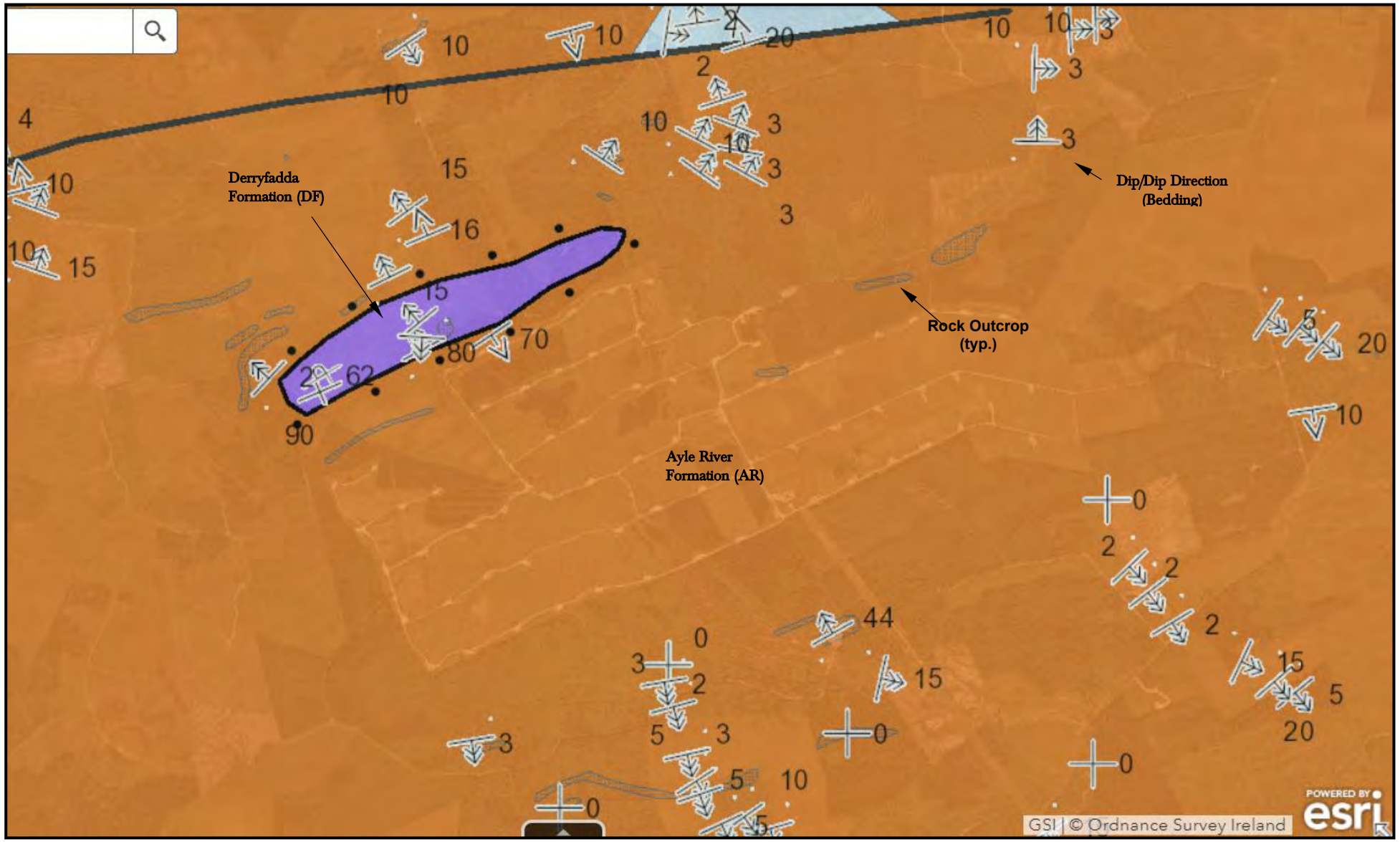


Figure 8-15: 1:100,000 Bedrock Geology Map – Geological Survey of Ireland

8.3.1.3.6 Surface Water, Watercourses and Surface Drainage

Figure 8-16 shows the network of natural watercourses and man-made drains that were on the wind farm site prior to construction. All of the existing drains and watercourses are narrow open drains, typically 1-2 m deep. Where the peat is shallow the drains and watercourses penetrate into the underlying glacial till. However, in deeper peat >1-2 m deep the drains are only excavated into the peat.

At the east end of the site the drainage network reflects the outline of the turbary plots. Over the rest of the site the drains follow improved natural watercourses or forestry furrows.

Figure 8-16 also illustrates how the site drainage feeds into the regional network of streams and rivers downslope from the site. Further information on the surface hydrology is provided in Chapter 9 – Hydrology and Hydrogeology.

Hydrology plays an important role in peat stability. Figure 8-16 illustrates how the peat slide that occurred during construction in 2003 is in the natural drainage channel for the watercourse in sub catchment SC7(b) (as described in Chapter 9). Groundwater and surface runoff from that part of the site has formed streams of concentrated flow in shallow channels on the glacial till or rock below the disturbed peat within the slide area. These streams flow into stream SC7(b) downslope from the site.

8.3.1.3.7 Bedrock Aquifer Classification

Figure 8-17 and shows the bedrock aquifer classification in the project area from the Geological Survey of Ireland (GSI). Bedrock on the site has been classified as a Poor Aquifer (Pl), i.e. bedrock which is generally unproductive except for local zones. This is characteristic of a low permeability rock with concentrated zones of higher permeability along open fissures or seams of highly fractured, highly weathered rock, particularly along fault lines.

The GSI classify aquifer vulnerability in terms of the geological and hydrogeological characteristics that determine the ease with which groundwater may be contaminated by human activities. The criteria with which aquifers are classified is described in the publication "Groundwater Protection Schemes" (DELG/EPA/GSI, 1999) and reproduced here as Table 8-1. Figure 8-18 shows the GSI vulnerability rating for the bedrock aquifer in the project area.

The GSI aquifer vulnerability area classification is based on desk study information on subsoil characteristics and depth to rock. Glacial tills are assigned a permeability category on the basis of a field assessment of texture, particle size distribution and mass characteristics of the exposure in combination with recharge observations such as vegetation and artificial drainage density. In-situ permeability test results are taken into account where available. The extent of the different zones using the criteria in Table 8-1 would generally be based on limited site-specific information. Therefore, the boundaries could be subject to change based on the results of the ground investigation on the site.

The aquifer vulnerability map of the area shown in Figure 8-18 indicates that the site is predominantly within an area of High (H) vulnerability with rock at a typical depth of 3-5 m covered by low permeability peat and clayey subsoil. There are some areas of Extreme (E) vulnerability where rock is shallow or outcropping on the steep slopes and stream channels to the north of the wind farm, and along the existing forestry access road into the site from the northeast.

Areas of Moderate (M) and Low (L) vulnerability have been identified in the southeast corner of the site, where the turbary plots are located. The lower classification in this area would be indicative of deeper bedrock.

Further information on the hydrogeology of the project area is presented in Chapter 9 – Hydrology and Hydrogeology.

Table 8-1: Aquifer vulnerability criteria (DELG/EPA/GSI, 1999)

Vulnerability Rating	Hydrogeological Conditions				
	Subsoil Permeability (Type) and Thickness			Unsaturated Zone	Karst Features
	High Permeability (sand/gravel)	Moderate Permeability (e.g. sandy subsoil)	Low Permeability (e.g. Clayey subsoil, clay, peat)	(Sand/gravel aquifers only)	(<30 m radius)
Extreme (E)	0 – 3.0 m	0 – 3.0 m	0 – 3.0 m	0 – 3.0 m	-
High (H)	>3.0 m	3.0 - 10.0 m	3.0 – 5.0 m	>3.0 m	N/A
Moderate M)	N/A	> 10.0 m	5.0 – 10.0 m	N/A	N/A
Low (L)	N/A	N/A	>10.0 m	N/A	N/A

Notes:
(1) N/A = not applicable
(2) Precise permeability values cannot be given at present
(3) Release point of contaminants is assumed to be 1-2 m below ground surface

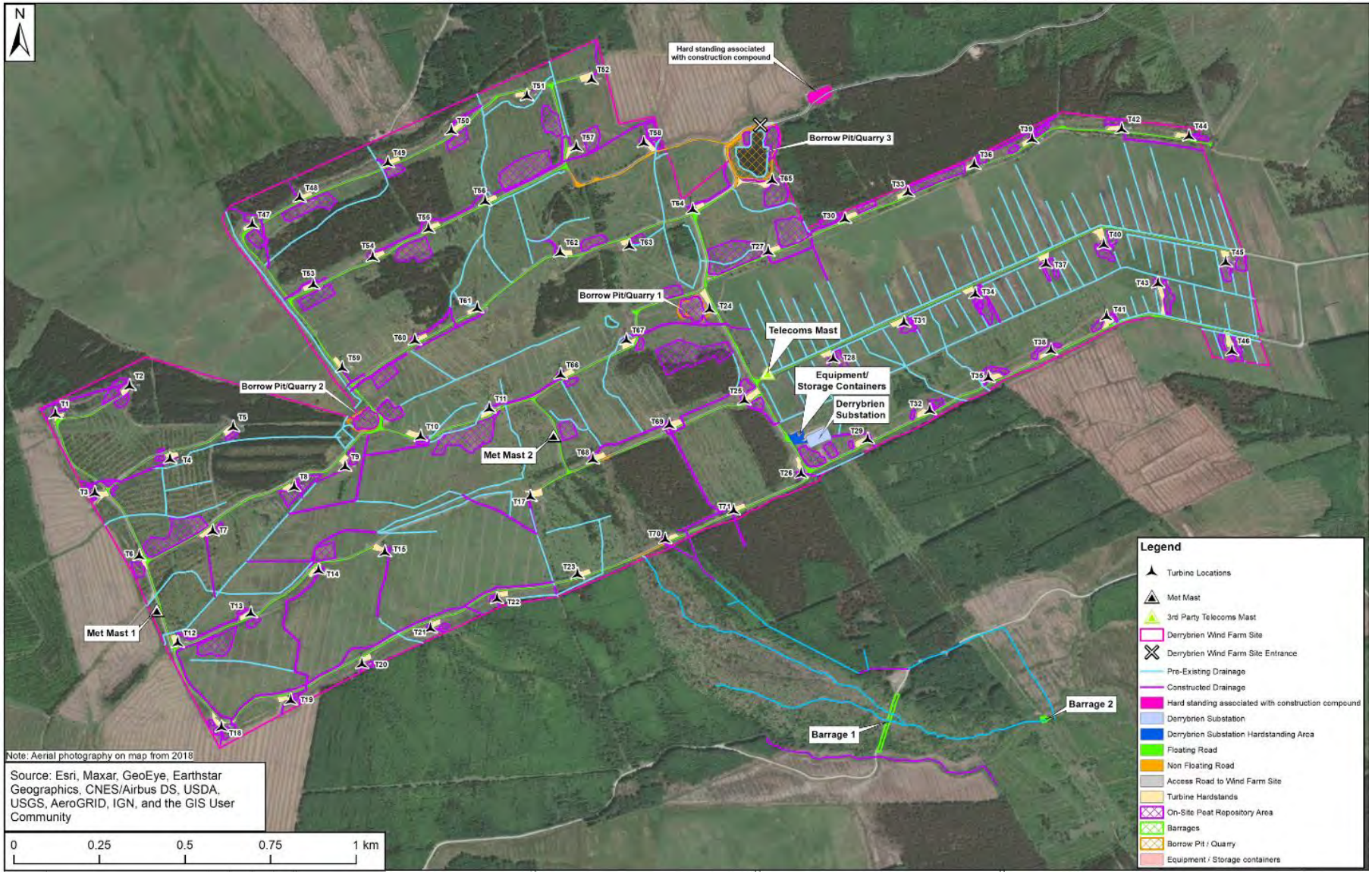


Figure 8-16: Layout of existing (pre-construction) and constructed drainage on the wind farm site

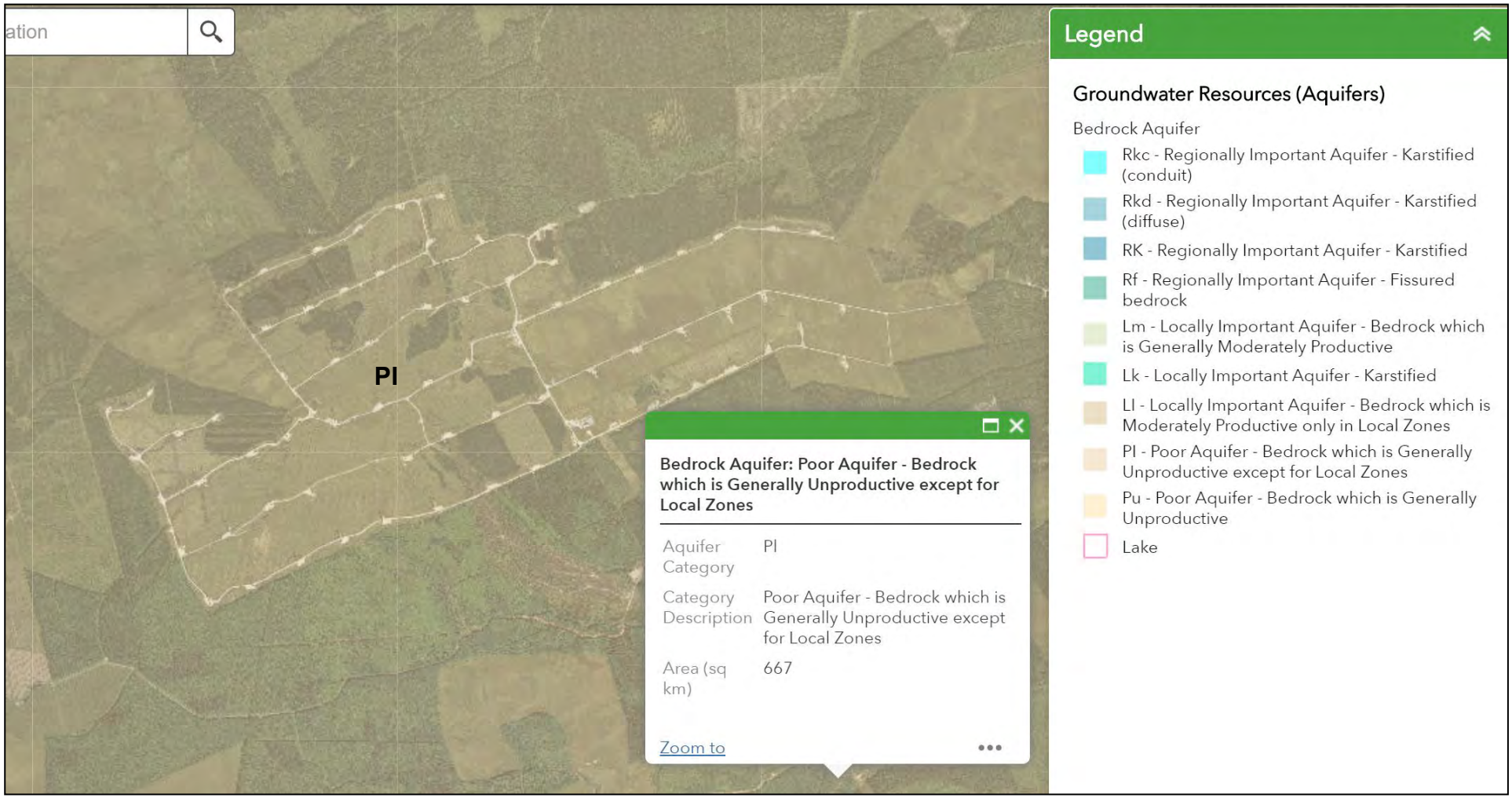


Figure 8-17: Bedrock Aquifer Classification (www.gsi.ie)

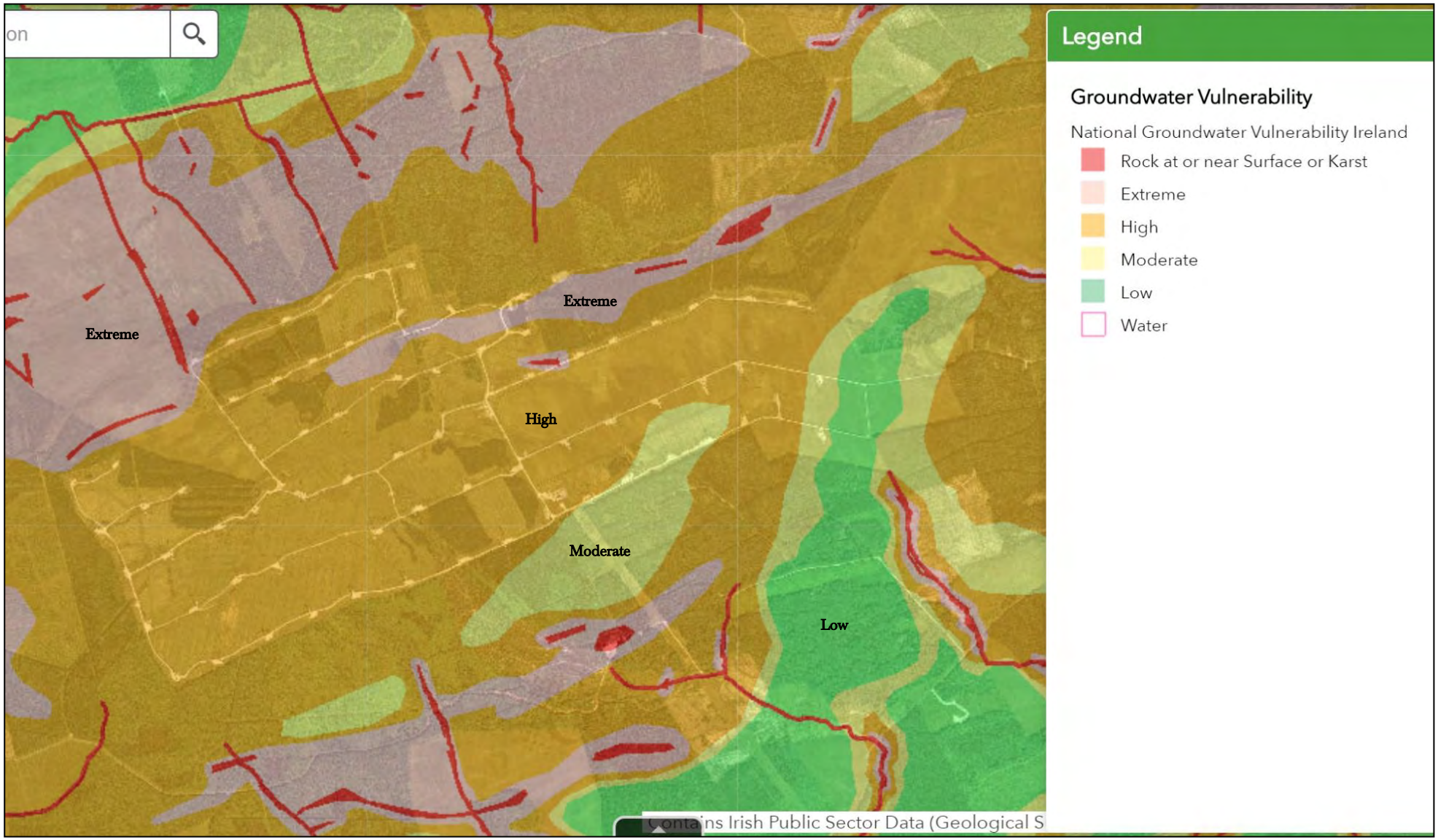


Figure 8-18: Bedrock Aquifer Vulnerability (www.gsi.ie)

8.3.1.4 Baseline Sensitivity of the Receiving Environment (Soils, Geology & Land Use) for the Wind Farm Site

The significance of effects on soils, geology and land on the site has been assessed as a function of the sensitivity of the receiving environment using the matrix in Figure 8-3. The sensitivity of the receiving environment is classified on a 7-point scale from Negligible to High as a function of the characteristics of the soils, geology and land that are directly impacted by the project.

For this project, the majority of the significant effects on soils, geology and land relate to the upland blanket bog that covers most of the wind farm site and surrounding area. Therefore, the characteristics of the blanket bog in the area govern the classification of the sensitivity of the receiving environment for assessing the significance of effects on soils, geology and land on this project. For stability impacts, consideration has also been given to the sensitivity of the blanket bog outside the wind farm site that could be directly impacted by a peat slide at the site. The potential impact of the project on Geological Heritage Sites has also been assessed.

For this project the sensitivity of the receiving soils, geology and land has been classified as **MEDIUM** based on a combination of factors, i.e.:

- Geological Heritage Sites that could be impacted by the project.
- The ecological importance of the blanket bog.
- The significance of the peat for carbon sequestration.
- The use and value of the land impacted by the project.

There are no audited or unaudited Geological Heritage Sites identified on the wind farm site or in the project area on the Geological Survey of Ireland Spatial Resources interactive map viewer. Therefore, the bedrock is not a sensitive receptor on the project.

The habitat impacted by the project is predominately conifer plantation on upland blanket bog that has been degraded by drainage and by the planting of the trees, and is therefore of low ecological value.

The open bog in the eastern portion of the site that was used for turbary is degraded due to drainage and turf cutting and is also of low ecological value. However, the open areas are rare in the wider landscape and suitable for use by hen harrier. Therefore, when all habitats are taken into account, the overall ecological value of the habitats is of Local Importance (higher value). This would be equivalent to a Medium to Low sensitivity.

Blanket bog is a significant source of carbon sequestration in Ireland. Stored carbon in the peat can be adversely impacted by excavation, disturbance, and drainage. The rate of decomposition of peat significantly increases when exposed to an aerobic environment above the water table and this results in a release of stored carbon as carbon dioxide. Carbon can also be lost in solution due to erosion of disturbed peat.

To give context to the scale of the impact of the project on carbon storage in the peat:

- The extent of upland blanket bog on the wind farm site (approximately 340 ha) is <0.1% of the total area of upland blanket bog in Ireland (≈436,690 ha in 1979 Hammond (1981), Conaghan (2000)).
- Less than 9.0% (≈30 ha) of the blanket bog on the site was directly impacted by the project (i.e. by the turbines, crane hardstandings, substation, borrow pits, material sidecast areas and peat repositories).
- A similar area of blanket bog (≈25 ha) outside the wind farm site boundary was directly impacted by the peat slide that occurred at the site in October 2003.

- The mass of carbon stored in peat is on the order of 0.055 tonnes/m3 (Holden & Connolly (2011) & Milne & Brown (1997)). This is equivalent to 0.2 tonnes CO_2 /m^3 if fully oxidised by decomposition.
- The total volume of peat excavated for the turbines, crane hardstandings, substation and borrow pits was approximately 185,000 m^3. About a further 450,000 m^3 of peat was displaced in the peat slide at the site in October 2003. If it is assumed that 100% of the combined volume of excavated peat and displaced peat could be lost due to a combination of excavation/displacement, and long-term erosion and/or decomposition on exposure then this would be equivalent to releasing 127,000 tonnes of CO_2 into the atmosphere. However, this is very conservative as there is still approximately 200,000 m^3 of disturbed peat within the slide area. Also, the excavated peat was all stored in designated storage areas on site and vegetation has re-established on the surface of the peat, which will slow down the rate of decomposition. Therefore, the actual long-term carbon release from the excavated and displaced peat will be significantly lower, possibly on the order of 40-60% of the total (i.e. 50-75kt CO_2).
- In terms of recent national statistics for greenhouse gas emissions in Ireland, 50-75 kt CO_2 is ≈ 0.10-0.15% of Ireland's total estimated annual CO_2-equivalent GHG emissions in 2023 (55,000 kt-CO2-eq) and ≈ 0.65-0.95% of the total emissions related to energy industries in that year (7,865 kt-CO_2-eq) [www.epa.ie, 2024].

Therefore, the impact of the Project on carbon storage is relatively Low and would be compensated by the net carbon gain over the design life of the wind farm.

In terms of land use, the value of the land impacted by the Project is largely determined by the forestry plantations and turbary plots on the wind farm site, which are of relatively low commercial value. The mature timber on the site was harvested during construction, but the trees could not be re-planted after the wind farm was completed. The wind farm also directly impacted approximately 25 ha of land on the site for the turbines, crane hardstandings, substation, borrow pits, material sidecast areas and peat repositories.

Based on the relatively low ecological importance of the land, the sensitivity of the receiving environment could be characterised as Medium to Low. However, when combined with the additional environmental value of the land as a carbon store and the relatively low commercial value of the land for forestry/agriculture, this is sufficient to raise the combined level of sensitivity of the peat to "**MEDIUM**".

For the assessment of stability impacts the sensitivity of the receiving soils, geology and land that could be impacted by a peat slide has also been classified as **MEDIUM** based on the characteristics of the very large peat slide that occurred on the site in October 2003, and the land that that was directly impacted by the slide, i.e.:

- The land that was disturbed by the peat slide covered an area of approximately 25 ha, which is comparable to the wind farm, and it was comprised of coniferous forests of low ecological and commercial value.
- Approximately 450,000 m^3 of peat was displaced in the slide, but about 200,000 m3 of this is still present on the slope.
- The agricultural land downslope from the main slide area that was impacted by peat from the slide was also of low ecological and commercial value.

Therefore, the impact on the blanket bog habitat, carbon storage and land use is of a similar scale and sensitivity to the wind farm project. The characteristics of the topography, ground and groundwater conditions in the area are also representative of the general conditions around the site that could be impacted by the project where there is a risk of a large peat slide. Therefore, for this project it has reasonably been considered as the worst-case scenario for assessing the impact of site activities on the receiving soils, geology and land with respect to site stability.

To accurately assess stability impacts on soils, geology and land, consideration has also been given to the scale and characteristics of the smaller, more localised peat failures that occurred on site during construction. For example, around the perimeter of the open excavations for the turbine foundations, the risk of peat instability was limited to localised shear failure or very small-scale peat slides where the side slopes were not adequately supported, which had a significantly lower impact on the receiving soils, geology and land.

8.3.2 Baseline Environment (1998) – Grid Connection

8.3.2.1 Introduction

This section gives an interpretation of the baseline conditions for soils, geology and land use for the grid connection in 1998, prior to construction of the windfarm project. The grid connection comprises the Derrybrien-Agannygal 110 kV Overhead Line and Agannygal Substation and associated ancillary works, see Chapter 4.

All available information was used to establish the baseline conditions on the grid connection site, and in areas off-site that could be impacted by a peat slide. This included a comprehensive review of relevant information from the ground investigations that were carried out, a desk study review of historical aerial photographs, topographical data, and relevant information on ground and groundwater conditions, bedrock, and geological heritage sites from online sources including the Geological Survey of Ireland (GSI), the Environmental Protection Agency (EPA) and the Ordnance Survey of Ireland (OSI).

Section 8.3.2.2 includes a summary of the ground investigations carried out on the grid connection site in 2004 to 2006, 2018 and 2019, which would be considered representative of the baseline conditions as most of the information is from areas not impacted by the project.

Section 8.3.2.3 gives a summary of the baseline conditions for the topography and land use, as well as the geotechnical characterisation of the soils, and the geological classification of the bedrock geology. Sections 8.3.2.3.5 and 8.3.2.3.6 give a summary of the groundwater conditions and an overview of the surface water, watercourses and surface drainage, which are particularly relevant to stability.

The characteristics and sensitivity of Geological Heritage Sites (GHS) are assessed in Section 8.3.2.3.3.

The baseline sensitivity of the receiving soils, geology and land impacted by the grid connection has been assessed in Section 8.3.2.4.

8.3.2.2 Geotechnical Investigations

8.3.2.2.1 *Introduction*

Details of ground investigations carried out along the grid connection are included in Appendix 8-6 within report entitled *"Geotechnical Stability Report 3 - Overhead Line and Substation Impact Assessment"* (FT, 2020) and Appendix 8.7 "Geotechnical & Peat Stability Report: Derrybrien Wind Farm – Grid Connection and Ancillary Works (FT, 2023). The ground investigations comprised:

- A comprehensive desk study of available information on soils, geology and groundwater conditions.
- Walkover survey (3 no.) to inspect ground conditions.
- Trial pits (2 no.) to determine the depth and characteristics of peat and subsoils at Agannygal substation to depths of about 3 m.
- Extensive peat probing (+160 no.) to establish a profile of the depth of peat.

- In-situ vane shear testing (+120 no.) to establish the undrained shear strength of peat.

8.3.2.2.2 Foundation Records at Mast Locations (2004/2005)

During construction of OHL masts from 2004 to 2005 excavations (trial pits) were carried out at mast locations which recorded ground conditions.

Trial pits with recorded ground conditions were carried out at 18 no. mast locations at each of the 4 no. mast legs giving a total of 72 no. trial pits. The records included a description of the ground conditions encountered and depths.

8.3.2.2.3 ESB Report on Stability for Section of Grid Connection (2006)

ESB (2006) assessed the stability of the peat along the grid connection from the windfarm substation to containment barrage 2, which was constructed following the peat slide in 2003. The stability of the peat in this area was assessed based on shear vane tests and peat probes.

27 no. shear vane tests and peat probes were carried out over a section 700 m in length directly south of the windfarm substation, as this area was considered the critical section in terms of existing slope angles and peat thickness.

The results of stability assessment showed a "lumped" or overall factor of safety of at least 1.4 under a 20 kPa surcharge, which would be considered an acceptable level of safety.

8.3.2.2.4 AGEC Ground Investigation & Walkover (2018)

Ground investigation and walkover survey was carried out by AGEC along the grid connection and at the Agannygal Substation in June 2018. This comprised peat depth probes, hand shear vanes and trial pits.

During the walkover survey, peat depth probing and shear vane testing were carried out at each pole set, mast location and at selected intermediate points along the grid connection to provide representative coverage of indicative peat depths and strengths.

60 no. hand shear vane strength tests were undertaken in peat at depths from 0.5 to 2.5m bgl.

75 no. peat probes were carried out along the route.

Shear vane testing was carried out using a Geonor H-60 hand field vane tester. From FT's experience hand vanes give indicative results for the in-situ undrained shear strength of peat and would be considered best practice for the field assessment of peat strength.

The depth of recorded peat varied from no peat to localised deeper areas of peat, especially near Lough Agannygal, although the Agannygal Substation which is only about 0.5 km further south is founded on mineral soil.

2 no. trial pits were excavated at Agannygal substation, referred to as TP10 and TP11. The 2 no. trial pits were consistent with each other and showed a ground profile consisting of deposited construction arisings from the substation excavation over a natural ground profile of soft organic topsoil over glacial till.

8.3.2.2.5 FT Ground Investigation & Walkover (2019)

Ground investigation and walkover survey was carried out by FT along the grid connection, access routes to public roads and at the Agannygal Substation in September and October 2019. This comprised hand shear vanes and peat depth probes.

35 no. hand shear vane strength tests were undertaken at depths from 0.5 to 2.5 m bgl.

In excess of 60 no. peat probes were carried out during the site walkover. Approximately 70 percent of the probes recorded peat depths of less than 1 m with over 90 percent of probes recorded peat depths of less than 2.5 m.

8.3.2.2.6 FT Ground Investigation & Walkover (2022)

Ground investigation and walkover survey was carried out by FT along the grid connection, access routes to public roads and at the Agannygal Substation in October 2022. This comprised hand shear vanes and peat depth probes.

13 no. hand shear vane strength tests were undertaken at depths from 0.5 to 3.5 m bgl.

31 no. peat probes were carried out during the site walkover, with peat depths ranging from 0.2 to 5.8 m. Approximately 50 percent of the probes recorded peat depths of less than 1 m with 80 percent of probes recorded peat depths of less than 2.5 m.

8.3.2.3 Baseline Conditions (1998) – Soils, Geology & Land Use

8.3.2.3.1 Land Use and Topography

The grid connection comprises the Derrybrien-Agannygal 110 kV Overhead Line (OHL) and Agannygal Substation and associated ancillary works. The substation connects into the existing Shannonbridge-Ennis 110kV Overhead Line.

The OHL route is 7.8 km long and is aligned essentially north south. The OHL route extends from the lower slopes of Cashlaundrumlahan Mountain (location of windfarm site) to the Agannygal Substation located about 1 km to the north of Lough Atorick. The OHL is supported on double pole sets and mast structures founded in the underlying competent ground. Further construction details of the OHL are included in Chapter 4.

The Agannygal Substation consists of a compound (approximately 63 m x 47.5 m) containing outdoor electrical equipment and a Control Building. The foundations for the control building and outdoor electrical equipment are supported on granular rockfill or the underlying competent ground. The compound hardstanding is capped with hardcore surfacing. Further construction details of the Agannygal Substation are included in Chapter 4.

In 1998 most of the grid connection site was managed commercial forestry. Forestry was planted in the project site from 1963 to 1994. An aerial photograph of the site in 2000, which would reasonably represent the baseline conditions in 1998, is shown on Figure 8-19. The OHL route corridor is highlighted with the OHL masts and pole sets shown. The figure shows the main features and land use that were on the route prior to construction, which includes:

- Extent of existing roads prior to construction.
- Extent of existing mature conifer plantations, recently planted/felled plantations and firebreaks.
- Existing watercourses and drainage channels.

The land use along the OHL route and at the Agannygal Substation prior to construction was essentially managed commercial forestry.

It is noted that the OHL route crosses the lower end of the source area of the peat slide of 16 October 2003 between pole sets 5 and 6, and also passes close to 2 no. containment barrages (barrage 3 and 4) constructed following the peat slide.

Figure 8-20 shows the general topography along the grid connection post construction (i.e. post 2005). With the exception of the Agannygal Substation site and several localised cuttings along the OHL route, for example where the OHL passes below an existing 400 kV overhead line between pole sets 28 and 29, the topography of the grid connection site would generally reflect the original topography in 1998, prior to construction works.

The grid connection route connects to the windfarm at the Derrybrien Substation located within the boundaries of the windfarm site at an elevation of approximately 330 mOD. From the Derrybrien Substation, the elevation along the route gradually falls to a wide valley floor where it crosses the R353 road and the tributaries of the Owendalulleegh River at an elevation of approximately 130 mOD. From here, the route passes around the Slieve Aughty Bog NHA (site number 001229) before gaining some elevation again as it passes Lough Agannygal, at about 195 mOD. The OHL route ends at the Agannygal Substation.

The Agannygal Substation site is located about 1 km to the north of Lough Atorick, at an elevation of approximately 190 mOD. The land is elevated with respect to the surrounding area to the north, west and south.

Slope angles at the pole set and mast locations typically range from 0 to 15 degrees. The topography is relatively steep initially over the initial c. 1.5 km and then crosses the more gently sloping terrain of the Owendalluleagh River valley to the Agannygal substation where the site has been cut and filled locally to provide a level platform.

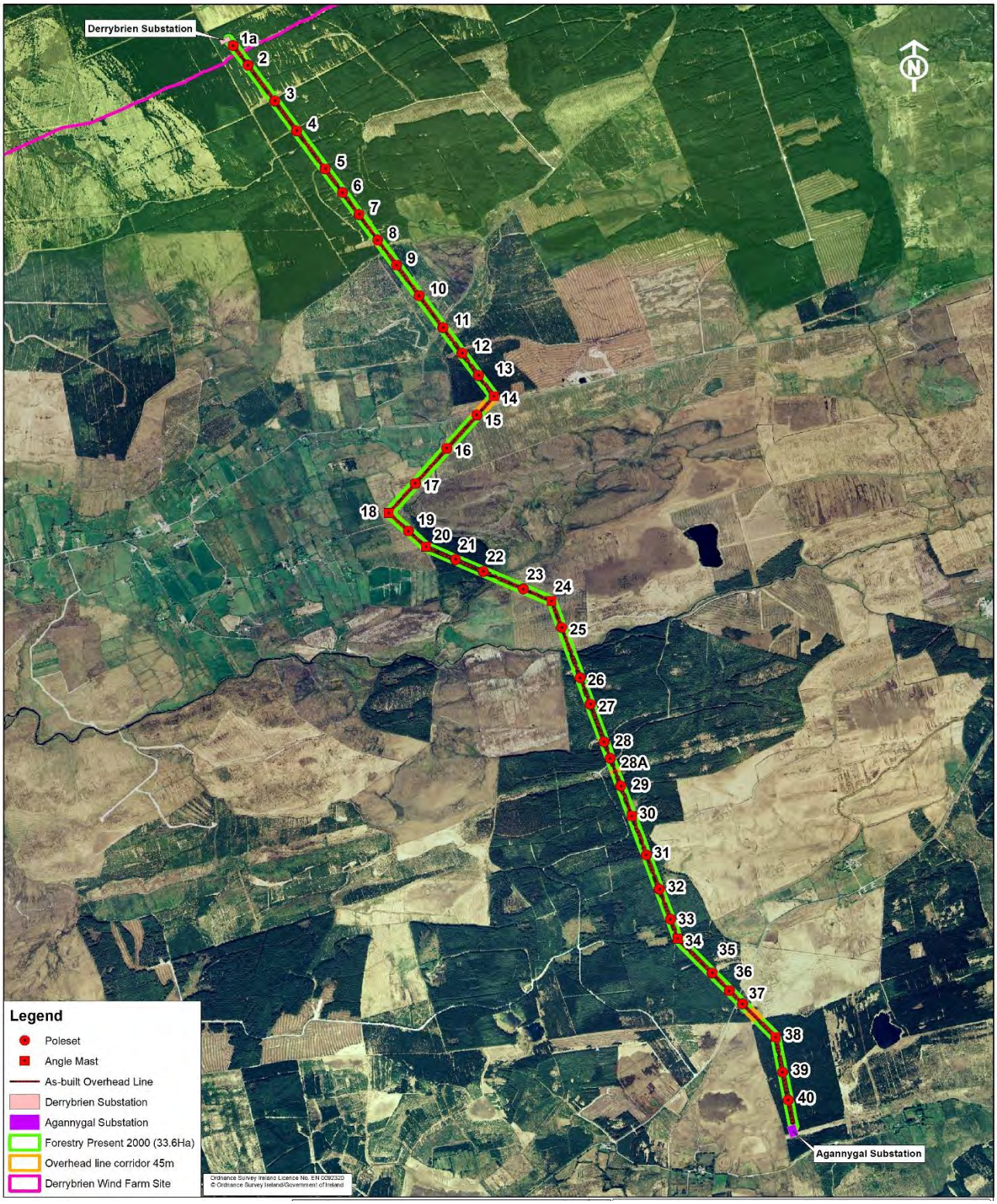


Figure 8-19: Aerial photograph of grid connection prior to construction in 2000

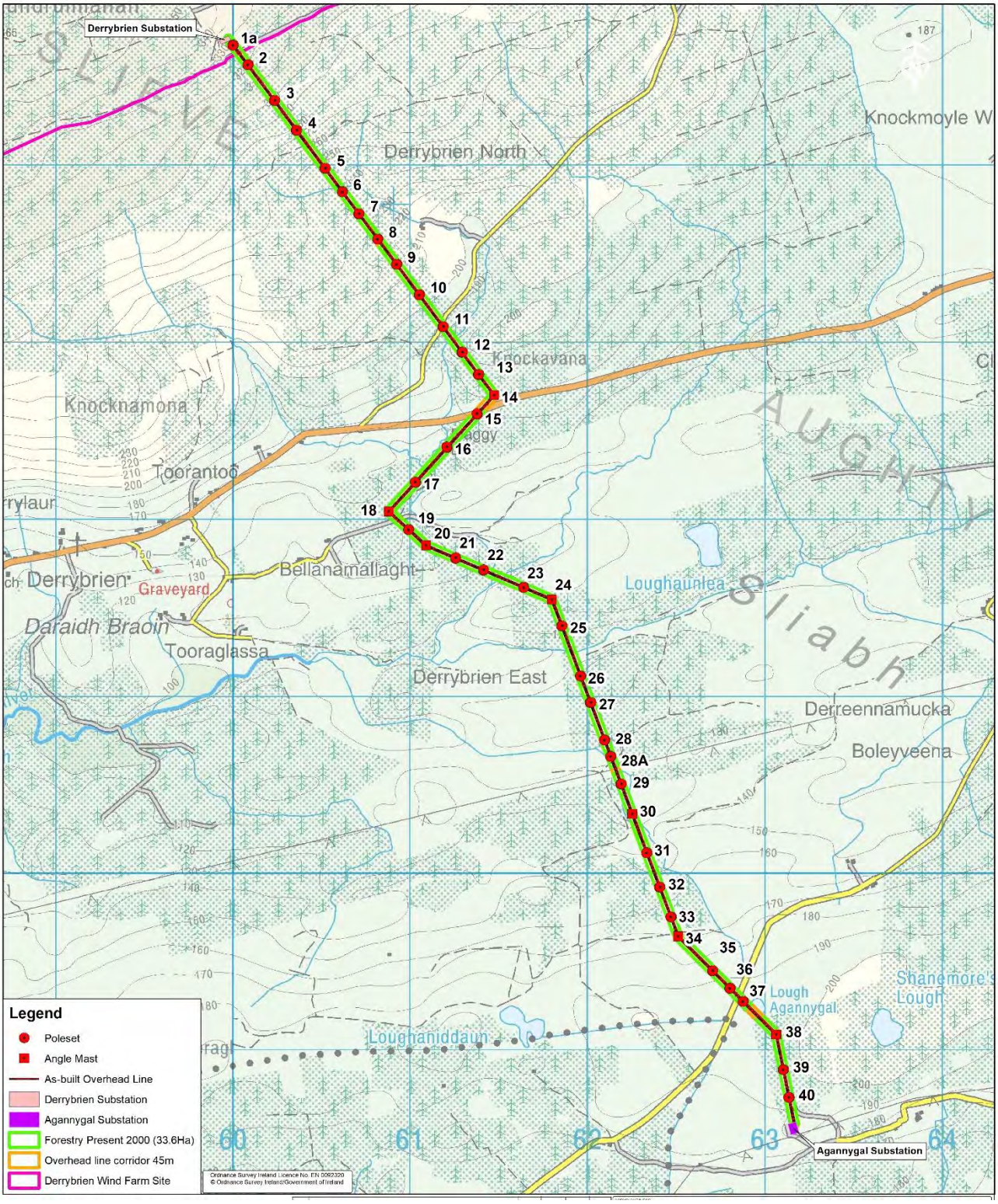


Figure 8-20: General topography along grid connection

8.3.2.3.2 Geotechnical Characterisation of Baseline Conditions

Quaternary Geology & Subsoils Map - GSI

Figure 8-21 shows a map of the Quaternary Geology along the grid connection generated from the Geological Survey of Ireland online database. The grid connection site is covered by blanket peat (BktPt) with locally glacial till (TDSs) present. There are occasional bedrock exposures (Rck), particularly along the banks of the nearby streams and watercourses, together with alluvium (A).

Peat

Most of the grid connection is covered by blanket peat. Figure 8-22 and Figure 8-23 shows the depth of peat along the grid connection. The depth of peat has been interpreted from the peat probes carried out by ESB, AGEC and FT along the grid connection route over a corridor width of 100 m.

The depth of peat recorded along the route ranged from 0.2 to 5.6 m with an average depth of 1.35 m. The peat is generally shallower along the northern part of the route, where the terrain is relatively steeper on the lower slopes of Cashlaundrumlahan Mountain. The deeper peat, say greater than 2.5 m, is localised in a few flatter areas within the southern part of the route.

The deeper peat areas correspond to shallow topographic depressions along the line of the Derrybrien East stream and around Lough Agannygal, see Figure 8-20. The area around Lough Agannygal has the deepest recorded peat with a depth of 5.6 m. This low-lying area was likely a topographic depression that would have originally contained an enclosed water body which over time has slowly infilled with peat, leaving a much smaller partially infilled waterbody, namely Lough Agannygal.

The nature of the blanket peat was assessed from the walkover surveys and ground investigation undertaken by AGEC in 2018 and FT in 2019 and 2022 which showed that the upper 1 m (approx.) of peat was generally very fibrous and locally desiccated becoming less fibrous with depth. The base of the peat from observations from exposures in excavations and along drains on the route, was described using BS5930 as very soft brown amorphous PEAT with recognisable plant structure. Peat appeared to lay directly on bedrock or a weathered rock/glacial till.

Shear strength profiles were measured using a Geonor H-60 hand vane tester at a number of locations by ESB in 2004 and 2005, AGEC in 2018 and FT in 2019 and 2022. A total of +120 no. shear vane strength tests were undertaken at depths from 0.5 to 3.5 m. Values for vane shear strength (unfactored) ranged from 5 to 68 kPa with an average of about 18 kPa, see Figure 8-24.

Typically for undisturbed blanket peat of significant depth there is a decrease in strength with depth. In this case the discernible trend appears to be a slight increase in strength with depth, which would suggest that the peat has been affected by existing forestry drainage.

There are no notable zones of low strength peat recorded. Typically, low strength would be considered to be less than about 5 kPa. The deeper peat areas around enclosed low-lying Lough Agannygal would be expected to have the lowest strength values.

Overall, the vane shear strength (unfactored) of peat along the grid connection was notably greater than that recorded on the windfarm site, this is primarily due to the shallower depth of peat along the grid connection. Shallower peat depth tends to have relatively greater strength due to its more fibrous nature and for it to be more prone to desiccation due to disturbance and drainage, for example.

The peat areas within the grid connection site have been used for commercial managed forestry and are of limited and marginal agricultural land use. There are no identified peat cuttings within the grid

connection site, which would reflect the general shallow nature of peat along the route, as such the peat has very limited economic extractable significance.

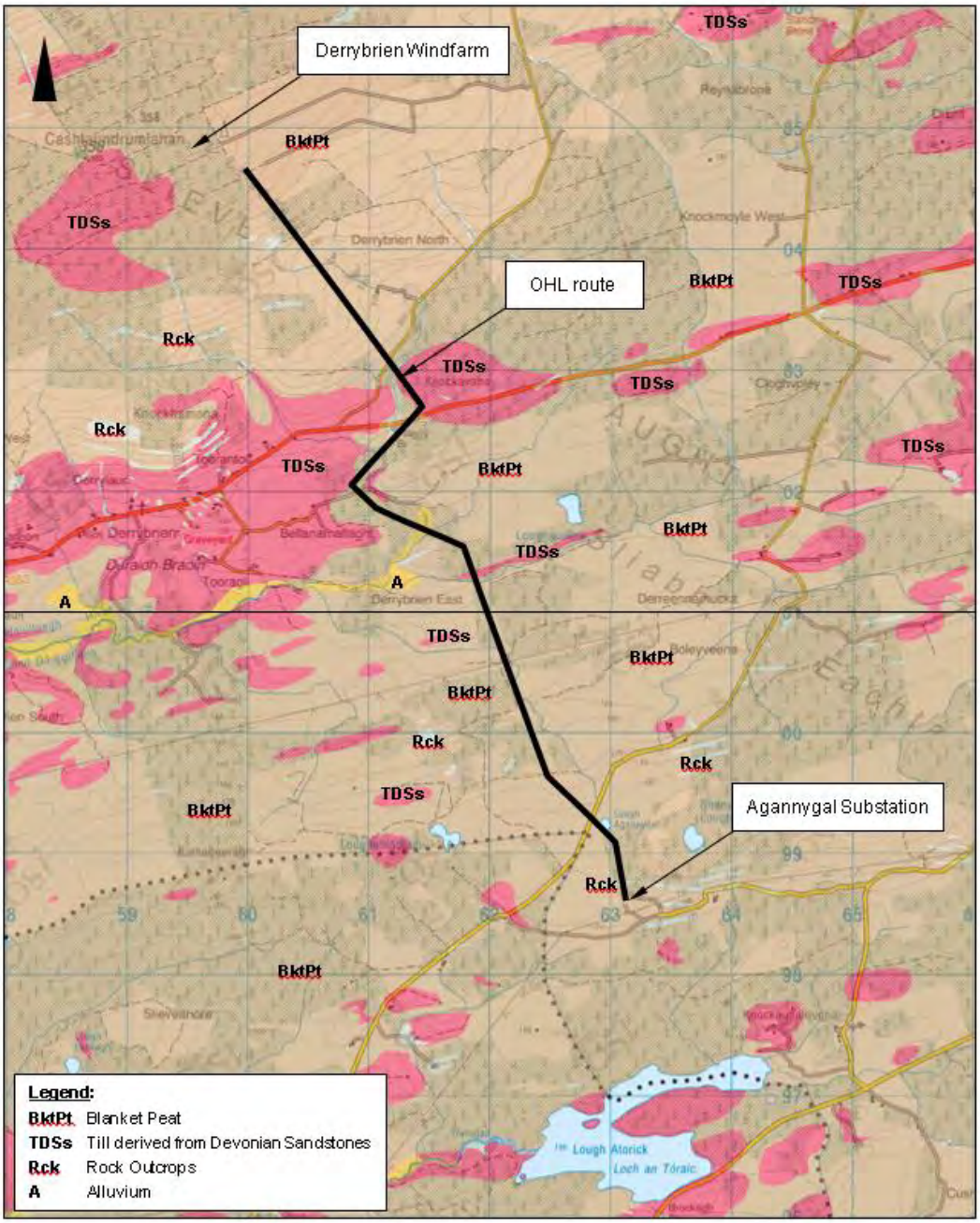


Figure 8-21: Quaternary geology map - grid connection.

Figure 8-22: Peat depths along grid connection (1 of 2) (FT, 2023)

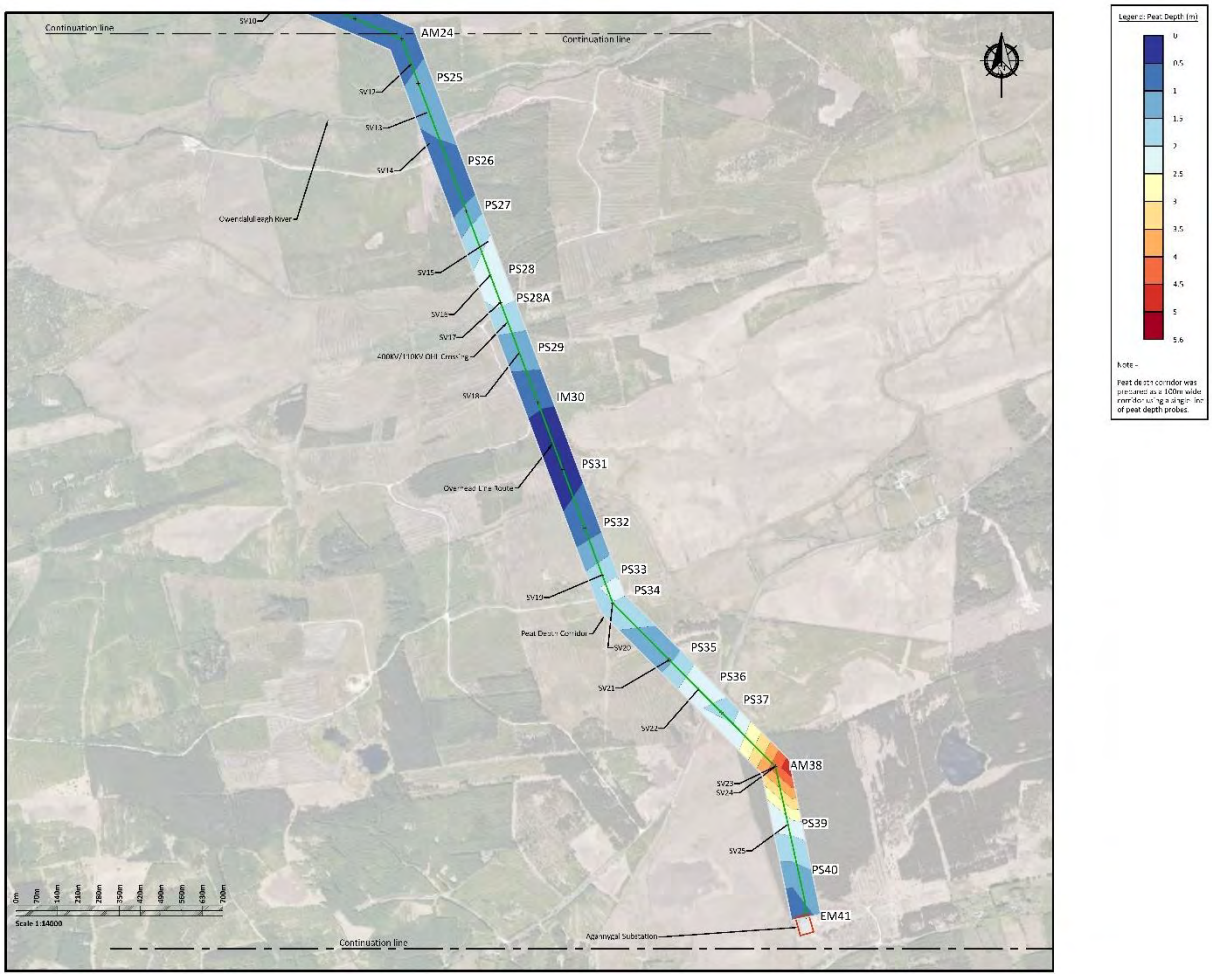


Figure 8-23: Peat depths along grid connection (2 of 2) (FT, 2023)

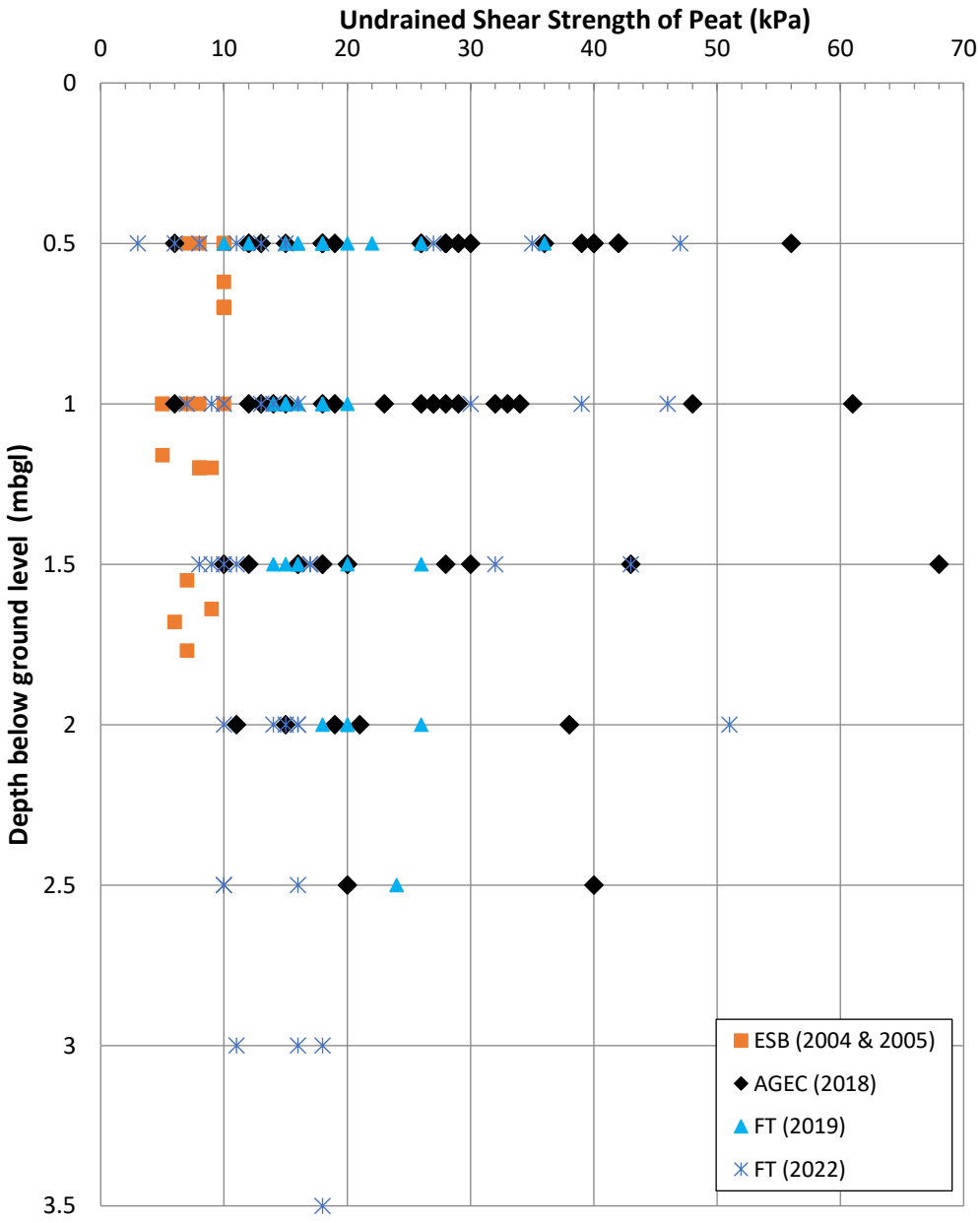


Figure 8-24: Profile of undrained shear strength with depth in peat recorded with Geonor H-60 – grid connection (FT, 2023)

Mineral Subsoil & Glacial Till

Varying thicknesses of glacial soils are present beneath the peat along the grid connection route. Figure 8-21 shows glacial till is locally present in the vicinity of the route. Exposures of glacial till noted during the walkover surveys were described using BS5930 as a reddish brown or whiteish brown well-graded material consisting of sandy slightly gravelly CLAY/SILT with occasional sub-angular to rounded cobbles and boulders of sandstone. The observed till is similar to that described in the above figure, that is till derived from Devonian Sandstones.

Typically, glacial till was encountered below the peat at depths that ranged from 0.2 to 5.6 m, though locally glacial till was at or close to the surface below a layer of peaty topsoil.

Alluvium was recorded along the grid connection route where the Owendalulleagh River and its tributaries cross the route. Alluvium deposits are localised and based on observations during the site

walkover by FT comprise predominantly coarse-grained alluvial soil comprising sand, gravel, cobbles, and boulders.

The mineral subsoil & glacial till are of no proven economic extractable significance.

Bedrock

Figure 8-25 shows the bedrock geology along the grid connection generated from the Geological Survey of Ireland online database.

The route lies dominantly within the Ayle River Formation which comprises mudstones, siltstones and conglomerates. The lower part of the formation is characterised by red siltstones, mudstones with carbonate concretions, sandstones and conglomerates. The nearest boreholes to the route are located within the windfarm site and these show that the Ayle River Formation varied from a medium-grained SANDSTONE to a thinly laminated slightly sandy SILTSTONE.

Localised parts of the route lie within the Derryfadda Formation (greywacke, siltstone and mudstone) and the Visean Limestones (undifferentiated limestone).

There are occasional bedrock exposures at the surface along the route particularly along the banks of the nearby streams and watercourses. A number of the trial pits at the mast locations encountered bedrock within 3 m of the surface. Overall, based on the ground investigation and walkover records the depth to bedrock along the route would be considered shallow with depth varying from near surface to locally greater than 5 m depth.

The general bedrock structure along the grid connection route comprises beds dipping to the southeast at about 0 to 5 degrees. A major fault aligned approximately east-west, which underlies the Owendalulleegh River valley, passes across the route.

The bedrock is not, nor does it contain minerals, of proven economic extractable significance.

8.3.2.3.3 *Geological Heritage Sites*

The Geological Survey of Ireland Spatial Resources interactive map viewer has been reviewed to identify the nearest designated Geological Heritage site to the grid connection as recorded from the Geological Survey of Ireland.

The grid connection route does not lie on or effect any designated Geological Heritage site.

8.3.2.3.4 *Geomorphology and Landslide Susceptibility*

Figure 8-26 shows the geomorphology along the grid connection generated from the Geological Survey of Ireland online database.

The geomorphology represents essentially glacial landforms created during previous Ice Ages. The landforms along the grid connection comprise a diverse range of glacial features that were created by either sub-glacial or ice marginal mechanisms.

The route crosses within the floor of the Owendalulleegh River valley ribbed moraines, which are hummocky wave ridges of sediment deposited by glacial movement, trending in a west-south-west to east-north-east direction. Numerous linearised drumlins are also present along the valley floor.

For most of the route there is very limited earthworks cuttings into the existing landforms. Localised cuttings are present around a number of pole sets and angle masts and on access tracks through the undulating terrain. Between 28A and 29 the OHL route crosses a 400 kV existing OHL where a cut approximately 25 m wide and 120 m long was formed in the mineral soil up to 3.8 m deep.

The landforms along the route are relatively common regionally and nationally and are not designated Geological Heritage sites.

The GSI online database also includes a landslide susceptibility map which provides a classification of the susceptibility of the ground to landslide. The susceptibility map uses a limited number of general factors (i.e. slope, soil type and a Topographic Flow Index) to assess landslide susceptibility. The susceptibility map at best provides a general indication of landslide susceptibility and is not a substitute for detailed investigation, which has been carried out for this assessment.

Along the grid line route, the GSI landslide susceptibility ranges from generally 'moderately low' to 'low' with localised areas of 'moderately high'. The path of the 110 kV overhead line crosses zones of Moderately Low and Moderately High susceptibility from the substation on the wind farm site to the crossing of the R353 near Flaggy Bridge which reflects more challenging conditions. However, this is not unusual for overhead transmission lines. To the south of the R353 the topography is varied and there are also broad zones of Low susceptibility along the route of the 110 kV overhead line. The site of the Agannygal substation is in an area of Low susceptibility, which is suitable for the project.

8.3.2.3.5 Groundwater

The grid connection route passes across a number of watercourses and an area of ponded water (Lough Agannygal) which would indicate that groundwater is close to the surface.

Based on information from the GSI online database, most of the OHL route and the substation is underlain by rock which is considered a poor aquifer (bedrock which is generally unproductive except for local zones). However, the segment of the route underlain by Visean Limestone (Figure 8-25) is considered a locally important aquifer (bedrock which is moderately productive only in local zones) although no evidence for groundwater usage from this aquifer was found.

Groundwater vulnerability ranges from low to extreme across the route, due to the shallow depth to bedrock. All drainage features along the route are noted as giving rise to extreme groundwater vulnerability. Details of hydrogeology are included in Chapter 9.

8.3.2.3.6 Surface Water, Watercourses and Surface Drainage

Figure 8-20 shows the topography and natural watercourses in proximity and that cross the grid connection route. Major watercourses tend to run east to west in the area, such as the Owendalulleagh River, which is approximately 6m wide where it passes beneath the OHL. The minor tributary watercourses are generally aligned approximately north to south and run approximately parallel to the route. Details of surface hydrology are included in Chapter 9.

The terrain along the route comprises several areas of naturally shallow depressions where local ponding of surface water naturally occurs. Such a feature, Lough Agannygal, is located near the southern end of the route.

Surface drainage along the route is generally associated with man-made drainage within the managed commercial forestry. This drainage comprises parallel drain furrows typically less than 1 m deep generally within the peat. Due to the general shallow nature of the peat the drains would essentially drain the full depth of the peat, which would tend to cause a degree of desiccation of the shallow peat.

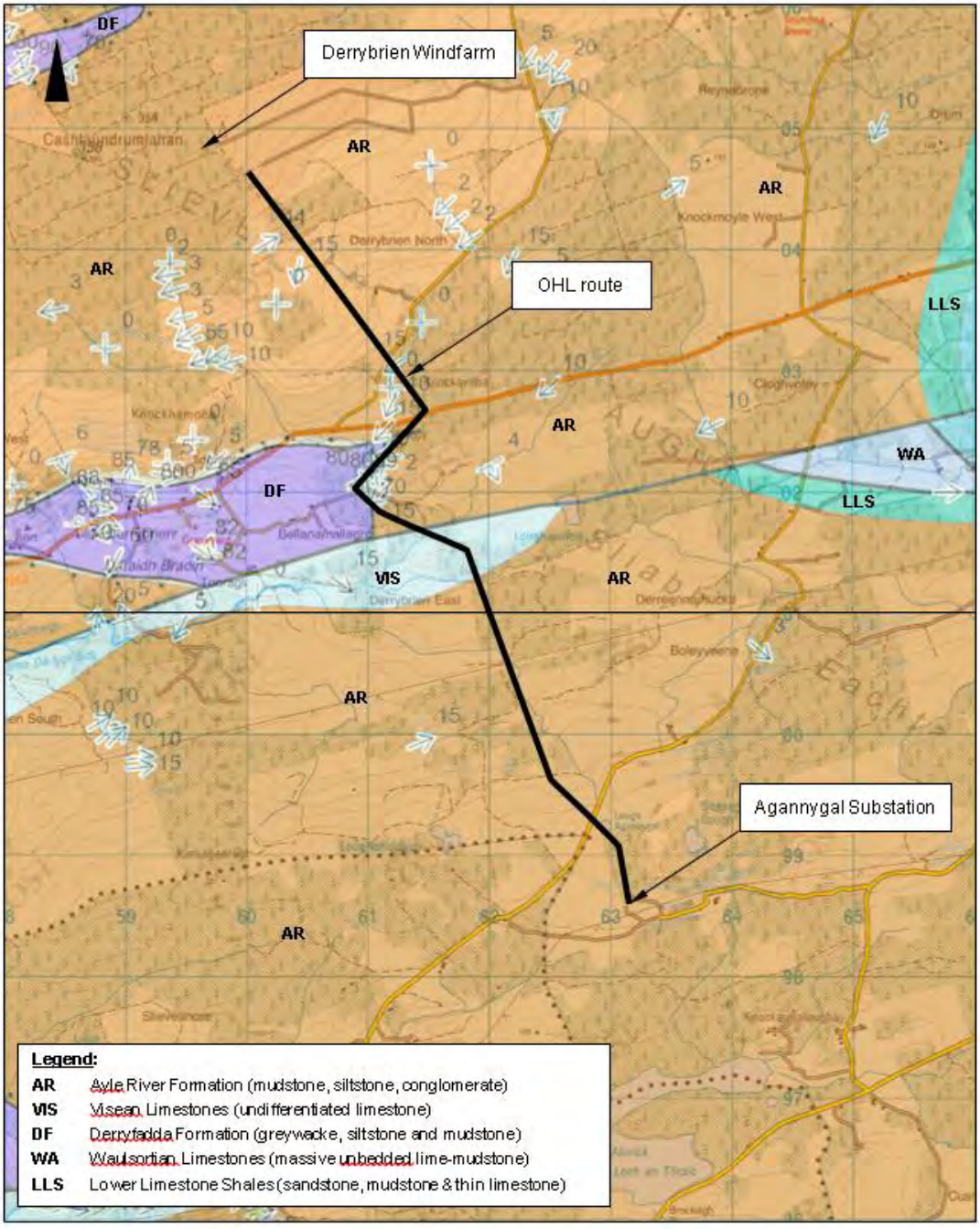


Figure 8-25: Bedrock geology map - Grid connection site

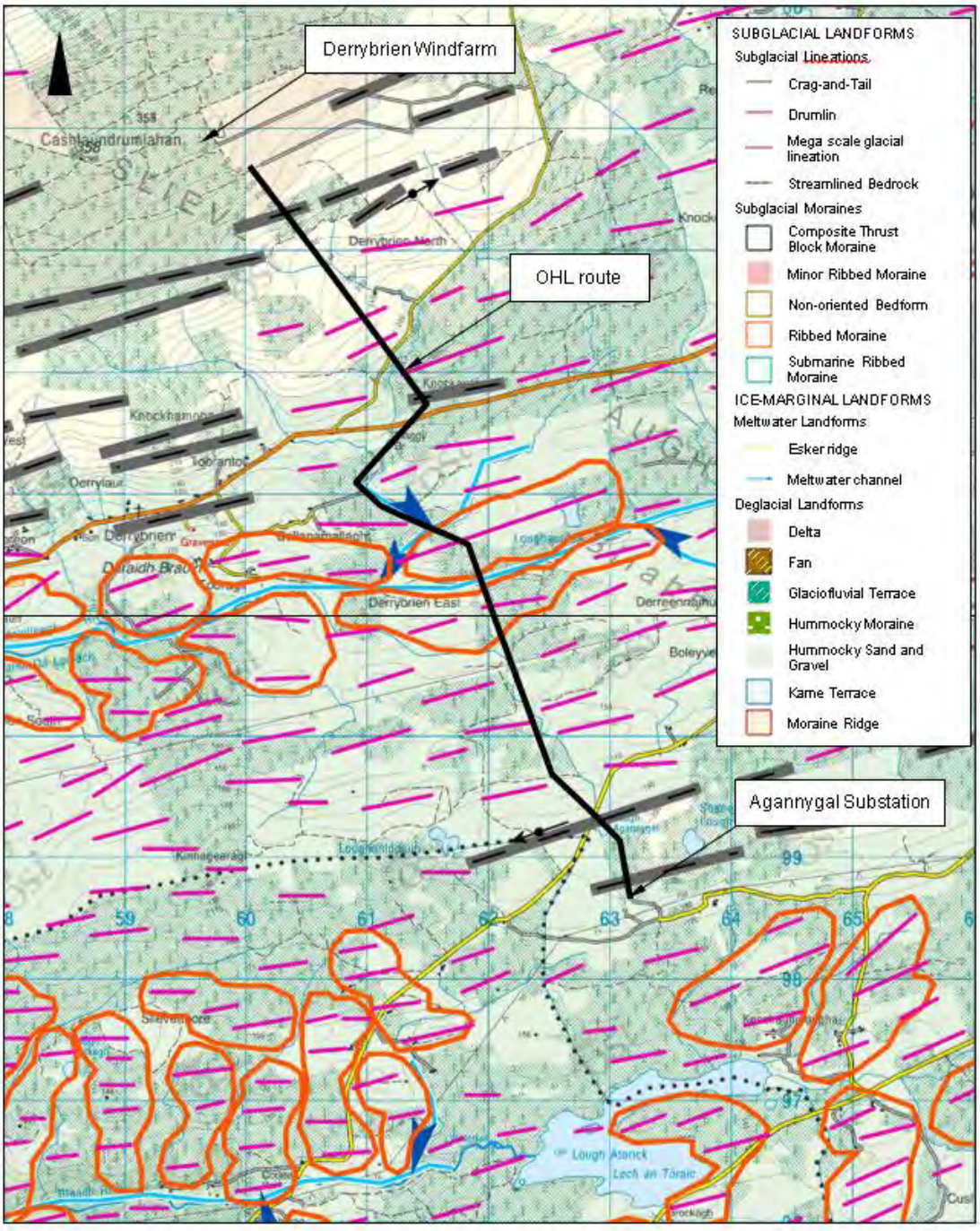


Figure 8-26: Geomorphological map - Grid connection Site

8.3.2.4 Baseline Sensitivity of the Receiving Environment (Soils, Geology & Land Use) for the Grid Connection

The significance of effects on soils, geology and land on the site has been assessed as a function of the sensitivity of the receiving environment using Figure 8-3. The sensitivity of the receiving environment is classified on a 7-point scale from Negligible to High as a function of the characteristics of the soils, geology and land that are directly impacted by this part of the project.

For this part of the project, the majority of the significant effects on soils, geology and land relate to the blanket bog that covers most of the project site, including the grid connection, and surrounding area. Therefore, the characteristics of dominantly the blanket bog govern the classification of the

sensitivity of the receiving environment for assessing the significance of impacts on soils, geology and land on this project. For site stability impacts, consideration has also been given to the characteristics of the blanket bog outside the project site that could be directly impacted by a peat slide on the project site.

For this project the sensitivity of the receiving soils, geology and land has been classified as **MEDIUM** for the Wind Farm site, see details provided in the previous section 8.3.1.4.

For the assessment of site stability impacts the sensitivity of the receiving soils, geology and land that could be impacted by a peat slide has also been classified as **MEDIUM** for the Wind Farm site based on the scale of the very large peat slide that occurred on the site in October 2003, and by the land that that was directly impacted by the slide, see details provided in the previous section 8.3.1.4.

As the soils, geology and land use along the Grid Connection site, and those lands which could be impacted by a peat slide, are predominantly consistent with the Wind Farm site, the sensitivity of the soils geology and land is also assessed as **MEDIUM.**

8.3.3 Baseline Environment – Peat Slide and Associated Works

8.3.3.1 Introduction

This section gives an interpretation of the baseline conditions for soils, geology and land use for the peat slide and response works in 1998, prior to construction of the windfarm project.

The peat slide which occurred in 2003 covered about 25 ha (within the source area) and contained an estimated peat volume of about 450,000 m^3. The associated works included the measures undertaken in response to the peat slide, which comprised the rebuilding of short sections of access tracks within the wind farm site at two locations in the vicinity of T68 and between T23 and T70, the rebuilding of a section of access track on Coillte lands outside of the site, and the construction of 8 no. containment barrages (1 to 4 and A to D) and 3 no. repositories. Of the constructed barrages, 4 no. barrages (A to D) were temporary and are no longer present. Stone from a borrow pit nearby to Barrage 1 was used for some local barrage construction. Bridge repair works were undertaken on the Flaggy Bridge and the Black Bridge, Unnamed Bridge C was replaced, and a set of stepping stones were also replaced. Further details of barrages and repositories construction are included in Chapter 4 and associated Appendix 4-2.

The assessment includes the following:

- Peat slide – source area (1).
- Peat slide – displaced material (1).
- Barrage 1 and associated replacement access track.
- Barrage 2, adjacent repository area and associated access track.
- Barrage 3 and repository area.
- Barrage 4.
- Construction and sourcing of material from borrow pit adjacent to Barrage 1.
- Repository at Black Road Bridge.
- Temporary barrages A to D.
- Bridge repairs to the Flaggy Bridge and Black Bridge.
- Replacement of Unnamed Bridge C.

(1) Note that the peat slide event has been divided into source area and peat material. This is because, even though they are assessed as a single impact, the components of the impact of the source area and displaced material are different and vary over time.

All available information was used to establish the baseline conditions at the peat slide and associated works sites, and in areas off-site that could be impacted by a peat slide. This included a comprehensive review of relevant information from the ground investigations that were carried out, a desk study review of historical aerial photographs, topographical data, and relevant information on ground and groundwater conditions, bedrock, and geological heritage sites from online sources including the Geological Survey of Ireland (GSI), the Environmental Protection Agency (EPA) and the Ordnance Survey of Ireland (OSI).

Section 8.3.3.2 includes a summary of the ground investigations carried out on the peat slide and response works sites from 2003 to 2019, which would be considered representative of the baseline condition.

Section 8.3.3.3 gives a summary of the baseline conditions for the topography and land use, as well as the geotechnical characterisation of the soils, and the geological classification of the bedrock geology. Sections 8.3.3.3.5 and 8.3.3.3.6 give a summary of the groundwater conditions and an overview of the surface water, watercourses and surface drainage, which are particularly relevant to stability.

The characteristics and sensitivity of Geological Heritage Sites (GHS) are assessed in Section 8.3.3.3.3.

The baseline sensitivity of the receiving soils, geology and land impacted by the peat slide and response works has been assessed in Section 8.3.3.4.

8.3.3.2 Geotechnical Investigations

8.3.3.2.1 *Introduction*

Details of ground investigations carried out in the peat slide and response works sites are included in Appendix 8-5 within the report entitled *"Geotechnical Stability Report 2 - Peat Slide and Associated Works"* (FT, 2020). The ground investigation information comprised:

- A comprehensive desk study of available information on soils, geology and groundwater conditions.
- Periodic, (predominantly performed annually), site inspection reports from 2006 to 2019.
- Walkover surveys (from 2006 to 2019) to inspect ground conditions and site stability.
- Trial pits (9 no.) to determine depth and characteristics of peat and subsoils at containment barrages and repositories to depths of about 3 m.
- Mackintosh probes (80 no.) to determine depth and characteristics of peat and subsoils at containment barrages and repositories to depths of about 3 m.
- Peat probing (59 no.) and in-situ vane shear (12 no.) to establish a profile of the depth of peat at containment barrages and repositories.
- Extensive peat probing (+200 no.) to establish a profile of the depth of peat in peat slide source area.
- In-situ vane shear testing (+130 no.) to establish the undrained shear strength of the peat in peat slide source area.

8.3.3.2.2 *Ground Investigations in Peat Slide Source Area (2003 to 2005)*

Following the peat slide extensive ground investigations were carried out at the wind farm site which included the upper part of the source area of the peat slide. These ground investigations are detailed in the previous section and included the following:

- AGEC Ground Investigation (2003) – Appendix 8-1 of this chapter.

- ESBI Ground Investigation (2004) – Appendix 8-2 of this chapter.
- AGL/BAM Supplemental Site Investigations – Construction Stage (Post-Slide – 2004/2005) – Appendix 8-2 of chapter.

8.3.3.2.3 ESB Ground-Related Reports for Derrybrien Wind Farm (2006 to 2019)

ESB International undertook annual site inspections covered the wind farm site and the peat slide and associated works during the operation of the wind farm. The findings of these inspections are presented in a number of "Annual Site Inspection Reports". The reports included for example the findings and recommendations of the monitoring regime for the project based on site walkovers. The recommendations included various site stability related issues to be addressed by wind farm operational manager (e.g. drainage maintenance, road maintenance, performance of retention measures (barrages) etc.).

8.3.3.2.4 AGEC Ground Investigation (2011)

Ground investigations were carried out by AGEC in the source area of the peat slide in December 2011. This comprised peat depth probes and hand shear vanes.

80 no. hand shear vane strength tests were undertaken in the source area of the peat slide in peat at depths from 0.5 to 2 m bgl.

80 no. peat probes were also undertaken in the source area of the peat slide in peat at depths from 0.5 to 2 m bgl.

Shear vane testing was carried out using a Geonor H-60 hand field vane tester. From FT's experience hand vanes give indicative results for the in-situ undrained shear strength of peat and would be considered best practice for the field assessment of peat strength.

8.3.3.2.5 AGEC Ground Investigation (2018)

Ground investigations were carried out by AGEC in the source area of the peat slide, at containment barrages and repository sites in June 2018. This comprised trial pits, peat depth probing and shear vane testing.

17 no. hand shear vane strength tests were undertaken in the source area of the peat slide in peat at depths from 0.2 to 1.3 m bgl.

+20 no. peat probes were also carried out in the source area of the peat slide.

9 no. trial pits at containment barrages and repositories to depths of about 3 m (of which 4 no. were located in the peat slide source area).

80 no. Mackintosh probes were undertaken at containment barrages and repository sites at depths to about 3 m bgl.

12 no. hand shear vane strength tests were undertaken at containment barrages and repositories.

59 no. peat probes were also carried out at containment barrages and repositories.

Shear vane testing was carried out using a Geonor H-60 hand field vane tester. Trial pits were located adjacent to barrages and repositories where there was available access. The purpose of the trial pits was to expose the founding materials.

8.3.3.2.6 FT Ground Investigation & Walkover (2019)

Ground investigation and walkover survey was carried out by FT in the source area of the peat slide and at containment barrages and repository sites in September and October 2019. This comprised hand shear vanes and peat depth probes.

34 no. hand shear vane strength tests were undertaken in the source area of the peat slide in peat at depths from 0.2 to 1.5 m bgl.

+40 no. peat probes were also carried out in the source area of the peat slide.

Shear vane testing was carried out using a Geonor H-60 hand field vane tester.

8.3.3.3 Baseline Conditions (1998) – Soils, Geology & Land Use

8.3.3.3.1 Topography and Land Use

An aerial photograph of the site in 2000 which would reasonably represent the baseline conditions in 1998, is shown on Figure 8-27. The peat slide and the associated works are shown and the land use in the area can be inspected from this figure.

In 1998 most of peat slide footprint and the associated works was managed commercial forestry. Forestry was planted in the project site from 1963 to 1994. The figure shows the main features and land use that were in the area prior to construction, which includes:

- Extent of existing roads prior to construction.
- Extent of existing mature conifer plantations, recently planted/felled plantations and firebreaks.
- Extent of agricultural area.
- Existing watercourses and drainage channels.

In general, the land use prior to the peat slide and the associated works was dominantly managed commercial forestry with some agricultural (pastoral) land.

The topography and land-use for all 8 no. barrages (1 to 4 and A to D) and 3 no. repositories together with the peat slide, which is divided into source area and the displaced material path is included below.

Peat Slide – Source Area

The peat slide source area is located on the upper southern slope of Cashlaundrumlahan Mountain, see Figure 8-30. The upper southern slope forms a gently sloping plateau aligned on a northeast to southwest axis.

The upper southern slope of the mountain is generally uniform with inclinations of typically from 3° to 5°. The source area is located in the head of a shallow valley which forms a subdued topographic depression in the topography. The peat slide occurred at the head of the valley that contained a tributary stream (SC7b) of the Owendalulleegh River.

Prior to construction of the project, the land use within the peat slide source area and on the upper slopes of Cashlaundrumlahan Mountain were managed commercial forestry, which extended downslope to above the Black Road Bridge.

Peat Slide - Material

The path of the peat slide followed a tributary stream valley (SC7b) of the Owendalulleegh River. From the source area, the peat slide passed down the tributary stream valley which narrows to form a steep-sided channel at about 250 m AOD before widening downslope above c.195 m AOD, which is the location of the Black Road Bridge, see Figure 8-30.

Below the Black Road Bridge (c.195 m AOD), the tributary stream follows a more southerly course within forestry to the Flaggy Bridge. Below the Flaggy Bridge (c.150 m AOD) the stream meanders around a number of shallow relief landforms in the floor of the Owendalulleegh River valley and is joined by further tributary streams (SC7a and SC7c) before joining the Owendalulleegh River about 1.3 km south of local road R353 (location of Flaggy Bridge).

The presence of the peat slide material is notably reduced beyond the confluence with the Owendalulleagh River and essentially there is no reported material deposited on the river banks after about 3.1 km downstream of the confluence with the Owendalulleagh River, see Figure 8-27.

At this location the peat slide debris would be entirely suspended within the river water and would be considered technically the termination point of the peat slide debris run-out for the purposes of the soils, geology and land impact assessment.

The length of the peat debris path from the end of the source area (assuming at about 250 m AOD) to the point where the peat slide debris was entirely suspended within river water is estimated at 6.9 km. Assuming an average width of debris path of 30 m then the footprint of the debris was about 17.4 ha.

Between barrage 2 and the Black Road Bridge the displaced material extended beyond the stream channel to an estimated total width of up to 100 m before narrowing and passing downstream. Below the Black Road Bridge, the extent of the land affected by the peat debris comprised up to about 10m width on either bank of the stream/river. The amount of deposited material on the banks reduced downstream.

Prior to construction of the project, the land use on the banks of the river/stream was a mix of managed commercial forestry and agricultural land. The mix of managed commercial forestry and agricultural land is typically classed as coniferous forestry and transitional woodland scrub by the EPA Corine mapping dataset.

Barrage 1 and Replaced Access Track

Containment barrage 1 is located within the source area of the peat slide about 1.2 km downslope of the head of the source area. The barrage was constructed to contain peat material but it also provides part of the replacement access road for the previous forestry access that was destroyed during the peat slide.

The barrage, which is predominantly constructed from large boulders, is located on the southern slope of Cashlaundrumlahan Mountain at an elevation of about 265m OD. The footprint of the barrage is approximately 94 m long and 8 m wide and it is aligned in a northeast to southwest direction.

The replacement access track, 830m long and 4.5 m wide, constructed to re-connect sections of forestry tracks existing prior to the slide in 2003 includes the barrage and a floated section of access track extending westerly from the barrage.

Average slope at the barrage are about 3 degrees and along the replacement access track is 2 to 3 degrees.

Ground conditions prior to the barrage and replaced access track would have comprised an estimated 1.5 to 2.5 m of peat over firm Silt/Clay or medium dense sand with many cobbles and boulders. The barrage was founded below the peat, the replaced access track is floating on the peat.

Prior to the peat slide the land-use was managed commercial forestry.

Barrage 2 and Repository Area

Containment barrage 2, which is predominantly constructed from large boulders, is located within the downstream end of a narrow steep-sided channel at approximately 245 m AOD (Figure 8-30). The footprint of the barrage is approximately 17 m long and 20 m wide. The general area comprises level ground, except within the stream channel, which is incised some 3 to 4 m.

There is a repository area adjacent to barrage 2 which comprises 2 no. separate storage areas used for storage of material removed from the upslope face of the barrage. The footprint of the repository is approximately 108 m long and 34 m wide.

As part of the construction of the barrage, a floated access track was constructed from the existing Coillte forestry track to the site of barrage 2. The footprint of the access track is 284 m long and about 4.5 m wide. The track is aligned downslope and connects to the existing Coillte forestry track at 265 m AOD. Average slope angle along the track is 3 to 4 degrees.

Prior to the peat slide the land-use was managed commercial forestry with the barrage located in the existing stream channel.

Barrage 3 and Repository Area

Containment barrage 3, which is predominantly constructed from large boulders, is located within the stream channel at 180 m AOD (Figure 8-30). At the barrage site, rock is exposed within the stream channel. The general area comprises level ground.

The footprint of the barrage is approximately 41 m long and 9 m wide.

There is a sunken repository area adjacent to barrage 3 used for storage of material removed from the upslope face of the barrage. The footprint of the repository is approximately 41.5 m long and 16 m wide.

As part of the construction of the barrage, temporary access was gained by construction plant from the existing Black Road to the northwest to the site of barrage 3. The access route is 100 m long and about 3 m wide. The access is aligned downslope and connects to the existing road at about 190 m AOD.

Prior to the peat slide the land use was managed commercial forestry with the barrage located in the existing stream channel.

Barrage 4

Containment barrage 4, which is predominantly constructed from large boulders is located within the stream channel at 170 m AOD (Figure 8-30). At the barrage site, rock is exposed within the stream channel. The general area comprises level ground.

The footprint of the barrage is approximately 25 m long and 10 m wide.

Temporary access was gained from the existing Black Road to the west to the site of barrage 4. The footprint of the access route is 100 m long and about 3 m wide. The access is aligned downslope and connects to the existing road at about 175 m AOD

Ground conditions included shallow peaty topsoil overlying shallow bedrock beside the stream with bedrock exposed in the stream.

Prior to the peat slide the land-use in the area of Barrage 4 was managed commercial forestry with the barrage located in the existing stream channel.

Repository at Black Road Bridge

The repository at Black Road Bridge is located to the east of the stream on essentially level ground within Coillte land at 200 m AOD (Figure 8-30). The repository comprises 2 no. separate storage areas used for storage of slide material that accumulated on the open area of ground above the Black Road Bridge.

The northwest section is approximately 130 m long and 73 m wide with an estimated area 5322 m^2, the south east section is approximately 68 m long and 51 m wide; estimated area 2898 m^2.

Access to the repository was from an existing track from the Black Road.

Ground conditions included shallow peaty topsoil overlying slightly gravelly very sandy Clay.

Prior to the peat slide the land-use was managed commercial forestry, though few trees were planted in the footprint of the repository.

Temporary Barrages A to D

Temporary containment barrages were constructed after the peat slide event from October to November 2003 and were subsequently eroded or removed sometime after the slide event. Date of removal is not known. The location and dimension of these temporary barrages is estimated. The topography and land-use at the location of the temporary barrages is given in Table 8-2.

Table 8-2: Temporary Containment Barrages (A to D)

Barrage	Footprint Dimensions	Topography and Land-use
Temporary Containment Barrage A	Estimated: 80m (long), 3m (wide)	Located upstream of Black Road Bridge on open level ground across stream channel at 200 m AOD. Access direct from existing road. Prior to the peat slide the land-use was agricultural grass land.
Temporary Containment Barrage B	Estimated: 80m (long), 3m (wide)	Located upstream of Black Road Bridge on open level ground across stream channel at 200 m AOD. Access direct from existing road. Prior to the peat slide the land-use in the area was agricultural grass land.
Temporary Containment Barrage C	Estimated: 20m (long), 3m (wide)	Located upstream of Flaggy Bridge on R353 within stream channel at 160 m AOD. Temporary access direct from existing road through managed commercial forestry. Prior to the peat slide the land-use in the area was managed commercial forestry with the barrage located in the existing stream channel.

Barrage	Footprint Dimensions	Topography and Land-use
Temporary Containment Barrage D	Estimated: 20m (long), 3m (wide)	Located downstream of Flaggy Bridge on R353 within stream channel at 150 m AOD. Temporary access direct from existing road through managed commercial forestry. Prior to the peat slide the land-use in the area was managed commercial forestry with the barrage located in the existing stream channel.

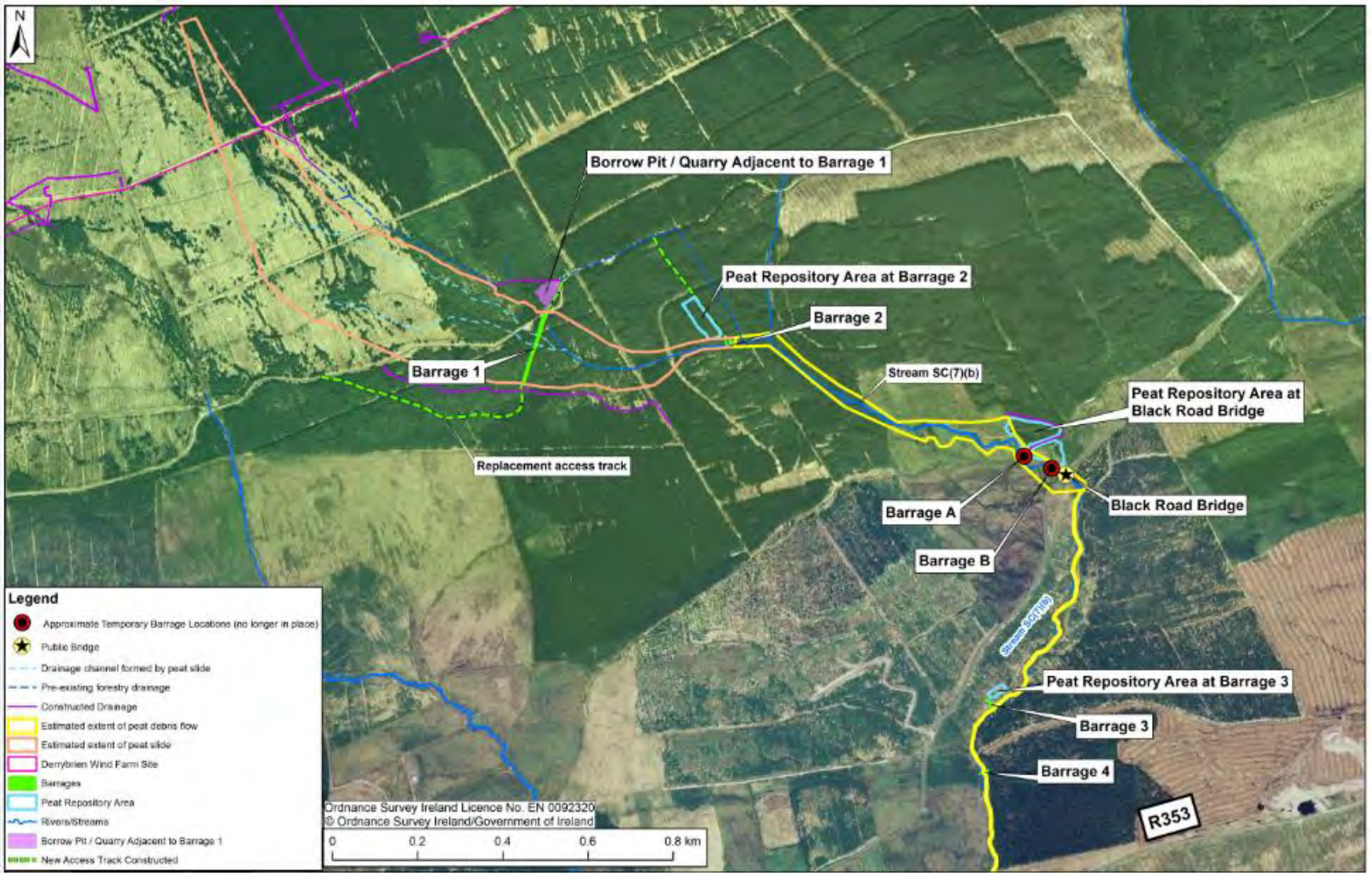


Figure 8-27: Aerial photograph of peat slide and associated works (c. 2000) (1 of 3)

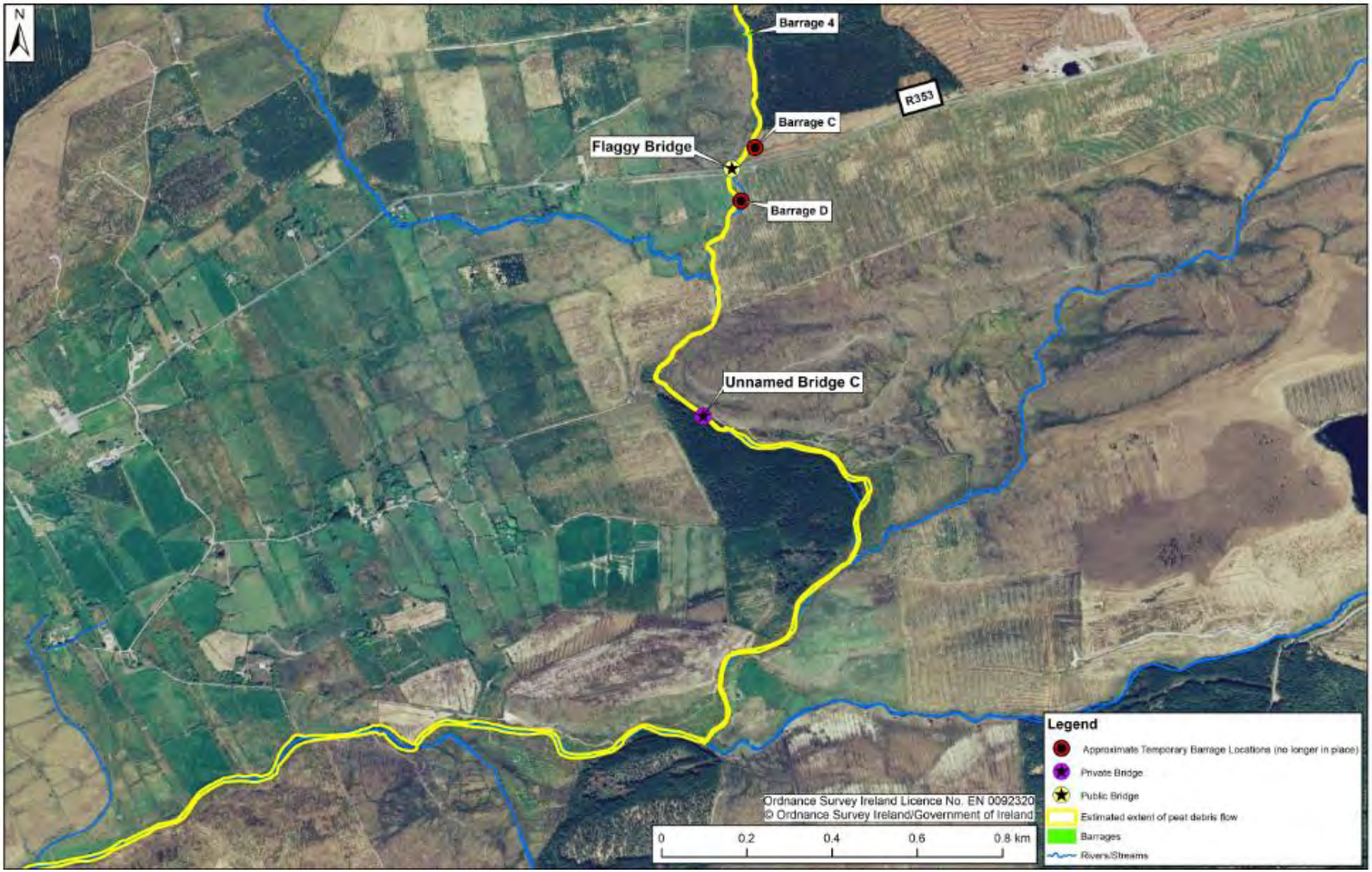


Figure 8-28: Aerial photograph of peat slide and associated works (c. 2000) (2 of 3)

Figure 8-29: Aerial photograph of peat slide and associated works (c. 2000) (3 of 3)

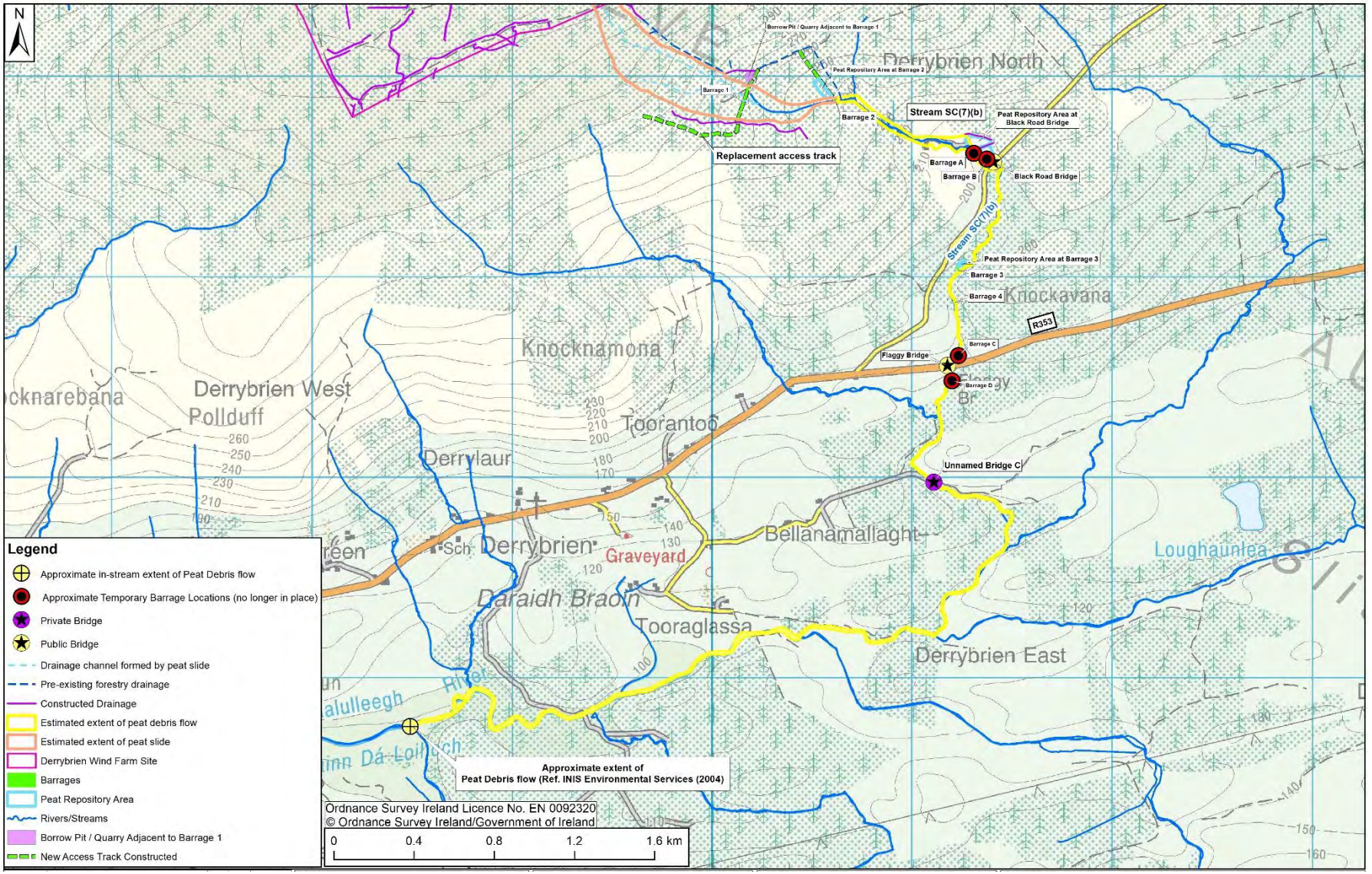


Figure 8-30: General topography – peat slide and associated works

8.3.3.3.2 Geotechnical Characterisation Conditions

Quaternary Geology & Subsoils Map - GSI

Figure 8-31 shows a map of the Quaternary Geology for the peat slide and associated work sites generated from the Geological Survey of Ireland online database. The peat slide and associated work sites are dominated by blanket peat (BktPt) with locally glacial till (TDSs) present. There are occasional bedrock exposures (Rck), particularly along the banks and bed of the stream, together with alluvium (A).

Peat

Peat Slide – Source Area

The peat slide source area is within blanket peat. This is consistent with site walkover and ground investigation findings. The thickness of peat, based on ground investigation, typically ranged from 1 to 4 m. There is no clear pattern of peat thickness, though locally thicker peat was recorded in the upper part of the area where slope angles are less. Further downslope, blanket peat thins.

Examination of peat exposures within the slide source area showed humification at the base of the peat varied from about H6 to H9 (Hobbs, 1986). The upper 1 m (approximately) of peat is generally very fibrous and locally desiccated which results in a relatively stronger and stiffer upper layer. The base of the peat, from observations within the source area, trial pits and in exposures in excavations and along drains, was described using BS5930 as very soft to soft brown to dark brown pseudo-fibrous and amorphous PEAT. Peat appeared to lie directly on bedrock or a glacial till/subsoil.

Shear strength profiles were measured using a Geonor H-60 hand vane tester at a number of locations by AGEC in 2011, 2018 and by FT in 2019. A total of +130 no. shear vane strength tests were undertaken at depths from 0.3 to 2 m. Values for vane shear strength (unfactored) ranged from 4 to 38 kPa with an average of about 17 kPa, see Figure 8-32.

Peat Slide – Displaced Material

Blanket peat thickness reduces downslope, with peat thickness reducing notably just above the Black Road Bridge where agricultural fields are present. Below the Black Road Bridge there is a mix of thin peat cover and glacial soils with rock at shallow depth or exposed and alluvium along the river channel.

Barrage 1 and Replacement Access Track

Barrage 1 is located in the source area and is founded on competent glacial soils. The original peat depth at this location prior to the peat slide is estimated at about 2 m.

No peat is present below the barrage.

The section of access track extending westerly from barrage 1 was constructed as a floating track on peat. The floating access track is estimated to be placed on peat about 0 to 1.5 m depth based on nearest available data.

Barrage 2 and Repository Area, and Access

Based on a trial pit carried out adjacent to barrage 2, the barrage is founded on glacial soil within the stream. Prior to the peat slide it is highly unlikely that peat would have been present at the location of the barrage.

The repository area adjacent to barrage 2 is founded on about 1 m depth of peat.

The floated access track to the barrage is estimated to be placed on peat up to about 1.5 m depth.

Barrage 3 and Repository Area

Barrage 3 located within the stream channel is founded on likely bedrock. Prior to the peat slide it is highly unlikely that peat would have been present at the location of the barrage.

The repository area adjacent to barrage 3 is founded on mixed ground conditions which are likely to comprise non-peat material i.e. silt and sand deposits. No in situ peat is present.

Barrage 4

Barrage 4 located within the stream channel is founded on likely bedrock. Prior to the peat slide it is highly unlikely that peat would have been present at the location of the barrage.

Repository at Black Road Bridge

The repository area is founded on minimal (about 0.3 m) in-situ peat. Inspection of the general area shows generally peaty topsoil present at existing ground level in the area. The in-situ peat cover in this area is unlikely to have been greatly affected by the peat slide.

Temporary Barrages A to D

Temporary barrages A and B were located in proximity to the repository at Black Road Bridge. Inspection of the general area shows generally peaty topsoil present at the existing ground level.

Temporary barrages C and D were located within the stream close to the Flaggy Bridge. Inspection of the ground conditions in the stream at these locations shows mixed rock and granular alluvial deposits, which may include some glacial soil. No peat was present.

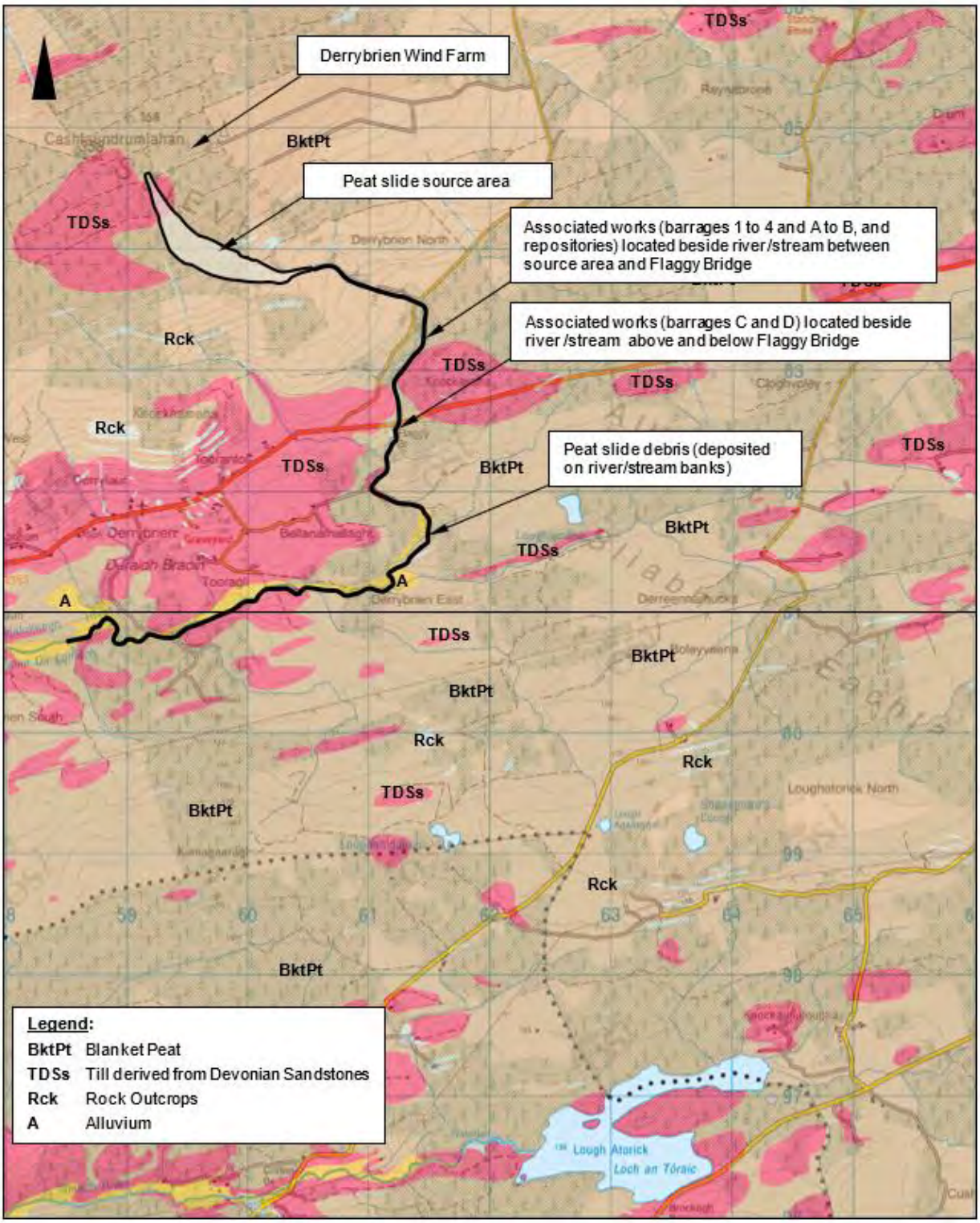


Figure 8-31: Quaternary geology map – peat slide and associated works

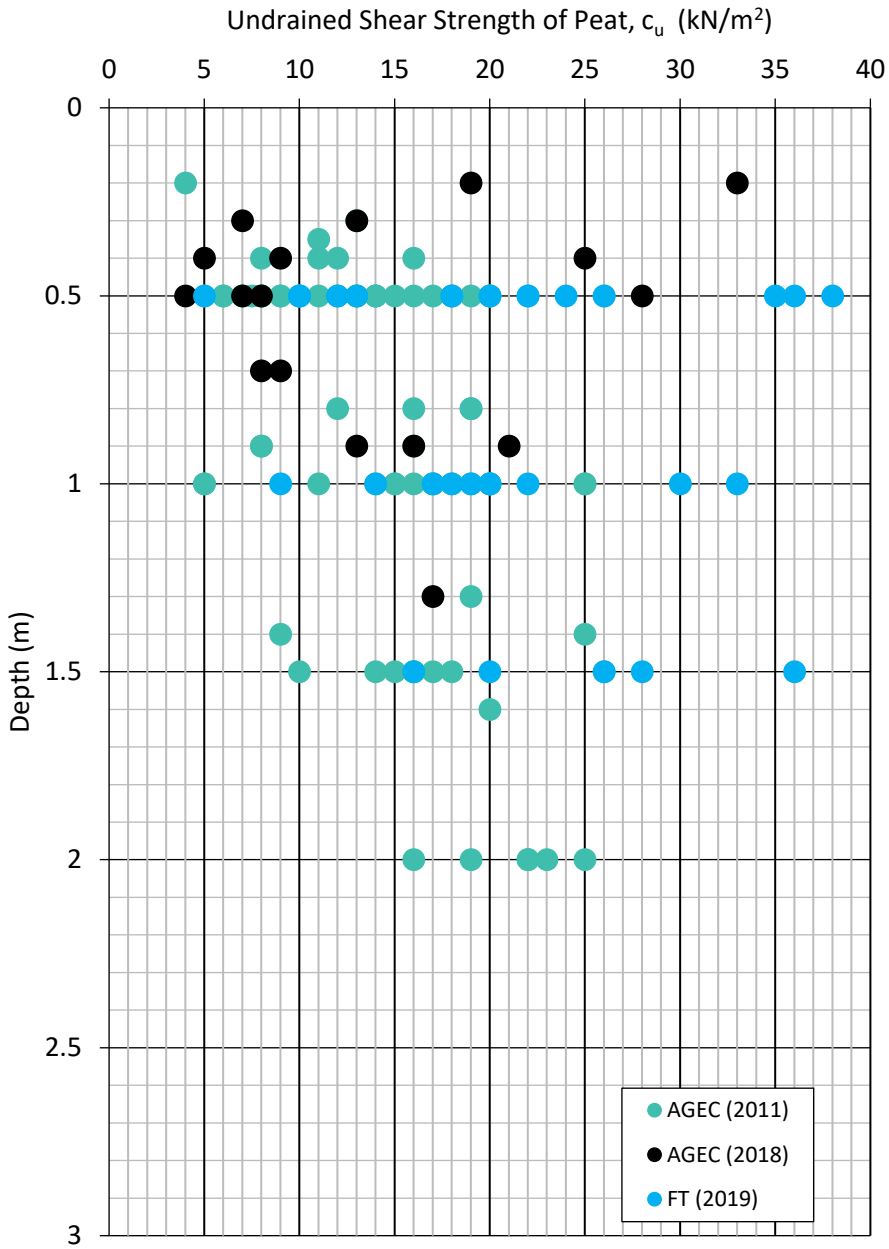


Figure 8-32: Profile of undrained shear strength with depth in peat recorded with Geonor H-60 – peat slide source area (FT, 2020)

Glacial Soils

Peat Slide – Source Area

Within the peat slide source area, peat is underlain by glacial soil or slightly silty sandy subsoil. The subsoil is likely derived from weathered rock. Generally, in exposures in the source area, both glacial soil and a subsoil layer were present below the peat and above weathered rock/rockhead.

The glacial soil within the source area was generally described as sandy gravelly SILT/CLAY with occasional to many sub-angular to rounded cobbles and boulders of sandstone. Subsoil was described as generally loose to medium dense silty Sand with occasional sandstone and quartz gravel.

Peat Slide – Material

Blanket peat thickness reduces downslope, with peat thickness reducing notably just above the Black Road Bridge where agricultural fields are present. Below the Black Road Bridge there is a mix of thin peat cover over glacial soils or exposed rock or alluvium.

Barrage 1

Barrage 1 located in the source area is founded on glacial soils, which prior to the peat slide would have underlain the peat. The description of the glacial soil is as given for the peat slide source area.

The access track to the barrage is either underlain directly by glacial soil (or weathered rock) or peat which would be underlain by glacial soil.

Barrage 2, Access Track and Repository Area

Based on a trial pit carried out adjacent to barrage 2, the barrage is founded on glacial soil. The repository area adjacent to barrage 2 and the floated access track are founded on about 1 to 1.5 m depth of peat, which is likely underlain by glacial soil.

Barrage 3 and Repository Area

Barrage 3, located within the stream channel, and the adjacent repository area are likely founded on bedrock. Localised glacial soil may also be present in particular at the base of the repository.

Barrage 4

Barrage 4 located within the stream channel is likely founded on bedrock. Localised glacial soil may also be present.

Repository at Black Road Bridge

The repository area is founded on minimal in situ peat which is likely underlain by glacial soil. Inspection of the drainage channels and watercourse surrounding the repository indicates glacial soils underlay the peat deposits at shallow depths.

Temporary Barrages A to D

Temporary barrages A and B were located in proximity to the repository at Black Road Bridge. Inspection of the area shows generally peaty topsoil present, which is likely underlain by glacial soil based on inspection of local watercourses and drainage channels.

Temporary barrages C and D were located within the stream close to the Flaggy Bridge. Inspection of the ground conditions in the stream at these locations shows mixed rock and granular alluvial deposits, which may include some glacial soil.

Alluvial Soils

Alluvial soils are present within the lower part of the tributary stream that flows from Cashlaundrumlahan Mountain and within the Owendalulleagh River about 1 km below the Flaggy bridge (Figure 8-31). Alluvial deposits are confined essentially to the stream/riverbed and consist of essentially a mix of sand, gravel, cobbles, and boulders. Whilst there may be some minor alluvial deposits below some of the barrages this would not be considered significant.

Rock

Figure 8-33 shows the bedrock geology along the peat slide and associated work sites generated from the Geological Survey of Ireland online database.

The dominant rock is the Ayle River Formation which comprises mudstones, siltstones and conglomerates. The lower part of the formation is characterised by red siltstones, mudstones with carbonate concretions, sandstones and conglomerates. The nearest boreholes to the route are located within the windfarm site and these show that the Ayle River Formation varied from a medium-grained SANDSTONE to a thinly laminated slightly sandy SILTSTONE.

Localised parts of the tributary lie within the Derryfadda Formation (greywacke, siltstone and mudstone) and the Visean Limestones (undifferentiated limestone).

There are occasional bedrock exposures at the surface particularly along the banks and bed of the stream. Overall, based on the ground investigation and walkover records the depth to bedrock along the tributary would be considered shallow.

The general bedrock structure in the area comprises beds dipping to the southeast at about 0 to 5 degrees. A major fault aligned approximately east-west, which underlies the Owendalulleegh River valley, passes across the route.

The bedrock is not, nor does it contain minerals, of proven economic extractable significance.

8.3.3.3.3 Geological Heritage Sites

The Geological Survey of Ireland Spatial Resources interactive map viewer has been reviewed to identify the nearest designated Geological Heritage site to the Peat Slide Response Works as recorded from the Geological Survey of Ireland.

The Peat Slide Response Works do not lie on or effect any designated Geological Heritage sites.

8.3.3.3.4 Geomorphology and Landslide Susceptibility

Figure 8-34 shows the geomorphology in the peat slide and associated work sites generated from the Geological Survey of Ireland online database.

The geomorphology represents essentially glacial landforms created during previous Ice Ages. The landforms in the area comprise a diverse range of glacial features that were created by either sub-glacial or ice marginal mechanisms.

The peat slide and associated work sites are located along an existing river/stream course which naturally passes around the mapped landforms, such as the ribbed moraines and linearised drumlins present on the floor of the Owendalulleegh River valley.

For most of the peat slide and associated work sites there is very limited disturbance of the existing landforms except in the peat slide source area. In the peat slide source area, the peat has been disturbed and moved, however the geomorphological landforms at this location comprise streamlined bedrock. The peat itself is not part of the mapped landforms.

The landforms in the area are relatively common regionally and nationally and are not designated Geological Heritage sites.

The GSI online database also includes a landslide susceptibility map which provides a classification of the susceptibility of the ground to landsliding. The susceptibility map uses a limited number of general factors (i.e. slope, soil type and a Topographic Flow Index) to assess landslide susceptibility.

The susceptibility map at best provides a general indication of landslide susceptibility and is not a substitute for detailed investigation, which has been carried out for this assessment. Within the peat slide and associated works areas, the GSI landslide susceptibility ranges from generally 'moderately low' to 'low'.

8.3.3.3.5 Groundwater

The peat slide and associated work sites are essentially within the tributary stream valley (SC7b) of the Owendalulleegh River which would indicate that groundwater is close to the surface.

Based on information from the GSI online database, most peat slide and associated work sites are underlain by rock which is considered a poor aquifer (bedrock which is generally unproductive except for local zones). However, the lower part of the peat slide path is underlain by Visean Limestone (Figure 8-33) which is considered a locally important aquifer (bedrock which is moderately productive only in local zones) although no evidence for groundwater usage from this aquifer was found.

Groundwater vulnerability ranges from low to extreme across the route, due to the shallow depth to bedrock. Details of hydrogeology are included in Chapter 9.

8.3.3.3.6 Surface Water, Watercourses and Surface Drainage

Figure 8-30 shows the topography and natural watercourses in proximity to the peat slide and associated work sites, which are essentially within the tributary stream valley (SC7b) of the Owendalulleegh River. Details of surface hydrology are included in Chapter 9.

Within the peat slide source area man-made drains, which were within the forestry prior to the peat slide, comprised a series of narrow open drains, typically 1 to 2 m deep with closely spaced furrows. The forestry drainage would have connected to the natural valley drainage in the area and flowed downslope.

The peat slide followed the tributary stream valley (SC7b) of the Owendalulleegh River. Peat slide material passed down this valley which widens above the Black Road Bridge. Below the Black Bridge Road (c.195 m AOD), the tributary stream follows a more southerly course within forestry to the Flaggy Bridge. Below the Flaggy Bridge (c.150 m AOD) the stream is joined by further tributary streams (SC7a and SC7c) before joining the Owendalulleegh River about 1.3 km south of local road R353 (location of Flaggy Bridge).

The impact of the peat slide is notably reduced beyond the confluence with the Owendalulleagh River with only some peat deposits recorded on the riverbanks. There was essentially no material reported deposited on the riverbanks after about 3.1 km downstream of the confluence with the Owendalulleagh River. A survey of the river following the peat slide by Inis Environmental Services (2004) recorded that the river in *"this section is unchanged from its original form"*. At this location the peat slide material would be entirely suspended within the river water and would be considered technically the termination point of the peat slide debris run-out for the purposes of the assessment of impacts on soils, geology and land.

The length of the peat debris path from the end of the source area (assuming at about 280 m AOD) to the point where the peat slide was entirely suspended within river water is estimated at 6.9 km. The Owendalulleagh River flows westward to Lough Cutra approximately 22 km downstream.

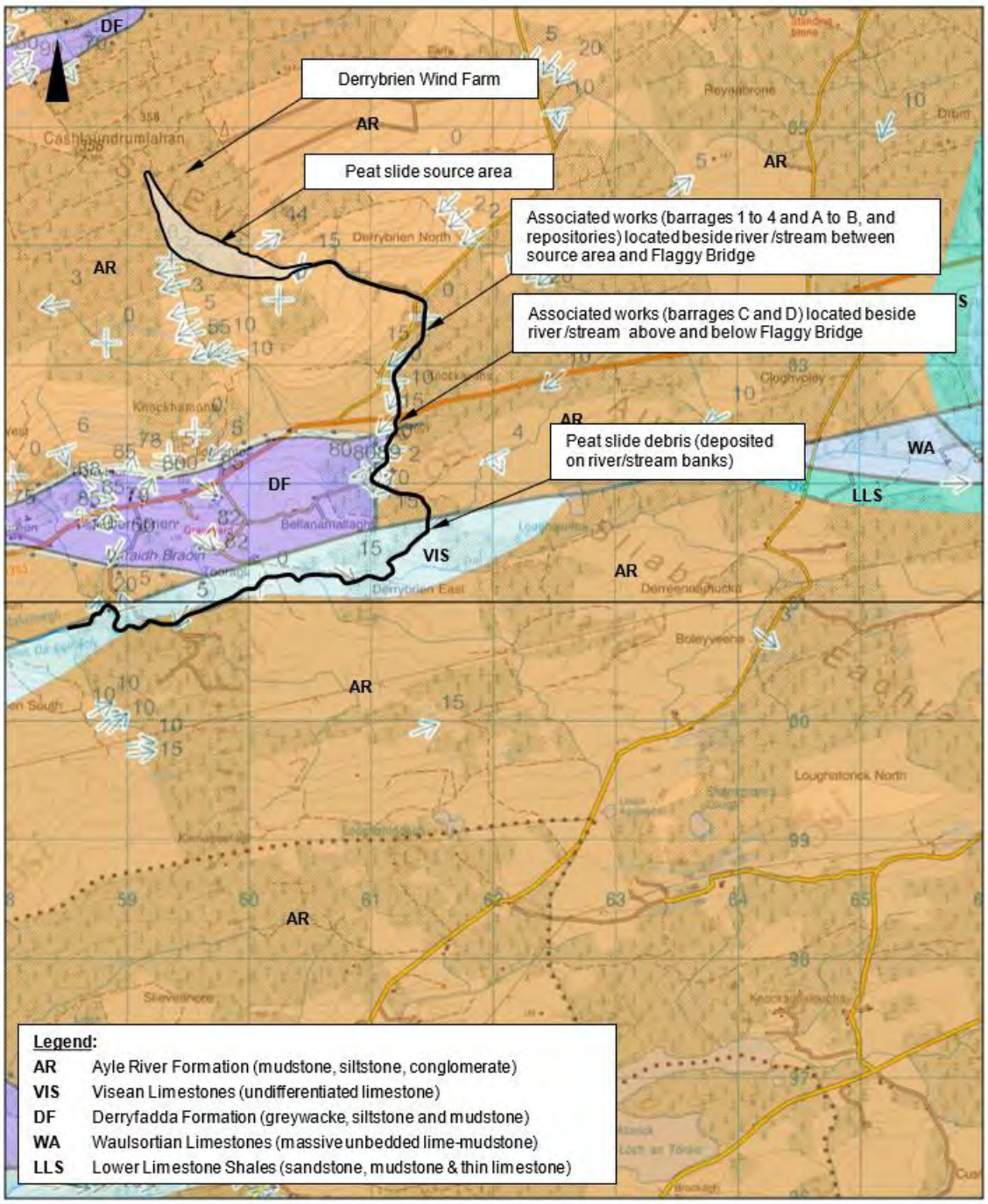


Figure 8-33: Bedrock geology map – peat slide and associated works

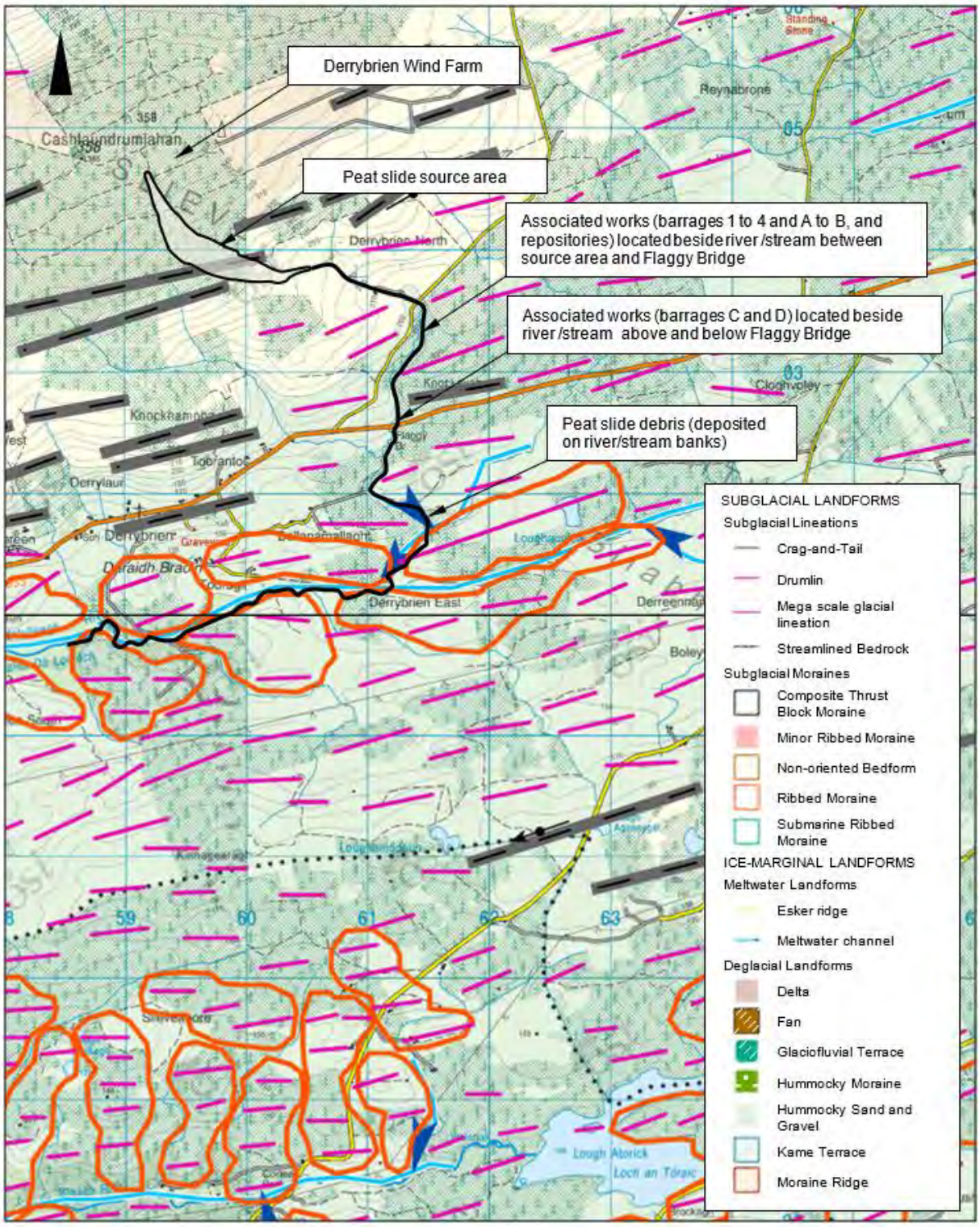


Figure 8-34: Geomorphological map – peat slide and associated works

8.3.3.4 Baseline Sensitivity of the Receiving Environment (Soils, Geology & Land Use) for the Peat Slide and Associated Works

The significance of effects on soils, geology and land on the site has been assessed as a function of the sensitivity of the receiving environment using Figure 8-3. The sensitivity of the receiving environment is classified on a 7-point scale from Negligible to High as a function of the characteristics of the soils, geology and land that are directly impacted by this part of the project.

For this part of the project, the majority of the significant effects on soils, geology and land relate to the blanket bog that covers most of the project site, including the peat slide and associated works, and surrounding area. Therefore, the characteristics of dominantly the blanket bog govern the classification of the sensitivity of the receiving environment for assessing the significance of impacts on soils, geology and land on this project. For site stability impacts, consideration has also been given to the characteristics of the blanket bog outside the project site that could be directly impacted by a peat slide on the project site.

For this project the sensitivity of the receiving soils, geology and land has been classified as **MEDIUM** for the Wind Farm site, see details provided in the previous section 8.3.1.4.

For the assessment of site stability impacts the sensitivity of the receiving soils, geology and land that could be impacted by a peat slide has also been classified as **MEDIUM** for the Wind Farm site based on the scale of the very large peat slide that occurred on the site in October 2003, and by the land that that was directly impacted by the slide, see details provided in the previous section 8.3.1.4.

As the soils, geology and land use for the Peat Slide response works site, and those lands which could be impacted by a peat slide, are predominantly consistent with the Wind Farm site, the sensitivity of the soils geology and land is also assessed as **MEDIUM.**

8.3.4 Baseline Peat Stability Risk Assessment & Likelihood of a Peat Slide Based on Site Conditions in 1998

Baseline peat stability risk assessments have been carried out for the project site that includes the following areas:

- Derrybrien Wind Farm and associated ancillary works.
- Grid connection comprising Derrybrien-Agannygal 110 kV Overhead Line and Agannygal Substation connecting into the Shannonbridge – Ennis 110 kV Overhead Line and associated ancillary works.
- Works undertaken in response to the peat slide and associated ancillary works.

The peat stability assessments have been carried out in accordance with the best practice guidelines given in *"Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Projects, published by the Scottish Government Energy Consent Unit (2nd Edition, April 2017)"*. The best practice guidelines identify a number of techniques that can be used to assess peat stability, and a number of these techniques are used in this case to suit the proposed construction works, ground conditions and type of development.

The best practice guidelines give no preferred technique but note that whatever techniques are employed should be clearly explained and incorporate consideration of the likelihood of instability based on a range of recognised hazards or contributary factors, and the consequences of a failure should it occur. Details of the techniques employed are included in the following documents contained in the Appendices to this chapter, as outlined in the sections below:

- Derrybrien Wind Farm Site – see "Derrybrien Windfarm - Geotechnical Stability Report & Assessment of Stability Impacts of On-Site Activities", by AGL Consulting, (2024) - in Appendix 8-2.
- Grid connection, see "Geotechnical Stability Report 3" (FT, 2020) and "Geotechnical & Peat Stability Report: Derrybrien Wind Farm – Grid Connection and Ancillary Works (FT, 2023) in Appendix 8-6 and 8-7.
- Peat slide and Work undertaken in response to the peat slide, see "Geotechnical Stability Report 2" (FT, 2020) in Appendix 8-5.

Considering that the origin of the peat slide on 16th October 2003 was within the wind farm site, a more detailed description of the peat stability risk assessment carried out at the wind farm site is provided in this chapter.

8.3.4.1 Baseline Peat Stability Risk Assessment – Wind farm Site

A baseline Peat Stability Risk Assessment (PSRA) has been carried out for the wind farm site to characterise the relative risk of peat instability in defined zones across the site in 1998, prior to construction of the wind farm. The purpose of the PSRA is to identify where there are compounding risk factors that lead to a higher risk of peat instability so that appropriate mitigation measures can be implemented to ensure that the risk of peat instability can be reduced to an acceptable level for each site activity. The results of peat stability risk assessment are presented in the report titled "*Derrybrien Windfarm - Geotechnical Stability Report & Assessment of Stability Impacts of On-Site Activities"*, by AGL Consulting in Appendix 8-2 of this Chapter. The following is an overview of the methodology.

For this assessment, the wind farm site has been split up into 71 No. representative zones corresponding to sections of the site around the turbines and access tracks on peat.

A qualitative **Peat Stability Risk Assessment (PSRA)** has been carried out for each zone to assess the **Risk Rating (R)** for a peat slide based on the interpreted **Likelihood (L)** (i.e. probability) of occurrence and **Impact (I)** of failure.

The PSRA has been carried out in accordance with the current best practice guidelines for peat landslide risk assessments for wind farms on upland blanket bogs (Scottish Government, Energy Consent Unit, 2017). The method of risk rating is also consistent with the Institution of Civil Engineers' publication outlining UK best practice in "*Managing Geotechnical Risk*" (Clayton, 2001).

The **Likelihood (L)** of a peat slide in each zone has been interpreted by evaluating factors related to the peat and subsoil conditions, topography, site hydrology/hydrogeology and other significant contributory factors such as peat harvesting or slide history to determine where there are conditions that could lead to an elevated risk of a peat slide.

The potential **Impact (I)** of a peat slide in each zone has been interpreted by evaluating factors related to the potential volume of peat, degree of contamination, sensitivity of the receiving environment, access for intervention, and land use and existing infrastructure within the potential slide area and run-out distance.

A baseline **Risk Rating (R=L x I)** has then been calculated for each zone prior to the implementation of risk mitigation measures to characterise the risk of peat instability across the site to identify where specific design, construction & operational mitigation measures are required to mitigate the risk of peat instability to an acceptable level.

The PSRA presented in the AGL report in Appendix 8.2 is an engineering risk assessment where the potential Impact of a peat slide includes factors other than those that are relevant to the environmental impact of the project on the receiving soils, geology and land. Therefore, only the interpreted Likelihood of a peat slide across the wind farm site is introduced here because it is an index of the probability or likelihood of a peat slide based on the site conditions, which is an input parameter for the environmental assessment of stability impacts presented in this chapter, as shown on the flow chart in Figure 8-2.

Figure 8-36 shows the interpreted **Likelihood (L)** of a peat slide across the site for the baseline conditions on the site in 1998, prior to construction. It should be noted that this is a qualitative assessment that reflects the interpreted probability of a peat slide occurring on the site based on site conditions in 1998 prior to the implementation of appropriate design and construction risk mitigation measures. It identifies areas of the site where there were compounding risk factors that could lead to a higher likelihood of peat instability on the site without appropriate controls or mitigation measures.

The site conditions vary across each zone. Therefore, the interpreted Likelihood of a peat slide in each zone is generally representative of the worst conditions within the zones. However, greater emphasis is applied to the site conditions along the corridor of the wind farm project, where the majority of the site activities related to the wind farm occurred.

The peat stability risk assessment identifies 38 No. zones across the site where the Likelihood of a peat slide, prior to mitigation measures, is characterised as **Very Possible (L=4) or Likely (L=5)**. These zones are located in areas across the site where there are compounding risk factors in relation to peat stability, including, for example:

- Deposits of deep (3-6 m) and relatively deep (2-3m) weak peat (cu ≈ 5 kPa) with low Factor of Safety (FoS) for infinite slope stability analyses.
- Areas of intermediate slope angles of 3-5° in close proximity to a convex break in slope to slope angles >5°.
- Zones that are in the broad valleys directly upslope from the rivers and streams downslope from the perimeter of the wind farm site.

- Zones of deep peat with poor drainage and ponded surface water at the head of a watercourse, or along the edges of the terraces on the north side of the site.
- Areas adjacent to the previous slide that have similar site characteristics.

The highest Likelihood (L=5) occurs where there are compounding risk factors leading to an elevated likelihood of peat instability under uncontrolled conditions i.e.

- At Turbines T17, T68 and T21 to T70 in the vicinity of the slide in relatively deep peat on a convex breaking slope directly upslope from the rivers and streams on the south side of the site.
- At Turbines T49 to T51 where there are deep deposits of peat in close proximity to a distinct convex break in slope to slopes >5.0-7.5° directly upslope from the rivers and streams on the north side of the site.
- At Turbines T60 to T62 where there are deep deposits of very soft peat with a high water table and ponded surface water at the head of a watercourse and along the edge of a terraced slope.

In the remaining 33 No. zones across the site the Likelihood of a peat slide, prior to mitigation measures would be characterised as **Possible (L=3)** or **Low (L=2)**, which would require early or regular attention with appropriate mitigation measures to reduce the risk of peat instability or to manage the risk on site. These were in areas where there were mitigating conditions that reduced the baseline risk of peat instability. For example:

- Areas of shallow (<1.0 m) or relatively shallow (1-2 m) peat.
- Areas of gently sloping ground (<3°) set well back from any convex break in slope to slopes >5°.
- Areas of relatively high Factor of Safety (FoS >1.4) for infinite slope stability analyses.
- Zones where there is well-developed drainage, and which are not directly upslope from the rivers and streams outside the wind farm site.

It should be noted that the methodology that was used in this case for the baseline peat stability risk assessment was developed after the peat slide at the site of the Derrybrien Wind Farm, based on research and guidelines published as a result of the slide, as discussed in Section 8.1.5.2. The methodology has also been calibrated by the peat slide at the Derrybrien site, as well as by peat slides that occurred on the site of other wind farm projects on upland blanket bogs in Ireland since 2003. Therefore, while it is consistent with current best practice guidelines and is representative of the conditions on the Derrybrien wind farm site, it represents a level of assessment that far exceeds that which would have been carried out for the site in 1998 or at the time of construction in 2003 when the construction industry's general knowledge of failures on peat slopes was very limited.

Furthermore, although the baseline PSRA identifies that there are areas of the Derrybrien wind farm site that had a high baseline risk of peat instability, this was prior to the implementation of appropriate mitigation measures and, based on our current experience with managing peat stability under similar conditions, it would not be considered an abnormal or exceptional risk for a wind farm project on an upland blanket bog in Ireland where the risk is appropriately managed. The qualitative risk assessment methodology is simply a tool that is used to identify where appropriate risk mitigation measures need to be implemented to reduce the risk of a peat slide to an acceptable level.

The design and construction mitigation measures that were successfully implemented on the Derrybrien site after the 2003 peat slide enabled the project to be completed without any further incidents of peat instability. Furthermore, many of these mitigation measures are now standard measures that are commensurate with the geotechnical risk of a peat slide and are routinely implemented on similar sites across Ireland and the UK where there could be a high risk of peat instability on upland blanket bogs. However, they would not have been standard practice at the time of construction on the Derrybrien Wind Farm in 2003.

8.3.4.2 Baseline Peat Stability Risk Assessment – Grid Connection

A baseline peat stability risk assessment has been carried out for the grid connection works to characterise the relative risk of peat instability in defined zones in 1998, prior to construction of the windfarm. The purpose of the peat stability risk assessment is to identify where there are compounding risk factors that lead to a higher risk of peat instability so that appropriate mitigation measures can be implemented to ensure that the risk of peat instability can be reduced to an acceptable level for each site activity.

The results of the peat stability risk assessment are presented in the report included in Appendix 8-7 entitled "Grid Connection and Ancillary Works" (FT, 2023) The following is an overview of the methodology.

The peat stability risk assessment employed for the grid connection comprises a deterministic approach in combination with a qualitative risk assessment in accordance with best practice guidelines (Scottish Government, Energy Consent Unit, 2017). This approach is a variation to that employed in the windfarm to suit the proposed construction works, ground conditions and type of development.

The deterministic aspects of the approach uses the infinite slope model (Skempton and DeLory, 1957) to combine a number of key factors in order to determine a factor of safety (FoS) against peat sliding. This model is based on a translational slide, which is a reasonable representation of the dominant mode of movement for peat slides.

The FoS provides a direct measure of the degree of stability of the peat slope. A FoS of less than unity indicates that a slope is unstable, an FoS of greater than unity indicates a stable slope. The FoS is calculated for the undrained (short term) and drained (long term) conditions.

The FoS was calculated at the location of all pole sets and mast locations, and at the Agannygal Substation. The FoS calculated for the grid connection generally shows an adequate FoS (>1.4) against peat slide and hence a low risk of instability. However, the use of conservative shear strength parameters for the peat has contributed to a small number of low FoS results (3 no. comprising about 3.5% of OHL route), particularly around areas of relatively steep slope angles, but where there is shallow peat and areas of relatively deep deposits of peat, but where there are shallow slope angles.

The qualitative risk assessment aspect of the approach takes into account factors which cannot necessarily be quantified in the deterministic approach (MacCulloch (2005), such as the presence of mechanically cut peat, previous local failures, vegetation type, slope characteristics and numerous other factors. The qualitative factors used in the risk assessment have been compiled based on experience of assessments and construction in peat land sites and peat slides throughout Ireland and the UK.

The PSRA presented in the FT report in Appendix 8-6 is a general risk assessment where the potential Impact of a peat slide includes factors other than those that are relevant to the environmental impact of the project on the receiving soils, geology and land. Therefore, only the interpreted Likelihood of a peat slide across the grid connection site is introduced here because it is an index of the probability of a peat slide based on the site conditions, which is an input parameter for the environmental assessment of stability impacts presented in this chapter, as shown on the flow chart in Figure 8-2.

For the purpose of the peat stability risk assessment, the grid connection was divided into 9 no. sections, including the Agannygal Substation. Sections were defined based on having similar topography and peat depth within each individual section. For each section the FoS results were combined with the qualitative factors to determine the peat slide likelihood, see Table 8-3. This represents peat slide likelihood prior to the application of mitigation measures.

The peat slide likelihood results clearly show that for the baseline condition the likelihood of a peat slide ranges from negligible (L=1) to low (L=2), which would be expected along the grid connection route given the relatively shallow nature of the peat and its relatively greater strength compared to the windfarm site.

Table 8-3: Peat Slide Likelihood - Grid Connection

Section	Likelihood
EM1 to PS5	Negligible (L = 1)
PS5 to AM14	Low (L = 2)
AM14 to AM18	Negligible (L = 1)
AM18 to AM24	Negligible (L = 1)
AM24 to PS28A	Low (L = 2)
PS28A to PS34	Low (L = 2)
PS34 to AM38	Low (L = 2)
AM38 to EM41	Low (L = 2)
Agannygal Substation	Negligible (L = 1)

Notes
(1) PS – pole set, AM – angle mast
(2) See Figure 8-19 for location of sections.

For the grid connection, the sections are classed as Low to Negligible likelihood of a peat slide and would require only at best routine construction practice and mitigation/control measures for working on peat. The proposed mitigation measures are considered routine and would include for example avoiding accessing areas of peat with the greatest slopes with plant, the use of suitable plant and equipment, and adequate monitoring of the works.

Overall, peat stability risk for the grid connection is considered to be acceptable. Where localised areas of elevated risk have been identified the level of risk is reduced by the application of mitigation measures.

8.3.4.3 Baseline Stability Risk Assessment – Peat Slide and Associated Works

A stability assessment of the remaining peat material within the peat slide source area and at locations of associated works was carried out to provide an indication of risk of instability. The results of the peat stability risk assessment are presented in the report included in Appendix 8.5 entitled *"Geotechnical Stability Report 2 - Peat Slide and Associated Works"* (FT, 2020). The following is an overview of the methodology.

The stability risk assessment for the peat slide and associated work sites is different from the preceding sections as follows:

1. **Peat slide source area –** The risk of peat instability in the source area, which is the location of the 2003 peat slide, is included above in the baseline conditions (1998) for peat stability risk assessment for the wind farm site (Section 8.3.1.4). The assessment included below is the stability of the remaining peat in the source area based on current (2020) conditions.
2. **Peat slide displaced material** – The peat material from the source area extended downstream for a distance of about 5.8 km. The peat material would have had little to no effect on the stability of the existing ground. Typical effects on the existing ground would be limited to localised scouring and erosion of the stream channel, details of which are included in the report in Appendix 8-5.
3. **Associated works** – A stability risk assessment has been carried out for each of the associated work's sites to characterise the relative risk of general instability in 1998, prior to construction of the windfarm.

8.3.4.3.1 *Peat Slide – Source Area*

The stability risk assessment employed for the peat slide source area comprises a deterministic approach in accordance with best practice guidelines (Scottish Government, Energy Consent Unit, 2017). This approach is a variation to that employed above to suit the proposed construction works, ground conditions and type of development.

The deterministic approach uses the infinite slope model as above to combine a number of key factors in order to determine a factor of safety (FoS) against peat sliding. This model is based on a translational slide, which is a reasonable representation of the dominant mode of movement for peat slides.

The FoS provides a direct measure of the degree of stability of the peat slope. A FoS of less than unity (1.0) indicates that a slope is unstable, an FoS of greater than unity indicates a stable slope. The FoS is calculated for the undrained (short term) and drained (long term) conditions.

The purpose of the analysis is to provide an indication of the likely susceptibility of instability. As the analysis uses generalised lower bound peat strength values the results provide an indication only of areas where instability might occur. The analysis assumes that all areas have lower bound peat strength values, which in the majority of instances is not expected to be the case.

The FoS was calculated at about 190 no. individual locations within the source area where in situ measurements were taken. The results of the analysis are summarised in Table 8-4.

Table 8-4: Peat Slide Source Area - Stability FoS

Factor of Safety (FoS)	Short-term (undrained)	Long-term (drained)
	% of Peat Slide Source Area	% of Peat Slide Source Area
Less than 1.0	0.5	0
1.0 to 1.3	0.5	1
1.3 to 1.4	0.5	0
Greater than 1.4	98.5	99

The FoS calculated shows an adequate FoS (>1.4) for both the short and long-term conditions.

For the short-term condition, 99.5% of the source area has a FoS greater than 1.0 and 98.5% has a FoS greater than 1.4. For the long-term condition, which is more representative of the current (2020) condition, 100% of the source area has a FoS greater than 1.0 and 99% has a FoS greater than 1.4. The results are shown graphically in Figure 8-35, which shows that the significant majority of the calculated FoS values are notably high, which would indicate that the source area is stable.

The above results confirm the findings of the periodic inspections of the source area carried out by ESB, AGEC and FT post the 2003 landslide up to the recent 2019 inspection, which showed that since the time of the peat slide, the displaced material within the source area had essentially drained and was locally desiccated, which would have increased the peat strength and overall stability. In addition, movement monitoring survey points installed within the source area showed negligible movement within this period.

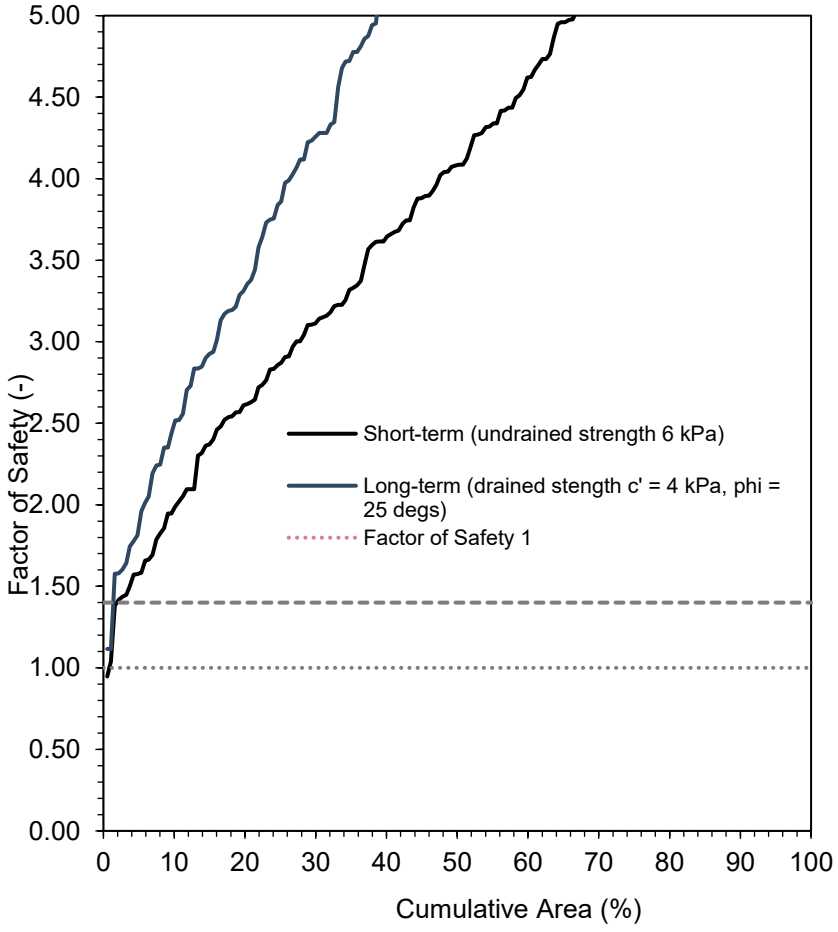


Figure 8-35: Peat slide source area factor of safety for short and long-term conditions

In general, the FoS's less than 1.4 generated from the analysis are not unexpected as generalised lower bound peat strength values are used in the analysis, which does not take into account areas of higher strength peat. In reality the displaced peat material within the source area has a significantly higher undrained shear strength than that used in the analysis.

Areas with a low FoS coincide with steeper slopes, typically from about 8.5 to 14 degrees. These slope angles are not a reflection of the overall topography of the peat slide source area. The slope angles are based on 5 m LIDAR survey data for the area and the steeper slope angles calculated are likely as a result of localised undulations in the displaced material or vegetation within the source area and specifically along the edge of the source area where localised steeper slopes would be expected.

8.3.4.3.2 *Peat Slide – Displaced Material*

As mentioned above, the displaced peat material would have had little to no effect on the stability of the existing ground. Typical effects on the existing ground would be limited to localised scouring and erosion of the stream channel, details of which are included in the report in Appendix 8-5.

8.3.4.3.3 *Associated Works*

The associated works which included the measures undertaken in response to the peat slide comprised 8 no. containment barrages (1 to 4 and A to D) and 3 no. repositories. The stability of each of these works was assessed individually.

The purpose of the analysis was to check that there is an adequate safety margin for the works against global stability taking into account loading from displaced material and possible flood conditions.

The stability of these works is based on ground conditions and loadings recorded from recent inspections and investigation which would also reasonably represent the conditions in 1998. The ground conditions and loadings are unlikely to change notably over the project life cycle and therefore in most cases the stability will remain relatively constant over time. For the repositories and floating roads, the loadings would have caused an increase in strength within any underlying peat with time which would result in an increase in stability with time.

Floating Roads

Inspection of the floating roads shows no signs of instability, this would be expected given the characteristics and relatively shallow peat thickness under the roads.

The access track to the west of barrage 1 was constructed as a floating road on peat with average slope angle along the track of 2 to 3 degrees and peat depth of about 0 to 1.5 m.

The floating road access to barrage 2 has an average slope angle along the road of 3 to 4 degrees with peat depth estimated to be up to about 1.5 m.

Periodic inspections of the floating roads were undertaken by ESB from 2004 to 2019. No significant issues regarding the stability of these floating roads were raised in the periodic inspections. Likewise, no significant issues regarding the stability of the floating roads were raised in the recent (2019) inspection by FT.

Barrages 1 to 4

The stability analysis for the barrages was carried out in accordance with accepted best practice as given in Eurocode 7 (EC7) to determine the safety margin (that is utilisation ratio). For an acceptable safety margin, the utilisation ratio is 1 or greater.

A summary of the results of the global stability for barrages 1 to 4 are given in Table 8-5. Temporary barrages A to D are no longer present and no calculations have been carried out for these barrages.

The results clearly show that the utilisation ratio is greater than 1, which represents an acceptable margin of safety. This is to be expected as the barrages are constructed of dominantly rock, and in many cases are founded on bedrock or other competent material.

Periodic inspections of the barrages were undertaken by ESB. No issues regarding the stability of the containment barrages were raised in the periodic inspections. Likewise, no issues regarding the stability of the containment barrages were raised in the inspections carried out by AGEC or FT.

Table 8-5: Associated Works – Stability of Barrages 1 to 4

Barrage	Loading Case (note 1, 2)	Utilisation Ratio for Global Stability (note 1, 2)					
		Short-term (undrained)			Long-term (drained)		
		Case 1	Case 2	Case 3	Case 1	Case 2	Case 3
1	1 & 2	4.09	3.20	-	1.67	1.50	-
2	1 & 2	2.69	2.48	-	1.48	1.35	-
3	2 & 3	-	3.58	1.86	-	3.83	2.95
4	2 & 3	-	3.66	1.91	-	3.79	2.59

Notes

1. The following load cases are used in the analyses:

   Case 1: Retaining remobilised peat (theoretical scenario) – applies to the containment barrages where peat had remobilised from the peat slide source area.

   Case 2: Retaining silt/sand – applies to all containment barrages. This is a highly unlikely theoretical situation where a build-up of silt or sand to the full height of the barrages would take place.

   Case 3: Retaining water under flood conditions – applies to containment barrages 3 and 4 only, which were constructed within sections of incised streams and could experience such high-water flow levels.

2. The utilisation ratio stated above is for the most conservative design approach, namely Design Approach 1 (Combination 2), in accordance with EC7.

Repositories at Barrage 2 and 3, and the Black Road Bridge

The assessment of the repository areas included a stability assessment using infinite slope analysis and an observational approach. The assessments and results are given below.

The deterministic approach uses the infinite slope model as above to determine a factor of safety (FoS) against peat sliding. The results are shown in Table 8-6.

The FoS calculated shows an adequate FoS (>1.4) for both the short and long-term conditions.

In addition to the FoS approach, an observational approach was adopted for assessing the stability of the 3 no. repository areas. The observational method is not a predefined design approach/check. The observational method is a continuous, managed monitoring and review approach which requires periodic visual inspections of the repositories.

The observational approach which involved periodic inspections of the repositories from 2004 to 2022 was undertaken by ESB and AGEC. No significant issues regarding the stability of the repositories were raised in the periodic inspections.

Table 8-6: Associated Works – Stability of Repositories at Barrage 2 and 3, and Black Road Bridge

Repository Area	Founding Stratum (1)	Thickness of Placed Arisings	Factor of Safety (FoS)	
			Short-term (undrained)	Long-term (drained)
Barrage 2	Peat	0.6 to 1.9m	>1.4	>1.4
Barrage 3	Mineral Soil	1 to 1.6m	>1.4	>1.4
Black Road Bridge	Peat	0.7 to 2m(2)	>1.4	>1.4

Notes

1. The founding stratum for each repository area refers to the ground conditions upon which the arisings were placed.
2. The thickness of the placed arisings in the repository areas is based on an interpretation of the ground investigation carried out by AGEC in 2018. 2m arising thickness assumed in assessment.

8.3.4.4 Changes in the Likelihood of a Peat Slide over the Project Life Cycle.

8.3.4.4.1 *Derrybrien Wind Farm Site*

The impact of site activities on peat stability reduces significantly over the project life cycle from the baseline conditions for the initial phase of construction in 2002/2003 to the second phase of construction after the peat slide (2004-2006) and through the operation and maintenance phase of the project between 2006 and 2022 up to decommissioning in 2025. This is due to changes to the probability of occurrence of a peat slide as a result of:

- Implementation of effective design mitigation measures and alternative construction methods (e.g. alternative methods of spoil management).
- Additional geotechnical investigations, stability analyses, testing, monitoring and geotechnical supervision (e.g. geotechnical assessment and full-scale proof testing of floating roads).
- Changes to the site characteristics due to improved drainage and an increase in the strength of the peat under sustained dead load surcharges (i.e. the floating roads, peat repositories and material sidecast areas).

The assessment of the impact of site activities on the peat necessarily takes into account the reduction in the likelihood of a peat slide in the medium to long-term. This is because, for activities that result in sustained dead load surcharges on the peat (e.g. construction of the floating roads, peat repositories and material sidecast areas on the intact peat slopes), the highest stability risk is in the short-term condition when the load is initially placed on the slope. The peat increases in strength as it consolidates and compresses under the applied load so that the probability of a peat slide reduces significantly over time. This is a fundamental geotechnical principle, which has been verified by testing on site. It is also consistent with the 2022 EPA Guidelines which includes the probability of occurrence as an input parameter for impact assessments. The significance of the impacts on the receiving soils, geology and land has still been assessed relative to the baseline conditions on the site in 1998, prior to construction, so it does not constitute a change in the baseline condition.

The changes in the Likelihood of a peat slide over the life cycle of the wind farm site are illustrated on Figure 8-36 to Figure 8-38.

- Figure 8-36 shows the baseline conditions on the site in 1998 prior to construction and prior to implementation of effective design and construction mitigation measures.

- Figure 8-37 reflects the reduced likelihood of a peat slide on the site with the mitigated site activities during the second phase of construction (e.g. the alternative methods of spoil management), and with the improved site conditions at the end of construction (e.g. improved drainage, increased strength under the floating roads – verified by full scale proof load testing).
- Figure 8-38 reflects the reduced likelihood of a peat slide on the site for the current conditions during the ceased operation phase (2022-2024) and for the activities that will be carried out on the site during decommissioning of the wind farm. It also reflects ongoing improvements in site conditions and performance of the floating roads due to the drainage improvements and the increased strength of the peat.

In each case the likelihood of a peat slide is representative of the range of site activities that occurred or are likely to occur over the corresponding period within the project life cycle.

Significantly, at this stage (2024), with the improvement of site conditions, the likelihood of a peat slide has reduced to **negligible** across the site for the project activities that are likely to be carried out during decommissioning of the wind farm and post decommissioning.

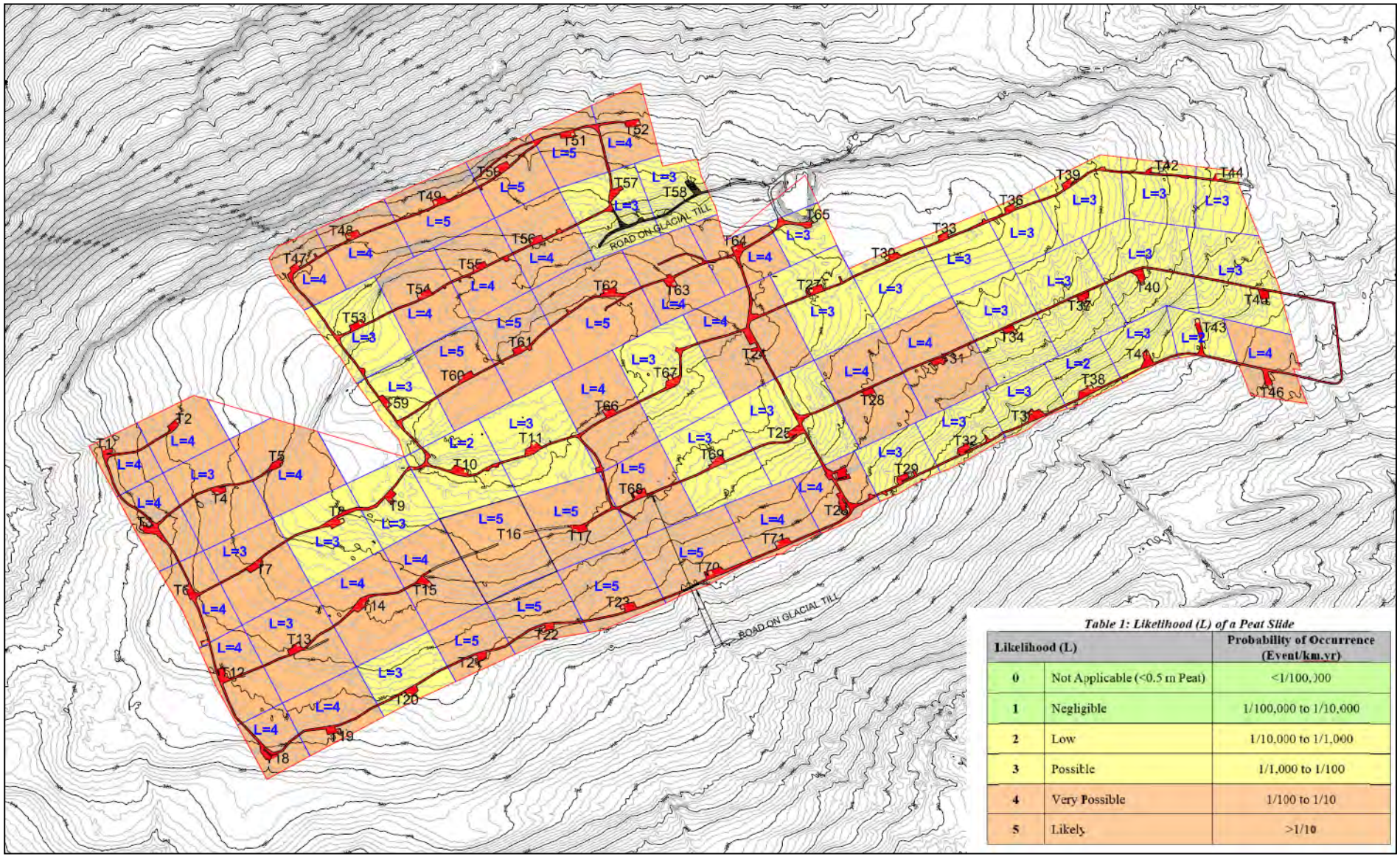
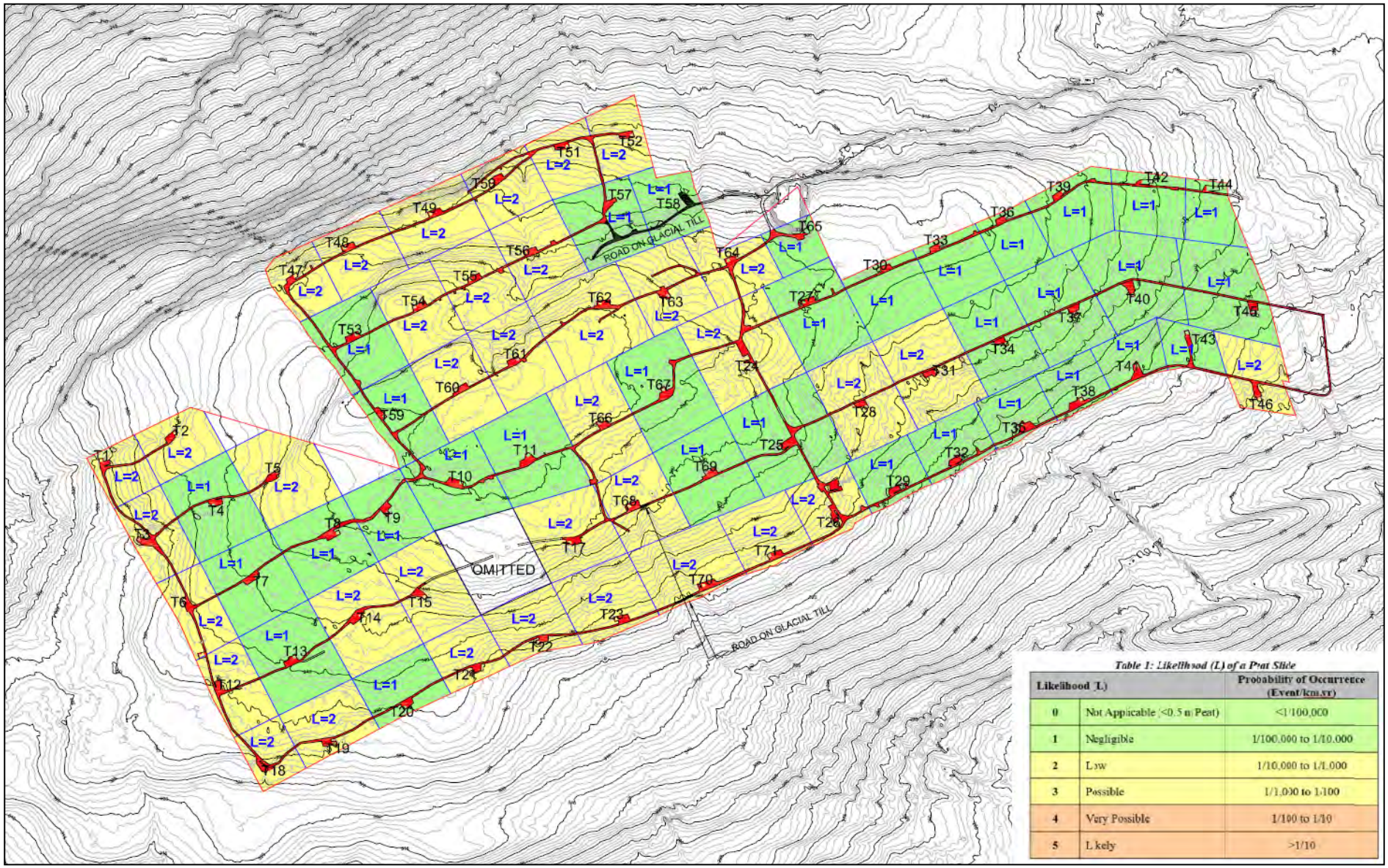


Table 1: Likelihood (L) of a Peat Slide

Likelihood (L)		Probability of Occurrence (Event/km.yr)
0	Not Applicable (<0.5 m Peat)	<1/100,000
1	Negligible	1/100,000 to 1/10,000
2	Low	1/10,000 to 1/1,000
3	Possible	1/1,000 to 1/100
4	Very Possible	1/100 to 1/10
5	Likely	>1/10

Figure 8-36: Likelihood (L) of a peat slide across the wind farm site for Baseline Peat Stability Risk Assessment based on site conditions in 1998



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Likelihood (L)		Probability of Occurrence (Event/km.yr)
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2	Low	1/10,000 to 1/1,000
3	Possible	1/1,000 to 1/100
4	Very Possible	1/100 to 1/10
5	Likely	>1/10

Figure 8-37: Likelihood (L) of a peat slide for mitigated site activities and improved site conditions at the end of construction in 2006

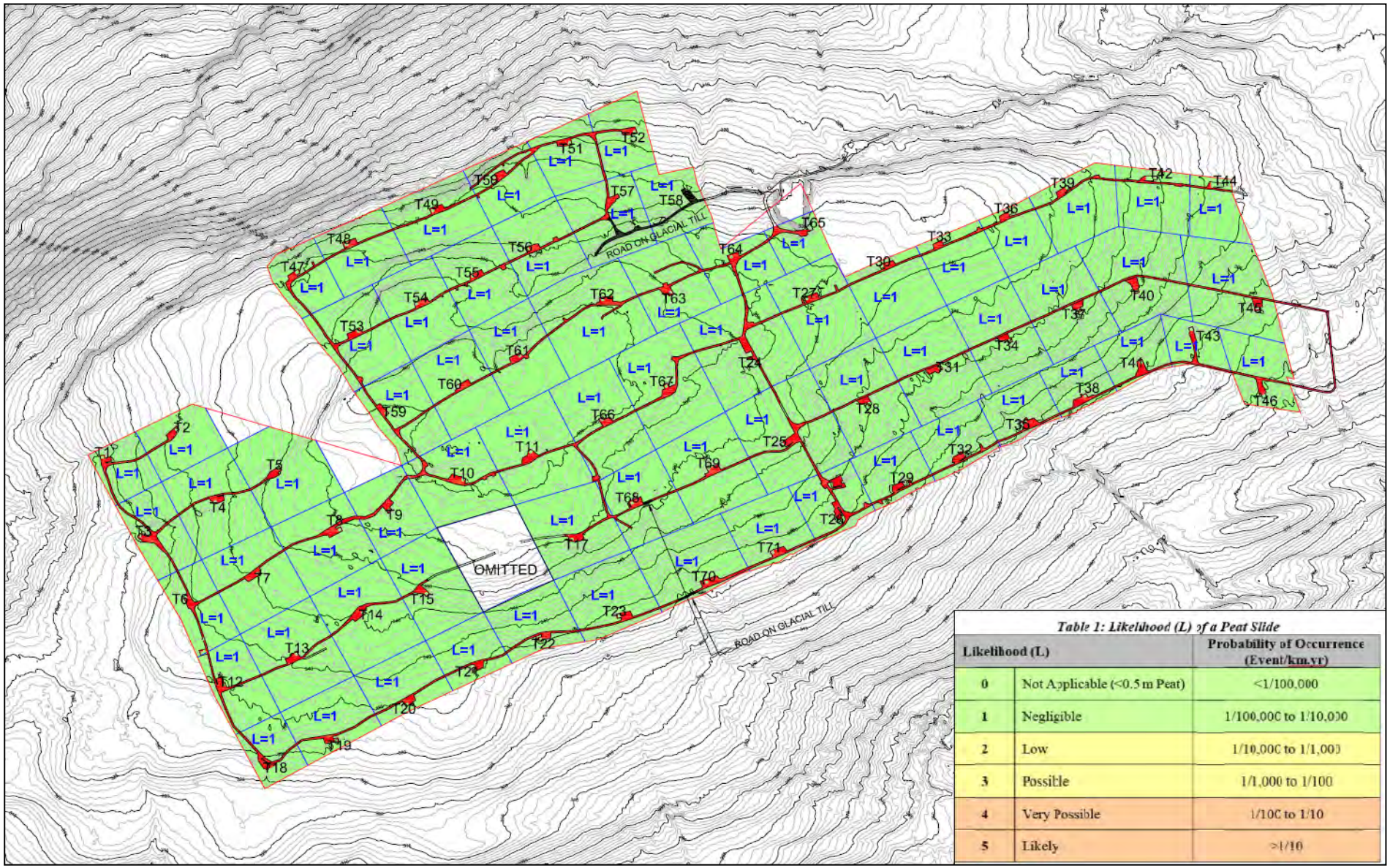


Table 1: Likelihood (L) of a Peat Slide

Likelihood (L)		Probability of Occurrence (Event/km.yr)
0	Not Applicable (<0.5 m Peat)	<1/100,000
1	Negligible	1/100,000 to 1/10,000
2	Low	1/10,000 to 1/1,000
3	Possible	1/1,000 to 1/100
4	Very Possible	1/100 to 1/10
5	Likely	>1/10

Figure 8.38: Likelihood (L) of a peat slide for mitigated site activities and improved site conditions in 2020

8.3.4.4.2 Grid Connection

The impact of site activities associated with the grid connection and site stability reduces significantly over the project life cycle. For the grid connection this is due to changes to the probability of occurrence of a peat slide as a result of primarily the following factors:

1. Implementation of effective mitigation/control measures during construction.
2. Changes to the site characteristics due to localised improved drainage.

Overall, for the baseline condition of 1998 the peat stability risk for the grid connection is considered to be acceptable. Taking into account the above factors the probability of occurrence of a peat slide would reduce over time.

8.3.4.4.3 Peat Slide and Associated Works

The impact of the peat slide and associated works on ground stability reduces significantly over the project life cycle. For the peat slide and associated works this is due to changes to the probability of occurrence of a peat slide as a result of a number of factors that are addressed below for each element of these works.

Peat Slide – Source Area

For the peat slide source area, the reduction in the probability of occurrence of a peat slide over the project life cycle is as a result of primarily the following factors:

1. Additional geotechnical investigations, stability analyses to identify critical areas.
2. Implementation of effective mitigation/control measures to contain material (i.e. barrage 1 and 2, reconstruction of windfarm roads across source area).
3. Changes to the site characteristics due to natural drainage of the source area
4. Re-vegetation of peat within source area.

An estimate of the reduction in likelihood of occurrence of a peat slide within the source area is provided in Figure 8-39. The likelihood is given in terms of FoS, where an FoS of 1.0 or greater indicates stability, and FoS of less than 1 indicates instability. The FoS has been calculated based on the measured gain in peat strength from 2003 to 2019 due to consolidation and drying out of the peat over time.

Overall, from 2003 the probability of occurrence of a peat slide from the source area over the project life cycle is reducing. At the time following the peat slide in 2003 over 10% of the remaining peat in the source area was likely unstable (FoS less than 1); with time the percentage of the source area containing unstable peat has reduced to the present (2020) to less than about 1%.

The further reduction in the probability of occurrence of a peat slide from the source area will continue over the project life cycle of the Derrybrien Windfarm Development Decommissioning Project.

The low FoS's are localised within the source area and not unexpected as generalised lower bound peat strength values are used in the analysis, which does not take into account areas of higher strength peat. In reality the displaced peat material within the source area has a significantly higher undrained shear strength than that used in the analysis. The low FoS's are associated with locally steeper slope inclinations likely as a result of localised undulations in the displaced material or vegetation within the source area and specifically along the edge of the source area where localised steeper slopes would be expected.

The distribution of calculated FoS for the source area are shown in Figure 8-40 and Figure 8-41 for 2020 and 2040 (postulated) respectively.

The above results reflect the actual reduction of peat material leaving the source area over time, as recorded by say the reduced need for material removal from behind barrage 2. The results are also confirmed by the findings of the periodic inspections of the source area carried out by ESB, AGEC and FT. The 2019 inspection showed that the debris within the source area had essentially drained and was locally desiccated, which would have increased the peat strength and overall stability.

Peat Slide – Displaced Material

As mentioned above, the displaced peat material would have had little to no effect on the stability of the existing ground. Typical effects on the existing ground would be limited to localised scouring and erosion of the stream channel immediately following the peat slide. Over time the peat material would have been eroded or degraded from the area of the stream. Taking into account, the probability of occurrence of a peat slide as a consequence of the peat slide material would have been essentially negligible to minimal in 2003 which would have further reduced over time.

Overall, from the probability of occurrence of a peat slide over the project life cycle is negligible.

Associated Works – Barrages 1 to 4

The impact of the associated works of barrages 1 to 4 and floating access tracks at barrage 1 and barrage 2 on the stability of the existing ground was minimal over the project life cycle is as a result of primarily the following factors:

1. Baseline (1998) conditions show an acceptable margin of safety.
2. Barrages are constructed of dominantly rock, and in many cases are founded on bedrock or other competent material.
3. Additional geotechnical investigations, stability analyses to identify critical areas.
4. Increase in the strength of the peat under sustained dead load form the floating roads at barrage 1 and 2.

Overall, from 2003 the probability of occurrence of a peat slide over the project life cycle is minimal.

Associated Works – Peat Repositories

The impact of site activities associated with the 3 no. peat repositories on stability of the existing ground reduces over the project life cycle. For the 3 no. peat repositories this is due to changes to the probability of occurrence of a peat slide as a result of primarily the following factors:

1. Additional geotechnical investigations, stability analyses to identify critical areas (i.e. periodic inspections).
2. Implementation of effective mitigation/control measures (i.e. bunds around some of the repositories).
3. Changes to the site characteristics due to improved drainage
4. Increase in the strength of the peat under sustained dead load surcharges under peat repositories.

Taking into account the above factors the probability of occurrence of a peat slide would further reduce over the project life cycle.

Overall, for the baseline condition of 1998 the peat stability risk for the 3 no. peat repositories is considered to be acceptable and the peat stability risk would further further reduce over the project life cycle.

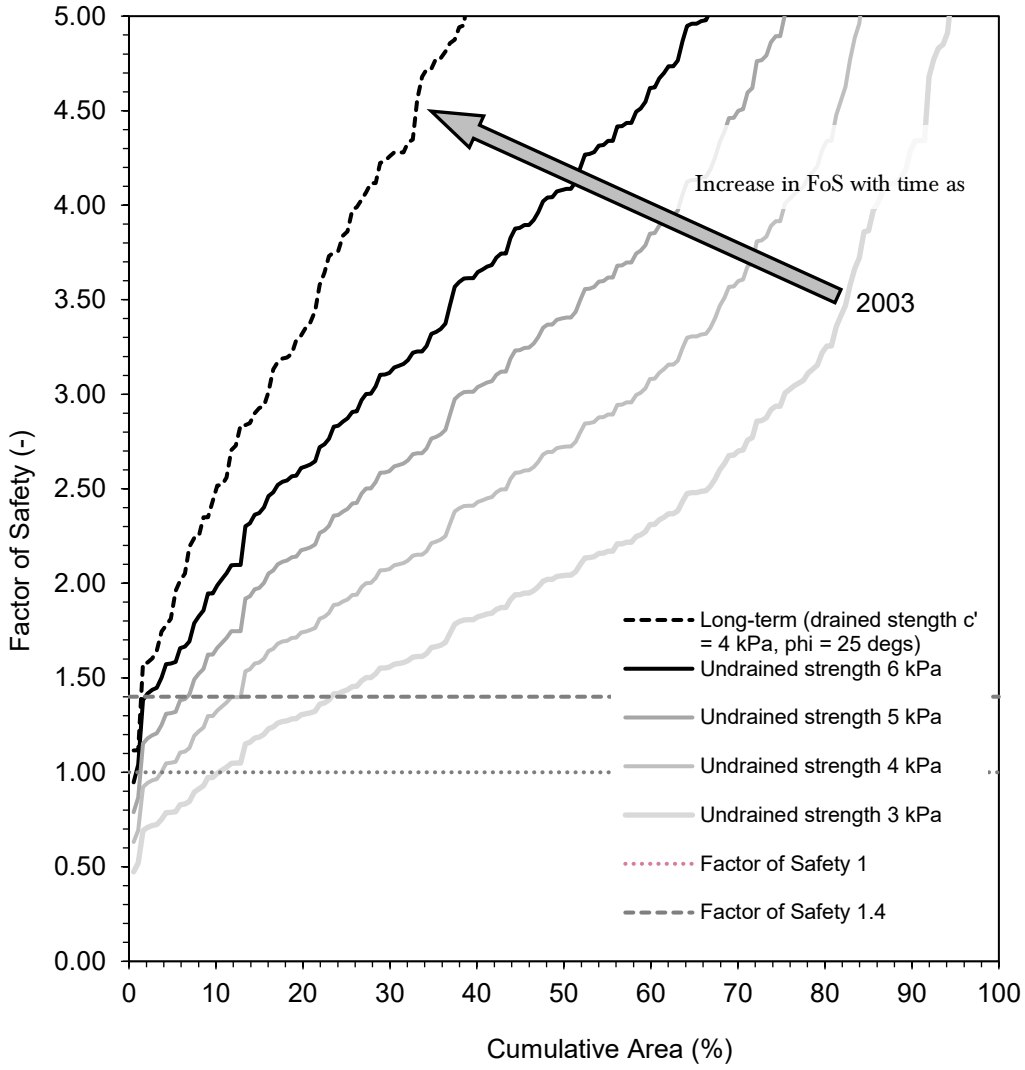


Figure 8-39: Likelihood (in terms of FoS) of a peat slide in source area with improved site conditions from 2003 to 2040 (decommissioning)

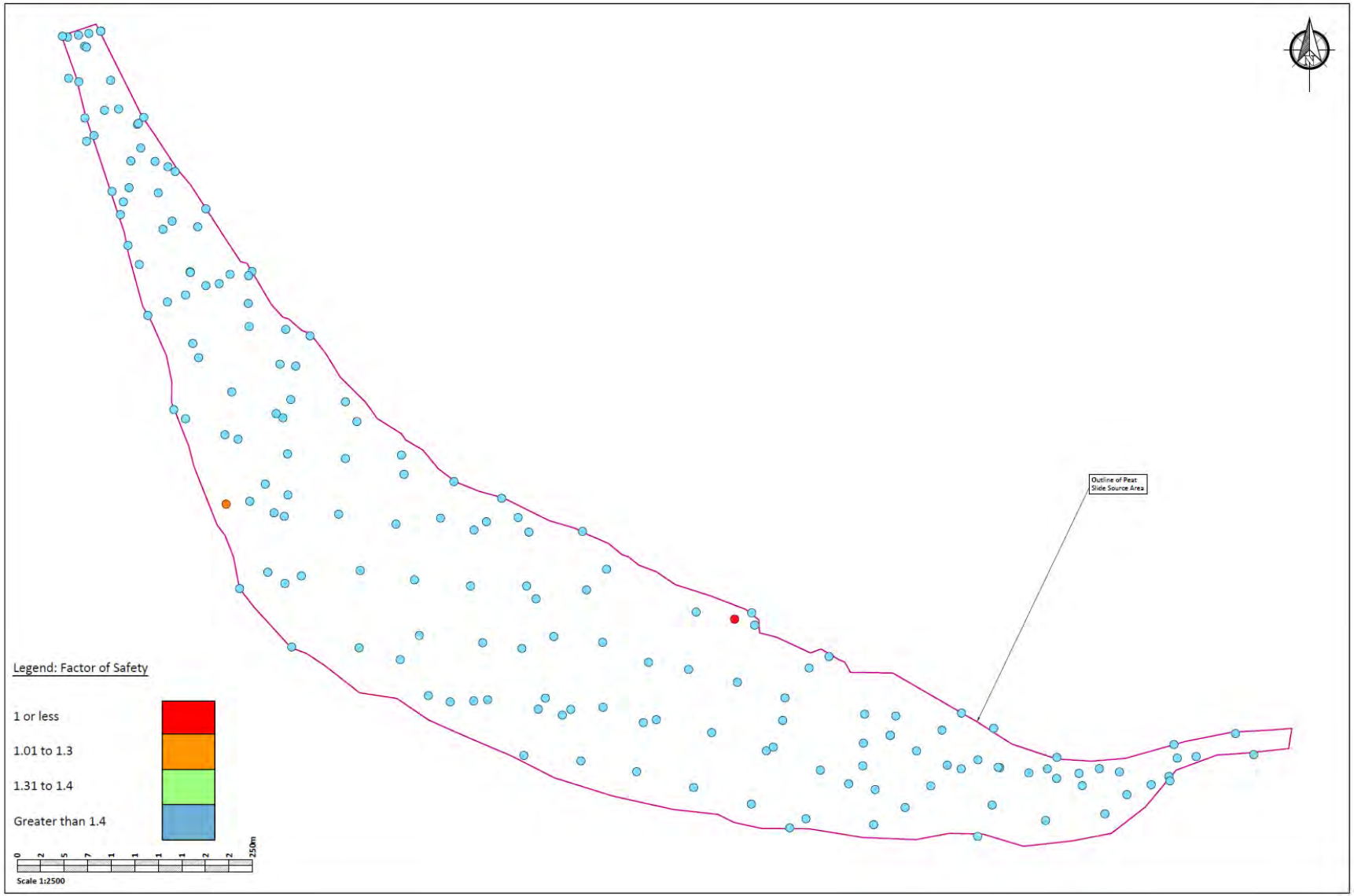


Figure 8-40: Likelihood (in terms of FoS) of a peat slide source area in 2020

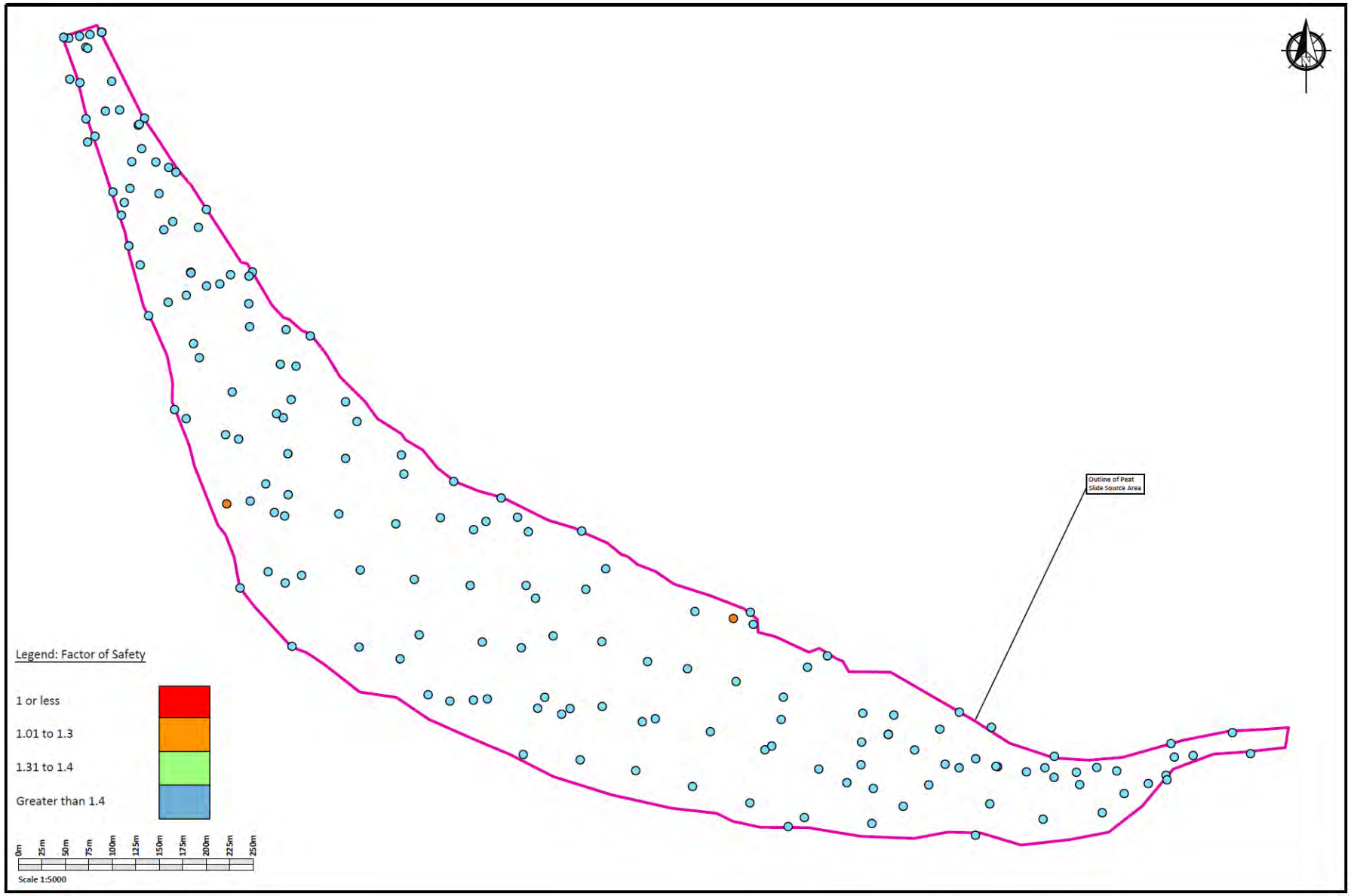


Figure 8-41: Likelihood (in terms of FoS) of a peat slide source area with improved site conditions 2040 (decommissioning)

8.4 Likely, Significant Impacts of the Project

This chapter presents an assessment of likely significant impacts on soils, geology and land for the following elements of the project:

- The Derrybrien Wind Farm and associated ancillary works.
- The Grid connection comprising the Derrybrien-Agannygal 110 kV Overhead Line and Agannygal Substation connecting into the Shannonbridge -Ennis 110 kV Overhead Line and associated ancillary works.
- The works undertaken in response to the peat slide and associated ancillary works.

Impacts on the receiving soils, geology and land for all elements of the wind farm, grid connection and ancillary works have been assessed over the following stages of the project:

- Impacts that have occurred:
  - Construction Phase (2003-2006).
  - Operation and Maintenance Phase (2006-2022).
- Impacts that are occurring:
  - Ceased Operations Phase (2022-Present).
- Impacts that are likely to occur:
  - Decommissioning Phase.
  - Post-Decommissioning Phase (for the Retained Development).

Within each of these categories the direct impacts, the stability impacts and the secondary or indirect impacts , where relevant, are assessed, and the corresponding effects on the receiving soils, geology and land are presented in order of decreasing significance.

For clarity, "significant effects" in this context refers to all of the effects that have been assessed as ***slightly significant, moderately significant, significant, very significant or profound*** using the methodology described in Section 8.2.1 and the matrix in Figure 8-3.

Where appropriate, impacts of site activities have been assessed in-combination to determine the significance of the effects (for example to assess the impact of the total volume of peat excavated from all of the turbine foundations; or to assess the combined effect of dead and live load surcharges on the intact peat slopes along the floating roads).

The baseline sensitivity of the receiving soils, geology and land for this report has been assessed based on the site conditions in 1998, prior to the construction of the wind farm.

The purpose of this assessment is to give context to the post-decommissioning impacts that are likely to occur on soils, geology and land from elements of the wind farm, grid connection and ancillary works that will be left in place after decommissioning (the Retained Development).

Impacts on soils, geology and land during the decommissioning phase of the project are addressed in more detail in Chapter 8 of the Environmental Impact Assessment Report (EIAR) that has been prepared for the Decommissioning works (the Prospective Development).

8.4.1 Derrybrien Wind Farm Site

8.4.1.1 Derrybrien Wind Farm Site - Construction Phase Impacts (2003 – 2006)

This section of the report assesses the impact of wind farm site works during the construction stage of the wind farm project between June 2003 and March 2006.

The primary works that were carried out on the wind farm site during this phase that had an impact on soils, geology and land included the following:

- Removing Forestry - Tree felling.
- Construction of the site compound.
- Construction of the wind farm access tracks.
- Excavation and construction of the turbine foundations.
- Excavation and construction of the crane hardstanding areas.
- Deposition and storage of surplus excavated materials on site.
- Excavation and processing of glacial till and bedrock from the borrow pits.
- Assembly and erection of the wind turbines.
- Drainage improvements.
- Excavation of cable trenches and installation of electrical cables and ducts.
- Construction of the substation and control building.
- Construction of the on-site twin poleset for the overhead 110 kV line.
- Construction and assembly of the anemometer masts.

Chapter 2 and the AGL Report No. 11-147B-R04 – "*Geotechnical Stability Report & Assessment of Site Stability Impacts on Soils, Geology and Land*" in Appendix 8-2 of this Chapter give a detailed summary of the construction activities associated with each of these works.

The direct impacts of these activities at the Derrybrien Wind Farm Site are assessed in Section 8.4.1.1.1. The stability impacts are addressed in Section 8.4.1.1.2, i.e., the direct impacts of site activities that had an effect on site stability, potentially causing a peat failure.

8.4.1.1.1 *Direct Impacts of Site Activities – Construction Phase (2003-2006)*

Several of the works that were carried out during the construction stage of the project involved similar site activities. Therefore, the direct impacts of the construction stage activities can be combined and assessed under the following headings:

- Removing forestry – tree felling.
- Construction and material deposition on the intact peat slopes.
- Excavation and disposal of peat.
- Excavation and disposal of glacial subsoil and bedrock.
- Improved drainage.

As discussed in Section 8.3.1.4, the baseline sensitivity of the receiving soils, geology and land impacted by the works has been assessed as **Medium** on the basis of the relatively low overall ecological value of the blanket bog in combination with its value for carbon sequestration, forestry, peat harvesting (turbary plots) and agricultural land use in the context of the overall wind farm project.

The following sections give a summary of the assessment of the direct impacts of the site activities and the significance of the corresponding primary effects on the receiving soils, geology and land. The effects are presented in order of decreasing significance.

Significant and Moderately Significant Effects (Direct Impacts)

The direct impact of site activities for the wind farm that had a **Moderately Significant** effect on soils, geology and land during construction was:

- Excavation and disposal of peat.

The peat slide that occurred on the site in October 2003 had a similar effect on the peat that was displaced within the slide area. The direct impact of the peat slide on the peat is assessed in Section 8.4.3.1.1. When the impact on the displaced peat is assessed in combination with the excavation and disposal of peat for the wind farm the combined effect on the peat is **Significant**, as discussed here.

Excavation and Disposal of Peat:

The main on-site activities that involved excavation and disposal of peat included construction of the 70 No. turbine foundations and adjacent crane hardstanding areas; opening up the borrow pits; and constructing the hardstanding areas and structure foundations for the site compound, substation and anemometer masts.

All of these activities were carried out on the blanket bog in peat depths generally ranging from 1.0-4.0 m, but locally up to 4-5 m. In the hardstanding areas all of the peat was excavated out and the excavation was backfilled with crushed rock granular fill supported on the underlying glacial till. The excavations for the turbine foundations were taken down to competent rock below the till. The foundations for the anemometer masts and substation control building were supported on the glacial till. At the borrow pits the peat was initially stripped off the sites to access the underlying glacial till and bedrock, as required.

Table 8-7 gives a summary of the extent of blanket bog impacted by the peat excavations for each activity along with the corresponding volume of peat that was excavated. The total volume of excavated peat was approximately 185,000 m^3. This was extracted from an area of 7.72ha. Most of the peat was excavated from the site of the turbines, crane hardstandings and borrow pits.

Table 8-7: Extent of site impacted by peat excavation and estimated volume of peat excavated

Construction Activity	Area of Site Impacted (ha)	Volume of Peat Excavated (m^3)
70 No. Turbine foundations and crane hardstandings	4.87 ha	135,815 m^3
Borrow Pits	2.43 ha	43,000 m^3
Substation	0.42 ha	5,250 m^3
Anemometers	0.004 ha	125 m^3
Total	**7.72 ha**	**184,190 m^3**

All of the excavated peat was stored on the wind farm site. Prior to the peat slide in 2003 the peat that was excavated from 39 No. turbine foundation excavations that had been completed was sidecast on the peat slopes adjacent to the excavations along with some of the glacial soils that were excavated for the foundations. Peat was also excavated for the site compound and to open up Borrow Pits No. BP-1 to BP-3 during this time.

For the second phase of construction in 2004/2005 all of the peat that was excavated for the construction of the turbines, crane hardstanding areas, substation, and anemometer masts, as well as

for the expansion of Borrow Pit No.3, was segregated from the glacial till and disposed of in designated peat repositories on the peat slopes within the wind farm site. In each of these areas the excavated peat was spread out uniformly over the surface of the intact peat to a maximum depth of 1.0 m. Some of the peat that was excavated from the site during the second phase of construction was stored in Borrow Pits BP-2 and BP-3 where it was contained within rockfill bunds.

The effect of the excavation and disposal of the peat on soils, geology and land was the loss of peat habitat and the corresponding carbon loss due to the disturbance of the peat in the short-term, and due to decomposition of the excavated peat stored in the deposition areas in the long-term.

A total of about 7.7 ha of blanket bog was excavated for the wind farm infrastructure, which is only 2.3% of the total site area. The effect that this had on the peat was **Medium to Low** because, although the peat was fully excavated out in this area, it was only within a small portion of the site and the degraded habitat in the areas of forestry and turbary plots was of low ecological value.

However, excavating the peat also had an effect on carbon sequestration as the disturbed material spread out over the slopes in the repository areas dried out and had an increased level of exposure to decomposition in an aerobic environment above the water table, which resulted in a release of stored carbon as carbon dioxide.

A total of approximately **185,000 m^3** of peat was excavated from the site for the construction of the wind farm. As discussed in Section 8.3.1.4, if it is assumed that 100% of this was lost to decomposition and erosion then this is equivalent to releasing **32,000 tonnes CO_2** at a rate of 0.2 tonnes/m^3. However, this is very conservative as the excavated peat was all stored in designated storage areas on site and left in place at the end of construction. The peat has settled into the ground and vegetation has re-established on the surface, which will slow down the rate of decomposition. Therefore, the actual long-term carbon release from the excavated and displaced peat will be significantly lower, possibly on the order of **40-60% of the total (i.e. ≈13-19kt CO_2).**

In terms of recent national statistics for greenhouse gas emissions in Ireland, **13-19kt CO_2** is **≈ 0.025%-0.035%** of Ireland's total estimated annual CO_2-equivalent GHG emissions in **2023 (55,000 kt-$CO_{2\text{-eq}}$)** and **≈ 0.15%-0.25%** of the total emissions related to energy industries in that year **(7,865 kt-$CO_{2\text{-eq}}$)** [www.epa.ie, 2024]. Therefore, when taken into account with the loss of habitat over 7.7 ha, the effect that this had on the peat was **Medium to High** and the Significance of the effect was **Moderate**. This should be considered in context with the overall carbon balance for the wind farm project as it was related to the construction of the site infrastructure.

The disturbance of the peat occurred frequently during active periods of construction of the civil works for the wind farm. However, the effect of carbon loss is a **Long-Term** effect because all of the peat was retained on the wind farm site and the release in carbon occurs over time as the material placed in the repository sites decomposes on exposure. Much of this material is still evident on the site. The excavated peat has settled into the underlying intact peat on the slopes, which has reduced the rate of decomposition of the peat that has settled below the water table. The surface of the excavated peat has also dried out and re-vegetated so that a new state of equilibrium is establishing in the natural rate of decomposition and accumulation of peat in the repository areas.

The peat excavation had a negligible effect on geology. In terms of land use, the peat excavation resulted in a loss of about 7.7 ha of land used for forestry. However, it has provided the necessary infrastructure for the construction and operation of the wind farm, which is a significant positive impact as a more concentrated alternative land use for renewable energy generation.

As discussed in Section 8.1.5, the peat slide that occurred at the wind farm site in October 2003 disturbed about 450,000 m^3 of intact peat over an area of approximately 25ha in blanket bog that was covered in coniferous forest plantations, the majority of which was outside the wind farm site boundary. There is about 200,000m^3 of displaced peat material still remaining in the slide area.

The balance was displaced and flowed downslope from the slide area along the channel for the stream in sub-catchment SC7(b).

When the direct impact of the peat slide on the peat in the slide area is assessed in combination with the peat that was excavated for the wind farm infrastructure:

- The total area of blanket bog disturbed was about **32.7 ha**.
- The total volume of peat excavated or displaced was **635,000 m^3**, of which approximately 40-60% could be lost due to erosion and decomposition over time, which would release approximately **50-75kt of CO_2**.
- This is equivalent to **≈0.10-0.15%** of Ireland's total estimated annual $CO_{2\text{-equivalent}}$ greenhouse gas emissions in 2023 (55,000 kt-$CO_{2\text{-eq}}$) and **≈ 0.65-0.95%** of the total emissions related to energy industries in that year (7,865 kt-$CO_{2\text{-eq}}$) [www.epa.ie, 2024].

The combined effect of this on the blanket bog on the site and in the slide area was **High**. Similar to the wind farm site, the blanket bog in the slide area was of low ecological importance as it had been degraded by coniferous forest plantations and drainage. Therefore, the sensitivity of the receiving soils, geology and land in the slide area was **Medium** and the combined effect of the peat excavations on the wind farm site and the disturbance to the peat in the slide was **Significant**.

Some peat was excavated for the foundations of the twin polesets along the 110 kV overhead line for the grid connection, and at the Agannygal Substation. However, these were small volumes that would not give rise to a further significant combined effect on the peat for the Project.

Slightly Significant Effects (Direct Impacts)

The direct impacts of site activities that had a **Slightly Significant** effect on soils, geology and land during construction were:

- Removing forestry – tree felling.
- Construction and material deposition on the intact peat slopes.
- Rock excavation.
- Improved drainage.

Removing Forestry – Tree Felling:

Felling the trees on the wind farm site was a project requirement related to the performance of the turbines. The felled trees were not re-planted and the site was not used for forestry over the operational life of the project. This is a restriction on land use. However, this is balanced by the alternative use of the land for renewable energy generation, with positive environmental benefits.

Where the trees were felled, they were cut as close as possible to the ground. The trunks and roots were left in place so that there was no excavation or disturbance of the peat. Therefore, the effect on carbon storage in the peat was negligible.

The surface of the peat was tracked over by the harvesting machines and forwarders that were used to cut, gather and stockpile the timber for transport off-site. In areas where the surface of the peat was very soft, brash and small branches were placed on the ground under the tracks of the harvester. Where the trees were small or where tree growth was poor the trees were felled by hand, arranged in windrows and left in place on the slopes. The overall effect that this work had on the peat habitat was **Very Low**, particularly given the low ecological value of the degraded blanket bog in the forested areas.

The duration of the forestry trafficking on the peat was **Temporary** during tree felling. However, the restriction on land use is **Long-term** as it applies over the design life of the project. The **Extent** of the impact was in areas where the trees were felled on the site.

Overall, the effect of felling the trees on the soils, geology and land in the felled areas was **Very Low** and the Significance of the effect was **Slight**.

Construction & Material Deposition on the Intact Peat Slopes:

The on-site activities that involved construction directly on the intact peat surface included:

- Construction of the floating roads.
- Sidecasting of excavated peat and glacial till from the turbine excavations that were completed prior to the peat slide in 2003.
- Disposal of peat excavated from the turbines, crane hardstanding areas, substation and borrow pits in designated peat repository areas.

This section assesses the direct impact of these activities on soils, geology and land, particularly the intact peat. The issue of peat instability under the applied surcharge loads is addressed separately as a stability impact in Section 8.4.1.1.2.

Approximately 14.6 km of new floating roads were constructed across the site for the project. They typically are comprised of 600-1000 mm of crushed rock granular fill reinforced with 1-2 layers of geogrids, as necessary, on a basal layer of timber brash, branches and logs from the site that was placed directly on the intact vegetated surface of the peat. The roads are typically 3.5-4.5 m wide at the surface and up to about 5.5-6.5 m wide at the base and cover an area of approximately 8.75 ha (2.6%) on the approximate 340 ha wind farm site.

During the first phase of construction prior to the peat slide in 2003, peat and mineral soil excavated from the foundation excavations that were completed for 38 No. turbines was sidecast and spread out over the intact peat surface adjacent to the excavations at depths typically less than 0.5-1.5 m, but locally up to 2.0-2.5 m at 3 No. turbines (T24, T27 & T40). Where there are records available for the extent of the sidecast material, it was spread out over an area ranging from 215 m^2 and 2,240 m^2, but was generally between 600 m^2 and 1340 m^2, with an average of 1,000 m^2. Therefore, the total extent of the site covered by sidecast material from the turbine excavations is on the order of 38,000 m^2, or 3.8 ha, which is only approximately 1% of the total wind farm site area.

During the second phase of construction in 2004/2005, peat excavated from the site of the remaining turbine foundations as well as from the crane hardstandings, the substation site and the expanded area of Borrow Pit BP-3 was disposed of in designated peat repository areas on the intact peat slopes within the wind farm site. The surveyed location of these repositories is shown on Figure 8-16. There are a total of 32 No. repositories, covering an area of about 114,700 m^2, or 11.47 ha, which is approximately 3.4% of the total site area. In each of these areas excavated peat was spread out over the surface of the intact peat slopes to a maximum depth of 1.0 m.

All of the material that was placed on the peat slopes for the floating roads and material deposition areas covered an area of approximately 24.02 ha, which is 7.2% of the total area of the wind farm site. These materials covered the vegetation that was originally on the intact peat slopes. However, the effect that this had on the peat was **Medium to Low** because the peat was left in place and the degraded habitat in the areas of forestry and turbary plots was of low ecological value.

Placing the materials directly on the slopes had a negligible effect on carbon storage in the underlying peat because the peat was left intact on the slopes and the loss of the existing surface vegetation covered by the deposited materials would have been compensated for by the reduction in the rate of decomposition of the additional volume of peat that was submerged below the water table as it compressed under the applied surcharge loads. The rate of decomposition of peat is dramatically

slowed under anaerobic conditions below the water table. Therefore, the **Significance** of the effect of the floating roads and material deposition areas on the peat was **Slight**.

The site access tracks and material deposition areas will be left in place after the wind farm is decommissioned. However, the main effect occurred in the **Short-term** during construction. The effect on the underlying glacial soils and bedrock was negligible and not significant.

In terms of land use, the material deposition areas are degraded habitats that would not be suitable for reforestation in the short to medium term. However, they would not restrict future forestry on the site after decommissioning of the wind farm because the disturbed peat and glacial subsoils have dried out and re-vegetated over time. Also, the floating roads provide improved access across the site.

Rock Excavation:

The Sandstone bedrock on the site was excavated from the borrow pits and processed into crushed rock granular fill for use in the construction of the site access tracks, and for the hardstanding areas at the turbines, substation, site compound and anemometer masts.

No rock was excavated from Borrow Pit BP-1. A small volume of rock was initially excavated from Borrow Pit BP-2, which was extracted by mechanical excavation without blasting. However, the main source of rockfill on the project was Borrow Pit BP-3, near the site entrance.

Borrow Pit BP-3 covers an area of approximately 1.20ha and it was excavated approximately 11-13 m into the bedrock. Assuming an average depth of rock of 12 m, the total volume of rock that was excavated from the borrow pit was approximately 144,000 m^3. This equates to approximately 180,000 m^3 of granular rockfill in the access tracks and hardstanding areas, assuming a net bulking factor of 1.25 (i.e. the volume change between the intact rock in-situ and the volume of well-graded crushed rock granular fill processed from the rock and placed and compacted on site).

As described in Section 8.3.1.3.4, no audited or unaudited geological heritage sites are identified on the wind farm site on the Geological Survey of Ireland Spatial Resources interactive map viewer. Therefore, the environmental sensitivity of the bedrock in the borrow pits was **Very Low**.

The effect of the significant rock excavation on the site geology would be classified as **Medium**. Therefore, the Significance of the effect was **Slight**.

Rock excavation was a **Frequent** activity during active periods of construction for the civil works on the wind farm. On completion of the works Borrow Pit BP-3 was left open and was not backfilled. Therefore, the effect of the rock excavation on the site geology is **Permanent**. Temporary dewatering inside the pit was ceased at the end of construction and the groundwater was allowed to rise back up to its current equilibrium level.

Improved Drainage:

There was an extensive existing network of drains on the site prior to the construction of the wind farm, particularly for the turbary plots on the east side of the site, as shown on Figure 8-16.

During construction of the wind farm, additional drains were constructed in the peat to provide drainage for the turbine foundations, which was a design requirement, and to improve the control of groundwater and surface runoff in areas of poor drainage and high water table, particularly in the coniferous forests where the majority of the additional drains were constructed. The locations of the new drains are also shown on Figure 8-16. These were constructed as shallow open trenches in the peat with piped culverts under the site access tracks.

Control of groundwater on the site has a positive impact on the peat with respect to site stability, which is addressed in Section 8.4.1.1.2. In terms of direct impact, the additional drains primarily increased the capacity of the existing drainage network to intercept and drain surface runoff or ponded surface water from poorly drained areas of flat or gently sloping ground on the site. It also provided drainage to groundwater accumulating in the permeable pockets of crushed rock granular fill at the turbines.

As the permeability of the peat is low, the extent of drawdown from the shallow open drains is limited to within a few meters of the drains rather than generally across the site. Nevertheless, the increased rate of surface runoff from the site reduces the rate of surface water infiltration into the peat, and this would have had a adverse impact on the ecology of the blanket bog by draining areas of ponded surface water and gradually lowering the water level in the upper acrotelm layers.

The improved drainage would also have had a adverse impact on the peat with respect to carbon storage in areas where the groundwater table was lowered i.e. the rate of decomposition of peat is greater in aerobic conditions above the water table, which releases stored carbon as CO_2. As the existing habitat was of low ecological value and was already degraded by drainage for the forestry and turbary plots, the effect that the improved drainage had on the peat was **Low** and the **Significance** of the effect was **Slight**. The effect on the peat would be **Long-Term.**

The impacts of the project on hydrology and hydrogeology are assessed further in Chapter 9.

Effects That Were Not Significant (Direct Impacts)

The direct impact of site activities that did not have a significant effect on soils, geology and land during construction was:

- Excavation of glacial subsoil.

Excavation of Glacial Subsoil:

The volume of excavation of the glacial till on the site was relatively low. All of the crane hardstanding areas adjacent to the turbines were supported on competent cohesive glacial till below the peat with only minor excavation of soft till at the interface. At the site compound and substation site, some minor cut and fill was carried out in the glacial till across the site to create a level platform prior to capping with the crushed rockfill. Glacial till was also excavated to access the shallow bedrock in Borrow Pits BP-2 and BP-3, and to source suitable material to backfill over the turbine foundations in Borrow Pit BP-1.

The majority of the glacial till was excavated from the turbine foundations and from Borrow Pit BP-3 near the site entrance. Based on the rotary coreholes and construction records, the total volume of cohesive glacial till that was excavated for the 70 No. foundations that were constructed on the site was in the order of about 26,500 m^3, which is relatively low. Assuming an average 1.0 m depth of glacial till over the footprint of the borrow pit, the total volume of glacial till excavated from the 1.2 ha site could have been in the order of 12,000 m^3.

In comparison to the peat, the environmental sensitivity of the glacial subsoil was **Very Low**. Therefore, the effect of the excavations on the glacial soils on the site would be classified as **Low** and **Not Significant**.

8.4.1.1.2 Stability Impacts of Site Activities – Construction Phase (2003-2006)

This section of the chapter presents the assessment of stability impacts for the construction stage of the wind farm project, i.e. the direct impacts of site activities on the receiving soils, geology and land that had an effect on site stability.

AGL Report No.11-147-R04 – "*Derrybrien Windfarm - Geotechnical Stability Report & Assessment of Stability Impacts of On-Site Activities*" in Appendix 8-2 of this Chapter gives a detailed assessment of the characteristics of site activities during construction and the corresponding impacts on soils, geology and land that had an effect on site stability, particularly in relation to the peat. The results are summarised in Table 8-8.

For each activity, Table 8-8 states the nature of the corresponding stability impact on soils, geology and land – typically a dead or live load surcharge on the intact peat slopes - as well as the extent, duration and frequency of that impact.

As described in Section 8.2.1, the corresponding effect on soils, geology and land is a function of the characteristics of the site activity, the quality of the effect with respect to site stability, the probability of a peat failure occurring, and the possible nature and extent of a peat failure. For example, surcharge loads on the intact peat slopes increase shear stresses in the underlying peat that increase the risk of a peat slide, which is an adverse impact on the peat with respect to site stability.

The probability of a peat failure has been assessed for each site activity based on the physical characteristics of the site (e.g. the topography, peat depth, strength and groundwater conditions), as well as the characteristics of the corresponding stability impact (e.g. the magnitude, extent, duration and frequency of loading). This is consistent with the EPA Guidelines (2022) as well as current best practice guidelines for peat stability risk assessments (Scottish Government, Energy Consent Unit, 2017).

Where peat failures did not occur the **Significance** of the **Effect** on Table 8-8 reflects the probability of a peat failure occurring due to the effect of the stability impact on the peat (e.g. due to the increased shear stresses under applied surcharge loads), as well as the sensitivity of the soils, geology and land potentially impacted by a peat slide, which has been calibrated by the peat failures that occurred during construction and assessed as **Medium**, as discussed in Section 8.3.1.4.

Table 8-8 identifies where peat failures actually occurred during construction as well as the nature and extent of the failures. In those cases, the effect of the stability impact on Table 8-8 and the significance of that effect are also consistent with the effect of the direct impact of the peat failure on the receiving soils, geology and land.

Many of the site activities during construction had similar effects on the stability of the peat slopes. Therefore, in the following summary, stability impacts have been combined by the characteristics of the impact and the significance of the corresponding effect on soils, geology and land (i.e. to group similar impacts with similar effects). The effects are presented in order of decreasing significance.

Table 8-8: Assessment of Stability Impacts – Construction Stage 2003 to 2006

Activity	Characteristics of Direct Impact of Site Activities with respect to Site Stability (Stability Impacts)				Assessment of Effect of Stability Impacts on Soils, Geology & Land						Did Peat Failure Occur? (Yes/No)
	Impact	Extent of Impact	Duration	Frequency	Quality of Impact	Possible Extent of a Peat Failure	Probability of Occurrence of a Peat Failure	Effect on Receiving Soils, Geology & Land	Sensitivity of Receiving Soils, Geology & Land	Significance of Effect	
Tree Felling	Loading from the tree felling equipment on the peat slopes	Across site, except turbary plots	Temporary	Frequently	Negative	Small (100m²-2500m²) to Very Large (>10Ha) Peat Slide	Very Low to Low	Medium to Low	Medium	Slight	No
	Loading of the stockpiled logs on the peat slopes in localised areas along the floating roads	Localised areas along floating roads	Temporary	Frequently	Negative	Small (100m²-2500m²) to Very Large (>10Ha) Peat Slide	Very Low to Low	Medium to Low	Medium	Slight	No
	Unloading of the peat slopes with the removal of the felled trees	Across site, except turbary plots	Permanent	Sustained	Positive	Not Applicable - Reduced risk of a peat slide due to unloading of peat slopes where trees were felled	Positive Impact - Reduced Probability of a Peat Slide	Very Low (Positive)	Medium	Slight (Positive)	No
Site Compound	Loading on peat slopes due to disposal of excavated peat & possibly glacial till (Prior to Peat Slide)	On-Site	Permanent	Sustained	Negative	Small (100m²-2500m²) to Very Large (>10Ha) Peat Slide	Possible to Very Possible	High	Medium	Significant	No
	Loading from engineered fill materials to form a level platform and hardstanding area	At site compound	Permanent	Sustained	Slight Negative	Not Applicable	Negligible	Negligible	Medium	Not Significant	No
	Loading on hardstanding area from temporary structures	At site compound	Short-term	Occasional	Slight Negative	Not Applicable	Negligible	Negligible	Medium	Not Significant	No
	Construction traffic loading on hardstanding area	At site compound	Short-term	Frequently	Slight Negative	Not Applicable	Negligible	Negligible	Medium	Not Significant	No
Site Access: Floating Roads	Live loading on the peat from wide-track excavator placing small trees as basal reinforcement	Along the floating roads	Temporary	Frequently	Negative	Small (100m²-2500m²) to Very Large (>10Ha) Peat Slide	Very Low to Low	Medium to Low	Medium	Slight	No
	Dead load surcharge on the peat from 5.0 m wide strip of rockfill used to construct roads	Along the floating roads	Permanent	Sustained	Negative	Small (100m²-2500m²) to Very Large (>10Ha) Peat Slide	Possible to Very Possible	High	Medium	Significant	No
	Live load surcharge from construction traffic on floating roads - prior to peat slide in October 2003	Along the floating roads	Short-term	Frequently	Negative	Small (100m²-2500m²) to Very Large (>10Ha) Peat Slide	Possible to Very Possible	High	Medium	Significant	No
	Live load surcharge from construction traffic on completed floating roads - 2nd Phase of Construction - After Testing	Along the floating roads	Short-term	Frequently	Negative	Small (100m²-2500m²) to Very Large (>10Ha) Peat Slide	Low to Possible	Medium	Medium	Moderate	No
Site Access: Access Tracks on Glacial Subsoil	Additional dead load from layer of rockfill used to upgrade existing access tracks	Along existing access tracks on glacial subsoil	Permanent	Sustained	Slight Negative	Not Applicable	Negligible	Negligible	Medium	Not Significant	No
	Construction traffic loading on upgraded access tracks	Along upgraded access tracks on glacial subsoil	Temporary	Frequently	Slight Negative	Not Applicable	Negligible	Negligible	Medium	Not Significant	No

Table 8-8 (Contd.): Assessment of Stability Impacts – Construction Stage 2003 to 2006

Activity	Characteristics of Direct Impact of Site Activities with respect to Site Stability (Stability Impacts)				Assessment of Effect of Stability Impacts on Soils, Geology & Land						Did Peat Failure Occur? (Yes/No)
	Impact	Extent of Impact	Duration	Frequency	Quality of Impact	Possible Extent of a Peat Failure	Probability of Occurrence of a Peat Failure	Effect on Receiving Soils, Geology & Land	Sensitivity of Receiving Soils, Geology & Land	Significance of Effect	
Site Access: Access tracks across slide area at Turbines T68 and T70	Rockfill loading on the glacial subsoil	Along reconstructed access tracks at T68 and T70	Permanent	Sustained	Slight Negative	Not Applicable	Negligible	**Negligible**	**Medium**	**Not Significant**	**No**
	Construction traffic loading on upgraded access tracks	Along reconstructed access tracks at T68 and T70	Temporary	Frequently	Slight Negative	Not Applicable	Negligible	**Negligible**	**Medium**	**Not Significant**	**No**
	Containment of disturbed peat upslope from the access tracks	Slide area directly upslope from reconstructed access tracks at T68 and T70	Permanent	Sustained	Positive	Not Applicable - Disturbed peat in slide area upslope from access track contained by rockfill berms	Positive Impact - Reduced Probability of a Peat Slide	**Medium (Positive)**	**Medium**	**Moderate (Positive)**	**No**
Construction of Turbine Foundations	Temporary stability of peat slopes around perimeter of excavation due to excavation of peat and mineral soil to rockhead	At turbine foundations	Temporary	Once at each turbine	Negative	Localised (<10m^2) to Very Small (10m^2-100m^2) Peat Slide [Upslope from excavation]	Possible to Very Possible	**Medium to Low**	**Medium**	**Slight**	**Yes** [**T52** - V Small Shear Failure Upslope from Excavation, **T66** - Tension Cracks over V Small Area Upslope]
	Excavation backfilling and construction of RC Foundation – loading from structural fill, steel and concrete	At turbine foundations	Temporary	Once at each turbine	Slight Negative	Not Applicable	Negligible	**Negligible**	**Medium**	**Not Significant**	**No**
	Construction traffic loading on floating roads	At turbine foundations and along floating roads	Short-term	Frequently	Negative	Small (100m^2-2500m^2) to Very Large (>10Ha) Peat Slide	Low to Possible	**Medium**	**Medium**	**Moderate**	**No**
Crane Hardstanding Areas	Temporary stability of peat due to excavation to suitable formation on glacial subsoil	At each turbine	Temporary	Once at each turbine	Negative	Localised (<10m^2) to Very Small (10m^2-100m^2) Peat Slide [Upslope from excavation]	Very Low to Low	**Low**	**Medium**	**Slight**	**No**
	Excavation backfilling and construction of crane hardstanding – loading from crushed rock granular fill on glacial subsoil	At turbine foundations	Permanent	Sustained	Slight Negative	Not Applicable	Negligible	**Negligible**	**Medium**	**Not Significant**	**No**
	Construction traffic loading on crane hardstanding	At turbine foundations	Temporary	Frequently	Slight Negative	Not Applicable	Negligible	**Negligible**	**Medium**	**Not Significant**	**No**
	Construction traffic loading on floating roads.	At each turbine and along floating roads.	Short-term	Frequently	Negative	Small (100m2-2500m2) to Very Large (>10Ha) Peat Slide	Low to Possible	**Medium**	**Medium**	**Moderate**	**No**
Spoil Management: Prior to Peat Slide on 16th October, 2003	Shear Failure due to sidecasting of excavated peat and glacial till	At 43 No. turbines - 39 No. completed, 2 No. in progress (T62 & T68), 2 No. partially completed (T6 & T31) prior to slide.	Permanent	Sustained	Negative	Small (100m2-2500m2) to Very Large (>10Ha) Peat Slide	Very Possible to Likely	**High**	**Medium**	**Significant**	**Yes** [**T68** - Very Large (25Ha); **T17** - Small (1,800m^2); **T23,T29 & T66**-Local Bearing Failure]
	Disposal of surplus excavated glacial subsoil in borrow pits	At Borrow Pits #1 & #2	Permanent	Sustained	Slight Negative	Not Applicable	Negligible	**Negligible**	**Medium**	**Not Significant**	**No**

Table 8-8 (Contd.): Assessment of Stability Impacts – Construction Stage 2003 to 2006

Activity	Characteristics of Direct Impact of Site Activities with respect to Site Stability (Stability Impacts)				Assessment of Effect of Stability Impacts on Soils, Geology & Land						Did Peat Failure Occur? (Yes/No)
	Impact	Extent of Impact	Duration	Frequency	Quality of Impact	Possible Extent of a Peat Failure	Probability of Occurrence of a Peat Failure	Effect on Receiving Soils, Geology & Land	Sensitivity of Receiving Soils, Geology & Land	Significance of Effect	
Tree Felling	Loading from the tree felling equipment on the peat slopes	Across site, except turbary plots	Temporary	Frequently	Negative	Small (100m^2-2500m^2) to Very Large (>10Ha) Peat Slide	Very Low to Low	Medium to Low	Medium	Slight	No
	Loading of the stockpiled logs on the peat slopes in localised areas along the floating roads.	Localised areas along floating roads	Temporary	Frequently	Negative	Small (100m^2-2500m^2) to Very Large (>10Ha) Peat Slide	Very Low to Low	Medium to Low	Medium	Slight	No
	Unloading of the peat slopes with the removal of the felled trees	Across site, except turbary plots	Permanent	Sustained	Positive	Not Applicable - Reduced risk of a peat slide due to unloading of peat slopes where trees were felled	Positive Impact - Reduced Probability of a Peat Slide	Very Low (Positive)	Medium	Slight (Positive)	No
Site Compound	Loading on peat slopes due to disposal of excavated peat & possibly glacial till (Prior to Peat Slide)	On-Site	Permanent	Sustained	Negative	Small (100m^2-2500m^2) to Very Large (>10Ha) Peat Slide	Possible to Very Possible	High	Medium	Significant	No
	Loading from engineered fill materials to form a level platform and hardstanding area	At site compound	Permanent	Sustained	Slight Negative	Not Applicable	Negligible	Negligible	Medium	Not Significant	No
	Loading on hardstanding area from temporary structures	At site compound	Short-term	Occasional	Slight Negative	Not Applicable	Negligible	Negligible	Medium	Not Significant	No
	Construction traffic loading on hardstanding area	At site compound	Short-term	Frequently	Slight Negative	Not Applicable	Negligible	Negligible	Medium	Not Significant	No
Site Access: Floating Roads	Live loading on the peat from wide-track excavator placing small trees as basal reinforcement.	Along the floating roads	Temporary	Frequently	Negative	Small (100m^2-2500m^2) to Very Large (>10Ha) Peat Slide	Very Low to Low	Medium to Low	Medium	Slight	No
	Dead load surcharge on the peat from 5.0 m wide strip of rockfill used to construct roads	Along the floating roads	Permanent	Sustained	Negative	Small (100m^2-2500m^2) to Very Large (>10Ha) Peat Slide	Possible to Very Possible	High	Medium	Significant	No
	Live load surcharge from construction traffic on floating roads - prior to peat slide in October 2003	Along the floating roads	Short-term	Frequently	Negative	Small (100m^2-2500m^2) to Very Large (>10Ha) Peat Slide	Possible to Very Possible	High	Medium	Significant	No
	Live load surcharge from construction traffic on completed floating roads - 2nd Phase of Construction - After Testing	Along the floating roads	Short-term	Frequently	Negative	Small (100m^2-2500m^2) to Very Large (>10Ha) Peat Slide	Low to Possible	Medium	Medium	Moderate	No
Site Access: Access Tracks on Glacial Subsoil	Additional dead load from layer of rockfill used to upgrade existing access tracks	Along existing access tracks on glacial subsoil	Permanent	Sustained	Slight Negative	Not Applicable	Negligible	Negligible	Medium	Not Significant	No
	Construction traffic loading on upgraded access tracks	Along upgraded access tracks on glacial subsoil	Temporary	Frequently	Slight Negative	Not Applicable	Negligible	Negligible	Medium	Not Significant	No

Table 8-8 (Contd.): Assessment of Stability Impacts – Construction Stage 2003 to 2006

Activity	Characteristics of Direct Impact of Site Activities with respect to Site Stability (Stability Impacts)				Assessment of Effect of Stability Impacts on Soils, Geology & Land						Did Peat Failure Occur? (Yes/No)
	Impact	Extent of Impact	Duration	Frequency	Quality of Impact	Possible Extent of a Peat Failure	Probability of Occurrence of a Peat Failure	Effect on Receiving Soils, Geology & Land	Sensitivity of Receiving Soils, Geology & Land	Significance of Effect	
Borrow Pits (Contd.)	Controlled disposal of excavated peat from Borrow Pits No.3 - 2nd Phase of Construction (2004/2005)	In designated peat repository areas	Permanent	Sustained	Negative	Small (100m2-2500m2) to Very Large (>10Ha) Peat Slide	Very Low to Low	**Medium to Low**	**Medium**	**Slight**	**No**
	Backfilling borrow pits with Glacial Subsoil (Borrow Pit No.2)	Borrow Pit No.2	Permanent	Sustained	Slight Negative	Not Applicable	Negligible	**Negligible**	**Medium**	**Not Significant**	**No**
	Backfilling borrow pits with Peat below ground level or contained by rockfill bunds (BP No.2 and small sections of BP No.3)	In BP No.2 and BP No.3 (small sections)	Permanent	Sustained	Negative	Localised flow slide of remoulded peat due to failure of containment bunds	Very Low	**Very Low**	**Medium**	**Slight**	**No**
	Blast-induced vibrations (BP No.3 Only)	Within 200-500 m of BP No.3	Momentary	Occasional	Negative	Small (100m2-2500m2) to Very Large (>10Ha) Peat Slide	Very Low to Low	**Very Low**	**Medium**	**Slight**	**No**
Drainage	Loading on peat slopes from wide-track excavators and locally sidecast peat.	Along open drains	Temporary	Occasional	Negative	Small (100m2-2500m2) to Very Large (>10Ha) Peat Slide	Very Low to Low	**Low**	**Medium**	**Slight**	**No**
	Improvement of groundwater conditions	In areas of improved drainage	Permanent	Sustained	Positive	Not Applicable - Reduced risk of a peat slide due to improved groundwater conditions	Positive Impact - Reduced Probability of a Peat Slide	**Medium (Positive)**	**Medium**	**Moderate (Positive)**	**No**
Cable Trenching and Ducting	Loading on peat slopes from wide-track excavators and cable transporting equipment	Across site, generally along site access tracks	Temporary	Frequently	Negative	Small (100m2-2500m2) to Very Large (>10Ha) Peat Slide	Very Low to Low	**Low**	**Medium**	**Slight**	**No**
	Installation of cable ducts under floating roads	At cable crossing points	Brief	Once at each crossing point	Slight Negative	Localised (<10m^2) at duct crossings under road	Very Low	**Very Low**	**Medium**	**Slight**	**No**
Erection of 110kv Twin Poleset	Live load surcahrge on intact peat from construction activities to excavate the foundations and erect the poleset	At the 110kv twin poleset on the windfarm site (adjacent to substation)	Temporary	Once	Slight Negative	Localised (<10m^2) to Very Small (10m^2-100m^2) Peat Slide	Very Low	**Very Low**	**Medium**	**Slight**	**No**
Construction of Anemometer Towers	Controlled excavation of peat for hardstand & RC foundation	At 2 No. anemometer locations	Temporary	Once at each location	Negative	Localised (<10m^2) to Very Small (10m^2-100m^2) Peat Slide [Upslope from excavation]	Very Low to Low	**Low**	**Medium**	**Slight**	**No**
	Permanent loading on glacial subsoil from hardstand and anemometer structure	At 2 No. anemometer locations	Permanent	Sustained	Slight Negative	Not Applicable	Negligible	**Negligible**	**Medium**	**Not Significant**	**No**
	Construction traffic loading on floating roads - spoil management, tranpsorting backfill materials & components	Along floating roads to anemometer locations	Brief	Occasional	Negative	Small (100m2-2500m2) to Very Large (>10Ha) Peat Slide	Low to Possible	**Medium**	**Medium**	**Moderate**	**No**

Significant Effects (Stability Impacts)

The following impacts of site activities had a **Significant** effect on the receiving soils, geology and land with respect to site stability during construction:

1. The dead load surcharge on the intact peat slopes from the construction of the floating roads.
2. The initial live load surcharge from the construction traffic on the floating roads i.e. during construction of the floating roads; and
3. The dead load surcharge on the intact peat slopes due to sidecasting and disposal of excavated peat and glacial subsoils on the surface of the peat prior to the peat slide in October 2003 for the site compound, borrow pits and turbine foundations.

This section includes a summary of the peat failures that occurred on the site during the initial phase of construction, including the large peat slide that occurred at Turbine T68 on the 16th October 2003. As discussed in Section 8.1.5.2, the October 2003 peat slide has been recorded in this section as an "***impact that has occurred***", specifically in the assessment of the impact of sidecasting materials excavated from the turbine foundations onto the intact peat slopes, which has been attributed to triggering the large slide at T68 along with more localised smaller scale peat failures at 4 No. other locations on the wind farm site.

Floating Road Construction & Live Load Surcharge:

The majority of the site access tracks (15.1 km) were constructed as floating roads on the peat. The 0.6-1.0 m thick layer of granular rockfill that was used to construct the floating roads was equivalent to a dead load surcharge of 12.5-20.0 kN/m^2 on the surface of the peat, which was spread out over typically a 5.5-7.0 m wide strip along the base of the roads. On sloping ground this applied a downslope shear stress in the peat, which increased the risk of instability due to shear failure in the peat. At the time that the floating roads were constructed the risk of a small to very large scale peat slide across the site under this loading was **Possible** to **Very Possible**, with the higher risk associated with the sections of the site where there was a higher likelihood of a peat slide based on the baseline site characteristics (see Figure 8-36). Therefore, the effect of the dead load surcharge on the peat was **High** and **Significant** with respect to the baseline sensitivity of the receiving soils, geology and land.

The rockfill that was used to construct the floating roads was transported along the site access tracks in standard 3 and 4 axle tipper trucks, and then spread out over the surface of the peat along the line of the roads using 13 tonne and 20 tonne hydraulic tracked excavators.

The maximum construction traffic loading was from the 4-axle trucks, which weighed up to 36.5 tonnes when fully loaded. This was equivalent to a live load surcharge of 20.75 kN/m^2 over the 7.5 x 2.3 m wide footprint of the truck, with a maximum axle load of 12 tonnes. The 20 tonne Hitachi EX200 long-reach tracked hydraulic excavator had a similar live load surcharge (20.8 kN/m^2) but over a smaller area (3.37 m x 2.8 m wide).

These additional surcharge loads on the peat increased the risk of a peat slide during the construction of the floating roads. Therefore, the effect of the live load surcharges on the peat was **High** and **Significant**.

The construction traffic loading on the floating roads was **Frequent** during the construction of the roads. However, the **Duration** of the loading was **Temporary**.

At the end of construction, the floating roads were left in place. Therefore, the dead load surcharge was **Permanent** and **Sustained.** However, the highest risk for peat instability was in the short-term undrained condition during construction. Over time, the peat consolidated and increased in shear

strength under the weight of the road, which significantly reduced the risk of peat instability. This was verified by in-situ measurements of the shear strength of the peat under the roads.

No peat failures occurred during the construction of the floating roads.

Sidecasting of Peat and Glacial Subsoil:

Prior to the peat slide in October 2003 material excavated from the site of the compound, borrow pits and turbine foundation excavations was stored on site and typically sidecast and spread out on the peat adjacent to the excavations. The majority of the sidecast material was from the turbine foundation excavations, where the material was comprised of peat, glacial till and occasionally weathered rock.

By the 16th October 2003 the Contractor had completed the excavation for the foundations of 39 No. turbines across the site, predominately in areas of shallow bedrock where the depth of excavation for the foundations was shallower (i.e. Turbines T1-T5, T9-T13, T17- T29, T32, T34, T35, T37, T38, T40-T46, T63, T66, T67 & T69). The extent of excavation was limited to the turbine foundations and did not include the adjacent crane hardstanding areas. Excavation was underway for the foundations at Turbines T62 and T68 at the time of the slide. The foundations for Turbines T6 and T31 had also been partially excavated in the peat.

The peat, glacial till and occasionally weathered rock excavated from these turbines was sidecast and spread out over a wide area across the surface of the peat slopes adjacent to the excavations generally to a depth of 0.5-1.5 m, but locally up to 2.0-2.5 m at T24, T27 and T40.

Applied Ground Engineering Consultants (AGEC) inspected each of the sidecast areas in their walkover inspections of the site after the slide. Records of the depth, extent, material characteristics and stability of the sidecast materials are presented in their final report on the post-landslide site appraisal (Ref. AGEC Report No. 378_099 dated 4/2/2004), which is included as Appendix 8-1 of this chapter.

Some slumping or localised flow of the saturated excavated material on the peat slopes was noted by AGEC. However, in terms of site stability, the primary impact of the material sidecasting was the dead load surcharge that was applied to the intact peat on the slopes.

There are no detailed records of the relative volume of peat and glacial subsoil sidecast at each turbine. In their post-landslide site appraisal report AGEC made some visual observations on the characteristics of the sidecast material – i.e. whether it was predominately peat, glacial till or some combination of both. Based on the ground investigation data and construction records, the average ratio of peat to glacial till in the excavation to rock at the turbines was approximately 1:1, excluding a few outliers in deep peat over shallow rock where the arisings were predominately comprised of peat (e.g. T2, T12 & T13). Assuming a unit weight of 10kN/m^3 for the peat and 20 kN/m^3 for the glacial till, an average unit weight of 15.0 kN/m^3 would give in indicative surcharge weight for the sidecast material.

Where the depth of sidecast material generally ranged from 0.5 to 1.5 m this was equivalent to a surcharge load of 7.5 - 22.5 kN/m^2. At turbines T24, T27 and T40 the surcharge was locally up to 30.0-37.5 kN/m^2 where the sidecast material was up to 2.0-2.5 m deep.

Where the extent of the sidecast material on the slopes was recorded by AGEC it covered an area ranging from 215 m^2 at Turbine T29 to 2,240 m^2 at T9. However, it was generally between 600 m^2 and 1,340 m^2, with an average of 1,000 m^2 (approximately 25 m x 40 m).

With respect to site stability, the primary effect of the surcharge load applied by the sidecast material was to increase shear stresses in the underlying intact peat, which increased the risk of a peat slide on the slopes. The surcharge also applied a concentrated bearing pressure on the peat which increased

the risk of localised bearing failure. The probability of a peat slide or bearing failure under the surcharge load was **Possible** to **Very Possible**, with the higher risk associated with the sections of the site where there was a higher likelihood of a peat slide based on the baseline site characteristics (see Figure 8-36). Therefore, the effect of the surcharge on the peat was **High** and **Significant** with respect to the baseline sensitivity of the receiving soils, geology and land that could be impacted by a slide, which has been assessed as **Medium**.

The probability of a peat failure would also have been higher where a greater depth and volume of excavated material was placed on the slopes, and where the sidecast material included a significant proportion of glacial till or weathered rock which are almost twice the weight of peat.

Peat Failures related to Sidecasting of Peat and Glacial Subsoil (Impacts that occurred):

Based on the records of the inspections carried out by AGEC, **the majority of the material sidecast areas [35 No. (≈90%)] were stable** with only minor slumping or localised flow of the excavated material, in some cases blocking drains on the site. In these areas the sidecast material was left in place so that the loading is **Permanent** and **Sustained**.

Of the 4 No. (≈10%) remaining sidecast areas inspected by AGEC where the turbine excavation had been completed:

- A local bearing failure was recorded under the sidecast material at Turbines T23, T29 and T66.
- A small-scale peat slide occurred at Turbine T17 on 2nd October 2003.

Excavation was underway for the foundation at Turbine T68 at the time of the slide and the excavated material was being sidecast on the slopes downslope from the turbine and floating road, where the slide is thought to have initiated (AGEC, 2004).

The following is a description of the failures that occurred. The impact of the large peat slide at Turbine T68 on the receiving soils, geology and land is assessed in Section 8.4.3.1.1.

Local bearing failure that occurred in the peat at T23, T29 and T66:

At 3 No. turbine bases (Turbines T23, T29 and T66) there was a localised bearing capacity failure in the intact peat under the weight of the sidecast material. At each of these turbines the arisings from the foundation excavation were placed on the intact peat slopes along the edge of the forest on the downslope side of the turbine and floating road.

The bearing capacity failures were characterised by a rotational shear failure in the intact peat under the arisings, which caused slumping of the excavated material and heave with tension cracks in the intact peat downslope, giving the slope an irregular stepped profile, as shown in Figure 8-42. Some trees within the zone of ground movement were tilted over.

Turbines T23 and T29 are located along the southern boundary of the site. The bearing capacity failure at these turbines occurred in relatively shallow peat (1.0-1.5 m deep) on gently sloping ground (2-4°).

Turbine T66 is located near the centre of the site, 250 m upslope from Turbine T68 where the large peat slide occurred in October 2003. At T66 the excavated material was placed on intact peat up to 2.8 m deep on intermediate slopes of 3-5°.

At each turbine the failure within the peat was localised and limited to an area that extended a few metres downslope from the sidecast material. The peat outside the zone of the bearing failure remained undisturbed and intact. Therefore, the effect that this had on the peat was **Very Low**, which is of **Slight** significance.

In these areas some or all of the sidecast material was removed after the failures occurred to stabilise the slope so that the impact of the loading was **Temporary**.

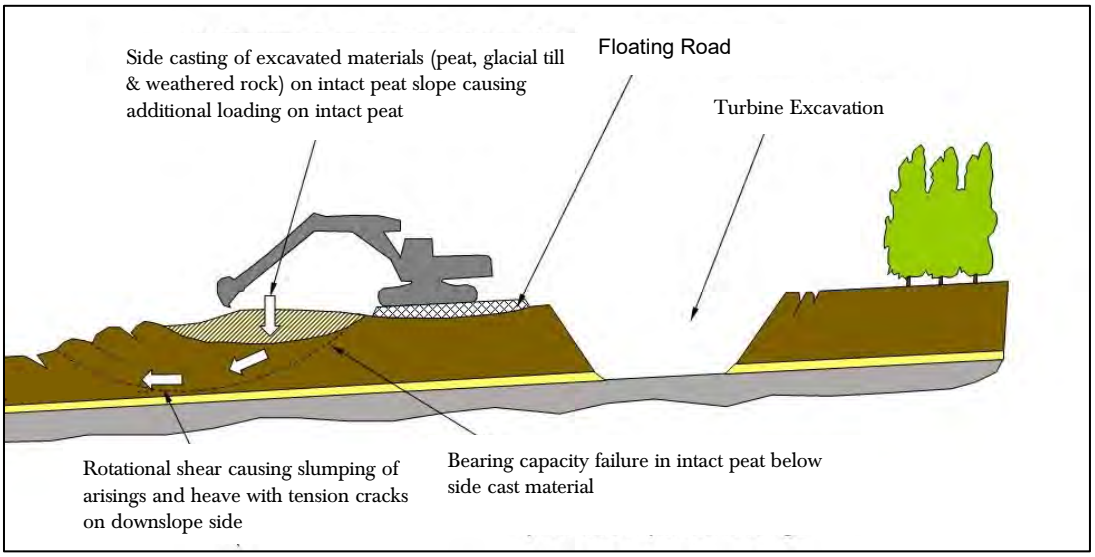


Figure 8-42: Bearing capacity failure below sidecast materials

Small scale peat slide that occurred at Turbine T17:

On the 2nd October 2003, at Turbine T17, there was a shear failure in the peat under the sidecast material which gave rise to a small peat slide over an area of about 22 m x 90 m (1,980 m^2) approximately 10 m east of the turbine on the south side of the floating road. The slide occurred as a planar shear failure near the base of the peat in peat up to 1.5-2.0 m deep on slopes of 2-4°.

The disturbed remoulded peat from the failed area flowed out in a lobe over the intact peat downslope from the failure for a run-out distance of about 45 m, where it came to rest on flatter slopes with shallower peat about 1.0 m deep.

There was no evidence of failure in the in-situ peat below the lobe of remoulded peat in the run-out zone. The slide was small (<2,500 m^2) and the peat slopes downslope from the failed area remained undisturbed and intact. Therefore, the effect that this had on the peat was **Low**, which is of **Slight** significance.

Very large scale peat slide that occurred at Turbine T68 on 16th October 2003:

At the time of the peat slide on the 16th October 2003 peat up to 3.5 m deep was being excavated from the site of Turbine T68 and placed on the intact peat slopes on the downslope side of the floating road, opposite the turbine, using 2 No. 20 tonne Hitachi EX200 long-reach excavators. Some of the excavated material was also placed on the slopes to either side of the turbine. The excavators were operating on the floating road and on a small section of granular hardstanding on the glacial till between the turbine and the hardstanding. The excavation had not progressed into the glacial till so only peat was sidecast on the slopes (see Plate 8-1 and Plate 8-2).

As discussed in Section 8.1.5.1, Applied Ground Engineering Consultants, Ltd. (AGEC) carried out an inspection and supplemental investigations on the site at the time of the slide to provide an opinion on the likely cause of the failure. A copy of their report - "*Derrybrien Windfarm – Final Report on Landslide of October 2003*" - is included in Appendix 8-1 of this Chapter.

AGEC concluded that the construction activity, and particularly the placing of arisings onto the intact peat slopes, most likely triggered the slide. The failure mechanism that they proposed is shown schematically in Figure 8-1.

Plate 8-1: Excavation at Turbine T68 at the time of the slide

Plate 8-2: Aerial view of the head of the slide at Turbine T68 (October 2003)

The peat slope and sidecast arisings downslope from the turbine were damaged in the slide. However, based on their site observations AGEC proposed that the additional surcharge load on the intact peat slopes could have initially caused a localised shear failure or bearing capacity failure in the underlying intact peat slope similar to that shown on Figure 8-42. This would have reduced the shear resistance in the failed peat, resulting in a redistribution or transfer of lateral load to the adjacent peat downslope. Additional transfer of lateral loading as more material was placed on the slopes could have led to a progressive shear failure and reduction in shear resistance along the base of the peat further downslope. Ultimately, this could have led to the large planar or translational peat slide that occurred on the inclined slopes.

Although the peat slide occurred while the excavated peat was being sidecast on the intact peat slopes, site observations at the time of the slide indicated that the failed mass of peat initially moved as a rigid body in a large planar slide over a wide area on the slopes of the mountain. The magnitude of loading from the sidecast material over a very small area at the top of the slide was actually quite low relative to the scale and characteristics of the slide. Furthermore, excavated arisings from the turbine foundations had already been sidecast on the intact peat slopes in a number of other locations on the site without causing a failure in the peat. Therefore, on its own it does not fully explain why the slide occurred at Turbine T68.

At the time of the peat slide at the Derrybrien Wind Farm the construction industry's general knowledge of failures on peat slopes was very limited. As discussed in Section 8.1.5.2, as a result of the Derrybrien slide there have been numerous investigations, research projects and publications into peat slope failures in Ireland and the UK which have greatly increased our knowledge of the behaviour of peat and of peat failures on upland blanket bogs. Subsequent investigations into peat slope failures have also shown similar types of triggering events and failure mechanisms to the slide that occurred at Derrybrien - specifically large peat slides caused by the placement of relatively small loads at the head of an intact peat slope (Dykes & Warburton (2007), Kane et al (2020)).

Based on their investigations into the peat slide at Derrybrien in 2003, AGEC identified additional contributory factors that would have made the slope predisposed to the failure in that area, as discussed in Section 8.1.5.1.

Their findings are consistent with the results of subsequent investigations and testing carried out on the site after the slide, as well as our current understanding of peat slope failures on upland blanket bogs. Based on the additional investigations that were carried out in the area and on subsequent developments in our understanding of peat slope failures on blanket bogs, it is recognised that the following expanded list of significant compounding factors and site conditions contributed to the peat slide occurring in that area of the wind farm at that time:

- There was a convex break in slope to locally steeper slopes >4-5° on the downslope side of the floating road at the top of the slide, where the excavated material was being sidecast on the peat slopes (see Figure 8-6).
- The slide occurred within a shallow buried valley that was filled with locally deeper peat, which would not have been evident from the ground surface.
- Laboratory testing of undisturbed samples from the base of the peat adjacent to the slide indicated that the failure occurred within a layer of uncharacteristically weak highly decomposed and possibly disturbed peat that was not encountered elsewhere on the site and may have been indicative of a previous historic peat slide in the area.
- The shallow buried valley where the slide occurred is directly upslope from the valley for the stream in sub-catchment SC7(b). Therefore it is likely that there was concentrated subsurface flow of groundwater within and below the peat in the valley at Turbine T68 which has since formed a stream within the disturbed peat in the slide area.

- Aerial photographs of the site from before the slide also showed evidence of concentrated subsurface drainage in the peat within the slide area in the form of lines of dark green vegetation on the slopes (see Figure 8-4).
- The historical aerial photographs of the site (Figure 8-4) also show that there was a large irregular area of smaller tree growth in the conifer plantations on the west side of the wind farm where the trees may have been destroyed by fire at some point in the past. The peat slide occurred at the eastern edge of this area.
- Prior to construction of the wind farm, the integrity of the upper fibrous layer of intact peat in the slide area would also have been damaged by the drains and furrows that were cut into the slope for the conifer forest plantations.
- At the time of the slide drainage works were also being carried out on the peat slope within the slide area approximately 300m downslope from the turbine.

All of these compounding factors would indicate that the peat on the slope in this area could have been at or close to the point of failure when the construction works were being carried out.

This is consistent with the current best practice guidelines for assessing the risk of peat instability for wind farm developments on upland blanket bogs (Scottish Government – Energy Consent Unit, 2017), which are based on assessing a range of similar contributory risk factors related to site characteristics to identify areas where there is an elevated risk of peat instability, as described in Section 8.2.1.

The peat slide displaced peat and forestry on the slopes over an area of about 25 ha that extended 1.68 km downslope from Turbine T68, which is very large (>10 ha). The majority of this (≈90%) was in the Coillte coniferous forests outside the wind farm site. From here fluidised remoulded peat from the slide entered the valley of the Derrybrien River North and impacted farmland down to the Black Road Bridge approximately 1.0 km downslope from the slide area where rockfill barrages were constructed to contain much of the material. This was the primary run-out zone for the slide. Some of the remoulded peat was transported further downstream along the river channel.

The total volume of peat from the slide area has been estimated at about 450,000 m^3, of which approximately 200,000 m^3 has remained on the slopes within the slide area.

The significance of the effect of the peat slide on the receiving soils, geology and land is discussed in further detail in Section 8.4.3.1 along with a more detailed description of the characteristics of the slide, the slide area and the debris runout zone downslope.

The effect of the slide has been assessed as **High** due to the extent of the slide and the volume of peat that was displaced from the slopes in the slide area.

The baseline sensitivity of the receiving soils, geology and land directly impacted by the slide has been assessed as **Medium** based on the low overall ecological value of the degraded blanket bog, the relatively low value of the land for forestry and agriculture, and the potential carbon loss in the disturbed peat in the context of the overall wind farm project and national annual carbon emissions. Therefore, the effect of the peat slide on soils, geology and land was **Significant**.

This is consistent with the assessment of the effect of the surcharge load from the sidecast materials on the intact peat slopes, which has also been assessed as **Significant,** even where no peat failure occurred. This is because it reflects the relatively high probability of a peat failure occurring under the sidecast material and the possible extent and characteristics of a peat failure that could occur under the surcharge loading, which in this case has been calibrated by the peat slide that occurred at Turbine T68 as a worst-case scenario.

Moderately Significant Effects (Stability Impacts)

The following impacts of site activities had a **Moderately Significant** effect on the receiving soils, geology and land with respect to site stability during construction:

1. The medium-term impact of the dead load surcharge from the excavated materials that were sidecast on the intact peat slopes during the initial phase of construction in 2003.
2. The live load surcharge from the construction traffic on the floating roads during the second phase of construction in 2004/2005 for:
    - Construction of the turbine foundations, crane hardstanding areas and substation.
    - Transporting spoil to designated disposal areas.
    - Transporting, assembling and erecting the turbines.
3. Improvement of groundwater conditions with improved drainage, which has a positive impact on the peat with respect to site stability.
4. The access tracks constructed as rockfill embankments across the slide area at T68 & T70, which have a positive stability impact on the disturbed peat within the slide area.

Dead Load Surcharge from Sidecast Materials: Most of the excavated peat and glacial till that was sidecast adjacent to the turbine foundations prior to the slide was stable and was left in place on the slopes to avoid disturbing the peat. Material was only removed from selected areas where there were concerns for the stability of the slopes (e.g.T18 & T34), or where there was evidence of instability, such as at the turbines where the localised bearing capacity failures occurred (T23, T29 and T66). The highest risk for peat instability in the material sidecast areas was in the short-term undrained condition during initial construction, specifically at the time that the material was placed on the slopes. Over time, the intact peat on the slope under the sidecast material consolidated and increased in shear strength, which significantly reduced the likelihood of a peat slide. As a result, in the medium-term the effect of the loading on the peat reduced to **Medium**, which is of **Moderate** significance relative to the baseline sensitivity of the receiving soils, geology and land.

Construction Traffic Loading on Floating Roads: Similarly, the peat under the floating roads gained strength as it consolidated under the weight of the rockfill so that the highest risk of a peat slide from the construction traffic loading was during initial construction of the roads and the likelihood of a peat slide reduced over time due to the improved site conditions, as discussed in Section 8.3.4.4.1. The increase in strength of the peat and the capacity of the roads was verified by site testing and analyses prior to resuming construction on the site in 2004. Therefore, the effect of the live load surcharge from the construction traffic on the floating roads on the peat reduced to **Medium** for the second phase of construction in 2004/2005, which is of **Moderate** significance relative to the baseline conditions.

Improved Drainage (Positive Impact) – Poor drainage is a recognised contributory risk factor for peat instability. During periods of heavy or sustained rainfall it can lead to elevated hydrostatic uplift pressures below the peat, or hydraulic surcharge pressures in the existing drainage network of pipes and seepage channels within the peat, which have a finite capacity. These elevated groundwater pressures within and below the peat can contribute to peat slides. The improved drainage has reduced that risk on the wind farm site.

In the medium to long-term, improved drainage would also have increased the shear strength of the peat, which has also had a positive impact on the peat with respect to site stability, i.e. wherever the groundwater table was lowered it reduced the buoyancy forces in the peat. This would have caused the peat to consolidate (compress) under the increased self-weight, which increased its shear strength, similar to the effect of a surcharge load. The peat above the lowered water table would also have increased in strength as it dried out.

Therefore, the improved drainage network that was constructed on the site has had a **Permanent** and **Sustained positive impact** on the peat with respect to site stability. The effect of the drainage improvements was **Medium,** and of **Moderate** significance.

Access Tracks Across Slide Area at T68 & T70: After the peat slide on the 16th October 2003, a 30 m long section of the floating road at Turbine T68, and a 105 m long section of the floating road to the west of Turbine T70 had to be reconstructed. The new sections of road were reconstructed across the slide area as rockfill embankments on competent glacial subsoil below the disturbed peat. The embankments have a **positive impact** as they act as a barrage to contain the disturbed peat within the slide area upslope from the roads. The effect of the barrages on the stability of the peat was **Medium** and of **Moderate Significance**. The embankments were left in place after construction. Therefore, the positive impact is **Permanent** and **Sustained**.

There have been no peat slides on the site related to the medium-term loading of the sidecast materials on the peat slopes in the areas that were stable at the time of the slide. Similarly, no peat slides have occurred due to the live load surcharge of the construction traffic loading on the floating roads.

Slightly Significant Effects (Stability Impacts)

The following impacts of site activities had a **Slightly Significant** effect on the receiving soils, geology and land with respect to site stability during construction:

- Loading from 1.0 m of excavated peat on the intact peat slopes in designated peat repository sites (after the peat slide in October 2003).
- The local stability of the temporary peat slopes around the perimeter of the excavations for the turbine foundations and crane hardstandings.
- The live load surcharge on peat slopes from low ground bearing pressure construction and forestry equipment operating on the peat slopes for:
- Tree felling, and gathering and stockpiling logs.
    - Laying the basal layer of timber and brash along the line of the floating roads.
    - Spreading peat out on the slopes in designated peat repository sites.
    - Excavating drainage trenches.
    - Cable trenching.
- Stockpiling timber logs.
- Local sidecasting of peat along drainage trenches and cable trenches.
- Installation of cable ducts below floating roads.
- Backfilling peat within Borrow Pit BP-2 and BP-3 – below ground level or within bunded pits.
- Dynamic inertial loading from blast-induced vibrations from rock excavation in Borrow Pit BP-3.
- Unloading of peat slopes from tree felling (Positive Impact).

Dead Load Surcharge in Peat Repository Sites: For the second phase of construction in 2004/2005, after the peat slide, alternative methods of managing and disposing of material excavated from the site of the turbines, crane hardstandings, substation, borrow pits and other minor infrastructure and civil works were adopted as preventative design mitigation measures to reduce the likelihood of a peat slide. The majority of the excavated peat was stored to a maximum depth of 1.0 m in designated repository areas on the intact peat slopes in suitable areas of flat or gently sloping ground on the site. The suitability of each repository area was verified by on-site testing and stability analyses so that the likelihood of a peat slide in each area under the applied surcharge loads was reduced to **Very Low to Low**, as discussed in Section 8.3.4.4.1, with the higher risk associated with the sections of the site where there was a higher likelihood of a peat slide based on the site characteristics (see Figure 8-37). Therefore, the effect of the dead load surcharge on the peat was **Medium to Low** and the

significance of the loading with respect to the baseline sensitivity of the receiving soils, geology and land was **Slight**.

The peat was left in place at the end of construction. Therefore, the impact of the surcharge load was **Permanent** and **Sustained**. However, the highest risk of a peat slide was at the time that the material was placed on the slopes during construction.

No peat slides occurred in the designated peat repository areas.

Local Stability in Peat at Excavations for Turbines and Crane Hard standings: The turbine foundations were constructed in open excavations in the peat and glacial till down to rock. For the short period of time that the excavations were open there was a risk of shear failure in the side slopes around the perimeter of the excavations. Where the slopes were left unsupported, they were trimmed back to stable temporary slope angles. In deep very soft peat rockfill berms were used to support the peat. The likelihood of shear failure in the sides of the turbine excavations was **Possible to Very Possible**. However, the extent of the possible effect was limited to localised shear failure of the side slopes or a localised to very small peat slide (<100 m^2) on the upslope side of the turbine excavation. Therefore, the effect of the excavation on the peat was **Medium to Low** and the significance of the effect was **Slight**.

During excavation for the foundation at Turbine T52 in January 2005 there was a very small planar peat slide (<100 m^2) in the intact peat on the upslope side of the turbine. The disturbed peat slid into the excavation so that the direct impact of the slide was limited to the effect on the peat that was disturbed within the slide area, which was **Low**. The baseline sensitivity of the peat in the slide area was **Medium**. Therefore, the significance of the slide was **Slight**, which is consistent with the assessment of the stability impact.

The excavations in the peat for the crane hardstandings were backfilled immediately with rockfill so that there was a lower risk of shear failure around the perimeter of the excavation. There was some movement in the peat upslope from the excavation for the turbine foundation and crane hardstanding at Turbine T66. Some of the peat slumped and large tension cracks opened up in the intact peat on the slope. However, the excavation was backfilled before a peat slide occurred. Therefore, at T66 the effect of the movement on the peat was **Negligible** and **Not Significant**.

Construction Traffic Live Load Surcharge on Peat: Many of the site activities during construction involved working directly on the surface of the intact peat slopes. Where construction plant and machinery were required to operate on the slopes, the machines were specially adapted as low ground bearing pressure (LGBP) machines suitable for working on peat. For example, 13-20 tonne wide-tracked LGBP hydraulic excavators were used for harvesting and handling trees, for spreading out peat in the repository areas, and for excavating trenches for drainage and electrical cables. In areas of very soft peat small branches and timber brash were placed on the surface of the peat under the tracks of the harvesting machines. Large rubber-tyred 8 and 12 tonne forestry forwarders were used to gather and stockpile the cut timber logs. The live load surcharge from these types of equipment was localised and spread out over the surface of the peat to prevent concentrated loading so that the risk of a peat slide was generally **Very Low to Low**. Therefore, the effect of the live load surcharge on the peat was **Medium to Low** or **Low,** depending on the volume of construction traffic and the magnitude of loading, and the significance of the effect was **Slight**.

No peat slide occurred due to equipment operating on the peat during the construction stage of the project.

Temporary Stockpiling of Timber Logs: The trees that were felled on the site were cut into 3 m long logs that were temporarily stockpiled on the intact peat adjacent to the floating roads. The stockpiles were 2.5-3.0 m high and extended over a length of about 20m along the side of the roads. This was equivalent to a localised surcharge of 12.5-15.0 kN/m^2 over the footprint of the stockpiles. The logs were regularly removed from the site by Coillte, so the loading was short-term. Therefore, the effect

of the live load surcharge on the peat was **Medium to Low** and the significance of the impact was **Slight**.

No peat failures occurred under the timber stockpiles.

Miscellaneous Construction Activities: The following site activities had a **Very Low** effect on the peat that was of **Slight** significance with respect to site stability:

- Where shallow drainage trenches or cable trenches were constructed across the slopes the excavated peat was locally sidecast and spread out on the peat adjacent to the trenches. The excavated peat was used to backfill the cable trenches but was left in place permanently for the drainage trenches. The sidecasting only resulted in minor localised redistribution of loading on the peat slopes along the line of the trenches.
- Where the electrical cables had to be installed below the floating roads PVC ducts were installed below the roads by pushing through the peat rather than by excavating a trench to minimise the impact on the roads.
- Some of the peat that was excavated from the turbines, crane hardstandings, substation and borrow pits was deposited inside Borrow Pits BP-2 and BP- 3. The excavated peat in each area was placed on glacial till or rock and fully contained below ground level or within rockfill bunds so that there was a very low likelihood of a peat slide due to failure or overtopping of the bunds.
- Rock was extracted from Borrow Pit No.3 by blasting. Vibration monitoring carried out during blasting confirmed that the large peat slide that occurred in 2003 was outside the range of the blast-induced vibrations from the borrow pit, and that the peak particle velocity and acceleration of the vibrations was within acceptable limits so that the likelihood of causing a peat slide from the dynamic inertial loads generated by the blasting was very low to low and primarily limited to the peat slopes around the perimeter of the borrow pit.

None of these activities caused a peat failure on the site during construction.

Tree felling – Positive Impact of Unloading: None of the areas where the trees were felled were re-planted. Therefore, tree felling also had a long-term **positive** impact on the peat with respect to site stability, i.e. where the large trees were felled and removed from site this has resulted in a **Permanent** and **Sustained** unloading of the peat slopes. However, the level of unloading was low (<1 kN/m^2). Therefore, the effect of the unloading on the peat was **Very Low** and the **Significance** of the effect was **Slight**.

Effects that were not Significant (Stability Impacts)

The following impacts of site activities did not have a significant effect on the receiving soils, geology and land with respect to site stability during construction:

1. The dead load from engineered fill materials on competent glacial till or rock at the site compound, substation, turbine and crane hardstanding areas.
2. The dead load from structures and equipment supported on the granular hardstanding areas at the site compound (short-term) and substation (permanent).
3. Live loading on hardstanding areas (crane hardstandings, site compound, substation) which are comprised of granular rockfill on competent glacial till.
4. Dead and live loading on the bedrock from the turbine foundations.
5. The dead load from the additional capping layer of granular fill that was used to resurface the existing site access tracks that were constructed on the glacial till below the peat.
6. The live load from the construction vehicles on the site access tracks constructed on the glacial till below the peat (i.e. not the floating roads).

7. The loading on competent glacial till from the foundations for the control building and anemometers.
8. Disposal of surplus excavated glacial subsoil in the borrow pits.

None of these impacts involved loading on the peat. Therefore, the risk of the corresponding site activities causing a peat slide was **Negligible**. All of the foundations for the turbines, structures and electrical equipment on the site were supported on competent soils and bedrock with sufficient bearing capacity to support the applied loads. The earthworks for the site compound and substation only involved minor cut and fill in the glacial till below the peat.

8.4.1.2 Derrybrien Wind Farm Site - Operation and Maintenance Phase Impacts (2006 – 2022)

This section of the report assesses the impact of wind farm site activities during the operation and maintenance phase of the wind farm between 2006 and 2022.

The primary works that were carried out on the site during this period that had an impact on soils, geology and land included the following:

- Power Generation and Transmission.
- Maintenance/Repair of Turbines.
- Maintenance/Repair of Substation & Control Building.
- Maintenance/Repair of Access Tracks.
- Cables & Ducting Improvements.
- Drainage Improvements.
- Maintenance of Instrumentation.
- Forestry – Tree Felling to the West of the Wind Farm Site and Temporary Stockpiling of Logs.
- Forestry - Tree Topping on the Wind Farm Site.
- Remedial works to right a crane that went off the narrow turbary road.

Chapter 2 and the AGL Report No. 11-147B-R04 – "*Geotechnical Stability Report & Assessment of Site Stability Impacts on Soils, Geology and Land*" in **Appendix 8-2** of this Chapter give a detailed summary of the site activities associated with each of these works. The following is an assessment of the impact of these activities on soils, geology and land during the operation and maintenance phase of the project between 2006 and 2022.

The **direct impacts** of these activities are assessed in Section 8.4.1.2.1.

The **stability impacts** are addressed in Section 8.4.1.2.2 i.e. the direct impacts of site activities that had an effect on site stability, potentially causing a peat failure.

There are no **indirect impacts** that have significant effects on soils, geology and land.

8.4.1.2.1 *Direct Impacts of Site Activities – O & M Phase (2006-2022)*

This section addresses the direct impact of site activities on soils, geology and land during the operation and maintenance phase of the wind farm project between 2006 and 2022.

Significant Effects (Direct Impacts)

None of the direct impacts of site activities during the operation and maintenance phase of the project between 2006 and 2022 had a **Significant** effect on soils, geology and land.

Moderately Significant Effects (Direct Impacts)

None of the direct impacts of site activities during the operation and maintenance phase of the project between 2006 and 2022 had a **Moderately Significant** effect on soils, geology and land.

Slightly Significant Effects (Direct Impacts)

The impact of the following site activities had a **Slightly Significant** effect on soils, geology and land during the operation and maintenance phase of the project between 2006 and 2022:

- Cables and Ducting – 2017 upgrade of turbine control systems.
- Drainage Improvements – to improve the performance and efficiency of the existing system.
- Forestry – Tree felling, tree topping and temporary stockpiling of logs.
- Remedial works to right a mobile crane that went off the narrow turbary road to Turbine T40.

Cables and Ducting: The 2017 upgrade of the turbine control systems involved installation of fibre-optic cables in 2.55 km of new 50 mm uPVC ducting in the intact peat across the site. The uPVC ducting and warning tape were installed directly into the peat at a depth of typically 0.5-0.6 m using a mole plough without having to open up a trench. At 5 No. road crossings the cables were installed in 75 mm uPVC ducts that were pushed through the peat under the floating roads to avoid having to open up a trench that would damage the basal reinforcement. At 7 No. junctions the peat was locally excavated to support manholes on the underlying glacial till. The direct impact of this work was limited to local disturbance of the peat along the line of the cable ducts, manholes and crossings. The effect that this had on the intact peat slopes was **Very Low**. Therefore, the significance of the effect was **Slight**. The duration of the work was **temporary** and was only carried out once in each area.

Drainage Improvements: The drainage improvements that were carried out during the operation and maintenance period generally involved minor excavation of peat along existing drains to:

- Clear out the inlet and outlet of blocked or collapsed drains.
- Deepen/widen drains to increase capacity and flatten side slopes along access tracks at main watercourse crossings.
- Regrade drains with insufficient fall.
- Repair/replace collapsed culverts.

In some existing drains cobbles and boulders were used to reduce flow velocity to prevent localised scour or erosion in the peat and glacial till.

The drainage works on the peat were carried out by hand or with an LGBP wide-tracked hydraulic excavator adapted for working on the peat. Some new drains were constructed to relieve ponded groundwater at the turbines, or to improve the connection between existing drains. However, in general the drainage works were required to improve the performance and efficiency of the existing drainage network without significantly increasing the capacity of the system. Therefore, the direct impact on the soils, geology and land was limited to local disturbance of the peat along the line of the drains where maintenance was carried out, with some additional groundwater lowering due to the improved efficiency of the drainage system. The effect of these works on the peat was **Low** and the Significance of the effect was **Slight**. The drainage works were carried out periodically so that the impact on the peat during each phase was temporary. Most of the significant works were completed within 6 years of completion of construction, up to 2012.

Forestry – Tree Felling & Temporary Stockpiling to the West of the Wind Farm Site: Between 2016 and 2018 trees were clear-felled for the Project over an area of approximately 46 ha in the mature conifer plantations on the west side of the wind farm, just outside the site boundary, as shown in

Figure 8-43. The trees were felled by experienced contractors working for Coillte using the same standard forestry equipment that was used for tree felling on the blanket bog during the construction of the wind farm, i.e. 10-13 tonne wide tracked low ground-bearing pressure excavators fitted with harvesting attachments to cut and trim the trees, and 8-12 tonne rubber-tyred forwarders to gather and stockpile the cut timber logs.

Short-sections of floating road ≈25-35 m long were constructed at Turbines T3 and T19 to access the area for felling. The roads were comprised of 300 mm of crushed rock on a layer of timber brash constructed directly on the surface of the peat. A short section of the existing Coillte track at the met mast between Turbines T6 and T12 was also re-surfaced with an approx. 150 mm thick capping layer of crushed rockfill. Felled timber logs 3 m long were temporarily stockpiled at stacking points adjacent to Turbines T3 and T19, and off the existing Coillte track near the met mast and Turbine T6, as shown on Figure 8-43.

The stockpiled logs were periodically collected by Coillte using articulated trucks fitted with a HIAB crane and then transported off site. Approximately half of the timber was transported off site along the access tracks on the wind farm site. The remainder were removed via the existing Coillte tracks to the south.

The conifer plantation at the northwest corner of the wind farm, which is highlighted in green in Figure 8-43, will not be felled. The areas that were clear felled will be re-planted.

Where the trees were felled, they were cut as close as possible to the ground. The trunks and roots were left in place so that there was no excavation or disturbance of the peat. Therefore, the effect on carbon storage in the peat was **Negligible**.

The surface of the peat was tracked over by the harvesting machines and forwarders operating on the surface of the peat. It was also locally covered by the new sections of floating roads and temporarily timber stockpiling areas. The overall effect that this work had on the peat habitat was **Very Low**.

The duration of the forestry trafficking on the peat was **Temporary** during tree felling. The **Extent** of the impact was in 46 ha of forest where the trees were felled to the west of the wind farm site. The blanket bog in the area has been degraded by forestry and drainage. Therefore, the sensitivity of the receiving soils, geology and land is **Medium** and the significance of the effect of the tree felling on the peat is **Slight**.

Tree Topping on the Wind Farm Site:

None of the areas on the site where trees were felled during construction were re-planted and no additional tree felling was carried out on site between 2006 and 2018. During this time however, some of the timber logs that were felled from the slopes outside the wind farm site were temporarily stockpiled on the site for collection and transport off-site. In 2018 and 2020 some scheduled tree topping was carried out on the site to trim back some of the small trees that had re-established naturally on the slopes where clear felling had taken place. The tree topping was carried out along a corridor within 10 m to either side of the site access tracks in selected areas. The work was carried out using standard LGBP wide tracked harvesters. The small trees were cut down and left in place on the slopes. No forwarders were used. Therefore, the direct impact that this work had on the soils, geology and land was limited to tracking over the surface of the peat where the works were carried out. The effect that this had on the degraded blanket bog was **Very Low** and the significance of the impact was **Slight**.

Remedial works to right a mobile crane that went off the narrow turbary road: In July 2007 a mobile crane travelling along the narrow turbary road to Turbine T40 to carry out maintenance on the turbine went off the edge of the floating road where there was a soft verge and overturned onto the peat on the downslope side of the road. Righting the crane involved excavating out the section of floating road adjacent to the crane and reconstructing it with granular rockfill supported on the

underlying glacial till. The crane was then winched up onto the road using the rockfill as a reaction for the winching loads. The direct impact of this work was limited to the local peat excavation. The effect that this had on the peat was **Very Low** and the significance of the effect was **Slight**. The impact only occurred once.

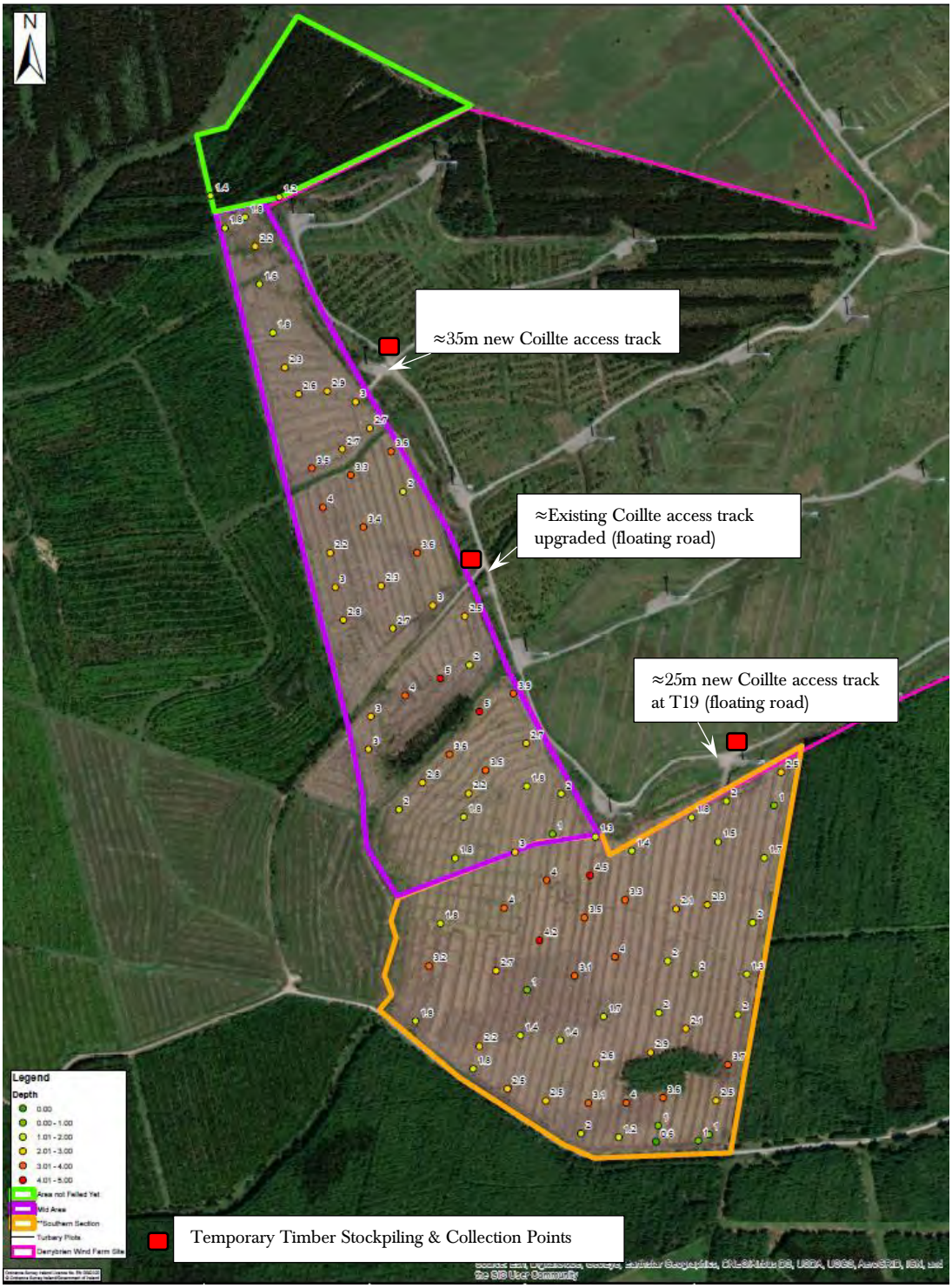


Figure 8-43: Location and extent of tree felling on the west side of the wind farm site in 2018 (including peat depth probes)

Effects that were not Significant (Direct Impacts)

The impact of the following site activities did not have a significant effect on soils, geology and land during the operation and maintenance phase of the project between 2006 and 2022:

- Power Generation/Power Transmission.
- Maintenance/Repair of Turbines.
- Maintenance/repair of substation & control building.
- Maintenance/repair of access tracks.
- Maintenance/repair of instrumentation on site.

This is because:

- The wind turbine foundations are designed to adequately support the static and dynamic wind loads on rock. Also, all of the transmission lines, electrical equipment and substation were in place and operational by the end of construction. Therefore, power generation and transmission had an imperceptible impact on soils and geology on the site.
- All of the maintenance and repair work carried out on the turbines, substation and control building was carried out from the existing granular hardstanding areas, which were designed to support the live loads from the cranes and service vehicles with negligible impact on the peat or underlying glacial till.
- The maintenance and repair work that was carried out on the site access tracks was carried out along the existing network of roads. No new access tracks were constructed.
- The 150 mm thick capping layer placed on some of the floating roads to upgrade them was imported from off-site quarries and has resulted in additional compression of the peat under the increased load. However, this had a negligible effect on the peat as no further vegetation was damaged. It has slightly increased the volume of peat submerged below the groundwater table, which reduces the rate of carbon release due to natural decomposition – a positive impact on carbon flux.
- The repair work and recalibration carried out on the instrumentation and protective fencing was carried out by hand with negligible effect on the peat.

8.4.1.2.2 Stability Impacts of Site Activities – O & M Phase (2006-2022)

This section presents the assessment of stability impacts for the operation and maintenance stage of the wind farm project between 2006 and 2022, i.e. the direct impacts of site activities on the receiving soils, geology and land that had an effect on site stability.

AGL Report No.11-147B-R04 – "*Geotechnical Stability Report & Assessment of Stability Impacts on Soils, Geology and Land*" in Appendix 8-2 of this Chapter gives a detailed assessment of the characteristics of the activities carried out on site between 2006 and Q2 2022 and the corresponding impacts on soils, geology and land that had an effect on site stability, particularly in relation to the peat. The results are summarised in Table 8-9: Assessment of Stability Impacts – Operation & Maintenance Phase (2006-2022) .

As discussed in Section 8.3.4.4.1, due to an improvement in site conditions since construction, Figure 8-37 reflects the reduced likelihood of a peat slide on the site based on the site conditions in 2006 and the range of activities that were carried out during the operation and maintenance phase of the project between 2006 and 2022.

There were no incidents of peat instability on the site related to the wind farm project between 2006 and 2022. Therefore, the **Significance** of the effect in Table 8-9: Assessment of Stability Impacts – Operation & Maintenance Phase (2006-2022) reflects the probability of a peat failure occurring due

to the effect of the stability impact on the peat (e.g. due to the increased shear stresses under applied surcharge loads), as well as the baseline sensitivity of the soils, geology and land potentially impacted by a peat slide, which has been calibrated by the peat failures that occurred on the site during construction, and assessed as **Medium**, as discussed in Section 8.3.1.4.

Many of the site activities had similar effects on the stability of the peat slopes. Therefore, in the following summary, stability impacts have been combined by the characteristics of the impact and the significance of the corresponding effect on soils, geology and land (i.e. to group similar impacts with similar effects). The effects are presented in order of decreasing significance.

Significant Effects (Stability Impacts)

None of the impacts of site activities had a **Significant** effect on soils, geology and land with respect to site stability during the operation and maintenance phase of the project between 2006 and 2022.

Moderately Significant Effects (Stability Impacts)

The impact of the following site activities had a **Moderately Significant** effect on soils, geology and land with respect to site stability during the operation and maintenance phase of the project between 2006 and 2022:

- Drainage Improvements (Positive Impact).

Drainage Improvements (Positive Impact) – As discussed in Section 8.4.1.1.2, poor drainage is a recognised contributory risk factor for peat instability as it can lead to elevated hydrostatic uplift pressures below the peat, or hydraulic surcharge pressures in the existing drainage network of pipes and seepage channels within the peat, both of which can contribute to peat slides. The improved drainage has reduced this risk on the wind farm site by increasing the performance and efficiency of the existing system. In the medium to long-term, improved drainage would also have increased the shear strength of the peat where the groundwater table was lowered (i.e. the peat compresses and dries out where the groundwater table is lowered, increasing in shear strength in the process). This has also had a positive impact on the peat with respect to site stability.

The drainage improvements that were carried out on site during the operation and maintenance phase were primarily required to improve the performance and efficiency of the existing drainage network without significantly increasing the capacity of the system. However, relative to the baseline condition in 1998 the impact of the improved drainage network that was constructed on the site was **Permanent and Sustained** and it had a **positive impact** on the peat with respect to site stability. Therefore, the effect on peat stability was **Medium,** and of **Moderate** significance.

Slightly Significant Effects (Stability Impacts)

The following impacts of site activities had a **Slightly Significant** effect on soils, geology and land with respect to site stability during the operation and maintenance phase of the project between 2006 and 2022:

- The increased dead load on the peat from the additional layer of granular rockfill that was placed on the floating roads that were upgraded or repaired.
- The dead load surcharge on the peat from the short sections of floating roads constructed at Turbines T3 and T19 to access the conifer forests at the west end of the wind farm site for clear-felling.
- The live load surcharge of maintenance and repair vehicles, tree-felling equipment and mobile cranes on the floating roads.
- The live load surcharge from light mechanical equipment operating on the intact peat slopes, including:

- Wide tracked 10-13 tonne LGBP excavators carrying out drainage improvements.
- Wide tracked 10-13 tonne LGBP excavators with harvester attachments used for felling trees and tree topping.
- 8-12 tonne rubber-tyred forwarders used for gathering and stockpiling felled timber.
- The mole-trench machine used for installation of cable ducts for the new fibre-optic cables.
- The localised temporary dead load surcharge on the peat from the stockpiled logs.
- The localised live load surcharge on the peat from the crane that overturned near Turbine T40.

Additional dead load on the floating roads: In 2014, 4.5 km of the floating roads across the site were upgraded with an additional layer of geogrid reinforcement and 150 mm of imported Class 6F2 crushed rock granular capping material blinded with a nominal 20 mm thick layer of fine gravel (0-6 mm). The works were carried out in areas where the condition and performance of the road had deteriorated significantly since the completion of the wind farm. In some cases, this was due to the basal layer of trees rotting and breaking over relatively deep very soft peat.

The additional thickness of granular fill was kept to a minimum to minimise the additional dead load surcharge on the peat (≈3.2 kN/m^2). Analyses were also carried out to demonstrate that the additional load had only a minor effect on the stability of the road, which was within its design capacity. It was also proportional to the increase in undrained shear strength that would have already occurred in the underlying peat as it consolidated (compressed) under the weight of the original road.

Between 2016 and 2018 Coillte also re-surfaced a short section (≈50 m) of access track on the west side of the wind farm site with an additional 150 mm of crushed rock granular fill to provide access for forestry equipment. The probability of a peat slide due to the increase in shear stresses in the peat from the additional layer of capping material and surfacing on the floating roads was **Very Low to Low** with the higher risk associated with the sections of the site where there was a higher likelihood of a peat slide based on the site characteristics (see Figure 8-37). The effect of the increased dead load on the stability of the peat was **Low** and the Significance of the effect was **Slight**.

Table 8-9: Assessment of Stability Impacts – Operation & Maintenance Phase (2006-2022)

Activity	Characteristics of Direct Impact of Site Activities with respect to Site Stability (Stability Impacts)				Assessment of Effect of Stability Impacts on Soils, Geology & Land						Did Peat Failure Occur? (Yes/No)
	Impact	Extent of Impact	Duration	Frequency	Quality of Impact	Possible Extent of a Peat Failure	Probability of Occurrence of a Peat Failure	Effect on Receiving Soils, Geology & Land	Sensitivity of Receiving Soils, Geology & Land	Significance of Effect	
Power Generation	Turbine Foundation Loading on Glacial Till	At turbine locations	Continuous		Slight Negative	Not Applicable	Negligible	Negligible	Medium	Not Significant (Imperceptible)	No
Power Transmission	Eletricity Transmission & Conversion	At Turbines and substation; along buried MV cables on-site & along 110 kV line off-site	Continuous		Neutral	Not Applicable	Negligible	Negligible	Medium	Not Significant (Imperceptible)	No
Maintenance/ Repair of Turbines	Crane Loading on Hardstanding Areas	Hardstanding areas adjacent to turbines	Temporary	Occasional	Slight Negative	Not Applicable	Negligible	Negligible	Medium	Not Significant	No
	Crane Loading on Floating Roads	Along Floating Roads travelled by Crane	Brief	Occasional	Negative	Small (100m^2-2500m^2) to Very Large (>10Ha) Peat Slide	Very Low to Low	Low	Medium	Slight	No
Maintenance/ Repair of Substation & Control Building	MEWP Loading on Hardstanding Areas	Hardstanding area at Substation site	Temporary	Occasional	Slight Negative	Not Applicable	Negligible	Negligible	Medium	Not Significant	No
	Service Vehicle Loading on Floating Roads	Along Floating Roads to Substation Site	Brief	Occasional	Slight Negative	Small (100m^2-2500m^2) to Very Large (>10Ha) Peat Slide	Very Low	Very Low	Medium	Slight	No
Maintenance/ Repair of Access Tracks	Increased Capping Load on Floating Roads - Roads Upgrade 2014	Extent of 2014 Floating Road Upgrade Works - ESBI Drawing No.P378015-C-003	Long-Term	Sustained	Negative (Short-term)	Small (100m^2-2500m^2) to Very Large (>10Ha) Peat Slide	Very Low to Low	Low	Medium	Slight (Short Term)	No
					Slight Negative (Medium-Term)	Small (100m^2-2500m^2) to Very Large (>10Ha) Peat Slide	Very Low	Very Low	Medium	Slight (Medium Term)	No
	Increased Capping Load on Floating Roads - Localised Repairs	Localised Sections of Floating Roads (See Section 3.1.4.3)	Long-Term	Sustained	Negative (Short-term)	Small (100m^2-2500m^2) to Very Large (>10Ha) Peat Slide	Very Low to Low	Low	Medium	Slight (Short Term)	No
					Slight Negative (Medium-Term)	Small (100m^2-2500m^2) to Very Large (>10Ha) Peat Slide	Very Low	Very Low	Medium	Slight (Medium Term)	No
Cables & Ducting	Equipment loading on peat during 2017 Fibre-Optic Cable Installation	Along route of new fibre-optic cable ducts (see Figure 3.1)	Temporary	Once	Slight Negative	Small (100m^2-2500m^2) to Very Large (>10Ha) Peat Slide	Very Low to Low	Low	Medium	Slight	No

Table 8-9: Assessment of Stability Impacts – Operation & Maintenance Phase (2006-2022) (Contd.): Assessment of Stability Impacts – Operation & Maintenance Phase (2006-2022)

Activity	Characteristics of Direct Impact of Site Activities with respect to Site Stability (Stability Impacts)				Assessment of Effect of Stability Impacts on Soils, Geology & Land						Did Peat Failure Occur? (Yes/No)
	Impact	Extent of Impact	Duration	Frequency	Quality of Impact	Possible Extent of a Peat Failure	Probability of Occurrence of a Peat Failure	Effect on Receiving Soils, Geology & Land	Sensitivity of Receiving Soils, Geology & Land	Significance of Effect	
Drainage Improvements	Low ground-bearing machine loading on Peat during Improvement Works	Along site drains at specified locations (see ESBI Geotechnical Inspection Reports)	Temporary	Occasional	Slight Negative	Small (100m²-2500m²) to Very Large (>10Ha) Peat Slide	Very Low to Low	Low	Medium	Slight	No
	Improvement of Groundwater Conditions	Sitewide - particularly upstream of drainage improvements	Long-Term	Sustained	Positive	In areas where drainage works were carried out	Positive Impact - Reduced Probability of a Peat Slide	Medium (Positive)	Medium	Moderate (Positive)	No
	Installation of drain to prevent overtopping of water in Borrow Pit No.3	Along adjacent site access road	Temporary	Once	Slight Positive	Not Applicable - Drain not required	Negligible	Negligible	Medium	Not Significant	No
Instrumentation	Manual repair work to instrumentation and fencing on peat.	At the 4 No. instrumentation logger units	Brief	Once	Slight Negative	Not Applicable	Negligible	Negligible	Medium	Not Significant	No
Forestry (Offsite) Clear Felling	Localised live load surcharge on peat from timber harvesters and forwarders	46ha conifer forest plantation offsite, along the west side of wind farm site	Temporary	Occasional (2016 to 2018)	Negative	Small (100m²-2500m²) to Very Large (>10Ha) Peat Slide	Low	Medium to Low	Medium	Slight	No
Forestry (Offsite) New Access Tracks (Floating) & Re-Surfacing of Existing Coillte Track	Small additional dead load surcharge on the peat	Short sections (25-35m) of new floating road at T3 and T19 & re-surfacing approx. 50m of existing Coillte track near T6	Permanent	Once	Negative	Small (100m²-2500m²) to Very Large (>10Ha) Peat Slide	Low	Medium to Low	Medium	Slight	No
Forestry (Offsite) Timber Stockpiling on WF site	Localised surcharge on peat from timber stockpile	Adjacent to Floating Road near Turbines T3, T6 & T19	Temporary	Occasionally (2016-2018)	Negative	Small (100m²-2500m²) to Very Large (>10Ha) Peat Slide	Low	Medium to Low	Medium	Slight	No
Forestry (Onsite) Tree Topping	Low ground bearing pressure equipment loading on peat	10 m either side of access track in areas specified for 2018 (see Section 3.17.4)	Temporary	Once	Slight Negative	Small (100m²-2500m²) to Very Large (>10Ha) Peat Slide	Very Low to Low	Low	Medium	Slight	No
Mobile Crane Going off the Turbary Road While Travelling	Localised surcharge on Peat from overturned crane.	Along turbary road near Turbine T40	Temporary	Once	Negative	Small (100m²-2500m²) to Very Large (>10Ha) Peat Slide	Low	Medium to Low	Medium	Slight	No
	Reaction loads on rockfill road from winching during crane righting	Along turbary road near Turbine T40	Brief	Once	Slight Negative	Small (100m²-2500m²) to Very Large (>10Ha) Peat Slide	Negligible	Negligible	Medium	Not Significant	No

Additional dead load on peat from of new (short) sections of floating roads for access to forestry at west end of windfarm site: Between 2016 and 2018 short-sections of floating road ≈25-35 m long were constructed at Turbines T3 and T19 to provide access for forestry harvesters and forwarders to the area off-site to the west for clear-felling of the conifer plantations. The roads were comprised of 300 mm of crushed rock on a layer of timber brash constructed directly on the surface of the peat. The tracks were only constructed over a short length to avoid damage to the electrical cables on the wind farm site. The thickness of rockfill was kept to a minimum so that the applied dead load surcharge on the peat was only approximately 6kPa, which is less than the dead weight of a layer of peat 1.0 m thick. A short (50 m) section of an existing Coillte access track near the met mast at T6 was also re-surfaced with a 150 mm thick layer of granular rockfill, which would apply a small additional load of 3 kPa on the underlying peat.

The probability of a peat slide occurring due to the increase in shear stresses in the peat under the small additional surcharge load from the new sections of floating roads and from the additional surfacing layer on the existing Coillte track was **Low**. Therefore, the effect of the increased dead load on the stability of the peat was **Medium to Low** and the Significance of the effect was **Slight**.

Live load surcharge on the floating roads: All of the mobile cranes and service vehicles accessing the turbines and substation during the O&M phase between 2006 and 2022 travelled along the existing site access tracks which were designed, tested and certified for the corresponding maximum live load surcharge. In addition to the tests that were carried out during construction, full scale proof tests were carried out on all of the floating roads except the turbary road in December 2011 and again after sections of the floating roads were upgraded in 2014. The 2014 tests were carried out using a large mobile crane with additional ballast to simulate the maximum axle load and live load surcharge from the crane that was used to erect the turbines. Therefore, the probability of a peat slide occurring as a result of the live load surcharge on the floating roads was **Very Low to Low,** the effect of the load on the stability of the peat was **Low** and the Significance of the effect was **Slight**.

Construction Traffic Live Load Surcharge on Peat: Very little work was carried out on the intact peat slopes within the wind farm site during the operation and maintenance phase of the project between 2006 and 2022. It was limited to the excavators that were periodically carrying out drainage improvements, the mole trench machine that was used for the installation of the cable ducts for the new fibre-optic cables, and the 10-tonne Hitachi 100 harvesters that were used for tree topping. All of these machines were light or low ground bearing pressure (LGBP) wide-tracked machines suitable for working on the peat. Therefore, the risk of a peat slide under the localised live load surcharge was **Very Low to Low**, the effect of the load on the stability of the peat was **Low**, and the Significance of the effect was **Slight**.

Between 2016 and 2018 trees were clear-felled for the Project over an area of approximately 46 ha in the mature conifer plantations on the west side of the wind farm, just outside the site boundary, as shown in Figure 8-43. The trees were felled by experienced contractors working for Coillte using the same standard forestry equipment that was used for tree felling on the blanket bog during the construction of the wind farm, i.e. 10-13 tonne wide tracked low ground-bearing pressure excavators fitted with harvesting attachments to cut and trim the trees, and 8-12 tonne rubber-tyred forwarders to gather and stockpile the cut timber logs.

The live load surcharge from these types of equipment was localised and spread out over the surface of the peat to prevent concentrated loading so that the risk of a peat slide was generally **Low**. Therefore, the effect of the live load surcharge on the peat was **Medium to Low**, and the significance of the effect was **Slight**.

No peat slide occurred due to equipment operating on the peat during the operation and maintenance stage of the project between 2006 and Q2 2022.

Live Load Surcharge from Stockpiled Timber: No further clear felling of conifer plantations was carried out on the wind farm site by Coillte after construction. However, when the trees were clear felled from the conifer plantation outside the site boundary to the west between 2016 and 2018 approximately half of the trees were temporarily stockpiled within the wind farm at stacking points adjacent to Turbines T3 and T19, and along the Coillte track near the met mast at Turbine T6, as shown on Figure 8-43. Plate 8-3 shows an image of the stockpile near T6 in May 2017, as noted in the ESBI site inspection report from 2017 (Document No. P378015-F105-016-R-0005, dated 6th October 2017).

Plate 8-3: Felled timber from an adjacent plantation stockpiled on the peat within the wind farm site near Turbine T6 in May 2017 (ESBI, 2017)

The 3 m long timber logs were typically stockpiled to a height of 2.5-3.0 m on the intact peat slopes over a length of about 20 m along the road. This is equivalent to a live load surcharge of 12.5-15.0 kN/m^2 over the footprint of the stockpile. The stockpiles were removed from the site periodically by Coillte, so the localised loading was **short-term**. The effect of the surcharge load on the stability of the peat was **Medium to Low** and the significance of the effect was **Slight**.

Remedial works to right a mobile crane that went off the narrow turbary road: Where the 250 tonne mobile crane went off the road and overturned onto the peat on the downslope side of the turbary road near Turbine T40 it would have applied a load of 60 tonnes over an area of approximately 15.0 x 4.0 m on the peat, which is equivalent to a surcharge of about 10 kN/m^2. This is similar to the weight of 1.0 m of excavated peat over the same area, although the load from the overturning crane would have had a dynamic component. The probability of a peat slide occurring under the crane load in this part of the site was **Low** (see Figure 8-37). Therefore, the effect of the load on the stability of the peat was **Medium to Low** and the Significance of the effect was **Slight**.

Effects that were not Significant (Stability Impacts)

The following site activities and corresponding stability impacts did not have a significant effect on the receiving soils, geology and land with respect to site stability during the operation and maintenance phase of the project between 2006 and 2022:

- Power Generation & Transmission.
- Live loading from maintenance and repair vehicles on the granular hardstanding areas at the turbines and substation.

- Winching loads on the reconstructed access track at T40 to right the overturned crane.
- Installation of drain at Borrow Pit 3 to prevent groundwater overtopping the access road into the site.
- Minor repairs/recalibration of instrumentation.

This is because:

- The wind turbine foundations are designed to adequately support the static and dynamic wind loads on rock. Also, all of the transmission lines, electrical equipment and substation were in place and operational by the end of construction. Therefore, the impact of the power generation and transmission had an imperceptible effect on site stability.
- The granular hardstanding areas at the turbines and substation are designed to support the applied live load surcharges from the mobile cranes and the maintenance and repair vehicles on competent cohesive glacial till and rock below the peat. None of the live loads exceeded the maximum loads applied during construction and steel outrigger pads were used to spread out the concentrated loads from the mobile cranes.
- Similarly, the reconstructed section of access track adjacent to the overturned crane near Turbine T40 was constructed on glacial till below the peat so that it could provide adequate reaction to the winching loads to right the crane.
- At Borrow Pit No.3 a drain was installed to prevent the rising water levels from flooding the site access track at the entrance to the pit. However, the groundwater level stabilised below the level of the road so that the drain was not required.
- The repair work and recalibration carried out on the instrumentation and protective fencing was carried out by hand with negligible impact on the peat.

8.4.1.3 Derrybrien Wind Farm Site - Ceased Operation Phase 2022 to 2024 (Impacts which are Occurring)

This section of the chapter assesses significant effects of impacts from the construction, operation and maintenance stages of the wind farm from 2003 to 2022 that are still occurring during the ceased operation phase at the end of 2024. The effects of direct impacts on soils, geology and land on the site are assessed in Section 8.4.1.3.1, and the effects of stability impacts, particularly in relation to peat stability, are assessed in Section 8.4.1.3.2. There are no **indirect impacts** that have significant effects on soils, geology and land.

8.4.1.3.1 *Direct Impacts (Ceased Operation Phase 2022-2024)*

The significant effects of direct impacts from the construction, operation and maintenance stages of the wind farm from 2003 to 2022 that are still occurring at the end of 2024 include:

- Decomposition of excavated peat (carbon flux).
- Groundwater lowering and accelerated peat decomposition due to drainage improvements.

Decomposition of Excavated Peat in Peat Storage Areas: All of the peat that was excavated from the site of the turbines, crane hardstandings, substation, borrow pits, anemometers and site compound was stored on-site. The total estimated volume of peat that was excavated was approximately 160,000m^3 (Table 8-7), which was placed in material sidecast areas and peat repositories on the intact peat slopes, and within bunded storage areas in the borrow pits. In Section 8.4.1.1.1 it was concluded that the effect that this had on soils, geology and land relative to the baseline site conditions was of **Moderate** significance because of the loss of peat habitat and the corresponding release of stored

carbon in the peat. The release of stored carbon is primarily due to the increased rate of decomposition of the disturbed peat above the water table as it dries out on exposure to the atmosphere on the slopes in the material storage areas. This is a **Long-Term** effect as it occurs slowly over time. Therefore, it is likely to be still occurring at the end of 2024, albeit at a lower rate.

Plate 8-4 shows a typical image of excavated peat being placed in a repository site during construction in 2004/2005. The peat was spread out uniformly over the undisturbed vegetated surface of the underlying peat to a maximum depth of 1.0m. Plate 8-5 and Plate 8-6 show typical images of the peat repositories at the end of 2018 and 2024, respectively. Additional photos of the repository sites from the site inspections carried out by AGL in 2018 and 2024 are included in AGL Report No. 11-147-R04 in Appendix 8-2.

In Section 8.4.1.1.1 the effect of the peat excavations on carbon storage was assessed by assuming that approximately 40-60% of the excavated peat and stored carbon will be lost due to decomposition, displacement and erosion. This would appear to be a reasonable assumption based on the observations from the site inspections in 2018 and 2024. Much of the excavated peat is still in place in the repository sites and in the bunded peat repository areas in the borrow pits.

Since the end of construction, the surface layer of excavated peat in the repository sites settled into the slopes as the underlying intact peat compressed under the weight of the disturbed peat that was placed on the slopes. This has partially compensated for the increased rate of decomposition in the excavated peat because more of the underlying intact peat has settled below the water table, where the rate of decomposition is significantly lower. Furthermore, the surface of the excavated peat in the repository areas has re-vegetated so that a new rate of carbon flux has been established between the decomposition and accumulation of peat on the surface.

Relative to the original baseline condition in 1998, prior to construction, the effect of the impact on the peat stored in the repository sites would still be **Significant** when considered in combination with the balance of peat displaced from the slide area. However, the net rate of carbon release has significantly reduced so that the incremental effect on the peat in these areas is possibly at a new equilibrium of peat accumulation and net carbon storage, which will help to mitigate the original impact.

Plate 8-4: Typical peat repository during construction in 2004

Plate 8-5: Peat Repository near turbine T48 at the end of 2018

Plate 8-6: Peat Repository near turbine T48 at the end of 2024

Groundwater lowering due to drainage improvements: During construction, some drains were excavated in the peat to provide drainage for the turbine foundations and to improve the control of groundwater and surface runoff in some areas of poor drainage and high-water table. There was an extensive existing network of drains on the site prior to the construction of the wind farm, particularly for the turbary plots on the east side of the site. Therefore, in Section 8.4.1.1.1 it was concluded that the effect that the additional drainage had on the peat relative to the baseline site conditions was of **Slight** significance because the new drains resulted in further lowering of the groundwater level in the peat in the areas of improved drainage. Groundwater lowering also effects the carbon flux in the peat because the rate of decomposition of peat is significantly higher above the water table.

Electronic piezometers were installed to monitor water levels in the peat at locations around the perimeter of the site near Turbines T2, T18, T34 and T49/T50. Groundwater levels were monitored in the piezometers over a period of 8 years between 2004 and 2012 before the instruments were decommissioned. Figure 8-44 shows the readings from the piezometers at T2, T18 and T34 up to November 2011. The readings from the piezometers at T49/T50 are not plotted because they malfunctioned after installation.

The short-term regular fluctuation in the data reflects seasonal fluctuations in groundwater level as well as changes in atmospheric pressure, which directly affect the water level readings as they are based on pressure. Nevertheless, the results indicate that, on average, between December 2005 and November 2011 the groundwater level in the peat gradually dropped by about 0.40 m at Turbine T18 in the SW corner of the wind farm site, and by about 0.75 m at T2 and T34 in the NW corner of the site and in the turbary plots at the east end of the site, respectively.

This level of groundwater lowering would not have occurred uniformly across the wind farm site. As discussed in Section 8.4.1.1.1, the permeability of the peat is low, therefore, the extent of drawdown from the shallow open drains would be limited to within a few meters of the drains rather than generally across the site. However, the new drains that were installed during construction would have increased the rate of surface runoff from the wind farm site, which would have reduced the rate of infiltration into the peat. Over time this has resulted in a gradual lowering of the groundwater levels on the site. The impact would be greatest on the steeper slopes at the downslope perimeter of the site, where the piezometers were located. Less drawdown would be expected at the upper levels of the wind farm and on the terraces of flat or gently sloping ground across the wind farm site where surface water accumulates.

During the operation and maintenance phase of the wind farm between 2006 and 2022, maintenance works were carried out to improve the performance and efficiency of the drainage network. However, the capacity of the system was not significantly increased and most of the works were completed by 2012. The groundwater levels in the piezometers had not stabilised fully by the end of 2011, but they did show a reduced rate of drawdown towards the end of the monitoring period.

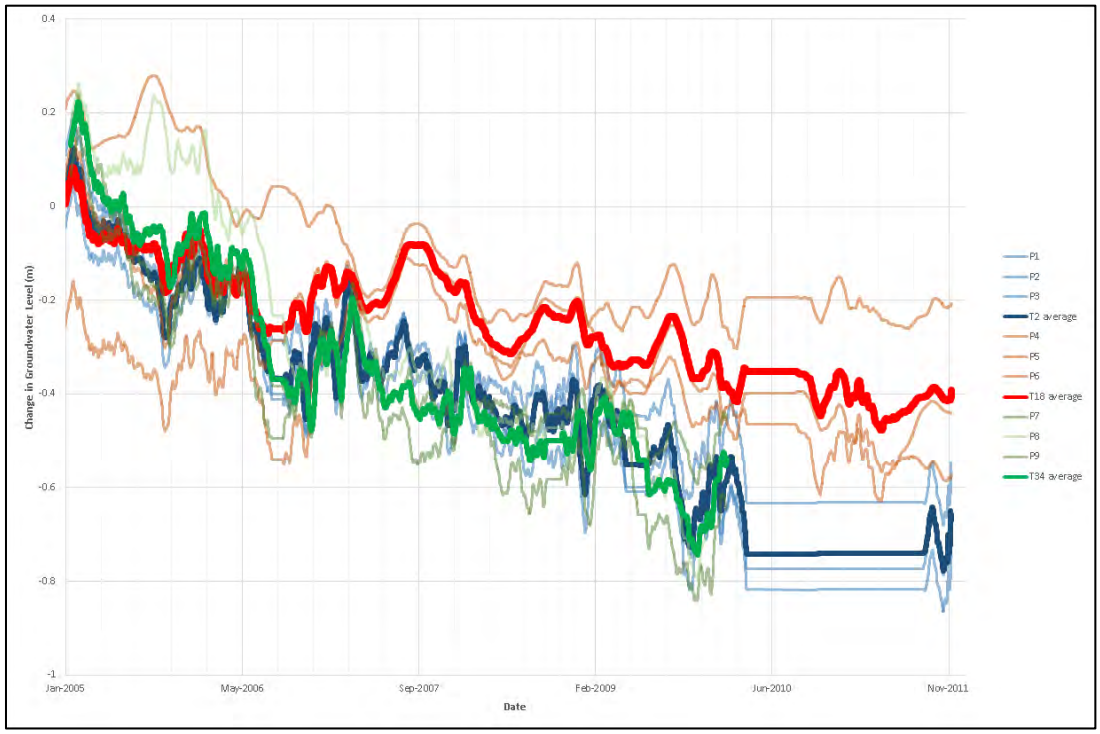


Figure 8-44: Water level readings from vibrating wire piezometers (January 2005 to November 2012)

It will take many years for the groundwater in the peat to stabilise at new equilibrium levels across the site. However, most of the major drainage works were completed during construction and during the maintenance period prior to 2012. Therefore, the majority of the groundwater lowering would have occurred by the end of 2022 and any further changes after decommissioning the wind farm should be minor.

None of the drains have been blocked or infilled. Therefore, the effect of the lowered groundwater level on the peat is still occurring. The rate of decomposition of peat is significantly higher in the aerobic conditions above the water table and peat releases stored carbon as CO_2 as it decomposes. Therefore, there has been a change in the carbon flux in the degraded blanket bog on the site, with an increase in the rate of depletion of stored carbon. It will take time for the carbon flux to reach a new equilibrium for the lowered groundwater levels. This is a long-term effect that would be still occurring at the end of 2024. However, relative to the original baseline condition in 1998, prior to construction, the effect of the impact would still be of **Slight Significance**.

A more detailed assessment of the impact of drainage in the project area is presented in Chapter 9 – Hydrology and Hydrogeology.

8.4.1.3.2 *Stability Impacts (Ceased Operation Phase 2022-2024)*

The significant effects of stability impacts from the construction, operation and maintenance stages of the wind farm from 2003 to 2022 that are still occurring during the ceased operation phase at the end of 2024 are related to:

- Surcharge loading on the peat from the floating roads, material sidecast areas and peat repository sites that were left in place at the end of construction.
- Groundwater lowering due to drainage improvements.

Surcharge loading on the peat: During construction dead load surcharges were applied to the intact peat slopes from:

- The construction of the floating roads.
- The sidecasting of peat and glacial till excavated from the turbine foundations that were completed prior to the peat slide.
- The controlled disposal of up to 1.0 m of peat excavated from the site of the remaining turbines, crane hardstanding areas, substation and anemometers in designated peat repository areas after the peat slide.

The initial loading on the intact peat slopes from the floating roads and material sidecast areas was assessed as having a **Significant** effect on the peat with regard to site stability for the construction stage of the project.

No peat failures occurred during the construction of the floating roads. However, the large peat slide on the 16th October 2003 occurred as material excavated from the foundation for Turbine T68 was being sidecast on the slopes downslope from the turbine. There was also a small scale peat slide where material was sidecast on the slopes adjacent to Turbine T17, and local bearing failure was noted in the peat under the excavated material that was sidecast at Turbines T23, T29 and T66.

Strict controls were implemented in the selection and usage of the peat repository areas for disposing of peat excavated after the slide. Therefore, they were assessed as having a **Slight** effect on peat stability and no peat failures occurred as a result of the loading.

With the exception of the sidecast areas at T18, T34, T23, T29 and T66, where some of the material was removed due to concerns with the local bearing failure in the peat, all of the remaining dead load surcharges from the floating roads, material sidecast areas and peat repository sites were left in place at the end of construction as a permanent and sustained load on the intact peat slopes. The

dead load surcharge on the floating roads was increased slightly where they were upgraded with an additional 150 mm thick layer of capping material in 2014.

The effect of these dead load surcharges on the peat would therefore still be occurring at the end of 2024. However, the highest risk for peat instability under the surcharge loads was in the short-term undrained condition at the time that the material was placed on the slopes during construction. Over time, the undrained shear strength of the underlying peat will have increased as it consolidated and compressed under the applied loads, which has significantly reduced the likelihood of a peat slide.

The increase in shear strength that occurs in cohesive soils such as peat when they are consolidated under an increased load is an established engineering principle and it was verified by in-situ testing in the peat under the floating roads on the site. Full scale proof load testing was also carried out on all the floating roads in 2018 to verify their capacity and performance under the design crane loads.

As discussed in Section 8.3.4.4.1, due to an improvement in site conditions, Figure 8-38 reflects the reduced likelihood of a peat slide on the site in 2024 based on the improved site conditions and the characteristics of the activities that are likely to be carried out during the decommissioning of the wind farm in 2025. It does not represent a change in the baseline condition of the receiving environment because in the assessment there is no change to the possible extent of a peat slide or the baseline sensitivity of the receiving soils, geology and land that could be impacted by a slide, which has been assessed as **Medium** based on the site conditions in 1998, prior to construction.

By the end of 2024 primary consolidation of the peat would be complete under the existing dead load surcharge of the floating roads, material sidecast areas and peat repositories that were stable and intact at the end of construction, including the additional load on the floating roads from the 2014 upgrade programme. Therefore, with the corresponding increase in undrained shear strength in the underlying peat, the likelihood of a peat slide under the surcharge loads has reduced to **Negligible,** so that by now the effect of the surcharge on the peat with regard to site stability is **Not Significant**.

Drainage Improvements in the peat:

As discussed in Section 8.4.1.1.2, poor drainage is a recognised contributory risk factor for peat instability as it can lead to elevated hydrostatic uplift pressures below the peat, or hydraulic surcharge pressures in the existing drainage network of pipes and seepage channels within the peat during periods of heavy or sustained rainfall, both of which can contribute to peat slides. The improved drainage has reduced this risk on the wind farm site by increasing the capacity, performance and efficiency of the existing system. In the medium to long-term, the improved drainage would also have increased the shear strength of the peat where the groundwater table was lowered (i.e. the peat compresses and dries out where the groundwater table is lowered, increasing in shear strength in the process). This has also had a positive effect on the peat with respect to site stability.

Therefore, the improved drainage network that was constructed on the site for the wind farm is a **Permanent** and **Sustained** impact on groundwater levels that has had a **positive** stability impact on the peat relative to the baseline conditions on site in 1998, prior to construction. The effect of the drainage improvements on the stability of the peat has been assessed as **Medium,** and of **Moderate** significance.

As discussed in Section 8.4.1.3.1, it will take many years for the groundwater in the peat to stabilise at new equilibrium levels across the site. However, most of the groundwater lowering would have occurred by the end of 2024 and any further changes would be expected to be minor. None of the drains have been blocked or infilled. Therefore, relative to the baseline site conditions, the effect would still be occurring on the site at the end of 2024.

8.4.1.4 Derrybrien Wind Farm Site – Prospective Development (Impacts which are Likely to Occur)

A detailed assessment of the impact of site activities on land, soils & geology during decommissioning of the wind farm is presented in Chapter 8 (Land, Soils & Geology) of the Environmental Impact Assessment Report for the decommissioning works (the Prospective Development). This section of the report gives a summary of that assessment but relative to the original baseline conditions on the site in 1998, prior to construction.

The impacts of the decommissioning works for the wind farm and for Polesets PS-1a to PS-4 of the 110kV OHL from Derrybrien to Annaygal are also assessed in this section of the chapter. The impact of the decommissioning works for the remaining sections of the 110kV OHL to Annygal as well as the Annaygal substation are assessed separately in Section 8.4.2.4.

It is considered that minimal decommissioning works will be the best approach on this site in terms of both site stability and environmental protection. Therefore, the decommissioning plan for the wind farm infrastructure will involve the following elements of work:

- De-energising the site by initially disconnecting the high voltage (HV) lines at the substation, followed by low voltage (LV) disconnection at each of the turbines as well as the 110kV OHL for the grid connection.
- Temporary widening of the narrow sections of the site access tracks in the turbary area and at selected junctions to provide safe access for mobile cranes to the turbines.
- Controlled dismantling of the turbine blades, nacelle and masts. The decommissioned components will be removed from the site for re-cycling, disposal or re-use elsewhere.
- Removal of the sub-station and associated buildings-including removal of all the electrical transmission components, capacitors, transformer, concrete plinths, control building and foundations.
- Controlled dismantling and removal of the steel lattice tower and timber twin polesets for the 110kV Overhead Line (OHL).
- Dismantling of the steel lattice towers for the anemometers.

This is based on the proposed decommissioning plan for the project. AGL Report No. 11-147-R04 – "*Derrybrien Wind Farm - Geotechnical Stability Report & Assessment of Stability Impacts of On-Site Activities*" in Appendix 8-2 of this Chapter give a detailed summary of the decommissioning activities associated with each of these works.

The following elements of the wind farm will be left in place in their final configuration after decommissioning:

- The reinforced concrete bases for the turbines and anemometer masts.
- All of the site access tracks including the floating roads on the peat;
- The crane hardstanding areas adjacent to the turbines;
- The hardstanding area for the substation and control building;
- All of the de-energised and disconnected LV electrical cables and fibre-optic cables that are direct-buried in the peat between the turbines and in ducts below the roads;
- The construction phase peat repository sites and material sidecast areas;
- The construction phase borrow pits, and
- The site drainage network.

The **direct impact** of the site activities that will occur during decommissioning is assessed in Section 8.4.1.4.1. The **stability impacts** are assessed in Section 8.4.1.4.2 i.e. the direct impacts that site

activities could have on soils, geology and land that could have an effect on site stability, potentially causing a peat failure.

8.4.1.4.1 Direct Impacts (Decommissioning Phase)

This section addresses the direct impact of site activities on soils, geology and land during the decommissioning phase of the wind farm.

As the decommissioning work will be limited to removing the above ground elements of the wind farm, there will be no excavations required other than to clear out drains if they have become blocked, or to trim peat banks, where necessary, along the edges of the existing floating roads where localised temporary widening works are required. Where peat is excavated to widen the roads it will be excavated in intact vegetated turves and retained on site for reinstatement when the widened sections of the roads are removed on completion of the decommissioning works.

Most of the decommissioning works will also not require any new crushed rock aggregates. Therefore, it will not be necessary to re-open the main borrow pit on the site to extract rock to process it into suitable rockfill materials. Where small volumes of aggregates are required for the localised road widening works these will be imported from a nearby quarry off-site or re-cycled from the existing hardstandings elsewhere on the site.

Therefore, there will be **no significant direct impacts** on soils, geology or land during de-commissioning.

8.4.1.4.2 Stability Impacts (Decommissioning Phase)

This section presents the assessment of stability impacts for the decommissioning of the wind farm, i.e. the direct impacts of site activities on the receiving soils, geology and land that could have an effect on site stability.

AGL Report No. 11-147B-R04 – "*Geotechnical Stability Report & Assessment of Stability Impacts on Soils, Geology and Land*" in Appendix 8.2 of this Chapter gives a detailed assessment of the characteristics of the activities that are likely to be carried out on site during decommissioning and the corresponding impacts on soils, geology and land that could have an effect on site stability, particularly in relation to the peat. The results are summarised in Table 8-10.

As discussed in Section 8.3.4.4.1, due to continued improvement in site conditions since construction, Figure 8-38 reflects the reduced likelihood of a peat slide on the site based on the site conditions in 2024 and the range of activities that are likely to be carried out during decommissioning.

Therefore, the **Significance** of the effect on Table 8-10 reflects the probability of a peat failure occurring due to the effect of the stability impact on the peat (e.g. due to the increased shear stresses under applied surcharge loads), as well as the sensitivity of the soils, geology and land potentially impacted by a peat slide, which has been calibrated by the peat failures that occurred on the site during construction and assessed as **Medium**, as discussed in Section 8.3.1.4.

In the following summary, stability impacts have been combined by the characteristics of the impact and the significance of the corresponding effect on soils, geology and land (i.e. to group similar impacts with similar effects). The effects are presented in order of decreasing significance.

Table 8-10: Assessment of Stability Impacts: Decommissioning Phase

Activity	Characteristics of Site Activities					Impact Assessment - Site Stability (Peat Slide)					
	Nature of Primary Impact	Probability of Occurrence	Extent	Duration	Frequency	Quality of Geotechnical Impact	Possible Extent of Impact (Peat Slide)	Probability of Occurrence (Impact)	Geotechnical Impact of Primary Effect on Site Stability	Sensitivity of Receiving Soils, Geology & Land	Significance of Geotechnical Impact
Dismantling of Turbine Blades, Nacelle & Mast	Crane Loading on Hardstanding Areas	Likely	Hardstanding areas adjacent to turbines	Temporary	Regularly	Slight Negative	Not Applicable	Negligible	**Negligible**	**Medium**	**Not Significant**
	Blade loading on peat in temporary set down areas	Likely	On peat on upslope side of crane hardstanding areas at each turbine	Temporary	Occasional (3 No. blades at each turbine)	Slight Negative	Not Applicable	Negligible	**Negligible**	**Medium**	**Not Significant**
	Crane Loading on Floating Roads	Likely	Along floating roads between turbines and site entrance	Temporary	Regularly	Negative	Small (100m^2-2500m^2) to Very Large (>10Ha)	Very Low	**Very Low**	**Medium**	**Slight**
	Low-Loader Transporter Loading with Turbine Components on Floating Roads	Likely	Along floating roads between turbines and site entrance	Temporary	Frequently	Negative	Small (100m^2-2500m^2) to Very Large (>10Ha)	Very Low	**Very Low**	**Medium**	**Slight**
Dismantling of Substation & Demolition of Control Building	Mobile Crane, MEWP and Vehicle Loading on Hardstanding Areas	Likely	Hardstanding area at Substation site	Temporary	Frequently	Slight Negative	Not Applicable	Negligible	**Negligible**	**Medium**	**Not Significant**
	Service Vehicle Loading on Floating Roads	Likely	Along Floating Roads to/from Substation Site	Temporary	Regularly	Slight Negative	Not Applicable	Negligible	**Negligible**	**Medium**	**Not Significant**
	Mobile Crane or Low-Loader Transporter Loading with Transformer on Floating Roads	Likely	Along Floating Roads from Substation Site	Brief	Occasional	Negative	Small (100m^2-2500m^2) to Very Large (>10Ha)	Very Low	**Very Low**	**Medium**	**Slight**
Localised Temp. Widening of Floating Roads & Hardstandings	Load from additional rockfill and crane wheel load on widened side of existing floating road	Possible	Localised Areas at T1, T4, T14 & T68, and possibly access track in turbary areas between Turbines T35 and T45, & T43-T46	Temporary	Occasional (Crane Load) Sustained (Add. Rockfill)	Negative	Small (100m^2-2500m^2) to Very Large (>10Ha)	Very Low to Low	**Low**	**Medium**	**Slight**
Dismantling the Anemometers	Mobile Crane and Vehicle Loading on Hardstanding Areas	Likely	Hardstanding area at Anemometers	Temporary	Occasional	Slight Negative	Not Applicable	Negligible	**Negligible**	**Medium**	**Not Significant**
	Mobile Crane or Transporter Loading with Anemometer Components on Floating Roads	Likely	Along Floating Roads from Anemometer Sites	Brief	Occasional	Negative	Small (100m^2-2500m^2) to Large (5Ha)	Very Low	**Very Low**	**Medium**	**Slight**
Dismantling OHL Timber Twin Polesets	Loading on Peat from Wide-Tracked Excavators and All-Terrain Vehicles (ATV)	Likely	Across pat slops from forestry access roads to OHL polsets PS-1a to PS-4	Brief	Occasional	Negative	Small (100m^2-2500m^2) to Very Large (>10Ha)	Very Low	**Very Low**	**Medium**	**Slight**
Cables & Ducting	De-energising and disconnecting HV and LV cables	Likely	At Substation (HV) and at Turbines (LV)	Temporary	Occasional	Neutral	Not Applicable	Negligible	**Negligible**	**Medium**	**Not Significant**

Significant or Moderately Significant Effects (Stability Impacts)

For the proposed scope and methodology of decommissioning works:

- All of the heavy lifting that will be required to dismantle the turbines, substation and anemometers will be carried out using large mobile cranes set up on the adjacent granular hardstand areas which are constructed of crushed rock granular fill supported on the glacial till below the peat and are designed to support the concentrated loads from the cranes.
- The mobile cranes, heavy low-loaders and construction/demolition vehicles will travel along the existing site access tracks and floating roads on peat which have been designed and fully proof tested for the maximum vehicle axle loads and design construction traffic surcharge loads.
- All of the existing LV electric cables, fibre-optic turbine control cables, copper earth wires and SCADA cables that have been direct buried at a depth of 0.90-1.1m in the peat between the turbines and substation and in ducts under the floating roads will be left in place after decommissioning to avoid excavating trenches across the peat to remove them.
- There will only be minimal temporary and localised additional loading on the peat in areas where existing narrow roads or bends at junctions need to be temporarily widened to provide safe access for the mobile cranes.
- The decommissioning works will not involve any significant excavations in peat, re-opening of borrow pits, or controlled disposal of excavated materials in designated material sidecast areas or peat repository sites.

Therefore, none of the impacts of site activities during decommissioning will have a **Significant or Moderately Significant** effect on soils, geology and land with respect to site stability.

Slightly Significant Effects (Stability Impacts)

The following impacts of site activities will have a **Slightly Significant** effect on soils, geology and land with respect to site stability during decommissioning:

- The heavy live load surcharge on the floating roads from the mobile cranes and low-loader transporters that will be used to dismantle the turbines, substation and anemometers and to transport the components offsite;
- Additional loading on the peat where the crane hardstanding needs to be temporarily extended (T4) or where sections of the existing site access tracks need to be temporarily widened at junctions near Turbines T68, T14 and T1, and along narrow sections of track at the east end of the turbary area between Turbines T35 and T45, and between T43 and T46; and
- The live load surcharge on the peat from the low ground bearing pressure (LGBP) wide-tracked excavators and ATV that will be used to take down & remove timber polesets PS-1a to PS-4 for the 110kV OHL.

Live load surcharge on the floating roads:

All the large mobile cranes and heavy transporters that will be required to access the turbines and substation during decommissioning to dismantle the components and transport them off site will travel along the existing site access tracks, most of which have been constructed as floating roads on the peat. The turbines will be fully dismantled to reduce the weight of the individual components on the low-loaders, and the size, weight and configuration of the mobile cranes will not exceed the design loads from the cranes that were used during construction. All the site access tracks have been designed, tested and certified for the maximum live load surcharge, which is from the mobile cranes. Therefore, the probability of a peat slide occurring under the surcharge from the construction

vehicles during decommissioning will be **Very Low,** so that the effect of the load on the stability of the peat will also be **Very Low** and the Significance of the effect will be **Slight**.

The decommissioning works are expected to take approximately 18-24 months. During that time, it is expected that the mobile cranes will be operating continuously on site when the turbines are being dismantled. They will be primarily set up at the hardstanding areas adjacent to the turbines but will travel along the floating roads when they are moving between turbines. There may also be more than one mobile crane on the site at any one time. Therefore, the loading will be **Regular** but the duration of loading will be **Temporary**. The specialist trucks and low-loader transporters will be **Frequently** required to remove the heavy and oversized components of the turbines from the site, but the duration of the loading will also be **Temporary**.

Localised additional dead and live load on the peat – widened turbary road:

Localised temporary widening of the access tracks at junctions near Turbines T68, T14 and T1 or along the narrow turbary road on the east side of the site between turbines T35 and T45, and between T43 and T46 will involve capping and widening the existing floating road to a minimum width of 4.5m with a 150-300mm thick layer of Class 6F2 crushed rock granular fill reinforced with two layers of geogrid and surfaced with a 100mm thick layer of Clause 804 granular subbase material, as illustrated in Figure 8-45.

Timber bog mats will initially be laid on the surface of the peat along the widened side of the roads to spread out the loads from the mobile cranes and granular capping/subbase layers. The geogrid reinforcement will be laid continuously across the full width of the road and will be designed with a wraparound detail at the edge of the road to reduce deflections under the concentrated wheel loads. Where necessary the peat under the widened section of the road will be trimmed down to ensure that the finished surface of the road has a uniform profile across the full width. The intact peat turves will be retained for reinstatement on completion of the decommissioning works.

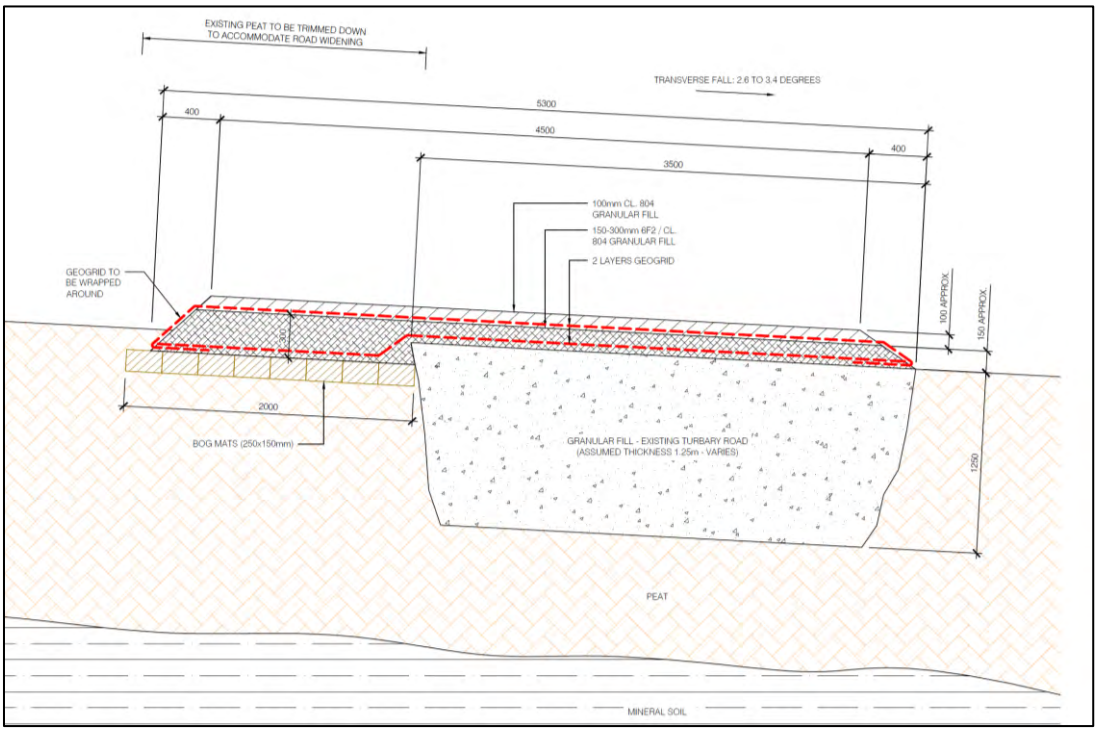


Figure 8-45 Temporary road widening detail (floating roads)

The impact of this will be to apply a small dead load surcharge of approximately 5-10kN/m^2 on the existing road and on the intact peat adjacent to the road. This is equivalent to the dead load from less than 1.0m of peat over the same area, which is low.

The existing 3.0-3.5m wide road was fully proof load tested for the design live load surcharge in 2018 and the peat has consolidated and gained strength under the road since it was constructed. Wherever possible the road will be widened on the upslope side as the higher strength peat under the existing road will provide greater resistance to shear failure than the virgin peat downslope from the road, which will reduce the likelihood of peat instability.

The widened road will spread the same traffic load out over a wider area (approx. 5m). Therefore, the effect that the load from the widened road will have on the stability of the peat will be **Low**, and the Significance of the effect will be **Slight.**

The short temporary spur extension to the hardstanding at Turbine T4 will be constructed as a floating road comprised of 600mm of crushed rock granular fill reinforced with two layers of geogrids. This will result in a localised dead load surcharge of approximately 12 kN/m^2 on the peat, which is equivalent to about 1.2m of peat, which is low. The section of road will also be connected to the hardstanding by the embedded geogrid reinforcements. Therefore, the effect that this will have on the stability of the peat will be **Low**, and the Significance of the effect will be **Slight**.

The additional surcharge loading from the widened roads and extended hardstanding will be **sustained** during decommissioning. However, the fill will be removed on completion of the works and the areas re-instated. Therefore, the effect will be **temporary**.

Dismantling Timber Twin Polesets PS-1a to PS-4 and the 110kV OHL

The timber twin polesets for the 110kV OHL that will be decommissioned with the wind farm (PS-1a to PS-4) will be cut down at ground level, cut into sections and transported off site for disposal. The de-energised cable will first be lowered from the supports, cut into sections and winched up onto reels from the Coillte forestry roads or wind farm access roads to be transported off site.

This work will be carried out along the line of the OHL using standard forestry equipment suitable for working on peat, including low ground-bearing pressure wide-tracked excavators fitted with chainsaw cutters to fell and cut-up the polesets, and ATV to transport the timber and de-energised electrical cables to a collection point on the windfarm or Coillte access roads for disposal offsite. The embedded foundations for the polesets will be left in place below finished ground level.

The work will be carried out in an area of established coniferous forestry and the polesets will be accessed as far as possible via existing site access tracks and Coillte forestry roads. Therefore, the probability of a peat failure occurring under the surcharge loads will be **Very Low**, the effect of the loading on the stability of the peat will be **Very Low** and only **Slightly Significant**.

The duration of loading on the peat will be **Brief** and **Occasional**.

Effects that are not Significant (Stability Impacts)

The following site activities and their stability impacts will not have a significant effect on the receiving soils, geology and land with respect to site stability during decommissioning:

- De-energising the site and disconnecting the LV and HV cables from the turbines and substation.
- Live load surcharges from the mobile cranes, low-loader transporters and general construction plant on the granular hardstanding areas at the turbines, substation and anemometer masts.
- Temporary loading from turbines blades in temporary set down areas on the peat adjacent to the turbines.
- Light live loading on the floating roads from light commercial vehicles, trucks and standard construction plant (e.g. hydraulic excavators, MEWP etc.).

This is because:

- De-energising the site will have an imperceptible effect on the peat.
- The LV and HV electrical cables will be disconnected at the turbines and substation transformer and transmission line structures.
- The granular hardstanding areas at the turbines and substation are designed to support the applied live load surcharges from the mobile cranes, low-loader transporters and construction plant on competent cohesive glacial till and rock below the peat. None of the live loads will exceed the maximum loads applied during construction, and steel outrigger pads will be used to spread out the concentrated loads from the mobile cranes.
- The temporary setdown areas for the dismantled turbine blades will be located on the upslope side of the crane hardstanding areas so that they act as a shear key to prevent shear failure in the peat under the surcharge load of the blades. Also, the 26m long blades weigh only 1,900kg each and they will be laid out uniformly across the surface of the peat so that the load is evenly distributed along the length of the blade at a nominal surcharge of <1.0-2.0kPa, which is negligible.
- The full-scale serviceability and proof load tests that were carried out on the floating roads in 2018 demonstrated that the roads are in very good condition and perform very well under the design loads from the large mobile cranes and low-loader transporters that will be used for dismantling the turbines and substation. Therefore, the effect of the lower live load surcharge from light service vehicles and standard commercial trucks on the stability of the peat will be negligible.

8.4.1.5 Derrybrien Wind Farm Site – Likely Impacts of the Retained Development Post-Decommissioning

This section of the report assesses likely impacts of the elements of the wind farm that will be left in place after decommissioning i.e. the Retained Development. During decommissioning all the above ground elements of the windfarm will be dismantled or demolished and taken off site so that the following elements will be left in place:

- The site access tracks, including 16.7 km of floating roads constructed on the peat with 0.6-1.0 m of granular rockfill reinforced with 1-2 layers of geogrids and a basal layer of timber, branches or small trees.
- The foundations for the turbines and anemometer lattice towers, which were constructed as reinforced concrete pad foundations supported directly on rock or on a layered profile of structural fill comprised of lean mix concrete and crushed rock granular fill down to rock.
- The hardstanding areas adjacent to the turbines and at the substation site, which are constructed of crushed rock granular fill supported on the glacial till or rock below the peat.
- All of the de-energised and disconnected LV electrical cables and fibre-optic cables that are direct-buried in the peat between the turbines and in ducts below the roads.
- The construction phase peat repository sites and material sidecast areas where excavated peat and mineral soils were placed on the surface of the peat during construction in 2003-2005 and which have since become re-vegetated and integrated into the surrounding landscape.
- The construction phase borrow pits.
- The current network of open drains and culverts across the site.

The effects of direct impacts on soils, geology and land on the site are assessed in Section 8.4.1.5.1 and the effects of stability impacts, particularly in relation to peat stability, are assessed in Section 8.4.1.5.2. There are no **indirect impacts** that have significant effects on soils, geology and land.

8.4.1.5.1 Direct Impacts (Retained Development - Post-Decommissioning)

Decomposition/Erosion of Excavated Peat from the Wind Farm site and Disturbed Peat from the Slide Area:

During the construction of the wind farm in 2003-2005 approximately 185,000m^3 of peat was excavated from the intact blanket bog over an area of about 7.7Ha for the turbine foundations, crane hardstanding areas, substation site, borrow pits and anemometers.

The peat slide that occurred at the wind farm site in October 2003 also disturbed about 450,000m^3 of intact peat over an area of approximately 25ha in blanket bog that was covered by coniferous forest plantations, the majority of which was outside the wind farm site boundary.

In Section 8.4.1.1.1 it was assessed that the excavation and on-site deposition/storage of approximately 185,000m^3 of peat for the wind farm had a **Medium to High** effect on the peat so that the Significance of the effect was **Moderate**. However, when this was assessed in combination with the direct impact on the peat that was displaced and disturbed in the side area:

- The total area of blanket bog disturbed was about **32.7 ha**.
- The total volume of peat excavated or displaced was **635,000 m^3**, of which approximately **40-60%** may have been lost due to displacement, erosion and decomposition over time, which would release approximately **50-75kt of CO_2**.
- This is equivalent to **≈0.10-0.15%** of Ireland's total estimated annual $CO_{2\text{-equivalent}}$ greenhouse gas emissions in 2023 (55,000 kt-$CO_{2\text{-eq}}$) and **≈ 0.65-0.95%** of the total emissions related to energy industries in that year (7,865 kt-$CO_{2\text{-eq}}$) [www.epa.ie, 2024].

The combined effect of this on the peat in the blanket bog on the site and in the slide area was **High**. The blanket bog in these areas was of low ecological importance as it had been degraded by coniferous forest plantations and drainage. Therefore, the sensitivity of the receiving soils, geology and land was **Medium** and the combined effect on the intact blanket bog was **Significant**.

All the peat that was excavated from the turbine foundations, hardstanding areas and borrow pits was retained on the wind farm site and stored in the borrow pits, peat repository sites and material sidecast areas. Much of this material is still on site and has not fully decomposed.

Since the end of construction, the surface layer of excavated peat in the repository sites has settled into the slope as the underlying intact peat compressed under the weight of the peat that was placed on the slopes. This has partially compensated for the increased rate of decomposition in the excavated peat on the surface of the slope because more of the underlying intact peat has settled below the water table, where the rate of decomposition is significantly lower. Furthermore, the surface of the excavated peat in the repository areas has now re-vegetated so that a new rate of carbon flux has been established between the decomposition and accumulation of peat on the slopes.

There is also about 200,000m^3 of displaced peat material remaining in the slide area, which is approximately 45% of the original volume of peat disturbed in the slide. The balance was displaced from the side area and flowed downslope along the channel for the stream in sub-catchment SC7(b). The enhanced drainage that formed within the slide area is likely to result in further degradation and decomposition of the disturbed peat. However, this is unlikely to result in loss of all the peat that has remained in the slide area and vegetation has re-established on the disturbed peat within the slide area, which will significantly reduce the rate of decomposition and erosion.

The full impact of the peat slide and the peat excavations on the wind farm site will have a long-term effect that will continue after decommissioning with ongoing degradation, decomposition and erosion

of the disturbed and remoulded peat. However, the primary effect occurred during the construction phase of the project when the peat was originally disturbed. The vegetation that has re-established on the repository sites and in the slide area will significantly reduce the rate of further erosion, degradation and decomposition of the disturbed peat so that the net rate of carbon release is significantly lower and is possibly at a new equilibrium of peat accumulation and net carbon storage.

While this significantly reduces the incremental effect on the peat post-decommissioning, it is considered that, relative to the original baseline condition in 1998, prior to construction, the combined effect on the peat would still be considered **High** so that the long-term effect on the intact blanket bog after decommissioning will be **Significant**.

Site Access Tracks, Peat Repository Sites & Material Sidecast Areas:

During the construction of the wind farm in 2003-2005 most of the site access tracks were constructed as floating roads directly on the intact vegetated surface of the peat typically using 600-1000mm of crushed rock granular fill reinforced with 1-2 layers of geogrids and a basal layer of timber brash.

The material sidecast areas were the locations where peat and mineral soil excavated from the foundation excavations was sidecast and spread out over the intact vegetated peat surface to depths of 0.5-1.5m adjacent to the excavations for the 39 No. turbine foundations that were completed during the first phase of construction, prior to the slide in 2003.

The peat repository sites were used to store up to 1.0m of remoulded peat that was excavated from the sites of the turbine foundations, crane hardstanding areas and substation site during the 2nd stage of construction in 2004/2005. The peat was spread out over the original vegetated surface of the peat in designated low-risk areas of the site with gently sloping ground.

Placing the materials directly on the slopes had a **negligible** effect on carbon storage in the underlying peat because the peat was left intact on the slopes and the loss of the existing surface vegetation covered by the deposited materials would have been compensated for by the reduction in the rate of decomposition of the additional volume of peat that was submerged below the water table as it compressed under the applied surcharge loads. The rate of decomposition of peat is dramatically slowed under anaerobic conditions below the water table.

The site access tracks, peat repository sites and material sidecast areas cover a combined area of approximately 24.0Ha, which is 7.2% of the total area of the wind farm site (340Ha). The materials covered the original peatlands vegetation on the surface of the blanket bog. The combined effect that this impact had on the peat during construction was **Medium to Low** because the degraded habitat in the areas of forestry and turbary plots was of low ecological value. Over time, peatlands vegetation has re-established on the disturbed materials in the repository sites and material sidecast areas, which has reduced the effect on the underlying peat to **Low**, which is of **Slight Significance**.

The site access tracks, peat repository sites and material sidecast areas will be left in place after decommissioning. Therefore, the effect that they have on the underlying peat will be **Permanent**.

In terms of land use, the material deposition areas would not restrict future forestry on the site after decommissioning of the wind farm because the disturbed peat and glacial subsoils have dried out and re-vegetated over time. Also, the floating roads, which will remain in place, provide improved access across the site for forestry equipment.

Improved Drainage:

During construction of the wind farm, additional drains were constructed in the peat to provide drainage for the turbine foundations, which was a design requirement for the foundations. The drains also improved the control of groundwater and surface runoff in areas of poor drainage and high water table, particularly in the coniferous forests where the majority of the additional drains

were constructed. The locations of the new drains are also shown on Figure 8-16. These were constructed as shallow open trenches in the peat with piped culverts under the site access tracks.

As the permeability of the peat is low, the extent of drawdown from the shallow open drains is limited to within a few meters of the drains rather than generally across the site. Nevertheless, the increased rate of surface runoff from the site reduces the rate of surface water infiltration into the peat, and this would have had a adverse impact on the ecology of the blanket bog by draining areas of ponded surface water and gradually lowering the water level in the upper acrotelm layers in some areas of the site.

The improved drainage would have had an adverse impact on the peat with respect to carbon storage in areas where the groundwater table was lowered i.e. the rate of decomposition of peat is greater in aerobic conditions above the water table, which releases stored carbon as CO_2. As the existing habitat was of low ecological value and was already degraded by drainage for the forestry and turbary plots, the effect that the improved drainage had on the peat was **Low** and the **Significance** of the effect was **Slight**.
The network of drains will be left in place after decommissioning. Therefore, the effect that they have on the peat will continue after decommissioning, albeit at a lower rate as most of the major drainage works were completed during construction and during the maintenance period prior to 2012. Therefore, the majority of the groundwater lowering would have occurred by the end of 2022 and any further changes after decommissioning of the wind farm should be minor.

8.4.1.5.2 *Stability Impacts (Retained Development - Post Decommissioning)*

Site Access Tracks:

The floating roads that are on the site will have been in place for approximately 20 years by the time the wind farm is decommissioned. The highest risk of shear or bearing failure in the peat was when the roads were originally constructed in 2003-2005, particularly under the design live load surcharge from the mobile crane that was used to erect the turbines. Since then the peat under the roads has increased in strength as it compressed under the weight of the rockfill, which has reduced the probability of shear failure occurring.

No failures occurred under the floating roads during construction or during the operation and maintenance period of the windfarm to date. They have also been fully proof load tested for the design crane loads. The most recent tests were carried out in 2018 and it was found that the performance of the roads had significantly improved due to the improvement in site conditions by that time, specifically the increase in strength and stiffness of the peat under the roads (see Section 8.3.4.4).

After decommissioning no further heavy construction traffic loading will be required on the floating roads for the wind farm. Therefore, the probability of a failure occurring in the peat due to the impact of the surcharge on the roads is **negligible** so that the effect of the surcharge load on the stability of the peat will be **negligible** and **Not Significant**.

The site access tracks across the slide area at T68 and T70 are constructed as rockfill berms supported on the glacial till below the peat. Therefore, the impact of the berms and the effect on the stability of the underlying glacial till or rock will be **negligible** and **Not Significant**.

The floating roads adjacent to the slide area at Turbines T68 and T70 were inspected by AGL Consulting in January 2024 and there was no evidence of further instability in the peat at the edges of the slide area. Therefore, the impact of the slide on the peat in the area and the corresponding effect on the stability of the floating roads post-decommissioning should be **negligible** and **Not Significant**.

Turbine Foundations & Crane Hardstandings:

The hardstanding areas adjacent to the turbines and at the substation site are constructed of crushed rock granular rockfill supported on the glacial till or rock below the peat. Therefore, they do not apply any load on the peat and the long-term effect of the load on the stability of the underlying glacial till or rock after decommissioning will be **negligible** and **Not Significant**.

Furthermore, the hardstanding areas will act as a shear key preventing shear failure in the peat directly upslope from them, which is a ***positive*** impact with respect to site stability. The effect of the support they provide will be **Slightly Significant**.

Similarly, the reinforced concrete turbine foundations are supported on rock or lean mix fill down to rock below the peat and glacial till so that they do not apply any load on the peat. Also, after the turbines are removed there will be no loading on the foundations. Therefore, the effect of the load on the stability of the underlying glacial till or rock after decommissioning will be **negligible** and **Not Significant**.

The turbine foundations will also act as a shear key preventing shear failure in the peat directly upslope from them, which is a ***positive*** impact with respect to site stability. The effect of the support they provide will be **Slightly Significant**.

The reinforced concrete bases would have been designed for the chemical exposure classification relevant to the ground conditions on the site. Therefore, the concrete would not be expected to deteriorate significantly in strength or disintegrate over time. Nevertheless, the long-term stability of the peat slopes after decommissioning is not dependent on the positive shear-key effect that the bases have on the stability of the peat upslope from the turbines.

Furthermore, leaving the bases in place after decommissioning would have a significantly lower effect on site stability when compared to the alternative of removing the bases during decommissioning. Removing the foundations would involve substantial intrusive deep excavation and demolition works at each turbine location, as well as management and disposal of excavated spoil and backfill with suitable imported or site-won materials.

Drainage:

Poor drainage is a recognised contributory risk factor for peat instability. Therefore, as discussed in Section 8.4.1.1.2, the improved drainage network that was constructed on the site for the wind farm has had a **sustained positive** effect on peat stability over the operational life of the wind farm. The improved drainage network has also had sufficient capacity to handle exceptionally high and sustained levels of rainfall without any further occurrences of peat instability related to the windfarm activities – for example during the high levels of rainfall recorded in December 2015.

The positive effect of the drainage improvements on the stability of the peat has been assessed as **Medium** and **Moderately Significant** relative to the original baseline conditions on the site in 1998, prior to construction.

The existing network of open drains and culverts across the site will be left in place at the end of decommissioning. It is not proposed to plug any of them to re-wet the blanket bog because the sudden change to hydrology on the site could have an adverse impact on peat stability. Therefore, the sustained positive effect that the drainage improvements have on the stability of the peat will continue after decommissioning.

No further maintenance will be carried out on the drains after decommissioning. Therefore, in the long-term the efficiency of the drains could reduce if they become clogged by vegetation over time, which would result in a partial gradual restoration of groundwater levels on the site.

The site maintenance records indicate that maintenance on the drainage network has been at a residual level since 2011– with only minor works required to maintain the efficiency and capacity of the existing system. There has been no experience of drains clogging or getting blocked because of vegetation growth, blocking or collapse over that time. Therefore, any reduction in the efficiency of the drainage network after decommissioning is expected to be minor and to occur gradually over time so that the positive long-term post-decommissioning effect on the stability of the peat will still be **Medium to Low** and **Slightly Significant** relative to the baseline conditions prior to construction.

Peat Repositories:

The peat repositories were used to store up to 1.0 m of peat from the excavations for the turbine foundations, crane hardstandings, substation site, borrow pits and anemometer masts during the second phase of construction in 2004/2005. All of the repository sites were located on the intact peat slopes in areas of gently sloping ground on the site. AGL Report No. 11-147-R04 in Appendix 8-2 describes the investigations and stability analyses that were carried out to assess each repository site as well as the control measures that were implemented when the peat was being placed on the slopes.

With the mitigation measures that were implemented during construction, the probability of a peat failure occurring in the peat repository areas was **Very Low** to **Low** so that the effect of the live load surcharge on the stability of the peat slopes was **Medium to Low** and only **Slightly Significant**.

The highest risk of a peat slide under the surcharge loads was at the time that the peat was placed in the repository during construction (i.e. the short-term undrained condition). Over time the peat has settled into the slope and the underlying peat has consolidated and increased in shear strength, which has reduced the likelihood of a peat failure. The remoulded excavated peat has also become more stable on the surface of the slope as it has dried out and vegetation has re-established on the surface, in many cases making the repository areas difficult to distinguish from the surrounding undisturbed ground, as shown in Plate 8-5, Plate 8-6 and Plate 8-7. A full set of photographs of the repository sites in 2018 and 2024 is included in AGL Report No. 11-147-R04 in Appendix 8-2.

The peat repositories will be left in place after decommissioning. Therefore, the impact of the repository sites will be permanent but the effect that they will have on the stability of the peat will be **Negligible** and **Not Significant**.

Plate 8-7: Re-vegetated surface of peat repository site opposite Turbine T50 in January 2024

Borrow Pits:

The borrow pits have been closed since construction was completed in 2005 and have remained undisturbed and stable since then. The main borrow pit (No.3) near the site entrance, where most of the rock was excavated, has been allowed to flood with groundwater and the level of groundwater in the pit has stabilized at a long-term natural level 1.0-1.5 m below the level of site access road at the entrance to the borrow pit. There are bunded cells of excavated peat contained by rockfill berms within the borrow pit, which were observed to be stable during the site inspections in 2018 and 2024.

No work will be carried out in the borrow pits during decommissioning and it is not anticipated that there will be any deterioration or change in the condition of the pits after decommissioning. Therefore, the impact that they will have on soils, geology and land in the area with respect to site stability will be **imperceptible**.

Photographs of the borrow pits in 2018 and 2024 are included in AGL Report No. 11-147-R04 in Appendix 8-2.

8.4.2 Grid Connection Impact Assessment

8.4.2.1 Grid Connection - Construction Phase Impacts (2003 – 2006)

This section of the chapter assesses the impact of the Grid Connection works with respect to soils, geology and land for the above period.

The section includes a summary of the Grid Connection activities that occurred during this period and the related impacts on soils, geology and land.

An assessment of the significance of these impacts on soils, geology and land is included. In addition, given the previous peat slide in the area, a specific assessment of the significance of these impacts with regards to peat stability is included.

The primary work activities that occurred during this period that have been assessed as having an impact on soils, geology and land included the following:

- Tree felling.
- Construction of temporary access tracks to poleset and mast locations.
- Construction of the twin polesets and masts for the overhead 110kv line.
- Deposition and storage of surplus excavated materials.
- Construction of the Agannygal substation and control building.
- Polesets and masts - ongoing loading.
- Upgrading of existing Coillte track to provide access to the Agannygal substation location.
- Construction of a new section of road at the entrance to Agannygal Substation.
- Ground lowering below the existing 400kV line.

The Project Description (Chapter 4) and the Geotechnical Stability Report 3 (FT, 2020) give a detailed summary of the construction activities and associated events during this period.

The activities and related effects are given in Table 8-11.

Table 8-11 Grid Connection and Related Effects

Activity/Item	Effect on Soils, Geology and Land Use	
	Direct	Secondary (Indirect)
Tree Felling	Settlement/Consolidation Land use of footprint Stability of weak ground	n/a
Construction of temporary access tracks	Settlement/Consolidation Land use of footprint Sealing (covering of land) Stability of weak ground	n/a
Deposition and storage of surplus excavated materials	Consolidation/Settlement Land use of footprint Carbon Release/Oxidisation Stability of ground	n/a
Construction of the Agannygal substation and control building	Settlement/Consolidation Erosion of exposed slope Carbon release/oxidisation Land use of footprint Sealing (covering of land) Stability of ground	n/a
Construction of twin polesets and masts for the overhead 110kV line	Settlement/Consolidation Stability of weak ground	n/a
Upgrade to existing Coillte access track	Land use of footprint	n/a
Construction of new section of entrance road to Agannygal substation	Carbon Release/Oxidisation Land use of footprint Sealing (covering of land) Stability of ground	n/a
Ground lowering beneath the existing 400kV line	Land use of Footprint Carbon Release Erosion of exposed slopes Stability of ground	n/a

Notes:

i. The order of effects listed above is not related to the significance of the impact.
ii. Only effects (e.g. direct, secondary) from the project that are considered to have a significance are included.
iii. Secondary (indirect) impacts on the environment are typically produced away from the project site or are due to a complex pathway.
iv. Settlement/consolidation are the same process whereby a load placed onto the ground would cause the ground to settle and consolidate (increase in density).

8.4.2.1.1 *Direct Impacts of Site Activities – Construction Phase (2003-2006)*

As discussed in Section 8.3.1.4, the baseline sensitivity of the receiving soils, geology and land impacted by the works has been assessed as **Medium** on the basis of the relatively low overall ecological value of the blanket bog in combination with its value for carbon sequestration, forestry, peat harvesting (turbary plots) and agricultural land use in the context of the overall wind farm project.

The following sections give a summary of the assessment of the direct impacts of the site activities and the significance of the corresponding primary effects on the receiving soils, geology and land. The effects are presented in order of decreasing significance.

Significant and Moderately Significant Effects (Direct Impacts)

There were no primary effects during the construction phase of the project from 2003 to 2006 where the direct effect on soils, geology and land use was Significant.

Moderately Significant Effects (Direct Impacts)

There were no primary effects during the construction phase of the project from 2003 to 2006 where the direct effect on soils, geology and land use was Moderate.

Slightly Significant Effects (Direct Impacts)

The significance of the effect of the following primary work activities on soils, geology and land during this period was Slight:

- Tree felling.
- Construction of temporary access tracks.
- Deposition and storage of surplus excavated materials.
- Construction of the Agannygal substation and control building.
- Construction of the twin polesets and masts for the overhead 110kv line.
- Loading of competent ground at poleset and mast locations.
- Ground lowering below the existing 400kV line.

Tree Felling

Felling the trees present along the route of the Grid Connection was a project requirement. Where the trees were felled, they were cut as close as possible to the ground. The trunks and roots were left in place so that there was no excavation or disturbance of the peat.

The surface of the peat was tracked over by the harvesting machines and forwarders that were used to cut, gather and stockpile the timber for transport off-site. In areas where the surface of the peat was very soft, brash and small branches were placed on the ground under the tracks of the harvester. Where the trees were small or where tree growth was poor the trees were felled by hand, arranged in windrows and left in place on the slopes.

The impact that this work had on the peat habitat was **Low**, particularly given the low ecological value of the degraded blanket bog in the forested areas.

The duration of the forestry trafficking on the peat was **Temporary** during tree felling. However, the restriction on land use is **Long-term** as it applies over the design life of the project. The **Extent** of the impact was directly along the route of the Grid Connection. However, the impact with regards to land use is **Low, given the small area of ground effected**.

Overall, the effect of felling the trees on the soils, geology and land in the felled areas was **Very Low** and the Significance of the effect was **Slight**.

Construction of temporary access track

In a single area of deep peat along the route of the OHL, a temporary access was constructed in order to provide access to AM38, around 600m north of the Agannygal substation. In this instance existing trees were felled and placed to form a 'floating road' mat of timber on the OHL corridor for access to the mast location.

Loading resulting in consolidation/settlement of the underlying ground would have occurred, and the impact is assessed as **Very low**, due to the limited extent of the works and the use of a floating road to reduce the loading on the peat.

The impact on land use is assessed as **Low**. As this was a temporary access, no significant sealing of the peat would have occurred.

The overall significance of the effect on land, soils and geology during the construction phase (2003 - 2006) is **Slight.**

Deposition and storage of surplus excavated materials

Access to the masts was from nearby road/forestry tracks. Construction for access to masts consisted of removal and disposal locally of peat (less than 1m typically) and tree stumps/brash to competent material to allow access for tracked excavators, dumpers and a rough terrain crane. Mast construction consisted of excavation of a hole to competent material at each of the 4 No tower legs. The excavated material was side cast in the area around the individual polesets and masts.

Loading resulting in consolidation/settlement of the underlying ground would have occurred, and the impact is assessed as **Very Low**. The removal of the excavated peat will have resulted in the release of carbon into the environment through decomposition and erosion, however the volume of peat excavated is very small, and therefore the impact is assessed as **Very Low**.

The area covered by this side casting is relatively small, around 20-30m^2 at each poleset. The impact on land use is assessed as **Low**.

The overall significance of the effect on land, soils and geology during the construction phase (2003 - 2006) is **Slight.**

Construction of Agannygal substation and control building

Following tree felling, earthworks were completed to form a level site in advance of the construction activities at the substation. A 72m x 52m levelled earth platform was constructed by cutting into the existing ground by up to 2.5m. Excess excavated material from this cutting activity was used to create an earth embankment around the external perimeter of the sub-station on three sides of approximately 2m height. Imported granular fill from local quarries was used to create a platform to allow for the construction of the control building and substation equipment.

The granular fill platform, substation equipment and control building all apply a load to the underlying competent ground. The duration of this load is **Long Term** and the load is **Constant**. The impact of this load in relation to settlement and consolidation of the underlying ground is **Low**. The removal of the excavated peat will have resulted in the release of carbon into the environment through decomposition and erosion, however the volume of peat excavated is very small, and therefore the impact is assessed as Very Low. The footprint of the substation platform is small when related to the extent of the surrounding forestry, and as such the impact on land use is **Low**.

The cut slope has had the topsoil removed which will have resulted in gradual erosion of the underlying soils. The impact of this was Low.

The overall significance of the effect on land, soils and geology during the construction phase (2003 - 2006) is **Slight.**

Construction of twin polesets and masts for the overhead 110kV

The excavation of peat along the OHL was undertaken in localised areas to provide access to the pole set locations where the peat was shallow. The volume of excavation of the peat along the route of the OHL was relatively small. Peat was also excavated at the pole set locations in order to construct the foundations for the pole sets. Excavations, where undertaken, were less than 1m in depth.

Loading resulting in consolidation/settlement of the underlying ground would have occurred, and the impact is assessed as **Low**.

The overall significance of the effect on land, soils and geology during the construction phase (2003 - 2006) is **Slight.**

Loading of ground at poleset and mast locations

The foundations for the individual polesets and masts apply a load to the underlying competent ground.

Loading resulting in consolidation/settlement of the underlying ground would have occurred, and the impact is assessed as **Very Low**.

The footprint of the foundations is very small, and the impact of the change in land use is assessed as **Very Low**.

The overall significance of the effect on land, soils and geology during the construction phase (2003 - 2006) is **Slight.**

Ground lowering below the existing 400kV line

In order to provide the required separation between pre-existing 400kV line and Derrybrien - Agannygal 110kV line passing underneath the 400kV line, and to provide sufficient ground clearance for the 110kV line, the ground was lowered by up to 3.5m below the crossing point of the two lines. Based on the available data and the findings of site walkovers, the total volume of glacial soils excavated at this location was of the order of 3,000m^3.

The excavated material was side cast onto the area around the excavation. The impact of the excavation on land use is **Negligible**, as the land use in this area was already restricted by the presence of the 400kV line. There is minimal peat present at this location, so the carbon release and oxidisation from the disturbance of the ground is also considered to be **Negligible**.

A cut slope in glacial soils was created as part of the works. The cut slope and area of ground beneath the 110kV line has had the topsoil removed which will have resulted in erosion of the underlying soils. The impact of this is **Low**.

The overall significance of the effect on land, soils and geology during the construction phase (2003 - 2006) is **Slight.**

Effects That Were Not Significant (Direct Effects)

The following primary effects of the construction stage activities did not have a significant direct effect on soils, geology and land use during construction:

- Upgrade of an existing founded Coillte track.
- Construction of a new access road to the Agannygal substation.

8.4.2.1.2 *Stability Impacts of Site Activities – Construction Phase (2003-2006)*

The following section gives a summary of the assessment of the primary work activities that had a direct effect with regards to site stability that were of significance.

For each activity, Table 8-12 states the nature of the corresponding stability impact on soils, geology and land – typically a dead or live load surcharge on the intact peat slopes - as well as the extent, duration and frequency of that effect.

Significant Effects (Stability Impacts)

No primary effects had a Significant impact with regards to site stability during the construction phase of the project between 2003 and 2006.

Moderately Significant Effects (Stability Impacts)

No primary effects had a Moderate impact with regards to site stability during the construction phase of the project from 2003 to 2006.

Slightly Significant Effects (Stability Impacts)

The significance of the impact of the following primary work activities with regards to site stability during this period was Slight:

- Tree felling.
- Construction of temporary access tracks.
- Deposition and storage of surplus excavated materials.
- Construction of the Agannygal substation and control building.
- Construction of the twin polesets and masts for the overhead 110kv line.
- Ongoing loading of competent ground at poleset locations.

Tree Felling

Felling the trees present along the route of the Grid Connection was a project requirement. Where the trees were felled, they were cut as close as possible to the ground. The trunks and roots were left in place so that there was no excavation or disturbance of the peat.

The surface of the peat was tracked over by the harvesting machines and forwarders that were used to cut, gather and stockpile the timber for transport off-site. In areas where the surface of the peat was very soft, brash and small branches were placed on the ground under the tracks of the harvester. Where the trees were small or where tree growth was poor the trees were felled by hand, arranged in windrows and left in place on the slopes. The risk of a peat slide under such machines loading would be limited. The impact in terms of site stability is **Low**, and the significance of the effect is **Slight,** due to the use of LGBP machinery and the shallow nature of the peat..

Construction of temporary access track

In a single area of deep peat along the route of the OHL, a temporary floating access was constructed in order to provide access to AM38, around 600m north of the Agannygal substation. In this instance existing trees were felled and placed to form a 'floating road' mat of timber on the OHL corridor for access to the mast location. The construction traffic loading on the floating road was **Frequent** during the construction of the road and the erection of the angle mast. However, the Duration of the loading was **Temporary**.

The impact of these works in terms of site stability was **Low**, and the significance of the effect is **Slight,** due to the use of a floating road and LGBP machinery, along with the low slope angles recorded at this location..

Deposition and storage of surplus excavated materials

Access to the masts was from nearby road/forestry tracks. Construction for access to masts consisted of removal and disposal locally of peat (less than 1m typically) and tree stumps/brash to competent material to allow access for tracked excavators, dumpers and a rough terrain crane. The excavated material was side cast in the area around the individual polesets and masts.

The side casting of this material will have resulted in an additional load on the peat and competent ground. Due to the small volume of material stored, the shallow depth of peat in most locations, and the relatively high peat strength, the impact as this activity in terms of site stability is **Very Low**, and the significance of the effect is **Slight**.

Construction of Agannygal substation and control building

Following tree felling, earthworks were completed to form a level site in advance of the construction activities at the substation. A 72m x 52m levelled earth platform was constructed by cutting into the existing ground by up to 2.5m. Excess excavated material from this cutting activity was used to create an earth embankment around the external perimeter of the sub-station on three sides of approximately 2m height. Imported granular fill from local quarries was used to create a platform to allow for the construction of the control building and substation equipment.

A cut slope in glacial soils was created as part of the works along the eastern side of the compound. The impact of the excavation of this cut slope on the site stability would be **Negligible.**

The granular fill platform, substation equipment and control building all apply a load to the underlying competent ground. The duration of this load is **Long Term** and the load is **Constant**. The impact of this load in relation to site stability is Low, and the significance of the effect is **Slight**, as all of the peat present was excavated to create the substation platform, and all slopes in the underlying clay were excavated at stable angles.

Construction of twin polesets and masts for the overhead 110kV

The excavation of peat along the OHL was undertaken in localised areas to provide access to the pole set locations where the peat was shallow. The volume of excavation of the peat along the route of the OHL was relatively small. Peat was also excavated at the pole set locations in order to construct the foundations for the pole sets. Excavations, where undertaken, were less than 1m in depth. The impact of these excavations on site stability was **Low** and the significance of the effect is **Slight**, as the peat was removed from these areas.

Loading of ground at poleset and mast locations.

The foundations for the individual polesets and masts apply a load to the underlying competent ground. However, given that the foundations bear on competent glacial soils the impact in terms of site stability was **Very low**, and the significance of the effect of loading on the competent ground is **Slight**, due to the relatively low loads involved..

Effects that were not Significant (Stability Impacts)

The following primary effects of the construction stage activities did not have a significant direct effect with regards to site stability use during construction:

- Upgrade of an existing founded Coillte track.
- Construction of a new access road to the Agannygal substation.
- Ground lowering below the existing 400kV line.

Table 8-12: Assessment of Stability Impacts – Construction Phase (2003-2006)

Activity	Characteristics of Direct Effect of Site Activities with respect to Site Stability (Stability Impacts)				Assessment of Effect of Stability Impacts on Soils, Geology & Land						Did Peat Failure Occur? (Yes/No)
	Effect	Extent of Effect	Duration	Frequency	Quality of Effect	Possible Extent of a Peat Failure	Probability of Occurrence of a Peat Failure	Effects on Receiving Soils, Geology & Land	Sensitivity of Receiving Soils, Geology & Land	Significance of Effect	
Tree Felling	Low ground pressure machinery on peat slopes	Along the OHL route	Long Term	Once	Slight Adverse	Small (100m^2-2,500m^2) to Medium (2,500m^2-25,000m^2)	Negligible to Low	Low	Medium	Slight	No
Construction of temporary access track to poleset location	Low ground pressure machinery on peat slopes	Along the OHL route	Temporary	Once	Slight Adverse	Small (100m2-2,500m2)	Negligible to Low	Low	Medium	Slight	No
Construction of twin polesets for 110kV line	Low ground pressure machinery on peat slopes	Along the OHL route	Temporary	Once	Slight Adverse	Small (100m^2-2,500m^2) to Medium (2,500m^2-25,000m^2)	Negligible to Low	Low	Medium	Slight	No
	Loading on ground from pole set foundations	At pole set locations	Long Term	Constant	Slight Adverse	Small (100m^2-2,500m^2)	Negligible to Low	Very Low	Medium	Slight	No
Deposition and storage of excavated materials on site	Loading on ground from placed excavated material	At pole set locations	Long Term	Constant	Slight Adverse	Small (100m^2-2,500m^2)	Negligible to Low	Very Low	Medium	Slight	No
Construction of Agannygal Substation	Removal of peat/placing stone for compound	At the substation location only	Short Term	Constant	Slight Adverse	Small (100m^2-2,500m^2) to Medium (2,500m^2-25,000m^2)	Negligible	Low	Medium	Slight	No
	Loading from stone platform/ substation equipment/ buildings	At the substation location only	Long Term	Constant	Adverse	Not Applicable	Negligible	Very low	Medium	Slight	No
Upgrade of access road to substation	Additional load on existing track	Along access track	Long Term	Constant	Slight Adverse	Not Applicable	Negligible	Negligible	Medium	Not Significant	No
Construction of entrance road to substation	Additional load on ground	Along entrance road	Long Term	Constant	Slight Adverse	Not Applicable	Negligible	Negligible	Medium	Not Significant	No
Ground Lowering below 400kV Line	Excavation of material and formation of cut slopes	Below 400kV line	Temporary	Constant	Adverse	Not Applicable	Negligible	Negligible	Medium	Not Significant	No

8.4.2.2 Grid Connection - Operation and Maintenance Phase Impacts (2006 – 2022)

This section of the chapter assesses the effect of the works activities related to the Grid Connection during the operation and maintenance stage of the Project from 2006 to 2022.

The primary work activities and events that occurred during this period that have been assessed as having an effect on soils, geology and land included the following:

- Forestry - Felling of regrowth.
- Deposition and storage of surplus excavated materials.
- Maintenance/Repair of Substation & Control Building.

The Project Description (Chapter 4) and the Geotechnical Stability Report 3 (FT, 2020) give a detailed summary of the construction activities and associated events during this period.

8.4.2.2.1 *Direct Impacts of Site Activities – O & M Phase (2006-2022)*

The following section gives a summary of the assessment of the Grid Connection that had a direct effect on soils, geology and land that were of significance.

The assessment details of the potential significance of these effects on soils, geology and land is given in Section 8.2.1.

Significant Effects (Direct Impacts)

None of the direct effects of site activities during the operation and maintenance phase of the Project between 2006 and 2022 had a **Significant** effect on soils, geology and land.

Moderately Significant Effects (Direct Impacts)

None of the direct effect of site activities during the operation and maintenance phase of the Project between 2006 and 2022 had a **Moderately Significant** effect on soils, geology and land.

Slightly Significant Effects (Direct Impacts)

The effect of the following site activities had a **Slightly Significant** effect on soils, geology and land during the operation and maintenance phase of the Project between 2006 and 2022:

- Forestry – Felling of Regrowth.

Forestry – Felling of Regrowth

In 2018 and 2019 some scheduled tree topping was carried out along the route of the OHL to trim back some of the small trees that had re-established naturally on the slopes where clear felling had taken place. The small trees were cut down and left in place on the slopes. The work was carried out using standard light or low ground bearing pressure (LGBP) wide tracked harvesters. All of these machines LGBP wide-tracked machines are suitable for working on peat. The duration of the work was temporary and was only carried out once in each area.

Loading resulting in settlement and consolidation of the underlying peat from trafficking of LGBP machines would be **Temporary** and very limited in extent. The effect is assessed as **Very Low**.

The overall significance of the effect of these impacts during the O&M phase (2006 - 2022) is **Slight**.

Effects that were not Significant (Direct Impacts)

The impact of the following operation and maintenance stage activities did not have a significant effect on soils, geology and land use during the operation and maintenance phase:

- Maintenance/repair of substation and control building.

8.4.2.2.2 *Stability Impacts of Site Activities – O & M Phase (2006-2022)*

The following section gives a summary of the assessment of the primary work activities that had a direct effect with regards to site stability that were of significance.

The assessment details of the potential significance of these effects with regards to stability is given in Table 8-13.

Significant Effects (Stability Impacts)

None of the effects of site activities had a **Significant** effect on soils, geology and land with respect to site stability during the operation and maintenance phase of the project between 2006 and 2022.

Moderately Significant Effects (Stability Impacts)

None of the effects of site activities had a **Significant** effect on soils, geology and land with respect to site stability during the operation and maintenance phase of the project between 2006 and 2022.

Slightly Significant Effects (Direct Impacts)

The following effects of site activities had a **Slightly Significant** effect on soils, geology and land with respect to site stability during the operation and maintenance phase of the project between 2006 and 2022:

- Forestry – Felling of Regrowth.

Forestry – Felling of Regrowth

In 2018 and 2019 some scheduled tree topping was carried out along the route of the OHL using standard LGBP wide tracked harvesters.

The risk of a peat slide under such machine loading would be limited. The effect in terms of site stability is **Very Low**, and the significance of the effect is **Slight.**

Effects that were not Significant (Stability Impacts)

The following site activities and corresponding stabilityeffects did not have a significant effect on the receiving soils, geology and land with respect to site stability during the operation and maintenance phase of the project between 2006 and 2022:

- Maintenance/repair of substation and control building.

Table 8-13: Assessment of Stability Impacts – Operation & Maintenance Phase (2006-2022)

Activity	Characteristics of Direct Effect of Site Activities with respect to Site Stability (Stability Impacts)				Assessment of Effect of Stability Impacts on Soils, Geology & Land						Did Peat Failure occur? (Yes/No)
	Effect	Extent of Effect	Duration	Frequency	Quality of Effect	Possible Extent of a Peat Failure	Probability of Occurrence of a Peat Failure	Effects on Receiving Soils, Geology & Land	Sensitivity of Receiving Soils, Geology & Land	Significance of Effect	
Forestry - Felling of Regrowth	Low ground pressure machinery on peat slopes	Along the OHL route	Temporary	Once	Slight Adverse	Small (100m^2-2,500m^2) to Medium (2,500m^2-25,000m^2)	Negligible to Low	Very low	Medium	Slight	No
Substation Maintenance	Loading from maintenance equipment	At the substation location only	Brief	Rarely	Slight Adverse	Not applicable	Negligible	Negligible	Medium	Not Significant	No

8.4.2.3 Grid Connection - Ceased Operation Phase 2022 to 2024 (Effects which are Occurring)

This section of the chapter assesses significant effects from the construction, operation and maintenance stages of the Grid Connection from 2003 to 2022 that are still occurring at the end of 2024.

The Project Description (Chapter 4) gives a detailed summary of the construction activities and associated events during this period.

8.4.2.3.1 *Direct Impacts (Ceased Operation Phase 2022-2024)*

The following section gives a summary of the assessment of the primary work activities relating to the OHL and Agannygal substation that have an ongoing direct impact on soils, geology and land that were of significance.

Slightly Significant Effects (Direct Impacts)

The significance of the effect of the following primary work activities on soils, geology and land during this period was slight:

- Decomposition of Excavated Peat

Decomposition of Excavated Peat

Access to the masts was from nearby road/forestry tracks. Construction for access to masts consisted of removal and disposal locally of peat (less than 1m typically) and tree stumps/brash to competent material to allow access for tracked excavators, dumpers and a rough terrain crane. The excavated material was side cast in the area around the individual polesets and masts.

The removal and side casting of the excavated peat will have resulted in the release of carbon into the environment through decomposition and erosion, however the volume of peat excavated is very small, and therefore the impact is assessed as **Very Low**. The significance of this impact relative to the baseline conditions has been assessed as **Slight**. This is a **Long-Term** effect as it occurs slowly over time. Therefore, it is likely to be still occurring at the end of 2024, albeit at a lower rate than during the Construction phase. Some revegetation of this excavated peat has occurred since the end of construction, which will have slowed the decomposition of the peat.

8.4.2.3.2 *Stability Impacts (Ceased Operation Phase 2022-2024)*

The following section gives a summary of the assessment of the primary work activities from the construction and operation and maintenance stages of the OHL from 2003 to 2019 that are having an ongoing impact with regards to site stability in 2024.

There are no ongoing impacts on site stability that have changed in significance since the construction phase, and therefore no reassessment of the effect of these impacts on site stability has been included.

8.4.2.4 Grid Connection – Likely Impacts of the Retained Development (Post-Decommissioning Phase)

This section of the report assesses likely impacts of the OHL after decommissioning. During decommissioning all the above ground elements of the grid connection will be dismantled or demolished and taken off site so that the following elements will be left in place:

- Below ground elements for 34 no. double wooden pole sets.
- Reinforced concrete foundations for 2no. end masts.
- Reinforced concrete foundations for 5no. angle masts.
- Reinforced concrete foundations for 1no. intermediate mast.
- Reinforced concrete foundations of structures within the Agannygal Substation compound.

The effects of direct impacts on soils, geology and land on the site are assessed in Section 8.4.2.4.1 and the effects of stability impacts, particularly in relation to peat stability, are assessed in Section 8.4.2.4.2.

8.4.2.4.1 *Direct Impacts (Retained Development – Post-Decommissioning)*

OHL and Substation Foundations

The reinforced concrete turbine foundations are supported on glacial till or rock below the peat and so that they do not apply any load on the peat. Also, after the polesets and the substation structures are removed there will be no loading on the foundations. Therefore, the effect of the load on the underlying glacial till or rock after decommissioning will be **Negligible** and **Not Significant**.

8.4.2.4.2 *Stability Impacts (Retained Development – Post-Decommissioning)*

OHL and Substation Foundations

The reinforced concrete turbine foundations are supported on glacial till or rock below the peat and so that they do not apply any load on the peat. Also, after the polesets and the substation structures are removed there will be no loading on the foundations. Therefore, the effect of the load on the stability of the underlying glacial till or rock after decommissioning will be **negligible** and **Not Significant**.

8.4.3 Peat Slide & Response Works - Impact Assessment

The following section gives a summary of the assessment of the peat slide and primary work activities that had a direct impact on soils, geology and land use that were of significance.

8.4.3.1 Peat Slide & Response Works - Construction Phase Impacts (2003 – 2006)

8.4.3.1.1 *Direct Impacts of Site Activities – Construction Phase (2003-2006)*

Significant and Moderately Significant Effects (Direct Impacts)

The significance of the impact of the following primary work activities/events on soils, geology and land use during this period was Significant:

- Peat slide – Displaced Material.

Peat Slide – Displaced Material

Material from the peat slide moved downslope and was deposited in a number of locations. A significant amount of the material remains within the source area (estimated at 200,000m^3). Peat material was also deposited along the slide path, that is along existing stream/river banks and in depositional lobes notably above Black Road Bridge. An amount of peat material was also placed within peat repositories, which is assessed separately under peat repositories.

A site walkover in 2019 (downslope of Black Road Bridge) showed little/no visual evidence of any remaining peat deposited along the banks of the streams/rivers. Over time, any material deposited along the river banks has been eroded/degraded.

Degradation (oxidisation) of peat significantly increases when exposed to aerobic conditions, such as peat slide material exposed above the water table. This results in release of stored carbon as carbon dioxide, which would have an adverse effect and the immediate impact is Moderate, which over time to the present the impact has reduced to Negligible, as exposed peat material volumes have reduced.

Based on the site walkover in 2019 on the accessible lands, there is little/no volume of displaced peat material debris present outside the source area, and as such the footprint of the displaced peat material area is considered minimal. Immediately after the event there would have been a substantial footprint which would have included most of the stream/river channels and adjacent banks downstream of the source area, and the impact on the land use would have been High.

The overall significance of the effect of these impacts during the construction phase (2003 - 2006) is **Significant.**

Moderately Significant Effects (Direct Impacts)

The significance of the impact of the following primary work activities/events on soils, geology and land use during this period was Moderate:

- Peat slide - source area;

Peat Slide - Source Area

The peat slide source area represents the area where the peat slide originated which has a plan area estimated at 253,000m^2. The peat slide volume was estimated to be about 450,000m^3 (AGEC, 2004).

The estimated volume of displaced material that remains within the source area is estimated at 200,000m^3. The footprint of the peat slide source area was estimated at 253,000m^2. The impact on land use is assessed as Medium.

Degradation (oxidisation) of peat significantly increases when exposed to aerobic conditions, such as within the peat slide source area where peat was exposed above the water table. This results in release of stored carbon as carbon dioxide, which would have an adverse effect and the immediate impact is Moderate, which over time to the present the impact has reduced to Negligible, as exposed peat has been revegetated.

The loss of peat cover in the source area would have exposed the underlying mineral soil to adverse climatic conditions, resulting in leaching and erosion of the exposed soil. The impact with respect to loss of peat cover is given as Medium to High.

The overall significance of the effect of these impacts during the construction phase (2003 - 2006) is **Moderate**.

Slightly Significant Effects (Direct Impacts)

The significance of the effect of the following primary work activities on soils, geology and land use during this period was Slight:

- Construction of barrages to restrict movement of slide material (peat).
- Construction of peat repositories to store slide material.
- Construction of borrow pit adjacent to barrage 1.
- Construction traffic on intact peat.
- Construction of floating access tracks to location of barrage 1 and 2.

Construction of Barrages to Restrict Movement of Slide Material (Peat)

In order to restrict the movement of the slide material , which was essentially peat, a series of barrages were constructed. These were constructed between the wind farm project site boundary and downslope of the Flaggy Bridge on the R353 local road. The permanent barrages (1 to 4) comprised coarse rock fill which was placed onto competent ground. The temporary barrages (A to D) typically consisted of a mixture of earthen and rock fill material, which were all removed during the construction period. A summary of the barrages is given in Table 8-14.

Table 8-14: Containment Barrages

Barrage	Typical Dimensions	Comments
Containment Barrage 1 (Coillte Road)	94m (long), 8m (wide), 2m (high)	Located within slide s source area Access directly from existing Coillte track
Containment Barrage 2	17m (long), 20m (wide), 5.5m (high)	Located within incised section of stream Access via constructed floating access track 300m (long), 3m (wide)
Containment Barrage 3	41m (long), 9m (wide), 3m (high)	Located across stream Temporary access from public road. Access route 100 m long and about 3 m wide
Containment Barrage 4	25m (long), 10m (wide), 3m (high)	Located across stream Temporary access from public road. Access route 100 m long and about 3 m wide

Barrage	Typical Dimensions	Comments
Temporary Containment Barrage A	Estimated: 80m (long), 3m (wide), 3m (high)	Located upstream of Black Road Bridge Barrage removed sometime after slide event Access direct from existing road
Temporary Containment Barrage B	Estimated: 80m (long), 3m (wide), 3m (high)	Located upstream of Black Road Bridge Barrage removed sometime after slide event Access direct from existing road
Temporary Containment Barrage C	Estimated: 20m (long), 3m (wide), 3m (high)	Located upstream of Flaggy Bridge on R353 Barrage removed sometime after slide event Access direct from existing road
Temporary Containment Barrage D	Estimated: 20m (long), 3m (wide), 3m (high)	Located downstream of Flaggy Bridge on R353 Barrage removed sometime after slide event Access direct from existing road

Notes:

(1) The temporary containment barrages were constructed from October to November 2003 by Galway County Council and were subsequently removed sometime after the slide event. Date of removal is not known.
(2) The dimensions of the temporary containment barrages are estimated based on available records and site inspection.
(3) Access track lengths to temporary containment barrages C and D are estimates.

Loading resulting in consolidation/settlement of the underlying ground would have occurred at each of these barrage locations however given the existing barrages are founded, and temporary barrages are assumed to be founded on competent material, the effect is assessed as **Very low**.

The footprint of the permanent barrages was relatively small and ranged from typically 250 to 750 m^2. The footprint of the temporary barrages was also relatively small and ranged from typically 60 to 240 m^2. The volume of coarse rock fill used in the permanent barrages was also relatively small and ranged from about 750 to 1500m^3 with approximately 4,500 m^3 of rock fill used in total. The rock used in the barrages 1 and 2 was extracted from a local borrow pit adjacent to one of the barrages. It is understood that the temporary barrages were constructed of locally sourced material (mix of soil and rock).

Associated access tracks were constructed to a few of the barrages, most notably barrages 1 and 2 where floating access tracks were constructed, which is addressed separately below. The accesses to the remaining barrages were either direct from existing roads or by essentially tracking plant and material over existing terrain to the barrage site (barrages 3 and 4).

The overall effect on land use as a consequence of the barrages and access for Barrage 3 and Barrage 4 is assessed as **Low to Medium**.

The permanent barrages would have sealed the ground. The barrages were placed onto glacial soil or a granular/rocky stream bed. The permanent barrages were constructed with materials that allowed water to flow through the barrage.

The effect with respect to sealing is given as Low.

The overall significance of these effects during the construction phase (2003 - 2006) is **Slight**.

Construction of Peat Repositories to Store Slide Material

Following the peat slide, a series of repositories were constructed along the path of the peat slide between the project site and the Flaggy Bridge on the R353 local road. A summary of the peat repositories is given in Table 8-15.

Table 8-15: Peat Repositories

Repository	Typical Dimensions (max.)	Comments
Repository at Barrage 2	108m (long), 34m (wide), 2m (high)	Founded on peat, partially bunded/bunded on the downslope side with earthen material
Repository at Black Road Bridge	140m (long), 85m (wide), 2m (high)	Founded on shallow peat, partially bunded/bunded with earthen material from drainage excavations. Removal of some Coillte forestry required.
Repository at Barrage 3	41.5m (long), 16m (wide), 1.6m (high)	Sunken in bunded excavation and founded on mineral soil

Loading resulting in some consolidation of the underlying peat in Repositories at Black Road Bridge and Barrage 2, where present, would have occurred but the effect is assessed as Low. In general, construction machines that trafficked over particularly deeper peat would have been light or low ground bearing pressure (LGBP) wide-tracked machines suitable for working on the peat. As the Repository at Barrage 3 is founded on mineral soil the effect is assessed as **Negligible**.

The footprint of the repositories was relatively small and ranged from typically 600 to 12,000 m^2. In total, the repositories covered an area of about 16,200 m^2 (1.6 ha), typically in forested areas which had been felled. The volume of material, comprising dominantly slide material, within the repositories ranged from about 1,200 to 14,000 m^3. These repositories were filled with slide material of dominantly peat and other minor material removed from the adjacent river/stream channel and in particular material which had accumulated on the upstream side of the barrages 1, 2 and 3. Material in the repository at the Black Road Bridge was removed from the lands and stream in the area where peat deposition had occurred.

The repository material was laid directly onto the ground surface. There was a very limited amount of construction material used for the repositories (such as in forming containment bunds).

The effect on land use is assessed as Low to Medium.

The repositories would have initially sealed the ground and prevented the previous land use, though the placed peat would in time have dried and allowed re-growth of vegetation to occur.

The placed peat will also have led to consolidation of the underlying peat. The effect is given as Low.

The overall significance of these effects during the construction phase (2003 - 2006) is **Slight**.

Effects That Were Not Significant (Direct Impacts)

The significance of the effect of the following primary work activities on soils, geology and land use during this period was not significant:

- Repairs to the Black Road Bridge, Flaggy Bridge and Unnamed Bridge C.
- Replacement of stepping stones.

Repairs to the Black Road Bridge, Flaggy Bridge and Unnamed Bridge C were carried out due to damage as a result of the peat slide. These repairs were of structural nature and the effect with respect to land soil and geology was **Not Significant**.

Downstream, on the Owendalulleegh River, a set of stepping stones at a ford location were replaced where they had been damaged by the peat slide. The effect with respect to land soil and geology was **Not Significant**.

8.4.3.1.2 Stability Impacts of Site Activities – Construction Phase (2003-2006)

The following section gives a summary of the assessment of the primary work activities that had a direct impact with regards to stability that were of significance. The assessment details of the potential significance of these impacts specifically with regards to stability is given in Table 8-16.

Significant Effects (Stability Impacts)

The significance of the impact of the following primary work activities with regards to stability during this period was Significant:

- Peat slide – Displaced Material.
- Construction of floating access tracks to location of barrage 1 and 2.

Peat Slide - Displaced Material

Immediately after the slide event there was a considerable amount of peat material that moved downslope following an existing natural valley. The highly fluid peat would have been notably unstable and would have caused erosion of the stream channel. As the peat was essentially confined in a stream/river channel, the risk of the load from the peat material causing further ground failure was limited, and there was possibly very localised failure/erosion of the stream banks. The impact with regards to stability would have been initially High which over time to the present the impact reduced to Negligible to Very low.

A site walkover in 2019 (downslope of Black Road Bridge) showed little/no visual evidence of any peat material deposited along the banks of the stream/river.

The overall significance of the effect of these impacts during the construction phase (2003 - 2006) is **Significant.**

Construction of Floating Access Tracks to location of Barrage 1 and 2

An access track 830m in length was constructed from an existing Coillte forest track in order to access the location of barrage 1 and replace the Coillte access track removed by the slide. The access track comprised a western and eastern section. The access track to the west of barrage 1 was constructed as a floating track on peat. The eastern access track was founded on competent ground.

A floating access track 300m in length was constructed from an existing Coillte forest track in order to access the location of barrage 2. The floating access track was constructed on peat.

As the floating tracks were constructed on peat there would be an elevated risk of instability. The highest risk for instability is in the short-term undrained condition during construction. Over time, the peat consolidates and increases in strength under the weight of the road, which significantly reduces the risk of peat instability. No failures of floating road resulting in peat slides have occurred on the project. The impact in terms of stability would have been High during construction.

The overall significance of the effect of these impacts during the construction phase (2003 - 2006) is **Significant.**

Moderately Significant Effects (Stability Impacts)

The significance of the impact of the following primary work activities/events with regards to stability during this period was Moderate:

- Peat slide - source area.

Peat Slide - Source Area

The peat slide source area represents the area where the peat slide originated which has a plan area estimated at 253,000m^2. The peat slide volume was estimated to be about 450,000m^3 (AGEC, 2004). The estimated volume of material that remains within the source area is estimated at 200,000m^3.

An assessment of peat stability within the peat slide source area was carried out (FT, 2019). The impact with regards to stability immediately after the slide would be Medium to High, reducing to Low, which would reduce further with time to Very low. The reduction in impact with time would be due to drainage of water from the peat slide source area (included as a secondary positive impact below) and re-establishment of vegetation. Notwithstanding the above, should any instability events occur within the peat slide source area, they are likely to be localised in nature.

The overall significance of the effect of these impacts during the construction phase (2003 - 2006) is **Moderate**.

Slightly Significant Effects (Stability Impacts)

Effects of Slight Significance

The significance of the effect of the following primary work activities with regards to stability during this period was Slight:

- Construction of barrages to restrict movement of slide materil (peat).
- Construction of peat repositories to store slide material.
- Construction traffic on intact peat.
- Construction of borrow pit adjacent to barrage 1.

Construction of Peat Repositories to Store Displaced Material

The repositories were founded on mineral soil (cohesive glacial soil) and peat. These repositories stored pre-dominantly material removed from the upstream side of the barrages. The assessment of ground stability ("*Geotechnical Stability Report 2*" (FT, 2020)) showed that the effect with regards to stability was low, and is discussed in detail above, see Table 8-6. Over time, consolidation would increase underlying soil/peat strength and together with removal of water and re-establishment of vegetation this would further reduce the effect.

The significance of these effects during the construction phase (2003 - 2006) is **Slight.**

Effects that were not Significant (Stability Impacts)

The following primary effects of the construction stage activities did not have a significant direct effect with regards to stability during construction:

- Repairs to the Black Road Bridge, Flaggy Bridge and Unnamed Bridge C.
- Replacement of stepping stones.

Repairs to the Black Road Bridge, Flaggy Bridge and Unnamed Bridge C were carried out due to damage as a result of the peat slide . These repairs were of structural nature and the effect with respect to stability was **Not Significant**.

Downstream, on the Owendalulleegh River, a set of stepping stones at a ford location were replaced where they had been damaged by the peat slide . The effect with respect to stability was **Not Significant**.

8.4.3.2 Peat Slide & Response Works - Operation and Maintenance Phase Impacts (2006 – 2022)

This section of the chapter assesses the impact of the peat slide and response works undertaken in response to the slide with respect to soils, geology and land use during the above operation and maintenance (O&M) period.

An assessment of the significance of these impacts on soils, geology and land use is included, in addition, given the peat slide event, a specific assessment of the significance of the impacts with regards to peat stability is included.

8.4.3.2.1 *Direct Impacts of Site Activities – O & M Phase (2006-2022)*

The following section gives a summary of the assessment of the peat slide and primary work activities that had a direct impact on soils, geology and land use that were of significance.

Significant Effects (Direct Impacts)

There were no primary effects during the operation and maintenance phase of the project from 2006 to 2022 where the direct impact on soils, geology and land use was Significant.

Moderately Significant Effects (Direct Impacts)

There were no primary effects during the operation and maintenance phase of the project from 2006 to 2022 where the direct impact on soils, geology and land use was Moderate.

Table 8-16: Assessment of Stability Impacts – Construction Phase (2003-2006)

Activity	Characteristics of Primary Effect of Site Activties with respect to Site Stability				Assessment of Site Stability Impacts on Soils, Geology & Land						Did Peat Failure occur? (Yes/No)
	Nature of Primary Effect	Extent of Primary Effect	Duration	Frequency	Quality of Impact	Possible Extent of a Peat Failure	Probability of Occurrence (Peat Failure)	Impact on Receiving Environment	Sensitivity of Receiving Soils, Geology & Land	Significance of Impact	
Peat slide source area	Localised retrogressive collapse of edge of peat slide source area	Within extent of peat slide source area	Temporary	Once	Negative	Small (100m^2-2,500m^2) to Medium (2,500m^2-25,000m^2)	Possible to Likely	Medium to high	Medium	Moderate	Yes
Peat slide debris	Increased loading on slope from weight of slide debris	Within extent of peat debris, most likely occurring in peat slide source area	Temporary	Once	Negative	Small (100m^2-2,500m^2) to Medium (2,500m^2-25,000m^2)	Possible to Likely	High	Medium	Significant	Yes
Construction of barrages to restrict movement of slide debris (peat)	Increased loading on slope from weight of barrage fill	At barrage locations	Long term	Constant	Negative	Small (100m^2-2,500m^2)	Negligible to Low	Very Low	Medium	Slight	No
Construction of peat repositories to store slide debris	Increased loading on slope from weight of stored material	At repository locations	Long term	Constant	Negative	Small (100m^2-2,500m^2) to Medium (2,500m^2-25,000m^2)	Negligible to Low	Low	Medium	Slight	No
Construction of borrow pit adjacent barrage 1	Excavation of slopes in overburden and bedrock	At borrow pit location	Long term	Constant	Negative	Small (100m^2-2,500m^2)	Negligible to Low	Low	Medium	Slight	No
Construction traffic on intact peat	Loading from machinery on peat slopes	At barrage/repository locations	Temporary	Rarely	Negative	Small (100m^2-2500m^2) to Medium (2500m^2-25000m^2)	Negligible to Low	Very Low	Medium	Slight	No
Construction of floating access tracks to location of barrage 1 and 2	Loading from floated access track	Along route of track	Long term	Constant	Negative	Small (100m^2-2,500m^2)	Negligible to Low	High	Medium	Significant	No
Other Activities/Items	Repairs to Black Road and Flaggy Bridge	At bridge location	Long term	Constant	Neutral	Not Applicable	Negligible	Negligible	Medium	Not Significant	No
	Replacement of Slattery Bridge	At bridge location	Long Term	Constant	Slight Negative	Not Applicable	Negligible	Negligible	Medium	Not Significant	No
	Replacement of Stepping Stones	At stepping stones location	Medium Term	Constant	Neutral	Not Applicable	Negligible	Negligible	Medium	Not Significant	No

Slightly Significant Effects (Direct Impacts)

The significance of the impact of the following primary work activities/events on soils, geology and land use during this period was Slight:

- Maintenance of barrages.

Maintenance of Barrages

In this time period, slide material accumulated behind some of the barrages. Works were undertaken in 2007 to remove this material from behind barrages 1 and 2. Works were undertaken from the barrage and the adjacent access tracks with the peat material placed into the adjacent repository. This likely resulted in an additional live load due to machinery during the works, plus an additional load within the adjacent repositories when the material removed from behind the barrages was placed in the repositories.

The additional loading in the repositories likely resulted in some consolidation of the underlying peat. As this peat would have previously been compressed by the construction of the repository, the impact of the additional placed material is assessed as Very low.

The footprint of the repositories would not have increased greatly due to the additional placement of peat during this period. The additional impact on land use due to maintenance is assessed as Very low.

The overall significance of these impacts during the O&M phase (2006 - 2019) is **Slight**.

Effects that were not Significant (Direct Impacts)

The significance of the effect of the following primary work activities on soils, geology and land use during this period was not significant:

- Repairs to the Black Road Bridge, Flaggy Bridge and Unnamed Bridge C.
- Replacement of stepping stones.

Repairs to the Black Road Bridge, Flaggy Bridge and Unnamed Bridge C were carried out due to damage as a result of the peat slide. These repairs were of structural nature and the effect with respect to land soil and geology was **Not Significant**.

Downstream, on the Owendalulleegh River, a set of stepping stones at a ford location were replaced where they had been damaged by the peat slide. The effect with respect to land soil and geology was **Not Significant**.

8.4.3.2.2 Stability Impacts of Site Activities – O & M Phase (2006-2022)

The following section gives a summary of the assessment of the peat slide and primary work activities that had a direct impact with regards to stability that were of significance.

Significant Effects (Stability Impacts)

No primary effects had a Significant impact with regards to site stability during the operation and maintenance phase of the project from 2006 to 2022.

Moderately Significant Effects (Stability Impacts)

No primary effects had a Moderately Significant impact with regards to site stability during the operation and maintenance phase of the project from 2006 to 2022.

Slightly Significant Effects (Stability Impacts)

The significance of the effect of the following works with regards to stability during this period was Slight:

- Maintenance of barrages.

Maintenance of Barrages

In this time period, slide material accumulated behind some of the barrages. Works were undertaken in 2007 to remove this material from behind barrages 1 and 2. Works were undertaken from the barrage and the adjacent access tracks with the peat material placed into the adjacent repository. This likely resulted in an additional live load due to machinery during the works, plus an additional load within the adjacent repositories when the material removed from behind the barrages was placed in the repositories.

Assessment of ground stability, including accessing the barrage, and placing additional material in the repositories, showed that the impact of this work in terms of stability was Very low.

With respect to stability, the overall significance of the effect of these impacts during the O&M phase (2006 - 2022) is **Slight**.

Effects that were not Significant (Stability Impacts)

The significance of the impact of the following primary effects did not have a significant direct effect with regards to stability during this period:

- Repairs to the Black Road Bridge, Flaggy Bridge and Unnamed Bridge C.
- Replacement of stepping stones.

Repairs to the Black Road Bridge, Flaggy Bridge and Unnamed Bridge C were carried out due to damage as a result of the peat slide. These repairs were of structural nature and the effect with respect to stability was **Not Significant**.

Downstream, on the Owendalulleegh River, a set of stepping stones at a ford location were replaced where they had been damaged by the peat slide. The effect with respect to stability was **Not Significant**.

Table 8-17: Assessment of Stability Impacts – Operation & Maintenance Phase (2006-2022)

Activity	Characteristics of Primary Effect of Site Activties with respect to Site Stability				Assessment of Site Stability Impacts on Soils, Geology & Land						Did Peat Failure occur? (Yes/No)
	Nature of Primary Effect	Extent of Primary Effect	Duration	Frequency	Quality of Impact	Possible Extent of a Peat Failure	Probability of Occurrence (Peat Failure)	Impact on Receiving Environment	Sensitivity of Receiving Soils, Geology & Land	Significance of Impact	
Maintenance of barrages	Loading on slope from weight of stored material	At repository locations	Brief	Constant	Slight Negative	Small (100m^2-2,500m^2) to Medium (2,500m^2-25,000m^2)	Negligible	Very low	Medium	Slight	No

8.4.3.3 Peat Slide & Response Works - Ceased Operation Phase 2022 to 2024 (Impacts which are Occurring)

This section of the chapter assesses the ongoing impact of the peat slide and the response works undertaken in response to the slide with respect to soils, geology and land use for the above period and that are still occurring at the end of 2024.

An assessment of the significance of these impacts on soils, geology and land use is included, in addition, given the peat slide event, a specific assessment of the significance of the impacts with regards to peat stability is included.

8.4.3.3.1 *Direct Effects (Ceased Operation Phase 2022-2024)*

The following section gives a summary of the assessment of the peat slide and primary work activities that have a direct ongoing effect on soils, geology and land use that were of significance.

The significance of the effect of the following primary work activities/events on soils, geology and land use during this period was **Slight**:

- Peat slide - Material.

Peat Slide - Material

As previously assessed for the construction stage, except as follows.

A site walkover in 2019 (below Black Road Bridge) showed little/no visual evidence of any remaining peat material deposited along the banks of the streams/rivers. Over time, any material deposited along the river banks has been eroded/degraded with removal of water and re-establishment of vegetation. The river banks and bed appear to have returned to baseline conditions. The overall ongoing impact is reduced to Negligible to Very low.

Degradation (oxidisation) of peat significantly increases when exposed to aerobic conditions, such as peat slide material exposed above the water table. This results in release of stored carbon as carbon dioxide, which would have an adverse effect, which over time to the present the impact has reduced to Negligible, as exposed peat material volumes have reduced.

The overall significance of the effect of these impacts still occurring at the end of 2024 is **Slight**.

8.4.3.3.2 *Stability Impacts (Ceased Operation Phase 2022-2024)*

The significance of the effectt of the following primary work activities/events on stability during this period was slight:

- Peat slide - source area.
- Peat slide - material.
- Floating access track to location of barrage 1 and 2.

Peat Slide - Source Area

Immediately after the peat slide there would have been little change in the drainage, and the impact with regards to stability would have been Medium to High, which over time to the present the impact would be positive and reduce due to drainage and re-vegetation to Low.

The overall significance of the effect still occurring at the end of 2024 is **Slight.**

Peat Slide - Material

A site walkover in 2019 (below Black Road Bridge) showed little/no visual evidence of any remaining peat material deposited along the banks of the streams/rivers. The overall ongoing impact with regards to stability is given as Negligible to Very low.

The overall significance of the effect still occurring at the end of 2024 is **Slight.**

Construction of a Floating Access Tracks to Location of Barrage 1 and 2

As previously assessed for the construction stage, except as follows.

Over time, under the weight of the road the underlying peat consolidates and increases in strength, which significantly reduces the risk of peat instability. No failures of floating road resulting in peat slides have occurred on the project. The potential impact in terms of stability is reduced to Low to Medium.

The overall significance of the effect still occurring at the end of 2024 is **Slight.**

8.4.3.4 Peat Slide & Response Works – Likely Impacts of the Retained Development (Post-Decommissioning Phase)

This section of the report assesses likely impacts of the wind farm development after decommissioning. During decommissioning all the above ground elements of the windfarm will be dismantled or demolished and taken off site so that the following elements will be left in place:

- Barrage 1 and Coillte Access Track.
- Barrage 2 and Repository Area.
- Barrage 3 and Repository Area.
- Barrage 4.
- Repository Area at the Black Road Bridge.
- Minor repairs work to instream structures/bridges – at Black Road Bridge, Flaggy Bridge, unnamed bridge C.

8.4.3.4.1 *Direct Impacts (Retained Development – Post-Decommissioning)*

Barrages 1 to 4

Barrages 1 to 4 are constructed as rockfill berms supported on the glacial till below the peat and will be retained. Therefore, the post-decommissioning effect of the berms and the effect on land, soil & geology will be **Negligible** and **Not Significant.**

Peat Repositories at Barrages 3 and 4 and the Black Road Bridge

The peat repositories will be left in place after decommissioning. Therefore, the long-term effect of the repository sites will be permanent but the effect that they will have on the land, soils & geology will be **Negligible** and **Not Significant**.

Minor repairs work to instream structures/bridges

The repair works will remain as is after decommissioning. Therefore, the post-decommissioning effect of the repair works and the effect on land, soil & geology will be **Negligible** and **Not Significant.**

8.4.3.4.2 Stability Impacts (Retained Development – Post-Decommissioning)

Barrages 1 to 4

Barrages 1 to 4 are constructed as rockfill berms supported on the glacial till below the peat and will be retained. Therefore, the post-decommissioning effect of the berms and the effect on the stability of the underlying glacial till or rock will be **Negligible** and **Not Significant.**

Peat Repositories at Barrages 3 and 4 and the Black Road Bridge

The peat repositories will be left in place after decommissioning. Therefore, the long-term effect of the repository sites will be permanent but the effect that they will have on the stability of the peat will be **Negligible** and **Not Significant**.

8.5 Cumulative Impacts

8.5.1 Introduction

Section 2.5 in Chapter 2 of this report gives a description of the projects in the vicinity of Derrybrien Wind Farm Project that have been considered in the assessment of cumulative impacts. The locations of these projects are identified on the map in Figure 2.7. The majority were carried out remote to the site of the Derrybrien Wind Farm Project and the related activities did not have and are not likely to have cumulative impacts with significant effects on soils, geology and land within the Project area.

The following sections of the chapter assess the potential cumulative impacts of activities related to other wind farm projects in the Slieve Aughty Mountains as well as other activities within and adjacent to the Project area where there was more potential for significant effects. These include:

- Other wind farms in the Slieve Aughty Mountains:
  - Sonnagh Old Wind Farm.
- Keelderry Wind Farm.
- Adjacent coniferous forestry plantations (not part of the Project).
- Peat extraction (turf cutting) outside the Project site.
- Mechanical peat extraction in the turbary plots within and immediately adjacent to the wind farm site.

8.5.2 Cumulative Impacts from Other Wind Farm Projects in the Slieve Aughty Mountains

8.5.2.1 Sonnagh Old Wind Farm.

The Sonnagh Old Wind Farm is located in the Slieve Aughty Mountains in Sonnagh Old, approximately 3.5 km northwest of the Derrybrien Wind Farm site. It is comprised of 9 No. Vestas V52/850 turbines and associated access roads and electrical transmission infrastructure, including a 38 kV overhead grid connection to the 38 kV Loughrea substation at Caherlavin. The turbines on Sonnagh Old are the same as those that were erected on the Derrybrien Wind Farm.

Construction of the Sonnagh Old Wind Farm coincided with the initial phase of construction on the Derrybrien Wind Farm in 2003, but it was commissioned in 2004, approximately two years before Derrybrien Wind Farm.

The characteristics of the soils, geology and land on the site of the Sonnagh Old Wind Farm are very similar to those in the Project are for the Derrybrien Wind Farm. Figure 8-46 shows the location of the Sonnagh Old Wind Farm on the Ordnance Survey of Ireland (OSI) 1:50,000 Discovery Series topographical map with the quaternary geology map from the Geological Survey of Ireland (GSI) superimposed. The wind farm was constructed within a coniferous forest plantation at an elevation of 290 to 320 mOD on the northern slopes of Sonnagh Old mountain. The GSI quaternary geology map indicates that the ground conditions on the site were comprised of upland blanket bog over Devonian Sandstone till. There are numerous rock outcrops in the vicinity of the site. The 1:100,000 geological map for the area from the GSI (Figure 8-15) indicates that bedrock in the area is comprised of Mudstone, Siltstone and Conglomerate of the Ayle River Formation. The site is outside the limits of the Sonnagh Bog SAC.

The site activities during construction on the Sonnagh Old Wind Farm would be broadly similar to those on the Derrybrien Wind Farm site, depending on the design for the site access tracks (i.e. whether they were constructed as floating roads on the peat or as rockfill embankments on the glacial till below the peat by excavate/replace). Therefore, the corresponding impacts on the receiving soils, geology and land would be similar in nature, albeit on a much smaller scale at Sonnagh Old due to the significantly lower number of turbines. However, the impact of the reasonably anticipated site activities at Sonnagh Old **would not have given rise to cumulative direct or stability impacts on the receiving soils, geology and land in the Derrybrien Wind Farm project area** because Sonnagh Old Wind Farm is a separate project with an independent grid connection and it is located on a different mountain in the Slieve Aughty Mountains, and is topographically remote and in a different river sub-catchment to the Derrybrien Wind Farm, as shown in Figure 8-47.

Figure 8-46 also shows the location of a peat slide that occurred at Sonnagh Old during the construction of the wind farm in 2003, prior to the large peat slide that occurred at the Derrybrien Wind Farm on the 16th October 2003. The cause of the slide at Sonnagh Old has not been reported in literature on the subject. However, Lyndsay and Bragg (2005) state that it appears to have originated along an access road on the wind farm site and that at involved 15,000 m^3 of peat.

An aerial photograph of the site from 2005 showing the location and extent of the slide is presented in Figure 8-48 along with a geomorphological map of the slide area produced by Dykes (2009). Based on this information it appears that the slide initiated in an area of peat on shallow slopes of 2.5-4.0° along the upslope edge of a steep scarp of 3-4 m high cliffs. Peat was displaced to the north over an area of about 0.50 to 0.75 ha from the upper slope and deposited over an area of about 1.25-1.50 ha on the shallow slopes of 3.5° downslope from the escarpment. Material from the slide appears to have reached the channel for the stream flowing from Lough Belsrah, approximately 450 m downslope. The stream is within a sub-catchment of the Kilchreest River to the north of Sonnagh Old.

The peat slide at Sonnagh Old was more localised and significantly smaller than the slide that occurred at the Derrybrien Wind Farm, which displaced approximately 450,000 m^3 of peat over an area of about 25 ha. Based on the criteria presented in Section 8.3.3.4, the sensitivity of the degraded blanket bog in the coniferous forest impacted by the peat slide at Sonnagh Old would be classified as **Medium**, and the effect of the slide on the receiving soils, geology and land in the area would also be classified as **Medium**, which is of **Moderate Significance**. However, **this does not give rise to a cumulative impact on soils, geology and land for the Derrybrien Wind Farm Project area because the slide at Sonnagh Old occurred in a different river sub-catchment to the large peat slide that occurred on the south side of the Derrybrien Wind Farm.**

8.5.2.2 Keelderry Wind Farm

The site for the Keelderry Wind Farm is located on the Slieve Aughty Mountains approximately 3.0 km west of the Derrybrien Wind Farm. Planning permission was granted to a developer in July 2002 for a 48 x 1 MW wind farm and associated works on the site. The site access roads were constructed

c. 2007. However, the rest of the project was never completed and a subsequent application for the site was refused.

Figure 8-49 shows the location of the Keelderry Wind Farm on the Ordnance Survey of Ireland (OSI) 1:50,000 Discovery Series topographical map with the quaternary geology map from the Geological Survey of Ireland (GSI) superimposed. Figure 8-50 shows a recent aerial photograph of the site from 2023.

The wind farm site is located at an elevation of 240 to 290 mOD at the west end of Cashlaundrumlahan Mountain. The GSI quaternary geology map indicates that the ground conditions on the site are comprised of upland blanket bog over Devonian Sandstone till. There are numerous rock outcrops in the vicinity of the site. The 1:100,000 geological map for the area from the GSI (Figure 8-15) indicates that the bedrock is comprised of Mudstone, Siltstone and Conglomerate of the Ayle River Formation.

The east side of the site is partially covered in coniferous forest plantations and there are turbary plots and areas of cutaway bog on the west side of the site. The aerial photo in Figure 8-50 shows the extent of access roads that have been constructed on the site. The main track along the west side of the site is an access road for the turbary plots that existed prior to 2007. Dirney's Lough is at the centre of the site.

On this site the site activities were limited to the construction of the site access tracks across the blanket bog – either as floating roads or as embankments of rockfill on the underlying glacial till. No peat slides occurred during the construction of the access tracks.

Although the wind farm site is located within the same river sub-catchment as the Derrybrien Wind Farm, the Keelderry Wind Farm was never and the site is at lower elevation and topographically remote to the Derrybrien site. **Therefore, the impact of the site activities at Keelderry would not have given rise to significant cumulative direct or stability impacts on the receiving soils, geology and land in the Derrybrien Wind Farm Project area.cumulative direct or stability impacts on the receiving soils, geology and land in the Derrybrien Wind Farm Project area.**

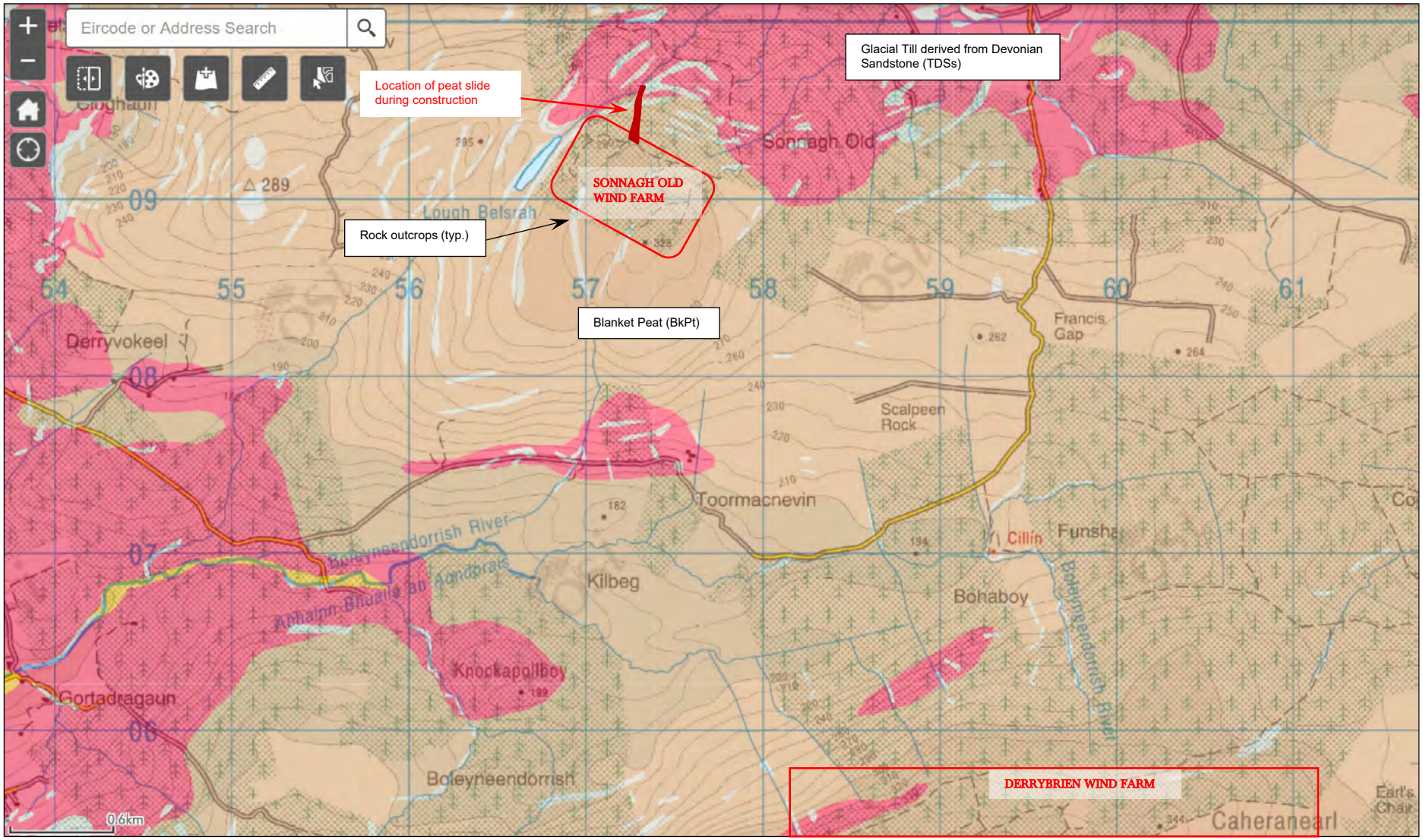


Figure 8-46: Sonnagh Old Wind Farm – Location, Topography and Quaternary Geology (GSI Online Portal, 2020)

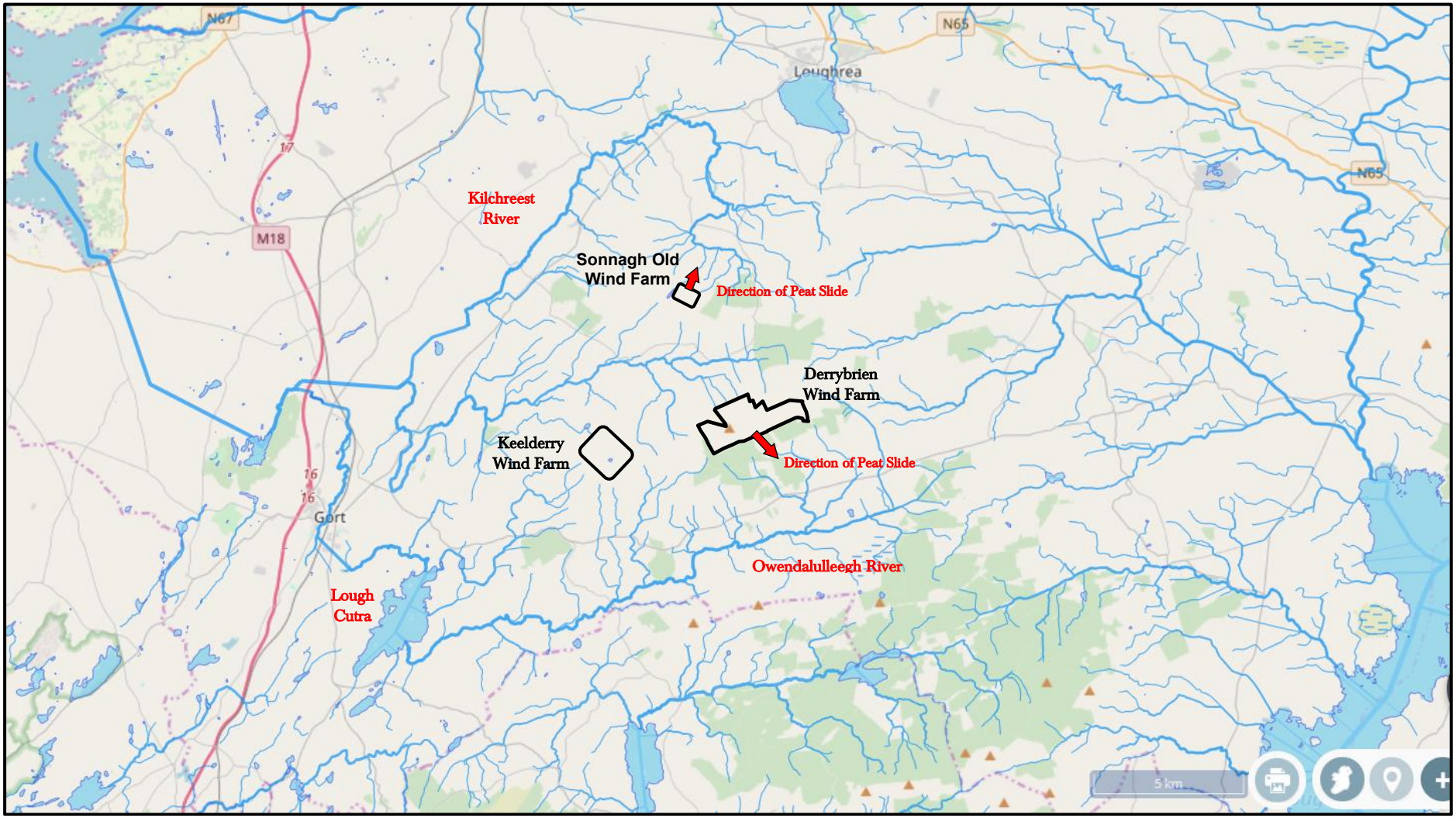


Figure 8-47: Regional hydrology for other wind farms in the Slieve Aughty Mountains

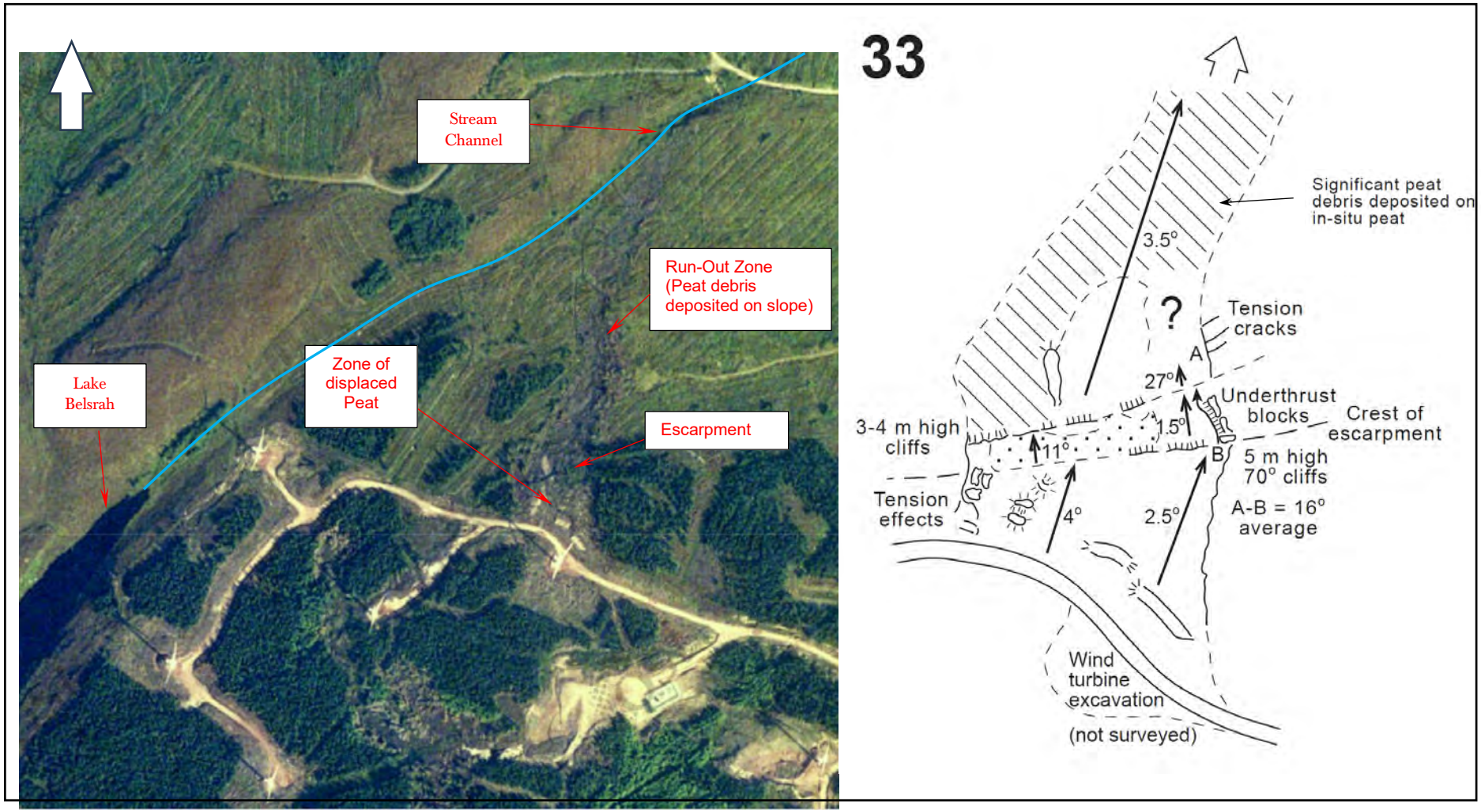


Figure 8-48: Characteristics of peat slide at Sonnagh Old Wind Farm (2005 Aerial Photo (OSI - Geohive Online Portal, 2020) & Geomorphological Map of Slide Area (Dykes, 2009)

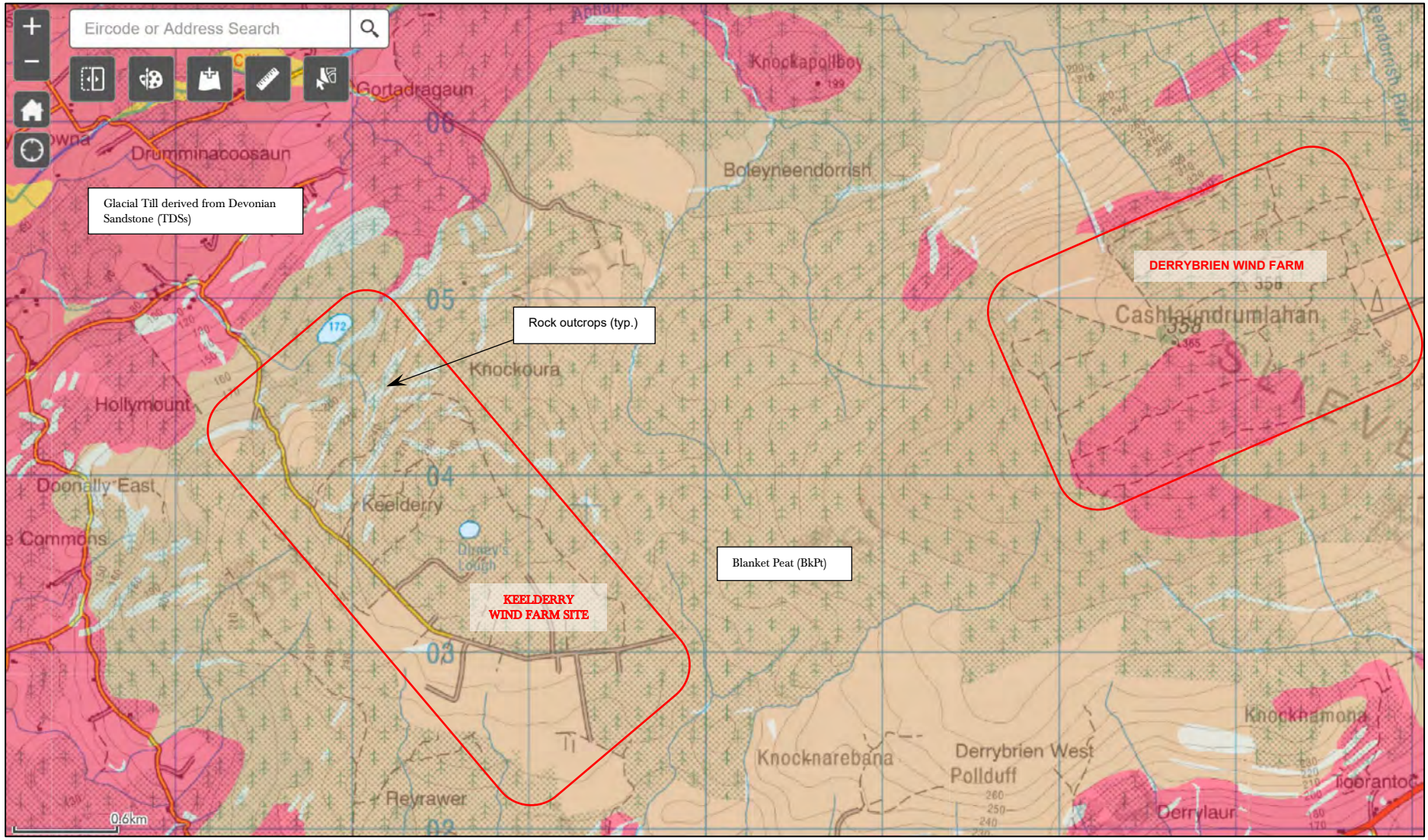


Figure 8-49: Keelderry Wind Farm – Location, Topography and Quaternary Geology (GSI Online Portal, 2020)

Figure 8-50: Keelderry Wind Farm – Recent Aerial Photograph [c 2015] (OSI Geohive Online Portal, 2020)

8.5.3 Cumulative Impacts from Adjacent Coniferous Forestry Plantations (Not Part of Project)

The impact of tree felling that was required as part of the project on soils, geology and land has been addressed in Section 8.4.1.1. This section assess the potential cumulative impact of forestry operations on adjacent lands in the Project area.

The majority of these are owned and operated by Coillte. According to their records forestry represents over 50% of land use within the river sub-catchment areas within which the wind farm site is located.

The forests in the area were mainly planted in the 1960s and 1970s. Therefore, most of the drainage, access tracks and site infrastructure required for the planting and management of the forests was in place prior to the construction of the Derrybrien Wind Farm. The extent of forestry has not changed significantly since the wind farm was constructed. However, due to its age profile, much of the forestry has recently required felling and replanting as part of the normal life-cycle of such commercial operations. For example, between 2016 and 2018 a total of 275 ha of forestry was earmarked for felling on Coillte land within the catchments within which Derrybrien Wind Farm is located, although the actual date of felling is no known. It is likely that felling and replanting of the forests in the project area will continue over the remaining operational life of the wind farm.

Figure 8-51 shows the forestry in the project area plotted on the Ordnance Survey of Ireland (OSI) 1:50,000 Discovery Series topographical map with the quaternary geology map from the Geological Survey of Ireland (GSI) superimposed. This indicates that the many of the forests around Derrybrien Wind Farm are located on the upland blanket bog. On the lower slopes to the west and east the blanket bog is absent and some of the forests are on the glacial till subsoil.

Coillte have extensive experience with management, felling and planting of conifer trees in these conditions. Assuming that the work will be carried out by experienced contractors using standard harvesting equipment and forwarders, as on the Derrybrien Wind Farm, then the direct impact that this will have on the degraded blanket bog will be **Very Low**, which is of **Slight Significance**. The effect of the live load surcharge from the forestry equipment and temporary timber stockpiles on the stability of the peat should be **Medium to Low**, which is also of **Slight Significance**, as discussed in Section 8.4.1.1.2.

All of the drainage, tree felling and planting on adjacent forestry plantations has been and will be carried out outside the site of the Derrybrien Wind Farm and downslope or topographically remote from the site (i.e. in different river sub-catchments, or on different slopes within the same river sub-catchment). Furthermore, all of the forestry along the Grid Connection route, at the site of the Agannygal substation and in the areas of the Peat Slide and Response Works were cleared for the project during construction. Therefore, the impact of the site activities for the forestry on the adjacent plantations will not give rise to significant cumulative direct or stability impacts on the receiving soils, geology and land in the Project area.

The impact of temporary stockpiling of felled trees on the Derrybrien Wind Farm site from adjacent plantations prior to removal by Coillte has been assessed in Section 8.4.1.2.2. When forestry equipment accesses the stockpiles or adjacent plantations using the site access tracks on the Derrybrien Wind Farm site they would be infrequent and they would have a live load surcharge less than the design load for the floating roads. Therefore, the effect that this would have on the stability of the peat would be low and would not lead to a significant cumulative stability impact on the wind farm site.

8.5.4 Cumulative Impacts from Peat Extraction or Turf Cutting outside the Project Area

Figure 4-5 in Chapter 4 shows the extent of habitat identified as "cutover bog" by the National Parks and Wildlife Service (NPWS) Hen Harrier mapping project for the Slieve Aughty Mountains SPA. As discussed in Section 4.4.2.1, this category identifies areas where part of the original mass of peat has been removed through turf cutting or other forms of peat extraction. No peat extraction activities subject to a development consent have been identified in the vicinity of the Project. Therefore, the extent of cutover bog identified by the NPWS has been used as an indication of the extent of turbary turf cutting in the Project area.

Turf cutting has likely been carried out and will continue to be carried out in many of these areas under turbary rights. This typically involves small scale seasonal peat extraction or turf cutting by individuals for personal use as fuel. It does not involve large scale intensive commercial mechanical peat harvesting. Historically turbary turf cutting in turbary plots has been carried out by hand using traditional peat spades or slanes. More recently, in some areas, where possible, the peat has been extracted by mechanical means using saw cutting machines, hydraulic excavators and hoppers to excavate the peat and extrude it into peat sods. Where turf cutting has been carried out on blanket bog a network of drains has normally been developed along the boundaries between turbary plots to drain and dry out the peat. It is likely that most of the areas of cutover bog identified on Figure 4-5 in Chapter 4 were existing prior to the construction of the Derrybrien Wind Farm.

The cumulative impact of the turbary turf cutting on the Derrybrien Wind Farm site is assessed in Section 8.5.5. With the exception of the turbary plots just outside the site boundary at the east end of the wind farm, (which are also addressed in Section 8.5.5), all of the areas of cutover bog outside the site that are shown on Figure 4-5 in Chapter 4 are remote to the site and separated from it by conifer plantations. Therefore, the site activities related to the turf cutting outside the project area will not give rise to significant cumulative direct or stability impacts on the receiving soils, geology and land in the Project area.

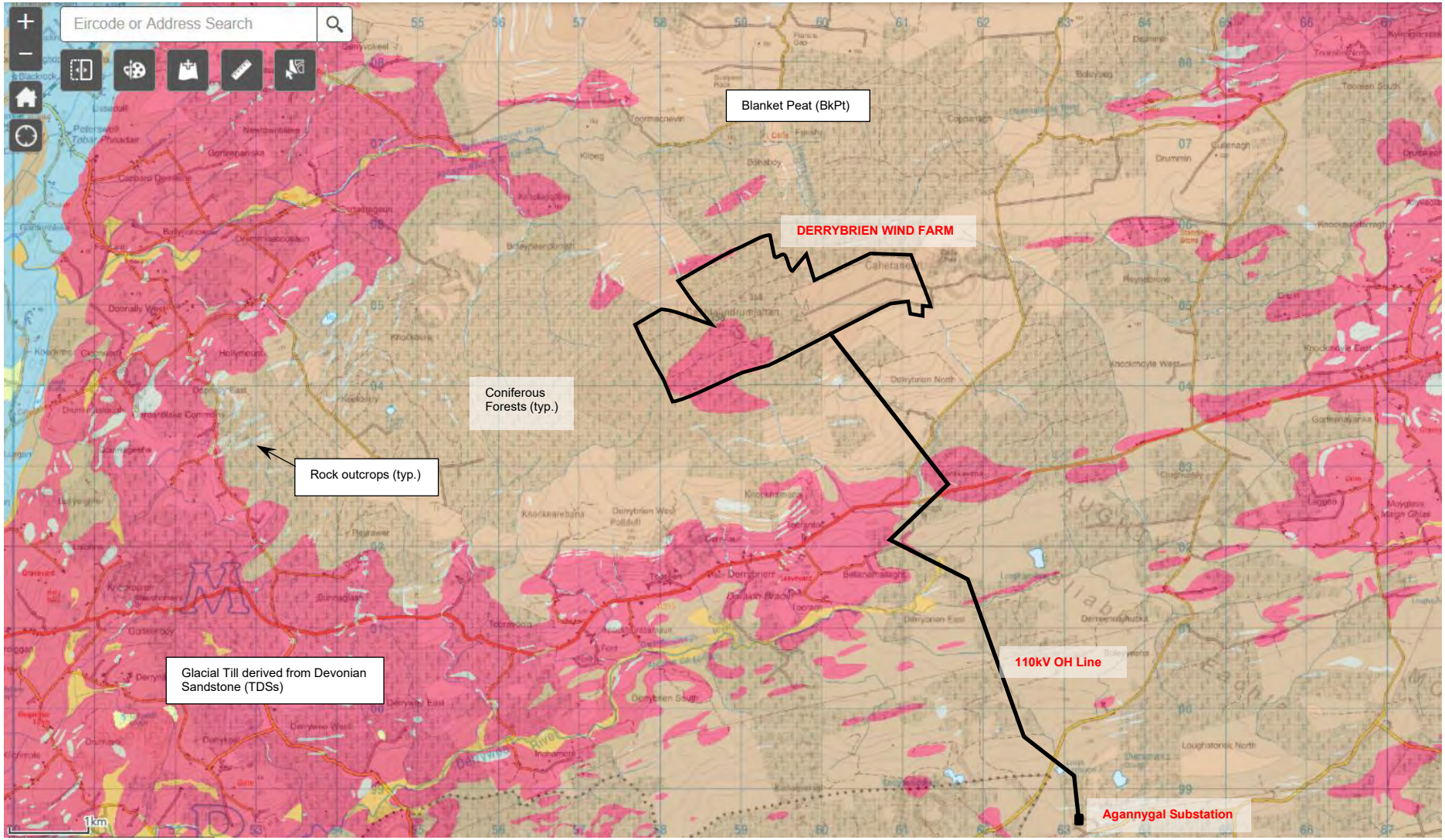


Figure 8-51 - Quaternary Geology for the Coniferous Forest Plantations in the Project Area (GSI Online Portal, 2020)

8.5.5 Cumulative Impacts from Mechanical Peat Harvesting in Turbary Plots Within and Immediately Adjacent to the Wind Farm Site

8.5.5.1 Baseline Conditions

Figure 8-52 shows the extent and layout of the turbary plots at the east end of the wind farm. There are a total of 136 No. plots. 114 of these are within the wind farm site boundary. The remaining 22 No. (#41-45, #178-180, #219-221, #223A, #223B, #224-232) are just outside the site at the east end of the wind farm.

26 No. of the plots (#182-207) have been used by Coillte for commercial forestry. The majority of the conifer trees that had been planted in this area were felled in 2004/2005, during construction of the wind farm, and were not subsequently re-planted. Some small trees have re-grown naturally in the area since construction was completed. However, the turbary plots have not and will not be used for peat harvesting up to or during decommissioning of the wind farm.

The remaining turbary plots in this area have been used for low-volume seasonal peat harvesting (turf cutting) for individual use as fuel. There has been no high-volume intensive commercial mechanical peat harvesting in the area.

The baseline conditions on the wind farm site, which includes the turbary area, are summarised in Section 8.3.1. Prior to construction of the wind farm, peat had been historically harvested from a significant number of the turbary plots. An extensive network of drains had been developed along the north-south boundaries between the turbary plots, and east-west collector drains had been constructed to link these to the main watercourses at this end of the wind farm site. The network of pre-existing drains in the turbary area is shown on Figure 8-16 along with those that were constructed for the wind farm. The existing access tracks on the site are identified on the aerial photograph from 2020 in Figure 8-4.

The majority of these are floating roads on the peat. The narrow track along the centre of the turbary area between plots 141 and 180 was in place prior to the construction of the windfarm along with a short spur down to plots 232 and 223A in the southeast corner of the turbary area. These tracks were partially upgraded with additional capping and geogrid reinforcement during the construction of the wind farm in 2004/2005.

As described in Section 8.3.3.4, based on the relatively Low ecological importance of the degraded blanket bog in the turbary areas the sensitivity of the receiving environment for the assessment of direct and stability impacts related to the mechanical peat harvesting could be characterised as **Medium to Low**. However, when combined with the additional environmental value of the peat as a carbon store and the relatively low commercial value of the land, this is sufficient to raise the combined level of sensitivity of the peat to **Medium**. This would also apply to land that could potentially be impacted by a peat slide in this area.

8.5.5.2 Turbary Activities – Peat Harvesting

There are no complete comprehensive records of the peat harvesting that has been carried out in this area. However, based on consultations with the wind farm manager for Gort Windfarms Ltd., a local peat harvesting contractor and some of the turbary plot holders it is understood that:

- Up until 2012 the extent of peat harvesting out mechanically in the area is not known. However, the level of peat harvesting was low and turf cutting was carried out by hand on a number of plots, normally in late Spring/early Summer.
- Since 2012 a local peat harvesting contractor has been retained by some of the plot owners to mechanically cut turf so there has been an increase in the number of plots where mechanical peat harvesting has been carried out. The contractor has worked in 34 No. of the turbary plots as follows: 6, 7, 9, 10, 15, 24, 27-29, 31-35, 39, 40, 42-44, 142, 143, 155, 159-162, 219-221, 228-232. These are identified on the aerial photograph in Figure 8-53. Figure 8-54 identifies typical evidence of recent peat harvesting that was evident in April 2020.
- The mechanical peat harvesting was carried out by the contractor with a wide track low ground bearing pressure hydraulic excavator and a Difco Bogmiser hopper, which is shown in Plate 8-8. It is a specialised track-mounted self-propelled diesel-powered machine that has a rear-mounted hopper and auger system to hold, compress, extrude and cut the peat into sods of turf. The peat below the vegetated surface layer is first loaded into the hopper by a hydraulic excavator that excavates the peat from the active bank or trench excavation. When fully loaded, the hopper is then driven away from the excavation area and the peat is extruded in 8 No. continuous rows of turf sods 100mm x 90mm in cross-sectional area over an 80m long strip on the surface of the peat in the turbary plot to allow it to dry. Subsequent loads are laid out in parallel strips across the turbary area. They are left to air-dry over a number of weeks before being bagged and collected for transport off site.
- When the hopper is fully loaded with peat it weighs on the order of 32 tonnes (≈315 kN). The hopper is fitted with low ground bearing pressure wide-tracks to spread the load out on the surface of the peat. Each track is 1.5m wide x 6.0m long so that, when the hopper is fully-loaded the bearing pressure under the tracks is on the order of 17.5 kN/m^2. This is equivalent to the surcharge load from approximately a 1.75m thick layer of intact peat over the same area.
- The mechanical peat harevsting is typically only carried out once in each turbary plot each year, in late Spring/early Summer. The volume of peat that is extracted in each area is on the order of 50-75m^3, which is equivalent to 8-10 hopper loads. Each hopper load creates a single row of 8No. 80 m long strips of peat sods along the length of the turbary plot and spaced evenly out across the width of the plot.
- Peat is not harvested from all of the turbary plots each year. However, if all 34 No. of the plots operated by the peat harvesting contractor were active each year, then this could involve the exctraction of up to about 2,500m^3 of peat.
- Mechanical peat harvesting has been carried out by saw cutting in 1 No. turbary plot between plots 20 and 30. The aerial photographs would indicate that this could have been in Plot #21 (Figure 8-54). Plate 8-9 shows a typical saw cutting device for mechanical peat harvesting. It is a specialised attachment that fits to the back of a tractor that resembles a large chainsaw. It cuts a narrow slot up to about 1.2m deep into the peat. Similar to the hopper, an auger system then compresses and extrudes the excavated peat directly into continuous rows of turf sods on the surface of the peat adjacent to the saw cut line. Again, the sods are left to air-dry over a number of weeks before being bagged and collected for transport off site. The saw cutting is normally carried out along closely-spaced parallel rows. The aerial photograph in Figure 8-54 indicates that these could be aligned north-south along the long axis of the turbary plot #21. Saw cutting is sometimes also carried out along perpendicular lines. However, this is not reflected in the marks on the peat and the narrow plot would make saw cutting less efficient across the width of the plot.
- Traditionally peat harvesting would have been carried out in the turbary plots by hand using a specialised turf spade called a slane. Manual turf cutting is still carried out in a small number of turbary plots in the area, albeit on a very limited scale.

- Some minor drainage works have also been carried out in the area to clear out the main east-west drainage ditch on the south side of the central turbary road, and, recently, to improve drainage to some of the plots that have become recently active for machine cutting (see Figure 8-54).

Plate 8-8 – Difco Bogmiser Peat Hopper extruding rows of peat sods

Plate 8-9 – Typical saw cutting attachment for mechanical peat harvesting

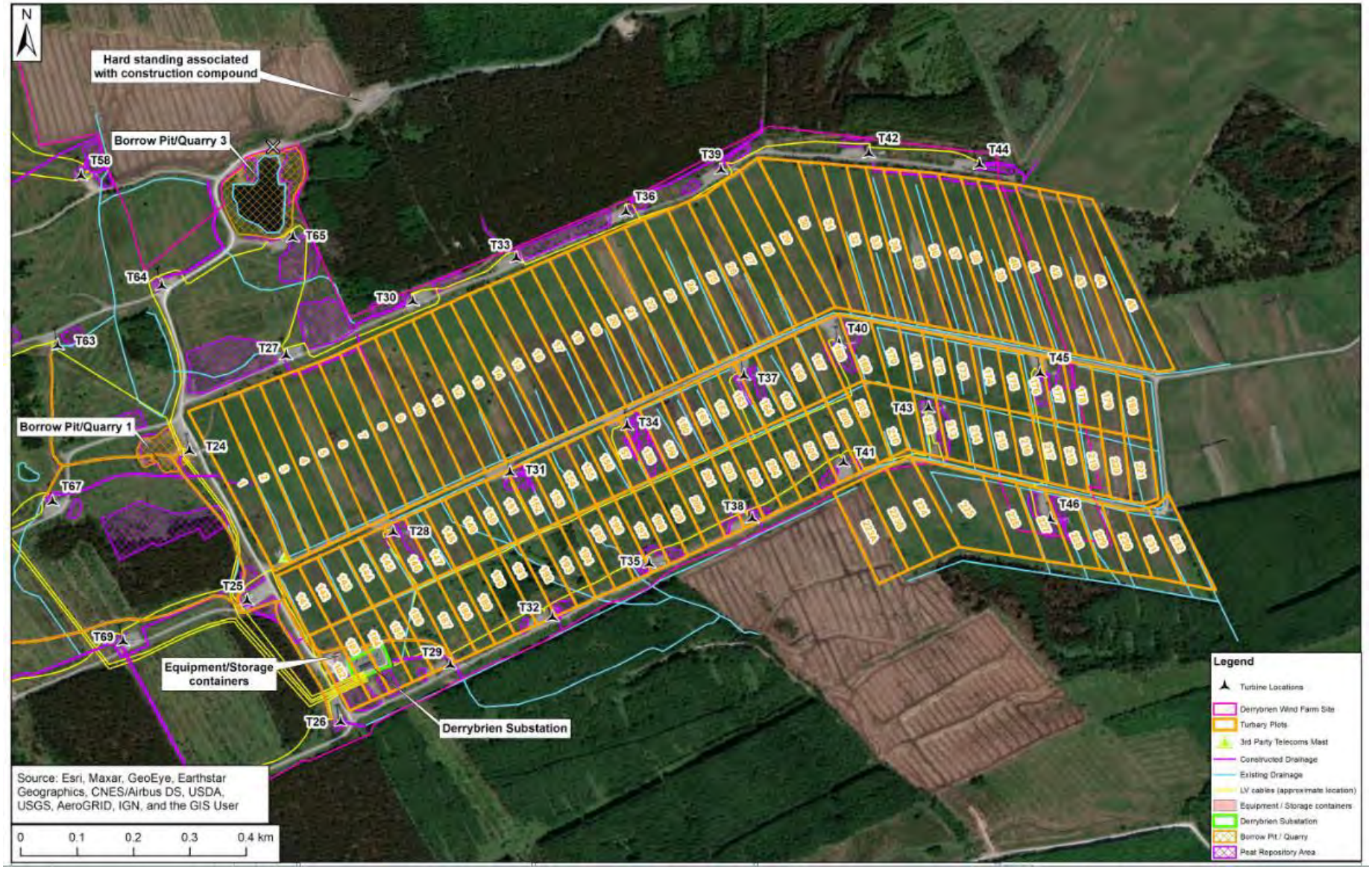


Figure 8-52 - Turbary plots at east end of wind farm site (ESBI Drawing No. QS-000280-01-0460-011-020-000)

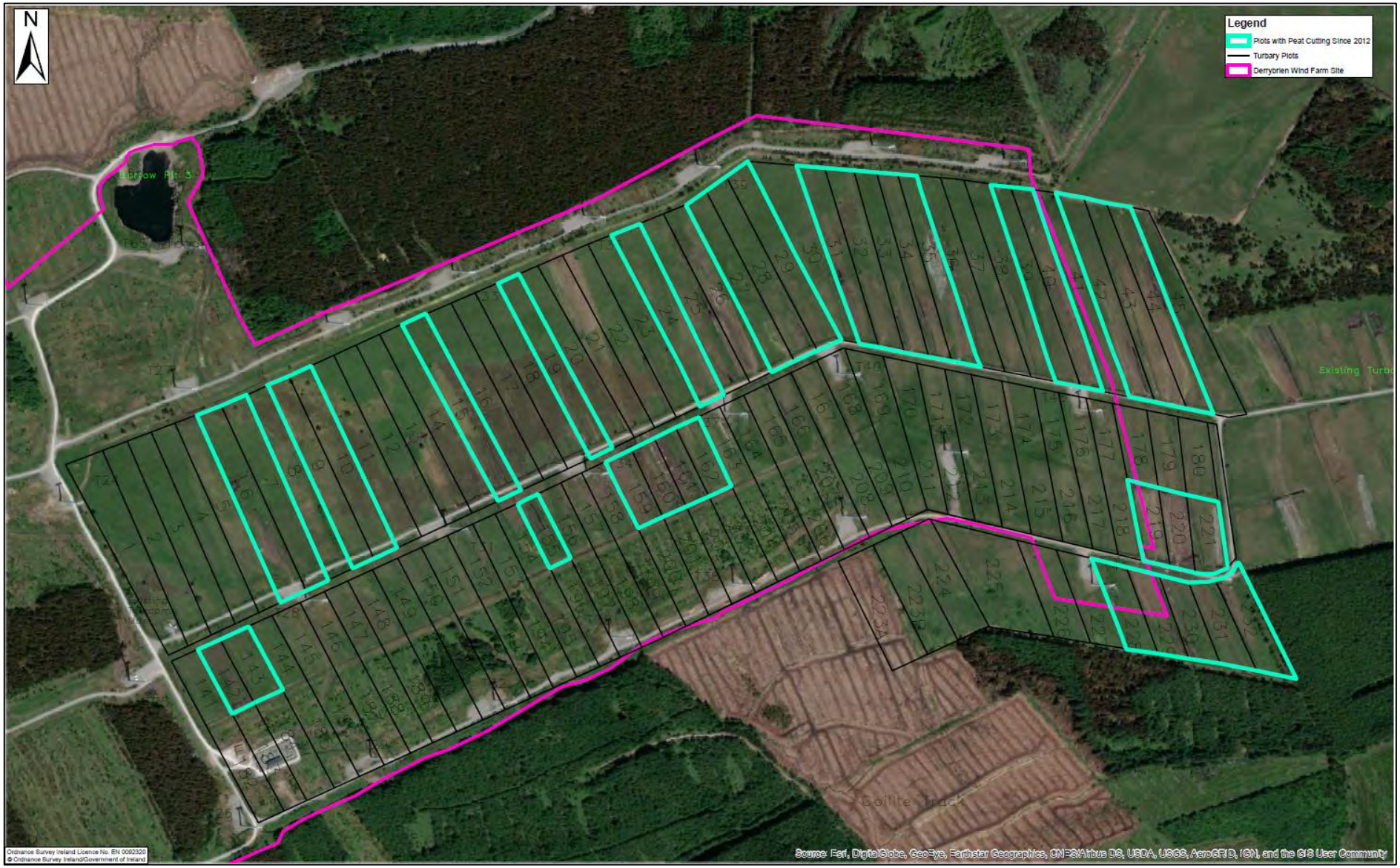


Figure 8-53 - Turbary plots where mechanical peat harvesting has been carried out by a local contractor since 2012

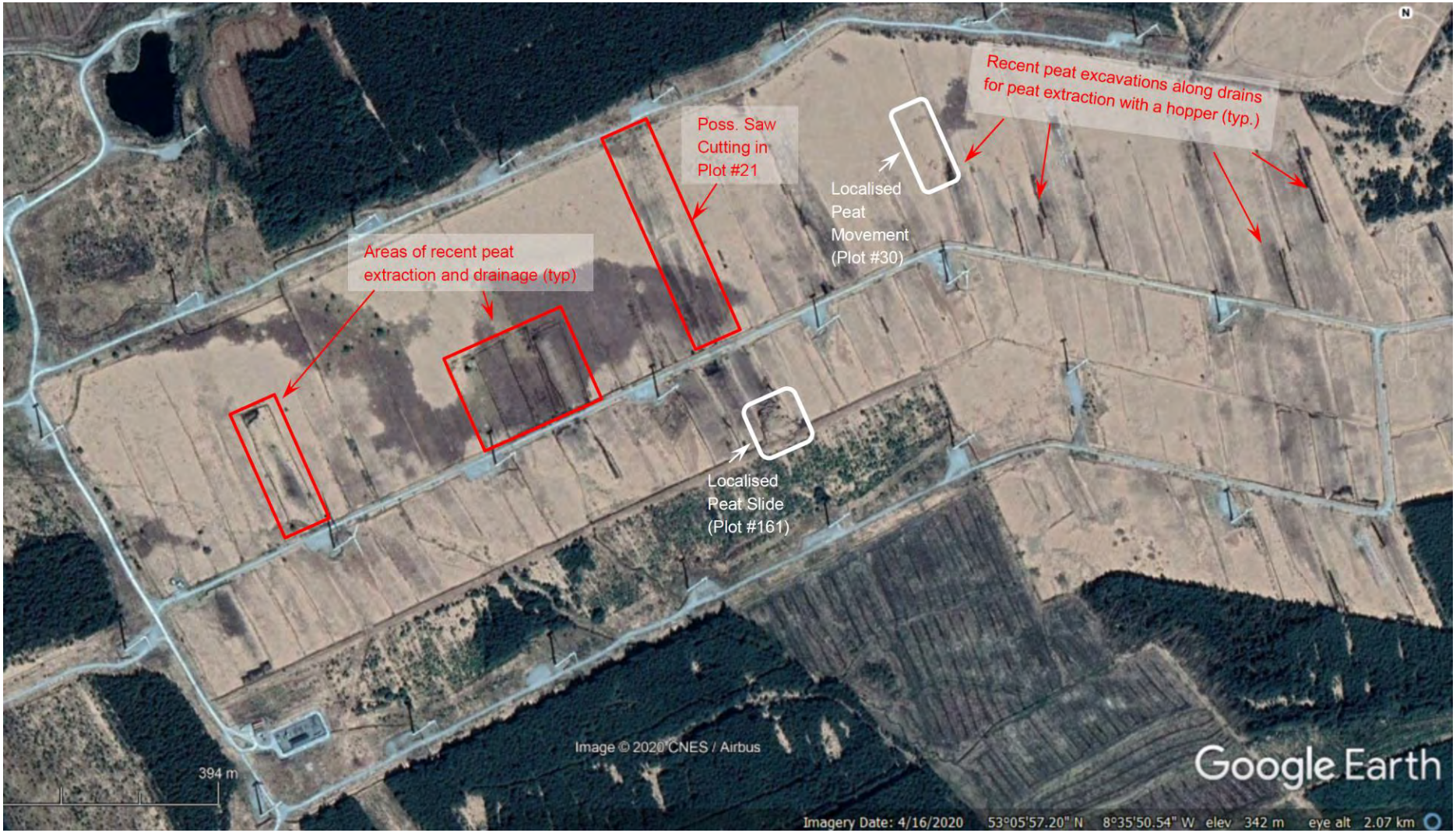


Figure 8-54 – 2020 Aerial photo of turbary plots illustrating recent mechanical peat harvesting activity & areas of local peat instability

8.5.5.3 Cumulative Direct Impacts of Mechanical Peat Harvesting from the Turbary Plots

The direct impacts of site activities related to mechanical peat harvesting from the turbary plots on the receiving soils, geology and land on the wind farm site are:

- The damage to the peat habitat from the peat excavation and from the machinery tracking over the surface of the bog.
- Groundwater lowering due to drainage.

Although these activities are not related to the wind farm project, they have been carried out within and immediately adjacent to the wind farm site and could be carried out during decommissioning of the wind farm. Therefore, the cumulative impact on soils, geology and land in the project area has been assessed.

The turbary plots, drainage network and turbary access roads were pre-existing on the site prior to the construction of the wind farm. Therefore, as described in Section 8.3.3.4, the baseline sensitivity of the degraded blanket bog habitat in the area is **Medium**.

Tracking across the surface of the peat damages the surface vegetation. The peat that is excavated from the site is used for fuel so there is a corresponding loss in stored carbon as CO_2. However, the volume of annual mechanical peat harvesting is low, probably less than 2,500m^3 per annum. Therefore, the effect that this has on the peat is **Low** and only **Slightly Significant.**

As described in Section 8.4.1.4, the decommissioning work for the wind farm will be limited to removing the above ground elements of the wind farm. There will be no excavations required other than trimming of peat banks, where necessary, along the edges of the existing floating roads where localised widening works are required, which will not have any significant impact on the peat. Therefore, if mechanical peat harvesting is carried out during decommissioning the cumulative effect on the peat will be **Low** and only **Slightly Significant** due to the low volumes of peat involved.

The electronic piezometers that were installed in the turbary plot downslope from Turbine T34 during construction of the wind farm indicate that the average groundwater level recorded in the peat was gradually lowered by about 0.75m over the monitoring period between December 2005 and November 2011, before monitoring was discontinued.

Long term drawdown of the groundwater table will have increased rate of decomposition of the peat in the partially saturated aerobic conditions above the water table. The effect that this has on the peat relative to the pre-existing condition prior to the construction of the windfarm is **Low**, which is **Slightly Significant**.

The impact is **long-term** and **sustained**. However, only minor improvements were carried out to the drainage networks for the turbary areas during this period. Therefore, it is considered that the groundwater lowering was largely due to the improved drainage for the wind farm - combined with the network of pre-existing drains in the turbary area.

No further drainage improvements are anticipated in the turbary area to facilitate peat extraction during the decommissioning of the wind farm. Therefore, there will be no significant cumulative effects on the peat as a result of groundwater lowering due to drainage.

8.5.5.4 Baseline Peat Stability Risk Assessment for Mechanical Peat Harvesting in the Turbary Area and Interpreted Likelihood of a Peat Slide prior to Mitigation

A baseline peat stability risk assessment (PSRA) has been carried out for mechanical peat harvesting in the turbary plots to assess the likelihood of a peat slide in each plot ***prior to mitigation*** based on site characteristics related to the peat/subsoil conditions, topography, hydrology, infinite slope factor of safety calculations, and other factors that are known contributory factors for peat instability including the methods of mechanical peat harvesting that have been carried out on the site since 2012, and evidence of pre-existing peat instability in the area.

The136 No. turbary plots on the site are numbered as follows, as shown on Figure 8-55:

- 1-45
- 144-180
- 182-221
- 223A, 223B and 224-232

Plots 1-45 are relatively long and almost double the size of the other turbary plots on the site. Therefore, for this assessment they have been split up into two zones (north and south) that are of comparable area to the other turbary plots, as shown on Figure 8-55.

The results of the PSRA are presented in AGL Report No. 11-147-R06 - "Peat Stability Risk Assessment (PSRA) for Turbary Plots at East End of Wind Farm Site", which is included in Appendix 8-4 of this chapter.

The PSRA has been carried out in accordance with the methodology described in Section 8.2.1. However, to get better definition of where there is a higher risk of peat instability in the turbary areas, additional intermediate categories of Likelihood (L) have been added at L=3.5 and L=4.5 based on the interpreted hazard rating for the site characteristics as shown on Table 8-18.

Table 8-18 - Total Hazard Rating and Likelihood (L) of a Peat Slide for Turbary Plots on Derrybrien Wind Farm site

Total Hazard Rating	Likelihood (L)		Probability of Occurrence (Event/km.yr)
0	0.0	Not Applicable (<0.5 m Peat)	<1/100,000
0-19	1.0	Negligible	1/100,000 to 1/10,000
20-39	2.0	Low	1/10,000 to 1/1,000
40-59	3.0	Possible	1/1,000 to 1/500
60-69 [Added]	3.5	Possible to Very Possible	1/500 to 1/100
70-79	4.0	Very Possible	1/100 to 1/50
80-89 [Added]	4.5	Very Possible to Likely	1/50 to 1/10
90-100	5.0	Likely	>1/10

The results of the baseline PSRA for the site activities related to mechanical peat harvesting and turf cutting in the turbary areas on and adjacent to the wind farm site *prior to implementing appropriate mitigation measures* are shown on Figure 8-55.

This is representative of the baseline site characteristics within the turbary plots for the methods of mechanical peat harvesting that have recently been carried out on the site, particularly since 2012. It has been assumed that the activities have not been restricted to the turbary plots where mechanical peat harvesting has been undertaken previously. Consideration has also been given to the areas where saw cutting is likely to have been carried out based on the available information.

The results show that there are significant areas of the turbary plots where the likelihood of a peat failure **without appropriate mitigation measures** could be Very Possible to Likely (L=4.0 to 5.0). These zones are in areas where there are compounding risk factors in relation to peat instability, including, for example:

- The zone of deep weak peat (3-6m deep) along the subsurface drainage channel between Turbines T27 and T35 where there is a convex break in slope at the head of the watercourse that flows off site to the south of T35 (Plots #7-13, #148-154; #191-195).
- The zone of deep weak peat upslope from the central turbary road between T28 and T37 where there are indications of subsurface seepage in the peat to the convex breaking slope downslope from the road (Plots #14-22).
- The plots on the convex breaking slope downslope from the central turbary road in the zone of deep peat between Turbines T28 and T37, where there are indications of subsurface seepage in the peat (Plots #155-164, #197-204) and low Factors of Safety (FoS) for slope stability.
- Along the watercourse channel in the peat at the west end of the turbary areas between Turbines T24 and T29 (Plots #1-5, #147 & #191).
- The area of relatively deep peat (2-3m) with the convex breaking slope at the southeast corner of the wind farm (Plots #219-221 & #229-232).
- Various plots at the east end of the site where there is locally a convex breaking slope in relatively deep peat (2-4m) and locally low FoS for slope stability (e.g. Plots #30-36, between #168 & 176, and #213-214).

In the remaining turbary plots across the site the Likelihood of a peat slide, prior to mitigation measures would be characterised as Possible to Very Possible (L=3.5). These are in areas where there are mitigating conditions that reduce the baseline risk of peat instability. For example:

- Areas of shallow (<1.0 m) or relatively shallow (1-2 m) peat.
- Areas of gently sloping ground (<3˚) set well back from any convex break in slope where the slope angles increases to >5˚.
- Areas of relatively high infinite slope Factor of Safety (FoS >1.5).
- Zones where there is well-developed drainage, and which are not directly upslope from the rivers and streams outside the wind farm site.

The risk of a peat failure in the turbary plots could range from localised shear failure of an unsupported peat face in an open excavation or small-scale peat slide confined within a turbary plot, to the worst-case scenario of a large or very large-scale peat slide along existing drainage channels similar to the slide that occurred at the site in October 2003, during the construction of the wind farm.

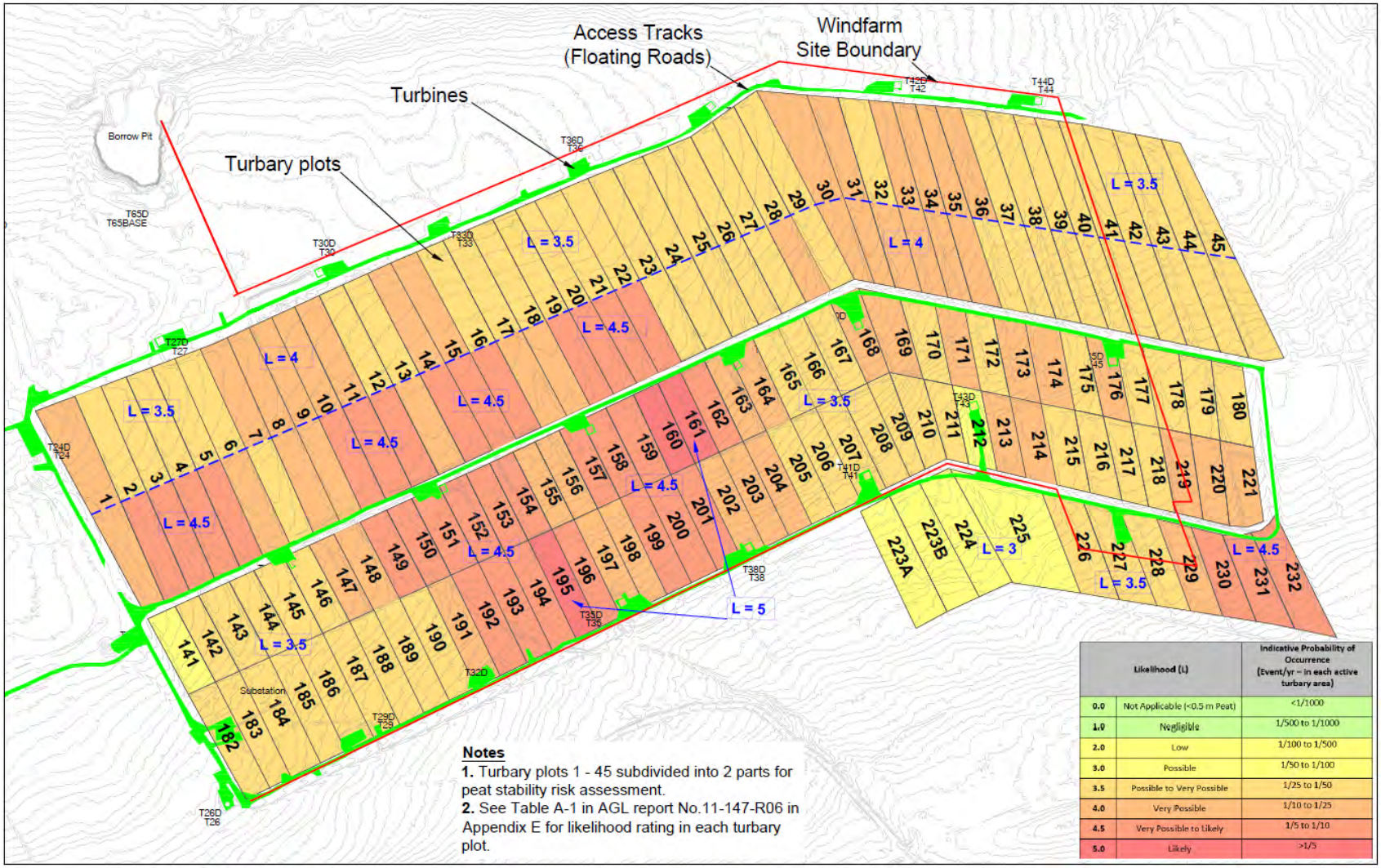


Figure 8-55 – Likelihood of a peat failure due to mechanical peat harvesting in the turbary plots prior to mitigation

8.5.5.5 Mechanical Peat Harvesting in Turbary Plots On the Wind Farm Site – Assessment of Stability Impacts Prior to Mitigation

The impacts of site activities related to mechanical peat harvesting in the turbary plots that can have an effect on the stability of the peat are:

- The live load surcharge from the mechanical peat harvesting equipment operating directly on the surface of the peat.
- Damage to the integrity of the peat mass from mechanical excavation or saw cutting.
- Removal of support to peat faces by bulk excavation for mechanical peat harvesting, or along drainage trenches.

The primary *effect* of the live load surcharge is the increase in shear stress in the underlying peat, which increases the risk of a peat failure, potentially triggering a peat slide on sloping ground where the magnitude of loading is such that the downslope shear stresses exceed the strength of the peat.

Saw cutting and mechanical excavation can also effect the integrity and stability of the peat by creating lines of weakness where vegetative fibres in the upper fibrous acrotelm layer are severed along saw cut lines, open drains or trench excavations, or by increasing the shear stresses in peat directly adjacent to or upslope from an unsupported open excavation, particularly where the slope has been undermined along an exposed peat bank at the downslope end of a turbary plot.

Saw cutting and mechanical excavation can also disrupt the existing pattern of surface water drainage in the turbary area, allowing water to infiltrate down into the lower peat layers which can lead to an increase in water content, swelling and reduction in shear strength.

As discussed in Section 8.4.1.1.2, drainage on the site has had and will continue to have a long-term sustained positive impact on the peat with respect to site stability. However minimal drainage improvements have been carried out for the turbary plots. Therefore, it is considered that the positive stability impact of drainage in this area is primarily related to the improved drainage for the wind farm development. Any further minor drainage improvements that are carried for the turbary plots during the decommissioning of the windfarm would not have any further significant positive effect on the stability of the peat relative to the baseline condition in 1998, prior to construction.

As noted in Section 8.5.5.4, the risk of a peat failure due to mechanical peat harvesting in the turbary plots could range from localised shear failure of an unsupported peat face in an open excavation or small-scale peat slide confined within a turbary plot, to the worst-case scenario of a large or very large-scale peat slide along existing drainage channels similar to the slide that occurred at the site in October 2003, during the construction of the wind farm.

Assuming that, in the worst-case scenario, peat failure due to excessive or intensive mechanical peat extraction in the turbary plots without appropriate mitigation measures could involve a very large-scale peat slide, which is consistent with the methodology for the assessment of stability impacts for the wind farm (see AGL Geotechnical Stability Report in **Appendix 8-2**), then:

- Where the likelihood of a peat failure is Very Possible to Likely (L=4.0 to 5.0) as a result of mechanical peat extraction on the turbary plots without appropriate mitigation measures, then the effect of the stability impacts on the peat would be **High** and **Significant**.
- Where the likelihood of a peat failure is Possible to Very Possible (L=3.5), then the effect of the stability impacts on the peat would be **Medium to High** and **Moderately Significant**.

It should be noted that this is an assessment of the significance of the ***effects*** of the stability impacts – i.e. the increase in shear stresses under the live load surcharge of the equipment, or the effects of saw cutting or mechanical excavation on the integrity of the peat.

In this context, the significance of the effects on the peat reflects the relative risk of a peat failure being caused by the corresponding mechanical peat harvesting activity, which has been calibrated by the potential impact of a large-scale peat slide as the worst-case scenario.

The methodology therefore identifies stability impacts that have significant effects whether or not a failure occurs so that appropriate design and construction mitigation measures can be implemented as preventative measures, where possible.

In reality, the interpreted likelihood of a peat failure shown on Figure 8-55 is more representative of smaller more localised peat failures, which would have a significantly lower impact on the peat. Therefore, the method of assessment is conservative.

It should also be noted that the risk of a peat failure due to mechanical peat extraction is independent of the wind farm activities and has not been exacerbated by the development of the wind farm.

Mechanical peat harvesting is currently only being carried out in about 35 No. of the 136 No. turbary plots and not all of these are cut each year (see Figure 8-54). No mechanical harvesting is carried out in Plots No. 182 to 207 along the southern boundary of the site, which have been used for forestry by Coillte.

The active turbary plots are only cut seasonally once a year in late spring/early summer so the frequency of the stability impact is Occasional. Mechanical Peat harvesting within any turbary plot only takes a few days. Therefore, the duration of the impact is Brief to Temporary.

8.5.5.5.1 *Evidence of Pre-Existing Peat Instability in the Turbary Areas*

No large or very large-scale peat failures have occurred in the turbary area on or immediately adjacent to the Derrybrien Wind Farm site over the project lifetime. However, there are 2 No. areas where localised peat instability has occurred in the turbary plots, which are identified on the aerial photograph in Figure 8-54 - **Plots No. 161 and 30.**

Plot 161: Plate 8-10 shows an image of the peat failure that has occurred at the south (downslope) end of Turbary Plot No. 161, which is directly upslope from Turbine T38.

Plate 8-10 – Peat Failure in Turbary Plot #161 (Site Photo May 2020)

The slide occurred as a planar slide in peat up to 2.0m deep over an area of approximately 2,500m^2 on the steeper lower slopes at the south end of the turbary plot. There is a convex break in slope to angles of 5.0°-7.5° at this end, compared to shallower slopes of 3.0°-4.0° on the upper half of the plot, near the central access track that runs between Turbines T34 and T37. There is also a large open drain running east-west along the southern, downslope end of the turbary plots on this side of the site.

The peat at the downslope (south) end of the turbary plot sheared along a surface at or near the base of the peat and slid downslope into the drain. The majority of the vegetated surface layer of the failed peat remained intact. There were large open water-filled tension cracks at the upslope end of the failed area. At the downslope end the drain was completely infilled and the displaced peat "buckled" and spilled over onto the surface of the peat in the firebreak that runs along the downslope side of the open drain, where the slope angle is locally flatter.

Based on historical aerial photographs from Google Earth and the OSI Geohive online portal, the peat slide appears to have initiated sometime between April 2015, when there were no tension cracks visible, and July 2018, when the tension cracks were visible in the peat and the drain on the downslope side had closed over. By May 2020 the failure had extended further upslope with a wider area of tension cracks on the upslope side. The main body of failed peat at the downslope end has also been pushed further onto the firebreak, indicating progressive downslope movement of the peat between July 2018 and May 2020. Some drainage works were carried out in 2020 to relieve ponded water in the tension cracks as a mitigation measure to prevent the slide progressing further upslope, as recommended in AGL Report No. 11-147-R06 in Appendix 8-4. The area was inspected again in January 2024 by AGL and appeared to be stable. There was no apparent significant upslope progression of the slide, or downslope movement of the peat within the failed area. Recent photographs of the slide area from 2024 are included in AGL Report No. 11-147-R04 in Appendix 8-2.

The peat slide was not caused by site activities related to the wind farm. The slope was intact up to April 2015, approximately 10 years after construction of the wind farm was completed and the slide is remote to the wind turbines and site access tracks. The trench for the electrical transmission cables along the firebreak at the south end of the turbary plot was also not impacted by the peat movement.

It is likely that the slide was caused by a combination of factors including poor or impeded drainage in the area, undercutting of the toe of the slope for the drain that runs across the downslope end of the plot, and possibly by the surcharge loads on the peat from mechanical harvesting equipment. Recent mechanical peat extraction has been limited to the zone upslope from the failed area. However, there is evidence of old machine track marks on the peat within the failed area.

Plot 30: Plate 8-11 shows an aerial view of the peat failure that has occurred at the centre of Turbary Plot No. 30.

The failure occurred as planar movement in peat 1.7 to 2.7m deep over an area of approximately 2,500m^2 along the boundary with Plot No.31 to the east. There is a local shallow convex break in slope to angles of 3.0˚-4.0˚ in the area. The peat appears to have failed upslope from an excavation for mechanical peat harvesting in Plot No. 31. The peat has moved into the excavation and closed over a section of the drain along the boundary between the two turbary plots. The majority of the vegetated surface layer of the failed peat has remained intact. However, tension cracks have opened up along the edge of the failed area, within Plot No. 30.

Based on historical aerial photographs from Google Earth and the OSI Geohive online portal, there may have been some movement of the peat in this area prior to 2011. However, it appears that the main movement occurred and the tension cracks formed when peat was excavated from the open excavation along the drain for peat extraction sometime around 2018. Therefore, this is the most likely cause of the recent movement. Undercutting of the toe of the slope in the drain along the site boundary would also have contributed to the peat movement.

The area was re-inspected by AGL in January 2024 and appeared to be stable. There has been no apparent further movement of the peat, and the tension cracks are not as evident because thicker vegetation has established in the area. Recent photographs of the area from 2024 are included in AGL Report No. 11-147-R04 in Appendix 8-2.

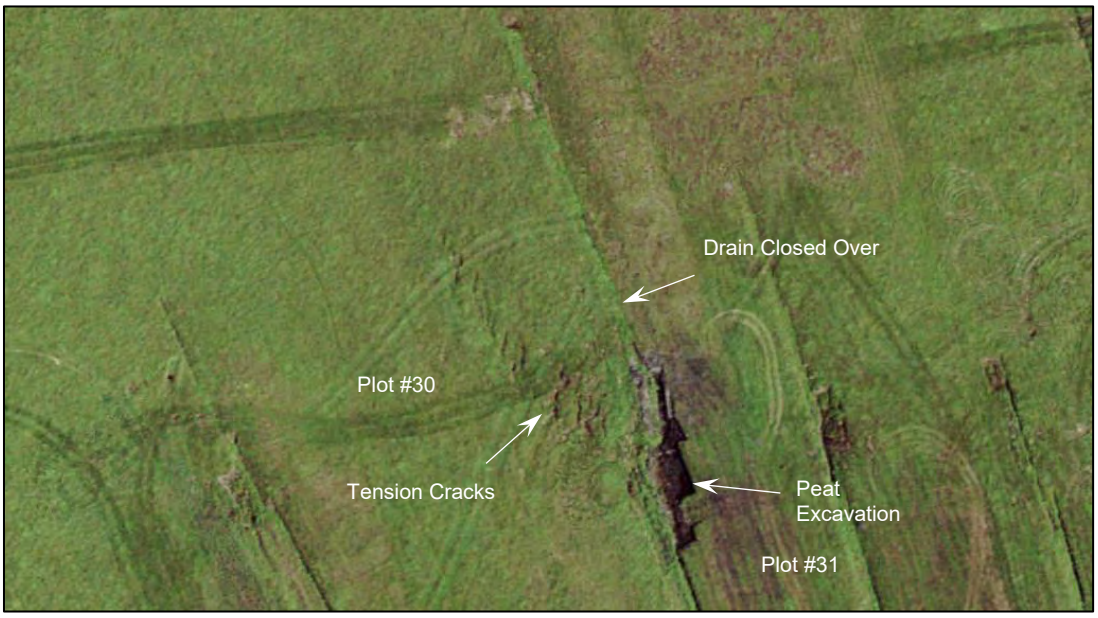


Plate 8-11 – Peat Movement in Turbary Plot #30 c2015-2018 (OSI Geohive Portal, 2020)

Both of these peat failures involved about 5,000m^3 of peat over an area of about 2,500m^2, which are small scale peat slides (1,000-5,000m^3). The baseline sensitivity of the degraded blanket bog in the area has been classified as **Medium**. Therefore, the combined effect of the peat slides on the disturbed peat would be classified as **Low** and only **Slightly Significant**. As these are pre-existing peat failures they will not lead to any cumulative impacts on the peat during the decommissioning of the windfarm.

Some drainage was carried out in Turbary Plot 161 in early August 2020 to relieve ponded water in the tension cracks as a mitigation measure to prevent any further movement of the peat. The details are shown on ESB Drawing No. QS-000314-01-D476-001-001-000 which is included as Figure 8-56.

Drains were hand excavated along the sides of the failed area to relieve the ponded water trapped in the tension cracks and divert it into the large open radial drain that runs east-west along the south end of the plots through this part of the site. Plot 161 is at a watershed along the drain so that the water diverted to either side of the failed area flows away from the turbary plot to the east and west. The existing drain along the west side of the turbary plot was also cleared out up to the access road between Turbines T34 and T27 at the north end of the plot. Check dams were installed in the radial drain for erosion and sediment control. The remedial drainage works were completed by early August 2020.

20 No. survey monitoring points were also installed on the surface of the peat within and around the failed area in Turbary Plot 161. The locations of the monitoring points are shown on the ESB Drawing reproduced in Figure 8-57. Points No. 10-20 are the most relevant in and around the failed area.

The location and elevation of the monitoring points was recorded to ITM coordinates by GPS survey over an initial period of 7 months between 21st May and 22nd December 2020 (Day 0 to Day 215). Follow up sets of readings were then taken on the 23rd November 2021 and again on the 23rd November, 2023.

Some of the points were damaged over the course of the monitoring period (#5, #8, #12 and #13) and had to be reset. Point No. 14 could not be located for the final set of readings in December 2021.

Figure 8-58 shows the change in the Northing coordinate for each of the monitoring points over the survey period. A negative reading represents downslope movement of the peat to the South, which would be the main direction that the failed peat could move if the slide area was unstable. Given the remote location and the variability in the readings, the degree of accuracy of the measurements is probably on the order of **+/- 10-20mm**. The peat could also exhibit movements of this order due to seasonal changes in moisture content and groundwater level.

Monitoring point MP-14 was located on the main body of displaced peat in the failed area. Although it could not be located for the set of readings taken in December 2021, the readings that were taken over the 7-month period between May and December 2020 indicated that the movement of the peg was within the range of +/-20mm (i.e. upslope/downslope), which is within the expected range of accuracy and indicates that main body of peat in the failed area is stable.

MP-17 to MP-20 were located along the approximate line of the wind farm underground cables along the south side of the drain downslope from the turbary plots in this area. MP-18 and MP-19 are on the downslope side of the peat slide. By November 2021 MP-18 and MP-19 had moved downslope by **<5mm** and **<25mm**, respectively. Most of this movement was recorded prior to the end of June 2020, which indicates that there has been no further movement in the peat downslope from the failed area since then. The failed peat is being supported by the buttressing effect of the intact peat downslope from the turbary plot. More recently an upslope change in position was recorded between the readings taken in 2021 and 2023. This could be an error or the survey pegs may have been disturbed. Nevertheless, the movements are slight and there is no indication of any significant downslope movement at this end of the slide, which confirms that the area of failed peat is stable.

Downslope movement of **60 mm** and **120mm** has been recorded at monitoring points MP-11 and MP-15, which are located on the surface of blocks of peat between tension cracks in and around the margins of the failed area. This is consistent with the movement that could occur in these areas due to the potential for the displaced blocks of peat to move or slump downslope into the tension cracks, particularly when the ponded water was drained away. Significant eastward displacement of

approximately 500mm was also recorded at MP-15, which is consistent with the location of the peg on the west side of the slide area. This is directly upslope from MP-18 where no downslope movement has been recorded. This indicates that the movement at MP-15 is localised displacement along the margins of the failed area, which is to be expected. MP-11 has been stable since 2021.

Downslope movement of about **50mm** has been recorded at monitoring point MP-16, which is on intact peat at the downslope end of Turbary Plot #159, to the west of the failed area. The aerial photo in Figure 8-56 indicates that the arterial drain at the south end of this plot could have partially closed over. This would be consistent with the movement that was recorded at MP-16 and identifies the risk of a potential peat failure in this area if any further mechanical peat extraction is carried out along the drain at the south end of the turbary plot, which could undermine the slope. MP-16 has been stable since 2011 and no downslope movement was recorded at MP-17 on the southern bank of the arterial drain, which indicates that the potential movement in the peat is localised to the upslope side of the drain.

The movements recorded at MP-1 to MP-10 and at MP-12 in 2023 were all very low and possibly within the degree of accuracy of the survey readings (i.e. ±10-15mm). Therefore, they indicate that the peat upslope from the failed area is stable, and that the peat slide has not progressed further upslope from the extent observed in Turbary Plot 161 in 2020.

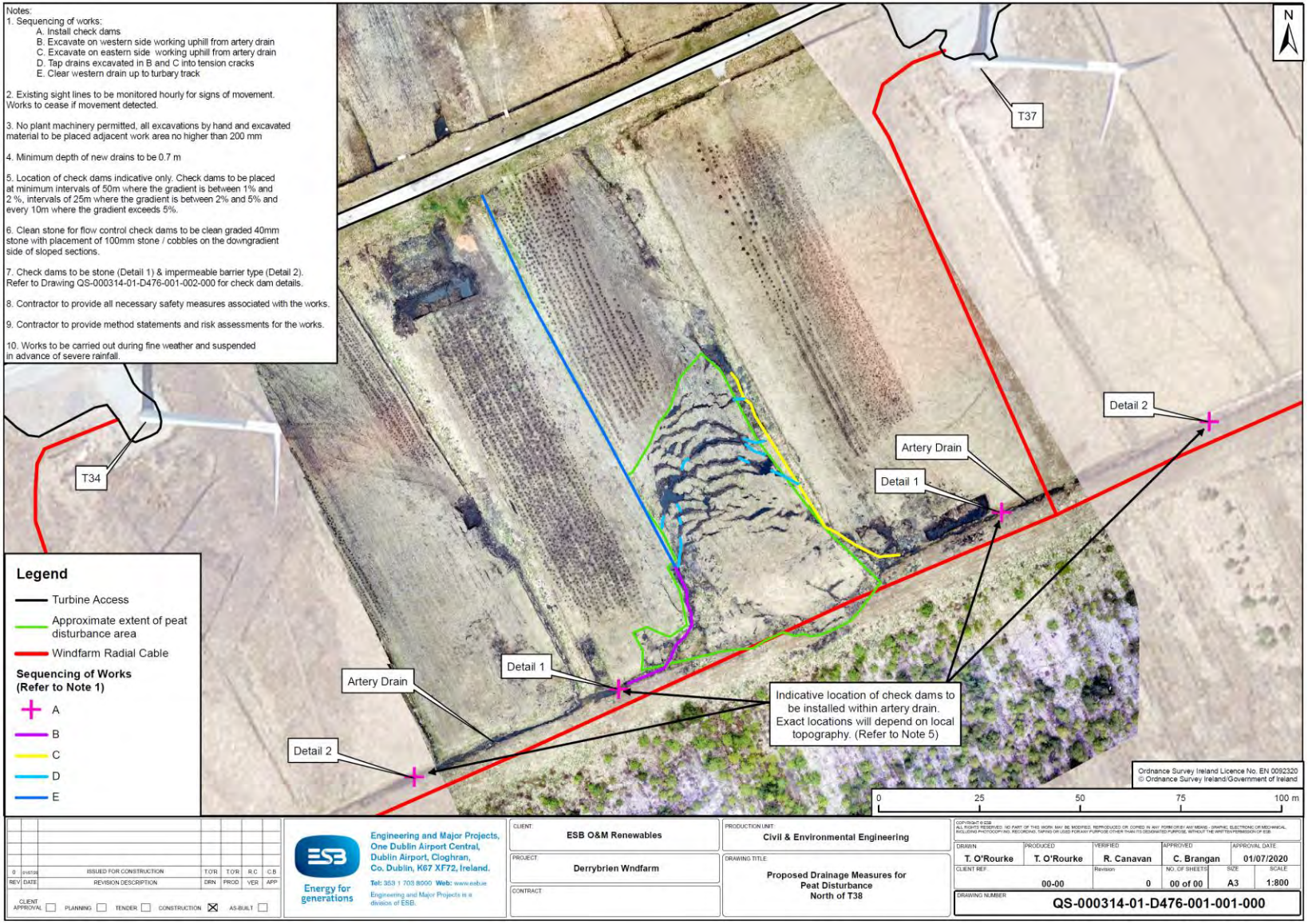


Figure 8-56 – Drainage works carried out in early August 2020 to relieve water pressures in zone of peat failure in Turbary Plot 161

Figure 8-57 – Survey monitoring points on the surface of the peat in and around the zone of peat failure in Turbary Plot 161

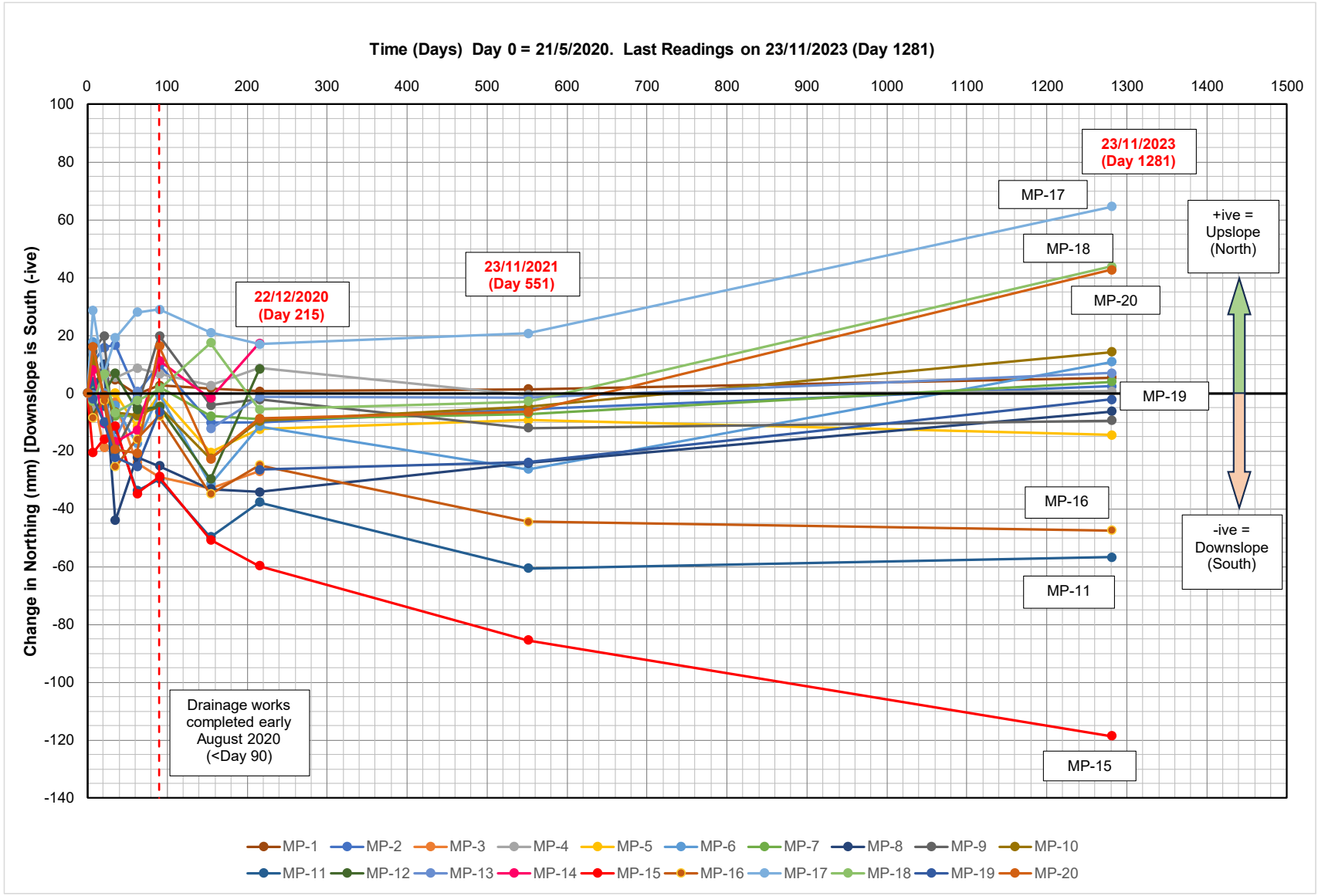


Figure 8-58 – Surveyed movement of monitoring points in zone of peat failure in Turbary Plot 161 in 2020/2021 (Day 0 = 21/5/2020)

8.5.5.6 Mitigation Measures for Mechanical Peat Harvesting and Assessment of Stability Impacts after Mitigation

The AGL Report No. 11-147-R06 in **Appendix 8-4** presents mitigation measures that, when employed by Gort Windfarms Ltd and turbary rights users for future mechanical peat harvesting in the turbary plots on and adjacent to the windfarm site, will reduce the likelihood of a peat failure and the effect of the activities on the stability of the peat in the Project area to an acceptable level during decommissioning.

The following mitigation measures have been implemented by Gort Wind Farms Ltd to reduce the likelihood of a peat failure occurring:

- The peat stability risk assessment and the associated mitigation measures have been shared with the turbary rights holders whose plots have been or are proposed to be harvested by mechanical means, and the turbary rights holders have been made aware of the potential site stability risks associated with mechanical peat harvesting methods in the absence of mitigation.
- Warning signs have been erected at the site by Gort Windfarms Ltd. to raise awareness of the peat stability risks associated with mechanical peat harvesting in the turbary area and to highlight the recommended mitigation measures.
- Where possible, communication has been established between the turbary plot owners, turf cutting contractors and the windfarm site manager for Gort Windfarms Ltd. to give notice of mechanical peat harvesting activities and to report any peat instability on the site.
- Gort Windfarms Ltd. have implemented the recommended remedial drainage works and survey monitoring in the failed area at the south end of Turbary Plot 161 to ensure that the peat there is stable.
- Periodic inspections of the mechanical peat harvesting are being carried out by the wind farm site manager for Gort Windfarms Ltd.

The following is a summary of the mitigation measures that are recommended in the AGL Report No. 11-147-R06 in Appendix 8-4 which specifically relate to mechanical peat harvesting in the turbary area and which are recommended to be implemented by the turbary rights holders:

- No mechanical peat harvesting should be carried out by saw cutting in any of the turbary plots.
- No mechanical peat harvesting should be carried out in the turbary plots where the likelihood of a peat failure without appropriate mitigation measures is interpreted as Very Possible to Likely (L=4.0 to 5.0). Manual turf cutting can be carried out but should be done during the drier months between May and September.
- Where the likelihood of a peat failure without appropriate mitigation measures is interpreted as Possible to Very Possible (L=3.0 to 3.5) the limitations recommended in Section 6.0 of AGL Report No. 11-147-R06 on the type and size of equipment that can be used for mechanical peat harvesting in the turbary plots and on the maximum level of surcharge loading on the peat should be implemented.
- The operational control measures recommended in Section 6.0 of AGL Report No. 11-147-R06 should be implemented by the turbary plot owners and their turf cutting contractors to manage the stability of peat excavations and to prevent excessive damage to the integrity of the vegetated surface of the peat.
- No mechanical peat harvesting should be carried out in the turbary area during the decommissioning stage of the wind farm project.

Where the mitigation measures are implemented by the turbary rights holders, their agents and by Gort Windfarms Ltd. then the interpreted likelihood of a peat failure occurring as a result of

mechanical peat harvesting in the turbary plots will reduce to a residual level of **Low (L=2)**, as illustrated on Figure 8-59.

The corresponding effect on the stability on the peat will be **Medium to Low**, which is of **Slight Significance**. This would also represent the residual effect of stability impacts on the peat where no mechanical peat harvesting is being carried out in the turbary areas in their existing condition.

The stability impact for mechanical peat harvesting will only occur in the turbary plots where peat extraction is likely to be carried out, which is currently about 35 No. of the 136 No. plots in the area. The active turbary plots will only be cut seasonally once a year between May and September so the frequency of the stability impact will be **Occasional**. Annual mechanical peat harvesting within any turbary plot will only take a few days. Therefore, the duration of the impact will be **Brief** to **Temporary**.

8.5.5.7 Cumulative Stability Impacts due to Mechanical Peat Harvesting in the Turbary Plots Within and Immediately Adjacent to the Wind Farm Site

This section discusses the cumulative stability impacts that could occur due to mechanical peat harvesting in the turbary areas within and immediately adjacent to the wind farm site during decommissioning of the wind farm.

Stability impacts directly related to the wind farm decommissioning works are assessed in Section 8.4.1.4.2 and the results are summarised on Table 8-10. The activities that were assessed as having significant impacts on the stability of the peat in the turbary area were limited to:

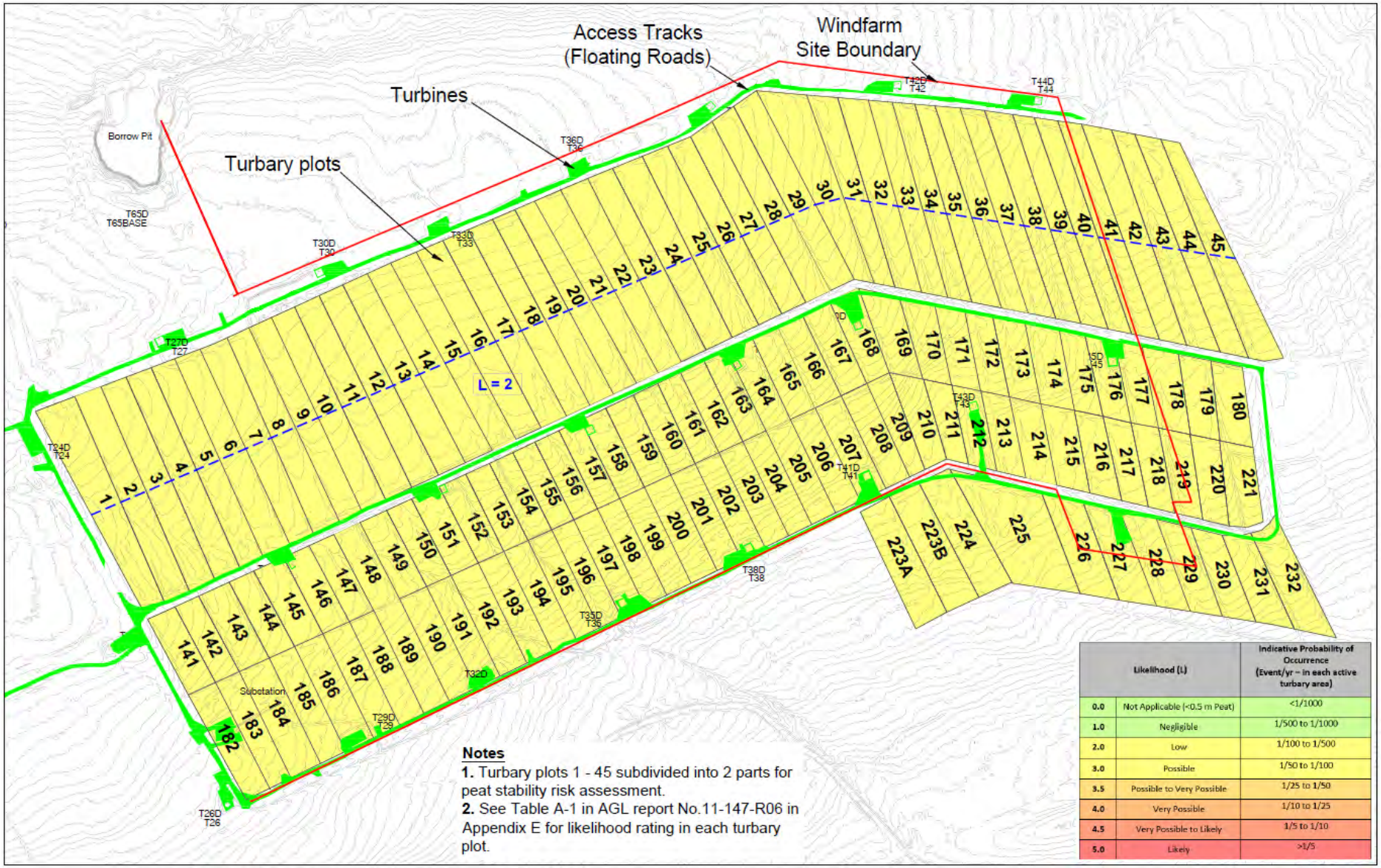
- Heavy construction traffic loading on the floating roads from the mobile cranes and low-loader transporters that will be used to dismantle the turbines, substation and anemometers and to transport the components offsite.
- Additional loading on the peat where the crane hardstanding needs to be temporarily extended (T4) or where narrow sections of the existing site access road need to be temporarily widened at the east end of the turbary area, and near Turbines T68, T14 and T1.
- Loading on the peat from the low ground bearing pressures (LGBP) wide-tracked excavators and ATV that will be used to take down & remove timber polesets PS-1a to PS-4 for the 110kV OHL.

It was assessed that the probability of a peat slide occurring as a result of these activities was very low to low so that the effect on the stability of the peat was **Very Low to Low**, which is only of **Slight Significance**.

The impact of the construction traffic loading on the existing floating roads will be **occasional** to **regular**, but only **temporary** or **brief** – limited to when the large mobile cranes and low-loader transporters are travelling along the roads. Also, all the existing floating roads have been successfully proof tested for the maximum design load.

The impact from the additional load from the widened roads will be temporary as the fill will be removed at the end of the decommissioning works. It will also be limited to the section of the existing access track between Turbines T35 and T45 and/or between T43 and T46.

The loading on the peat to dismantle the OHL downslope from the substation will also be brief and limited to the area where polesets PS-1a to PS-4 will be dismantled.



Likelihood (L)		Indicative Probability of Occurrence (Event/yr – in each active turbary area)
0.0	Not Applicable (<0.5 m Peat)	<1/1000
1.0	Negligible	1/500 to 1/1000
2.0	Low	1/100 to 1/500
3.0	Possible	1/50 to 1/100
3.5	Possible to Very Possible	1/25 to 1/50
4.0	Very Possible	1/10 to 1/25
4.5	Very Possible to Likely	1/5 to 1/10
5.0	Likely	>1/5

Figure 8-59 – Likelihood of a peat failure due to mechanical peat extraction in the turbary plots after mitigation measures have been implemented.

The potential cumulative stability impacts due to mechanical peat harvesting on the wind farm site will not arise as a direct result of the wind farm decommissioning, but from the separate and unrelated activities for mechanical peat harvesting in the turbary areas under established turbary rights, which are outside of the control of Gort Windfarms Ltd.

Stability impacts related to mechanical peat harvesting do not increase or amplify the effects of stability impacts from the wind farm decommissioning activities because the location and characteristics of the impacts are different (e.g. peat harvesting in the turbary plots vs surcharge loading on the floating roads between the plots from construction traffic during decommissioning). Therefore, in this case the cumulative impacts represent the impact of the activities that have a greater effect on the stability of the peat at that time. Furthermore, cumulative impacts only occur when mechanical peat harvesting is carried out at the same time as the wind farm decommissioning works.

Section 8.5.5.6 summarises the mitigation measures that have been implemented and recommended to reduce the likelihood of a peat failure due to mechanical peat harvesting in the turbary areas. However, some of these relate to the turbary activities that are outside of the control of Gort Windfarms, therefore 2 No. scenarios have been considered in assessing the potential cumulative stability impacts:

1. Cumulative impacts that could occur if the recommended mitigation measures are not implemented by the turbary plot holders.
2. Cumulative stability impacts that could occur if the mitigation measures are implemented by the turbary plot holders.

Cumulative stability impacts are also considered if no mechanical peat harvesting is carried out in the turbary area during decommissioning of the wind farm.

8.5.5.7.1 *Cumulative Stability Impacts that Could Occur If the Recommended Mitigation Measures are not Implemented by the Turbary Plot Holders:*

As discussed in Section 8.5.5.5, the impacts of site activities related to peat extraction from the turbary plots that can have an effect on the stability of the peat are:

- The live load surcharge from the mechanical peat harvesting equipment operating directly on the surface of the peat.
- Damage to the integrity of the peat mass from mechanical excavation or by saw cutting.
- Removal of support to peat faces by bulk excavation for mechanical peat harvesting, or along drainage trenches.

The primary *effect* of the live load surcharge is the increase in shear stress in the underlying peat, which increases the risk of a peat failure, potentially triggering a peat slide on sloping ground where the magnitude of loading is such that the downslope shear stresses exceed the strength of the peat.

Saw cutting and mechanical excavation can also effect the integrity and stability of the peat by creating lines of weakness where vegetative fibres in the upper fibrous acrotelm layer are severed along saw cut lines, open drains or trench excavations, or by increasing the shear stresses in peat directly adjacent to or upslope from an unsupported open excavation, particularly where the slope has been undermined along an exposed peat bank at the downslope end of a turbary plot.

Saw cutting and mechanical excavation can also disrupt the existing pattern of surface water drainage in the turbary area, allowing water to infiltrate down into the lower peat layers which can lead to an increase in water content, swelling and reduction in shear strength.

The interpreted likelihood of a peat failure occurring as a result of mechanical peat harvesting in the turbary plots without appropriate mitigation measures is shown on Figure 8-55. As discussed in Section 8.5.5.4, the failure could range from localised shear failure of an unsupported peat face in an excavation or a small-scale peat slide confined within a turbary plot, to the worst-case scenario of a large or very large-scale peat slide along existing drainage channels similar to the slide that occurred at the site in October 2003, during the construction of the wind farm.

Assuming that, in the worst-case scenario, peat failure due to excessive or intensive mechanical peat harvesting in the turbary plots without appropriate mitigation measures could involve a very large-scale peat slide, then:

- Where the interpreted likelihood of a peat failure shown on Figure 8-55 is **Very Possible** to **Likely (L=4.0 to 5.0)**, then the effect of the stability impacts on the peat would be **High** and **Significant**.
- Where the likelihood of a peat failure is **Possible** to **Very Possible (L=3.5)**, then the effect of the stability impacts on the peat would be **Medium to High** and **Moderately Significant**.

In reality, the interpreted likelihood of a peat failure shown on Figure 8-55 is more representative of smaller more localised peat failures, which would have a significantly lower impact on the peat. Therefore, the assessment is conservative.

As the mechanical peat harvesting activities without mitigation have a more significant effect on the stability of the peat than the activities related to the wind farm decommissioning, they represent the cumulative effects of stability impacts that could occur if peat extraction is carried out during decommissioning and if the recommended mitigation measures are not implemented by the turbary plot holders.

The cumulative impacts will only occur in the turbary plots where mechanical peat harvesting is likely to be carried out during decommissioning, which is currently about 35 No. of the 136 No. plots in the area and not all of these are cut each year (see Figure 8-54). No mechanical peat harvesting is carried out in Plots No. 182 to 207 along the southern boundary of the site, which have been used for forestry by Coillte.

The active turbary plots will only be cut seasonally once a year between May and September so the frequency of the stability impact will be **Occasional**. Annual mechanical peat harvesting within any turbary plot will only take a few days. Therefore, the duration of the impact will be **Brief** to **Temporary**.

It should be noted that this is an assessment of the significance of the ***effects*** of the stability impacts – i.e. the increase in shear stresses under the live load surcharge of the equipment, or the effects of saw cutting or mechanical excavation on the integrity of the peat. In this context, the **Significance** of the effects reflects the relative risk of a peat failure being *caused* by the corresponding peat extraction activity, which has been calibrated by the potential impact of a large-scale peat slide as the worst-case scenario. The methodology therefore identifies stability impacts that have significant effects *whether or not a failure occurs* so that appropriate design and construction mitigation measures can be implemented as preventative measures, where possible.

8.5.5.7.2 *Cumulative Stability Impacts that Could Occur If the Recommended Mitigation Measures are Implemented by the Turbary Plot Holders:*

Section 8.5.5.6 gives a summary of the mitigation measures that are recommended to be implemented by the turbary rights holders for peat extraction in the turbary areas within and immediately adjacent to the wind farm site. If the mitigation measures are implemented, then:

- No mechanical peat harvesting will be carried out by saw cutting in any of the turbary plots.
- No mechanical peat harvesting will be carried out in the turbary plots where the likelihood of a peat failure without appropriate mitigation measures is interpreted as Very Possible to Likely (L=4.0 to 5.0), as shown on Figure 8-55. Peat harvesting in these areas (if any) will be limited to manual turf cutting during the drier months between May and September.
- Where mechanical peat harvesting is carried out in areas where the likelihood of a peat failure without appropriate mitigation measures is interpreted as Possible to Very Possible (L=3.0 to 3.5) then restrictions will be placed on the type and size of mechanical harvesting equipment that will be used, as recommended in Section 6.2 of AGL Report No. 11-147-R06 in **Appendix 8-4**, and the works will only be carried out during the drier months between May and September.
- The turbary plot owners and their turf cutting contractors will implement the operational control measures for mechanical peat extraction that are recommended in Section 6.0 of AGL Report No. 11-147-R06 to ensure that good practice is adopted to manage the stability of peat excavations and to prevent excessive damage to the integrity of the vegetated surface of the peat.

As discussed in Section 8.5.5.6, where the mitigation measures are implemented by the turbary rights holders, their agents and by Gort Windfarms Ltd. then the interpreted likelihood of a peat failure occurring as a result of mechanical peat harvesting in the turbary plots will reduce to a residual level of **Low (L=2)**, as illustrated on Figure 8-59. The corresponding effect on the stability on the peat will be **Medium to Low**, which is of **Slight Significance**.

When compared to the wind farm decommissioning activities, mechanical peat harvesting in the turbary plots with appropriate mitigation measures has a slightly higher effect on the stability of the peat because it mainly involves excavation works with plant and equipment operating directly on the surface of the peat **(i.e. Medium-Low vs Low/Very Low)**. However, using the matrix in Figure 8-3, the significance of the effects is the same **(Slight)**. Therefore, this will represent the cumulative effect of stability impacts that could occur if mechanical peat harvesting is carried out during decommissioning and if the recommended mitigation measures on mechanical peat extraction are implemented by the turbary plot holders and their agents.

The cumulative impacts will only occur in the turbary plots where mechanical peat harvesting is likely to be carried out during decommissioning, which is currently about 35 No. of the 136 No. plots in the area and not all of these are cut each year (see Figure 8-54). No mechanical peat harvesting is carried out in Plots No. 182 to 207 along the southern boundary of the site, which have been used for forestry by Coillte.

The active turbary plots will only be cut seasonally once a year between May and September so the frequency of the stability impact will be **Occasional**. Annual peat extraction within any turbary plot will only take a few days. Therefore, the duration of the impact will be **Brief** to **Temporary**.

8.5.5.7.3 *Cumulative Stability Impacts that Could Occur If No Mechanical Peat Extraction is Carried Out in the Turbary Area during Decommissioning of the Wind Farm:*

The mitigation measures in Section 6 of AGL Report No. 11-147-R06 in Appendix 8-4 include a recommendation that no mechanical peat harvesting should be carried out in the turbary areas during decommissioning of the wind farm. If this is agreed with the turbary rights owners, then there will be no significant cumulative impacts due to peat harvesting in the turbary plots on and immediately adjacent to the site during decommissioning.

8.5.6 Summary – Cumulative Impacts

Cumulative impacts have been assessed for the following projects and activities in and around the project area:

- Other wind farm projects in the Slieve Aughty Mountains (Sonnagh Old Wind Farm & Keelderry Wind Farm, including a smaller scale and more localised peat slide that occurred on the site of the Sonnagh Old Wind Farm during construction in 2002/2003).
- Adjacent coniferous forestry plantations.
- Turf cutting or peat extraction outside the Project Area.
- Mechanical Peat Harvesting in Turbary Plots within and immediately adjacent to the Project Area.

The other wind farm projects, adjacent coniferous forestry plantations and turf cutting or peat extraction outside the Project Area have not and will not give rise to any likely significant cumulative direct or stability impacts on soils, geology and land within the Project Area for the Derrybrien Wind Farm because:

- The Sonnagh Old Wind Farm and Keelderry Wind Farms are separate projects to the Derrybrien Wind Farm.
- The Sonnagh Old Wind Farm has an independent grid connection and it is located on a different mountain in the Slieve Aughty Mountains, which is topographically remote and in a different river sub-catchment to the Derrybrien Wind Farm.
- Although the Keelderry Wind Farm site is located within the same river sub-catchment as the Derrybrien Wind Farm, the wind farm was never constructed and the site is at lower elevation and topographically remote to the Derrybrien site.
- All of the drainage, tree felling and planting on adjacent forestry plantations has been and will be carried out outside the site of the Derrybrien Wind Farm and downslope or topographically remote from the site (i.e. in different river sub-catchments, or on different slopes within the same river sub-catchment).
- All of the forestry along the Grid Connection route, at the site of the Agannygal substation and in the areas of the Peat Slide and Response Works were cleared for the project during construction.
- No peat extraction activities subject to a development consent have been identified in the vicinity of the Project.
- Turf cutting in the areas of cutover bog outside the site that are shown in Chapter 4 are remote to the site and separated from it by conifer plantations.

Therefore, significant cumulative impacts are limited to mechanical peat harvesting in turbary plots within and immediately adjacent to the wind farm site, but unrelated to the project.

In terms of **direct** impacts:

- Mechanical peat harvesting involves excavating and removing peat from the turbary area, which results in a loss of habitat and CO_2 storage in the peat.
- Historically this has been limited to low volumes of peat harvesting by manual turf cutting for personal use. However, there has been in increased in mechanical peat harvesting in some of the turbary plots since about 2012, which has increased the rate of peat extraction to about 2,500m^3 per year.
- This is still a very low volume of peat loss relative to the wind farm site and the baseline sensitivity of the degraded blanket bog in the area is **Medium to Low**. Therefore, the cumulative effect that this has on the peat is **Low** and only **Slightly Significant**.

The impacts of site activities related to mechanical peat harvesting from the turbary plots that can have an effect on the **stability** of the peat are:

- The live load surcharge from the mechanical peat harvesting equipment operating directly on the surface of the peat.
- Damage to the integrity of the peat mass from mechanical excavation or by saw cutting.
- Removal of support to peat faces by bulk excavation for mechanical peat harvesting, or along drainage trenches.

Two areas on the site have been identified where localised or small-scale peat slides have occurred on the wind farm site, possibly as a result of mechanical peat harvesting, i.e. in Turbary Plots #161 and #30. These failures are unrelated to the wind farm i.e. they are remote to the wind farm infrastructure and occurred after construction was completed on the site.

The potential cumulative stability impacts due to mechanical peat harvesting on the wind farm site during or after decommissioning will not arise as a direct result of the wind farm decommissioning or from the elements of the wind farm that will be left in place after decommissioning (the Retained Development), but from the separate and unrelated activities for mechanical peat harvesting in the turbary areas under established turbary rights, which are outside of the control of Gort Windfarms Ltd.

Mitigation measures have been implemented by Gort Windfarms Ltd. and recommended to the turbary rights holders for managing the risk of peat stability during mechanical peat harvesting on the wind farm site.

If the recommended mitigation measures are **not** adopted by the turbary rights holders for mechanical peat harvesting in the turbary areas then the cumulative effect on the stability of the peat could be **Medium to High** or **High**, depending on the interpreted likelihood of a peat failure in the area that the work is carried out (see Figure 8-55), which is **Moderately Significant** to **Significant**.

If the recommended mitigation measures **are** adopted by the turbary rights holders for mechanical peat harvesting in the turbary areas then there will be a lower likelihood of a peat failure (see Figure 8-55) and the cumulative effect on the stability of the peat will be **Medium to Low**, which is of **Slight Significance**.

This has conservatively been assessed on the basis that peat failure due to excessive or intensive mechanical peat harvesting in the turbary plots without appropriate mitigation measures could initiate a very large-scale peat slide as a worst-case scenario, which is conservative. In reality, the interpreted likelihood of a peat failure is more representative of smaller more localised peat failures, such as those observed n Plots #161 & #30, which would have a significantly lower impact.

Cumulative impacts are limited to the areas of the site where mechanical peat harvesting is carried out and ***when*** the work is being carried out. The limited number of active turbary plots are only cut seasonally once a year in late spring/early summer so the frequency of the stability impact is Occasional. Mechanical peat harvesting within any turbary plot only takes a few days. Therefore, the duration of the impact is Brief to Temporary.

8.6 Remedial (Mitigation) Measures and Monitoring

8.6.1 Introduction

This section presents a summary of the remedial measures that were implemented to mitigate or monitor significant effects of the project on soils, geology and land during construction and during the operation and maintenance phase of the project up to the end of 2022. Mitigation and monitoring measures that will be implemented for significant effects during and after decommissioning are also presented.

8.6.2 Remedial (Mitigation) Measures & Monitoring - Wind Farm Site

Remedial measure to mitigate or monitor significant effects of impacts on soils, geology and land are presented in this section of the Chapter for the following stages of the wind farm project:

- Construction Stage – Prior to October 2003 Peat Slide.
- Construction Stage – 2nd Phase after October 2003 Peat Slide.
- Operation and Maintenance Phase (2006-2022).
- Ceased Operation Phase (2022-Present Day).
- Decommissioning Phase (the Prospective Development).
- Post-Decommissioning (the Retained Development).

For clarity, "significant effects" in this context refers to all of the effects that have been assessed as ***slightly significant***, ***moderately significant*** or ***significant*** using the methodology described in Section 8.2.1 and the matrix in Figure 8-3.

None of the impacts on soils, geology and land for the wind farm project had effects that would be classified as ***very significant*** or ***profound***.

8.6.2.1 Wind Farm Site: Construction Phase – Prior to October 2003 Peat Slide

The activities that were carried out on the wind farm site during this period that had an impact on soils, geology and land with significant effects included the following:

- Tree felling.
- Construction of the site compound.
- Construction of the wind farm access tracks.
- Excavation and construction of turbine foundations.
- Deposition and storage of surplus excavated materials on site.
- Excavation and processing of bedrock from the borrow pits.
- Drainage improvements.

8.6.2.1.1 *Mitigation of Direct Impacts*

The direct impact of the site activities that had a **Moderately Significant** effect on soils geology and land was the excavation of peat for the turbines, crane hardstandings and site compound.

The site activities and direct impacts that had a **Slightly Significant** effect were:

- Damage to the degraded peat habitat from the construction of the floating roads and deposition of excavated peat and glacial till on the intact peat slopes.
- Groundwater drawdown in the peat due to drainage improvements.
- Trafficking on the surface of the peat by the machinery used to fell the coniferous forests on the site.
- Excavation of rock from Borrow Pit No.3 to process it into granular fill for the access tracks and granular hardstand areas.

As discussed in Section 8.2.2.1, there is limited information on measures that were taken to mitigate the effect of direct impacts of the wind farm project on soils, geology and land during the initial construction stage of the project, prior to the peat slide in October 2003. However, there are aspects of the wind farm design prepared on behalf of the Contractor that had significant mitigating effects that are notable, i.e.,

- Approximately 17.5 km of new access tracks on the site were designed as floating roads on the peat rather than as rockfill roads on the underlying glacial till. Construction of the floating roads did not involve any peat excavation. The alternative method of constructing the roads on the glacial till would have involved excavating all of the peat out from under the roads and backfilling the excavation with crushed rock granular fill, which would have had a significantly higher effect on the peat habitat.
- Constructing the new access tracks as floating roads rather than on the underlying glacial till by excavate/replace also significantly reduced the volume of excavated peat that had to be disposed of on site, which reduced the effect on the peat habitat in the peat storage areas.
- The floating road design also significantly reduced the volume of crushed rockfill that had to be generated from the borrow pits on the site, which would have significantly increased the size of the pits.
- On the east side of the site the length of new site access tracks that had to be constructed on the blanket bog was significantly reduced by incorporating the existing turbary roads into the layout of the site access tracks for the wind farm.

8.6.2.1.2 *Mitigation of Stability Impacts*

The impacts of site activities that had a **Significant** effect on the peat with respect to site stability were:

- The dead load surcharge on the intact peat slopes from the construction of the floating roads with 0.6-1.0 m of crushed rock granular fill.
- The live load surcharge on the floating roads from the vehicles and machinery that were used to construct the floating roads.
- The dead load surcharge on the intact peat slopes where peat, glacial till and occasionally weathered rock excavated from the turbine foundations was sidecast on the peat adjacent to the excavation.

None of the adverse impacts of the site activities had a **Moderately Significant** effect on the peat with respect to site stability.

The improved drainage was a ***positive*** impact that had a **Moderately Significant** effect on the stability of the peat.

The impacts of site activities that had a **Slightly Significant** effect on the peat with respect to site stability were:

- The live load surcharge on peat slopes from low ground bearing pressure construction and forestry equipment operating on the peat slopes.

- The local stability of the temporary peat slopes around the perimeter of the excavations for the turbine foundations and crane hard standings.
- Dynamic inertial loading on the peat from blast-induced vibrations from rock excavation in Borrow Pit No.3.
- Miscellaneous localised loading on the peat slopes from work related to tree felling and drainage.

The following is a summary of the peat stability risk mitigation measures were implemented on the project prior to the peat slide in October 2003:

Construction Management and Supervision

The civil works were carried out by an experienced earthworks and civil contractor – Ascon Ltd. (now BAM Civil).

The works were carried out under the supervision of ESBI engineers with experience of construction for wind farms on upland blanket bogs in Ireland.

Site Access Tracks

A basal layer of brash and small trees and 1-2 layers of geogrid reinforcement were incorporated into the design of the floating roads to minimise the thickness of granular rockfill used to construct the roads, and to spread the dead load of the road evenly over the surface of the intact peat.

On the north side of the site the access track between Turbines T50 and T47 was originally aligned along the north side of the turbines – in close proximity to the edge of the steep slopes on that side of the site. At an early stage in construction the track was re-aligned to the south side of the turbines to move it further back from the edge of the steep slopes.

Spoil Management

Peat and glacial till excavated from the turbine foundations sidecast on the intact peat slopes adjacent to the excavations was spread out over the surface of the peat, generally to a depth of 0.5-1.5 m, to minimise the dead load surcharge and distribute it over a wide area.

The live load surcharge from construction plant operating on the peat slopes was minimised through a combination of long reach excavators operating on the access tracks, and LGBP (low ground-bearing pressure) wide-tracked excavators operating on the peat.

Stability of Peat Excavations at Turbine Foundations

Wherever possible the temporary peat slopes at the turbine foundations were battered back to a stable temporary slope angle of 1V:1H or flatter. Where the sides of the excavations were unstable in deep weak peat, rockfill was backfilled up against the slopes as temporary support.

Drainage

Some improvements were carried out to the existing drainage network on the site to clear out blocked drains, to relieve groundwater levels in areas of deep peat, and to prevent ponding of surface runoff in areas where the access roads and turbines were constructed. Culverts were also installed under the new site access tracks to preserve the existing hydrology.

Borrow Pits

Borrow pits were opened up on the site to extract rock and process it into the granular rockfill that was used to construct the site access tracks and crane hardstandings. Blasting was only carried out in Borrow Pit No.3, near the site entrance. The blasting was carried out by an experienced licensed professional and charge delays were used to minimise blast-induced vibrations.

Tree Felling

Tree felling works were carried out by experienced specialist subcontractors under the management of Coillte. The trees were felled and gathered using specialised forestry equipment comprised of a wide-tracked hydraulic excavator fitted with a harvesting attachment and 8-12 tonne rubber-tyred forwarders that have been widely used in commercial conifer forests on upland blanket bogs in Ireland.

In areas of soft peat the contractors placed timber brash and trimmed branches along the access routes of the harvesters and forwarders through the forest to spread out the concentrated live load surcharge under the tracks or tyres of the machines.

8.6.2.2 Wind Farm Site: Construction Phase (2003-2006) – After the October 2003 Peat Slide

The activities that were carried out on the wind farm site during this period that had an impact on soils, geology and land with significant effects included the following:

- Tree felling.
- Construction of the remaining wind farm access tracks.
- Excavation and construction of the remaining turbine foundations.
- Excavation and construction of the remaining crane hardstanding areas.
- Deposition and storage of surplus excavated materials on site.
- Excavation and processing of bedrock from the borrow pits.
- Assembly and erection of the wind turbines.
- Drainage improvements.
- Excavation of cable trenches and installation of electrical cables and ducts.
- Construction of the substation and control building.
- Construction of the on-site twin poleset for the overhead 110 kV line.
- Construction and assembly of the anemometer masts.

After the peat slide in October 2003 a significant level of mitigation was implemented on site to prevent any further peat instability on the site. AGL Report No. 11-147B-R04 – "*Geotechnical Stability Report & Assessment of Site Stability Impacts on Soils, Geology and Land*" in Appendix 8.2 of this Chapter gives a detailed assessment of the mitigation measures that were implemented on site. This section presents a summary of the measures that mitigate the impact of the wind farm on soils, geology and land.

The majority of the mitigation measures related to stability impacts, i.e. to reduce the risk of a peat slide. In general, there were no changes to the overall design of the wind farm. However, there were some changes to the scope of the works which were implemented as a precautionary measure to mitigate against stability impacts which also mitigated the direct impact of the project, as summarised here.

8.6.2.2.1 Mitigation of Direct Impacts

The direct impact of the site activities that had a **Moderately Significant** effect on soils, geology and land for this phase of construction was the excavation of peat for the turbines, crane hardstandings, substation and anemometer mast foundation.

The site activities and corresponding direct impacts that had a **Slightly Significant** effect on the soils, geology and land were:

- Damage to the degraded peat habitat from the construction of the floating roads and deposition of excavated peat on the intact peat slopes.
- Groundwater drawdown in the peat due to drainage improvements.
- Excavation of rock from Borrow Pit No.3 to process it into granular fill for the access tracks and granular hardstand areas.
- Trafficking on the surface of the peat by the machinery used to fell the coniferous forests on the site.

During the second phase of construction in 2004/2005, Turbine T16 and a 475 m long section of floating road between Turbines T15 and T17 were omitted from the scope of work on the project as a precautionary measure out of concerns for site stability in the area, which was close to where the peat slide occurred in October 2003 and had similar topography and ground/groundwater conditions. The sections of partially completed floating roads that had been constructed between T15 and T17 at the time of the slide were closed and abandoned. In addition to mitigating against the risk of peat stability, this reduced the direct impact of the project on the peat habitat in this part of the site, i.e.:

- It reduced the total volume of peat excavated on the site at the turbine foundation and crane hardstanding.
- It reduced the area of peat habitat covered by the floating roads.

8.6.2.2.2 Mitigation of Stability Impacts

The impacts of site activities that had a **Significant** effect on the peat with respect to site stability during the second phase of construction were:

- The dead load surcharge on the intact peat slopes from the construction of the remaining floating roads with 0.6-1.0 m of crushed rock granular fill.
- The live load surcharge on the floating roads from the vehicles and machinery that were used to construct the remaining floating roads.

The adverse impacts of site activities that had a **Moderately Significant** effect on the stability of the peat were:

- The dead load surcharge on the peat from the material sidecast areas in the medium-term as the peat gained strength under the load.
- The live load surcharge from the construction traffic on the floating roads during the second phase of construction in 2004/2005, which was within the proven capacity of the roads.

The improved drainage was a **positive** impact that had a **Moderately Significant** effect on the stability of the peat.

The impacts of site activities that had a **Slightly Significant** effect on the stability of the peat were:

- The dead load surcharge from up to 1.0 m of excavated peat placed on the intact peat slopes in designated peat repository areas in 2004/2005.

- The local stability of the temporary peat slopes around the perimeter of the excavations for the turbine foundations and crane hardstandings.
- The live load surcharge on peat slopes from low ground bearing pressure construction and forestry equipment operating on the peat slopes.
- Dynamic inertial loading on the peat from blast-induced vibrations from rock excavation in Borrow Pit BP-3.
- Miscellaneous localised loading on the peat slopes from work related to tree felling, drainage, and cable trenching.

The following is a summary of the measures that were implemented on the site to mitigate the effect of the stability impacts on soils, geology and land.

Instrumentation and Monitoring

4 No. clusters of instrumentation were installed to monitor groundwater levels and ground movements in the peat around the perimeter of the site near Turbines T2, T18, T34 and T49/50. At each location:

- 3 No. vibrating-wire push-in piezometers were installed to provide a continuous record of daily and seasonal groundwater level fluctuations [12 No. total].
- 3-4 No. electronic tiltmeters provided a continuous record of any downslope movement or creep in the peat at the sensor locations [15 No. total].

The electronic sensors were connected to a central logger unit in each area. The logger units were fitted with GSM cards to allow remote access to the data, which was downloaded regularly to a central server. The tiltmeters were set up with an automated alarm system to alert wind farm technical representatives of incidents of peat movement that exceeded pre-defined limits for rapid response.

Geotechnical Supervision and Certification

The level of geotechnical supervision for the civil works contract was significantly increased for the second phase of construction on the site in 2004/2005.

AGL Consulting were appointed by the main contractor Ascon Ltd. (now BAM Civil) to provide geotechnical analysis, design, supervision and inspection services for the project from October 2003 and the end of the civil works in 2005. The scope of services included:

- An assessment of the peat slide, including walkover surveys, specialised sampling and testing of the peat, stability analyses and computer modelling.
- Specification, supervision and reporting of supplemental geotechnical investigations on the site.
- Slope stability analyses for all of the floating roads.
- Identification and assessment of suitable peat repository sites.
- Inspection of full-scale load testing on the floating roads.
- Assessment and monitoring of the impact of blast-induced vibrations on peat.
- Periodic site inspections and attendance at progress meetings by a Geotechnical Director.
- Full-time on call office-based technical support.
- Review and certification of the Contractor's Method Statements.

Engineers from ESB International had a full-time presence on site to supervise the civil works, manage the Permit to Work scheme, and coordinate with the mechanical/electrical sub-contractors. Geotechnical engineers from ESBI also carried out extensive supplemental ground investigations to establish the depth and strength of the peat across the site to assess the potential impact of tree felling

operations on peat stability. They also carried out site inspections, reviewed Contractor's design submittals and attended project meetings.

Applied Ground Engineering Consultants (AGEC) provided geotechnical services to ESBI between October 2003 and the end of the civil works contract in 2005 including:

- An appraisal of site stability after the peat slide, with detailed walkover surveys, supplemental ground investigations (peat probing and in-situ vane shear testing), and slope stability analyses.
- Review of technical submittals from the Contractor, including certified method statements and reports for additional geotechnical investigations, site stability analyses, and in-situ testing.
- Periodic site inspections and attendance at project meetings.

Supplemental Geotechnical Investigations

As summarised in Section 8.3.1.2, comprehensive supplemental geotechnical investigations were carried out after the peat slide in October 2003 to characterise the depth and material characteristics of the peat, glacial till and bedrock across the site, as well as the groundwater levels in the peat. In general, the scope of the supplemental investigations included:

- A desk study review of aerial photography – including 3D stereoscopic imaging.
- Detailed walkover surveys and inspections by suitably qualified and experienced geotechnical engineers.
- Aerial LiDAR surveys, satellite GPS surveys, and in-situ slope angle measurements with a hand-held Abney Level to characterise the site topography.
- Extensive peat probing, in-situ vane shear testing, undisturbed sampling and specialised laboratory testing to characterise the depth, strength and material characteristics of the peat.
- Rotary coring at the remaining turbine foundations to determine the strength of the cohesive glacial till overburden below the peat and the depth to competent rock.
- Installation of manual and electronic piezometers in the peat to monitor groundwater levels.

Analysis and Testing of the Floating Roads

The mitigation measures for the floating roads on the peat consisted of:

- Supplemental investigations.
- Stability analyses.
- Full-scale serviceability and proof load tests on the working roads.
- A trial load test on a test section of floating road.
- Remedial works to improve the performance of sections of the floating roads.
- Site controls.
- Modifications to the site access tracks in the vicinity of the slide.

Supplemental investigations comprised of peat probes, in-situ vane shear tests and slope angle measurements were carried out at regular intervals along the floating roads to characterise the depth, strength and material characteristics of the peat, and the topography of the slope. At 1 No. location near Turbine T55, vane shear tests were carried out in the peat under a section of floating road to confirm that the strength of peat had increased as it consolidated under the weight of the road.

Slope stability analyses were carried out at representative profiles along the roads using the Slope/W computer software to demonstrate that there was an acceptable margin of safety against shear failure

in the peat under the self-weight of the roads and the design live load surcharge from the construction traffic in accordance with IS EN 1997-1:Eurocode 7 for Geotechnical Design, Part 1– General Rules.

Full-scale serviceability and proof load tests were carried out on all of the floating roads to confirm their capacity and performance under the design live load surcharges prior to resuming construction on the site. Initially the tests were carried out by incrementally increasing the load on the floating roads with a standard 4-axle tipper truck to model the maximum construction traffic load for the completion of the access tracks, turbine foundations and crane hardstanding areas (37.5 tonnes). Prior to the transportation, assembly and erection of the turbines the roads were tested again with 2 No. fully-loaded 4-axle tipper trucks travelling back to back to simulate the design live load surcharge from the largest mobile crane that was used to erect the turbines (72 tonnes). Prior to bringing the heavy step-up transformer to the substation a full-scale proof load test was carried out on a trial section of floating road on very soft peat along the access route to the substation to validate the method of in-situ testing and stability analyses so that the site access tracks along the route to the substation could be certified for the full 130 tonne combined load of the transformer and low-loader transporter.

Remedial works were carried out on sections of the floating roads that performed poorly under the initial load tests with the 4-axle trucks, i.e. where visual observations and measurements identified that there were excessive concentrated deflections under the wheel and axle loads from the fully loaded truck. The remedial works involved re-surfacing the roads with an additional layer of geogrid and a 150 mm capping layer of crushed rock granular fill. All of the re-surfaced roads were retested to verify their load capacity, and to confirm that the additional geogrid reinforcement and capping layer effectively spread out the concentrated axle loads across the surface of the peat to significantly reduce the deflections under the concentrated wheel and axle loads.

Site controls were implemented for the use of the floating roads during the second phase of construction, i.e.:

- All of the roads had to be certified for use by AGL Consulting for the Permit to Work protocols based on the results of the additional investigations, stability analyses and full-scale serviceability and proof load tests.
- All of the construction vehicles were driven slowly and steadily across the floating roads within the specified site speed limit of 10 mph.
- The size and weight of the construction vehicles using the floating roads was not permitted to exceed the design surcharge load from the mobile crane that was used to erect the turbines, or from the low-loader transporter that was used to bring the step-up transformer to the substation.
- The cranes were stripped of any unnecessary ballast when travelling across the floating roads to the turbine sites.
- The mobile cranes and large low-loader transporters were transported across the site under the direct supervision of site personnel using the shortest and most direct route possible.
- The cranes were not stopped on the floating roads. All intermediate stopping points were on crane hardstandings adjacent to turbines.
- Where necessary, steel plates were placed along on the edges of the floating roads to facilitate access around tight bends where there was a risk of excessive deflection and overturning on a soft verge.

Modifications to the site access tracks in the vicinity of the slide:

A 30 m long section of the floating road at Turbine T68, and a 105 m long section of the floating road to the west of Turbine T70 had to be reconstructed because they were damaged in the peat slide on October 2003. These sections of the site access tracks were reconstructed as rockfill embankments on competent glacial till below the disturbed peat. The roads performed a dual function of reinstating the site access tracks that had been damaged in the slide, and acting as a

permeable barrage across the slide area to contain the disturbed peat upslope from the embankments while allowing free drainage of groundwater through the rockfill.

As a further risk mitigation measure in this area, Turbine T16 and a 475 m long section of floating road between Turbines T15 and T17 were omitted from the scope of work on the project as a precautionary measure out of concerns for site stability in the area, which was close to where the peat slide occurred in October 2003 and had similar topography and ground/groundwater conditions. The sections of partially completed floating roads that had been constructed between T15 and T17 at the time of the slide were closed and abandoned.

Assessment of the Excavations for the Turbine Foundations & Crane Hardstandings

The mitigation measures for the excavation of the turbine foundations and crane hardstanding areas consisted of:

- Supplemental investigations.
- Stabilisation measures and temporary works designs for the side slopes around the perimeter of the excavations.
- Review and certification of the Contractor's Method Statements.

Supplemental investigations were carried out at the remaining turbine foundations and crane hardstanding areas in advance of excavation. They were comprised of peat probes and vane shear tests in the peat, with rotary coreholes at the majority of the remaining turbine foundations. The peat probes were used to determine the depth and volume of peat that needed to be excavated and disposed of on site, while the vane shear tests measured the undrained shear strength of the peat to assess the stability of the excavation side slopes and the requirements for temporary support. The rotary coreholes at the turbine foundations were used to determine the depth of excavation to suitable formation on competent rock. Standard Penetration Tests (SPT) were carried out in the overlying cohesive glacial till to determine the undrained shear strength of the till to assess the stability of the temporary excavation slopes.

Stabilisation measures: Wherever possible the sides of the temporary excavations were battered back to stable slopes of about 1V:1H (=45 degrees) or flatter. Side slopes in stiff glacial till and weathered rock were increased to 2V:1H (=63.4 degrees) or steeper to minimize the extent of the excavation. In areas relatively deep (>2.5 - 3.0 m), weak peat in poorly drained areas with a high water table a rockfill berm was constructed down to mineral soil around the perimeter of the excavation to provide temporary support to the peat during construction.

Review and Certification of the Contractor's Method Statements: Method statements were produced by the Contractor for each turbine to detail the following:

- The depth of peat and the depth to formation for the foundations on rock.
- Drainage requirements.
- The method of excavation and temporary support requirements for the side slopes.
- The plant requirements for the handling and transporting of peat.
- The location of the approved repository site for the peat.
- Traffic management plan with the proposed haul routes.
- Risk assessment and health and safety considerations.

The method statements were reviewed by AGL Consulting prior to works commencing on site and a Geotechnical Approval Certificate was signed by a Geotechnical Director as part of the Permit to Work system.

Spoil Management & Disposal – Peat Repository Sites

After the peat slide strict controls were placed on the disposal of peat and glacial till excavated from the turbine foundations, crane hardstanding areas, substation site, borrow pits and anemometer masts. The heavier glacial till was segregated from the peat and stored in the borrow pits so that it was not placed on the intact peat slopes. The majority of the excavated peat was stored to a maximum depth of 1.0 m in designated repository areas on the intact peat slopes in suitable areas of flat or gently sloping ground on the site. A small volume of the peat was stored within rockfill bunds in Borrow Pits BP-2 and BP-3.

The additional mitigation measures that were implemented for the peat repository sites on the slopes included:

- Desk studies and walkover surveys.
- Supplemental investigations.
- Stability analyses.
- Geotechnical certification.
- Site control measures.

Desk studies and walkover surveys: A comprehensive desk study was carried out to identify suitable peat repository areas on the site. Topographical maps, aerial photographs and 3D stereoscopic imaging of 1970s black and white aerial photographs of the site were used to locate areas of gently sloping ground (≤3°) set back >25 m from any defined or steep convex break in slope and outside the influence of the main hydrological features. Detailed walkover surveys were then carried out by geotechnical engineers from AGL Consulting to confirm which areas were suitable for further consideration.

Supplemental investigations comprised of peat probes and slope angle measurements to define the peat depth and topography on a 25 m grid within the plan area of each peat repository site with additional peat probes 50 and 100 m downslope from the sites on two orthogonal planes. In-site vane shear tests were used to measure the undrained shear strength of the peat and undisturbed sampling was carried out to inspect the material characteristics of the peat at the interface with the underlying glacial till.

Slope stability analyses were carried out for representative profiles within the repository sites using the Slope/W computer software to demonstrate that there was an acceptable margin of safety against a planar shear failure in the intact peat under the surcharge of 1.0 m of excavated peat in accordance with IS EN 1997-1:Eurocode 7 for Geotechnical Design, Part 1 – General Rules.

Geotechnical Certification: For the Permit to Work system a Geotechnical Approval Certificate was signed by a Geotechnical Director for AGL Consulting for each repository site that was confirmed to be suitable based on the supplemental investigations and stability analyses.

Site controls were implemented on site for the use of the peat repository areas, i.e.:

- The boundaries of the approved repository sites were clearly marked out on site with survey tape between probe locations.
- The depth of excavated peat that was placed in the site was strictly limited to 1.0 m and no temporary stockpiling was permitted on the peat slopes.
- "Floating" depth markers were set up within the repository sites to control the depth of peat placed on the slopes. These were wooden stakes that were embedded in the peat so that they could settle with the peat as it compressed under the weight of the additional material that was placed on the slopes.
- The live load surcharge on the peat slopes was minimised using a combination of long reach excavators operating on the access tracks, and LGBP (low ground-bearing pressure) wide-tracked excavators on the peat.

- Geotechnical engineers from AGL Consulting carried out periodic inspections of the works to ensure that they complied with the method statements and specified risk mitigation measures.

Tree Felling

The following monitoring and risk mitigation measures were implemented for the felling of the trees that were remaining on the site after the slide:

- Extensive geotechnical investigations comprised of peat depth probes, in-situ vane shear tests, slope angle measurements, piezometers and undisturbed gouge auger core sampling were carried out across the site by ESB International to assess the stability of the peat on the site for the tree felling operations.
- Site stability analyses were carried out in order to inform the appropriate felling methodology for various areas across the site.
- The trees were left in place in areas that were considered unsuitable for the mechanical harvesting and forwarding equipment.
- Where clear felling was permitted the works were carried out by experienced specialist subcontractors under the management of Coillte.
- The trees were felled and gathered using specialised equipment that has been widely used in commercial conifer forests on upland blanket bogs in Ireland.
- In areas of soft peat, the contractors placed timber brash and branches under the harvester tracks to spread out the concentrated live load surcharge on the surface of the peat.
- Where the trees were too small for the harvesting machinery, the trees were felled by hand. Some of the larger trees in these areas were felled with a light machine harvester, formed into windrows and left in place on the slopes.

Rock Blasting in Borrow Pit No.3

Blasting was carried out in Borrow Pit No.3 (BP3) to extract the rock that was processed into granular fill for the construction of the floating roads, and the hardstanding areas for the crane pads, substation and anemometer masts. The following monitoring and mitigation measures were implemented to confirm that the large peat slide that occurred in 2003 was outside the range of the blast-induced vibrations from the borrow pit, and that the peak particle velocity and acceleration of the vibrations were within acceptable limits:

- The blasting was carried out by a suitably qualified fully licensed professional.
- The pattern, sequence, timing and maximum instantaneous charge of the blasts were designed to minimise blast-induced vibrations on the slopes around the perimeter of the borrow pit.
- Vibration monitoring was carried out on the site for the blasts.
- AGL Consulting carried out a comprehensive review of the blast monitoring records to establish threshold limits for the Peak Particle Velocity (PPV) and Peak Particle Acceleration (PPA) of the blast-induced vibrations, and to establish the radius of impact for the blasting.
- Glacial till excavated from the site was used to construct a berm along the face of the peat at the top of the rock slope around the perimeter of the borrow pit to act as a shear key to prevent a localised peat slide inundating the pit where the surrounding slopes were sloping down towards the pit.

Drainage

The following risk mitigation measures were also implemented for the drainage works:

- Wherever possible, minor drainage works were carried out by hand to avoid machine or equipment loading on the peat.
- Where mechanical excavators were required the works were carried out using wide-tracked LGBP 10-13 tonne excavators suitable for working directly on the peat.
- The peat excavated from the trenches was sidecast on the adjacent intact peat slopes and spread out to depths typically <0.5 m.
- Where large culverts were constructed at road crossings over the main watercourses on the site all of the peat was excavated out from under the culverts and granular surround to avoid surcharge loading on the peat.

Cable Trenching & Ducting

The following risk mitigation measures were implemented for the cable trenching and ducting:

- The alignment of the cable trenches were designed to follow the shortest, most direct route across the site to the control building with the minimum number of road crossings.
- Most of the cable trenches were aligned alongside the site access tracks so that the cable spools could be transported along the floating roads, minimising construction traffic on the intact peat slopes.
- The cable trenches in the peat were excavated using wide-tracked LGBP 10-13 tonne excavators suitable for working directly on the peat.
- To minimise the impact of the road crossings on the floating roads the new ducts were pushed horizontally through the peat under the roads to avoid having to open up a trench across the road, which would cut through the geogrid reinforcement.
- The works were carried out by specialist sub-contractors who were experienced with similar work for wind farms on upland blanket bogs in Ireland.

8.6.2.3 Wind Farm Site: Operation & Maintenance Phase (2006-2022)

The activities that were carried out on the site during this period that had an impact on soils, geology and land with significant effects included the following:

- Maintenance/Repair of Turbines.
- Maintenance/Repair of Substation & Control Building.
- Maintenance/Repair of Access Tracks.
- Cables & Ducting Improvements.
- Drainage Improvements.
- Forestry – Tree Topping/Log Stockpiling.
- Remedial works to right a crane that went off the narrow turbary road.

AGL Report No. 11-147B-R04 – "*Geotechnical Stability Report & Assessment of Site Stability Impacts on Soils, Geology and Land*" in **Appendix 8-2** of this Chapter gives a detailed assessment of the mitigation measures that were implemented on site for this phase of the wind farm. There were no changes to the design of the wind farm. Therefore, this section presents a summary of the measures that were implemented to mitigate stability impacts on soils, geology and land, i.e. to reduce the risk of a peat slide.

8.6.2.3.1 Mitigation of Stability Impacts

The drainage improvements had a permanent and sustained ***positive*** impact on the peat that had a **Moderately Significant** effect on peat stability relative to the baseline conditions on site in 1998, prior to construction.

The adverse impacts of site activities that had a **Slightly Significant** effect on the peat with respect to site stability were:

- The additional dead load surcharge on the 4.5 km of floating roads that were upgraded in 2014 with an additional 150 mm of crushed rock capping material and a nominal 10 mm thick surfacing layer of fine gravel.
- The live load surcharge on the floating roads from the general maintenance and repair vehicles, and from the large mobile cranes that were occasionally required to carry out repairs to the turbines.
- The occasional live load surcharge on the intact peat slopes from low ground bearing pressure equipment that was required for tree topping, to install the new cable ducts and to carry out improvements to the drainage network.
- The one-off temporary live load surcharge of 10 kN/m^2 on the peat slope at Turbine T40, where the 250 tonne mobile crane overturned when travelling along the floating road.

The following is a summary of the monitoring and mitigation measures that were implemented on the Project to mitigate the effect of the stability impacts on soils, geology and land.

Instrumentation and Monitoring

Between 2006 and 2012 ESBI continued to monitor groundwater levels and movement in the peat at the clusters of electronic piezometers and tiltmeters installed near Turbines T2, T18, T34 and T49/50.

The instruments were decommissioned in 2014 as some of them showed signs of malfunction. It was considered that they had been in place for a sufficient period of time to ensure that they were exposed to a range of environmental conditions on the site, and they did not indicate any evidence of peat instability.

In May 2005, 7 No. monitoring points were established on the peat within the slide area for long-term monitoring of movement and settlement of the disturbed peat. The ITM coordinates and level of the monitoring points were recorded periodically by GPS surveys between 2005 and 2020.

Geotechnical Supervision and Inspections

Gort Windfarms Ltd. (GWL) appointed a site manager who was responsible for coordinating and managing the operation of the wind farm and the maintenance of the turbines and site infrastructure. His responsibilities included regular site inspections and managing health and safety for the operation and maintenance of the wind farm, including co-ordinating and supervising access to the turbines for the large mobile cranes.

ESBI engineers carried out regular periodic geotechnical inspections of the site between 2005 and 2020 to assess maintenance requirements for short and long-term stability. The majority of the recommendations in the reports relate to maintenance works on the site access roads and site drainage which were incorporated into the maintenance programme for the site.

AGL Consulting were appointed by ESB International to provide geotechnical support services periodically over the operation and maintenance phase of the project between 2011 and 2020, including:

- Site inspections and walkover surveys by Senior Geotechnical Engineers and Geotechnical Directors (2011, 2014 & 2018).
- Inspection and certification of full-scale proof load tests on the floating roads in 2011, 2014 and 2018.
- Geotechnical analysis and design services for the upgrade of the floating roads in 2014, including a site-wide Peat Stability Risk Assessment.
- Site supervision and office-based technical support services during construction stage of the 2014 civil contract to upgrade the floating roads, including a review and certification of the Contractor's Method Statements.

Maintenance and Repair of the Site Access Tracks

The following design, construction & operational risk mitigation measures were implemented for the main roads upgrade contract in 2014, which accounts for the majority of the works that were carried out on the floating roads on the site between 2006 and 2020.

- In 2011 all of the site access tracks were inspected by a geotechnical engineer from AGL Consulting and full-scale proof load tests were carried out on the floating roads to assess the nature and extent of the upgrade works that would be required, and to verify the capacity and stability of the floating roads under the design crane load prior to designing the upgrade works.
- For continuity of geotechnical risk management, the geotechnical engineer for AGL Consulting who carried out the 2011 inspections and the design for the 2014 upgrade works was the same person who evaluated the design and stability of the roads for the Contractor after the peat slide during the construction stage of the project in 2003/2004 – Mr. Conor O'Donnell.
- To minimise the additional load on the peat where the floating roads were upgraded:
- The roads were reinforced with an additional layer of geogrid to reduce the thickness of granular capping material required;
    - The thickness of the capping material was limited to 150 mm; and
    - The coarse granular capping material was surfaced with a nominal 20 mm thick blinding layer of fine gravel in lieu of a thicker layer of granular subbase material (Clause 804) that would normally be used.
- The additional dead load on the floating roads was designed to be within the factor applied to the live load surcharge in the stability analyses [i.e. <30% of characteristic (unfactored) live load surcharge].
- Stability analyses were carried out to demonstrate that the additional load had only a minor impact on the factor of safety against bearing capacity or shear failure in the peat under the roads, and that the difference (<5-10%) was proportional to the increase in undrained shear strength that would have already occurred in the underlying peat as it consolidated (compressed) under the weight of the roads since they were constructed in 2003-2005;
- The construction stage traffic and live load surcharges were also restricted so that the combination of the temporary live load surcharge and the increased dead load on the road did not exceed the design live load surcharge for the floating roads.
- A Peat Stability Risk Assessment (PSRA) was carried out in advance of construction in accordance with industry best practice guidelines to characterise the risk of peat instability across the site during the 2014 road upgrade works.
- Construction stage risk mitigation measures were incorporated into the Geotechnical Risk Register for the works on site, including:
    - Designated access routes for construction plant and machinery.
    - Limits on the maximum size of plant that could be used on the roads, particularly in areas where there was a higher risk of peat instability.

- A requirement to stockpiling granular fill materials in the crane hardstanding areas to avoid concentrated loading on the floating roads.
- Restrictions on the way in which the fill was tipped and spread on the roads to minimise dynamic impact loads and to avoid concentrated static loads from temporary piles of rockfill that exceeded the design surcharge load of the road.
- Compaction by static rolling only.

- During construction full-time supervision of the works was carried out jointly by geotechnical engineers from AGL Consulting and ESB International to ensure that the works complied with the specification and that the specified risk mitigation measures were implemented on site.
- A certification procedure was implemented for the review and approval of the Contractor's method statements to certify that reasonable skill and care was taken in ensuring that appropriate measures were implemented to mitigate against the risk of peat instability during construction. The Geotechnical Approval Certificates were issued by AGL Consulting and signed by a Director of the company.
- On completion of the works, full scale proof load tests were successfully carried out on the upgraded roads, to verify the capacity of the roads under the design crane load using a mobile crane loaded with additional ballast.

Maintenance/repair of turbines

The following design, construction & operational risk mitigation measures were implemented for the maintenance and repair of the turbines on the site:

- All heavy lifting operations involving mobile cranes were carried out from the hardstanding areas adjacent to the turbines so that the loads were adequately supported on the glacial till and rock below the peat.
- Steel bearing plates were used to reduce the bearing pressure under the crane outrigger pads to prevent any localised bearing failure on the hardstanding areas.
- The capacity of the floating roads to support the design load for the mobile cranes carrying out maintenance at the turbines was verified by full-scale proof loading at the end of the construction period in 2005, after the roads were upgraded in 2014, and again in 2018, when the narrow turbary road was also re-tested.
- The comprehensive upgrade programme that was carried out on the floating roads in 2014 improved the condition and performance of the sections of roads that had deteriorated significantly since they were constructed in 2005.
- The number of crane mobilisations to site during the operation and maintenance period between October 2005 and Q2 2020 was minimised by combining maintenance work on turbines, wherever possible.
- The smallest size and of mobile crane with sufficient capacity for the required maintenance lifting loads was mobilised to the site; for example, based on an audit of crane movements between 2005 and 2018, which is representative of the typical operations on site to date:
- Approximately 80% of the 86 No. crane operations on the site were carried out using a 100-tonne crane (e.g. the Liebherr LTM 1100-5.2 which is 2.75 m wide and has a total travelling weight of 60 tonnes on 5 axles, with a maximum axle load of 12 tonnes/axle).
- All but one of the remaining operations were carried out using a 130-tonne crane (e.g. the Liebherr LTM 1130-5.1 which is also 2.75 m wide and has a total travelling weight of 60 tonnes on 5 axles, with a maximum axle load of 12 tonnes/axle).
- 1 No. operation at Turbine T17 in July 2018 required the larger 200 tonne Liebherr LTM 1200-5.1 mobile crane, which is 3.0 m wide and has a total travelling weight of 60 tonnes on 5 axles, with a maximum axle load of 12 tonnes/axle.

- In comparison, the design crane load for the floating roads is the 300 tonne Grove GMK6300 All-Terrain crane, which is 3.0 m wide and has a total travelling weight of 72 tonnes on 6 axles with a maximum axle load of 12 tonnes/axle.
- All of the cranes were stripped of any unnecessary additional ballast when travelling across the floating roads to the turbine sites.
- The cranes were transported across the site under the direct supervision of the ESB site maintenance manager.
- The cranes were driven directly to the required turbine using the shortest route across the floating roads, avoiding unnecessary turns at tight junctions where there was a risk of going off the road, or sections of floating roads that were in poor condition prior to the 2014 roads upgrade programme.
- The mobile cranes were driven slowly and steadily across the floating roads within the specified site speed limit of 5 km/hr. All intermediate stopping points were on crane hardstandings adjacent to turbines, not on the roads.
- Where necessary, steel plates were placed along on the edges of the floating roads to facilitate access around tight bends where there was a risk of excessive deflection on a soft verge.
- Strict restrictions were placed on access for cranes along the narrow 3.0-3.5 m wide turbary road between Turbines T25 and T45.

Maintenance/repair of Derrybrien substation and control building

The following design, construction & operational risk mitigation measures were implemented for the maintenance and repair of the substation and control building:

- All maintenance operations were carried out from the hardstanding area around the substation and control building which was designed to support the loads from the vehicles and equipment on the glacial till below the peat.
- All of the vehicles and equipment were driven directly to the substation site across the minimum length of floating road.
- The dead weight and axle loads of the vehicles and equipment was kept to a minimum and the loads were within the design crane load that was verified by the proof load tests that were carried out on the floating roads.
- Trucks that were used to bring materials or large equipment such to the substation were escorted along the roads by the ESB site maintenance manager.
- The vehicles were driven slowly and steadily across the floating roads within the specified site speed limit of 15 km/hr.

Drainage Improvements

The primary adverse impact of the drainage improvements was the occasional localised temporary loading on the peat slopes by mechanical excavators used to clear out, deepen or realign existing drains. The following risk mitigation measures were implemented to mitigate the effect of the loading on the stability of the peat:

- Wherever possible, minor maintenance works and drain clearing was carried out by hand to avoid machine or equipment loading on the peat.
- Where mechanical excavators were required the works were carried out using wide-tracked low ground bearing pressure 10-13 tonne excavators suitable for working directly on the peat.
- Where significant excavations were required the excavated peat and mineral soil was removed to a secure material disposal area to avoid side-casting the material on the peat adjacent to the drain.

- Where culverts were widened at road crossings all of the peat was excavated out from under the rockfill used to widen the road to avoid surcharge loading on the peat.
- The inspections used to assess the requirements for maintenance and improvement works to the drainage network were typically carried out over the wetter months in winter or early spring when groundwater levels on the site were higher and drainage issues would have been more apparent.
- The drainage improvement works were prioritised so that:
    - Only priority work to improve the drainage at the turbine foundations was carried out urgently in the winter or early spring.
    - All other general maintenance and drainage improvement works on the site were carried out during the drier summer months when there would be a lower risk of peat instability on the site.

Poor drainage is a recognised contributory risk factor for peat slides. Therefore, as such, the drainage improvement would in itself be a significant risk mitigation measure for site stability during the operation and maintenance of the wind farm.

Cable Ducting

The main work that was carried out on the cables and ducting on the site of the wind farm between October 2005 and Q2 2020 was the installation of the new ducting and fibre-optic cables for the upgrade of the turbine control systems in September 2017. The following risk mitigation measures were implemented for the works:

- The length of new cable ducts that had to be installed on the site was minimised by optimising the layout of the ducts to combine clusters of fibre-optic cables on different circuits into the same duct. In this way it was possible to reduce the total length of new ducts to 2.55 km to house 7.6 km of fibre-optic cables.
- The alignment of each of the ducts follows the shortest, most direct route across the site to the control building and the number of road crossings was minimised.
- The ducts were installed using a mole-plough capable of installing the ducts directly into the peat without the need for open-trench excavation and backfilling.
- The mole-plough was a low ground-bearing tracked machine suitable for working directly on the peat.
- To minimise the impact of the road crossings on the floating roads the new ducts were pushed horizontally through the peat under the roads to avoid having to open up a trench across the road, which would cut through the geogrid reinforcement.
- The manholes were constructed on the glacial till below the peat to avoid any loading on the peat.
- The works were carried out by personnel that were experienced with similar work for wind farms on upland peat bogs in Ireland.

Forestry – Tree Topping

No commercial forestry planting or felling was permitted on the wind farm site during the operation and maintenance period between October 2005 and Q2 2020.

In September/October 2018, tree topping was carried out for a distance of 10 m either side of the access track in selected areas around the site. The following risk mitigation measures were implemented for the works:

- The tree-topping works were limited to clearing small trees (typically conifers <4-5 m high) and shrubs that had re-grown naturally within areas that had been cleared during the construction of the wind farm.

- The tree topping was carried out using a light 10 tonne wide-tracked excavator with a saw head attachment, which is a specialist low-ground bearing pressure forestry machine suitable for working directly on the peat.
- All of the trimmed vegetation was cut and left in place on the peat slopes with no additional handling, which minimises machine movements and loading on the peat.
- The works were carried out at the end of the drier summer months when the risk of peat instability on the site is lower.
- The tree topping works were scheduled on a priority basis as part of a multi-year annual maintenance plan under the supervision of the ESB site maintenance manager. No unscheduled works were carried out.

Forestry – Timber Stockpiling

In the 2017, Geotechnical Inspection Report by ESBI it was noted that stockpiles of timber that had been felled outside the wind farm site had been stockpiled on the peat near Turbine T6. Therefore, the following measures were implemented to mitigate the impact of the live load surcharge on the peat:

- The timber stockpile was removed shortly after it had been reported.
- No further timber stockpiling was permitted on the site.

Significant Cumulative Impacts Due to Peat Extraction in Turbary Plots Within & Immediately Adjacent to the Wind Farm Site

Remedial measures and monitoring associated with this phase of the project relating to peat extraction in the turbary plots within and immediately adjacent to the wind farm site are presented in Section 8.5.5.6.

8.6.2.4 Wind Farm Site: Ceased Operation Phase (2022-2024)

Following the decision by An Bord Pleanála to refuse substitute consent for the wind farm in February 2022 there have been no commercial operations at the wind farm. This has had significant mitigating effects on the impact of the wind farm on soils, geology and land, i.e.:

- The turbines were turned off to cease electricity generation and the blades were feathered to the wind to reduce the wind loads on the turbines .
- Only essential maintenance has been carried out on the turbines with minimal loading from mobile cranes, trucks or commercial vehicles on the floating roads.
- No other wind farm related activities have been carried out on the site.

8.6.2.5 Wind Farm Site: Decommissioning Phase

The site activities that are likely be carried out on the site during decommissioning of the wind farm that could have an impact on soils, geology and land with significant effects include the following:

- De-energising the site by initially disconnecting the high voltage (HV) lines at the substation, followed by low voltage (LV) disconnection at each of the turbines as well as the 110kV OHL for the grid connection.
- Temporary widening of the narrow sections of the site access tracks in the turbary area and at selected junctions to provide safe access for mobile cranes to the turbines.

- Controlled dismantling of the turbine blades, nacelle and masts. The decommissioned components will be removed from the site for re-cycling, disposal or re-use elsewhere.
- Removal of the sub-station and associated buildings-including removal of all the electrical transmission components, capacitors, transformer, concrete plinths and control building.
- Controlled dismantling and removal of the steel lattice tower and timber twin polesets for the 110kV Overhead Line (OHL).
- Dismantling of the steel lattice towers for the anemometers.

This is based on the proposed decommissioning plan for the project, which will involve removing all of the above ground elements of the turbines, substation, anemometers and transmission line structures. The turbine foundations and granular hardstanding areas for the cranes, substation, site compound and anemometer masts will be left in place along with the de-energised and disconnected LV electrical cables and fibre-optic cables that are direct-buried in the peat between the turbines and in ducts below the roads. The construction phase peat repository sites, material sidecast areas and borrow pits will also be left in place in their current condition, along with the improved site drainage network.

8.6.2.5.1 *Mitigation of Stability Impacts*

Section 8.6.2.2 and Section 8.6.2.3 outline the mitigation measures that were implemented during the construction stage of the project and during the operation and maintenance phase of the wind farm up to the end of Q2 2022 to mitigate the impact of site activities at the turbines, substation and along cable trenches. These measures have been incorporated into the standard operating procedures for maintenance works on the wind farm site and will continue to be applied for activities that have a comparable impact during decommissioning of the wind farm (i.e. for dismantling/demolition vs assembly/construction/maintenance of turbines and substation, and for construction traffic loading on floating roads and on intact peat slopes). Therefore, none of the activities will have a direct impact or stability impact that will have a **Significant** or **Moderately Significant** effect on the receiving soils, geology and land.

The impacts of site activities during decommissioning that could have a **Slightly Significant** effect on the peat with respect to site stability are limited to:

- The heavy live load surcharge on the floating roads from the mobile cranes and low-loader transporters that will be used to dismantle the turbines, substation and anemometers and to transport the components offsite.
- Additional loading on the peat where the crane hardstanding needs to be temporarily extended (T4) or where sections of the existing site access tracks need to be temporarily widened at junctions near Turbines T68, T14 and T1, and along narrow sections of track at the east end of the turbary area between Turbines T35 and T45, and between T43 and T46.
- The live load surcharge on the peat from the low ground bearing pressure (LGBP) wide-tracked excavators and ATV that will be used to take down & remove timber polesets PS-1a to PS-4 for the 110kV OHL.

Therefore, in addition to the standard operation procedures that are already being implemented on the site, the following additional mitigation measures will be implemented during decommissioning to mitigate the effect of the impacts on soils, geology and land:

- The carriageway requirements for the large mobile crane that will be used to dismantle the turbines will be reviewed in advance of the works and the road will be widened, where necessary, to prevent the crane going off the road.

- Where it is necessary to widen the narrow road at junctions near Turbines T68, T14 and T1, and along narrow sections of road at the east end of the turbary area between Turbines T35 and T45, and between T43 and T46:
    - Detailed design of the widened road will be carried out by a suitably qualified geotechnical engineer.
- Additional site investigations will be carried out, where necessary, to characterise the depth and strength of the peat and the composition of the existing floating road.
- Stability analyses will be carried out in advance of the works on site to confirm that the stability of the widened road is acceptable in accordance with IS EN 1997-1: Eurocode 7 for Geotechnical Design, Part 1 – General Rules.
    - The works on site will be supervised by a suitably qualified geotechnical engineer on behalf of Gort Windfarms Ltd.
- The size, weight and axle load of the large mobile crane that will be used to dismantle the turbines shall not exceed the design load for the floating roads (i.e. the 300 tonne Grove GMK6300 all-terrain mobile crane with a travelling weight of 72 tonnes on 6 axles – max 12 tonnes/axle).
- The size, weight and axle load of the low-loader transporter used to transport the transformer off the site shall not exceed the load of the vehicle that was used to bring the transformer to the substation site during construction (i.e. a total combined load of 130 tonnes over 28.5 m x 3.0 m area with 12 axles and a maximum axle load of 12 tonnes).
- The equipment used to take down & remove timber polesets PS-1a to PS-4 for the 110kV OHL will be limited to LGBP wide-tracked excavators, ATV or forestry forwarders suitable for working on the peat.
- If possible, it will be agreed with the turbary rights holders not to carry out any mechanical peat harvesting during decommissioning.
- The decommissioning works will be supervised by a suitably qualified engineer from ESB Engineering and Major Projects.
- A permit to work scheme will be implemented on the site for the works.
- The Contractor's method statements will be reviewed and certified by a suitably qualified geotechnical engineer.

8.6.2.6 Wind Farm Site: Post-Decommissioning (The Retained Development)

After decommissioning of the wind farm has been completed there will be no more activity or works related to the wind farm on the site. The reinstated site with the Retained Development will be returned to the landowner and Gort Windfarms Ltd. will not have any involvement in future land use or site activities. Therefore, the primary mitigation measure that will be used to mitigate the post-decommissioning impact of the Retained Development is in the compilation and handover of the **Safety File** for the site to the landowner by Gort Windfarms Ltd.

Among other information, the Safety File for the site will include:

- Construction records from the decommissioning works to confirm compliance with the design and specifications for the works.
- Design and as-built construction details for all the elements of the windfarm that have been left in place after decommissioning (the Retained Development), including:
    - The reinforced concrete bases for the turbines and anemometer masts.
- All of the site access tracks including the floating roads on the peat.
- The crane hardstanding areas adjacent to the turbines.
    - The hardstanding area for the substation and control building.

- All of the de-energised and disconnected LV electrical cables and fibre-optic cables that are direct-buried in the peat between the turbines and in ducts below the roads.
- The construction phase peat repository sites and material sidecast areas.
- The construction phase borrow pits.
    - The site drainage network.
- Records of significant maintenance works that have been carried out on the retained elements of the project, including the 2014 upgrade of the floating roads and the 2017 fibre-optic upgrade of the turbine control systems.
- Reports on all the full-scale serviceability and proof load tests that have been carried out on the floating roads across the site, which includes the design criteria for the maximum axle loads and live load surcharges from the mobile cranes that govern the capacity of the roads.
- Records of all the site investigation works and in-situ tests that were carried out for the project during construction and over the operational and maintenance phase of the project.
- Results of stability analyses that have been carried out for the floating roads and peat repository sites.
- Geotechnical stability report for the wind farm site including the Peat Stability Risk Assessment (PSRA) for the site and design/construction mitigation measures that have been implemented to mitigate the risk of peat instability for the wind farm activities.
- Peat Stability Risk Assessment for the turbary area on the east side of the site, including mitigation measures that have been recommended to manage the risk of peat instability due to mechanical peat harvesting in that part of the site.

The Safety File will provide the landowner with all relevant information necessary to make informed decisions on the maintenance and safe use of the Retained Development post-decommissioning.

8.6.3 Remedial (Mitigation) Measures & Monitoring – Grid Connection

Remedial measure to mitigate or monitor significant effects of impacts on soils, geology and land are presented in this section of the Chapter for the following stages of the grid connection:

- Construction Stage – Prior to October 2003 Peat Slide.
- Construction Stage – 2nd Phase after October 2003 Peat Slide.
- Operation and Maintenance Phase (2006-2022).
- Ceased Operation Phase (2022-2024).
- Decommissioning Phase.
- Post-Decommissioning.

For clarity, "significant effects" in this context refers to all of the effects that have been assessed as ***slightly significant***, ***moderately significant*** or ***significant*** using the methodology described in Section 8.2.1 and the matrix in Figure 8-3.

None of the impacts on soils, geology and land for the wind farm project had effects that would be classified as ***very significant*** or ***profound***.

8.6.3.1 Grid Connection: Construction Phase (2003-2006)

The activities that were carried out on the wind farm site during this period that had an effect on soils, geology and land with significant effects included the following:

- Tree felling.
- Construction of temporary access tracks to poleset and mast locations.
- Construction of the twin polesets and masts for the overhead 110kv line.
- Deposition and storage of surplus excavated materials.
- Construction of the Agannygal substation and control building.
- Polesets and masts - ongoing loading.
- Upgrading of existing Coillte track to provide access to the Agannygal substation location.
- Construction of a new section of road at the entrance to Agannygal Substation.
- Ground lowering below the existing 400kV line.

8.6.3.1.1 Mitigation of Direct Effects

The site activities and direct effects that had a **Slightly Significant** effect were:

- Tree felling.
- Construction of temporary access tracks to poleset and mast locations.
- Construction of the twin polesets and masts for the overhead 110kv line.
- Deposition and storage of surplus excavated materials.
- Construction of the Agannygal substation and control building.
- Polesets and masts - ongoing loading.
- Ground lowering below the existing 400kV line.
- As discussed in Section 8.2.2.1, there is limited information on measures that were taken to mitigate the effect of direct impacts of the grid connection on soils, geology and land during the initial construction stage of the project, prior to the peat slide in October 2003.

8.6.3.1.2 Mitigation of Stability Impacts

None of the effects of the site activities had a **Significant** or **Moderately Significant** effect on the peat with respect to site stability.

The significance of the effect of the following primary work activities with regards to site stability during this period was **Slight**:

- Tree felling.
- Construction of temporary access tracks.
- Construction of the Agannygal substation and control building.
- Construction of the twin polesets and masts for the overhead 110kv line.
- Ongoing loading of competent ground at poleset locations.

Tree Felling

Tree felling works were carried out by experienced specialist subcontractors under the management of Coillte. The trees were felled and gathered using specialised forestry equipment comprised of a wide-tracked hydraulic excavator fitted with a harvesting attachment and 8-12 tonne rubber-tyred forwarders that have been widely used in commercial conifer forests on upland blanket bogs in Ireland.

In areas of soft peat the contractors placed timber brash and trimmed branches along the access routes of the harvesters and forwarders through the forest to spread out the concentrated live load surcharge under the tracks or tyres of the machines.

Site Access Track

In a single area of deep peat along the route of the OHL, a temporary floating access was constructed in order to provide access to AM38, around 600m north of the Agannygal substation. In this instance existing trees were felled and placed to form a 'floating road' mat of timber on the OHL corridor for access to the mast location. This mat of timber would spread the dead load of the road evenly over the surface of the intact peat.

For the remainder of the grid connection, access to the masts was from existing roads and forestry tracks. Construction for access to masts consisted of removal and disposal locally of peat (less than 1m typically) and tree stumps/brash to competent material to allow access for tracked excavators and dumpers and a rough terrain crane.

8.6.3.2 Grid Connection: Operation & Maintenance Phase (2006-2022)

The activities that were carried out on the site during this period that had an effect on soils, geology and land with significant effects included the following:

- Maintenance/Repair of Substation & Control Building.
- Forestry – Tree Topping.

8.6.3.2.1 *Mitigation of Stability Impacts*

The following is a summary of the monitoring and mitigation measures that were implemented on the Project to mitigate the effect of the stability impacts on soils, geology and land.

Maintenance/repair of Agannygal substation and control building

The following design, construction & operational risk mitigation measures were implemented for the maintenance and repair of the substation and control building:

- All maintenance operations were carried out from the hardstanding area around the substation and control building which was designed to support the loads from the vehicles and equipment on the glacial till below the peat.

Forestry – Tree Topping

In 2018 and 2019, tree topping was carried out along the route of the OHL to trim back some of the small trees that had re-established naturally on the slopes where clear felling had taken place. The following risk mitigation measures were implemented for the works:

- The tree-topping works were limited to clearing small trees (typically conifers <4-5 m high) and shrubs that had re-grown naturally within areas that had been cleared during the construction of the grid connection.
- The tree topping was carried out using a light 10 tonne wide-tracked excavator with a saw head attachment, which is a specialist low-ground bearing pressure forestry machine suitable for working directly on the peat.
- All of the trimmed vegetation was cut and left in place on the peat slopes with no additional handling, which minimises machine movements and loading on the peat.

8.6.3.3 Grid Connection: Ceased Operation Phase (2022-2024)

The activities that were carried out on the site during this period that had an impact on soils, geology and land with significant effects included the following:

- Maintenance/Repair of Substation & Control Building.

Maintenance/repair of Agannygal substation and control building

The following design, construction & operational risk mitigation measures were implemented for the maintenance and repair of the substation and control building:

- All maintenance operations were carried out from the hardstanding area around the substation and control building which was designed to support the loads from the vehicles and equipment on the glacial till below the peat.

8.6.3.4 Grid Connection: Decommissioning Phase

The site activities that are likely be carried out on the site during decommissioning of the wind farm that could have an effect on soils, geology and land with significant effects include the following:

- Removal of the sub-station and associated buildings-including removal of all the electrical transmission components, capacitors, transformer, concrete plinths, control building and foundations.
- Controlled dismantling and removal of the steel lattice tower and timber twin polesets for the 110kV Overhead Line (OHL).

This is based on the proposed decommissioning plan for the project, which will involve removing all of the above ground elements of the substation and transmission line structures.

8.6.3.4.1 *Mitigation of Stability Impacts*

None of the activities will have a direct effect or stability impact that will have a **Significant** or **Moderately Significant** effect on the receiving soils, geology and land.
The impacts of site activities during decommissioning that could have a Slightly Significant effect on the peat with respect to site stability are limited to:

- Forestry – Felling of regrowth.
- Removal of the Grid Connection Polesets (Deep Peat Area).

No additional mitigation measures are proposed for these activities outside of the procedures described in the Decommissioning Management Plan (**Appendix 4-1**).

8.6.3.5 Grid Connection Site: Post-Decommissioning (The Retained Development)

After decommissioning of the grid connection has been completed there will be no more activity or works related to the grid connection on the site. The reinstated site with the Retained Development will be returned to the landowner and Gort Windfarms Ltd. will not have any involvement in future land use or site activities. Therefore, the primary mitigation measure that will be used to mitigate the post-decommissioning impact of the Retained Development is in the compilation and handover of the **Safety File** for the site to the landowner by Gort Windfarms Ltd.

8.6.4 Remedial (Mitigation) Measures & Monitoring – Peat Slide and Response Works

Remedial measure to mitigate or monitor significant effects of impacts on soils, geology and land are presented in this section of the Chapter for the following stages of the wind farm project:

- Construction Stage – 2nd Phase after October 2003 Peat Slide.
- Operation and Maintenance Phase (2006-2022).
- Ceased Operation Phase (2022-2024).
- Decommissioning Phase.
- Post-Decommissioning.

8.6.4.1 Peat Slide and Response Works: Construction Phase (2003-2006) – After the October 2003 Peat Slide

The activities that were carried out on the wind farm site during this period that had an impact on soils, geology and land with significant effects included the following:

- Construction of floating access tracks to the location of Barrages 1 and 2.
- Construction of barrages to restrict the movement of slide material.
- Construction of peat repositories to store slide material.
- Construction traffic on intact peat.
- Construction of borrow pit adjacent to Barrage 1.

The majority of the mitigation measures related to stability impacts, i.e. to reduce the risk of a peat slide.

8.6.4.1.1 *Mitigation of Direct Impacts*

The site activities and corresponding direct effects that had a **Slightly Significant** effect on the soils, geology and land were:

- Construction of barrages to restrict the movement of slide material.
- Construction of Repositories to Store Slide Material.
- Construction traffic on intact peat.
- Construction of borrow pit adjacent to Barrage 1.

Each of the above activities were constructed in response to the peat slide.

Construction of Barrages to Restrict the Movement of Material

In order to restrict the movement of the slide material, which was essentially peat, a series of barrages were constructed. These were constructed between the wind farm project site boundary and downslope of the Flaggy Bridge on the R353 local road. The permanent barrages (1-4) comprised coarse rock fill which was placed onto competent ground.

8.6.4.1.2 *Mitigation of Stability Impacts*

The direct effect of the site activities that had a **Significant** effect on site stability was:

- Construction of floating access tracks to Barrages 1 and 2.

The site activities and direct impacts that had a **Slightly Significant** effect were:

- Construction of Barrages 1 to 4.
- Construction of Repositories to Store Slide Material.
- Construction traffic on intact peat.
- Construction of borrow pit adjacent to Barrage 1.

Construction of Floating access tracks to Barrages 1 and 2

An access track 830m in length was constructed from an existing Coillte forest track in order to access the location of barrage 1 and replace the Coillte access track removed by the slide. The access track comprised a western and eastern section. The access track to the west of barrage 1 was constructed as a floating track on peat. The eastern access track was founded on competent ground.

A floating access track 300m in length was constructed from an existing Coillte forest track in order to access the location of barrage 2. The floating access track was constructed on peat.

Both access tracks were designed to the appropriate standards and constructed using low pressure bearing pressure excavators when working on peat or were constructed from the existing section of track. Construction of these tracks was closely monitored to ensure that no peat stability issues arose.

Construction of Barrages to Restrict the Movement of Material

In order to restrict the movement of the slide material, which was essentially peat, a series of barrages were constructed. These were constructed between the wind farm project site boundary and downslope of the Flaggy Bridge on the R353 local road. The permanent barrages (1-4) comprised coarse rock fill which was placed onto competent ground, which avoided any loading of peat.

Construction of Repositories to Store Slide Material

The majority of the peat was stored to a maximum depth of 1.0 m in designated repository areas on the intact peat slopes in suitable areas of flat or gently sloping ground on the site.

Site controls were implemented on site for the use of the peat repository areas, i.e.:

- The boundaries of the approved repository sites were clearly marked out on site with survey tape between probe locations.
- The depth of excavated peat that was placed in the site was strictly limited to 1.0 m and no temporary stockpiling was permitted on the peat slopes.

Construction Traffic on Intact Peat

Construction traffic was required to pass over intact peat during the construction of some of the barrages, peat repositories and other construction activities. In general, construction machines that trafficked over particularly deeper peat would have been light or low ground bearing pressure (LGBP) wide-tracked machines suitable for working on the peat. The risk of a peat slide under such machines loading would be limited.

Construction of Borrow Pit adjacent to Barrage 1.

None of the borrow pit works took place on peat, and as such no mitigation was required.

8.6.4.2 Peat Slide and Response Works: Operation & Maintenance Phase (2006-2022)

The activities that were carried out on the site during this period that had an effect on soils, geology and land with significant effects included the following:

- Maintenance of Barrages 1 and 2.

8.6.4.2.1 *Mitigation of Stability Impacts*

Maintenance of Barrages 1 and 2

The following design, construction & operational risk mitigation measures were implemented for the maintenance of barrages 1 and 2:

- All maintenance operations were carried out from the access tracks adjacent to the barrages which were designed to support the loads from the vehicles and equipment on the glacial till below the peat.

8.6.4.3 Peat Slide and Response Works: Ceased Operation Phase (2022-2024)

No activities were undertaken on site that relate to the peat slide and response works. As such, no mitigation measures were required.

8.6.4.4 Peat Slide and Response Works: Decommissioning Phase

There are no site activities proposed relating to the peat slide and response works that will be undertaken during the decommissioning of the wind farm. As such, no mitigation measure are proposed relating to the peat slide and response works.

8.6.4.5 Peat Slide and Response Works: Post-Decommissioning (The Retained Development)

After decommissioning of the wind farm and grid connection has been completed there will be no more activity or works related to the wind farm or grid connection on the site. The reinstated site with the Retained Development will be returned to the landowner and Gort Windfarms Ltd. will not have any involvement in future land use or site activities. Therefore, the primary mitigation measure that will be used to mitigate the post-decommissioning impact of the Retained Development is in the compilation and handover of the **Safety File** for the site to the landowner by Gort Windfarms Ltd.

8.7 Residual Impacts of the Retained Development

8.7.1 Derrybrien Wind Farm - Residual Impacts of the Retained Development

After decommissioning of the wind farm has been completed there will be no more activity or works related to the wind farm on the site. The reinstated site with the Retained Development will be returned to the landowner and Gort Windfarms Ltd. will not have any involvement in future land use or site activities. Therefore, the primary mitigation measure that will be used to mitigate the post-decommissioning impact of the Retained Development is in the compilation and handover of the Safety File for the site to the landowner by Gort Windfarms Ltd., as discussed in Section 8.6.2.6.

The assessment of the impact of future uses of the site or retained wind farm infrastructure by others is outside the scope of this report. However, if no further work is carried out on the site to alter or modify the Retained Development and if future uses of the site do not exceed the original design criteria for the Retained Development, as set out in the Safety File, then the Residual Impacts post-decommissioning will be comprised of ongoing direct impacts from the construction, operation and maintenance, and decommissioning stages of the wind farm, as well as the long-term effects of direct and stability impacts from the components of the windfarm that will be left in place after decommissioning (the Retained Development), as discussed in Section 8.4.1.5.

The Retained Development will be comprised of the following at and below ground elements of the wind farm that will be left in place after decommissioning:

- The site access tracks, including 16.7 km of floating roads constructed on the peat.
- The hardstanding areas adjacent to the turbines and at the substation, which are constructed of crushed rock granular fill supported on the glacial till or rock below the peat.
- The foundations for the turbines and anemometer lattice towers, which were constructed as reinforced concrete pad foundations supported directly on rock or on a layered profile of structural fill comprised of lean mix concrete and crushed rock granular fill down to rock.
- The de-energised and disconnected LV electrical cables and fibre-optic cables that are direct-buried in the peat between the turbines and in ducts below the roads.
- The existing network of open drains and culverts across the site.
- The construction phase peat repository sites with re-generated surface vegetation.
- The construction phase borrow pits including the main borrow pit near the site entrance.
- Below ground foundations of the Derrybrien Substation

The residual impacts of these elements of the wind farm project on the receiving soils, geology and land on the wind farm site have been assessed relative to the original baseline conditions on the site in 1998, prior to construction, assuming that

- No further work will be carried out on the site to alter or modify the Retained Development.
- Future uses of the site will not exceed the original design criteria for the Retained Development, as set out in the Safety File.

Residual Direct Impacts:

- Where excavated peat has been stored on site in repository sites and bunded storage areas the peat has settled into the slopes and peatland vegetation has re-established on the surface of the disturbed peat. This will significantly reduce the rate of further erosion, degradation and decomposition of the peat so that the net

rate of carbon release will be significantly lower than during construction, and possibly at a new equilibrium of peat accumulation and net carbon storage.

- While this significantly reduces or possibly mitigates the incremental effect on the peat post-decommissioning, it is considered that, relative to the original baseline condition in 1998, prior to construction, the effect on the peat would still be **High** when considered in combination with the volume of peat that was displaced in the slide. Therefore, the long-term effect on the intact blanket bog after decommissioning will still be Significant.
- The site access tracks, peat repository sites and material sidecast areas cover an area of approximately 24Ha of degraded blanket bog making up about 7.2% of the total area of the wind farm site. The combined effect that this had on the underlying intact peat during construction was assessed as **Medium to Low**. However, as peatlands vegetation has re-established on the disturbed materials in the repository sites and material sidecast areas, the effect on the underlying peat has reduced to Low, which is of Slight Significance.
- The site access tracks, peat repository sites and material sidecast areas will be left in place after decommissioning. Therefore, the long-term residual effect that they have on the underlying peat will be **Permanent**.
- The improved drainage would have had a adverse impact on the peat with respect to carbon storage in areas where the groundwater table was lowered i.e. the rate of decomposition of peat is greater in aerobic conditions above the water table, which releases stored carbon as CO_2. As the existing habitat was of low ecological value and was already degraded by drainage for the forestry and turbary plots, the effect that the improved drainage for the wind farm had on the peat was **Low** and the **Significance** of the effect was **Slight**.
- The network of drains will be left in place after decommissioning. Therefore, the effect that they have on the peat will continue as a residual impact after decommissioning. Most of the major drainage works were completed prior to 2012. Therefore, any further changes after decommissioning of the wind farm should be minor.

Residual Stability Impacts:

- The floating roads on the site will have been in place for approximately 20 years by the time the wind farm is decommissioned. The highest risk of shear or bearing failure in the peat was when the roads were originally constructed in 2003-2005, particularly under the design live load surcharge from the mobile crane that was used to erect the turbines. Since then, the peat under the roads has increased in strength as it compressed under the weight of the rockfill, which has reduced the probability of shear failure occurring.
- After decommissioning no further heavy construction traffic loading will be required on the floating roads for the wind farm. Therefore, the probability of a failure occurring in the peat due to the impact of the surcharge on the roads is negligible so that the effect of the surcharge load on the stability of the peat will be Negligible and Not Significant.
- The site access tracks across the slide area at T68 and T70 are constructed as rockfill berms supported on the glacial till below the peat. Therefore, the impact of the berms and the effect on the stability of the underlying glacial till or rock will be Negligible and Not Significant.
- The hardstanding areas adjacent to the turbines and at the substation site are constructed of crushed rock granular rockfill supported on the glacial till or rock below the peat. Therefore, they do not apply any load on the peat and the long-term effect of the load on the stability of the underlying glacial till or rock after decommissioning will be Negligible and Not Significant.
- Similarly, the reinforced concrete turbine foundations are supported on rock or lean mix fill down to rock below the peat and glacial till so that they do not apply any load on the peat. Also, after the turbines are removed there will be no loading

on the foundations. Therefore, the effect of the load on the stability of the underlying glacial till or rock after decommissioning will be Negligible and **Not Significant**.

- The crane hardstandings and turbine foundations will also act as a shear key preventing shear failure in the peat directly upslope from them, which is a positive impact with respect to site stability. The effect of the support they provide will be Slightly Significant.
- The reinforced concrete bases would have been designed for the chemical exposure classification relevant to the ground conditions on the site. Therefore, the concrete would not be expected to deteriorate significantly in strength or disintegrate over time. Nevertheless, the long-term stability of the peat slopes after decommissioning is not dependent on the positive shear-key effect that the bases have on the stability of the peat upslope from the turbines.
- Poor drainage is a recognised contributory risk factor for peat instability. Therefore, the improved drainage network that was constructed on the site for the wind farm has had a sustained positive effect on peat stability over the operational life of the wind farm which has been assessed as Medium and Moderately Significant relative to the original baseline conditions on the site in 1998, prior to construction.
- No further maintenance will be carried out on the drains after decommissioning. Therefore, in the long-term the efficiency of the drains could reduce if they become clogged by vegetation over time, which would result in a partial gradual restoration of groundwater levels on the site.
- The site records indicate that maintenance on the drainage network has been at a residual level since 2012– with only minor works required to maintain the efficiency and capacity of the existing system. There has been no experience of drains clogging or getting blocked because of vegetation growth, blocking or collapse over that time. Therefore, any reduction in the efficiency of the drainage network after decommissioning is expected to be minor and to occur gradually over time so that the positive long-term residual post-decommissioning effect on the stability of the peat will still be Medium to Low and Slightly Significant relative to the baseline conditions prior to construction.
- The peat repositories were used to store up to 1.0 m of peat from the excavations for the turbine foundations, crane hardstandings, substation site, borrow pits and anemometer masts during the second phase of construction in 2004/2005.
- The highest risk of a peat slide under the surcharge loads was at the time that the peat was placed in the repository during construction (i.e. the short-term undrained condition). Over time the underlying peat has consolidated and increased in shear strength, which has reduced the likelihood of a peat failure. The remoulded excavated peat on the slopes has also dried out and vegetation has re-established on the surface. Therefore, the residual impact of the repository sites after decommissioning will be permanent but the effect that they will have on the stability of the peat will be Negligible and Not Significant.
- The borrow pits have been closed since construction was completed in 2005 and have remained undisturbed and stable since then. No work will be carried out in the borrow pits during decommissioning and it is not anticipated that there will be any deterioration or change in the condition of the pits after decommissioning. Therefore, the impact that they will have on soils, geology and land in the area with respect to site stability will be imperceptible.

8.7.2 Grid Connection - Residual Impacts (Retained Development)

After decommissioning of the grid connection has been completed there will be no more activity or works related to the grid connection on the site. The reinstated site with the Retained Development

will be returned to the landowner and Gort Windfarms Ltd. will not have any involvement in future land use or site activities.

The following elements of the grid connection will be left in place after decommissioning:

- The hardstanding area and below ground foundations at the Agannygal substation, which are constructed of crushed rock granular fill supported on the glacial till below the peat.
- The foundations for the grid connection pole sets.
- The access road to the substation.

The original direct effect of these was assessed as **Low,** and the significance of the effect was assessment as **Slight**. This effect will continue after decommissioning and will not have a significant residual effect on the stability of the peat.

8.7.3 Peat Slide & Response Works - Residual Impacts (Retained Development)

The following elements of the Response Works will be left in place after decommissioning:

- Barrages 1 to 4.
- Peat repositories at Barrage 2, Barrage 3 and at the Black Road Bridge.

The barrages are constructed as rockfill berms supported on the glacial till below the peat. Therefore, the residual impact of the berms and the effect on the stability of the underlying glacial till or rock will be **Negligible** and **Not Significant**.

8.8 Summary

This chapter presents the assessment of the impact of site activities for the following elements of the Derrybrien Wind Farm project that have an effect on the receiving soils, geology and land in the project area:

- The Derrybrien Wind Farm and associated ancillary works.
- The Grid connection comprising the Derrybrien-Agannygal 110 kV Overhead Line and Agannygal Substation connecting into the Shannonbridge -Ennis 110 kV Overhead Line and associated ancillary works.
- The works undertaken in response to the peat slide and associated ancillary works.

Commercial operations at Derrybrien Wind Farm ceased in February 2022 after An Bord Pleanála refused substitute consent for the project. All the infrastructure for the wind farm and grid connection has been temporarily left in place and only essential maintenance has been carried out on the turbines since then. It is now proposed to fully decommission the wind farm in 2025.

In terms of both site stability and environmental protection it is considered that minimal decommissioning works is the best approach for the site. Therefore, the decommissioning plan will entail the following:

- De-energising the site by initially disconnecting the high voltage (HV) lines at the substation, followed by low voltage (LV) disconnection at each of the turbines as well as the 110kV OHL for the grid connection.
- Temporary widening of the narrow sections of the site access tracks in the turbary area and at selected junctions to provide safe access for mobile cranes to the turbines.

- Controlled dismantling of the turbine blades, nacelle and masts. The decommissioned components will be removed from the site for re-cycling, disposal or re-use elsewhere.
- Removal of the sub-station and associated buildings-including removal of all the electrical transmission components, capacitors, transformer, concrete plinths and control building.
- Controlled dismantling and removal of the steel lattice tower and timber twin polesets for the 110kV Overhead Line (OHL).
- Dismantling of the steel lattice towers for the anemometers.
- Removal of the Agannygal sub-station and associated buildings-including removal of all the electrical transmission components, capacitors, transformer, concrete plinths and control building.

The features of the Retained Development, to remain *in situ in* perpetuity after the Prospective Development has been completed are listed below:

- **At-ground and below-ground structures/features associated with the Derrybrien Wind Farm Development, including**:

  Derrybrien Windfarm including the Derrybrien 110kV Substation
  - Reinforced concrete foundations for 70no. wind turbines.
  - Reinforced concrete foundations of structures within the Derrybrien Substation compound.
  - Reinforced concrete foundations of 2no. Anemometer masts.
  - Approximately 17.5km of access tracks and 70no. hardstand areas.
  - Direct buried underground electrical and communications cabling.
  - 3no. Borrow Pits / Quarries.
  - Naturalised Peat Repository areas.
  - Onsite Drainage Infrastructure.

  Derrybrien to Agannygal 110 kV OHL and Agannygal 110kV Substation
  - Below ground elements of 34no. double wooden pole sets.
  - Reinforced concrete foundations for 2no. end masts.
  - Reinforced concrete foundations for 5no. angle masts.
  - Reinforced concrete foundations for 1no. intermediate mast.
  - Reinforced concrete foundations of structures within the Agannygal Substation compound.

- **Offsite development constructed in response to the peat slide in 2003, including**:
  - Barrage 1 and Coillte Access Track.
  - Barrage 2, Access Track and and Repository Area.
  - Barrage 3 and Repository Area.
  - Barrage 4.
  - Repository Area at the Black Road Bridge.
  - Drainage Diversion Works.
  - Repairs to Black Road Bridge, Flaggy Bridge and Unnamed Bridge C and Crooked Bridge.

The purpose of this report is to give context to the post-decommissioning impacts that are likely to occur on soils, geology and land from elements of the wind farm, grid connection and ancillary works that will be left in place after decommissioning (the **Retained Development**).

Impacts on soils, geology and land during the decommissioning phase of the project are summarised in this report but are addressed in greater detail in Chapter 8 of the Environmental Impact Assessment Report (EIAR) that has been prepared for the Decommissioning works (the **Prospective Development**).

An **'Impact'** is defined here as an action from a site activity that results in a change to the receiving soils, geology and land e.g. for construction of the turbine foundations the impact on the receiving soils, geology and land is the excavation of the peat and glacial till to construct the foundation on the underlying rock.

The **'Effect'** is the change or changes resulting from that impact, e.g., the changes to the characteristics of the peat and glacial till that occur after they are excavated.

Direct Impacts of project activities are those that are assessed based on the direct physical impact on the receiving soils, geology and land use.

Particular consideration has been given to the stability of peat on the site. Therefore, **Stability Impacts** have been assessed separately as direct impacts where the effect on the receiving soils, geology and land increases or decreases the risk of instability, typically in the peat, potentially triggering a large peat slide as a worst-case scenario.

Impacts on the receiving soils, geology and land for all elements of the wind farm, grid connection and ancillary works have been assessed over the following stages of the project:

- Impacts that have occurred:
  - Construction Phase (2003-2006).
  - Operation and Maintenance Phase (2006-2022).
- Impacts that are occurring:
  - Ceased Operations Phase (2022-Present).
- Impacts that are likely to occur:
  - Decommissioning Phase (2025).
  - Post-Decommissioning Phase (the Retained Development).

The assessment has been carried out in accordance with the 2022 EPA Guidelines on Information to be Contained in Environmental Impact Assessment Reports. The assessment of impacts that have an effect on the stability of the peat (i.e. stability impacts) have also been assessed in accordance with current best practice guidelines for peat landslide hazard and risk assessments in *"Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Projects,* 2nd Edition, April 2017 (Scottish Government – Energy Consent Unit, 2017). Specific consideration has been given to the peat failures that occurred on the wind farm site during construction, particularly the large peat slide that occurred in October 2003.

The baseline sensitivity of the receiving soils, geology and land for this report has been assessed based on the site conditions in 1998, prior to the construction of the wind farm.

Remedial mitigation and monitoring measures that were implemented on the site during construction and during the operation and maintenance phase of the project are summarised in this chapter. It also includes the mitigation measures that will be implemented for decommissioning the wind farm, grid connection and ancillary works, and for the Retained Development post-decommissioning.

Cumulative impacts from other projects or activities in the area are also assessed along with the likely long-term residual impacts of the Retained Development after decommissioning with mitigation.

The **effects** of stability impacts on the peat have been qualitatively assessed as a function of:

- The characteristics of the site activity and the corresponding impact on the peat (e.g. the location, magnitude, extent, frequency and duration of surcharge loading on the peat).
- The quality of the impact (i.e. positive or adverse impacts with respect to stability).
- The likelihood of a peat failure occurring as a result of the impact on the peat; and
- The possible extent and characteristics of a peat failure.

The **significance** of the effects of stability impacts has then been assessed on a 7-point scale from Imperceptible to Profound as a function of the baseline sensitivity of the receiving soils, geology and land potentially impacted by a peat failure using the matrix in Figure 8-3, which has been adapted from the chart in Figure 3.4 of the 2022 EPA Guidelines.

The likelihood of a peat failure occurring is a function of the characteristics of the site as well as the effects of the stability impacts of site activities on the peat. Therefore, a Peat Stability Risk Assessment (PSRA) has been carried out for the Project in accordance with current best practice guidelines to interpret the likelihood of a peat slide across the site based on factors that are relevant to peat stability such as topography, peat depth, peat strength, hydrology, and groundwater conditions.

The likelihood of a peat failure occurring for each site activity has then been assessed based on the results of the PSRA and on the characteristics of the stability impacts. For recurring activities, the likelihood of a peat slide has also been reassessed at key stages of the project to take account of

- The reduced impact of site activities with the implementation of appropriate mitigation measures.
- Improvements in site conditions that occur over time, such as the increase in strength that occurs in peat as it consolidates under sustained surcharge loads (e.g. under the floating roads and peat repository sites), as well as the medium to long-term effects of the drainage improvements on the wind farm site, which reduce the risk of a peat slide – a positive stability impact.

The *significance* of the effects of stability impacts on the peat are still assessed relative to the baseline sensitivity of the peat in 1998, prior to construction.

For the project, activities that have adverse stability impacts on the receiving soils, geology and land typically involve temporary or permanent loading on the surface of the blanket bog that covers the site. For example, where peat and glacial till excavated from the turbine foundations were placed or "sidecast" on the intact peat slopes adjacent to the excavations:

- The stability impact was the surcharge load that was applied to the surface of the peat due to the weight of the materials.
- The corresponding effect on the peat was the increase in stress that occurred under the applied loads, which could potentially have triggered a failure where the stresses exceed the strength of the peat. Failures could range from a local bearing failure in very weak peat under a concentrated load, to a large peat slide on the slopes such as that which occurred at the site during construction on the 16th October 2003.

Baseline Conditions – Soils, Geology & Land:

The available desktop information and the numerous geotechnical site investigations undertaken on the Project site have been used to interpret the baseline Soils, Geology and Land conditions in 1998, prior to construction, and to undertake the assessment of the impacts for the Project. The majority of the Project site is characterised by a continuous cover of upland blanket bog over cohesive glacial till (boulder clay), and Sandstone/Siltstone bedrock.

The wind farm site is located on Cashlaundrumlahan Mountain at an elevation between +325mAOD and +365mAOD. The topography on the site typically consists of flat, terraced or gently sloping ground (<3-5^0) with steeper slopes closer to the southern and northern boundaries of the site (>5-7^0). From the wind farm site, the overhead line (OHL) is routed in a southernly direction where the topography is relatively steep initially over the initial 1.5 km and then crosses the more gently sloping terrain of the Owendalluleagh River valley to the Agannygal substation where the site has been cut and filled locally to provide a level platform at about 190 m AOD.

The depth of peat on the wind farm site ranged from 1-6 m but is generally <3.0m. The deeper peat (>3 m) is located on the flat or gently sloping terraces on the site. In-situ vane shear testing indicates that the peat is of Extremely Low Strength (Very soft), with an undrained shear strength typically between 4kPa and 10kPa.

For the grid connection route and substation, the peat depths typically vary between 0.2 to 5.6 m with an average of 1.35 m. The peat is generally shallower along the northern part of the route, where the terrain is relatively steeper on the lower slopes of Cashlaundrumlahan Mountain. The deeper peat is localised in a few flatter areas within the southern part of the route.

The mineral subsoil below the peat is comprised of boulder-clay type deposits of gravelly cohesive glacial till. On the wind farm site, the glacial till is typically 0.5-3.5m thick, but locally up to 7.6m in places. In-situ testing indicates the indicate that the soil would be classified as a Medium to High or Very High Strength material. Some Low Strength (Soft) layers were encountered locally at shallow depths of 3.5-4.5m.

Bedrock on the wind farm site is comprised of Sandstone, Siltstone and Conglomerate of the Ayle River Formation. The depth to rock on the site ranges from 1.3 to 10.3m but was generally between 3.0m and 6.2 m. 0.6 to 3.6m of weathered rock was encountered at rockhead.

There are no audited or unaudited geological heritage sites identified on the wind farm site on the Geological Survey of Ireland (GSI) Spatial Resources interactive map viewer.

The GSI Landslide Susceptibility Map for the Project area indicates that conditions on the windfarm site are suitable for the project with appropriate design and mitigation measures for working in peat. Most of the wind farm site would be classified as being of **Low** susceptibility to landslides with localised areas of slightly steeper slopes on the south side of the site and between terraces on the north side where the susceptibility is classified as **Moderately Low**. The areas of Moderately High and High susceptibility are generally limited to the steeper slopes outside the site boundary to the north and south of the wind farm, particularly to the north.

Prior to construction of the Project, most of the site and surrounding land downslope had been used by Coillte for commercial coniferous forestry. The open area at the east end of the wind farm site was used for peat harvesting and is sub-divided into turbary plots.

The blanket bog has been degraded due to drainage, forestry and turf cutting and is of low ecological value. However, the open areas are rare in the wider landscape and suitable for use by hen harrier. Therefore, when all habitats are considered, the overall ecological value of the habitat is of Local Importance (higher value), which would be equivalent to a Medium to Low sensitivity. However, when combined with the additional environmental value of the peat as a carbon store as well as the relatively low commercial value of the land for forestry/agriculture, this is sufficient to raise the combined baseline sensitivity of the peatland habitat to "**MEDIUM**".

The characteristics of the site activities and the impacts on the peat are based on records from construction and from the operation and maintenance phase of the Project up to Q2 2022, which are summarised in this report. The characteristics of the activities that are likely to occur during decommissioning will be similar. Both positive and adverse impacts have been assessed.

For this project, the possible extent of a peat slide and the characteristics of soils, geology and land potentially impacted by a slide have been calibrated by the very large peat slide that occurred on the site in October 2003, which has reasonably been considered the worst-case scenario. Consideration has also been given to the smaller more localised peat failures that occurred in a few areas on site during construction, which had a significantly lower impact on the soils, geology and land.

Direct Impacts

The vast majority of direct impacts on Soil, Geology and Land occurred during the construction phase of the project. These impacts mainly include

- The excavation of peat for the turbines, crane hardstandings and substation site.
- The covering/sealing of land with the site access roads and material deposition areas.
- The change in the water table levels within the peat due to improved drainage.

The effects of these impacts are assessed based on a combined level of sensitivity of the peat.

The excavation and disposal of the peat had the most significant direct impact on soils geology and land as the overall volume of peat excavated for the Project was on the order of 185,000 m^3. The majority of this was on the wind farm site. The volume of peat excavated for the Grid Connection and Peat Slide Response Works were negligible in comparison. All of the excavated peat was stored in designated material deposition areas, repository sites and bunded storage areas on site. However, the peat was disturbed in the process and would be susceptible to aerobic decomposition and loss of stored Carbon in the form of CO_2. The effect of this on the peat has been assessed as **Moderately Significant**. However, when considered in combination with the peat slide that occurred on the site in October 2003, which resulted in the displacement of 450,000m^3 of peat, 55% of which was lost in the stream channel downslope from the slide area, the combined effect on the peat was assessed as **Significant**. Approximately 200,000m^3 of peat material remains in the slide area.

Other direct impacts have resulted in only **Slightly Significant** effects on the receiving soils, geology and land including the covering/sealing of the land with the site access roads, material deposition areas and peat repository sites, the removal of forestry, and the excavation of rock from borrow pits established on the site.

Additional drains were constructed to provide drainage for the turbine foundations, which was a design requirement, and to improve the control of groundwater and surface runoff in areas of poor drainage and high water-table. Drainage has a adverse effect on peat where the groundwater table is lowered i.e. the rate of decomposition of peat is greater in aerobic conditions above the water table, which releases stored carbon as CO_2. Piezometers on the site indicate that water levels have been lowered by 0.40-0.75m in some parts of the site. However, the impact of the drains would be localised, and the site had already been degraded by drainage for forestry and turbary plots. Therefore, the effect of the direct impact of the improved drainage on the peat has been assessed as **Slightly Significant**.

For the grid connection works the effects of the construction of Agannygal substation and the lowering of the ground below the 400 kV line have been assessed as **Slightly Significant**.

For the peat slide response works the effects of the construction of the barrages, borrow pits, peat repositories and temporary access roads on the receiving soils, geology and land were also considered to be **Slightly Significant**.

Most of the maintenance works that were carried out on the site over the operational life of the wind farm between 2006 and 2022 would have had negligible direct impacts on the receiving soils, geology and land. The works that would have had a **Slightly Significant** effect on the peat were limited to the 2017 fibre optic upgrade of the turbine control systems, ongoing tree felling and tree topping, and drainage improvement works. Remedial works involving peat excavation were also required to right a mobile crane that went off the narrow turbary road near Turbine T40.

At this stage, during the ceased operational phase of the wind farm (2022-2024), the effects of direct impacts from the construction, operation and maintenance phases of the windfarm that are still occurring at the end of 2024 would include ongoing decomposition of excavated peat in the peat

storage areas, repository sites and slide area, and accelerated peat decomposition due to groundwater lowering caused by drainage improvements on the wind farm site.

At this stage the peat repository sites have sunk into the underlying intact peat on the slopes and peatlands vegetation has become well established on the surface. Therefore, the net rate of carbon release has significantly reduced so that the incremental effect on the peat in these areas is at a new equilibrium of carbon flux, possibly with peat accumulation and net carbon storage, which will help to mitigate the original impact. However, relative to the original baseline conditions the effect on the peat is still **Moderately Significant**.

Similarly, although there is still approximately 200,000m^3 of peat material in the slide area and peatlands vegetation has also become well established on the surface of the peat which will slow down the rate of decomposition and establish a new rate of carbon flux, the effect on the peat is still **Significant** relative to the original baseline condition when assessed in combination with the peat excavations for the wind farm.

The works that were carried out on drainage over the operational phase of the windfarm were limited to localised maintenance works to improve the capacity and performance of the existing network and not to increase the capacity, and only minimal maintenance works were required since 2012. Therefore, further drawdown of the groundwater levels on the site should be minimal. However, relative to the original baseline condition in 1998, prior to construction, the effect of the impact would still be of **Slight Significance**.

The improved drainage network on the wind farm site will remain in place after decommissioning along with the peat repository sites, deposition areas, and bunded storage areas in the borrow pits. Therefore, the effects of peat decomposition and carbon loss in the excavated peat stored on site and in the peat material remaining in the slide area will continue as a residual impact post-decommissioning along with the accelerated rate of decomposition in peat above the water table in areas where the groundwater level was lowered by the drainage improvements on the wind farm site. However, the rate of decomposition will be significantly lower due to continued vegetation growth and a possible reduction in the capacity and efficiency of the drainage system without maintenance. It could also reach a point of peat accumulation and net carbon capture in the long-term, particularly in the repository sites.

Stability Impacts

All the stability impacts that have significant effects on the receiving soils, geology and land relate to the blanket bog that covers the site and surrounding area. Prior to construction of the wind farm the bog had been degraded by drainage, forestry plantations and peat harvesting. Therefore, the baseline sensitivity of the soils, geology and land that could be impacted by the project has been assessed as **MEDIUM** based on a combination of the ecological value of the bog, the significance of carbon storage in the peat and the value of the land for forestry, agriculture and turbary rights. There are no recorded Geological Heritage Sites in the area.

Table 8-19, Table 8-20 and Table 8-21 give a summary of the stability impacts that had significant effects on the stability of the peat for the different phases of the Project. In accordance with the 2022 EPA Guidelines "Significant" impacts include those that have been qualitatively assessed on a scale from Slight to Profound based on the severity of the interpreted effect on the peat and the sensitivity of the receiving soils, geology and land. None of the Project activities had impacts that have been assessed as having **Very Significant** or **Profound** effects on soils, geology and land in the Project area, which is largely due to the relatively low ecological importance and baseline sensitivity of the receiving environment. This chapter also identifies stability impacts of site activities which had effects that were **Not Significant** or **Imperceptible**.

In general, the stability impacts with the most significant effects occurred during the construction stage of the project when there would have been a higher level of activity on the site, particularly on the wind farm site prior to the large peat slide that occurred at the site in October 2003.

The impact of site activities also reduces significantly over the project life cycle from the second phase of construction after the peat slide (2004-2005), through the operation and maintenance phase of the project (2005-2022), to decommissioning in 2025. This is due to a combination of:

- The reduced level of activity on the site and the less onerous nature of the activities in terms of loading on the peat.
- The implementation of appropriate mitigation measures for site activities.
- Gradual improvements in site conditions, including:
- The increase in strength of the peat under the material sidecast areas, peat repository sites and floating roads, which has been verified by site testing.
    - The improved drainage conditions, which have a positive effect on peat stability.

The significance of the effects is still assessed relative to the baseline conditions prior to construction.

During the first phase of construction, prior to the peat slide on the 16th October 2003, the stability impacts with effects that were **Significant** were related to the construction of the site access tracks as "floating roads" directly on the peat, the construction traffic loading on the floating roads, and the sidecasting of excavated materials on the intact peat slopes adjacent to the turbine foundation excavations.

In comparison, the stability impacts from other activities that were being carried out on the wind farm site at the time only had **Slightly Significant** effects on the stability of the peat. These included the live load surcharge from low ground bearing pressure construction and forestry equipment operating directly on the peat, the vibrations induced by rock blasting in the main borrow pit, and the local stability of temporary peat slopes around the perimeter of the turbine foundation excavations.

Prior to the peat slide in 2003, most of the c. 15 km of new floating site access tracks had been constructed on the wind farm site. Excavation to suitable formation on rock had also been completed at 39 No. turbines and the excavated peat and mineral subsoil had been sidecast on the intact peat slopes adjacent to the excavations.

No peat failures occurred under the floating roads. However, at the excavations for the turbine foundations there was a local bearing failure in the peat under the sidecast materials at Turbines T23, T29 and T66 and a small-scale peat slide at Turbine T17. At the time of the very large peat slide on the 16th October 2003 excavation was underway at Turbine T68 and the excavated materials were being sidecast on the slope downslope from the turbine, where the slide is thought to have initiated.

The loading from the sidecast materials has been attributed with triggering the slide, although there were a number of other contributory factors related to the topography, hydrology and peat strength in the area that made the location particularly susceptible to a peat failure at that time. Approximately 450,000m3 of peat was displaced over an area of approximately 25 Ha on the southern slopes of the wind farm, which resulted in a direct **Significant** effect on soils, geology, and land within the slide area.

Approximately 250,000 m^3 of the displaced peat from the source area of the slide flowed downslope into a stream channel. From here it was routed down the mountain slopes to an elevation of approximately 200 mAOD, where it spread out on a relatively flat area of agricultural land almost as far as the Black Road Bridge. Following some heavy rainfall, the material was forced further downslope along the Owendalluleagh River channel before reaching a phase of dispersion in the river water approximately 5.8 km downstream from the source area. At the time, the peat slide significantly impacted the integrity of the peat from the slide area and the use and characteristics of

the land within the slide area and along the flow path. This included Coillte forestry lands, agricultural lands and the river channel. Sections of wind farm and forestry access tracks were also damaged as part of the event.

In response to the slide a number of temporary and permanent retention barrages were constructed within the slide area and along the flow path. These had a **positive** impact in terms of site stability by controlling further peat discharges from the source area and by containing some of the displaced peat that flowed downstream along the river channel.

While there were adverse site stability impacts associated with the construction of various temporary floating access tracks and bunded repositories to access and store the displaced peat, the effect that these had on soils, geology and land was considered to be Slightly Significant, primarily based on their site location, ground conditions, topography, loadings and the extent of a potential slide event which could be caused.

For the second phase of construction after the peat slide there was a significant reduction in the effects of stability impacts, primarily as a result of additional risk mitigation measures that were implemented on the site. In particular this was due to *inter alia* extensive additional site investigations and stability analyses for the wind farm infrastructure and designated repository areas for excavated materials, full scale proof load testing on the existing and new floating roads, controlled peat and spoil management on site with identification and assessment of suitable repository areas for excavated peat and mineral subsoils, on site geotechnical supervision, and review and certification of the contractor's method statements. Uncontrolled sidecasting of excavated materials was not permitted and areas that were considered to have an elevated risk of peat instability were avoided for peat repository sites. Design modifications were also made to the design and layout of the windfarm to avoid areas of elevated risk, i.e.: the floating road between Turbines T47 and T51 was relocated to the south side of the turbines to bring it further away from the steep slopes to the north, and Turbine T16 and the section of floating road between Turbines T15 and T17 were not constructed.

There was also a reduction in risk of peat instability for the material sidecast areas and sections of floating road that were completed during the first phase of construction due to the delay between the first and second phase of works. The highest risk of peat instability for these areas was at the time that the materials were placed on the slopes. Over time the peat compressed and increased in strength under the weight of the material so that the effect of the load on the stability of the peat reduced to **Moderately Significant** for the second phase of construction.

However, the stability impact associated with the construction of the remaining lengths of floating roads was assessed as **Significant** and the live load from the construction vehicles and mobile cranes on all the roads for the second phase of construction was **Moderately Significant**.

Other stability impacts that had a **Slightly Significant** effect on the stability of the peat during the second phase of construction included the live load surcharge from low ground bearing pressure construction and forestry equipment operating directly on the peat, the vibrations induced by rock blasting in the main borrow pit, the local stability of temporary peat slopes around the perimeter of the remaining turbine foundation excavations, and miscellaneous localised live loads on the peat slopes from work related to tree felling, drainage and cable-trenching.

The positive impact of drainage was sustained with further improvements during the second phase of construction, which had a **Moderately Significant** effect on the stability of the peat relative to the baseline conditions on the site prior to construction.

The site stability impacts associated with the grid connection were assessed as considerably less than the wind farm site mainly due to the nature of the activities (discrete pole and angle mast construction, substation of relatively small footprint) and topography of the OHL route, the majority of which was at a lower elevation and typically on more gently sloping ground. Site stability impacts associated with the construction of the grid connection did not exceed slight significance.

No peat failures occurred during the second phase of construction.

The site activities during the operation and maintenance phase of the windfarm between 2005 and 2022 have had a much lower impact on the peat. There are no adverse stability impacts that have **Significant** or **Moderately Significant** effects on peat stability. Operation and maintenance traffic loading on the floating roads is less frequent than during construction and the size of the mobile cranes that were used to service the turbines was kept within the design capacity for the roads, which has been proven by full scale load tests. Also, the performance and capacity of the roads has continued to improve due to the increase in the strength and stiffness of the underlying peat, which has compressed under the weight of the roads. Therefore, the effect of the traffic loading on the stability of the peat was **Slightly Significant**.

Upgrading works to c. 4.5 km of access tracks were undertaken in 2014 however the thickness of the fill material was minimised to reduce the additional dead load on the roads, and all the upgraded roads were proof tested to the design crane load on completion to verify their capacity and performance. Therefore, the effect of the additional dead load on the stability of the peat was **Slightly Significant**.

Other routine operations that were carried out over the operation and maintenance phase of the Project involved machinery operating directly on the peat, e.g. for tree felling and stockpiling, tree topping (re-growth), drainage maintenance works, and the 2017 upgrade of fibre optic control cables, which were direct buried in the peat across the site, or for the maintenance of the barrages along the flow path for the peat slide. All this work was carried out using low ground bearing pressure plant and all-terrain vehicles suitable for working on the peat so that the effect on peat stability was only **Slightly Significant.** Similarly, where a mobile crane overturned onto the peat near Turbine T40, it resulted in a temporary localised live load surcharge that had a Slightly Significant effect on peat stability in the area.

The stability impacts associated with the disturbed peat in the source area and the remaining peat material downslope are currently considered to be **Slightly Significant**. This is mainly due to drainage and revegetation of the peat in the source area, degradation of the deposited peat material along the flow footprint, and the positive impact that the barrages have on site stability, particularly 1 and 2.

No peat failures occurred during the operation and maintenance phase of the wind farm.

Stability impacts from the construction, operation and maintenance stages of the wind farm that are still occurring during the ceased operation phase at the end of 2024 are related to groundwater lowering due to drainage, and sustained surcharge loading on the peat from the floating roads, material sidecast areas and peat repository sites that were left in place at the end of construction.

Due to the lack of wind-farm related activity on the site and due to the ongoing improvement in the strength and stiffness of the peat under sustained surcharge loads the effect of the loading on peat stability is no longer significant.

There has been no reduction in the capacity and efficiency of the drainage network on the site. Therefore, the impact of the drainage continues to have a sustained positive effect on peat stability that is **Moderately Significant** relative to the baseline conditions on the site prior to construction.

Decommissioning the Project in 2025 will broadly involve the dismantling and removal of all above ground structures on the wind farm site and grid connection route, including the Agannygal substation.

Most of this work will be carried out from the granular hardstanding areas for the cranes at the turbine and substation sites, which are designed for the loads and will not have a significant effect on the stability of the peat. Therefore, the primary stability impact of the decommissioning work will be the live load surcharges on the floating roads on the wind farm site from the construction vehicles,

trucks, low-loader transporters and mobile cranes that will be used to dismantle the turbines and the electrical equipment at the substations and transport the components off site. The loading will not exceed the design capacity of the roads, which has been verified by full scale proof load testing. Therefore, the effect of the live load surcharge on the stability of the peat will be **Slightly Significant**.

Minor temporary road widening works may be required to provide safe access for the mobile cranes at junctions near Turbines T1, T14 & T68, and along narrow sections of track in the eastern turbary area between Turbines T35 and T35, and between T43 and T46. This will involve additional surcharge loads on the peat which will have a **Slightly Significant** effect on peat stability in these areas.

For the grid connection the main stability impacts during decommissioning will be the live loadings on the peat due to removal of the OHL structures. Insofar as possible the construction stage access routes will be reused to access the structure locations, the effect of which is assessed as not significant except for polesets PS-1 to PS-4 and at AM38 which has been assessed as **Slightly Significant** due to the presence of deeper peat.

When the wind farm is decommissioned the site access tracks, turbine foundations, material deposition areas, and hardstanding areas at the turbines and substations will all be left in place on the site along with all the electrical transmission and control cables that have been direct buried in the peat across the site and in ducts at road crossings. The existing drainage network will also be left in place. It is not proposed to block any of the drains to re-wet the site.

There will be no activity related to the wind farm on the site after decommissioning. Therefore, the sustained surcharge loads on the peat from the floating roads and the material deposition areas will not have a significant effect on the stability of the peat after decommissioning.

The turbine foundations, hardstanding areas and barrages are constructed on the glacial till and rock below the peat so they will not have a significant adverse effect on site stability. The turbine foundations and crane hardstanding areas will provide some support to the peat upslope from the turbines, which is a **Slightly Significant *positive*** effect on peat stability. However, the site stability is not dependent on this support. Also, the reinforced concrete turbines would not be expected to deteriorate and disintegrate over time.

The improved drainage network on the wind farm site will continue to have a sustained positive effect on peat stability post decommissioning that is **Moderately Significant** relative to the baseline conditions on the site prior to construction. No maintenance works will be carried out on the drainage after decommissioning. Therefore, the efficiency and capacity of the drains could reduce over time if they become clogged due to vegetation growth. In the long-term this could result in gradual partial restoration of groundwater levels on the site which would reduce the positive effect on the stability of the peat to **Slightly Significant**.

Gort Windfarms Ltd. will not have any control over the activities that will be carried out on site after decommissioning. However, the long-term effects of residual impacts on peat stability will be the same as the post-decommissioning effects for the Retained Development provided that no work is carried out on the site to alter or modify the Retained Development, and provided that future uses of the site will not exceed the original design criterial for the Retained Development, as set out in the Safety File that will be handed over when decommissioning is completed.

Cumulative impacts

The cumulative impacts due to adjacent projects and activities in and around the project area have also been assessed. It was concluded that there are no significant cumulative direct or stability impacts due to other windfarm projects in the area, adjacent forestry plantations that are not part of the Project, or from peat extraction or turf cutting outside the project area. Significant cumulative

impacts are limited to mechanical peat harvesting in turbary plots within or immediately adjacent to the wind farm site.

In terms of direct impacts, the volume of annual mechanical peat harvesting is low, probably less than 2,500m^3 per annum. Therefore, the effect that this has on the peat is only **Slightly Significant.**

Drainage improvements in the turbary area to facilitate mechanical peat extraction have been minor and no further drainage works are expected during decommissioning of the wind farm. Therefore, there are no significant cumulative effects on the peat due to groundwater lowering for mechanical peat extraction in the turbary areas on the site.

The effect of cumulative stability impacts that have already occurred as a consequence of the increase in mechanical peat harvesting activities in the turbary area since 2012 has been assessed as **Moderately Significant** to **Significant**, depending on the interpreted likelihood of a peat slide where the work was carried out, as summarised in the Peat Stability Risk Assessment that has been prepared for mechanical peat harvesting in the turbary area.

The effects are limited to the small number of turbary plots where mechanical peat harvesting is carried out. The active plots are only cut seasonally once a year and mechanical peat harvesting within any plot only takes a few days. Therefore, the frequency of the stability impact is **Occasional** and the duration of the impact is **Brief** to **Temporary**.

These effects will not arise as a direct result of the wind farm, but from the separate and unrelated activities for mechanical peat harvesting in the turbary areas under established turbary rights, which are outside of the control of Gort Windfarms Ltd. Furthermore, development of the wind farm has not increased the risk of peat instability in the turbary areas.

Two areas on the site have been identified where localised or small-scale peat slides have occurred on the wind farm site, which are unrelated to the wind farm but possibly caused by mechanical peat harvesting, i.e. in Turbary Plots #161 and #30. These have been assessed as having a **Slightly Significant** effect on the peat in the area.

Warning signs have beeen erected at the site by Gort Windfarms Ltd. (GWFL) to raise awareness of the peat stability risks associated with mechanical peat harvesting in the turbary area. GWFL have also recommended mitigation measures to the turbary rights holders to manage the risk of peat stability if they are carrying out mechanical peat harvesting in the area. The measures include recommended restrictions on mechanical harvesting of some turbary plots with a higher likelihood of instability, and appropriate controls and restrictions for mechanical harvesting in the remaining turbary plots. It is recommended that no harvesting take place during decommissioning.

f the recommended mitigation measures are **not** adopted by the turbary rights holders, then the cumulative effect on the stability of the peat could be **Moderately Significant** to **Significant**.

If the recommended mitigation measures **are** adopted by the turbary rights holders then there will be a lower likelihood of a peat failure and the cumulative effect on the stability of the peat will be **Slightly Significance**.

There will be no cumulative impacts if no further mechanical peat harvesting is carried out in the area during or after decommissioning.

Remedial (Mitigation) Measures and Monitoring

Mitigation of Direct Impacts

Wind Farm Site

The primary mitigation of significant direct impacts on the wind farm site involved constructing the new site access tracks as floating roads which minimised the volume of peat that needed to be excavated and disposed of on site. This approach also minimised the volume of crushed rock that was which was required to construct the roads. Also, the existing network of access tracks (approx. 2.0 km) was upgraded and integrated with the turbine layout.

Grid Connection

For the grid connection works the remedial measures to mitigate the direct impacts on soils, geology and land which were of significance included the used of the existing forestry roads and access tracks were used insofar as possible. Where necessary (i.e. for access to Agannygal substation) these were upgraded as opposed to the construction of new roads. LGBP plant was used for the construction and felling works. These minimised the requirement to excavate or cover the peat with temporary or permanent access. Furthermore, this meant that the used of crushed rock was minimised for the construction of the grid connection.

Peat Slide Response Works

For the peat slide response floated roads were constructed in order to gain access to specific points along the slide and to reinstate the existing forestry access track. These minimised the requirement to excavate the peat permanent access. Furthermore, this meant that the used of crushed rock was minimised for the construction of the grid connection. LGBP plant was used for the construction and felling works. These minimised the requirement to excavate or cover the peat with temporary or permanent access.

Mitigation of Stability Impacts

Prior to the slide in 2003, impacts that had an effect on peat stability were primarily mitigated by:

- Minimising the thickness of the floating roads using geogrid reinforcement,
- Generally limiting the depth of sidecasted materials spread out across the surface of the peat to 0.5m - 1.5 m.
- Minimising loading from construction plant on the peat slopes using appropriate LGBP equipment suitable for operating on peat for drainage, tree felling and cable installation.
- Some improvements to the site drainage.

Following the slide in 2003 more extensive remedial measures were adopted to minimise the risk of further site instability on the wind farm site. The primary additional remedial measures included:

- Extensive geotechnical investigations and stability analyses for elements of the project that could have had an impact on the peat stability including the floating roads, material deposition areas, peat repositories, turbine excavations and tree felling.
- Installation and monitoring of 4 No. clusters of electronic piezometers and tiltmeters to monitor groundwater levels and peat movement with an automated alarm system.
- Controlled deposition of excavated peat into designated peat repositories that had been confirmed as suitable by desk study, geotechnical investigation and stability analyses.

- Full-scale monitored serviceability and proof load testing of all floating roads on the site.
- Full time supervision of the works by geotechnical engineers.
- Remedial works to upgrade the floating roads, where necessary.
- Specification and implementation of controls on construction methodology for works that could impact peat stability, including construction traffic loading on the floating roads, spoil management, and deposition of peat in designated repository areas.
- The implementation of a geotechnical certification process which controlled site activities that involved working with or on the peat.
- Construction of rockfill embankments to replace two sections of access track removed during the slide which provided a shear key to contain material upslope from the roads in the slide source area.
- Avoiding or amending elements of the Project where the potential of further peat instability was considered to be excessive e.g. the relocation of the floating road between T47 and T50 to the south side of the turbines to set it back further from the steep slopes to the north; the omission of Turbine T16 and the section of floating road between T15 and T17; avoiding mechanical tree felling in particular areas.
- The design and monitoring of the rock blasting at borrow BP-3.
- Drainage improvement works to assist in the drainage of the peat.

For the grid connection works the primary remedial measures adopted were the undertaking of site investigations and stability analysis along the steeper section of the OHL, the use of appropriate LGBP plant on the peat slopes, the use of established forestry access tracks to minimising loading of the peat and the implementation of appropriate monitoring and supervision of the works by an experienced contractor.

For the peat slide response works 8 no. barrages in total were originally constructed to minimise the peat from leaving the slide source area and from progressing down the river channel. The siting of the three repositories in areas suitable for storing peat and the partial construction of bunds around their perimeter minimised the risk of further peat stability in the area. The routing of the two sections of floating roads adjacent to barrage 1 and barrage 2 were such that they were constructed in areas suitable for this type of road construction. The access routes to barrages 3 and barrages 4 were chosen in areas with shallow peat cover.

7 No. monitoring points along the peat slide source are also monitored on a regular basis.

For the Operation and Maintenance phase of the Project, many of the remedial measures adopted during construction were also adopted for the O&M phase to minimise the risk of further peat instability e.g.

- Carrying out all of heavy lifting operations for the maintenance of the turbines and substation components from the granular hardstand areas, which are supported on glacial till below the peat and designed to support the loads.
- Limitations and controls on the size and frequency of construction traffic loading on the floating roads.
- Geotechnical analysis and design of the road upgrade works in 2014, including full time geotechnical supervision on site and certification of contractors method statements.
- Periodic full scale proof load tests to verify the capacity and performance of the floating roads, including after the road upgrade works in 2014.
- Regular drainage maintenance and improvements to maintain the capacity and performance of the improved network on the wind farm site.

- Continuous monitoring of groundwater levels and ground movement in electronic piezometers and tiltmeters on the wind farm site until the instrumentation was decommissioned in 2014.
- Use of appropriate LGBP plant and machinery for minor works on the peat slopes including drainage improvements, tree felling, tree topping and the installation of new fibre optic cable control systems in 2017.
- Regular monitoring of the wind farm site and peat slide response measures by ESB geotechnical engineers and other geotechnical consultants familiar with the Project.

The mitigation measures that were established during the second phase of construction and for the O&M phase will be adopted for the relevant activities during decommissioning. e.g. use of hardstanding areas for heavy lifting operations; site controls on construction traffic loading on the floating roads, geotechnical supervision on site; geotechnical analysis and design for temporary widening of floating roads; minimal activity on peat with access limited to LGBP plant and equipment suitable for working on peat; and use of established forestry access routes along the grid connection route, where possible.

The decommission plan has also been devised to minimise the impact of the works on peat stability by leaving the site access tracks, turbine foundations, hardstanding areas and electrical transmission and fibre optic control cables in place to avoid extensive excavation works on the site, which would also involve frequent heavy construction traffic loading on the floating roads, and intrusive material handling and spoil management works on the site. The improved drainage network will also be left in place without blocking any drains to avoid any sudden changes to the groundwater regime on the site, and to allow the site to adapt gradually to changing conditions over time if the efficiency of the system is reduced by vegetation growth.

After decommissioning there will be no more activity or works related to the wind farm on the site. The site will be returned to the landowner and Gort Windfarms Ltd. will not have any involvement in future land use or site activities. Therefore, for the Retained Development the primary mitigation measure that will mitigate the impact of the Retained Development on the peat is the compilation and handover of the **Safety File** for the Project to the landowner. This will include detailed construction records for the decommissioning works as well as design and as-built construction details for all the elements of the wind farm, grid connection and ancillary works that will be left in place after decommissioning (the Retained Development), including the Peat Stability Risk Assessments and risk mitigation measures for the Project. This will provide the landowner with all relevant information necessary to make informed decisions on the maintenance and safe use of the Retained Development post-decommissioning.

Table 8-19: Summary of impacts of Wind Farm site activities on soils, geology and land that had significant effects with regard to site stability (i.e. Stability Impacts)

	*Stability Impacts with Significant Effects	*Stability Impacts with Moderately Significant Effects	*Stability Impacts with Slightly Significant Effects
Construction Stage – Phase 1 (2003) (prior to peat slide on 16th October 2003) ***(Impacts which have occurred)***	• Dead load surcharge from floating roads constructed on the peat slopes with 0.6-1.0m of granular rockfill. • Live load surcharge from construction traffic on the floating roads. • Dead load surcharge from excavated peat, glacial till and occasionally weathered rock placed on the intact peat slopes in material sidecast areas adjacent to turbine foundation excavations.	• **[Positive Impact]** Reduction of groundwater levels and groundwater pressures in peat due to improved drainage. • **[Positive Impact]** Rockfill embankments constructed across slide area at T68 and T70, which act as a barrage with a positive effect on stability of disturbed peat within the slide area upslope from the roads. • No adverse impacts	• Live load surcharge on peat slopes from low ground bearing pressure construction & forestry equipment. • Local stability of temporary peat slopes around the perimeter of turbine foundation & hardstanding excavations. • Dynamic inertial loading on peat from blast-induced vibrations due to rock blasting in Borrow Pit BP-3. • Miscellaneous localised live loads on peat slopes from work related to tree felling and drainage.
Construction Stage – Phase 2 (2004/2005) (after the peat slide) ***(Impacts which have occurred)***	• Dead load surcharge from the remaining floating roads constructed on the peat slopes with 0.6-1.0m of granular rockfill. • Live load surcharge on the new floating roads from the construction traffic used to construct the roads.	• **[Positive Impact]** Reduction of groundwater levels and groundwater pressures in peat due to improved drainage. • Dead load surcharge on the intact peat slopes from the excavated peat, glacial till and weathered rock in the material sidecast areas in the medium-term as the peat compressed and gained strength under the loads. • Live load surcharge from the construction traffic on the floating roads after the capacity and performance of the roads had been verified by full-scale proof load tests.	• Dead load surcharge from up to 1.0m of excavated peat placed on the peat slopes in designated repository areas. • Local stability of temporary peat slopes around the perimeter of turbine foundation & hardstanding excavations. • Live load surcharge on peat slopes from low ground bearing pressure construction & forestry equipment. • Dynamic inertial loading on peat from blast-induced vibrations due to rock blasting in Borrow Pit BP-3. • Miscellaneous localised live loads on peat slopes from work related to tree felling, drainage and cable-trenching.
Operation & Maintenance Phase 2005-2022 ***(Impacts which have occurred)***	• None	• **[Positive Impact]** Sustained long-term reduction of groundwater levels and groundwater pressures in peat due to maintenance of improved drainage network. • No adverse impacts	• Increased dead load surcharge on the peat from crushed rock granular fill used to re-surface 4.5km of floating roads in 2014 (150mm capping + 20mm surfacing). • Live load surcharge on the floating roads from maintenance vehicles, trucks and mobile cranes used to carry out repairs to the access tracks, turbines and substation; • Occasional live loads on the peat slopes from low ground bearing pressure equipment used for the cable installations, drainage improvements, tree felling (west of the windfarm), and topping/felling small trees on the windfarm site. • Localised surcharge load from temporary timber stockpiles at T3, T19 & Coillte forestry track on west side of windfarm. • One-off localised live load surcharge (10kPa) on the peat from a large mobile crane that went off the road and overturned at Turbine T40 in 2007.

*all stability impacts are adverse unless otherwise stated

Table 8-19 (Contd.): Summary of impacts of Wind Farm site activities on soils, geology and land that had significant effects with regard to site stability (i.e. Stability Impacts)

	*Stability Impacts with Significant Effects	*Stability Impacts with Moderately Significant Effects	*Stability Impacts with Slightly Significant Effects
Ceased Operation Phase (2022-2024) ***(Impacts which are occurring)***	• None	• **[Positive Impact]** Sustained long-term reduction of groundwater levels and groundwater pressures in peat due to improved drainage network – relative to baseline condition in 1998, prior to construction. • No adverse impacts	• **None** – i.e. effect of dead load surcharge from the floating roads, peat repository sites and material sidecast areas on the peat is **Not Significant** because the underlying peat has compressed and increased in shear strength under the sustained loads to reduce the risk of a peat slide to **Negligible.**
Decommissioning Phase (2025) ***(Impacts which are likely to occur)***	• None	• None	• Live load surcharge on the floating roads from construction vehicles, trucks, low-loader transporters and mobile cranes used to dismantle turbines and substation and transport the components offsite for re-use, recycle or disposal in a suitably licensed facility. • The additional dead and live load surcharge where the existing floating roads will be temporarily widened at junctions near T1, T14 and T68, and along narrow sections of the tracks in the turbary area between T35 and T45, and between T43 and T46. • Live load surcharge on the peat from LGBP wide-track excavators and ATV that will be used to take down and remove OHL and timber polesets between PS-1a and PS-4.
Impacts after Decommissioning (the Retained Development) & Residual Impacts (in accordance with Safety File) ***(Impacts which are likely to occur)***	• None	• **[Positive Impact]** Sustained long-term reduction of groundwater levels and groundwater pressures in peat due to improved drainage network – relative to baseline condition in 1998, prior to construction. Reduces to **Slightly Significant** over time as drains become clogged by vegetation, resulting in partial restoration of groundwater levels on site. • No adverse impacts	• **[Positive Impact]** Permanent support provided to the peat slopes by the turbine foundations and crane hardstandings, which are constructed on rock and glacial till below the peat. **[Note – the stability of the peat slopes does not rely on this effect]** • No adverse impacts

*all stability impacts are adverse unless otherwise stated

Table 8-20: Summary of impacts of Grid Connection site activities on soils, geology and land that had significant effects with regard to site stability (i.e. Stability Impacts)

	*Stability Impacts with Significant Effects	*Stability Impacts with Moderately Significant Effects	*Stability Impacts with Slightly Significant Effects
Construction Stage – (2003 - 2005) *(Impacts which have occurred)*	• None	• None	• Dead load surcharge from surplus excavated material. • Live load surcharge on peat slopes from low ground bearing pressure construction & forestry equipment. • Surcharge from temporary access track (AM38) • Excavation for construction of twin pole sets and angle masts • Construction of substation and angle masts and pole sets on competent ground
Operation & Maintenance Phase 2005-2022 *(Impacts which have occurred)*	• None	• None	• Live load surcharge on peat slopes from low ground bearing pressure construction & forestry equipment.
Ceased Operation Phase (2022-2024) *(Impacts which are occurring)*	• None	• None	• None
Decommissioning Phase (2025) *(Impacts which are likely to occur)*	• None	• None	• Live load surcharge on peat slopes from low ground bearing pressure forestry equipment.
Residual Impacts after Decommissioning *(Impacts which are likely to occur)*	• None	• None	• None

**all stability impacts are adverse unless otherwise stated*

Table 8-21: Summary of impacts of Peat Slide Response Measures site activities on soils, geology and land that had significant effects with regard to site stability (i.e. Stability Impacts)

	*Stability Impacts with Significant Effects	*Stability Impacts with Moderately Significant Effects	*Stability Impacts with Slightly Significant Effects
Construction Stage – (2003 - 2005) ***(Impacts which have occurred)***	• Intrinsic stability of peat in peat slide source area and in peat slide material	• Construction of floating access tracks at Barrage 1 and Barrage 2	• Construction of barrages to restrict movement of slide material (Initially adverse impact, positive impact once constructed) • Live load surcharge on peat slopes from low ground bearing pressure construction & forestry equipment. • Loading on peat from peat repositories to store slide material • Construction of borrow pit adjacent to Barrage 1 • Construction of substation and angle masts and pole sets on competent ground
Operation & Maintenance Phase 2005-2022 ***(Impacts which have occurred)***	• None	• None	• Loading of peat from the works associated with maintenance of barrages
Ceased Operation Phase (2022-2024) ***(Impacts which are occurring)***	• None	• None	• Stability of material in peat slide source area and peat slide material flow
Decommissioning Phase (2025) ***(Impacts which are likely to occur)***	• None	• None	• None
Residual Impacts after Decommissioning ***(Impacts which are likely to occur)***	• None	• None	• None

**all stability impacts are adverse unless otherwise stated*

9. HYDROLOGY AND HYDROGEOLOGY

9.1 Introduction

9.1.1 Chapter Scope

This chapter provides an assessment of the likely significant effects of the Retained Development (as described in Chapter 4)with respect to hydrology and hydrogeology. The assessment process highlights any areas where mitigation measures may be necessary to protect the surrounding water environment from any negative impacts associated with the works above. This assessment highlights any areas where mitigation measures may be necessary to protect the surrounding water environment from any negative likely significant impacts associated with the Retained Development.

It should be noted that assessment of the surface water quality associated with the Retained Development is discussed in detail in Chapter 7 Biodiversity – Aquatic Ecology and Fisheries.

9.1.2 Statement of Authority

This chapter has been prepared by Harry Griffin BA BAI, MSc Hydrology and Climate Change, C.Eng., MIEI, ESB Engineering and Major Projects (EMP). Mr. Griffin has over 10 years of experience in hydrological/hydrogeological assessment, flood risk analysis and drainage design. He is appropriately experienced and competent to undertake the assessment having worked on flood risk assessments associated with Grousemount and Crockahenny Wind Farms and, drainage design for Cappawhite, Castlepook and Crockdun Wind Farms and a large number of hydrological and hydrogeological assessments for electrical substations, power stations and other ESB developments across the country.

The assessments undertaken within this chapter were carried out in association with Anthony Cawley B.E. M.EngSc. C.Eng. M.I.E.I Consulting Hydrologist and director of Hydro Environmental Ltd. Mr. Anthony Cawley has over 30 years professional consulting experience in the water engineering field, in a wide variety of activities relating to hydrology, hydrogeology, flooding, and hydrodynamic and water quality assessments. Over that period, he has carried out well over 100 flood risk assessment studies which included groundwater, rivers, estuarine and coastal flooding throughout Ireland and also in the UK. He has over the past twenty years been involved in preparing the Hydrological Impact Assessments for over 20 major road schemes throughout Ireland, hydrological and flood risk assessment of two major solar farm projects and five large wind farm developments. He has been an expert witness on hydrology and flooding related issues at numerous oral hearings for major infrastructure projects (such as the M6, M20/M21, N23, Lansdowne Stadium redevelopment, Galway Harbour Development). He was also retained as an expert consultant to An Bord Pleanála for large housing development proposals at Kilcock, the Dublin Docks Gateway and Alexandra Basin projects in respect to flooding and hydrodynamic processes and is experienced in the requirements of strategic environmental assessments (SEA) and environmental impact assessments (EIA).

9.1.3 Relevant Legislation

The rEIAR is prepared in accordance with the requirements of the 'EIA Directive' (Directive 2011/92/EU as amended by Directive 2014/52/EU) on the assessment of the effects of certain public and private projects on the environment.. The requirements of the following legislation are also complied with:

- Directives 2011/92/EU and 2014/52/EU on the assessment of the effects of certain public and private projects on the environment, including Circular Letter PL 1/2017: Implementation of Directive 2014/52/EU on the effects of certain public and private projects on the environment (EIA Directive).

- Planning and Development Act, 2000, as amended.
- Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy or, for short, the EU Water Framework Directive (WFD), established a framework for the protection of both surface and groundwater. Transposing Irish legislation with regard to surface waters, namely S.I. 272 of 2009, European Communities Environmental Objective (Surface Water) Regulations 2009 (as amended), outlines the water protection and water management measures required in Ireland to maintain high status of surface waters where it exists, prevent any deterioration in existing water status and achieve at least good status for all waters i.e., requirement to implement the WFD.
- The EU Floods Directive 2007/60/EC.
- S.I. 722 of 2003, European Communities (Water Policy) Regulations, as amended.
- S.I. 350 of 2014, European Union (Water Policy) Regulations 2014.
- S.I. 9 of 2010, European Communities Environmental Objectives (Groundwater) Regulations.
- Council Directive 80/68/EEC of 17 December 1979 on the protection of groundwater against pollution caused by certain dangerous substances.
- Directive 2006/118/EC of the European Parliament and of the Council of 12 December 2006 on the protection of groundwater against pollution and deterioration.
- S.I. 122 of 2010, European Communities (Assessment and Management of Flood Risks) Regulations.

9.1.4 Relevant Guidance

This chapter of this rEIAR was prepared having regard, where relevant, to guidance contained in the following documents:

- Environmental Protection Agency (2022): Guidelines on the Information to be contained in Environmental Impact Assessment Reports.
- European Union (2017) Environmental Impact Assessment of Projects – Guidance on the preparation of the Environmental Impact Assessment Report.
- National Roads Authority (NRA) Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes (NRA 2009).
- "The Planning System and Flood Risk Management - Guidelines for Planning Authorities (DECLG/OPW, 2009)".
- Galway County Development Plan 2022-2028 Strategic Flood Risk Assessment.
- Guidelines for the Assessment of Indirect and Cumulative Impacts as well as Impact Interactions (European Commission, 1999).Forest Road Manual Guidelines for the design, construction and management of forest roads (COFORD, 2004).
- Climate Change Sectoral Adaptation Plan. Flood Risk Management (2015-2019). FRAM Section, Office of Public Works (OPW, 2019).
- Drainage of Runoff from Natural Catchments. Volume 4 Section 2 Part 1. NRA HD 106/15 (TII, 2019).
- A number of River Basin Management Plans (RBMPs) were developed to address the requirements of the WFD. The first cycle RBMP of relevance to this assessment (the Western RBMP 2009-2015) was adopted in 2009 and this included a programme of measures required to facilitate the achievement of the WFD objectives. This programme of measures included full implementation of existing legislation including the Water Pollution Acts, Water Services Act, Bathing Water Quality Regulations, Integrated Pollution Prevention and Control (IPPC) Regulations, Urban Wastewater Treatment Regulations and the Birds and Habitats Directives (particularly the Appropriate Assessment (AA) process).
- The second cycle of the river basin management planning is completed, and the Government has published the River Basin Management Plan for Ireland 2018 – 2021 which merges the Eastern, South Eastern, South Western, Western and Shannon River Basin Districts to form one national River Basin District. As outlined in the RBMP this "Irish River Basin District" is

"...broken down into 46 catchment management units. These units are, in the main, based on the hydrometric areas in use by authorities– with, for example, the Shannon District being sub-divided on the basis of the catchments of its major tributaries. The 46 catchment management units have been broken down further into 583 subcatchments". The Derrybrien Wind Farm location in relation to adjacent Water Management Units (WMU) as defined by the EPA (Environmental Protection Agency) is shown in Figure 9-1. The third cycle of the River Basin Management Plan for the period of 2022-2027 is currently being prepared. Individual catchment assessments for each of the 46 WMUs have been developed and published by the EPA's Catchment Science and Management Unit. The area encompassing Derrybrien Wind Farm is captured entirely in the Galway Bay South East Catchment Assessment 2016-2021 (HA 29) with the exception of a small area at the northeast corner of the wind farm which lies in the neighbouring Lower Shannon Catchment (HA 25C) (EPA, 2021).

9.2 Methodology

9.2.1 Impact Assessment Methodology

Figure 2-1 of the EPA EIAR Guidelines (EPA, 2022) demonstrates how the identification of impacts leads to effects which should be classified and addressed accordingly. The significance of effects of the Project has been assessed in accordance with the EPA Guidelines (EPA, 2022).

9.2.2 Flood Risk Assessment Methodology

The methodology used to assess the flood risk associated with the Project is based on The Planning System and Flood Risk Management - Guidelines for Planning Authorities (OPW, 2009). The site-specific Flood Risk assessment is presented in Appendix 9-1 and the findings summarised later in this document.

The Guidelines set out a staged approach for the consideration of flood risk in relation to developments as follows:

> *"Stage 1: Flood risk identification – to identify whether there may be any flooding or surface water management issues related to either the area of regional planning guidelines, development plans and LAP's or a proposed development site that may warrant further investigation at the appropriate lower level plan or planning application levels;"*
>
> *"Stage 2: Initial flood risk assessment – to confirm sources of flooding that may affect a plan area or proposed development site, to appraise the adequacy of existing information and to scope the extent of the risk of flooding which may involve preparing indicative flood zone maps. Where hydraulic models exist the potential impact of a development on flooding elsewhere and of the scope of possible mitigation measures can be assessed. In addition, the stage 2 assessment scopes the requirements of the detailed assessment;" and*
>
> *"Stage 3: Detailed flood risk assessment – to assess flood risk issues in sufficient detail and to provide a quantitative appraisal of potential flood risk to a proposed or existing development or land to be zoned, of its potential impact on flood risk elsewhere and of the effectiveness of any proposed mitigation measures. The stage 3 should also address the residual risks and impacts, flood risk management plan and future climate change implications."*

Methodologies used for assessing flood regime impacts from the Retained Development relative to the baseline are discussed in **Appendix 9-1**.

9.2.3 Zone of Influence

The boundaries of the rEIAR Study Area on a regional scale lie almost entirely in the Galway Bay South-East WFD Catchment (hydrometric area 29). A small area (<0.02 km^2, representing only 0.6% of the overall wind farm site area) to the northeast corner of the wind farm site lies within the neighbouring Lower Shannon WFD Catchment (hydrometric area 25C) (Figure 9-1).

The Derrybrien Wind Farm site lies on Cashlaundrumlahan Mountain in south County Galway, 12.7 km east-northeast of Gort, 11 km due south of Loughrea and 25 km west of Portumna. The overall area of the wind farm site is approximately 344 ha (3.44 km^2). The lands within the wind farm site comprise disturbed peat bog, all of which was formerly used either for commercial Coillte forestry plantation (263 ha) or turbary and other bog lands (81 ha). The wind farm infrastructure only comprises approximately 9% of the site area in terms of tracks, turbine bases and access areas. Site elevations range from 320–365 mOD on the upper slopes forming the wind farm, which form a gently sloping plateau aligned on a northeast / southwest axis.

Slopes range from less than 3 degrees up to 7.5 degrees locally, increasing up to 10 degrees in places (Figure 9-2). There is a broad zone that runs across the full width of the site for a distance of approximately 250 – 300 m to the north and south of the peak of the mountain where the ground surface slopes gently away from the peak at slope angles of less than 3 degrees. This is within the central three rows of turbines. To the south of this zone the slope is convex in profile with slopes generally increasing up to 4 – 5 degrees and locally 5.0 – 7.5 degrees within the site boundary, particularly between Turbines T21 and T41 along the southern boundary.

Downslope from the site in this area the slopes increase up to 7.5 degrees more consistently and locally up to 10.0 degrees.

The northern upper slopes of the mountain within the site boundary are characterised by a terraced profile with broad flat areas where the slope angles are less than 3 degrees, separated by benches where the slopes are locally steeper at up to 5.0 – 7.5 degrees, locally up to 10 degrees. In general, the depth of peat is inversely proportional to the slope angles, i.e. peat is deeper across the middle of the site and shallower around the boundaries.

The elevation of the OHL route falls from Derrybrien Substation on the southern end of the wind farm site at an elevation of 330 mOD to a flat-bottomed valley where it crosses the R353 road and the tributaries of the Owendalulleegh River at an elevation of approximately 130 mOD. From here, the route skirts around the Slieve Aughty Bog Natural Heritage Area (NHA – site number 001229) before gaining elevation again as it passes Lough Agannygal, at about 195 mOD. The route ends at the Agannygal Substation, just to the north of Lough Atorick, at an elevation of approximately 190 mOD.

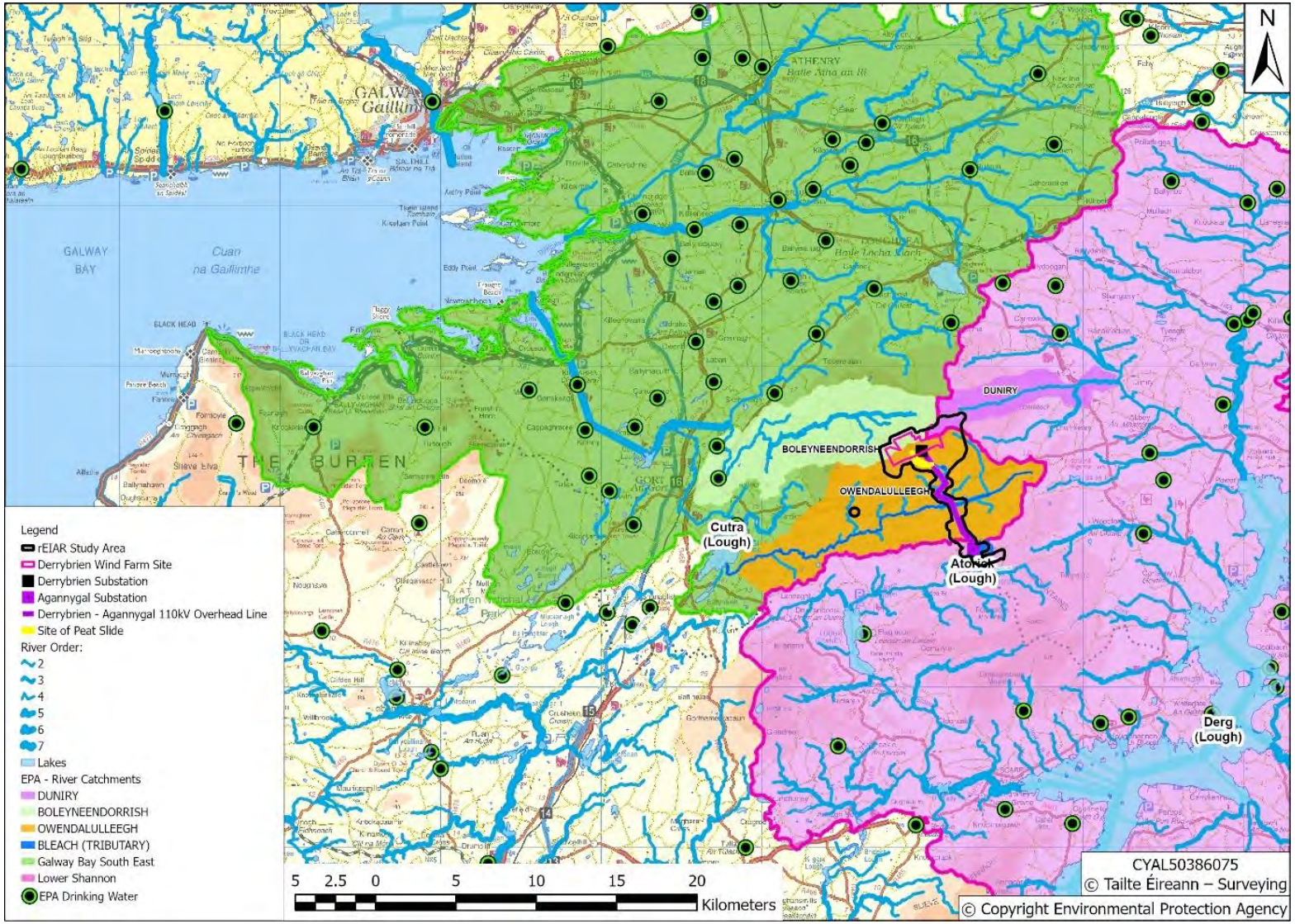


Figure 9-1Catchments in relation to wind farm project area

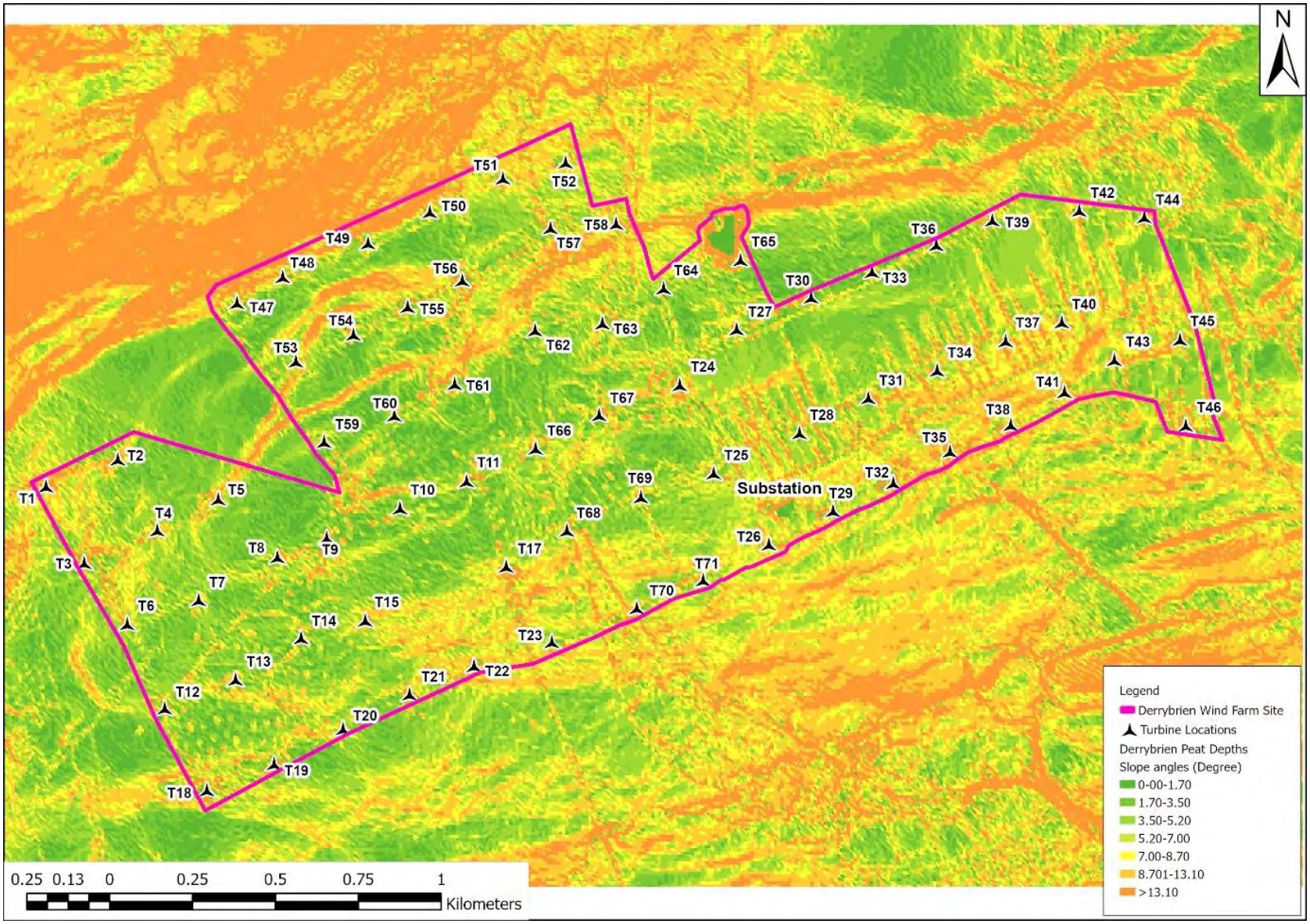


Figure 9-2 Ground slope angles on wind farm

9.2.4 Baseline Data Gathering

A desk study was carried out to collate the available information on the surface water and groundwater environments of the study area with the following data sources referenced:

- Available contemporaneous information.
- Periodic (predominantly performed annually) Geotechnical Inspection Reports from the beginning of operational stage onward (2006 to 2024).
- Tailte Éireann - current and historical mapping.
- Aerial photography.
- LIDAR survey carried out by Fugro in 2012. This data remains valid based on subsequent spot checks.
- Met Éireann (www.met.ie) for local and regional rainfall data and climatological data including evaportranspiration, soil moisture deficits.
- Office of Public Works (OPW) Flood Studies Update (FSU) portal (opw.hydronet.com) for catchment analyses and flood risk assessment including catchment mapping.
- OPW floodinfo.ie for predictive and historical flood mapping, reports, press archives and photographs.
- EPA Water map viewer (https://gis.epa.ie/EPAMaps/Water).
- Water Framework Directive Ireland Database (www.wfdireland.ie).
- The Western River Basin Management Plan (WRBMP) 2016-2022.
- Geological Survey of Ireland (GSI) Groundwater Mapping and records for the Project location.
- OPW floodinfo.ie predictive and historical flood mapping.
- The River Basin Management Plan for Ireland 2018-2021 (Department Housing, Planning, Community and Local Government (DHCLG), (2018).
- The Western River Basin District Catchment Flood Risk Assessment and Management Study (CFRAMS).
- Catchments.ie provides EPA Water quality data, etc.
- Site investigation reports prepared by AGL Consulting.
- Peat stability reports prepared by AGL Consulting.
- Piezometer measurements.
- Topographical survey.

Much of the information on the baseline (pre-construction) environment within the Project site was gathered through a desktop review of literature prepared from 1998 to 2003 from various sources and an analysis of aerial photography (Tailte Éireann Aerial Photography dated 1995 and 2000).

9.2.5 Site Walkover

Substantial field work in the form of geotechnical investigations throughout the life of the Derrybrien Wind Farm Development have informed the establishment of baseline data for this chapter.

Field work carried out between 2018 and 2024 for the purpose of assessing the current state of the Project site specifically involved a series of walkover surveys of the wind farm site, the peat slide area, the overhead line (OHL) route and two electrical substations that comprised the Project. These were carried out in tandem with topographical and drone surveys. Detailed surveys were carried out on the wind farm site of the drainage channels and on the in-stream structures. A Light Detection and Ranging (LIDAR) survey of the entire wind farm site was carried out in 2012 and informed the flood risk assessment for the site including the 110 kV Derrybrien substation compound (See **Appendix 9-1** – Flood Risk Assessment). Following on from these field surveys, the results were reviewed in ArcGIS software in conjunction with publicly available hydrological and hydrogeological data from the GSI, EPA, and OPW historical records. A site walkover to review the condition of the drainage network was conducted in September 2024.

9.2.6 Scoping and Consultation

As detailed in Chapter 2 Scoping and Consultation was undertaken in September 2024. No responses relating to the Hydrology and Hydrogeology were received.

9.2.7 Limitations/Difficulties Encountered

The EIA Directive states that difficulties encountered should refer to the forecasting methods or evidence, used to identify and assess the significant effects –

> *"...including details of difficulties (for example technical deficiencies or lack of knowledge) encountered compiling the required information and the main uncertainties involved."*

This chapter has been prepared many years after the commencement of the construction phase of the wind farm project.

Certain specific information was no longer available or could not be sourced, including:

- Detailed information on the condition of the 27 km of pre-existing drainage channels within the wind farm site prior to construction of Project, in particular the depth and width of these drains.
- Information on site controls from the construction period prior to the peat slide.
- Information in relation to temporary barrages which were removed some time after the peat slide. Following the 2003 peat slide event, a number of temporary barrages were constructed at intervals downstream to intercept the path of the peat slide debris. These barrages were constructed immediately following the peat slide and a number were subsequently removed prior to completion of construction. Details of the extent of these structures is not known, and a 2019 inspection of their known locations showed no evidence of them.
- Private lands in the immediate vicinity of the slide area were not accessible.
- Rainfall data for the site is only available up to August 2022.

Despite these constraints, it is considered that the data available is adequate for the purposes of carrying out this assessment.

9.3 Receiving Environment

The decisions in relation to planning applications and appeals for the wind farm and grid connection were made in the period 1998-2001. Therefore, for the purposes of this rEIAR the baseline date is circa 1998. Refer to Chapter 7 of this rEIAR for details of receiving environment with respect to surface water quality criteria such as SAC features and surface water sensitivity criteria.

9.3.1 Study Area Location

The boundaries of the Project area on a regional scale lie almost entirely in the Galway Bay South-East WFD Catchment (hydrometric area 29). A small area (<0.02 km2) to the northeast corner of the wind farm site lies within the neighbouring Lower Shannon WFD Catchment (hydrometric area 25C) (Figure 9-1).

The Derrybrien Wind Farm site lies on Cashlaundrumlahan Mountain in south County Galway, 12.7 km east-northeast of Gort,11 km due south of Loughrea and 25 km west of Portumna. The lands within the wind farm site comprise disturbed peat bog, all of which was formerly used either for commercial Coillte forestry plantation (263 ha) or turbary and other bog lands (81 ha). The overall area of the wind farm site is approximately 344 ha (3.44 km^2) while the wind farm infrastructure only comprises approximately 9% of the site

area in terms of tracks, turbine bases and access areas. Site elevations range from 320–365 mOD on the upper slopes forming the wind farm, which form a gently sloping plateau aligned on a northeast to southwest axis.

Slopes range from less than 3 degrees up to 7.5 degrees locally, increasing up to 10 degrees in places (Figure 9-2). There is a broad zone that runs across the full width of the site for a distance of approximately 250 – 300 m to the north and south of the peak of the mountain where the ground surface slopes gently away from the peak at slope angles of less than 3 degrees. This is within the central three rows of turbines. To the south of this zone the slope is convex in profile with slopes generally increasing up to 4 – 5 degrees and locally 5.0 – 7.5 degrees within the site boundary, particularly between Turbines T21 and T41 along the southern boundary.

Downslope from the site in this area the slopes increase up to 7.5 degrees more consistently and locally up to 10.0 degrees. The peat slide during construction occurred within this zone of locally steeper slopes between Turbines T68 and T70.

The northern upper slopes of the mountain within the site boundary are characterised by a terraced profile with broad flat areas where the slope angles are less than 3 degrees, separated by benches where the slopes are locally steeper at up to 5.0 – 7.5 degrees, locally up to 10 degrees. In general, the depth of peat is inversely proportional to the slope angles, i.e. peat is deeper across the middle of the site and shallower around the boundaries.

At the peat slide source area there is a natural shallow valley which drained to a tributary stream of the Owendalulleegh River (sometimes referred to as Derrywee River) at which point the valley becomes more distinct before widening above the Black Road Bridge on the Black Road.

The elevation of the OHL route falls from Derrybrien Substation on the southern end of the wind farm to a flat-bottomed valley where it crosses the R353 road and the tributaries of the Owendalulleegh River at an elevation of approximately 130 mOD. From here, the route skirts around the Slieve Aughty Bog Natural Heritage Area (NHA – site number 001229) before gaining elevation again as it passes Lough Agannygal, at about 195 mOD. The route ends at the Agannygal Substation, just to the north of Lough Atorick, at an elevation of approximately 190 mOD.

9.3.2 Baseline Drainage Network

Peatland bogs such as that on which Derrybrien Wind Farm is sited are wetlands that are fed directly by rainfall to give rise to their characteristic saturated surface conditions and water logging. These are generally characterised as having a living surface peat layer typically 0.1 – 0.3 m thick, the acrotelm, with moisture content up to 90 – 98% and features the peat-forming vegetation, i.e. sphagnum moss, cotton grass and other materials including purple moor grass, heather stems and roots. The acrotelm supplies plant material which then slowly forms peat in the underlying catotelm layer. Typically, active peat bogs grow slowly at 0.5 – 1.0 mm per annum. In active bogs sphagnum mosses form a protective carpet which is a mosaic of sphagnum species growing as dense hummocks, low growing lawns and as hollows that create the characteristically undulating bog surface. In these undrained conditions the saturated bog promotes increased surface ponding as pools and mires, also generating overland runoff as sheet flow across the surface of the bog. Active blanket bog generally remains close to saturation throughout the year and therefore has limited available storage except in depressions where larger pools can form before spilling overland.

In the case of Derrybrien wind farm the baseline land use prior to its development was primarily –

i. turbary bog, and
ii. commercial forestry

which both represent a drained bog situation, i.e. where active blanket bog has been degraded. The wind farm site had been extensively drained in the past, prior to any wind farm construction, by a series of parallel open ditches to facilitate commercial forestry and turf cutting under turbary rights. Turf cutting has and continues to

take place on the eastern part of the site. Farming is also undertaken in the lower lying areas. The principal economic activity in the immediate area is forestry and farming, the latter being dominated by grazing of cattle.

The ditches and drains in the worked bog and forestry discharged to the natural drainage and watercourses in the area (Plate 9-1 and Plate 9-2).

Plate 9-1 Typical site land at Derrybrien Wind Farm

Plate 9-2 Interceptor Drainage channel at Derrybrien wind farm near Turbine T35

i) Turbary Bog

In a damaged or degraded bog, the acrotelm has been lost through drainage, burning, trampling / grazing, afforestation or agriculture (which includes fertiliser application as well as drainage). The degradation exposes the unprotected underlying catotelm layer more acutely to atmospheric conditions including the surface water environment. Subsequently, non-wetland vegetation becomes established, accelerating the aeration, drying and shrinkage process (primary consolidation) within the bog.

The loss of moisture and thus buoyancy in the upper layers further squeezes water from the catotelm layer (secondary compression). Drainage of peat bogs is generally focused on lowering the water table through a network of deep connecting drains often for domestic and commercial peat production, for forestry production or for agricultural grassland reclamation to provide an unsaturated soil root zone that enables plant growth to succeed. The construction of drainage ditches in a bog provides shorter pathways for surface water to run off and depending on the density of the drainage network will ultimately reduce waterlogging and over time dry out the surface acrotelm layer and more gradually the upper layers of the catotelm. The acrotelm layer offers relatively low resistance to vertical and lateral water movement and, consequently, drainage tends to empty water reasonably readily from the acrotelm layer. However, given this layer is relatively thin, the drainage effects on the surrounding water table are minor. The drying process should over time alter the surface topography and increase the range in the water table between summer and winter levels.

ii) Commercial Forestry

Forestry plantations such as that which occupied the majority of the wind farm site prior to 2003 cannot tolerate permanently waterlogged conditions such as the saturated conditions found in active blanket bogs. For forestry to flourish it is necessary to drain the peat and remove excess surface water to locally lower the perched water table level. It is also necessary to plough the surface to provide a slightly raised ridge that acts as a micro-habitat for tree seedlings to establish with the ploughed furrow conveying the drainage away from the planted ridge.

Tree planting takes place in rows parallel to the ploughed furrow with the areas in between the ridges often an efficient avenue for runoff to collect and migrate downgradient to receiving watercourses. As such, the overall effect of forestry plantations like this is to increase peak winter flood runoff rates from upland areas. It should be noted however that this only applies when antecedent conditions are wet such as during winter. In drier conditions, the soil moisture deficit may be greater where the root zone promotes drying of the underlying peat, thus effectively providing a degree of attenuation.

Given the upland nature and gradients of the area, the site on which the wind farm was developed represented high runoff category land. This classification is further discussed in Appendix 9-1.

The pre-existing drainage network on the wind farm site shown in Figure 9-3 overlain on an OSI aerial photograph from 2000, represents a baseline condition for the wind farm. It shows the extent of pre-existing access roads (2.0 km), the extent of conifer plantations (2.63 km^2), the turbary plots in the open blanket bog at the east end of the site (0.81 km2), potential subsurface drainage channels along lines of vegetation and patches of poor tree growth which is generally associated with deep peat and high-water tables.

The roads on site prior to the wind farm project generally follow an east-west axis parallel to contour lines. The road layout of the wind farm also generally followed an east-west orientation with a number of spur roads connecting these from north to south, particularly along the internal boundary of the wind farm site. The study area also comprises the 7.8 km overhead line running southward from the wind farm site and the tee-in substation at Agannygal connecting the wind farm to the National Grid (Figure 9-4).

The elevation along the route falls to a flat-bottomed valley where it crosses the R353 road and the tributaries of the Owendalulleegh River at an elevation of approximately 130 mOD. From here, the route skirts around the Slieve Aughty Bog NHA (site number 001229) before gaining elevation again as it passes Lough Agannygal, at about 195 mOD. The route ends at Agannygal Substation, which is located to the south-east of Cashlaundrumlahan Mountain and north of Lough Atorick, at an elevation of approximately 190 mOD. The substation location prior to construction was in afforested Coillte-owned land. The land is elevated with respect to the surrounding area to the north, west and south.

The peat slide which occurred during project construction in October 2003 extended from within the southern end of the wind farm site further south through Coillte land and onto private land between the wind farm site and Flaggy Bridge on the R353. Measures undertaken in response to the peat slide included the rebuilding of short sections of road within the wind farm site and the installation of eight barrages (three temporary earthen barrages, one temporary rockfill barrage and four extant boulder barrages) along and downslope of the route of the slide between the wind farm and downstream of Flaggy Bridge. The intended function of all barrages was stabilise and contain the peat slide. These barrages were constructed along and downslope of the route of the slide between the wind farm and downstream of Flaggy Bridge of which four (Barrages 1,2, 3 and 4) remain in-situ. Peat and soil from the peat slide which had accumulated on adjacent lands, together with material excavated for the construction of barrages and had accumulated behind the barrages was placed in three peat repository areas. Man-made drains constructed within the source area of the slide comprised a series of narrow open drains 1 – 2 m deep with closely spaced furrows. These drains connected to the natural valley drainage in the area and flowed downslope. It is not proposed that any of the elements constructed in response to the slide shall be decommissioned as part of the current Project.

The OHL route crosses the site of the peat slide between pole sets 5 and 6, and also crosses two of the remaining in-place barrages (Barrages 2 and 3) installed as a result of the peat slide. Several watercourses cross the footprint along the OHL route, the largest being the main stream of the Owendalulleegh River which passes beneath the OHL between pole sets 25 and 26. Lough Agannygal passes underneath the section between pole set 37 and angle mast 38.

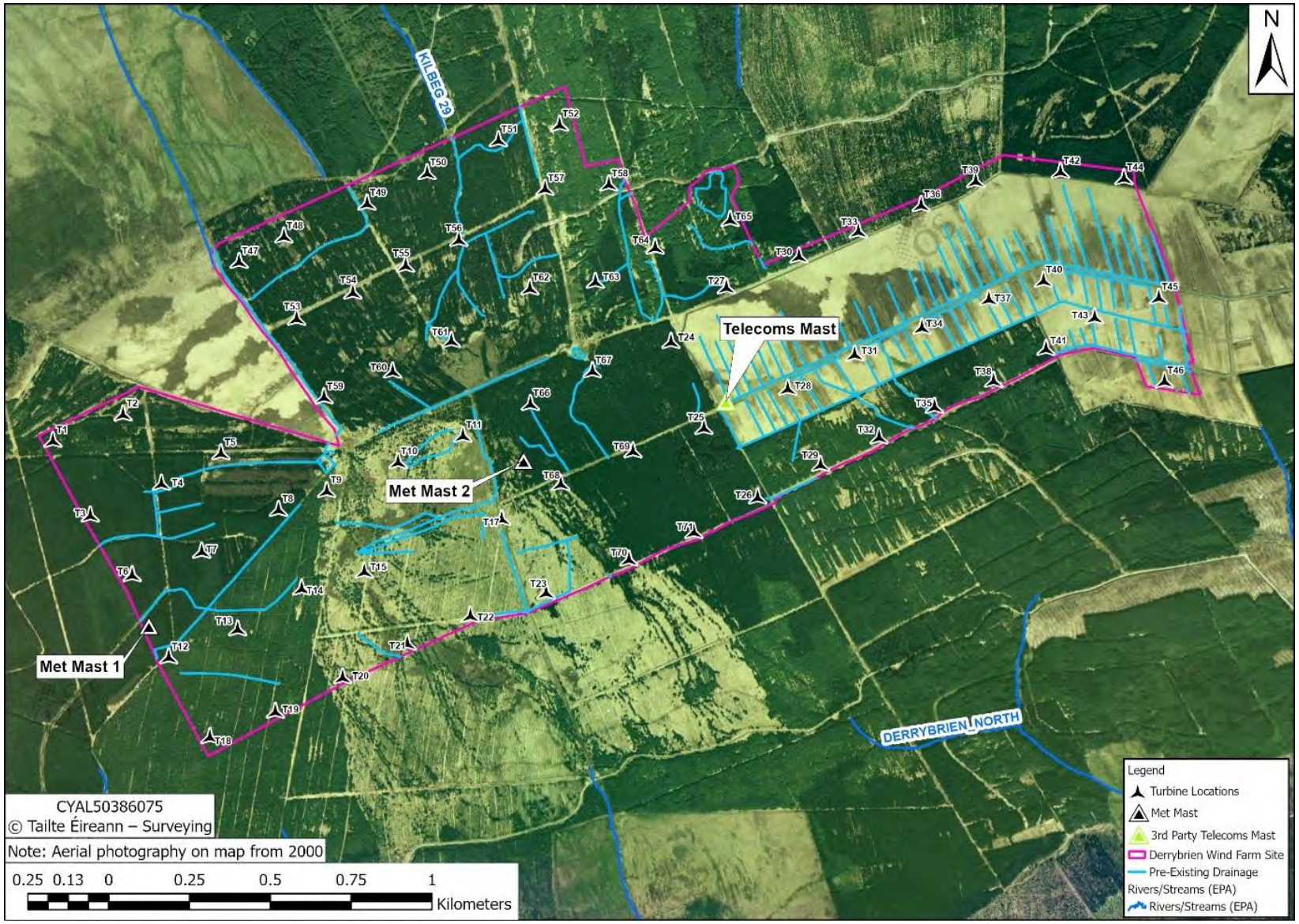


Figure 9-3 Pre-existing (baseline) wind farm drainage

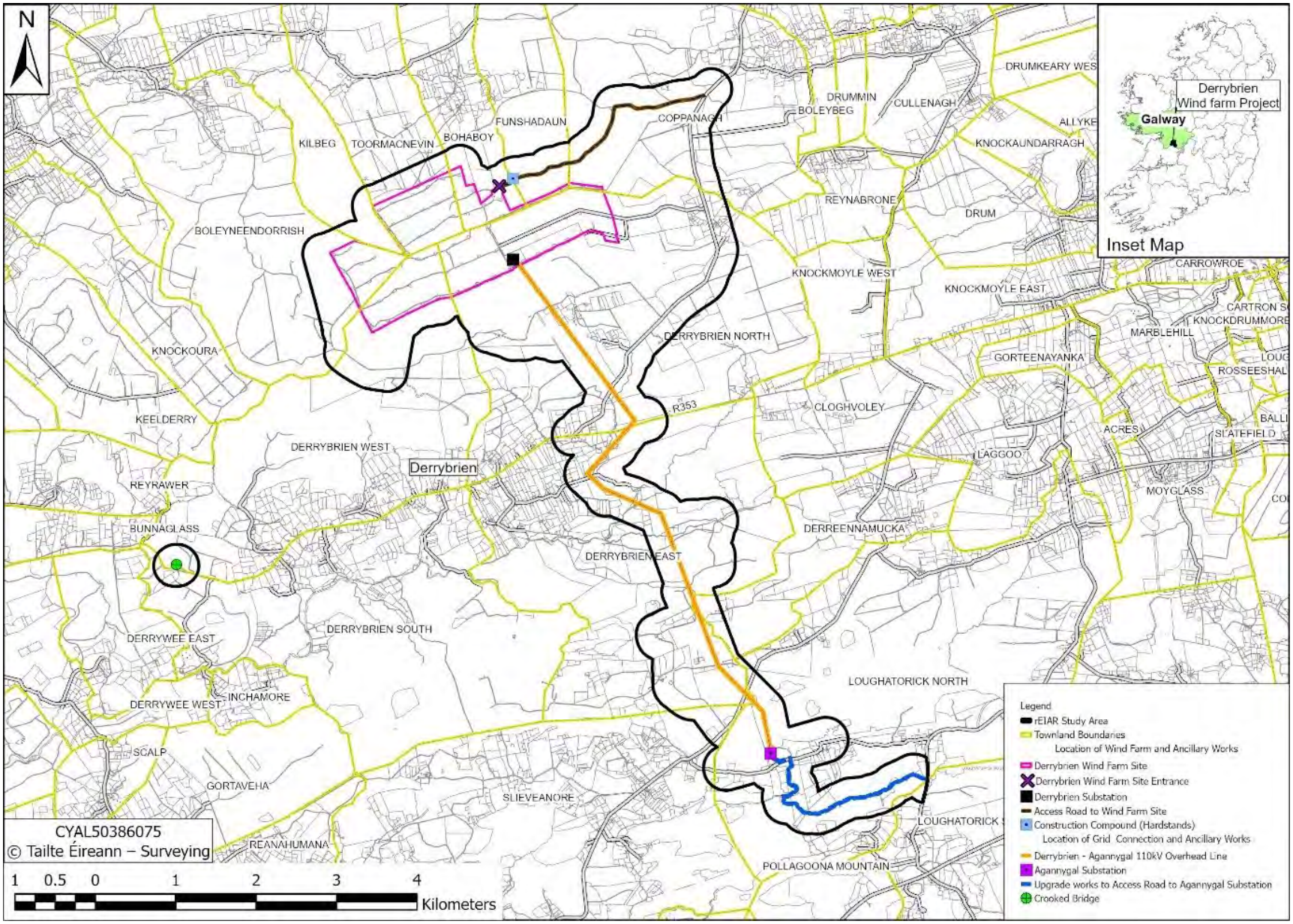


Figure 9-4 Location of Project Works

9.3.3 Water Balance

The long-term rainfall and evapotranspiration data relevant to the study area was sourced from Met Éireann. The Standard Annualised Average Rainfall (SAAR), i.e. long-term annual average rainfall) recorded at Gort (Derrybrien II) Met Station 3 km south of the site is 1431 mm. This rain gauge is the closest Met Éireann gauge but is at a lower elevation (155 mOD) than the wind farm (which is at a minimum elevation of 320 mOD). Data for the site is only available up to August 2022 (Table 9-1).

Table 9-1 Monthly Rainfall (mm) at Gort Derrybrien II Met Station

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2022	84	208	55	84	69	94	49	43					
2021	199	159	117	22	137	31	131	128	102	131	74	133	1363
2020	130	348	128	51	-	106	187	205	71	204	166	177	
2019	127	99	224	104	48	89	82	247	174	121	166	172	1652
2018	250	76	76	108	69	16	63	100	138	64	125	174	1258
2017	59	112	179	19	54	119	153	112	153	139	130	207	1435
2016	205	206	98	63	87	125	87	137	136	53	94	91	1380
2015	95	98	128	93	178	46	111	122	75	67	268	384	1664
2014	255	285	106	45	149	52	105	126	20	160	151	205	1658
2013	136	71	58	104	125	81	-	79	74	157	111	258	
2012	168	88	38	125	62	224	141	140	106	146	162	179	1580
2011	103	173	65	61	127	158	82	80	184	145	140	234	1553
2010	70	62	115	98	48	52	170	63	174	96	171	37	1156
2009	196	23	96	154	135	97	190	191	58	139	428	113	1820
2008	260	100	149	53	41	149	105	220	124	210	138	114	1662
2007	171	101	99	26	90	121	182	133	77	54	90	199	1341
2006	96	44	142	53	143	30	57	65	220	139	180	230	1399
2005	164	68	62	107	110	54	72	97	92	116	123	81	1147
2004	147	49	93	75	57	108	85	89	139	157	103	149	1253
2003	98	71	64	65	152	116	104	22	47	80	147	110	1076
2002	197	235	96	105	139	134	64	101	44	164	178	112	1568
2001	67	67	109	101	37	85	97	113	59	132	137	77	1079
2000	123	162	-	53	-	77	92	96	142	220	175	147	
1999	169	99	75	95	102	71	72	85	238	105	169	289	1570
mean	151	120	110	76	99	92	110	117	115	130	158	168	1431

Met Éireann provides a 2 km x 2 km grid of SAAR nationally, available from Met Eireann Web site. and. The Met Éireann SAAR model gives an annual rainfall estimate for the nearest node points to the summit of the site of 1573 and 1591 mm respectively. These estimates are higher than the gauged estimate which is expected given the higher altitude of the nodal points to the gauge site. The latter of the Met Éireann figures is taken as the SAAR figure from hereon.

Met Éireann via the Flood Studies Update (FSU) web portal provides a 2 km x 2 km grid of rainfall Depth Duration Frequency (DDF) data (Table 9-2). The depth duration frequency model allows for the estimation of point rainfall frequencies for a range of durations for any location in Ireland. The model consists of an index (median) rainfall and a log-logistic growth curve which provides a multiplier of the index rainfall.

Table 9-2 Rainstorm Depth (mm) Duration Return Period Table for wind farm site from FSU Web Portal

Duration (hrs)	Return Period (years)				
	5	10	50	100	250
1	16.0	19.1	27.5	32.1	39.1
3	24.2	28.4	39.7	45.5	54.7
6	31.4	36.5	49.8	56.7	67.2
9	36.5	42.2	56.9	64.4	75.9
12	40.6	46.7	62.4	70.5	82.6
18	47.2	53.9	71.2	80.0	93.1
24	50.6	57.6	75.5	84.4	97.9
48	63.5	71.4	91.2	101	115.3
96	84.1	93.4	116.3	127.4	143.5

The closest synoptic weather station where the average Potential Evapotranspiration (PE) is recorded is Mellows College Athenry, approximately 25 km to the north northwest of the wind farm. The next nearest is located at Shannon Airport which is a synoptic weather station site adjacent to the Shannon Estuary located 48 km south southwest of the site. Measurement of Penman PE is only generally available at the 25 Met Éireann synoptic weather stations throughout Ireland and average PE rates across the nation vary from 425 mm to 600 mm per annum. The median PE for this station for the period 2016 to 2024 is 523 mm/year (Table 9-3).

Table 9-3 Potential Evapotranspiration (mm) at Athenry Synoptic Station

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2024	11	16	33	54	73	83	78	64	46	26	12*	9*	505
2023	11	19	33	54	84	100	74	66	47	23	11	3	525
2022	11	20	42	57	78	79	85	82	45	26	13	6	544
2021	7	22	30	63	77	79	79*	67	43*	25	12	11	515
2020	13	20	36	64	92	75	69	67	43	27	13	8	527
2019	10	21	34	55	76	84	85	62	42	25	11	10	515
2018	11	17	31	52	83	102	93	62	39	25	14	12	541
2017	12	18	37	49	85	77	76	61	42	24	10	9	500
2016	13	17	35	53	80	84	72	61	40	27	10	10	502
Long term mean	11	19	35	56	81	85	79	66	43	25	12	9	519

*Missing – estimated value

This PE value is used as a best estimate of the site PE. Actual Evapotranspiration (AE) at the site is also estimated as 519 mm/year based as there is unlikely to be any soil moisture deficit within the raised bog on the mountain given the generally saturated conditions.

The Effective Rainfall (ER) represents the water available for runoff and groundwater recharge. The annual ER for the site is calculated as follows:

ER = SAAR – AE = 1591 mm/year – 519 mm/year = 1072 mm/year.

Based on recharge coefficient estimates from the Geological Survey of Ireland (GSI, www.gsi.ie), a conservative estimate of 10% groundwater recharge is taken for the site as an overall average. This value is for "Peat" with a "Moderate" vulnerability rating. Areas of thinner peat or thin peaty soils, i.e. extreme vulnerability, may have slightly higher recharge rates, but on this site these areas are generally on sloping ground with very poor natural drainage. The lowest value in the available range was chosen to reflect the large coverage of peat and poorly draining soil types, and the high stream drainage density. Therefore, annual recharge and runoff rates for the site are estimated to be 107 mm/year (10% x ER) and 965 mm/year respectively. Note that according to the GSI

Groundwater Data Viewer, annual recharge rates are expected to be very low at approximately 100 mm/year in this area. The baseline hydrology of the site can therefore be expected to be characterised by high surface water runoff rates and a very flashy stream network with limited baseflow contribution.

9.3.4 Regional & Local Hydrology

A catchment can be defined as a topographic surface area contributing to a watercourse and its tributaries, with all the water ultimately merging downstream at a single channel outlet point. The catchment boundary (watershed divide) is simply the dividing line either side of which surface drainage flows towards separate streams to separate outlet points though these may merge downstream.

9.3.4.1 Wind Farm Site

The 344.5 ha wind farm site partially extends over the catchments of three rivers – Boleyneendorrish and Owendalulleegh in the Galway Bay South East WFD Catchment and Duniry in the Lower Shannon WFD Catchment. These catchments and the associated tributary subcatchments draining to each of the rivers are mapped in Figure 9-5 and tabulated in Table 9-4 and Table 9-5.

Each of the subcatchments' boundaries are as defined by the EPA and the OPW Flood Studies Update (FSU) portal with the exception of the boundary between SC7(a) and SC7(b) which has been modified upon examination of OSI 6-inch mapping and up-to-date aerial photography. The FSU methodologies are now recommended by the OPW as being the preferred method for extreme rainfall and flood estimation in Ireland. The land use for all of the small and very small upper tributaries of the catchments that drain the footprint of the wind farm is almost exclusively a combination of coniferous forest in various states of growth or re-growth and open blanket bog moorland which has not been afforested. Details of the three catchments draining from the wind farm site are described below. Within these catchments there are a number of subcatchments (SC1 to SC9) which have been identified for the purposes of this study.

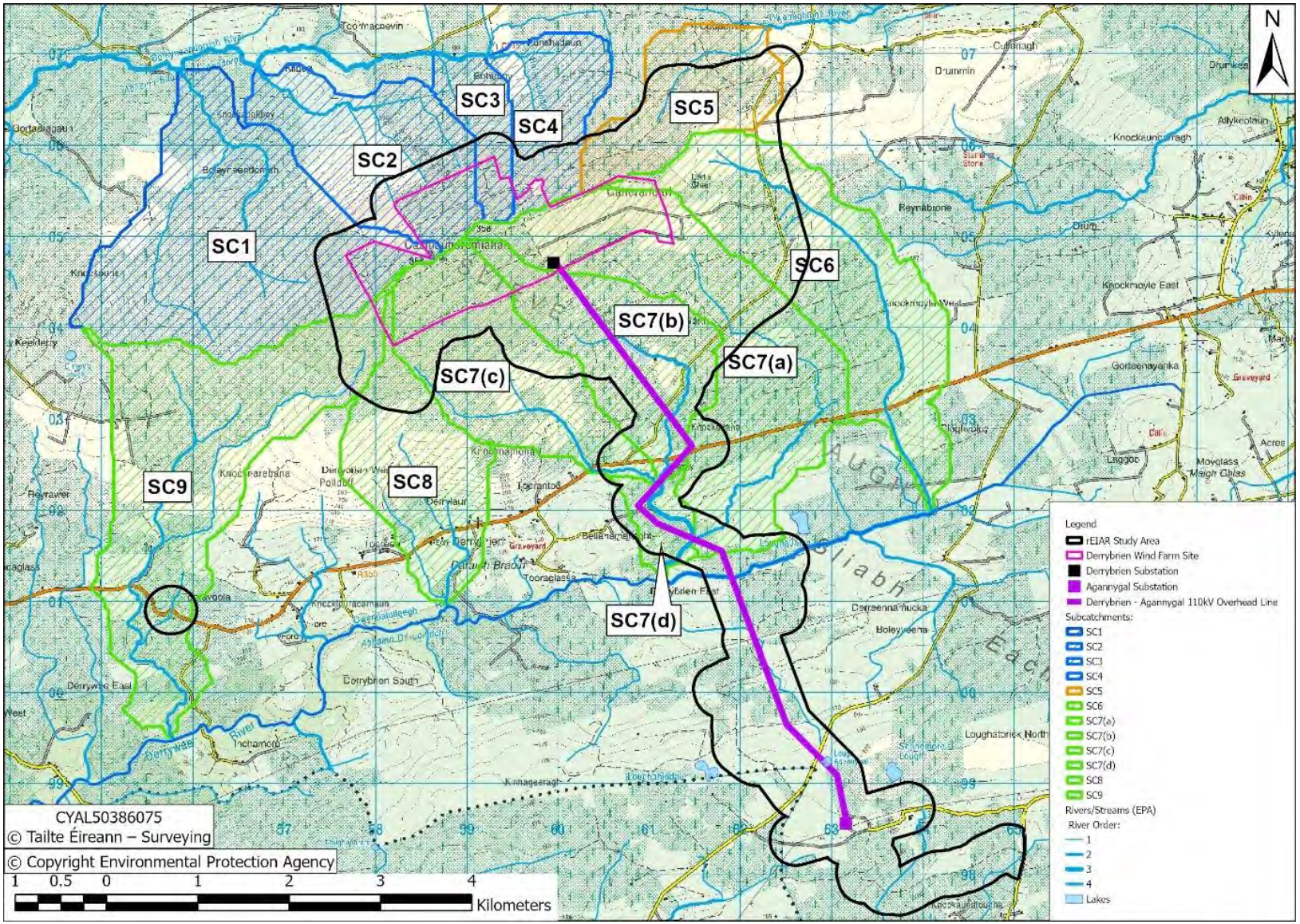


Figure 9-5 Subcatchments draining from wind farm site to major rivers

Table 9-4 Summary of rivers draining from Derrybrien wind farm

Catchment	River Basin (Area km²)	Drainage Area within wind farm boundary (km²)	% wind farm site draining to each river	No. of Turbines in catchment	Area of Access Track/roads (km²)
Boleyneendorrish	Kinvarra (490)	1.15	33.3	26	0.065
Owendalulleegh	Kinvarra (490)	2.28	66.1	43	0.105
Duniry	Kilcrow / Shannon (11461)	0.02	0.6	1	0.003

Table 9-5 Summary of river subcatchments draining from Derrybrien wind farm

Watercourse Name	Subcatchment Designation	Hardstanding area (km²)	Turbines in Subcatchment	Turbine Numbers	Turbines in Catchment
Boleyneendorrish	SC1	0.012	7	T1, T2, T3, T4, T5, T6, T59	26
	SC2	0.019	10	T47, T48, T49, T50, T53, T54, T55, T56, T60, T61	
	SC3	0.010	7	T51, T52, T57, T58, T62, T63	
	SC4	0.007	2	T64, T65	
Owendalulleegh	SC6	0.004	3	T39, T42, T44	43
	SC7(a)	0.038	19	T24, T25, T27, T28, T29, T30, T31, T32, T33, T34, T35, T37, T38, T40, T41, T43,	

Watercourse Name	Subcatchment Designation	Hardstanding area (km^2)	Turbines in Subcatchment	Turbine Numbers	Turbines in Catchment
				T45, T46, T67	
	SC7(b)	0.008	5	T26, T66, T68, T69, T71	
	SC7(c)	0.025	14	T8, T9, T10, T11, T13, T14, T15, T17, T18, T19, T20, T21, T22, T23, T70	
	SC7(d)	0	0	-	
	SC8	0.001	0	-	
	SC9	0.003	2	T7, T12	
Duniry	SC5	0.001	1	T36	1

- The Boleyneendorrish River drains approximately 33% of the wind farm site via subcatchments denoted SC1, SC2, SC3 and SC4. It flows 16km downstream, westward through Blackrock Turlough and Lough Coy, having catchment areas of c. 64 km^2 upstream of its confluence with the Ballylee River and c. 152 km^2 downstream at Ballyloughaun to the east of Kiltartan. It joins up with the Gort River in the Kiltartan Flood Plain area upstream of the Coole Turlough and SAC having a combined catchment area of 300 km^2. The Lough Coole system discharges north-west as groundwater flow and overland flow through a heavily karstified region before entering the sea at Kinvarra town.
- The Owendalulleegh River System drains approximately two-thirds (66%) of the wind farm site through a number of small hill slope stream tributaries – Cloghvoley (designated as subcatchment SC6), Derrybrien North (SC7, further divided into SC7(a), (b) and (c) owing to the large portion of the wind farm which drains to the respective streams; SC7(d) is the remaining subcatchment area but is not located within the wind farm itself) and Derrybrien South (SC8 and SC9). The Owendalulleegh River rises in the townland of Gorteenayanka and flows westward to the south of the site to Lough Cutra approximately 22 km further downstream. The catchment area of the Owendalulleegh River to Lough Cutra inlet is 90 km^2 (area to lake outlet is 124 km^2). Downstream of Lough Cutra it flows through a heavily karstified region disappearing underground at the Punch Bowl swallow hole, re-emerging as the Gort river and again disappearing underground at Kiltartan Swallow holes before re-emerging to enter the Lough Coole System. Downstream of Gort at Kiltartan it joins up with the Ballylee River before entering the Lough Coole system, after which it flows to the northwest through a heavily karstified region where it disappears underground. It reaches Kinvarra town approximately 15 km further downstream, at which point it enters Galway Bay. The entire Kinvarra catchment drains an area of c. 490 km^2. For both the Boleyneendorrish and Owendallulleegh rivers, there is hydraulic contact with the following SACs – Sonnagh Bog, Peterswell Turlough, Lough Coy, Carrowbaun, Newhall and Ballylee Turlough, Ballinduff Turlough, Coole-Garryland Complex, Caherglassaun Turlough, Cahermore

Turlough, Lough Gortacarraun Wood, Drummin Wood, Lough Cutra, and eventually Inner Galway Bay Complex.

- The Duniry River drains a very small section of the overall site 0.6%) to the northeast, designated as subcatchment SC5 with only one turbine present there. The river is a tributary of the River Kilcrow which flows into Lough Derg on the River Shannon. The Shannon then drains a catchment of 11,641 km^2 before entering the sea at the mouth of the Shannon Estuary. The total area of the Kilcrow catchment upstream of Lough Derg is 394 km^2. The Duniry river has hydraulic contact with the Ballyoughter Bog SAC and Lough Derg Northeast Shore SAC.

9.3.4.2 OHL and Agannygal Substation

Several watercourses exist within the footprint of the OHL route, the largest being the Owendalulleegh River, approximately 6.0 m wide, which passes beneath the OHL halfway between pole sets 25 and 26, approximately 150 m from both. The main stream channel drainage features tend to run east to west in the OHL corridor, with minor tributary features aligned approximately north to south to tie into the major drainage features. There are several flat areas where local ponding of surface water occurs. Such a feature – Lough Agannygal (area 0.85 ha), located between pole set 37 and angle mast 38 – prevents access directly beneath the OHL. The land on which Agannygal substation is located (0.5 ha in the Bleach River Catchment) is elevated with respect to the surrounding area to the north, west and south. There is no record of drainage on or in the vicinity of the site prior to construction.

9.3.5 Hydrogeology

9.3.5.1 Aquifer Classification

Receptor sensitivity criteria are set out in Table 9-6.

Table 9-6 Receptor Sensitivity Criteria (adapted from www.sepa.org.uk)

Sensitivity Criteria	
Not sensitive	Receptor is of low environmental importance (e.g. surface water quality classified by EPA as A3 waters or seriously polluted, fish sporadically present or restricted). Heavily engineered or artificially modified and may dry up during summer months. Environmental equilibrium is stable and is resilient to changes which are considerably greater than natural fluctuations, without detriment to its present character. No abstractions for public or private water supplies. GSI groundwater vulnerability "Low" – "Medium" classification and "Poor" aquifer importance.
Sensitive	Receptor is of medium environmental importance or of regional value. Surface water quality classified by EPA as A2. Salmonid species may be present and may be locally important for fisheries. Abstractions for private water supplies. Environmental equilibrium copes well with all natural fluctuations but cannot absorb some changes greater than this without altering part of its

Sensitivity Criteria	
	present character. GSI groundwater vulnerability "High" classification and "Locally" important aquifer.
Very sensitive	Receptor of high environmental importance, of national or international value i.e. NHA or SAC. Surface water quality classified by EPA as A1 and salmonid spawning grounds present. Abstractions for public drinking water. GSI groundwater vulnerability "Extreme" classification and "Regionally" important aquifer

The Ayle River Formation, comprising mudstones, siltstones and conglomerates, underlie most of the wind farm site. This bedrock formation is predominantly classified by the GSI (www.gsi.ie) as a poor bedrock aquifer (Pl), having bedrock that is generally unproductive except for local zones. This bedrock is a muddy impermeable bedrock that is not very conducive to transmitting and storing groundwater flow or karstification due to its higher clay composition. There are no mapped fault lines traversing the site.

The upland areas comprise blanket peat, which underlies all the forestry in the area, with acid brown earths/brown podzolics and acidic peaty gleys underlying most of the agricultural lands farther down the valleys in both the Boleyneendorrish and Owendalulleegh catchments.

The closest karst features to the Project area according to GSI mapping are a number of limestone springs and depressional features near Ballynakill, approximately 5 km to the southeast of the wind farm site at its closest point (Figure 9-6). These springs are at the source of the Owendalulleegh River where the bedrock is a combination of dark muddy limestone / shale and massive unbedded lime-mudstone. They are not hydraulically connected to the wind farm site.

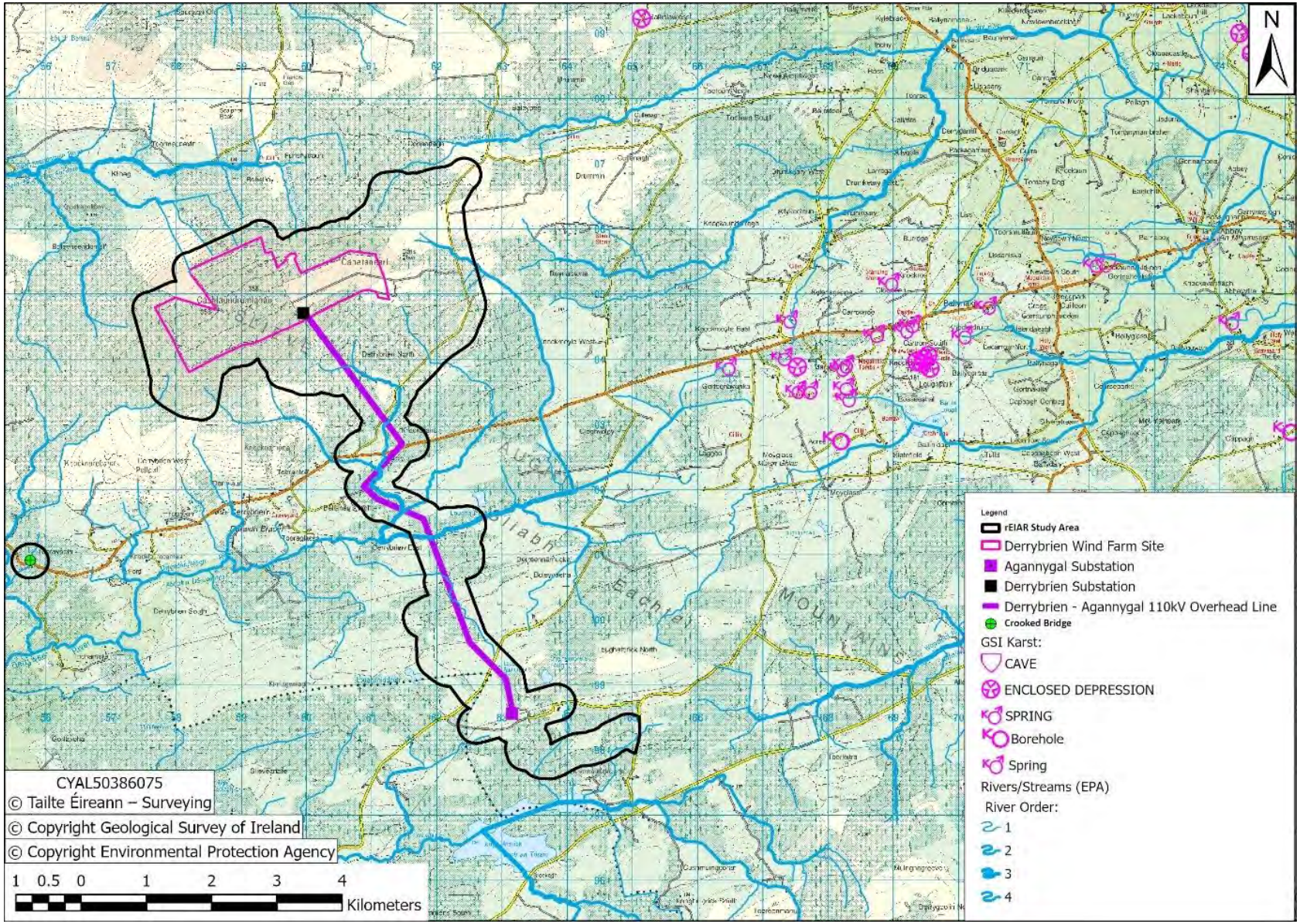


Figure 9-6 Karst features in relation to wind farm study area

The majority of the OHL route including the grid connection at Agannygal is underlain by rock which is considered a poor aquifer (Pl) (bedrock which is generally unproductive except for local zones).

However, the segment of the route underlain by Visean Limestone (between pole sets 23 and 26 approximately) is considered a locally important aquifer (LM) (bedrock which is moderately productive only in local zones) although there is little evidence for groundwater usage from this aquifer locally that has been discovered in preparing this report.

Groundwater within the wind farm site boundary would be expected to flow downslope through a network of natural open pipes within the peat as well as possibly through an open joint network in the underlying bedrock. Several minor spring risings have been identified on site, particularly within scarp faces on the northern slopes.

9.3.5.2 Groundwater Vulnerability

Groundwater vulnerability represents the intrinsic geological and hydrogeological characteristics that determine how easily groundwater may be contaminated by activities at the surface. Vulnerability depends on the time taken by water to infiltrate to the water table (itself dependent on infiltration path length and infiltration rate) and the attenuating capacity of the geological deposits through which the water travels. The GSI groundwater vulnerability rating of the aquifer underlying the wind farm ranges from Moderate in the south-west corner of the site to High over most of the site. The High vulnerability rating suggests that the combined thickness of peat and mineral subsoils above bedrock at the site ranges from 3 – 5 m in these areas (Table 9-7). Ground investigation information showed the depth to the top of the rock was variable but typically ranged from 3.5 to 6.2 m, which generally reflects the GSI vulnerability classification of High (3 to 5m overburden depth) and Moderate (5 to 10m overburden depth). However, the rock was shallower (1.3 m to 2.9 m) at the northern part of the site representing extreme vulnerability (i.e. < 3m overburden depth) as per Table 9-7 and there were some locally deeper depths to rock (8 m to 9.1 m) at the north-eastern and central parts of the wind farm site.

Table 9-7 Groundwater Vulnerability Categories (GSI)

Sensitivity	Hydrogeological Conditions				
	Subsoil Permeability (Type) and Thickness			Unsaturated Zone	Karst Features
	High Permeability (Sand and Gravel)	Medium Permeability (Sandy Subsoil)	Low Permeability (Clayey Subsoil/Peat)	Sand and Gravel aquifers only	<30 radius
Extreme (E)	0 – 3.0 m	0 – 3.0 m	0 – 3.0 m	0 – 3.0 m	-
High (H)	>3.0 m	3.0 – 10.0 m	3.0 – 5.0 m	>3.0 m	N/A
Moderate (M)	N/A	>10.0 m	5.0 – 10.0 m	N/A	N/A
Low (L)	N/A	N/A	>10.0 m	N/A	N/A

Based on the receptor sensitivity criteria, groundwater at the wind farm site can be classed as Not Sensitive to pollution, as the underlying bedrock is classified as a Poor Aquifer. In addition, most of the site is covered in peat and poorly draining soils, which act as a protective cover to the underlying aquifer. Any contaminants that may be accidentally released on site are more likely to travel to nearby watercourses within surface runoff. The relatively low permeability of the bedrock means that contaminants in the overburden will not be very mobile and any contaminant that may reach the bedrock would not disperse and would remain localised to the source or would be diluted and removed as part of runoff during wet periods.

Groundwater vulnerability ranges from low generally up to extreme in pockets of the most low-lying areas across the OHL route and grid connection due to the shallow depth to bedrock in these areas. There are no mapped karst features in these areas.

9.3.5.3 Groundwater Levels

In January 2005, 12 no. electronic vibrating-wire piezometers were installed to the base of the peat layer in clusters of three located at different depths and at four locations across the site to get continuous readings of piezometric pressure head and the free water level in the peat. The piezometers were situated at points which, due to their proximity to turbine bases and the need to protect the bases from flooding, received substantial new drainage. The piezometers were installed adjacent to turbines T2 and T18 near the western boundary and near T34 in the middle of the turbary land at the eastern end of the site (Figure 9-7). Piezometers installed at the northern end of the site at T49 and T50 malfunctioned and provided no useful measurements. All piezometers indicated that the depth to groundwater generally fluctuated between 0.3 and 1.1 mBGL at the end of construction on the wind farm site, which was consistent with the pre-construction site investigation (Table 9-8).

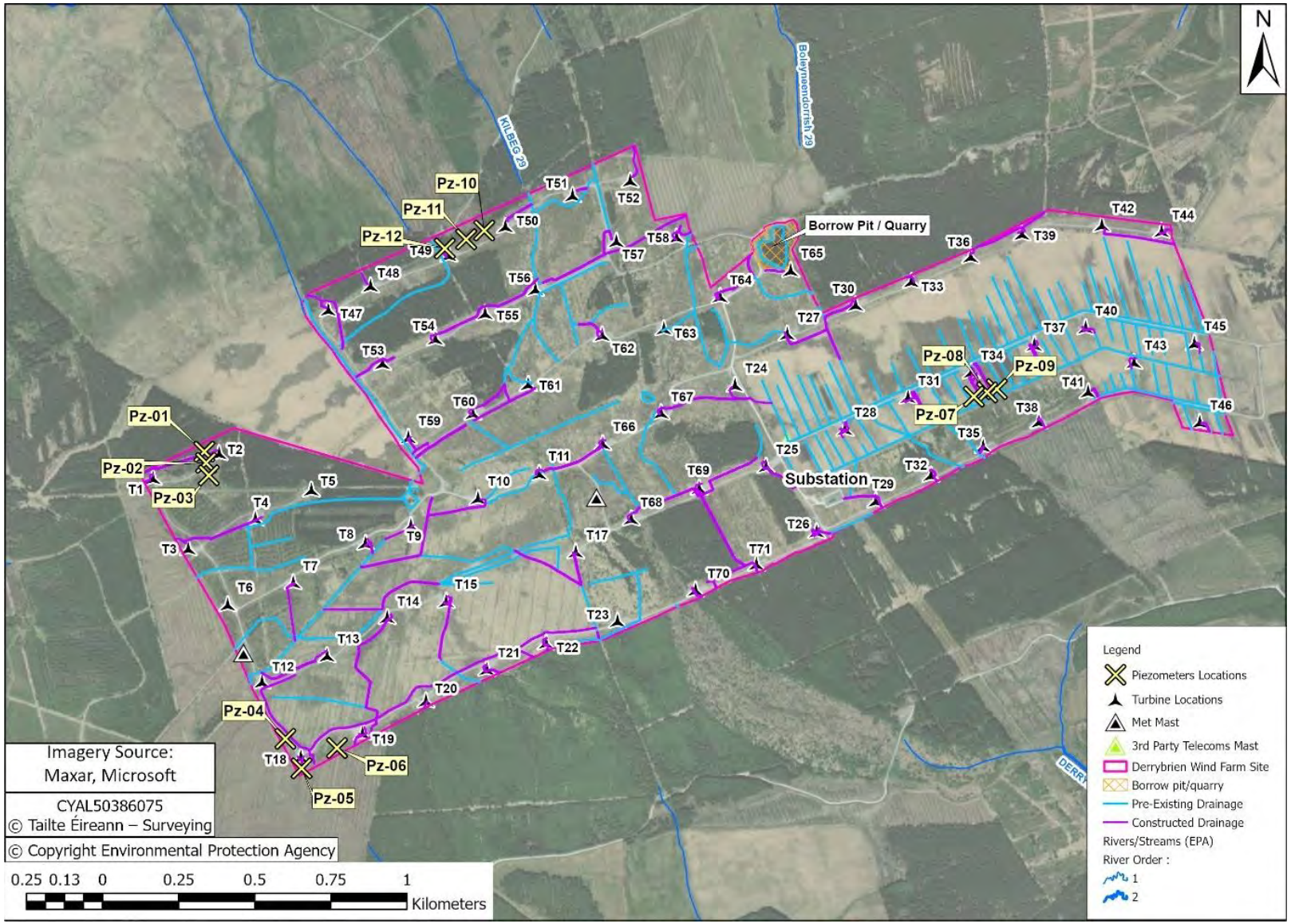


Figure 9-7 Locations of piezometers and tiltmeters

Table 9-8 Summary information of piezometers installed on site between 2005 and 2011

Piezometers / Turbine No.	Piezo Distance from Nearest Drain (m)	Drain depth (m)	Fall in Groundwater Level (m)	Years of data
P1 – P3 / T2	4.5	0.85	0.7 (0.6 – 0.8)	Jan-05 to Nov-11
P4 – P6 / T18	13	1.4	0.4 (0.2 – 0.6)	Jan-05 to Nov-11
P7 – P9 / T34	5	1.3	0.6 (0.4 – 0.85)	Jan-05 to Feb-10

In the years following commissioning, groundwater levels in the peat at these monitoring locations gradually reduced by between 0.2 and 0.85 m (Figure 9-8). This gradual reduction is consistent with the very low permeability and correspondingly slow reaction time of groundwater levels in peat to newly excavated drainage. The ultimate reduction in groundwater levels was dependent on the depth to which the channels were excavated and the distance of measuring points from the channels. For instance, piezometers 4 – 6 are further away from the nearest excavated drains and therefore have taken longer to reduce towards a final drawdown level. Piezometers 7 – 9, given their relative proximity to a drain, should stabilise at no lower than 0.85 mBGL. Given the baseline level in this area was close to the surface it was already close to stabilising by 2010 At T34 the nearby drain was a pre-existing turbary drain which was cleaned out and most likely deepened as part of the wind farm construction, resulting in a drawdown in groundwater levels.

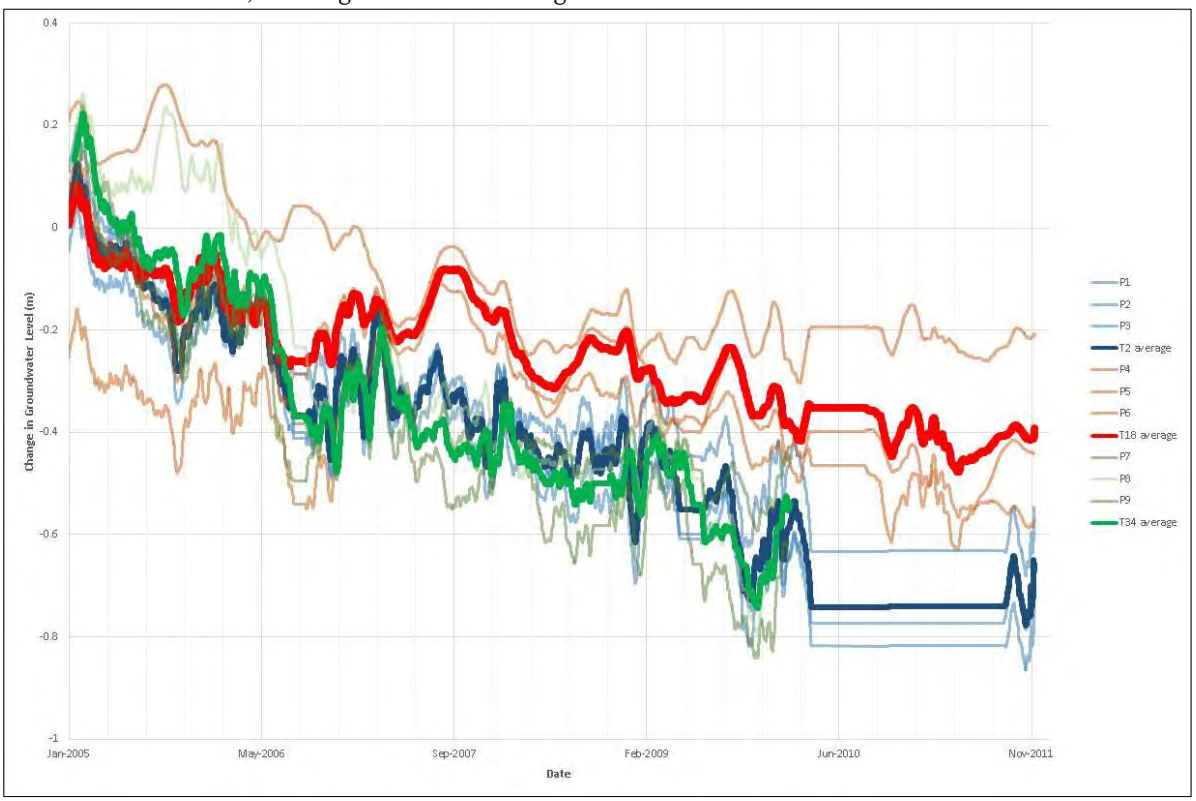


Figure 9-8 Piezometer Data (2005-2011)

9.3.5.4 Groundwater Abstractions

The EPA have launched a register of water abstractions in accordance with the European Union (Water Policy) (Abstractions Registration) Regulations 2018 (S.I. No. 261 of 2018). Abstractions in excess of 25 m^3 of water or more per day are required to register their water abstraction. Searches of the GSI well database and the EPA WFD database indicate that there are no known groundwater abstraction wells within 5 km of the wind farm site boundary. The nearest mapped well is located 7 km to the south-west of the site boundary.

However, given the rural location many houses obtain their water supply from private wells. The 2016 census showed the percentage of private water supplies to houses in the surrounding Electoral Divisions (EDs) is in the order of 90%.

Communication with local authorities and the local community has yielded information that Derrybrien village is the only area identified in the vicinity of the wind farm requiring water supply. A number of private dwellings here are part of a group scheme covering 10 houses, while others have their own independent wells and some others harvest rainwater from their roofs. The local church gathers its own water supply from its roof.

9.3.6 Flood Risk Identification

A Flood Risk Assessment (FRA) in line with The Planning System and Flood Risk Management - Guidelines for Planning Authorities (OPW, 2009) has been conducted for all the Derrybrien Wind Farm retained development areas. The FRA was carried out both to provide an overview of the potential flood risks to the retained development and to assess the impact of the decommissioning works on flood risk downstream (see **Appendix 9-1**).

A desktop review of historic flooding was undertaken primarily using OPW website www.floodinfo.ie. The 'Past Flood Events' dataset forms a record of all available flood records held by the OPW, all local authorities and other relevant state organisations such as the EPA and the Department of Communications, Climate Action and Environment. Despite this, the dataset is not exhaustive particularly in regard to recent floods in remote areas. There were no mapped reports of recurring flooding within the Project areas and there is no significant risk of flooding within the Project area due to the elevated nature of the majority of the Project area relative to the surrounding area. The nearest area downstream affected by flooding in the catchment which drains the north side of the wind farm site is 15 km downstream at Ballylee on the Streamstown River. The nearest area downstream affected by flooding in the catchment draining the south side of the wind farm is over 20 km downstream close to Gort. The National Indicative Fluvial Mapping shows the extents of the indicative 100-year flood zone which relates to fluvial (river) flood. This mapping is based on fluvial sources for catchments in excess of 5km^2 and assumes within channel has capacity for 80% of the annual flood and remainder floods its overbanks based on hydraulic modelling using a DTM ground level model. There is no 100-year or 1000-year fluvial flood zone mapped within the Project area, which includes the overhead line (OHL) route and Agannygal substation. Where it is mapped in close proximity to the development, it typically exists in close proximity to the main Owendalulleegh and Boleyneendorrish River channels or its contributing second or third order streams.

With regard to groundwater, it is likely that groundwater levels across the wind farm site have stabilised since piezometers installed during construction stopped measuring in 2012. In general, the vast majority of dewatering of the peat took place in the early years following construction, but the degree and rate of change would have varied significantly with the greatest changes most likely taking place in the southwest of the site where most of the new drainage channels were introduced while the relatively undisturbed areas such as the peatland between T62 and T67 in the centre of the site undergoing little evident change and remaining largely intact. An empirical Sichardt formula can be used to determine the zone of influence of the channel drains cut across the site –

$R_0 = C*(H-h_w)*\sqrt{K}$ where

R_0 = Zone of influence (m)
C = 3000 (constant)
K = hydraulic conductivity in peat (m/s)
$H-h_w$ = drawdown (m). Calculated using drainage channel depth below ground level and highest water level in channel.

Assuming $K = 10^{-6}$ and $H-h_w = 0.6$ m (on average), therefore $R_0 = 1.8$ m.

Given 12 km of drains were excavated for the wind farm and drawdown occurs 1.8m either side of drains, this suggests 0.043 km^2 of the site was subject to drawdown in the long-term from their installation. Given these drains were situated across 3.4 km^2, this suggest 1.3% of the overall wind farm area was subject to drawdown from the installation of new drainage because of the wind farm construction while the remainder saw

groundwater levels unchanged. The fall in groundwater levels was consistent and gradual at a rate of approximately 0.1 m/year in close proximity to new drains and would not have a significant impact on the onsite and downstream environment with respect to flood risk. This will not change as a result of the decommissioning works.

The FRA concludes that the Retained Development areas are not within floodplains and lie within Flood Zone C (Low risk of flooding) as defined by the guidance document to Planning Authorities in relation to Flood Risk Management. Furthermore, the existing flood risk in the downstream catchment has not been increased by any works over the operational life of the wind farm. Infilling of the drainage constructed as part of the wind farm development has been reviewed as part of the assessment of decommissioning options in Chapter 3 Assessment of Reasonable Alternatives. This was considered as part of Alternative 2 which included site restoration works, subsequent landscaping and bog rehabilitation measures. Reinstating the drains that were constructed for the wind farm through blocking and infilling the drains would result in a gradual rise in the groundwater level on the upper slopes of the mountain. This could lead to periodic flooding in low-lying areas on flat ground within the wind farm site, which will increase groundwater pressures on the network of natural drainage pipes in the peat. There may also be a moderate to significant impact on peat stability if active reinstatement measures result in localised flooding and ponding of surface runoff in areas where there is an elevated risk of peat instability due to natural conditions on the site such as zones of deep peat at convex breaks in slope directly upslope from natural watercourses where there is evidence of concentrated subsurface drainage. Given the adverse risks to the stability of the site from enacting such measures, the decision has been taken to instead leave the drains on site to infill and revegetate naturally following completion of decommissioning works. Several elements of the wind farm infrastructure are currently vulnerable to pluvial flooding in extreme rainfall events. However, as this infrastructure is due to be removed as part of decommissioning, effects arising from such flooding are eliminated. This flood risk assessment meets the requirements of the planning guidelines in respect to a site-specific FRA as the entire proposed Retained Development falls under the category of water-compatible type development and therefore suitable in all flood risk zones. The proposed Retained Development will not impede access to watercourses nor does the project result in an increase in flood risk to third party lands locally or downstream.

9.3.7 Groundwater Quality

The WFD establishes a framework for the protection, improvement and management of groundwater. All groundwater bodies (GWB) are validated by scientists in the Geological Survey of Ireland and the EPA Scientists as meeting the criteria for a WFD GWB. For a groundwater body to be of good quantitative status the following criteria for the definition of good status must be met:

- Available groundwater resource is not exceeded by the long-term annual average rate of abstraction.
- No significant diminution of surface water chemistry and/or ecology resulting from anthropogenic water level alteration or change in flow conditions that would lead to failure of relevant WFD Article 4 objectives for any associated surface water bodies.
- No significant damage to groundwater dependent terrestrial ecosystems resulting from an anthropogenic water level alteration.
- No saline or other intrusions resulting from anthropogenically induced sustained changes in flow direction.

The latest groundwater status assessment was carried out in 2022 for the period 2016-2021. The wind farm site and most of the OHL route is located in the Caherglassaun Turlough GWB. This has a Good quantitative status but a Poor chemical status according to the latest round of monitoring. It had previously held a Good GW Status in the 2007-2012 round of monitoring. Its current poor chemical status is driven by elevated total phosphorous concentrations as measured at Poldeelin Spring (Gort).

The southern end of the OHL route and Agannygal substation are located in the Lough Graney GWB and has a Good status. The status of these two GWBs have not changed over time during the monitoring cycles.

There has been no effect on EPA assigned status of the above GWBs arising from the construction, operational and ceased operation phases of the project. There is a small natural peat-floored lake present close to the centre of the wind farm just north of T67. The lake appears to be in a relatively natural state despite the planted forestry in the adjacent area and the development of the wind farm infrastructure close-by. It most likely would not have been affected by installation of wind farm drainage given the distance to the nearest drains, the size of these drains and the extremely low hydraulic conductivity of peat.

The residual effect on quantitative and chemical status of the GWBs will be neutral. Overall quantitative GWBs status has not deteriorated with respect to the baseline and in the long-term the Retained Development would not prevent attainment of good chemical status (in the case of the Caherglassaun Turlough GWB), and hence overall 'good' status in the future.

9.3.8 Surface Water Quality

The surface water quality is discussed in detail in Chapter 7– Aquatic Ecology and Fisheries. This includes an assessment of compliance with the Water Framework Directive.

9.4 Likely, Significant Impacts and Mitigation Measures Implemented

This section addresses the impacts on the hydrological and hydrogeological environment of the proposed retained elements of the Derrybrien Wind Farm following decommissioning. The impacts may comprise the changes in volume and rate of surface water flow and direct or indirect impacts on the quality of surface waters and groundwater. Direct impacts here refer to those which occur at the same time and location as the action itself whereas indirect Impacts are reasonably foreseeable and occur as a result of an action but occur later in time or are removed from the action location. Following the identification of sensitive waterbodies, the extent and severity of decommissioning impacts were evaluated considering all existing and proposed control measures.

The sensitivity of surface environmental receptors and surface water quality is discussed in detail in Chapter 7 – Biodiversity – Aquatic Ecology and Fisheries.

The primary risks to groundwater at wind farm sites are during construction stage while risks at operational stage are generally much lower because of the limited work activities that take place in maintaining the site. The risks to both groundwater and surface waters at decommissioning would be expected to be generally higher than operational stage but less than during the construction phase. Risks associated with the site post-decommissioning are much lower again than the operational stage as the site is not to undergo any future work activities in this phase.

9.4.1 Construction Phase Impacts (2003-2006)

The goals of this section are to describe construction operations in the context of their potential to generate pollutant material and their resultant implications for surface and subsurface runoff. The different elements of the construction are summarised below with respect to hydrology and hydrogeology.

The construction of the temporary site compound areas, site access tracks, turbine foundations, turbine hardstands, substation compounds, underground low-voltage (LV) cables and ducting, borrow pits / quarries and drainage channels involved the removal of vegetation and forestry and the excavation of peat and mineral subsoil.

There were 70 no. turbines of two different types constructed on the wind farm site. The foundation of 64 no. turbines measured 9.8 m x 9.8 m and 6 no. foundations measured 11 m x 11 m. The foundations consisted of 1

m depth of reinforced concrete from the formation layer. Hardstanding areas located adjacent to each wind turbine were designed to support the load of the large mobile cranes used to erect the turbines, to facilitate any large-scale maintenance activity involving the use of cranes that arise over the lifetime of the wind farm and for decommissioning of the turbines. Each individual hardstanding covers an area of approximately 47 m x 18 m.

The turbine bases were excavated to the required bearing level after any trees had been removed. This entailed removal of the peat layer and any boulder clay or rock using a mechanical digger on wide tracks or bog mats to protect the underlying peat from damage. All excavated peat and boulder clay material was sidecast (for works undertaken prior to the peat slide) and / or removed to a peat repository (works after the peat slide). Once a base was prepared and shuttering and steel reinforcing installed, concrete was poured to form the pads. The concrete was provided by an external supplier with no concrete batched on site. Once in place the surrounds of the base were backfilled with the boulder clay originally stripped from the footprint and then topped with crushed stone from the borrow pits. At this time also a buried land drain was installed around the base, the outlet of which was connected into the surface drainage network. Water ponding in any of the turbine foundation excavations was pumped out to nearby surface drainage, often over the vegetated surface to filter out solids.

The 3 no. borrow pits / quarries developed on site had the potential to be the source of mineral solids due to the washout of dust and mineral particles associated with concentrated heavy vehicle movements with residual solids generated from the excavation of stone and boulder clay. Crushed stone in itself would be unlikely to generate high levels of solids and any generated would be amenable to rapid deposition due to it being coarser in nature. Frequent movement of heavy machinery at entrances and blasting in the case of borrow pit / quarry 3 could have increased the amount of fines available to be washed out at these locations.

There were 32 no. peat repositories dotted throughout the wind farm which were maintained on level ground with no more than 1 m of deposited material. While active, these could have been the source of some peat silt runoff some of which would have been filtered out in surface vegetation and some eventually reaching the surface drainage system. After completion, these repositories would have rapidly been revegetated by pioneer species such as bulbous rush and successively by other species thereby reducing and eventually preventing further erosion of peat solids. Some of the peat silt washed from the repositories while they were still being used would have been intercepted in vegetation at the margins of tracks and between these and the drainage system. However, the assumption is being made that at least a portion of the mobilised solids would have left the site in all drainage channels during heavy rainfall events despite the presence of silt traps on outlet drains.

The 17.5 km of internal access tracks were laid in a primarily east-west orientation in parallel rows to provide access to the turbine locations. Over 90% of these roads were floating built on top of the existing peat layer, with just a short length of non-floating road between T68 and T70 and in the vicinity of Borrow Pit / Quarry 3. Floating roads were composed of a number of layers as follows:

i. A base layer of timber from felled trees, laid at right angles to the direction of travel, and 1 - 2 layers of geogrid, laid directly onto the peat surface;
ii. A regulation layer of crushed rock from an onsite borrow pit;
iii. Another layer of geogrid;
iv. A 500 mm layer of crushed rock from the borrow pits on site; and
v. A 50 mm layer of imported Clause 804. This was overlain in place by a thin layer of quarry dust.

Non-floating roads were constructed by:

i. Stripping the thin overlying vegetated peat layer and side casting it,
ii. Trimming the underlying boulder clay to the formation level
iii. Laying a layer of 1000 gauge filter membrane followed by a 225 mm layer of crushed rock from the onsite borrow pits and
iv. Finishing with a 50 mm layer of imported crushed stone.

Drainage associated with these roads are discussed in the next section.

The site compound hardcore area for the construction phase (77 m x 38 m) was established at the north-east corner of the site not far from Borrow Pit / Quarry 3 on an existing Coillte track turning area. The site compound area was formed by stripping and sidecasting the excavated peat and backfilling with crushed rock from the nearby borrow pit. The surface was finished with imported hardcore. The construction of this compound area would have generated some silt at the time, mainly associated with washout of fines from the hardcore surface layer.

The 2 no. substations each consisted of a control building with associated electrical equipment and an outdoor area including concrete footings. The on-site 110 kV substation also included a step-up transformer. Both substation compounds are finished on 50 mm single-size clean compound limestone. The permeable compound stone provides a means of attenuation of runoff and allows rainwater to infiltrate to ground as it would prior to development. A drainage ditch was dug around the northern and eastern perimeter of Derrybrien substation compound set back between 7 - 13m from its perimeter. This drain exited site to the south via an existing Coillte drain. The edge of the substation is set back 75 m from the southern perimeter of the wind farm. Therefore, assuming that the new perimeter drain was not inserted until after the compound had been completed, solids-contaminated runoff from the construction area would not have quickly exited the wind farm site without having time to settle and/or be captured by treatment features onsite. However, given the frequent movements of heavy traffic in and around the compound during construction which was undertaken in winter, it is likely that some suspended solids would have reached surface drainage downstream from this site i.e. into sub-catchment SC7(a) during construction.

The 8 no. cable routes constructed within the wind farm site generally ran east-west, close to and parallel to the access tracks, all of them eventually linking to the substation. They were laid in shallow peat trenches (without ducting) which were being backed-filled as soon as the cables were being laid with the excavated peat that had been temporarily side cast when opening the trenches. This procedure is likely to have given rise to the washout of small amounts of peat solids which would have entered the drainage network throughout the site with residual amounts exiting the site via the sub-catchments draining the site. Where the trenches had to cross under existing cross drains the potential for solids washout would have been higher. Overall, however, given that this was a continuous cut, lay and back-fill exercise, it is unlikely to have given rise to appreciable amounts of peat silt washout. Whatever amount would have exited the site would have been distributed across all subcatchments rather than concentrated in any one. Note the washout of silt and how this was addressed more generally during construction is explained in more detail in a later section.

Works to improve and maintain sections of local roads and bridges included –

a) minor widening works and resurfacing of sections of the Black Road used for construction and operational access, and
b) road widening for a distance of approximately 30 m on either side of the Crooked Bridge on the R353 to facilitate the delivery of equipment to the wind farm site.

Road widening included extension of existing drains which passed underneath these road sections.

9.4.1.1 Flood Risk / Flow rates

The surface drainage patterns at Derrybrien wind farm generally follow the natural hill slope gradients and the overland flow regime of the site which existed prior to the Project. The pre-existing drainage on the site is associated with forestry (generally in the western and northern part), turbary (eastern part) or the wind farm Project itself.

Progressive replacement of vegetated surfaces with hardstanding surfaces had the potential to result in:

- An increase in the proportion of surface water runoff reaching the surface water drainage network.
- A reduction in the response times between rainfall and runoff during storm events.

The extent of construction works to extend and / or enhance the pre-existing wind farm drainage network is, in comparison to similar developments of this type and scale, minor relative to the overall extent of pre-existing drainage that already was present on the baseline site. The site, being located near the watershed boundaries, has a small number of upstream contributing catchment areas and consequently the wind farm project had limited potential to affect hydrological regimes downstream of the site during the construction stage. The new drainage works were carried out by hand or with a wide-tracked hydraulic excavator suitable for working on the peat. Works on the drainage system were carried out on a non-continuous basis to lessen the impact on ground conditions.

During construction there was no engineered storage or attenuation of storm runoff provided on site before discharging to receiving watercourses. Runoff water from the gravelled turbine bases and roads was discharged as over-the-edge drainage distributed over the entire site with limited concentration of development drainage to single point outfalls.

The relevant footprint of new works associated with the Project comprises turbine bases and hardstanding, access tracks, one electrical substation compound on the wind farm site, Agannygal substation compound and the OHL line. During storm events increased runoff from the new areas of hardstanding (although minor in the context of the overall wind farm site area) coupled with higher velocities of flow from newly constructed drains could have had the potential to increase hydraulic loading, resulting in localised erosion of watercourses and impact on aquatic ecosystems. Precipitation affecting the undisturbed area of the wind farm site continued as prior to construction to either infiltrate or flow across the ground. Increased runoff was restricted to areas of the site being converted to gravel access tracks, concrete pads and hardstands. During periods of average or low flow there was likely negligible impact on overall flows in downstream watercourses from the construction of the new tracks, concrete pads and hardstands as these made up a small fraction of their overall catchment.

9.4.1.2 Felling of Forestry

The felling license granted to Gort Windfarms Ltd. in 2003 for the felling associated with the wind farm was granted subject to a number of standard conditions including the requirement to carry out operations in accordance with 'Forestry and Water Quality' and 'Forest Harvesting and the Environment' guidelines published by the Department of Agriculture, Food and the Marine, as well as the 'Irish National Forest Standard' and the 'Code of Best Forest Practice – Ireland'.

Where peat and steep slopes occur together such as at Derrybrien wind farm, there is a greater risk of soil erosion and subsequent sedimentation. Correct buffer zone management helps to reduce these risks. A buffer zone is an area adjacent to an aquatic zone and managed for the protection of water quality and aquatic ecosystems. Ground preparation and other forest operations are curtailed in the zone and drainage channels leading from the felling area must taper out before entering the zone. This ensures that discharged water gently fans out over the buffer zone before entering the aquatic zone, with sediment filtered out from the flow by ground vegetation within the zone. Brash mats should be used where risk of erosion is high to avoid soil damage, erosion and sedimentation (Forestry Service, 2000a).

The guidelines include the requirement to prevent accumulation of brash, logs and debris in drains and aquatic zones. Temporary crossing points are to be examined regularly and removed, if necessary, to avoid blockages and localised flooding. Following completion of harvesting works debris and sediment should be removed from drains, sediment traps and culverts. Drains damaged during the course of operations should also be repaired. Any temporary structures such as log bridges should be removed immediately after use (Forestry Service 2000b).

The methodology agreed for carrying out felling between ESBI and Coillte included the requirement that existing drains be regularly inspected and maintained. Immediately following clearance of plots on site, the drainage in that area was to be evaluated and any required drainage works carried out. The suitability of new drain designs for the terrain of any given felling area was also to be re-evaluated on site following felling. Silt traps were installed along all newly constructed drains before they entered any pre-existing drainage systems or watercourses and were subject to regular maintenance. Drainage discharges were monitored for suspended

solids content to determine the effectiveness of silt traps. All available records of this monitoring noted no cause for concern.

Tree felling was the first action on site in preparation for the construction and installation of the wind farm infrastructure. It began in June 2003, a month prior to civil works commenced, but was interrupted in October 2003 due to the peat slide. In this initial felling period, felling was along a 15 – 40 m wide corridor in order to open up the line of the turbine access tracks and for the 3 no. on-site borrow pits. This amounted to approximately 0.31 km^2 of the 2.22 km^2 of forestry felled within the wind farm site.

A significant feature of the felling over the whole construction period was its diffuse distribution across the site with any derived runoff divided across 9 – 11 distinct subcatchments draining the site. During this period, felling at the Agannygal substation site and on the OHL was also beginning at the wind farm end of the OHL route. The first 0.5 km of the route, all within subcatchment SC7(b), was felled before work ceased in mid-October 2003. Between mid-2004 and September 2005, felling of the remaining 1.91 km^2 on the wind farm of mixed maturity stage forestry and along the remaining OHL route were completed.

The total area of forestry felled on the wind farm site has been apportioned between each of those subcatchments draining the wind farm in Table 9-9 along with the percentage of the overall area of each subcatchment to where it joins the major rivers (i.e. Boleyneendorrish, Owendalulleegh and Duniry). This also includes the smaller areas felled along the section of the OHL that drain to the same subcatchments, i.e. in SC7(a), SC7(b) and SC7(d) and from the southern end of the OHL line at Agannygal which drains towards Lough Atorick. The greatest proportion of felling for the Project was in SC2, SC3, SC7(a) and SC7(c).

Table 9-9 Areas felled in subcatchments influenced by Project

Sub-catchment	Area (km2)	Wind farm Site Area (km2)	Area felled on wind farm site (km2)	Area felled on OHL route (km2)	Felled as a % of subcatchment area
SC1	6.44	0.31	0.18	0	2.86%
SC2	3.17	0.53	0.36	0	11.61%
SC3	0.96	0.22	0.20	0	20.73%
SC4	1.74	0.09	0.09	0	5.06%
SC5	2.22	0.01	0.01	0	0.41%
SC6	5.14	0.06	0.02	0	0.33%
SC7	13.04	2.13	1.26	0.20	11.20%
SC7(a)	5.87	1.11	0.34	0.03	6.27%
SC7(b)	3.02	0.23	0.18	0.12	9.85%
SC7(c)	3.60	0.79	0.75	0	21.04%
SC7(d)	0.61	0	0	0.05	8.20%
SC8	2.81	0.04	0.04	0	1.56%
SC9	6.48	0.05	0.05	0	0.71%
Agannygal / Atorick	2.00	na	na	0.04	2%

In addition, the OHL route further south includes an additional 11.5 ha (0.11 km^2) of felling that drained over an extensive area within the Owendalulleegh catchment. As the felled areas intersect a large number of subcatchments and the total area felled is small in any one of them, it can be reasonably assumed that the impact of this felling on the hydrological flow regimes of the Project areas would likely have been **Not Significant** and **Temporary to Short-term** and not persisted beyond the construction phase of the project.

9.4.1.3 Suspended Solids – Wind Farm, OHL Route and Grid Connection

Construction phase activities including access track, turbine foundation and hardstand construction required earthworks resulting in removal of vegetation cover and excavation of soil and mineral subsoil where present.

The majority of the rock used to construct access tracks, crane hardstanding and for backfilling was sourced from on-site borrow pits / quarries. The estimated volume of rock sourced from wind farm site borrow pits / quarries was 232,000 m^3. The stone material imported comprised of Clause 804 stone for track and hardstand surfacing and 50 mm single sized crushed limestone for surfacing inside the substation compound.

The main factors influencing the rate of soil loss and subsequent sediment release include:

- Climate.
- Length and gradient of slopes.
- Soil type / erosion potential.
- Vegetation / cover.
- Duration and extent of works.
- Construction erosion and sediment control measures.

Identified potential sources of sediment-laden water included:

- Drainage and seepage water resulting from road and turbine base excavation.
- Stockpiled excavated material providing a point source of exposed sediment.
- Construction of access road culverts resulting in entrainment of sediment from the excavations during construction.
- Erosion of sediment from emplaced site drainage channels and cleared/regraded existing channels.
- Clear unvegetated ground after tree felling and tracking causing ground disturbance for soiled water runoff.

The above activities could have resulted in the release of suspended solids. Detailed discussion of the effects of these activities on water quality are described in Chapter 7 – Biodiversity (Aquatic Ecology and Fisheries), section 7.4.2.

9.4.1.4 Hydrocarbons and Cement

Oils and fuels were used in plant and equipment during the construction phase. Accidental spillage during refuelling of construction plant with petroleum hydrocarbons is a significant pollution risk to groundwater, surface water and associated ecosystems. The accumulation of small fuels and lubricant spills from site traffic can also be a pollution risk.

Hydrocarbons, at high concentrations, have a high toxicity to humans and all flora and fauna, including fish, and is persistent in the environment. It is also a nutrient supply for adapted micro-organisms, which can rapidly deplete dissolved oxygen in waters, resulting in death of aquatic organisms. Spillages arising from the use of concrete for construction of turbine foundations and hardstanding areas pose a risk if not properly managed. Concrete, particularly the cement component, is highly alkaline and any spillage to a local watercourse would be detrimental to water quality and associated fauna or flora.

The potential impact of spills was **Slight to Moderate** and **Negative** on the Local environment and **Brief** throughout the construction stage.

A number of mitigation measures were put in place to address the risk to both surface and groundwater. Concrete wash-out areas were established for the purpose of capturing wash-out water from ready-mix concrete lorries. All concrete lorries delivering ready-mix concrete to the site were required to wash-out their vehicles at these specific wash-out points upon completion of their concrete deliveries and prior to exiting the site. Spill kits

were available and used to deal with any minor or localised oils and / or fuels from the machinery in operation at the site and the re-fuelling of that machinery. Drip trays were used during refuelling.

Following mitigation the risk arising from hydrocarbons and cement is reduced from **Slight to Moderate to Not Significant.**

There is record of one spill taking place during Project construction when a concrete lorry overturned on the main turbary access track on the eastern side of the wind farm site. The contents of the lorry required washing out by Gort Fire Brigade before the lorry could righted onto the road using a Hyundai 360 tracked excavator. The contractor, after initially unsuccessfully attempting to flush out the concrete from the bottle of the lorry, excavated a hole in the bog into which the concrete was flushed and subsequently removed. The drains in the vicinity were blocked to prevent runoff from the immediate area.

9.4.1.5 Wastewater

Release of effluent from domestic wastewater treatment systems has the potential to impact on groundwater and surface waters if site conditions are not appropriate for an on-site percolation unit. Due to the low permeability of the subsoils associated with the Project area, surface waters are more likely to be susceptible to impact than groundwater.

The main toilet facilities on site during construction were at the site compound in the north-eastern corner of the site. The toilet facilities were comprised of a self-contained toilet block with a temporary holding tank for managing sewage and wastewater. These facilities were removed upon completion of the construction works. There were also circa 9 no. self-contained portaloos purpose designed for temporary use located around the wind farm site.

Without appropriate mitigation the impacts from discharging untreated wastewater from these facilities would be expected to be **Slight to Moderate** but **Brief** on the environment throughout construction.

The portaloos were serviced and maintained on a regular basis during the construction activities. All toilet facilities were sealed with no discharge to the surface water or groundwater environment adjacent to the site. This reduces the risk rating to for this impact to **Not Significant**.

9.4.1.6 Offsite peat slide works: October 2003 – March 2006

Following the peat slide event in October 2003, extensive studies and investigations were carried out on the wind farm site, including a full review of the drainage within the site, landslide area and affected areas downstream. Measures were undertaken as required by geotechnical experts, Galway County Council and Coillte to contain and minimise the impact of the peat slide.

The nature of peat slides such as that which occurred at Derrybrien is that they typically occur upslope from natural watercourses. As such, the failed peat becomes fluidised into a remoulded peat slurry that flows down into the river valleys directly inundating the river. The peat slurry can have significant run-out distances along the river valleys, and where the volume of peat exceeds the capacity of the valley it can spread out over the surrounding land to either side of the valley. Where rivers or streams cross public roads the peat can block culverts or bridges, sometimes overtopping the road and blocking public access.

The offsite measures to minimise the impact of the peat slide included the installation of a 10 no. barrages, two within the wind farm boundary with the remaining eight, (of which four remain in place) along the route of the slide on Coillte land between the wind farm and Flaggy Bridge on the R353.

The assessment of the potential impacts of the offsite peat slide works from a hydrological and hydrogeological standpoint is discussed below.

9.4.1.7 Drainage Diversions

Surface runoff from the part of the site where the peat slide originated formed streams of concentrated flow within the slide area that fed into the river downslope from the site. This is the river forming subcatchment SC7(b). Among the emergency measures taken to stabilise the slide area (and which has remained in place since) was the diversion of drains away from both sides of the slide area and upstream of it on the wind farm site. This was achieved by digging new drains along the route indicated in Figure 9-9 in the weeks following the initial slide. These diverted drains would ultimately join up within the same river subcatchment a short distance downstream of the slide area. The work was carried out over a few days from the 30th October 2003. Where new drainage was constructed in a wooded area, minor tree felling within these commercial forestry areas was carried out to create a corridor of sufficient width to allow an excavator to excavate the drain. A watercourse downstream of the peat slide area was also re-routed just upstream of the Black Road bridge around displaced peat in the neighbouring privately-owned land. Approximately 0.012 km^2 (1.2 ha) of tree felling within commercial forestry was required in order to gain access for the diversion drain.

Following the initial peat slide mitigation measures, the contractor was instructed to carry out further precautionary drainage measures as follows:

- Improvement of drainage in the slide area of the wind farm, clearance of obstructions and release of any visibly trapped water and construction of silt traps.
- Cleaning out of 3 no. gorges (pre-existing narrow steep-sided streams adjacent to offsite repositories) including construction of areas locally from available materials (trees, brash, boulder clay, etc.) to store removed peat, removal of sidecasting of the removed peat, provision of silt traps as necessary and possible reduction of rock barrage.
- Re-establishment of the original stream and access road at Black Road Bridge to include construction of areas to store removed peat from available materials (trees, brash, boulder clay, etc.), removal and side casting of the removed peat, provision of silt traps as necessary.

In general, the drain diversions had a **Permanent** but **Imperceptible** downstream hydrological impact, both in the short- and long-term.

9.4.1.8 Offsite Peat Repositories

Peat displaced by the landslide had accumulated in large quantities on land upstream of Black Road Bridge. This was placed in a newly constructed repository on the left-hand bank of the watercourse. Additional repositories were constructed to store peat excavated for the construction of two barrages.

Apart from the requirement to divert drainage around the repository upstream of Black Road bridge (discussed above), there were no hydrological impacts from their construction. As such, the repositories had an **Imperceptible** hydrological impact, both in the short- and long-term.

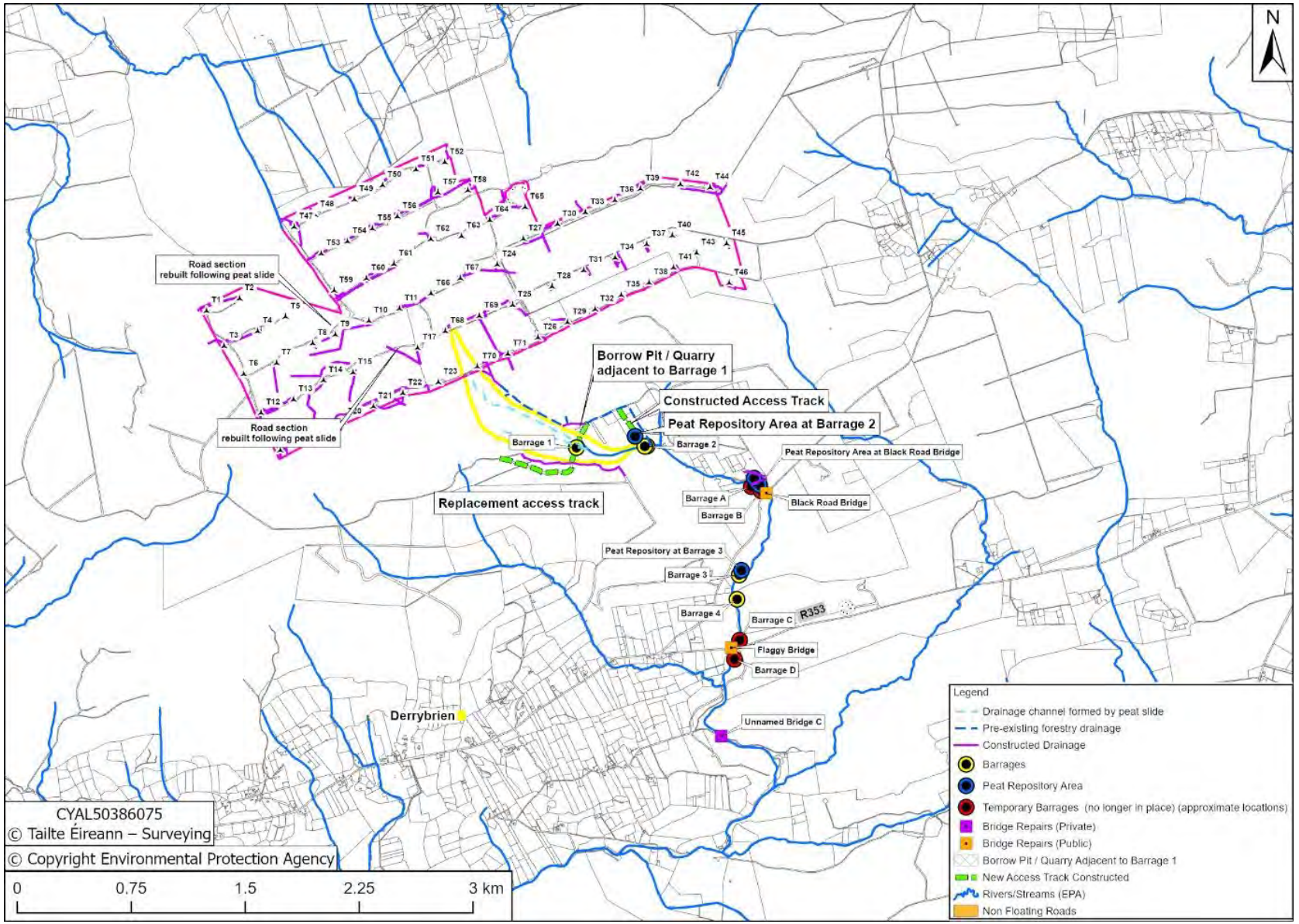


Figure 9-9 Emergency Works in aftermath of Peat Slide 2003-2004

9.4.1.8.1 Hydromorphology

Hydromorphology refers to the physical form, condition and processes with a surface waterbody. After the heavy rains of October 30th, 2003, a very large mass of peat and associated surface woody and herbaceous vegetation advanced downstream under the weight of the fluidised peat. Just over a month later in December 2003 a walkover survey of the entire 20 km of channel from Flaggy Bridge downstream to Lough Cutra was undertaken by the officers of the then Shannon Regional Fisheries Board (ShRFB) in order to establish the extent to which the peat and debris had progressed down the Owendalulleegh catchment, and to gauge the type and degree of damage to riverine habitats caused. The survey was undertaken over a period of two weeks in favourable weather conditions.

The physical nature of the river downstream of the slide area was altered following the slide. The most detailed available record of these physical impacts on the river is a study undertaken by Inis Environmental Services in association with ESBI and the Shannon Regional Fisheries Board (ShRFB) (Anon, 2004). The most severe impacts associated with the landslide were in the upper reaches of the river. In these areas, the energy of moving peat, water and debris was greatest and resulted in the near total loss of vegetation and scouring of the riverbed in some parts. Parts of the channel were re-aligned due to the force of the peat flow. Heavy deposition of peat on the banks also occurred in this area. The Inis study did not include the reaches upstream of Flaggy Bridge as part of its survey. The area between Flaggy Bridge and Unnamed Bridge C was noted in the report as being among the most heavily impacted areas of the river with strong scouring and removal of all instream vegetation. There were large amounts of peat deposited on the river margins with sand banks evident at river bends. The riverbed was scoured with gravels and rocks transported downstream.

There was damage noted directly above and around a culvert running under a Coillte access track between the two bridges. However, no repair works were required and water continued to be conveyed downstream here due to the porous nature of the surrounding rock structure. Downstream of Unnamed Bridge C there was less scouring but large amounts of siltation was evident. The peat slide is therefore classified as having a **Slight** (further downstream) to **Moderate** (upstream) effect on the hydromorphology downstream of the slide area. The effect is considered to have only been **Short-Term** as the environment was judged by Inis in subsequent surveys to have recovered back towards pre-slide conditions in the following years.

9.4.1.8.2 Containment Barrages

In order to control the passage of the peat slide, 8 no. barrages were installed along the route of the slide from the boundary of the wind farm site downstream to just below Flaggy Bridge.

Details of each barrage are summarised in Table 9-10. To facilitate these works and to further reduce the risk from the flowing peat, an extension to an existing Coillte track was constructed to access the site of Barrage 1 from the west and another to access Barrage 2 from an existing Coillte track on the eastern side of the slide.

Table 9-10 Details of containment barrages

Barrage	Typical Dimensions (long m x wide m x high m)	Comments
Containment Barrage 1 (Coillte Road)	140 x 6 x 2	Located within slide source area. Access directly from existing Coillte track.
Containment Barrage 2	15 x 5 x 6	Located within incised section of stream. Access via constructed floating access track 300 m (long), 3 m (wide).
Containment Barrage 3	15 x 3 x 3	Located across stream. Access via constructed access track from Black Road on Coillte land 100 m (long), 3 m (wide).

Barrage	Typical Dimensions (long m x wide m x high m)	Comments
Containment Barrage 4	20 x 3 x 3	Located across stream. Access via constructed access track on Coillte land 100 m (long), 3 m (wide).
Temporary Containment Barrage A	Estimated: 80 x 3 x 3	Located upstream of Black Road Bridge. Barrage removed sometime after slide event. Access direct from existing road.
Temporary Containment Barrage B	Estimated: 80 x 3 x 3	Located upstream of Black Road Bridge. Barrage removed sometime after slide event. Access direct from existing road.
Temporary Containment Barrage C	Estimated: 20 x 3 x 3	Located upstream of Flaggy Bridge on R353. Barrage removed sometime after slide event. Access direct from existing road.
Temporary Containment Barrage D	Estimated: 20 x 3 x 3	Located downstream of Flaggy Bridge on R353. Barrage removed sometime after slide event. Access direct from existing road.

From a hydrological perspective, the deliberately porous nature of the barrage structures allowed water to flow through without any excessive build-up of water on the upstream side of each structure. In a number of cases drainage pipes enabled the flow of water through the structure. The barrages were each constructed to prevent further propagation of the peat slide and to prevent possible further release of debris into the watercourse downstream. As a consequence of this silt, peat and other debris did build up on the upstream side of a number of barrages. If this material was not removed the impact of the barrages from a hydrological perspective was classed as **Moderate** due to the knock-on effect of the barrages. Upon completion of the construction stage, the four temporary containment barrages were removed while Barrages 1 to 4 were left in place, as shown in Figure 9-9 (Note: the access tracks at T68 and between T23 and T70 also act as rockfill containment barrages but are not considered in isolation due to their position at the top of the subcatchment as part of the overall on-site wind farm drainage system).

9.4.2 Operation and Maintenance Phase Impacts (2006 – 2022)

9.4.2.1.1 *Flood Risk / Flow Rates*

The pre-existing drainage system (i.e. pre-2003) consisted of previously dug longitudinal drains and stream channels which discharged surface drainage waters off site to the local river systems. The majority (27 km out of 39 km) of drainage channels on site prior to construction were ditches that had been dug prior to the wind farm Project and ran parallel to existing floating access roads on one or both sides of the track to avoid problems of localised ponding. These pre-existing drains were retained as operational drains for the wind farm. The remaining 12 km of road drainage was constructed for the wind farm Project and connected into the pre-existing site drainage. Figure 9-10 shows the network of open drains on the site, both existing former drainage (cyan) and constructed collector drainage (magenta), all of which was retained following commissioning of the wind farm.

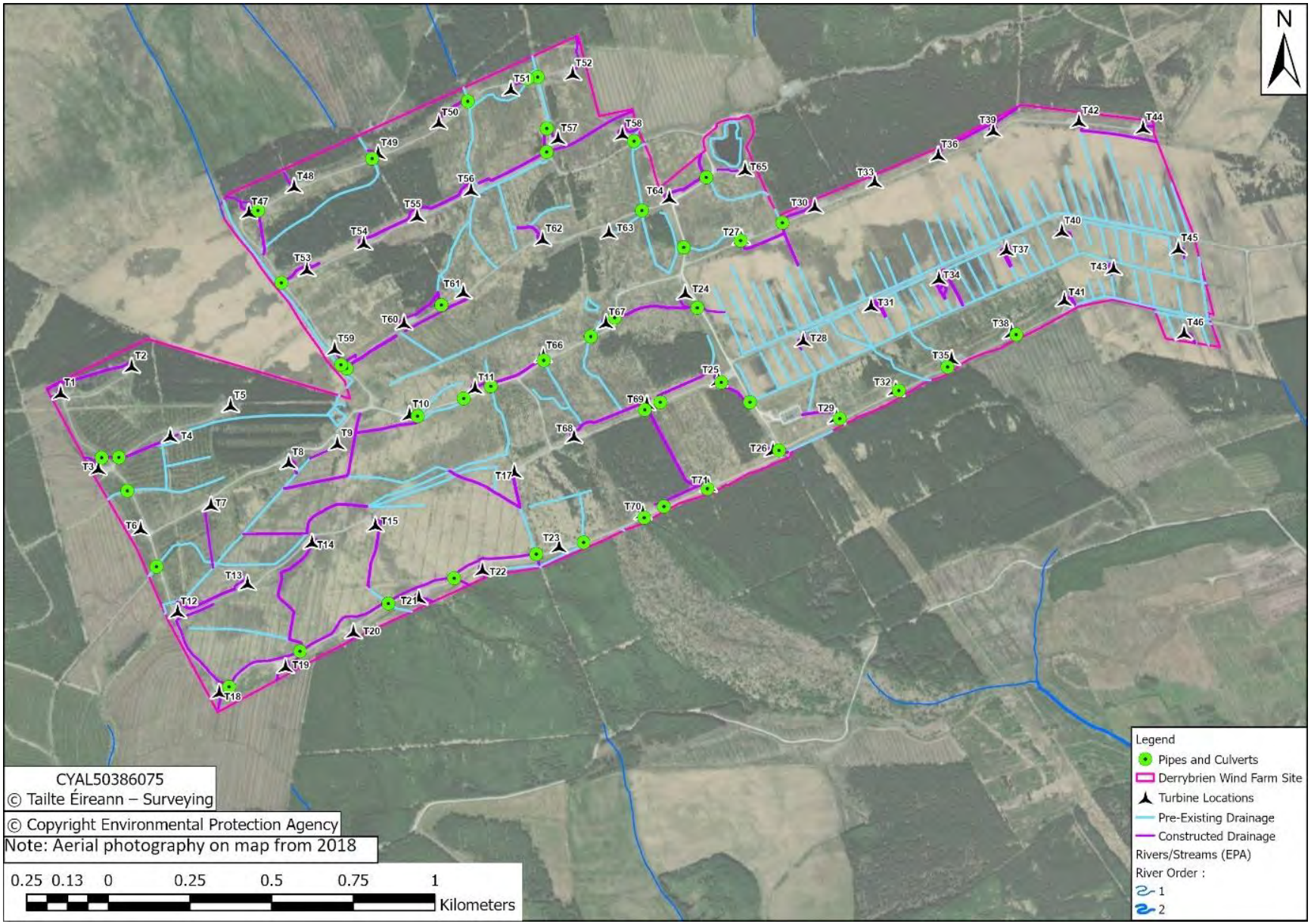


Figure 9-10 Pre-existing (baseline) and constructed drainage on wind farm

All of the constructed channels are narrow open drains (Plate 9-3), typically 0.5 to 1.5 m deep, with culverts under the site access tracks. Where the peat is shallow the drains penetrate into the underlying glacial till. However, in deeper peat (greater than 1 – 2 m deep) the drains are only excavated into the peat and more easily eroded by streamflow. At the east end of the site the drainage network reflects the outline of the turbary plots in that area of the site. Over the rest of the site the pre-existing drains / watercourses have been retained and newly constructed drains connect the turbine foundation drainage to the watercourses.

Plate 9-3 Typical drain installed during wind farm construction

The use of floating roads, which accounts for 18.8 km of the 19.7 km of on-site access tracks (the 2.0 km of tracks existing on site which pre-existed the Project were all floating roads), facilitate rainwater infiltration into the peat layer beneath and as such generally do not require additional roadside drainage with rainwater falling onto the road allowed to spill over the edge into the undisturbed peat. Floating roads are sympathetic to the natural drainage as they act neither as a barrier nor as a deep wide permeable drain that would dewater the adjacent saturated peat into its formation layer and convey elsewhere with the gradient of the road.

However, depending on local topography, some concentration of flows and preferential pathways are unavoidable unless suitable drainage is put in place. The 4.5 m wide roads were comprised of 0.6 – 1.0 m of crushed rock granular fill with 1-2 layers of geogrid reinforcement and a basal reinforcing layer of small trees and branches placed directly on the vegetated surface of the peat.

Culverts were constructed at various wind farm access road crossings to maintain the conveyance path of the pre-existing and constructed drains crossed and thus prevent excessive ponding of water on the uphill sides of these roads. The culverts installed are necessary to maintain the drainage runs and avoid unnecessary diversion of drainage on the site. The culverts are mainly located under tracks on the edge of the site, as indicated on Figure 9-10. The outlet drains exiting the wind farm site are all pre-existing drainage channels with the exception of the drainage channels formed following the October 2003 slide.

During the post-construction phase of the wind farm, the drainage network has experienced a variety of large storm events. These have ranged from intense short-duration events in which approximately 60 mm of rain fell in 24 hours (as measured at Gort Derrybrien II Met Station) (7th June 2012, Storm Desmond on 5th December 2015) to long-duration winter rainfall events which saturated the wider area (November 2009, December 2015 to January 2016, February 2020).

The drainage network on the wind farm has to date demonstrated sufficient capacity to convey heavy flows without excessive flooding of access tracks and turbine bases or erosion of drainage channels. Similarly, the drainage network associated with both substations have no record of flooding issues since commissioning (14 years). The Flood Risk associated with the Project is discussed in more detail in Appendix 11.A.

The change in land use in some areas from pre-construction "Greenfield" to gravel and concrete (with associated drainage efficiency) was, along with tree felling and improvements to the drainage network, responsible for any theoretical increase in flood flows downstream beyond the immediate vicinity of the wind farm. Overall, it is considered that the wind farm development through constructed drainage and additional drainage has increased the flood runoff rate over its former forestry and turbary uses from a high runoff category to a very high runoff category. The modelling assessment of the effect of drainage associated with the wind farm (Appendix 9-1) showed a minor local increase in the predicted mean annual flood flows leaving the wind farm site. This synthesised flow increase is not significant in respect of the downstream receiving watercourses and as such did not result in any significant increase in flood risk or changes to river/stream channel morphology. It was concluded based on past studies (refer to Appendix 9-1) on the subject that any impact the tree felling associated with the construction activities would have on downstream flood peaks and volumes could reasonably be expected to dissipate and not have any perceptible impact beyond the local scale. Similarly, at a broader regional scale, where downstream floodplains would be more sensitive to any increased flood risk, it has been concluded in Appendix 9-1 that any increases in flood peaks and volumes would be imperceptible. The impact overall this has had on flood risk downstream is described as **Imperceptible** at the scale of major rivers and areas prone to flooding to **Not significant** within the subcatchments which have undergone the most tree felling. The duration of the impact has been **Momentary** to **Brief** (i.e. minutes to hours) given the small size of the subcatchments.

9.4.2.1.2 *Drainage Issues*

The wind farm Project introduced additional drainage and as such required increased maintenance and inspection of a number of on-site drains. The drainage solution for the wind farm was not designed to extensively lower the water table level but focused on collecting and conveying surface water runoff away from the turbine bases and therefore for the scale of the 3.44 km^2 site does not represent a substantial network of drainage channels over its former use.

Poor drainage at turbine bases can give rise to local stability issues. If water levels rise above the base foundation of a turbine during periods of high wind speeds, overturning of the base is a potential risk. There is a potential impact of such a long-term risk if there is not an appropriately designed drainage network put in place at construction stage.

Drainage installed at each of the turbine bases during construction stage generally consisted of a buried land drain around the perimeter of the turbine base. The outlet of each land drain is to an open drainage channel, which was specifically installed to transfer the water to one of the existing main drains within the site. As required at specific turbine excavation locations, existing drains were re-routed around the excavation area

when they were present. This ensured the continuing operation of drainage in the area and non-entry of silt into the existing drains.

The permeable area of the 110kV Derrybrien Substation and Agannygal Substation sites constructed as part of the wind farm project were finished on 50 mm single size clean compound stone. The permeable compound stone provides a means of attenuation of runoff and allows rainwater to infiltrate to ground as it would typically on a Greenfield portion of the site. Rainwater from the roof of the control buildings, which is considered the cleanest runoff from hardstanding areas, connects via downpipes away from the compound into the wind farm drainage system. The concrete access road within the compound is cambered to drain to the permeable compound stone. Agannygal substation also includes a system of land drains and catchpits around its perimeter. No drainage issues that have not already been mitigated in the design of the substations are expected to arise going forward through the remainder of the operational life of the Project.

The effectiveness of the surface water drains on the wind farm site had the potential to be reduced due to blockages from peat bank slippages into drains and from heavy vegetation growth either inside the drains or to their side walls. Inadequate falls in some drains could also result in ponding water. It is noted that the potential impact on the stability of foundation bases without an appropriately rigorous inspection and maintenance regime is moderate to significant with respect to peat stability (see Chapter 8 – Land, Soils and Geology) but only **Slight**, **Local** and **Brief** with respect to hydrology.

Regular maintenance has been carried out as necessary since commissioning of the wind farm. Drainage inspections are carried out monthly and following heavy rainfall or snow events. In addition to this, periodic geotechnical inspections have identified drainage maintenance issues which generally involve localised clearing out and maintaining sections of site drains. This mitigation reduces the risk of drainage issues arising to **Imperceptible**. Most maintenance issues arose in the first few years following commissioning and have reduced since. These included clearing out blocked drains at inlets or outlets, deepening or widening drains to increase capacity and flattening of side slopes along access tracks at the main watercourse crossings, regrading drains that were shown to have insufficient fall and repair or replacement of collapsed culverts.

During the first periodic inspection in November 2006 shortly after commissioning, poor drainage around wind turbines was noted at several locations around the site. This resulted either from the drain around a wind turbine or a drain outside the turbine area impeding water flow due to vegetation growth, inadequate fall or settlement of the drainage pipe at the cable crossing. In some instances, stagnating water was observed around wind turbines while in others, signs of dampness were noted on the turbine foundation.

In one instance, Turbine T35 was at one periodic inspection identified as being vulnerable to a sudden increase in water level due to its level and proximity to one of the existing drains leaving the site and potential blockage of a single 600 mm diameter culvert under the adjacent track road downstream of T35. In response to this risk an additional 600 mm diameter pipe was installed at this location along with a screen upstream of this to capture any removed peat and vegetation debris (Plate 9-4 and Plate 9-5). No further drainage issues have arisen in this area since these works were completed and only routine drainage maintenance is now required.

Plate 9-4 Twin 600 mm pipes at crossing near T35

Plate 9-5 Location of T35 in relation to crossing point

Road widening in the locality of the wind farm site necessitated lengthening of culverts and other minor modifications of existing drainage crossings below relevant sections of road. This has not led to any known impact with regard to drainage.

9.4.2.1.3 Water Quality - Hydrocarbons

There have been two known past incidents of oil-spills on the wind farm, in 2017 and 2019 respectively. In the first such incident, a spill kit was deployed around the base of turbine T56 before oil reached ground and the leak was subsequently stopped. In the second incident, a bleed screw was left not fully tightened after a service was carried out on T5. This caused 150 litres of oil to leak from the gearbox with some of it leaking down the side of the wind turbine tower and getting to the ground. Vestas technicians contained the spill using the contents of the spill kit.

The Derrybrien 110kV substation consists of a control building and associated electrical equipment with an outdoor area including concrete footings and a step-up transformer inside a fenced off compound area. Other aspects of note relating to drainage include a reinforced concrete transformer bund support, and oil separator, an effluent treatment system and a well supplying non-potable water supply (Figure 9-11). Clean surface water drainage from the control building roof is collected by guttering and downpipes and directed to the substation site drainage system. Elements of the electrical plant, primarily transformers, may contain oil for insulation purposes. The released hydrocarbons would have the potential to percolate to ground or contaminate surface water runoff from the substation if not properly managed. To mitigate this hydrological risk, a pump sump is provided with a float switch outside the transformer bund. This is a proprietary pump that only allows water discharge to take place when no oil is detected. This is connected to a BMS (Butler Manufacturing Services) Ltd. PIF Class 1 Full Retention Oil Separator which discharges to a wind farm drain outside the substation boundary. This provides an adequate treatment prior to discharge to the wind farm drainage network. Regular inspections are carried out to ensure this system is in correct working order. As such, the drainage design put in place has no perceptible effect and requires no further mitigation.

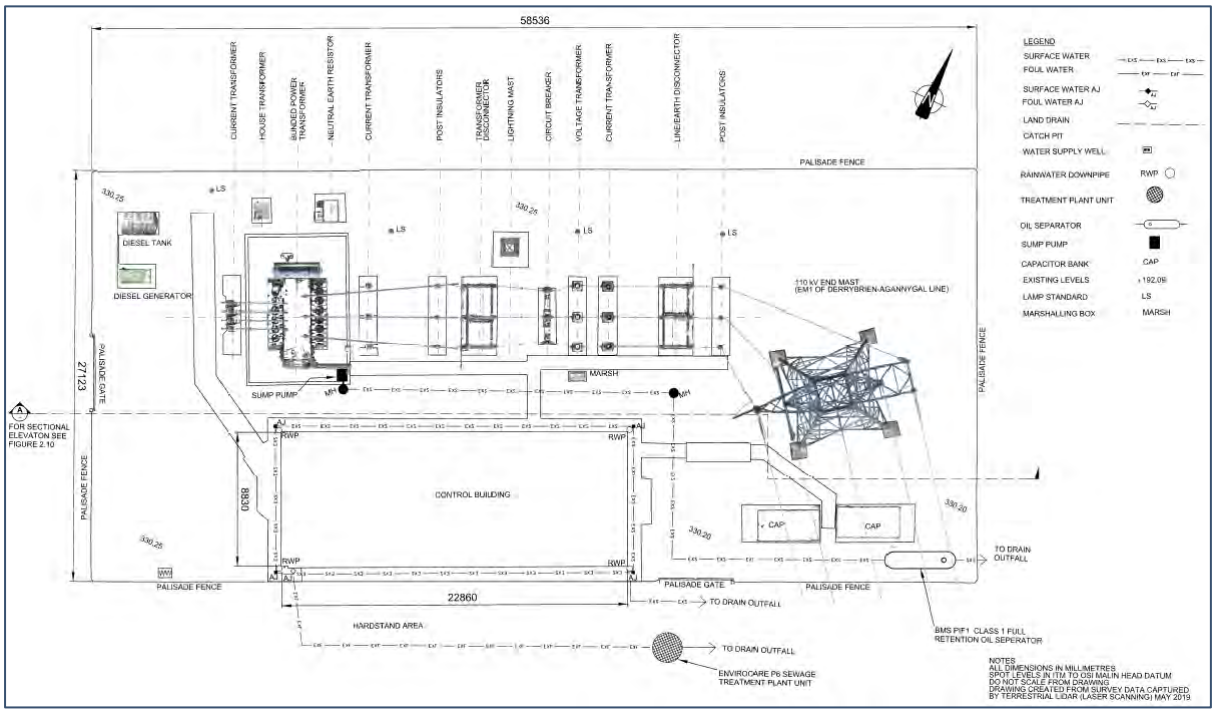


Figure 9-11 Derrybrien 110kV substation layout plan

Agannygal Substation includes a control building, an effluent treatment system, and a well supplying non-potable water to the control building (Figure 9-12). Clean surface water drainage from the control building roof is collected by guttering and downpipes and directed to the substation drainage system. Land drains surrounding the substation compound collects surface water runoff which does not drain to ground. All surface

water ultimately drains downhill offsite along the edge of the access road constructed to the substation and discharges to an existing drainage channel.

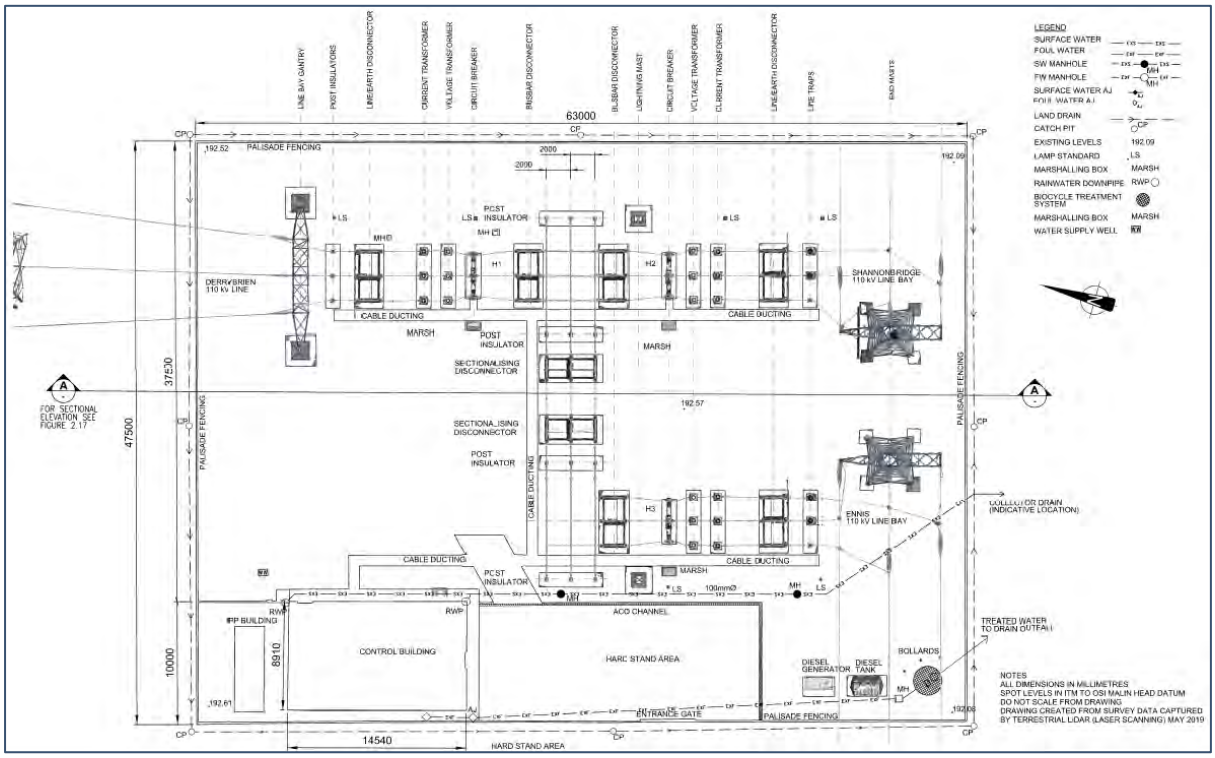


Figure 9-12 Agannygal 110kV Substation Layout Plan

9.4.2.1.4 Water Quality - Wastewater

The welfare facilities in the control building of the Derrybrien 110kV substation consists of one toilet and two sinks. The intermittent presence of maintenance staff at the substation leads to the generation of foul sewage from these facilities. If discharged offsite untreated, there would be a slight impact on local downstream water quality. An Envirocare P6 sewage treatment plant unit caters for the wastewater generated in these facilities. It is regularly serviced under a maintenance contract with Environmental Services.

At Agannygal Substation wastewater is adequately treated by a Biocycle wastewater treatment system before discharge off site.

9.4.2.1.5 Containment Barrages

As discussed in section 9.4.2.1.5, all the barrages pose no significant risk of acting as miniature reservoirs for floodwaters which could overtop and lead to sudden, larger releases of water downstream. As the barrages are highly permeable structures composed of boulders in which in some cases drainage pipes are provided (Barrages 1 and 2) it is not expected that it could cause a substantial build-up of water. The remaining barrage structures are also stable enough that a relatively sudden build-up of water in a large flood event is not expected to damage the integrity of any barrage itself. As such, from a hydrological perspective, the impact of the remaining barrages on the flow regime is deemed to be **Not Significant**.

The build-up of silt, peat and debris on the upstream side of the remaining barrages causing potential blockages is seen as a non-significant risk. Barrages 1 and 2 have only required a small amount of debris clearance since commissioning, most recently in 2009. Barrages 3 and 4 have not required any clearing out of debris since commissioning and only small amounts of accumulated sediment or debris was evident on the most recent site visits (see Chapter 8 – Land, Soils and Geology). As such, the containment barrages also pose a **Not Significant** flood risk as they are sufficiently wide and porous to convey flood water through them.

9.4.3 Ceased Operation Phase Impacts (2022- Present)

This section considers and assesses the hydrological and hydrogeological impacts associated with the Wind Farm Project since operation has ceased. Surface water generated on the site has continued to drain predominantly as it had under pre-development conditions, discharging to existing established drainage channels through the site. Access tracks and structures are generally located on relatively high areas and on / near local watershed boundaries, away from rivers.

9.4.3.1.1 *Flood Risk*

As discussed in the Flood Risk Assessment (Appendix 9-1), there is no significant increase to date in the risk of flooding arising in the wind farm Project areas during the operational and ceased-operational stage. It can be concluded that most of the Project areas are not within floodplains and lie within Flood Zone C (Low risk of flooding) as defined by the guidance document to Planning Authorities in relation to Flood Risk Management. Furthermore, the existing flood risk in the downstream catchment has not to date been increased over the ceased operational life of the wind farm. Several elements of the wind farm infrastructure are vulnerable to pluvial flooding in extreme rainfall events. However, it is judged that the Project satisfies the criteria set out in the Justification as part of "The Planning System and Flood Risk Management – Guidelines for Planning Authorities".

The wind farm Project is therefore considered to be in overall compliance with the objectives of the above Guidelines. It therefore has not and is not anticipated to give rise to any significant impacts related to flood risk locally or downstream of the site (see Appendix 9-1).

9.4.3.1.2 *Drainage Issues*

There is no engineered storage or attenuation of surface water runoff provided on site before discharging to receiving watercourses. Runoff water from the gravelled turbine bases and roads is discharged as over the edge drainage distributed over the entire site with limited concentration of wind farm site drainage to single point outfalls. The relevant footprint comprises turbine bases and hardstanding, access tracks, one electrical substation on the wind farm site, OHL route and Agannygal substation. During storm events increased runoff coupled with higher velocities of flow has the potential to increase hydraulic loading, resulting in localised erosion of watercourses and impact on aquatic ecosystems.

The effectiveness of the surface water drains on site has had the potential to be reduced due to blockages from peat bank slippages into the drain and from heavy vegetation growth either inside the drain or to its side walls. Inadequate falls in some drains can also result in ponding water. A recent inspection carried out in September 2024 indicated that drains continue to act effectively for more than 2 years after maintenance activities would have ceased. Based on this and past experience, the effects of ceasing drain maintenance are considered to be imperceptible to slightly negative and temporary.

9.4.3.1.3 *Water Quality – Suspended Solids*

Water quality impacts potentially arising during this phase of the wind farm are considered to be limited to minor low-level siltation on the minor watercourses within the site. As discussed in Chapter 7 - Biodiversity (Aquatic Ecology and Fisheries) section 7.4.4, currently no aspect of the ceased operation of the wind farm, the OHL line or the Agannygal Substation is known to be giving rise to, nor has potential to cause, any negative effects on surface water quality, aquatic habitats or fish. There have been no changes to the recorded high ecological status (Q5/Q4-5) of the main rivers draining the site between 2021 and 2024.

9.4.4 Impacts of Retained Development

During the post-construction phase of the wind farm from 2006 to the present day, the drainage network has experienced a variety of large storm events ranging from intense short-duration events to long-duration winter floods which saturated the wider area. The drainage network has to date demonstrated sufficient capacity to convey floodwaters without causing excessive flooding of access tracks and turbine bases and not requiring any significant drainage maintenance works.

As outlined in Appendix 9-1 there is no increase in the risk of flooding arising from the retained development in the locality of the wind farm itself. Similarly, on the broader regional scale, any change in flood risk associated with the Project is deemed imperceptible given the broader extent of the Boleyneendorrish and Owendalulleegh catchments. The Project is therefore in overall compliance with the objectives of the Planning and Flood Risk Management Guidelines.

Water quality effects associated with the Retained Development are discussed in detail in Chapter 7 – Biodiversity – Aquatic Ecology & Fisheries section 7.4.5. No mitigation measures are deemed required for these effects and

For the above reasons, the Retained Development will not give rise to any significant residual hydrological and hydrogeological impacts.

9.4.5 Cumulative and In-Combination Effects

The projects considered in relation to the potential for cumulative impacts arising during all phases of the Prospective Development and for which all relevant data was reviewed include those listed below:

- Cumulative Effects with the Prospective Development
- Cumulative Effects with other applications developments/adjacent Landuses

9.4.5.1 Cumulative impacts with the Prospective Development

As discussed in Chapter 9 of the EIAR, decommissioning of Derrybrien Wind Farm is not anticipated to give rise to any significant impacts related to the drainage flow regime and flood risk classification or result in any unacceptable hydrological or hydrogeological impacts both on-site or off-site.

Water quality impacts potentially arising during the decommissioning phase of the wind farm development are likely to be limited to minor siltation or pollution incidents as a result of small-scale maintenance and decommissioning works. Such local incidents will not give rise to significant impacts on water quality in downstream receiving streams and rivers. Appropriate precautions will be taken to ensure the protection of watercourses from silting during any maintenance activities.

There are no significant cumulative impacts on drainage and flooding arising from the wind farm decommissioning works when considered cumulatively and in-combination with the Retained Development and any other projects in the locality.

9.4.5.2 Wind Farms in Slieve Aughty Mountains

There is a second wind farm (Sonnagh Old Wind Farm) within the Slieve Aughty Mountains to the north of the Derrybrien Wind Farm site which was commissioned a year before Derrybrien Wind Farm in 2004. This wind farm is a small development comprising 9 no. turbines situated on high ground immediately east of Lough Belsrah about 3.4 km north west of the Derrybrien wind farm. 0.013 km^2 (1.3 ha) of the 0.46 km^2 (46 ha) site drains into a tributary to the north of the Boleyneendorrish River. Within this small area, there was no wind farm infrastructure developed. As such, any cumulative

impact from a hydrological or hydrogeological perspective is considered imperceptible, particularly given the Boleyneendorrish catchment is 25 km^2 at the point where the relevant tributary meets the main river.

Planning permission was granted to a developer in early 2000s for a wind farm at Keeldeery approximately 3 km to the west of the site. Internal access roads were constructed circa 2007 but the rest of the development was never built out. There was no felling carried out as part of these works.

The location of the site at the headwaters of a number of different streams draining to the Owendalulleegh and Boleyneendorrish catchments indicate that impacts in relation to hydrology would have been diffuse and short term. For reason of the development in the context of the wider catchment, any cumulative impact from a hydrological or hydrogeological perspective is considered neutral. A subsequent application for the site was refused.

9.4.5.3 Thermal Generation

Tynagh 400MW Power Station in the townland of Derryfrench County Galway at the site of Tynagh Mines was granted planning permission in 2003 (GCC Reg. Ref. 03/2943). The main construction activity for the Power Station took place in 2004-2006.

The Tynagh 220kV grid connection to the ESB Oldstreet to Cashla Line was granted planning permission in 2003 (GCC Reg. Ref. 04/1974). The main construction activity for the Power Station grid connection took place in 2004-2006.

Given that only a small section in the north-eastern corner of the wind farm site (draining to subcatchment SC5) drains to the Shannon WMU, any cumulative impact from a hydrological or hydrogeological perspective is considered imperceptible.

9.4.5.4 Overhead Transmission Lines

The Moneypoint – Oldstreet 400 kV Overhead Line was developed two decades prior to the development of the Derrybrien Wind Farm Project. Planning permission for refurbishment works on the overhead line was granted by Clare County Council (CCC) (Reference 16/1011) in September 2017 and Galway County Council (GCC) (Reference 16/1747) in October 2017. The Derrybrien-Agannygal 110 kV line passes under the 400 kV line at ITM co-ordinates 562119 E, -700626 N. The refurbishment works have no perceptible cumulative impact with respect to hydrology or hydrogeology.

The Ennis – Shannonbridge 110 kV Line was installed in 1952 with some further structures installed in 1968. Refurbishment of one circuit on this line, Ennis – Agannygal, is scheduled for 2023/2024. The refurbishment works have no perceptible cumulative impact with respect to hydrology or hydrogeology.

9.4.5.5 Gort Regional Water Supply Scheme

The public water supply for Gort was and continues to be supplied from the Gort Regional Water Supply Scheme which is sourced from the Gort/Cannahowna River. The water treatment plant is located in the townland of Rindifin to the east of Gort. The Derrybrien Wind Farm Project given its scale and remoteness from Rindifin has no perceptible impact on this water supply from a hydrological or hydrogeological perspective.

9.4.5.6 Proposed Gort Lowlands Flood Relief Scheme

The proposed Gort Lowlands Flood Relief Scheme is currently completing the preliminary engineering design and feasibility stage. This stage is well advanced and is expected to be completed by Autumn

2023 after which the proposed scheme will be subject to a planning application to an Bord Pleanala including an NIS and EIAR. This Gort Lowland Flood Relief Scheme is examining options of providing flood overflow pathways from a number of turloughs including Ballylee, Lough Coole to Caherglassaun to Cahermore and an overland spill to the Galway Bay near Dungory Castle at Kinvarra, including the upgrade of a number of culverts and bridges along its route.

It is most probable that this proposed Derrybrien decommissioning application will be submitted well in advance of any application for the Gort Lowland flood relief scheme. In any case consideration of in-combination impacts are addressed below.

Large scale land management changes of the entire Slieve Aughty Mountains in terms of returning the hill slopes and plateau (watershed) areas, which are predominantly commercial forestry, to undrained peatlands will not produce the desired effect of achieving flood reduction in the downstream Gort Lowlands area. The blocking of drains and generation of more saturated conditions on the bog surface will only, at most, slow the rapid runoff of surface water but will have minimal effect on altering the flood volume generated, particularly for the prolonged winter flood events that cause the flooding in the downstream Gort Lowlands basin.

Attenuation and land management measures (i.e. restoring undrained peatlands and reducing drainage affects in forestry) can be effective in reducing the flood runoff rates for short duration flood events. Such measures are not very effective for prolonged winter rainfall events where the flood volume as opposed to the flood rate is critical, and this applies in particular to the case of the Gort Lowlands turlough flooding situation. These attenuation and land management measures do not provide a sink or longer-term store for rainfall with the volume of rainfall becoming the runoff volume particularly on these elevated winter-saturated catchments which have low permeability sub-soils overlying a low permeability argillaceous limestone bedrock.

It is important to note that the Derrybrien wind farm site of 3.44 km^2 is a relatively small section of the overall Slieve Aughty Mountain catchment and therefore land use changes there have had no perceptible effect on flooding in the downstream Gort Lowlands catchment. Even if wind farm decommissioning and construction of the flood relief scheme take place at the same time no significant in combination impact will occur as there will be no perceptible changes in the hydrological or hydrogeological regime arising from the decommissioning works. The decommissioned site will not see the flood runoff volume or rate increase and therefore not affect the performance of the flood relief scheme design.

9.4.5.7 Flood Relief Works at Kinvarra

Temporary flood relief works were undertaken at Kinvarra during the long winter floods of winter 2015-2016. The potential hydrological impacts of the Derrybrien Wind Farm Project are assessed as not extending far enough downstream to impact on flood-prone areas. Therefore, there is no cumulative impact arising with respect to hydrology and hydrogeology.

9.4.5.8 M18 Motorway Project

The M18 motorway project was planned and constructed after the Derrybrien Wind Farm Project was developed. Construction of the motorway between Oranmore and Gort as part of the overall Gort to Tuam scheme was carried out between January 2015 and September 2017. This resulted in the N18 being retained as the R458 regional road while the newly constructed M18 became the primary route between Galway and Limerick. As any hydrology and flooding effects associated with the wind farm are within the vicinity of the wind farm and have no significance downstream as far as areas that have been subject to flooding in the past, there is no potential cumulative impact with this project.

9.4.5.9 Sand Extraction at Cloghvoley

Planning permission was granted for a sand extraction site (GCC Ref. Ref. 08/1664) located at Cloghvoley to the south-east of the wind farm in May 2008 after the wind farm project was commissioned. On inspection of the planning files there is no cumulative impact arising with respect to hydrology and hydrogeology, there is no indication that there was historic activity that could have coincided with the wind farm Project construction. As such there is no cumulative impact arising with respect to hydrology and hydrogeology.

9.4.5.10 Quarry at Ballynakill

Ballinakill Quarry is operated by Ballinakill Quarries Ltd at Cregg on the R353. The quarry was registered under Section 261 of the Planning and Development Act 2000 (as amended) ((ref QY 6). In October 2013, An Bórd Pleanála granted a substitute consent for works and operations undertaken prior to August 2012 (Ref. 07.SU0038). Planning permission was granted in December 2018 for the quarry extension (GCC Ref:18/687). An examination of the EIS for the project indicates that the quarry is within the drainage area of the Ballinlough Stream (River Waterbody Code: IE_SH_25B150300) draining ultimately to Lough Derg in the River Shannon catchment. Only a very small portion of the northeastern corner of the wind farm, covering ~0.6 % of its entire area drains via the Duniry River towards Lough Derg. This low drainage contribution, combined with the very large distance between the wind farm and Lough Derg would indicate that there was no cumulative impact between the wind farm project and the Ballynakill Quarry development.

9.4.5.11 Coillte Quarry

There is a registered quarry just east of the junction between the R353 and the Black Road, to the south-east of the Derrybrien wind farm site; reference number QRY62. This is a quarry that was accepted as being post-1964 but without the benefit of planning. Reasonable assumptions are made on the basis that no information was available from An Bord Pleanála. Documents in relation to quarry registration were submitted to GCC in April 2005 by Coillte – the site owners. It is a relatively small (1.8 ha) aggregate quarry with an extraction area of 1.3 ha, the aggregate being used for forest road repairs.

The area where the quarry is situated shows no surface drainage channels on OSI 6 inch maps for the area nor is there any indication from aerial photos of the area. The downslope over-ground distance between the quarry and the nearest stream, a tributary of the Owendalulleegh, is just over 500 m through forestry and damp grassland / blanket peat. Given that the material being quarried was predominantly coarse, the likelihood of any suspended solids from the site reaching any of the wind farm drainage streams is considered to have been extremely low. As such, there is believed to be no cumulative impact arising with respect to hydrology. Any cumulative impacts and effects with respect to hydrogeology from the quarry are unknown but would not have been exacerbated by the wind farm Project given the lack of any significant impacts arising from the Project with respect to hydrogeology.

9.4.5.12 Turbary within and outside the wind farm site

An area of approximately 67 ha of drained turbary land occupies the eastern part of the wind farm site. Turbary lands also extend immediately beyond the site to the east covering an area of approximately 15 ha. Up until 2012, the extent of turf cutting carried out mechanically is not known but based on observations by wind farm staff on site, turf cutting by hand was carried out on a number of plots, normally in late Spring / early Summer. Since 2012 a contractor has been retained by some plot owners to mechanically cut turf and there has been an increase in the number of plots where mechanical turf cutting has been carried out. The mechanical turf cutting has been carried out using a Difco Bogmiser hopper machine, which cuts 8 sods wide and approximately 72 m in length. Turf cutting using a sausage machine is still being carried out on a single plot.

In April 2020, a peat disturbance was noticed in the turbary area of the wind farm site. The exact date of the original occurrence of the disturbance is unknown. The disturbance was located in the southern portion of Turbary Plot No 160 which is located south of the central turbary access track in an area between turbines T34, T37 and T38. The area of peat disturbed is approximately 0.25 ha and remained very local within the Turbary area. At the time the peat disturbance mass was heavily saturated with water.

Following inspection by geotechnical specialists, it was concluded that no wind farm related activity could have contributed to the peat disturbance and that it was likely to have been caused by a combination of:

- Concentrated groundwater pressures in the peat within the turbary plot.
- Artificial undercutting for the drain along the toe of the slope.
- Loading due to the more recent use of mechanical harvesting in the peat involving large hoppers.

Further details in relation to this incident are provided in Chapter 8 – Land, Soils and Geology. The peat disturbance did not give rise to any off-site discharge of materials to watercourses.

Subsequently, remedial drainage works were carried out and in the vicinity of the affected turbary plot to mitigate the risk of water pressure build up in the peat. The excavation of drains was undertaken by hand. Check dams were provided in the drains of alternating straw bale, stone and impermeable barrier type. Geotechnical risk assessments were carried out in advance of the work.

The peat slide appears to have initiated at some time between April 2015 and July 2018, based on historical aerial photographs from Google Earth and the OSI Geohive online portal, and had extended by 2020. The likelihood is that over the weeks or months since its appearance, peat silt had mobilised from the exposed peat tears during periods of intense rainfall. These will have flushed out in the east and west drain at the base of the disturbance entering the two main upper branches of the SC7(a) sub catchment. The impact of this appears to have been minimal, based on the results of the two kick-samples (see Chapter 7- Biodiversity (Aquatic Ecology and Fisheries)). Overall, the impact of this event is thought to have been a slight negative temporary cumulative effect resulting in a low-level diffuse addition of peat silt to the affected SC7(a) watercourse, barely perceptible, if at all, in terms of biological water quality.

Outside of the Project site, no peat extraction activities subject to a development consent have been identified in the vicinity. An inspection of EPA licences and planning files in the area has not found any peat extraction projects in the area. Despite no licensed or permitted projects being identified, turbary turf cutting is likely to be practiced in the wider area as at the Derrybrien site.

9.4.5.13 Adjacent coniferous forestry plantations

In the subcatchments draining from the wind farm there is a high percentage of land on which forestry is present. A feature of the areas surrounding the wind farm site is the regularity of felling that takes place of this forestry. For example, between 2016 and 2018 a total of 2.57 km2 of forestry was earmarked for felling on Coillte land in the catchments within which Derrybrien Wind Farm is located. OPW have advised that felling should be considered as having a potential impact on flood regime downstream both through reduced time to peak and, until new forestry re-grows, an increase in the runoff rates. When reviewing felling license applications, the Forest Service consider the cumulative effect of all forest operations in the catchment, as individual impacts may be small but the combined impact may be significant. The felling programme in the catchment may comprise one or more coupes. As the difficulty of preventing sediment and nutrient losses tends to increase with increasing coupe size, smaller coupes are preferable. The Forest Service currently limits clear-felling to coupes no greater than 25 ha in area. The Forest Harvesting and the Environment Guidelines recommend phased felling in a way that minimises cumulative effects as adjoining felling coupes harvested in a short time scale are likely to have a cumulative impact on the environment (Forestry Service, 2000b). Based on this

information and the assumption that the limits on clear-felling are implemented, cumulative effects arising from felling are not significant, temporary and short-term in duration.

9.4.5.14 Compensation Planting in Lieu of Felling on Wind Farm Site

On 20th May 2003, Coillte was granted a two-year felling licence by the Forest Service under the Forestry Act 1946, to fell 263 ha of forestry on the wind farm site. In lieu of the clear-felling and non-replanting of 263 ha of forestry on the wind farm site, the Felling Licence (Ref FL 3983) required the licensee, within 1 year from the expiry date of the felling licence, to plant 119.3 ha within identified townlands in Counties Tipperary and Roscommon. The locations where Coillte have advised planting has been carried out are over 50 km and 80 km respectively from the wind farm site and are not physically connected to the Wind Farm Project site.

A full description of the activities around afforestation is provided in the Forestry Service "Code of Best Forest Practice – Ireland (Part 1) (Forestry Service, 2000c). Typically, drainage systems and soil preparation are required to prevent subsurface water rising into and saturating the root zone and waterlogging the soil. By maintaining the water table below the root zone, drainage promotes deep rooting, improves tree anchorage and strengthens the soil. Given the remoteness of these townlands from the Project areas, it can be assumed that there is no cumulative impact arising with respect to hydrology and hydrogeology.

9.5 Conclusion

Based on the assessment undertaken, it can be concluded that the Retained Development is not anticipated to give rise to any significant adverse effects on the drainage flow regime and flood risk classification or result in any significant adverse hydrological or hydrogeological effects both on-site or off-site.

No significant effects arose from the construction phase of the wind farm with respect to hydrology and hydrogeology.

During the post-construction phase of the wind farm from 2006 to the present day, the drainage network has experienced a variety of large storm events ranging from intense short-duration events to long-duration winter floods which saturated the wider area. The drainage network has to date demonstrated sufficient capacity to convey floodwaters without causing excessive flooding of access tracks and turbine bases and not requiring any significant drainage maintenance works.

There is no increase in the risk of flooding arising from the Retained Development in the locality of the wind farm itself. Similarly, on the broader regional scale, any change in flood risk associated with the Project is deemed imperceptible given the broader extent of the Boleyneendorrish and Owendalulleegh catchments. The Project is therefore in overall compliance with the objectives of the Planning and Flood Risk Management Guidelines.

The Derrybrien Wind Farm Project therefore has not given rise to and its proposed retained elements are not anticipated to give rise to any significant impacts related to flood risk locally or downstream of the site.

There are no significant cumulative impacts on drainage and flooding arising from the Retained Development in combination with any other projects constructed since commissioning, under construction or in planning.

10. AIR AND CLIMATE

10.1 Air

10.1.1 Introduction

10.1.1.1 Chapter Scope

This chapter provides an assessment of the impact of the Derrybrien Wind Farm Development (Project) across all stages of the project (from baseline prior to construction through construction, operation, and the ceased operational phase). This chapter also identifies, describes and assesses the potential significant direct and indirect effects on air quality and climate arising from the Derrybrien Wind Farm Development Decommissioning Project - Retained Development. The Retained Development description is detailed in Chapter 4.

10.1.1.2 Statement of Authority

This section of the rEIAR has been prepared by Morgan Valvik and Catherine Johnson, and reviewed by Thomas Blackwell, all of MKO. Morgan is an Environmental Scientist at MKO. Morgan holds an MSc in Environmental Science from Trinity College Dublin. Catherine is an Environmental Scientist and Climate Practitioner at MKO with over three years of consultancy experience in climate and sustainability. Prior to joining MKO in 2022, Catherine worked as an Environmental Social Governance (ESG) analyst for Acasta in Edinburgh. Catherine has expertise in international climate law and policy, earth science, and sustainability/ESG processes. Catherine has a BSc in Earth and Ocean Science and an LLM in Global Environment and Climate Change Law. Thomas Blackwell is a Senior Environmentalist with MKO with over 17 years of progressive experience in environmental consulting. Thomas holds a BA (Hons) in Geography from Trinity College Dublin and a M.Sc. in Environmental Resource Management from University College Dublin. Thomas has extensive experience with private consulting firms in both the USA and Ireland.

10.1.1.3 Relevant Legislation

The air quality section of this rEIAR has been completed in accordance with the EIA Directive 2011/92/EU as amended by Directive 2014/52/EU and having regard, where relevant, to guidance listed below.

- Air Quality Assessment of Proposed National Roads – Standard PE-ENV-01107' (Transport Infrastructure Ireland, December 2022).
- Guidelines on the Information to be contained in Environmental Impact Assessment Reports – June 2022' (EPA, 2022).
- Environmental Impact Assessment of Projects: Guidance on the preparation of the Environmental Impact Assessment Report' (EC, 2017).
- Environmental Protection Agency (2024) Air Quality in Ireland Report 2023.
- Environmental Protection Agency (2021) Best Practice Guidelines on the Preparation of Resource and Waste Management Plans for Construction & Demolition Projects.
- Environmental Protection Agency
- Guidance on the Assessment of Dust from Demolition and Construction V1.1 (IAQM 2016).
- Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes (TII 2011).
- Guidelines for Assessment of Ecological Impacts of National Roads Schemes (TII

2009).
- Rialtas na Éireann Clean Air Strategy for Ireland (April 2023).
- UK Department of Environment Food and Rural Affairs (DEFRA) Part IV of the Environment Act 1995: Local Air Quality Management, LAQM.TG (16) (DEFRA 2018).
- UK Highways Agency (UKHA) Design Manual for Roads and Bridges (DMRB) – LA
- 105 Air Quality (UKHA 2019).
- World Health Organization (WHO) Air Quality Guidelines for Particulate Matter, Ozone, Nitrogen Dioxide and Sulfur Dioxide Global Update 2005 (WHO 2005).
- Air Quality Assessment of Proposed National Roads – Standard PE-ENV-01107' (TII 2022a).
- Climate Assessment of Proposed National Roads – Standard and Overarching technical Documentation (TII 2022b/c).

10.1.1.4 Relevant Legislation

In 1996, the Air Quality Framework Directive (on ambient air quality assessment and management) (96/62/EC) was published. This Directive was transposed into Irish law by the Environmental Protection Agency Act 1992 (Ambient Air Quality Assessment and Management) Regulations 1999 (S.I. No. 33 of 1999). The Directive was followed by four Daughter Directives, which set out limit values for specific pollutants:

- The first Daughter Directive (1999/30/EC) addresses sulphur dioxide, oxides of nitrogen, particulate matter and lead.
- The second Daughter Directive (2000/69/EC) addresses carbon monoxide and benzene. The first two Daughter Directives were transposed into Irish law by the Air Quality Standards Regulations 2002 (SI No. 271 of 2002).
- The third Daughter Directive, Council Directive (2002/3/EC) relating to ozone was published in 2002 and was transposed into Irish law by the Ozone in Ambient Air Regulations 2004 (SI No. 53 of 2004).
- The fourth Daughter Directive (2004/107/EC), published in 2004, relates to polyaromatic hydrocarbons (PAHs), arsenic, nickel, cadmium and mercury in ambient air and was transposed into Irish law by the Arsenic, Cadmium, Mercury, Nickel and Polycyclic Aromatic Hydrocarbons in Ambient Air Regulations, 2009 (S.I. No. 58 of 2009) (amended by SI 659/2016 - Air Quality Standards (Amendment) and Arsenic, Cadmium, Mercury, Nickel and Polycyclic Aromatic Hydrocarbons in Ambient Air (Amendment) Regulations 2016.)

The Air Quality Framework Directive and the first three Daughter Directives were replaced by the Clean Air for Europe (CAFE) Directive (Directive 2008/50/EC on ambient air quality and cleaner air for Europe) (as amended by Directive EU 2015/1480) which encompasses the following elements:

- The merging of most of the existing legislation into a single Directive (except for the Fourth Daughter Directive) with no change to existing air quality objectives.
- New air quality objectives for $PM_{2.5}$ (fine particles) including the limit value and exposure concentration reduction target.
- The possibility to discount natural sources of pollution when assessing compliance against limit values.
- The possibility for time extensions of three years (for particulate matter PM_{10}) or up to five years (nitrogen dioxide, benzene) for complying with limit values, based on conditions and the assessment by the European Commission.

Table 10-1 below sets out the limit values of the CAFE Directive, as derived from the Air Quality Framework Daughter Directives. Limit values are presented in micrograms per cubic metre ($\mu g/m^3$) and parts per billion (ppb). The notation PM_{10} is used to describe particulate matter or particles of ten

micrometres or less in aerodynamic diameter. $PM_{2.5}$ represents particles measuring less than 2.5 micrometres in aerodynamic diameter.

The CAFE Directive was transposed into Irish legislation by the Air Quality Standards Regulations 2011 (S.I. No. 180 of 2011) as amended by the Air Quality Standards (Amendments) and Arsenic, Cadmium, Mercury, Nickel and Polycyclic Aromatic Hydrocarbons in Ambient Air Regulations, 2016 (S.I. 659 2016). The 2011 Regulations superseded 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 Ambient Air Quality Assessment and Management Regulations 1999 (S.I. No. 33 of 1999). The Air Quality Standards Regulations 2011 (S.I. No. 180 of 2011) was revoked on 31 December 2022 and has been replaced by the Ambient Air Quality Standards Regulations 2022 (S.I. No. 739/2022).

10.1.1.5 Air Quality Standards

The recently implemented Ambient Air Quality Standards Regulations 2022 (S.I. No. 739/2022) remains aligned to the CAFÉ Directive and defers to the CAFÉ Directive for the Limit values outlined in Table 10-1, the Assessment Thresholds in Table 10-2, the Ozone limits and Assessment Thresholds in Table 10-3 and Table 10-4 respectively.

Table 10-1 Limit values of the CAFE Directive 2008/50/EC (Source: https://airquality.ie/information/air-quality-standards)

Pollutant	Limit Value Objective	Averaging Period	Limit Value ($\mu g/m^3$)	Limit Value (ppb)	Basis of Application of Limit Value	Attainment Date
Sulphur dioxide (SO_2)	Protection of Human Health	1 hour	350	132	Not to be exceeded more than 24 times in a calendar year	1st Jan 2005
Sulphur dioxide (SO_2)	Protection of human health	24 hours	125	47	Not to be exceeded more than 3 times in a calendar year	1st Jan 2005
Sulphur dioxide (SO_2)	Protection of vegetation	Calendar year	20	7.5	Annual mean	19th Jul 2001
Sulphur dioxide (SO_2)	Protection of vegetation	1st Oct to 31st Mar	20	7.5	Winter mean	19th Jul 2001
Nitrogen dioxide (NO_2)	Protection of human health	1 hour	200	105	Not to be exceeded more than 18 times in a calendar year	1st Jan 2010
Nitrogen dioxide (NO_2)	Protection of human health	Calendar year	40	21	Annual mean	1st Jan 2010

Pollutant	Limit Value Objective	Averaging Period	Limit Value ($\mu g/m^3$)	Limit Value (ppb)	Basis of Application of Limit Value	Attainment Date
Nitrogen monoxide (NO) and nitrogen dioxide (NO_2)	Protection of ecosystems	Calendar year	30	16	Annual mean	19th Jul 2001
Particulate matter 10 (PM_{10})	Protection of human health	24 hours	50	-	Not to be exceeded more than 35 times in a calendar year	1st Jan 2005
Particulate matter 2.5 ($PM_{2.5}$)	Protection of human health	Calendar year	40	-	Annual mean	1st Jan 2005
Particulate matter 2.5 ($PM_{2.5}$) Stage 1	Protection of human health	Calendar year	25	-	Annual mean	1st Jan 2015
Particulate matter 2.5 ($PM_{2.5}$) Stage 2	Protection of human health	Calendar year	20	-	Annual mean	1st Jan 2020
Lead (Pb)	Protection of human health	Calendar year	0.5	-	Annual mean	1st Jan 2005
Carbon Monoxide (CO)	Protection of human health	8 hours	10,000	8,620	-	1st Jan 2005
Benzene (C_6H_6)	Protection of human health	Calendar Year	5	1.5	-	1st Jan 2010

* AOT40 is a measure of the overall exposure of plants to ozone. It is 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.

Table 10-2 Assessment Thresholds from CAFE Directive 2008/50/EC

Pollutant	Limit Value Objective	Averaging Period	Limit Value ($\mu g/m^3$)	Basis of Application of Limit Value
Sulphur dioxide (SO_2)	Upper assessment threshold for the protection of Human Health	24 hours	75	Not to be exceeded more than 3 times in a calendar year

Pollutant	Limit Value Objective	Averaging Period	Limit Value ($\mu g/m^3$)	Basis of Application of Limit Value
Sulphur dioxide (SO_2)	Lower assessment threshold for the protection of human health	24 hours	50	Not to be exceeded more than 3 times in a calendar year
Nitrogen dioxide (NO_2)	Upper assessment threshold for the protection of human health	1 hour	140	Not to be exceeded more than 18 times in a calendar year
Nitrogen dioxide (NO_2)	Lower assessment threshold for the protection of human health	1 hour	100	Not to be exceeded more than 18 times in a calendar year
Particulate matter 10 (PM_{10})	Upper assessment threshold	24 hours	35	Not to be exceeded more than 35 times in a calendar year
Particulate matter 10 (PM_{10})	Lower assessment threshold	24 hours	25	Not to be exceeded more than 35 times in a calendar year
Lead (Pb)	Upper assessment threshold	Calendar Year	0.35	n/a
Lead (Pb)	Lower assessment threshold	Calendar Year	0.25	n/a
Carbon Monoxide (CO)	Upper assessment threshold	8 hours	7000	n/a
Carbon Monoxide (CO)	Lower assessment threshold	8 hours	5000	n/a
Benzene (C_6H_6)	Upper assessment threshold	Calendar Year	3.5	n/a
Benzene (C_6H_6)	Lower assessment threshold	Calendar Year	2	n/a

The Ozone Daughter Directive 2008/50/EC is different from the other Daughter Directives in that it sets target values and long-term objectives for ozone rather than limit values. 3 presents the limit and target values for ozone.

Table 10-3 Thresholds Defined in Directive 2008/50/EC (source: https://airquality.ie/information/air-quality-standards)

Pollutant	Averaging Period	Threshold
Sulphur Dioxide	To be measured over three consecutive hours at locations representative of air quality over at least 100 km^2 or an entire zone or agglomeration, whichever is the smaller.	500 $\mu g/m^3$
Nitrogen Dioxide	To be measured over three consecutive hours at locations representative of air quality over at least 100 km^2 or an entire zone or agglomeration, whichever is the smaller.	400 $\mu g/m^3$
Ozone Information Threshold	1 hour average	180 $\mu g/m^3$
Ozone Alert Threshold	1 hour average	240 $\mu g/m^3$

Table 10-4 Target values for Ozone Defined in Directive 2008/50/EC (source: https://airquality.ie/information/air-quality-standards)

Objective	Parameter	Target Value for 2010	Long term Target Value
Protection of human health	Maximum daily 8 hour mean	120 $\mu g/m^3$ not to be exceeded more than 25 days per calendar year averaged over 3 years	120 $\mu g/m^3$
Protection of vegetation	AOT_{40} calculated from 1-hour values from May to July	18,000 $\mu g/m^3$-h averaged over 5 years	6,000 $\mu g/m^3$-h

AOT_{40} is a measure of the overall exposure of plants to ozone. It is the sum of the excess hourly concentrations greater than 80 g/m^3 and is expressed as g/m^3 hours.

10.1.2 Methodology

10.1.2.1 Assessment of Significance

The effects associated with the Project are described with respect to the EPA Guidelines on the information to be contained in Environmental Impact Assessment Report (EIAR), May 2022.

10.1.2.2 Air Quality Zones

The EPA has designated four Air Quality Zones for Ireland:

- Zone A: Dublin City and environs.
- Zone B: Cork City and environs.
- Zone C: 16 urban areas with population greater than 15,000.
- Zone D: Remainder of the country.

These zones were defined to meet the criteria for air quality monitoring, assessment and management described in the Framework Directive. The site of the Project lies within Zone D, which represents rural areas located away from large population centres.

10.1.2.3 Air Quality Data Review

The EPA commenced reporting on Air Quality in Ireland in 1996. At that time, the principal focus was on air quality in urban areas where air pollution by smoke and SO_2 from coal burning in the residential sector had been identified as a significant problem. With the extension of smoke control legislation to several urban areas outside Dublin and Cork (Dundalk, Drogheda, Limerick, Arklow and Wexford), significant improvements in air quality in Ireland had occurred as evidenced by the monitoring data from urban air quality monitoring stations.

Baseline air quality monitoring data was sourced from monitoring stations which were in operation in 1998, during the construction period 2003 to 2006 and more recently is presented based on EPA published Annual Air Quality in Ireland Reports as follows:

- EPA Air Quality Monitoring Report 1998 (published in 1999).
- EPA Air Quality Monitoring Report 2003 (published in 2005).
- EPA Air Quality Monitoring Report 2004 (published in 2005).
- EPA Air Quality Monitoring Report 2005 (published in 2006).
- EPA Air Quality Monitoring Report 2006 (published in 2007).
- EPA Ireland's Environment an Assessment 2016.
- EPA Air Quality in Ireland - Indicators of Air Quality 2017 (published in 2018).
- EPA Air Quality Monitoring Report 2018 (published in 2019).

The EPA compiles and collates the air quality monitoring data from the network of stations and historical and current air quality monitoring data from these stations has been obtained from the EPA SAFER online database as part of the baseline assessment.

EPA Air Quality Reports for the period 1998 to 2006, which encompasses the 1998 baseline year and the period of construction from 2003 to 2006, have been reviewed to provide a baseline of air quality in Ireland prior to and during construction. The EPA Air Quality in Ireland Report for 2018 published in 2019, the EPA data on the Air Quality Index for Health and SAFER data have been reviewed to assess the baseline quality for the current non-operational wind farm.

Potential impacts on air quality would have occurred principally during the construction phase of the project in the period 2003 to 2006 when significant excavation, earth moving, and material transportation and the main felling took place. The potential for air quality impacts to occur during the operational phase are significantly less, as levels of activity are significantly lower. The principal pollutants generated during the construction, operation, and ceased operational stage of the Derrybrien Wind Farm relate to air borne dust and equipment exhaust emissions. An assessment of the impacts of these pollutants against the baseline has been carried out based on the Institute of Air Quality Management Guidance document[1].

10.1.2.4 Limitations/Difficulties Encountered

Limited historical data on air quality was available for the applicable period from the historic records and database of the Environmental Protection Agency (EPA). However, these were sufficient to provide an assessment of the air quality status that prevailed in 1998, the baseline year of the Retained Development and during the construction period 2003 to 2006 and subsequent operational years. As

[1] *https://iaqm.co.uk/guidance/*

the EPA air quality monitoring network evolved more comprehensive data and reporting became available.

It should be noted that as this rEIAR assesses a project that is already complete, the opportunity to directly measure or monitor certain environmental effects — such as dust deposition or air quality impacts — no longer exists. The absence of continuous historical air quality data (for example, dust monitoring during construction) limits the ability to quantify actual effects with certainty.

In such cases, the assessment relies on standard methodologies, professional judgment, and contextual information such as separation distances to sensitive receptors, site conditions, and the nature of construction activities. This approach reflects best practice where data gaps exist. Any reference to potential or estimated effects should be understood within this context of data limitation.

10.1.3 Receiving Environment

10.1.3.1 Baseline Air Quality

In 1999, the third Environmental Protection Agency (EPA) air quality report[2] covering the year 1998, the project baseline year, was published by the EPA. It reported on air quality data for a variety of air pollutants in Ireland assessing them against the air quality standards. Monitoring was undertaken at mainly Local Authority stations and some EPA sites. These monitoring locations were essentially all urban in nature (the major urban areas) with additional Ozone monitoring related rural air quality monitoring stations in operation.

At this time, air quality monitoring remained concentrated mainly on smoke and sulphur dioxide (SO_2) with simultaneous measurement of daily values of the two pollutants at almost 60 monitoring sites throughout the country but mainly in urban areas. Measurement values indicated that the levels of both smoke and SO_2 in 1998/99 were very low and fully in compliance with the Irish air quality standards and the EU Directive on SO_2 and particulates.

The monitoring of particulate matter of ten microns in size or less (PM_{10}) was focused on four stations in Dublin and indicated a continuing trend in high concentrations which were closely associated with heavy traffic (the annual mean PM_{10} level in 1998 was 49 $\mu g/m^3$ and daily values exceeded 50 $\mu g/m^3$ on approximately 40 percent of days for which measurements were made.

Monitoring of Nitrogen oxides, a significant air pollutant, was also carried out in some urban area (Cork and Dublin) with monitoring indicating general compliance with air quality standards. However, in semi urban areas levels of Nitrogen Dioxide (NO_2) were identified as being related to traffic and approaching new target limits set by the European Union (EU).

Ozone levels recorded during 1998 were very low, which was regarded by the EPA as typical of the normal situation in Ireland. There were a few exceedances of the EU thresholds for the protection of human health (eight-hour health protection threshold of 110 $\mu g/m^3$ was exceeded for one or more periods on a total of only 10 days. There were no occasions when hourly mean ozone exceeded 180 $\mu g/m^3$ during 1998).

In relation to the thresholds for the protection of vegetation, the one-hour value of 200$\mu g/m^3$ was not reached but the 24-hour threshold of 65 $\mu g/m^3$, which was close to the Northern European background level, was exceeded on as many as 294 days at the Mace Head station on the west coast of Ireland and also regularly at the other monitoring stations.

[2] *http://www.epa.ie/pubs/reports/air/quality/epaairqualityreport1998pdf.html*

The1999 Report also identified ambient lead associated with traffic as being very low in line with the phasing out of leaded petrol in motor vehicles with annual mean concentrations recorded being five percent of the limit value of 2 µg/m^3.

Carbon monoxide data collected in Dublin City indicated that levels were well within the World Health Organization (WHO) guidelines for both one-hour and eight-hour averaging periods.

The 1999 Report also identified the clear need to expand the air quality monitoring network in Ireland to meet the requirements of EU and National legislation. This legislation also expanded the parameters to be monitored across the country. This was subsequently implemented through an expanded Network of monitoring stations.

10.1.3.2 Construction Phase Air Quality (2003-2006)

The EPA has operated and continue to operate a network of air monitoring stations including some in Zone D. Although there is no specific monitoring station at Derrybrien,, it would be expected that due to the remote location of the site, and the absence of significant sources of air pollution, air quality would be similar to that monitored at other Zone D monitoring stations. . Typical Zone D monitoring stations that can be referenced for this purpose are Mountrath and Emo Court in County Laois, Ferbane in County Offaly and Kilkitt in County Monaghan. Both Mountrath and Ferbane monitoring stations operated for a period; while they are no longer in operation, they still provide useful historic data.

10.1.3.2.1 *Sulphur Dioxide (SO_2)*

Sulphur dioxide data for Mountrath, County Laois (from 2004-2005), Ferbane, County Offaly (from October 2006), and Kilkitt, Water Treatment Plant, Co. Monaghan (continuous) is presented in Table 10-5.

Table 10-5 Sulphur Dioxide Data for Zone D Sites

Parameter	Measurement				
	Mountrath		Kilkitt		Ferbane
	2004	2005	2005	2006	2006
Annual Mean (µg/m^3)	4	4	3	2	2
Hourly max value (µg/m^3)	28	22	10	13	7
Median (µg/m^3)	3	4	3	2	1

Notes: [1-] SO_2 annual mean limit value for the protection of ecosystems: 20 µg/m^3 applicable from 2001.SO_2 hourly limit value: No more than 24 hourly values > 350 µg/m^3, SO_2 daily limit: No more than 3 daily values > 125 µg/m^3.

During the monitoring period there were no exceedances of the daily limit values for the protection of human health. In addition, there were no exceedances of the annual mean limit for the protection of ecosystems. It would be expected that, due to the remote location of the site, and the absence of

significant sources of air pollution, existing SO_2 values at the Project site would have been similar or lower than those recorded for the Zone D sites above.

10.1.3.2.2 Particulate Matter (PM_{10})

Sources of particulate matter include vehicle exhaust emissions, soil and road surfaces, construction works and industrial emissions. PM_{10} data for Mountrath, County Laois (from 2004-2005), Ferbane, County Offaly (from October 2006), and Kilkitt, Water Treatment Plant, Co. Monaghan (continuous) is presented in Table 10-6. Particulate matter (PM_{10}) data is presented in Table 10-6.

Table 10-6 Historical Particulate Matter (PM_{10}) Data for Zone D Sites

Parameter	Measurement				
	Mountrath		Kilkitt		Ferbane
	2004	2005	2005	2006	2006
Annual Mean ($\mu g/m^3$)	26	21	No data	10	17
Max value ($\mu g/m^3$)	25	43	No data	47	45
Median ($\mu g/m^3$)	44	20	No data	8	15

Notes: [1-] PM_{10} daily limit for the protection of human health: No more than 35 days >50 $\mu g/m^3$. [-] PM_{10} annual mean limit value: 40 $\mu g/m^3$.

The PM_{10} levels during this period were below the daily limit of 50 $\mu g/m^3$ for the protection of human health. It is expected based on professional judgement that PM_{10} values at the Project site would be similar or lower than those recorded for the Zone D sites above.

10.1.3.2.3 Nitrogen Dioxide (NO_2)

Nitrogen dioxide data for Mountrath, County Laois (from 2004-2005), Ferbane, County Offaly (from October 2006), and Kilkitt, Water Treatment Plant, Co. Monaghan (continuous) is presented in Table 10-7.

Table 10-7 Historical Nitrogen Dioxide Data for Zone D Sites

Parameter	Measurement					
	Mountrath		Kilkitt			Ferbane
	2004	2005	2004	2005	2006	2006
Annual Mean ($\mu g/m^3$)	13	12	3	2	3	4
Max hourly	57	63	43	33	58	40

Parameter	Measurement					
value ($\mu g/m^3$)						
Median ($\mu g/m^3$)	11	10	2	1	2	2

Note: NO_2 hourly limit value: No more than 18 hours >200 $\mu g/m^3$ applicable from 2010 NO_2 annual mean limit value: 40 $\mu g/m^3$ applicable from 2010.

The annual NO_2 value was below the annual mean limit value for the protection of human health of 40 $\mu g/m^3$. It would be expected that, due to the remote location of the site, and the absence of significant sources of air pollution, t NO_2 values at the Project site would have been similar or lower than those recorded for the Zone D sites above.

10.1.3.2.4 Carbon Monoxide (CO)

The EPA Report provides rolling 8-hour carbon monoxide concentrations for Mountrath (from 2004-2005) and Ferbane (from October 2006). Carbon Monoxide data for this period is presented in Table 10-8 below.

Table 10-8 Historical Carbon Monoxide Data for Mountrath and Ferbane - Zone D Sites

Parameter	Measurement		
	Mountrath		Ferbane
	2004	2005	2006
Annual Mean mg/m^3	0.5	0.3	0.2
Max hourly value mg/m^3	1.6	0.8	1.5
Median mg/m^3	0.3	0.3	0.1

Note: CO Limit Value: Maximum daily 8-hr mean value of 10 mg/m^3.

The carbon monoxide limit value for the protection of human health is 10,000 $\mu g/m^3$ (or 10mg/m^3). On no occasions were values in excess of the 10 mg/m^3 limit value set out in Directive 2008/50/EC. It would be expected that, due to the remote location of the site, and the absence of significant sources of air pollution, that CO values at the Project site during this period would have been similar or lower than those recorded for the Zone D sites above.

10.1.3.2.5 Ozone (O_3)

The EPA report provide rolling 8-hour ozone concentrations for Zone D sites, including Emo Court, Kilkitt, and Mountrath. Ozone (O_3) data for the construction period of the Project is presented in Table 10-9.

Table 10-9 Ozone Data for Zone D Sites in 2022

Parameter	Measurement						
	Mountrath		Kilkitt			Emo	
	2004	2005	2004	2005	2006	2004	2005
Annual Mean (µg/m^3)	42	48	57	56	62	42	48
Max value (µg/m^3)	123	105	108	121	194	123	105
Median (µg/m^3)	42	49	57	57	61	42	49

Note: Max Ozone daily 8-hr mean limit: No more than 25 days >120 µg/m^3.

In 2006, Ozone (O_3) concentrations measured in Ireland in general were higher than previous years with a high concentration measured in July. One non-compliance with the rolling 8-hour standard for Ozone occurred at Kilkitt monitoring station. The hourly information threshold of 180 µg/m^3 was exceeded at four stations: including Emo Court (Kilkitt, Valentia, Glashaboy and Emo Court). The 8-hour target value of 120 µg/m^3 was exceeded at almost every station. These exceedances were attributed to a combination of transboundary pollution and hot, sunny weather. Given the remote location of the Project site it is likely that Ozone levels at the site would be broadly similar to those recorded at other Zone D site, albeit it is possible that Ozone levels at the Project site may be slightly lower than those recorded at other sites due the relatively higher altitude of the Project site.

10.1.3.2.6 Dust

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.

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, etc., and the weather. In addition, dust dispersion is influenced by external factors such as wind speed and direction and/or, periods of dry weather. Dust had the potential to be generated during the construction activities of the Project from on-site activities such as excavation. Traffic movements also had the potential to generate dust as they travel along the Project site roads.

The potential dust-related effects on local air quality and the relevant associated mitigation measures are presented in Sections 10.1.4.1.1. below.

10.1.3.3 Operational and Maintenance Phase Air Quality (2006 to 2022)

In the EPA Report[3] (2016) "Ireland's Environment - an Assessment 2016" a summary of air quality between the period 2012 and 2015 is provided which is reflective of the operational period of Derrybrien Wind Farm. In general, the Report indicates that Ireland's air quality was good, relative to other European Union (EU) Member States, with monitoring stations indicating that Ireland continued to meet all EU air quality standards but with some localised air quality issues.

The report also referenced the emerging challenges as the knowledge and understanding of the link between air quality and human health becomes better understood and indicated a growing realisation that compliance with EU air quality limit values is not enough to protect the health of people from the negative effects of poor air quality (World Heath Organization (WHO), 2016). When compared with the more stringent WHO guideline values and European Economic Area (EEA) reference level values, ozone, particulate matter and Polycyclic aromatic hydrocarbons (PAHs) emerge as pollutants of concern in the short term, while NO_2 is expected to increase as road networks become more congested. The adoption of the stricter WHO air quality guidelines (Air Quality Guidelines, Global Update 2005) and their update relating to $PM_{2.5}$ ((Krzyzanowski and Cohen, 2008)[4] is identified as being required to protect human health. In 2018 the WHO bulletin of May 2nd indicated the following:

> *"Ambient (outdoor) air pollution in both cities and rural areas was estimated to cause 4.2 million premature deaths worldwide per year in 2016; this mortality is due to exposure to small particulate matter of 2.5 microns or less in diameter ($PM_{2.5}$), which cause cardiovascular and respiratory disease, and cancers"*

The EPA Report[3] attributed 1,200 premature deaths to poor air quality. The most common causes of premature death are attributable to strokes and heart disease.

The EPA Air Quality Reports for 2017 and 2018 provide a similar picture indicating that Ireland's air quality was compliant with the EU limits but was above the World Health Organization (WHO) air quality guideline value levels at a number of monitoring sites for fine particulate matter, ozone and nitrogen dioxide (NO_2) and above the European Environment Agency reference level for PAH, a toxic chemical, at three monitoring sites. The EPA estimated the number of premature deaths from air quality at 1,180 people in 2018. For rural areas, particulate matter from the burning of fossil fuel is a key concern.

To provide up to date air quality information the EPA launched the 5-year National Ambient Air Monitoring Programme in November 2017. This has seen an expansion of the air monitoring network with upgrading of existing stations to provide real time for air borne particulate matter and other pollutants.

Based on this network the EPA publishes an Air Quality Index for Health (AQIH) map providing up to date information on air quality in any particular area. The AQIH is described by the EPA as

> *"a number from one to 10 that tells you what the air quality currently is in the station nearest you and whether or not this might affect the health of you or your child. A reading of 10 means the air quality is very poor and a reading of one to three inclusive means that the air quality is good. The AQIH map updates every two to five minutes with the most up-to-date calculated Air Quality Index for Health (AQIH) for each station."*

[3] EPA - Ireland's Environment 2016 - An Assessment
[4] http://www.euro.who.int/en/health-topics/environment-and-health/air-quality/publications/journal-articles/update-on-who-air-quality-guidelines

The Derrybrien wind farm is located in the AQIH Region West, which area includes towns with population less than 5,000, villages and rural areas in Counties Clare, Cork, Donegal, Galway, Kerry, Leitrim, Limerick, Mayo, Roscommon and Sligo. The AQIH is based on measurements of five air pollutants all of which can harm health. The five pollutants are:

- Ozone gas.
- Nitrogen dioxide gas.
- Sulphur dioxide gas.
- $PM_{2.5}$ particles.
- PM_{10} particles.

The EPA data for assessment for these pollutants is derived from automatic air quality monitors. The AQIH for the Derrybrien Area (Region West) is generally Good. Continuous monitoring data from Emo Court shows that nitrogen dioxide concentration is consistently below the 200µg/m^3 limit value and Ozone concentration is consistently below the 180µg/m^3 limit (based on fourteen-day data[5]).

Similarly, continuous monitoring data from the Kilkitt station shows that nitrogen dioxide concentration is consistently below the 200µg/m^3 limit, sulphur dioxide concentrations are below the 350 ug m^3 limit and Ozone is below the information threshold of 180 ug m^3. PM_{10} levels are below the daily limit of 50 ug m^3 and heavy metals (Nickel, Arsenic, Cadmium and Lead) are all below the Lower Assessment Thresholds indicating good air quality in Zone D in the rural areas, http://www.epa.ie/air/quality/data/kt/.
In September 2023, the EPA published a report on air quality in Ireland, 'Air Quality in Ireland 2022' (https://www.epa.ie/publications/monitoring–assessment/air/air-quality-in-ireland-2022.php). The EPA reports provide SO_2, PM_{10}, NO_2 and O_3 concentrations for areas in Zone D. Values for each of these elements recorded within the Zone D monitoring stations listed in the report, have been averaged to give representative values for Zone D. Similar measurement values for all air quality parameters would be expected for the Project site as it lies in a rural location, within Zone D.

Sulphur Dioxide (SO_2)

Sulphur dioxide data for Cork Harbour, Kilkitt, Askeaton, Edenderry and Letterkenny in 2022 is presented in table 10-10.

Table 10-10 Average Sulphur Dioxide Data for Zone D Sites in 2022

Parameter	Measurement
Annual Mean	5.0 µg/m^3
Hourly values > 350	0
Hourly max (Average)	83.6 µg/m^3
Daily values > 125	0
Daily max (Average)	22.8 µg/m^3

During the monitoring period there were no exceedances of the daily limit values for the protection of human health. As can be observed from Table 10-5, the average maximum hourly value recorded during the assessment period was 83.6 µg/m^3. In addition, there were no exceedances of the annual

[5] http://www.epa.ie/air/quality/data/emo/gas/

mean limit for the protection of ecosystems. It would be expected that existing SO_2 values at the Project site would be similar or lower than those recorded for the Zone D sites above.

Particulate Matter (PM_{10})

Sources of particulate matter include vehicle exhaust emissions, soil and road surfaces, construction works and industrial emissions. The EPA report provides annual mean PM_{10} concentration for sixteen Zone D towns, Tipperary Town, Carrick-on-Shannon/ Askeaton, Enniscorthy, Birr, Macroom, Castlebar, Cobh Carrignafoy, Claremorris, Kilkitt, Cavan, Roscommon Town, Edenderry, Mallow, Longford, Killarney and Cobh Cork Harbour. Particulate matter (PM10) data for 2022 is presented in Table 10-11.

Table 10-11 Average Particulate Matter (PM_{10}) Data for Zone D Sites in 2022

Parameter	Measurement
Annual Mean	12.7 µg/m^3
% Data Capture (Average)	93.2%
Values > 50 ug/m^3	Max. 10
Daily Max (Average)	56.5 µg/m^3

Notes: [1.] PM_{10} daily limit for the protection of human health: No more than 35 days >50 µg/m^3

The daily limit of 50 µg/m^3 for the protection of human health was not exceeded more than 35 days during the monitoring period. It would be expected that PM_{10} values at the Project site would be similar or lower than those recorded for the Zone D sites above.

Nitrogen Dioxide (NO_2)

Nitrogen dioxide data for Emo Court, Birr, Castlebar, Carrick-on-Shannon, Edenderry and Kilkitt in 2022 is presented in table 10-12.

Table 10-12 Average Nitrogen Dioxide Data for Zone D Sites in 2022

Parameter	Measurement
Annual Mean (Average)	7.4 µg/m^3
NO_2 Values >200	0
Values > 140 (UAT)	1
Values >100 (LAT)	4
Hourly Max. (Average)	87.3 µg/m^3

The annual NO_2 value was below the annual mean limit value for the protection of human health of 40 µg/m^3.

The annual NO_2 value was below the annual mean limit value for the protection of human health of 40 µg/m^3. Furthermore, the lower assessment threshold of 100 µg/m^3 was exceeded 4 no. times during the monitoring period in Emo Court, Co. Laois and the upper assessment threshold of 140 µg/m^3 was exceeded once during the monitoring period, also in Emo Court, Co. Laois. Both did not exceed the 18days limit during the monitoring period. In 2022, no other monitoring locations in Zone D had exceedances in the lower and upper assessment thresholds of 100 and 140 µg/m^3. The average hourly

max. NO_2 value of 87.3 µg/m³ measured during the monitoring period was below the hourly max threshold of 200 µg/m³. It would be expected that NO_2 values at the Project site would be similar or lower than those recorded for the Zone D sites above.

Carbon Monoxide (CO)

The EPA Report provides rolling 8-hour carbon monoxide concentrations for Birr, a Zone D site. Carbon Monoxide data for 2022 is presented in Table 10-13 below.

Table 10-13 Carbon Monoxide Data for Birr - Zone D Site in 2022

Parameter	Measurement
Annual Mean	0.8 mg/m³
Median	0.7 mg/m³
% Data Capture	95.9%
Values > 10	0
Max	3.4mg/m³

The average annual mean concentration of carbon monoxide was 0.8 mg/m³. The carbon monoxide limit value for the protection of human health is 10,000 µg/m³ (or 10mg/m³). On no occasions were values in excess of the 10 mg/m³ limit value set out in Directive2008/50/EC. It would be expected that CO values at the Project site would be similar or lower than those recorded for the Zone D sites above.

Ozone (O_3)

The EPA report provide rolling 8-hour ozone concentrations for seven Zone D sites, Emo Court, Kilkitt, Carnsore Point, Mace Head, Castlebar, Valentia and Malin Head. Ozone (O_3) data for 2022 is presented in Table 10-14. As can be observed from Table 10-14, in 2022 there were 17 no. exceedances of the maximum daily eight-hour mean limit of 120 µg/m³. The legislation stipulates that this limit should not be exceeded on more than 25 no. days. It would be expected that O_3 values at the Project site would be similar or lower than those recorded for the Zone D sites below.

Table 10-14 Average Ozone Data for Zone D Sites in 2022

Parameter	Measurement
Annual Mean	61.7 µg/m³
Median	62.2µg/m³
% Data Capture	89.5%
No. of days > 120 µg/m³	17 days

Dust

There are no statutory limits for dust deposition in Ireland. However, EPA guidance suggests that a deposition of 10 mg/m²/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.

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, etc., and the weather. In addition, dust dispersion is influenced by external factors such as wind speed and direction and/or, periods of dry weather. Small amounts of dust had the potential to be generated during the operation and maintenance activities of the Project from traffic movements as they travel along the Project site roads.

The potential dust-related effects on local air quality and the relevant associated mitigation measures are presented in Sections 10.1.4.4.1. below.

10.1.3.4 Ceased Operational Phase Air Quality

The air quality in the vicinity of the Project area is typical of that of rural areas in the West of Ireland, i.e., Zone D. Prevailing south-westerly winds carry clean, unpolluted air from the Atlantic Ocean onto the Irish mainland. Current land-use on the Wind Farm Site comprises of commercial forestry and areas of blanket bog currently used for turf cutting. Land-use in the wider landscape of the Site include forestry, peat cutting, agriculture and low-density rural residential areas. It is expected that air quality in the existing environment is good, since there are no major sources of air pollution (e.g. heavy industry) in the vicinity of the site.

The EPA publishes Air Monitoring Station Reports for monitoring locations in all four Air Quality Zones. The most recent report on air quality in Ireland, Air Quality in Ireland 2023' was published by the EPA in September 2024. The EPA reports provide SO_2, PM_{10}, NO_2 and O_3 concentrations for areas in Zone D. Values for each of these elements recorded within the Zone D monitoring stations listed in the report, have been averaged to give representative values for Zone D. Similar measurement values for all air quality parameters would be expected for the Proect site as it lies in a rural location, within Zone D.

10.1.3.4.1 *Sulphur Dioxide (SO_2)*

Sulphur dioxide data for Cork Harbour, Kilkitt, Shannon Estuary/Askeaton, Edenderry and Letterkenny (Zone D) is presented in Table 10-15.

Table 10-15 Average Sulphur Dioxide Data for Zone D Sites in 2023

Parameter	Measurement
Annual Mean	4.3 µg/m^3
Hourly values > 350	0
Hourly max (Average)	80.9 µg/m^3
Daily values > 125	0
Daily max (Average)	23.2 µg/m^3

During the monitoring period there were no exceedances of the daily limit values for the protection of human health. As can be observed from Table 10-15, the average maximum hourly value recorded during the assessment period was 80.9 µg/m^3. In addition, there were no exceedances of the annual mean limit for the protection of ecosystems. It would be expected that existing SO_2 values at the Project site would be similar or lower than those recorded for the Zone D sites above.

10.1.3.4.2 Particulate Matter (PM_{10})

Sources of particulate matter include vehicle exhaust emissions, soil and road surfaces, construction works and industrial emissions. The EPA report[6] provides annual mean PM_{10} concentration for 18 no. Zone D towns, Carrick-on-Shannon, Shannon Estuary/Askeaton, Birr, Castlebar, Kilkitt, Claremorris, Enniscorthy, Roscommon Town, Cobh Carrignafoy, Cobh Cork Harbour, Macroom, Cavan, Edenderry, Mallow, Longford, Killarney, Malin Head and Tipperary Town. Particulate matter (PM_{10}) data for 2023 is presented in Table 10-16.

Table 10-16 Average Particulate Matter (PM_{10}) Data for Zone D Sites in 2023

Parameter	Measurement
Annual Mean	11.0 µg/m^3
% Data Capture (Average)	90.8%
Values > 50 ug/m^3	Max 6
Daily Max (Average)	45.4µg/m^3

Notes: [1-] PM_{10} daily limit for the protection of human health: No more than 35 days >50 µg/m^3

The daily limit of 50 µg/m^3 for the protection of human health was exceeded on 13 days, which is greater than the PM_{10} daily limit for the protection of human health of a max 35 days >50 µg/m^3 applicable from 2005. The greatest number of exceedances occurred at Edenderry where the PM_{10} daily limit was exceeded on 6 no. occasions. In the EPA 2023 report, it notes that there were breaches in the levels of particulate matter (PM), which in Ireland, mainly comes from the burning of solid fuel, such as coal, peat, and wood to heat our homes. It is expected based on professional judgement that PM_{10} values at the Project site is similar or lower than those recorded for the Zone D sites above.

10.1.3.4.3 Nitrogen Dioxide (NO_2)

Nitrogen dioxide data for Emo Court, Birr, Castlebar, Carrick-on-Shannon, Kilkitt, Briarhill, and Edenderry in 2023 is presented in Table 10-17.

Table 10-17 Average Nitrogen Dioxide Data for Zone D Sites in 2023

Parameter	Measurement
Annual Mean (Average)	8.1 µg/m^3
NO_2 Values >200	0
Values > 140 (UAT)	0
Values >100 (LAT)	4
Hourly Max. (Average)	67.6 µg/m^3

The annual NO_2 value was below the annual mean limit value for the protection of human health of 40 µg/m^3. Furthermore, the lower assessment threshold of 100 µg/m^3 was exceeded 4 no. times during the monitoring period in Briarhill and the upper assessment threshold of 140 µg/m^3 was not exceeded during the monitoring period. The 18 days limit during the monitoring period was not exceeded. In

[6] *Environmental Protection Agency: Air Quality in Ireland 2023. Available at:* https://www.epa.ie/publications/monitoring--assessment/air/air-quality-in-ireland-2023.php#:~:text=Summary%3A%20Air%20quality%20in%20Ireland,based%20WHO%20guidelines%20in%202023

2023, no other monitoring locations in Zone D had exceedances in the lower and upper assessment thresholds of 100 and 140 µg/m^3. The average hourly max. NO_2 value of 67.6 µg/m^3 measured during the monitoring period was below the hourly max threshold of 200 µg/m^3. It would be expected that NO_2 values at the Project site would be similar or lower than those recorded for the Zone D sites above.

10.1.3.4.4 Carbon Monoxide (CO)

The EPA Report[7] provides rolling 8-hour carbon monoxide concentrations for Birr, a Zone D site. Carbon Monoxide data for 2023 is presented in Table 10-18 below.

Table 10-18 Carbon Monoxide Data for Birr - Zone D Site in 2023

Parameter	Measurement
Annual Mean	0.6 mg/m^3
Median	0.6 mg/m^3
% Data Capture	99.8%
Values > 10	0
Max	2.2 mg/m^3

The average annual mean concentration of carbon monoxide was 0.6 mg/m^3. The carbon monoxide limit value for the protection of human health is 10,000 µg/m^3 (or 10mg/m^3). On no occasions were values in excess of the 10 mg/m^3 limit value set out in Directive 2008/69/EC. It would be expected that CO values at the Project site would be similar or lower than those recorded for the Zone D sites above.

10.1.3.4.5 Ozone (O_3)

The EPA report[7] provide rolling 8-hour ozone concentrations for seven Zone D sites, Emo Court, Kilkitt, Carnsore Point, Mace Head, Castlebar, Valentia and Malin Head. Ozone (O_3) data for 2023 is presented in Table 10-9. As can be observed from Table 10-9, there were 10 no. exceedances of the maximum daily eight-hour mean limit of 120 µg/m^3. The legislation stipulates that this limit should not be exceeded on more than 25 no. days. It would be expected based on professional judgement that O_3 values at the Project would be similar or lower than those recorded for the Zone D sites below.

Table 10-19 Ozone Data for Zone D Sites in 2023

Parameter	Measurement
Annual Mean	61.5 µg/m^3
Median	72.8 µg/m^3
% Data Capture	95.5%
No. of days > 120 µg/m^3	10 days

10.1.3.4.6 Dust

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.

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, etc., and the weather. In addition, dust dispersion is influenced by external factors such as wind speed and direction and/or, periods of dry weather. Small amounts of dust have the potential to be generated during the maintenance activities of the Project during the ceased operational phase. Traffic movements also have the potential to generate dust as they travel along the Project site roads.

10.1.4 Likely, Significant Impacts and Mitigation Measures Implemented

10.1.4.1 Do-Nothing Scenario

Under the do-nothing scenario, the Derrybrien Wind Farm Development would remain in-situ in its current state i.e., as an unauthorised windfarm development the ceased commercial electricity generation in February 2022. No decommissioning works would be undertaken. The infrastructure would continue to degrade over time

If the Derrybrien Wind Farm Development Decommissioning Project were not to proceed, no changes would be made to the current land-use practice of agriculture and coniferous forestry. Since the Project is not currently operational it is not currently contributing to a reduction in Ireland's emissions of carbon dioxide, oxides of nitrogen (NO_x), and sulphur dioxide (SO_2). Under the "Do-Nothing" scenario this would not change. The effect on air quality would therefore be neutral.

10.1.4.2 Construction Phase Impacts (2003-2006)

10.1.4.2.1 *Air Quality*

Construction of Derrybrien Wind Farm Development

The construction of the Derrybrien Wind Farm site occurred at specific locations within the site and involved site preparation, access track and hardstand construction, foundation excavations for the wind turbine generators, substation and control building and materials and turbine deliveries. All of these activities could give rise to airborne dust. However, the nearest occupied dwellings to the wind farm site itself was located over 2km distance from the nearest wind turbine and there are no human receptors within 500m of the site entrance hence the risk of air borne dust or dust deposition on human receptors is negligible, indirect and short-term.

The grid connection would have required angle mast construction, and the erection of intermediary wooden pole sets along its route. Erection of wooden pole sets involves excavation and insertion of the wooden pole to a depth of circa 2.5 m. Typically a wooden pole set is erected in less than a day and would not give rise to significant dust as the footprint of the excavation is circa 3m^2. Angle masts are erected along the line length where a change in direction occurs. Their construction requires excavation of foundations, typically a 2m^2 excavation for each leg of the mast with temporary stockpiling of material for subsequent reinstatement. The closest proximity of a construction location (an angle mast) on the 110kV overhead line to an occupied dwelling is 380m. Construction would have been over a very short duration with limited excavation and earth moving at a small, focused site. The location of construction along the overhead line would also have been variable occurring at different sites in a progressive manner. The impact from dust arising from construction of this line would therefore have been of negligible risk and no significant impact would have occurred.

The Agannygal substation would have required site preparation, excavation of the foundation, stockpiling of materials and substation construction. Construction would have lasted a period of circa six months but activities giving rise to dust would be intermittent. The nearest dwelling to the Agannygal site construction is located circa 540m from the site, with the site entrance also located more than 500m from any dwelling. The potential risk of dust impact on the nearest dwelling is therefore negligible and no significant impact would have occurred.

The operation of construction equipment gives rise to combustion emissions such as carbon dioxide, nitrogen oxides and sulphur oxides from combustion of fossil fuels. In terms of air quality these could give rise to respiratory effects at high concentrations.

Exhaust emissions from construction and delivery vehicles would have been localised at the individual construction sites and would have quickly dispersed in the atmosphere. Given that the nearest occupied dwellings to the wind farm site itself are located over 2km distance no significant impact would have occurred during the construction phase of the wind farm site.

As noted above, the closest proximity of a construction location on the 110kV overhead line to an occupied dwelling is 380m and construction would have been for a very short duration with limited excavation and earth moving at a small focused site and no significant impact would have occurred.

The nearest dwelling to the Agannygal site construction is located circa 540m from the site, with the site entrance also located more than 500m from any dwelling and no significant impact would have occurred.

Peat Slide

The peat slide incident impacted primarily on the aquatic environment and did not give rise to significant airborne dust particles as the slip material was mainly wet peat and forest materials. However, peat deposition on lands effected by the slide did occur and this peat could potentially dry out giving rise to localised airborne dust. Wet peat was also deposited in the peat repositories but did not give rise to airborne dust. Excavation of material for barrage construction and construction of the barrages themselves would have given rise to localised dust and exhaust emissions from the plant and equipment used at the time but this would have been confined to the period of construction of the remedial peat slide measures. The potential for impact from this source is again dependent on the distance to the receptor, size and scale of the construction site and area of activities giving rise to dust, weather conditions and dispersion through the air.

In the case of the peat slide the nearest occupied dwellings to the slide area, to areas where material to construct the barrages were excavated and to the areas where the barrages were constructed are located at a sufficient distance such that any dust or emissions generated during these activities would have dispersed before reaching sensitive receptors. The barrages will be left in situ as part of the Retained Development. These barrages are constructed mainly of well-graded coarse rock pieces from about 300mm up to typically 1,200mm in size and will not give rise to significant dust generation.

In addition, construction works associated with these remedial works were of short duration and the risk of air borne dust or dust deposition on human receptors would have been negligible and no significant impact would have occurred.

Combustion emissions such as nitrogen oxides and sulphur oxides from equipment used to undertake the remedial works arising from the peat slide could also impact on air quality. The exhaust emissions from remedial construction and delivery vehicles would have been very localised at the peat deposition areas and at the barrage sites and would have quickly dispersed in the atmosphere. Given that the nearest occupied dwellings these locations are well in excess of 500m no significant impact on air quality would have occurred during the remedial works.

Mitigation Measures

- Dust suppression measures were implemented on site to minimise the potential nuisance caused by dust at the nearest sensitive receptors and on sensitive eco systems. Water misting was used as required if particularly dusty activities were necessary on site during dry and/or windy conditions.
- All site related traffic had speed restrictions on un-surfaced roads.
- Regular inspection of the site was undertaken to examine dust measures and their effectiveness.
- All plant and materials vehicles were stored in dedicated areas (on site).
- Turbines and construction materials were transported to the site on specified haul routes only.
- The agreed haul route roads adjacent to the site was regularly inspected for cleanliness and cleaned as necessary.
- The Site access roads were checked regularly for damage/potholes and repaired as necessary.
- The transport of construction materials which had the potential to generate dust was undertaken with tarpaulin cover or similar, where necessary.

Residual Impact

The distance between construction activities and the nearest occupied dwellings, ensured that any emissions generated during these activities was unlikely to reach sensitive receptors at concentrations that would result in health effects. Furthermore, the short-term nature of construction activities, along with the implementation of measures outlined above, reduced the potential for emissions.

Therefore, the residual effect on air quality during the construction phase of the Project was negligible, indirect, and short term.

Significance of Effects

No significant effects on air quality occurred during the construction phase of the Derrybrien Wind Farm Development.

10.1.4.2.2 *Effect on Human Health*

Potential dust and exhaust emissions sources during the construction phase of the Project included construction works and vehicle and plant movements. An increase in dust emissions had the potential to cause a nuisance to receptors in the immediate vicinity of the site. However, the nearest occupied dwellings to the wind farm site itself were located just over 2km distance from the site. Based on the Institute of Air Quality Guidance, the risk of air borne dust or dust depositing on human receptors at this distance is imperceptible and not significant.

The entry and exit of staff vehicles and heavy machinery had the potential to result in the transfer of mud to the public road, particularly when the weather was wet. This in turn had the potential to cause nuisance to residents and other road users by generating dust as it dried. However, these effects would not be significant and would be relatively short-term in duration. Additional potential dust and exhaust emissions sources during construction phase of the project included Light Goods Vehicles ferrying staff and light machinery used for the construction of the Project within the site. An increase in dust emissions had the potential to cause nuisance on sensitive receptors in the immediate vicinity of the site. The potential dust impacts that occurred are further described in Section 10.1.4.2.1.

The peat slide material consisted of wet peat and did not give rise to air quality impacts. The measures taken in response to the peat slide included the rebuilding of short sections of road within the wind

farm site at two locations and the installation of barrages along the downslope of the route of the slide between the wind farm and downstream of Flaggy Bridge. Peat from the slide area was also removed and deposited in peat repositories. There would therefore have been some potential for air borne dust and vehicle emissions to impact on air quality. However, the distance from the slide area to an occupied dwelling was over 500m. Furthermore, the timeframe of the effects would have been limited to the peat slide and remediation works. Therefore, the impact from dust would have been imperceptible, negative, and short-term.

Residual Impact

Effects on human health from exhaust emissions and dust associated with construction activities and machinery are considered to have been **short-term, direct, imperceptible and** ne**utral** due to the distance from the works to the nearest sensitive receptors, as well as the implementation of standard construction-phase controls.

Significance of Effects

There were no significant effects on human health from dust or exhaust emissions during the construction phase of the Project.

10.1.4.3 Operation and Maintenance Phase Impacts (2006 – 2022)

10.1.4.3.1 *Air Quality*

During the operational phase of the wind farm, the Project did not give rise to significant emissions to atmosphere and thus, no adverse effect on general air quality has arisen. None of the air quality parameters for which limits values are set have been affected by the Derrybrien Wind Farm Development.

The Project had a beneficial effect in providing energy without emissions of recognised environmental pollutants through displacement of fossil fuel energy production with clean renewable energy. The moderately positive effect on air quality through the reduction in emissions of NO_x, CO, NMVOC, SO_x and $PM_{2.5}$ through displacement of fossil fuel combustion for electricity generation continued throughout the Project's operational period.

Residual Impact

Given the regional/transboundary effect on air quality through emissions displacement which occurred over the life-span of the Project, the residual effect of the Project's operational/maintenance phase was moderately positive, indirect, and long term..

Significance of Effects

The effect of the operational phase of the Project on air quality was not significant.

10.1.4.3.2 *Effect on Human Health*

As set out in Section 10.1.4.3.1 above, the Project had a beneficial effect in providing energy without emissions of recognised environmental pollutants through displacement of fossil fuel energy production with clean renewable energy. There was a moderately positive effect on air quality through the reduction in emissions of NO_x, CO, NMVOC, SO_x and $PM_{2.5}$ through displacement of fossil fuel combustion for electricity generation continued throughout the Project's operational period.

Considering that the WHO and the EPA regard NOx and particulate matter (dust) as key air pollutants for human health a reduction in these emissions can be seen as an indirect, moderately positive benefit in the long term.

Mitigation Measures

- Ensured that all maintenance and monitoring vehicles were maintained in good operational order while onsite, and, when stationary, were required to turn off engines thereby minimising any emissions that arose.

Residual Impact

The associated reduction in key air pollutants such as nitrogen oxides and particulate matter resulting from the operation of the Derrybrien Wind Farm had indirect positive effects for population and human health. These air quality improvements contribute to the overall reduction of ambient pollutant concentrations associated with respiratory and cardiovascular illnesses, as recognised by the WHO and the EPA. Therefore, the effect on human health during the operational phase of the Project was positive, indirect, moderate, and long-term.

Significance of Effects

Based on the assessment, there were no significant negative direct or indirect effects on human health during the operational phase of the Project.

10.1.4.4 Ceased Operation Phase Impacts (2022-Present)

10.1.4.4.1 *Air Quality*

The windfarm ceased generating electricity in February 2022. Since that time, the turbines have been maintained by the turbine supplier while in a prolonged non-operational state. Minimal movement of vehicles and plant has occurred on the Project site which could give rise to limited airborne dust and vehicle emissions.

Mitigation Measures

- All site related traffic had speed restrictions on un-surfaced roads.

Residual Impact

Given the minimal works involved in maintaining the non-operational state of the Derrybrien Wind Farm Development, as well as distances to the nearest occupied dwellings (over 2km) the effect of airborne dust or dust deposition on human receptors is indirect, imperceptible, neutral, and short term.

The effect on Air Quality in general is considered to be direct, imperceptible, neutral, and short term.

Significance of Effects

No significanteffect on Air Quality is occurring during the ceased-operational phase of the wind farm site.

10.1.4.5 Impacts of Retained Development

Once the Prospective Development is complete (decommissioning of above ground structures and buildings) the remaining elements of the Project (the Retained Development) will be the at and below ground structures such as reinforced concrete foundations of the wind turbine and hard stand areas, farm, substation and the OHL structures, borrow pit/quarries and access tracks, the underground cabling and peat repositories etc.

As there will be no ongoing activities (e.g. vehicle/plant operation, material handling, or excavation) associated with the Retained Development, there will be no effect on air quality.

10.1.1 Cumulative and In-Combination Effects

Potential cumulative effects on air quality between the Retained Development and other relevant developments (including the Prospective Development) were also considered as part of this assessment.

Following completion of the Prospective Development, the remaining elements of the Project (the Retained Development) will not involve significant sources of dust or exhaust emissions. Given the limited scale and nature of emissions associated with both developments, and considering the short-term and localised nature of any emissions related to the decommissioning works, no significant cumulative impacts on air quality are anticipated as a result of the Retained and Prospective Developments in combination.

10.1.2 Conclusion

During the construction phase of the Project, including the period when the peat slide event occurred, localised air quality impacts would likely have occurred from dust generation and from vehicle exhaust emissions at the wind farm itself, along the overhead line route, and at the Agannygal Substation site. However, these would have been of short duration and given the distances from construction activity locations to the nearest occupied dwellings no significant impacts occurred. No significant negative air quality impacts occurred during the Operation and Maintenance phase of the Ceased Operation Phase of the Project. It is not anticipated that any air quality impacts will occur as a result of the Retained Development.

10.2 Climate

10.2.1 Introduction

10.2.1.1 Relevant Guidance

The climate chapter of this rEIAR is carried out in accordance with the 'EIA Directive' as amended by Directive 2014/52/EU and has been prepared in accordance with guidance listed in Section 1.5.3 of Chapter 1: Introduction. Due to the nature of the Project, the following methodology and guidance was utilised for the climate section of this rEIAR:

- '*Guidance on Integrating Climate Change and Biodiversity into Environmental Impact Assessment'* (2013) European Commission.
- *'Calculating Carbon Savings from Wind Farms on Scottish Peat Lands*' (University of Aberdeen and the Macauley Institute 2008).
- '*Wind Farms and Carbon Savings*' (Scottish Natural Heritage, 2003).
- Macauley Institute Carbon Calculator for Wind Farms on Scottish Peatlands (Version 2.14.1) (2023).
- Transport Infrastructure Ireland (TII) Carbon Assessment Tool (Version 0.7.10) (TII, 2020).

Consideration has also been given to the 'Air Quality Assessment of Proposed National Roads – Standard PE-ENV-01107' (Transport Infrastructure Ireland, December 2022 (2022a)), Climate Assessment of Proposed National Roads – Standard and Overarching Technical Documentation (Transport Infrastructure Ireland December 2022b/c) and Transport Infrastructure Ireland Carbon Tool for Road and Light Rail Projects: User Guidance Document, GE-ENV-01106 (TII 2022d).

10.2.2 Methodology

10.2.2.1 Assessment of Significance

The effects associated with the Project are described with respect to the EPA Guidelines on the information to be contained in Environmental Impact Report (EIAR), May 2022.

10.2.3 Climate Change and Greenhouse Gases

Although variation in climate is thought to be a natural process, the rate at which the climate is changing has been accelerated rapidly by human activities. Climate change is one of the most challenging global issues facing the world today and is primarily the result of increased levels of greenhouse gases in the atmosphere. Increasing human emissions of carbon dioxide and other greenhouse gases cause a positive radiative imbalance at the top of the atmosphere, meaning energy is being trapped within the climate system. The imbalance leads to an accumulation of energy in the Earth system in the form of heat that is driving global warming.[7,8] Greenhouse gases come primarily from the combustion of fossil fuels in energy use.

[7] *Hansen, J.; Sato, M.; Kharecha, P. et al. Earth's Energy Imbalance and Implications. Atmospheric Chemistry and Physics 2011, 11 (24), 13421–13449.* https://doi.org/10.5194/acp-11-13421-2011
[8] *von Schuckmann, K.; Palmer, M. D.; Trenberth, K. E. et al. An Imperative to Monitor Earth's Energy Imbalance. Nature Clim Change 2016, 6 (2), 138–144.* https://doi.org/10.1038/nclimate2876.

In March 2024 the European Environment Agency (EEA) published the European Climate Risk Assessment.[9] This assessment states that Europe is the fastest warming continent on the planet and is warming at about the twice the global rate. The average global temperature in the 12-month period between February 2023 and January 2024 exceeding pre-industrial levels by 1.5°C. 2023 was the warmest year on record in more than 100,000 years, at 1.48°C above pre-industrial levels, with the world's ocean temperature also reaching new heights.[10]

The Intergovernmental Panel on Climate Change (IPCC), in their AR6 Synthesis Report: Climate Change 2023[11], state that widespread and rapid changes in the atmosphere, ocean, cryosphere and biosphere have occurred. This has led to widespread adverse impacts and related losses and damages to people and nature due to the pressures of climate change and the inability to adapt to a rapidly changing environment. Moving away from our reliance on coal, oil and other fossil fuel-driven power plants is essential to reduce emissions of greenhouse gases and combat climate change.

10.2.3.1 International Greenhouse Gas Emission and Climate Targets

Globally, governance relating to climate change has changed significantly since 1994 when the United Nations Framework Convention on Climate Change (UNFCCC) entered into force. Greenhouse gas emissions have been a primary focus of climate related international agreements for almost two decades.

Table 10-20 below identifies international instruments relating to greenhouse gas emissions and climate targets. The following table provides an overview of the international agreements that have played key roles in establishing climate governance; please refer to **Appendix 10-1** for further detail on each of the below international instruments.

Table 10-20 International Instruments Relating to Greenhouse Gases and Climate Change

International Instrument	Description
Kyoto Protocol	The Kyoto Protocol was adopted on 11th December 1997; this Protocol operationalised the UNFCCC and was the first international agreement that committed countries to reduce their greenhouse gas emissions. The Kyoto Protocol came into effect in 2005, as a result of which, emission reduction targets agreed by developed countries, including Ireland, became binding for the first time.
Doha Amendment to the Kyoto Protocol	In Doha, Qatar, on 8th December 2012, the "Doha Amendment to the Kyoto Protocol" was adopted. The amendment includes: › New commitments for Annex I Parties to the Kyoto Protocol who agreed to take on commitments in a second commitment period from starting in 2013 and lasting until 2020. › A revised list of greenhouse gases to be reported on by Parties in the second commitment period; and › Amendments to several articles of the Kyoto Protocol which specifically referenced issues pertaining to the first commitment period and which needed to be updated for the second commitment period.
	COP21 – Paris (30th November to 12th December 2015)

[9] *European Environment Agency (2024) European Climate Risk Assessment <https://www.eea.europa.eu/publications/european-climate-risk-assessment>*
[10] *Ibid.*
[11] *IPCC AR6 Synthesis Report: Climate Change 2023. https://www.ipcc.ch/report/sixth-assessment-report-cycle/*

International Instrument	Description
Conference of the Parties (COP): *Every year since 1995, the Conference of the Parties (COP) has gathered the 196 Parties (195 countries and the European Union) that have ratified the Convention in a different country, to evaluate its implementation and negotiate new commitments, and is the supreme decision-making body of the UNFCCC.*	COP21 closed with the adoption of the first international climate agreement (concluded by 195 countries and applicable to all). The twelve-page text, made up of a preamble and 29 articles, provides for a limitation of the temperature rise to below 2°C above pre-industrial levels and even to tend towards 1.5°C.
	COP25 – Madrid (December 2nd to December 13th 2019) At COP25 the European Union launched its most ambitious plan, 'The European Green Deal' which aims to lower CO_2 emissions to zero by 2050.
	COP28 – Dubai (30th of November 2023 to the 13th of December 2023) COP28 resulted in a landmark deal to 'transition away' from fossil fuels, the United Arab Emirates (UAE) Consensus. The agreement calls for 'transitioning away from fossil fuels in energy systems, in a just, orderly, and equitable manner.' COP28 concluded the first ever Global Stocktake under the Paris Agreement. The Global Stocktake recognises that the world is not on track to meet 1.5°C and will require Parties to align their national targets and measures with the Paris Agreement.
	COP29 – Azerbaijan (11th November 2024 to 22nd November 2024) COP29 focused on accelerating global efforts to address climate change, in particular global efforts related to climate finance. The New Collective Quantified Goal on Climate Finance (NCQG) was agreed in the final days of COP with developed nations agreeing to triple finance to developing countries, with commitments increasing from USD 100 billion annually to USD 300 billion annually by 2035. Significant progress was made in the discussions surrounding carbon markets, with nearly 200 nations agreeing on critical rules under Article 6 of the Paris Agreement. The adoption of these rules is seen as a crucial step towards operationalising a robust and credible carbon market. Despite the advances, concerns were expressed about the potential for weak governance and risks of exploitation in the system; these issues must be addressed to ensure the market's full functionality.
United Nations Sustainable Development Goals	On the 28th of June 2024, the United Nations published 'The Sustainable Development Goals Report 2024' this report finds that, following an assessment of all 169 targets, for which trend data is available, only 17% of the Sustainable Development Goals (SDG) targets are on track, 48% of SDG targets are showing minimum or moderate progress, 18% having stalled in progress and 17% having regressed from 2023. Please see Section 1.1.3 of **Appendix 10-1** for further detail.
Climate Change Performance Index 2025	Established in 2005, the Climate Change Performance Index (CCPI)[12] is an independent monitoring tool which tracks individual countries climate protection performance. Ireland, ranked 37th in 2023, has fallen 6 places to 43rd for 2024, and remains as a "low" performer in international performance. The CCPI states that Ireland's policies are missing a long-term strategy for phasing out fossil fuel infrastructure and shifting investments from natural gas towards an emissions-neutral energy supply.

[12] *Climate Change Performance Index 2024* <https://ccpi.org/>

International Instrument	Description
State of the Global Climate 2024	In March 2025, the World Meteorological Organisation (WMO) published a report entitled the 'State of the Global Climate 2024. This report provided a summary on the state of the climate indicators in 2023 with sections on key climate indicators, extreme events and impacts. The key messages in the report include: › Greenhouse gases reached record observed levels in 2023. Real time data indicate that they continued to rise in 2024. › The annually averaged global mean near-surface temperature in 2024 was 1.55 °C ± 0.13 °C above the 1850–1900 average used to represent pre-industrial conditions.
European Green Deal	The European Green Deal is a comprehensive package of policy initiatives aimed at achieving climate neutrality across the EU by 2050. It features a wide range of actions and targets in different sectors such as energy, transport, industry, environment and agriculture. The goal is to transform the EU into a resource-efficient, competitive circular economy that is fair and inclusive for every individual and region. In its approach to decarbonisation, the EU has split greenhouse gas emissions into two categories, the Emissions Trading System (ETS) and the non-ETS. Under the EU Green Deal, the targets for the ETS and non-ETS sectors will be revised upwards in order to achieve the commitment, at EU level, to reach an economy-wide 2030 reduction in emissions of at least 55%, compared to 1990 levels.
Renewable Energy Directive	The first Renewable Energy Directive (RED)[13] is legislation that influenced the growth of renewable energy in the EU and Ireland for the decade ending in 2020. From 2021, RED was replaced by the second Renewable Energy Directive (REDII),[14] which continues to promote the growth of renewable energy out to 2030. REDII introduced a binding EU-wide target for overall RES of 32% in 2030 and requires Member States to set their national contributions to the EU-wide target. As per the National Energy and Climate Plan (NECP) 2021-2030, Ireland's overall RES target is 34.1% in 2030. Given the need to ratchet up the EUs clean energy transition, RED was revised in 2023, and the amending Directive EU/2023/2413 (REDIII)[15] entered into force on 20 November 2023. REDIII amended the EU-wide overall 2030 RES target from 32% to at least 42.5%, and it is assumed that Irelands 2030 RES target will increase accordingly.
EU Effort Sharing Regulation	Emissions from all other sectors, including agriculture, transport, buildings, and light industry are covered by the EU Effort Sharing Regulation (ESR). This established binding annual greenhouse gas emission targets for Member States for the period 2021–2030. Ireland is required to reduce its emissions from these sectors by 30% by 2030, relative to 2005 levels. Please see Section 1.1.9 of **Appendix 10-1** for further details on the EU ESR

[13] *Directive 2009/28/EC on the promotion of the use of energy from renewable sources. Available from: https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:140:0016:0062:en:PDF*
[14] *Directive (EU) 2018/2001 on the promotion of the use of energy from renewable resources (recast). Available from: https://eurlex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32018L2001*
[15] *Directive (EU) 2023/2413 amending Directive (EU) 2018/2001, Regulation (EU) 2018/1999 and Directive 98/70/EC as regards the promotion of energy from renewable sources and repealing Council Directive (EU) 2015/652. Available from: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:L_202302413*

International Instrument	Description
Council Regulation (EU) 2022/2577 and 2024/223	Council Regulation (EU) 2022/2577 and 2024/223 lay down a framework to accelerate the deployment of renewable energy. Regulation 2022/2577 and 2024/223 recognises the relative importance of renewable energy deployment in the current difficult energy context and provides significant policy and legislative support to enabling renewable energy projects. Further detail is provided in Section 1.1.1.9 of **Appendix 10-1** rEIAR.
EU Nature Restoration Law	The Nature Restoration Law is the first continent-wide, comprehensive law of its kind. It is a key element of the EU Biodiversity Strategy, which sets binding targets to restore degraded ecosystems, in particular those with the most potential to capture and store carbon and to prevent and reduce the impact of natural disasters. The law aims to restore ecosystems, habitats and species across the EU's land and sea areas in order to › Enable the long-term and sustained recovery of biodiverse and resilient nature › Contribute to achieving the EU's climate mitigation and climate adaptation objectives › Meet international commitments The EU Nature Restoration Law was approved on June 17th, 2024; EU countries are expected to submit National Restoration Plans to the Commission within two years of the Regulation coming into force (by mid-2026), showing how they will deliver on the targets. They will also be required to monitor and report on their progress.

10.2.3.2 National Greenhouse Gas Emission and Climate Targets

Ireland has reached a crucial point in addressing climate change with a goal to becoming climate neutral by 2050 and to significantly cut greenhouse gases by 2030. National greenhouse gas emission and climate targets are critical for achieving Irelands climate ambitions.

Table 10-21 below provides an overview of the national agreements that have played key roles in establishing climate governance; please refer to **Appendix 10-1** for further detail on each of the below national legislation measures.

Table 10-21 National Legislation and Reports relating to Greenhouse Gas Emission and Climate Targets

National Instrument	Description
Programme for the Government	The Programme for Government – Our Shared Future was published in October 2020 and last updated July 2021. The programme notes that the government are committed to reducing greenhouse gas emissions by an average 7% per annum over the next decade in a push to achieve a net zero emissions by the year 2050. The programme also recognises the severity of the climate challenge as it clarifies that: "*Climate change is the single greatest threat facing humanity*".
Climate Action and Low Carbon Development (Amendment) Act 2021	The Climate Action and Low Carbon (Amendment) Act 2021 is a piece of legislation which commits the country to move to a climate resilient and climate neutral economy by 2050. This was signed into law in July 2021 and commenced in September 2024. The Programme for Government has committed to a 7% average yearly reduction in overall greenhouse gas emissions over the next decade, and to achieve net zero emissions by 2050. This Act will manage the implementation of a suite of policies to assist in achieving these annual targets.

National Instrument	Description
Climate Change Advisory Council	The Climate Change Advisory Council (CCAC) was established on 18th January 2016 under the Climate Action and Low Carbon Development Act 2015. The Annual Review 2024: Electricity report has been released by the CCAC and focuses specifically on key findings and recommendations for the Electricity sector. In 2023, emissions from the sector reduced by approximately 21% from 2022 to the lowest level since records began in 1990. This was driven by a considerable decline in the use of coal for electricity generation, coupled with a notable rise in imported electricity.
Carbon Budgets	The first national carbon budget programme proposed by the CCAC, approved by Government and adopted by both Houses of the Oireachtas in April 2022 comprises three successive 5-year carbon budgets. The total emissions allowed under each budget are shown in Section 1.2.4 of **Appendix 10-1**.
Sectoral Emission Ceilings	The Sectoral Emissions Ceilings were launched in September 2022. The Sectoral Emissions Ceilings alongside the annual published Climate Action Plan provide a detailed plan for taking decisive action to achieve a 51% reduction in overall greenhouse gas emissions by 2030. The Sectoral Emission Ceilings for each 5-year carbon budget period was approved by the government on the 28th of July 2022 and is shown in Section 1.2.5 of **Appendix 10-1**.
Climate Action Plan 2025	The National Climate Action Plan (CAP) 2025 was launched in April 2025. CAP 2025 sets out the roadmap to deliver on Ireland's climate ambition. It aligns with the legally binding economy-wide carbon budgets and sectoral ceilings that were agreed by Government in July 2022 following the Climate Action and Low Carbon Development (Amendment) Act 2021, which commits Ireland to a legally binding target of net-zero greenhouse gas emissions no later than 2050, and a reduction of 51% by 2030. CAP 2025 highlights the firm commitment that has been made by Ireland in relation to the clean energy transition and provides an outline of precise goals for renewable energy, focusing on solar, onshore wind, and offshore wind.
Irelands Climate Change Assessment	In 2023 the Environmental Protection Agency (EPA) published Irelands Climate Change Assessment (ICCA). This assessment provides a comprehensive overview and breakdown of the state of knowledge around key aspects of climate change with a focus on Ireland. The ICCA report is presented in four volumes. › Volume 1: Climate Science – Ireland in a Changing World. › Volume 2: Achieving Climate Neutrality in 2050. › Volume 3: Being Prepared for Irelands Future. › Volume 4: Realising the Benefits of Transition and Transformation. Please refer to Section 1.2.7 of **Appendix 10-1** for further information on the ICCA.

10.2.3.3 Greenhouse Gas Emissions Projections

In its approach to decarbonisation, the EU has split greenhouse gas emissions into two categories, the Emissions Trading System (ETS) and the non-ETS. Emissions from electricity generation and large industry in the ETS are subject to EU-wide targets which require that emissions from these sectors be reduced by 43% by 2030, relative to 2005 levels. Within the ETS, participants are required to purchase

allowances for every tonne of emissions, with the amount of these allowances declining over time to ensure the required reduction of 43% in greenhouse gas emissions is achieved at EU-level[16].

Emissions from all other sectors, including agriculture, transport, buildings, and light industry are covered by the EU Effort Sharing Regulation (ESR[17]). This established binding annual greenhouse gas emission targets for Member States for the period 2021–2030.

Considerable progress has been made in the decarbonisation of the Electricity Sector, with emissions falling by 45% between 2001 and 2022.[18] The decarbonisation of the Electricity Sector has been made possible through the deployment of renewables and their successful integration into the national grid, further facilitating the decarbonisation other sectors, such as transport, heating and industry as they look towards electrification.

The Environmental Protection Agency (EPA) publish Ireland's greenhouse gas emission projections and at the time of writing, the most recent report, *'Ireland's Greenhouse Gas Emissions Projections 2023-2050* was published in May 2024. The report includes an assessment of Ireland's progress towards achieving its emission reduction targets out to 2030 set under the ESR.

The EPA has produced two scenarios in preparing these greenhouse gas emissions projections: a "With Existing Measures" (WEM) scenario and a "With Additional Measures" (WAM) scenario. These scenarios forecast Irelands greenhouse gas emissions in different ways. The WEM scenario assumes no additional policies and measures, beyond those already in place by the end of 2020. This is the cut off point for which the latest national greenhouse gas emission inventory data is available, known as the 'base year' for projections. The WAM scenario has a higher level of ambition and includes government policies and measures to reduce emissions such as those in Ireland's Climate Action Plan 2024 that are not yet implemented. As implementation of policies and measures occurs, they will be migrated into the WEM Scenario.

The EPA Emission Projections Update notes the following key trends:

- Ireland is not on track to meet the 51% emissions reduction target by 2030 (as compared to 2018 levels) based on most up to date EPA projections which include the majority of Climate Action Plan 2024 measures
- The first two carbon budgets (2021-2030), which aim to support achievement of the 51% emissions reduction goal, are projected to be exceeded by a significant margin of between 17 and 27%.
- Sectoral emissions ceilings for 2025 and 2030 are projected to be exceeded in almost all cases, including Agriculture, Electricity, Industry and Transport.
    - Total emissions from the agriculture sector are projected to decrease by between 1 and 18% over the period 2022 to 2030
    - Transport emissions are projected to decrease by 5 to 26% over the period 2022-2030
    - Emissions from the LULUCF sector have been revised significantly to reflect new science. Total emissions from the LULUCF sector are projected to increase over the period 2022 to 2030
- Emissions from the Energy Industries sector are projected to decrease by between 57 and 62% over the period 2022 to 2030

[16] *Department of the Environment, Climate and Communications (2023) - Climate Action Plan 2024* https://www.gov.ie/en/publication/79659-climate-action-plan-2024/
[17] *Regulation (EU) 2018/842 of the European Parliament and of the Council of 30 May 2018 on binding annual greenhouse gas emission reductions by Member States from 2021 to 2030 contributing to climate action to meet commitments under the Paris Agreement and amending Regulation (EU) No 525/2013 (Text with EEA relevance)*
[18] *Department of the Environment, Climate and Communications (2023) - Climate Action Plan 2024* https://www.gov.ie/en/publication/79659-climate-action-plan-2024/

- Renewable energy generation at the end of the decade is projected to range from 69 to 80% of electricity generation as a result of a projected rapid expansion in wind energy and other renewables

- Ireland will not meet its non-ETS EU targets of a 42% emissions reduction by 2030 in WAM even with both the ETS and LULUCF flexibilities.
- Emissions in the WAM Scenario are projected to be 29% lower in 2030 (compared with 2018) whereas in the WEM Scenario the emissions reduction is projected to be 11%
- There has been no improvement on these figures since EPA projections published in 2023.

10.2.3.4 Local Greenhouse Gas Emission and Climate Targets

Galway Local Authority Climate Action Plan 2024-2029

The Galway County Council Local Authority Climate Action Plan 2024-2029 (Galway LACAP)[19] was adopted on 19th February 2024.

The Galway LACAP highlights the current state of climate action in Ireland, and how Galway County Council intends to deliver and enable climate action for a just transition to a low carbon and climate resilient future within County Galway.

Overall, the greenhouse gas emissions generated from County Galway equated to 1,950,000 tCO2eq in the baseline year, 2018.[20] The top emitting sectors within County Galway in terms of total greenhouse gas emissions in the baseline year were Agriculture, Transport, Land use, Land Use Change and Forestry (LULUCF) and Residential producing 44%, 16%, 16% and 15% respectively of the total greenhouse gas emissions in the county. In 2019, Irelands national emissions totalled 65,152,000tCO2eq, with County Galway being responsible for approximately 5% of this (i.e., 3,009,000 tCO2eq).

The Galway LACAP assesses climate risk relevant to Ireland and to County Galway, this, plus the evidence baseline, inform the climate objectives and actions that will be undertaken by Galway County Council to assist in the achievement of national and international climate targets. Key objectives form the Galway LACAP include:

- Support the development of renewable energy sources, such as offshore wind only, solar, tidal, and biomass in suitable locations
- Ensure the integration of climate action in spatial planning to enable the County of Galway to transition to a low carbon and resilient society.

The Galway County Development Plan 2022-2028[21] sets out the overall strategy for the proper planning and sustainable development of the County over a 6-year period.

10.2.4 Climate and Weather in the Environment

Ireland has a temperate oceanic climate, resulting in mild winters and cool summers. The prevailing wind direction is between south and west which bring moist air and frequent rain.

[19] *Galway County Council (2024) Local Authority Climate Action Plan* <https://consult.galway.ie/en/consultation/galway-county-council-local-authority-climate-action-plan-2024-2029>
[20] *Galway County Council (2023) Baseline Emissions Inventory* <https://consult.galway.ie/en/system/files/materials/7736/Baseline%20Emissions%20Inventory_Galway.pdf>
[21] *Adopted Galway County Development Plan 2022-2028* <https://consult.galway.ie/en/consultation/adopted-galway-county-development-plan-2022-2028>

The Met Eireann weather station at Shannon Airport, Co. Clare is the nearest weather and climate monitoring station to the Project site that has long-term meteorological data recorded for the 30-year period from 1991-2020. The monitoring station is located approximately 62km kilometres southwest of the site. Meteorological data recorded at Shannon Airport over the 30-year period from 1991 - 2020 is shown in Table 10-22 overleaf. The wettest months are November and December, and April is usually the driest. July is the warmest month with a mean daily temperature of 16° Celsius.

Recent monthly meteorological data recorded at Shannon Airport, Co Clare, located approximately 62km southwest of the site, from January 2022 to January 2025 is available at: https://www.met.ie/climate/available-data/monthly-data. December 2023 was the wettest month in this time period, with 202.9mm of rainfall recorded, while March 2022 was the driest month with 39mm of rainfall. June 2023 was the warmest month in this time period, with a mean monthly temperature of 16.7° Celsius. December 2022 was the coldest month in this time period with a mean monthly temperature of 3.4° Celsius.

Table 10-22 Data from Met Éireann Weather Station at Shannon Airport, 1990-2020: Monthly and Annual Mean and Extreme Values

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
TEMPERATURE (degrees Celsius)													
Mean daily max	8.9	9.4	10.9	13.4	16	18.3	19.5	19.1	17.5	14.2	11.1	9.2	14
Mean daily min	3.3	3.3	4	5.8	8.1	10.8	12.6	12.4	10.7	8.1	5.5	3.7	7.4
Mean temperature	6.1	6.3	7.5	9.6	12	14.5	16	15.8	14.1	11.2	8.3	6.4	10.7
Absolute max.	14.7	15.5	19.6	23	27.8	32	30.2	29.2	25.6	21.9	17.2	15.4	32
Absolute Min.	-11.2	-5.1	-5.8	-2.9	0.1	3.1	6.2	4.4	1.7	-2.3	-6.6	-11.4	-11.4
Mean No. of Days with Air Frost	5.2	4.6	3.2	0.6	0	0	0	0	0	0.4	1.9	4.4	20.3
Mean No. of Days with Ground Frost	13	11.8	11.9	7.7	2.9	0.2	0	0	0.8	3.3	8	11.3	70.9
RELATIVE HUMIDITY (%)													
Mean at 0900UTC	87.8	87.9	85	79.3	76.2	76.6	80	82.3	85.1	87.4	89.9	88.9	83.9
Mean at 1500UTC	81.2	75.4	69.8	64.1	63.5	64.6	69.3	69.1	70	75	81	83.5	72.2
SUNSHINE (Hours)													
Mean daily duration	1.7	2.4	3.6	5.4	5.9	5.5	4.4	4.6	3.9	3	2.1	1.5	3.7
Greatest daily duration	8.1	10.2	11.5	13.6	15.6	15.8	15.7	14.4	12.2	10.1	8.3	7.1	15.8
Mean num. of days with no sun	9.1	5.9	5.3	2.3	1.9	1.8	2.1	2.1	2.6	5.1	7.7	10.1	56

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
WIND (knots)													
Mean monthly speed	10	10.1	9.6	9.2	9	8.5	8.4	8.3	8.4	8.9	9.1	9.7	9.1
Max. gust	75	86	63	66	52	51	52	61	58	66	69	83	86
Max. mean 10-minute speed	47	61	44	45	37	37	38	44	44	47	50	57	61
Mean num. of days with gales	1.8	1.2	0.9	0.4	0.2	0.2	0	0.1	0.1	0.5	0.8	1.3	7.5
WEATHER (Mean No. of Days With:)													
Snow or sleet	1.5	1.8	1.2	0.3	0	0	0	0	0	0	0.1	1	5.9
Snow lying at 0900UTC	0.2	0	0.1	0	0	0	0	0	0	0	0	0.1	0.5
Hail	3.1	3.4	2.8	2	0.7	0	0	0.1	0.1	0.5	1	2.3	16
Thunder	0.9	0.4	0.3	0.3	0.5	0.4	0.7	0.5	0.2	0.3	0.3	0.4	5.2
Fog	3.4	2.2	2.4	1.8	1.3	1	0.9	1.6	2.8	3.1	4	3.8	28.3

10.2.5 Calculating Carbon Losses and Savings from the Project

10.2.5.1 Background

In addition to the combustion of fossil fuels, greenhouse gases are also released through natural processes such as the decomposition of organic material (which is composed of carbon). Bogs and peatlands are known to store large amounts of carbon. Due to the waterlogged nature of these habitats, stored carbon is not broken down and released into the atmosphere. Construction on bog and peat habitats may affect the natural hydrological regime, thus exposing and drying out the peat and allowing the decomposition of carbon. It is therefore necessary to demonstrate that any construction on such sites saves more carbon than is released.

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 have a significant capacity to store 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 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, or from the reinstatement of extracted peat. 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 saves more CO_2 than is released.

10.2.5.2 Methodology for Calculating Losses

A methodology was published in June 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 previous rEIAR which accompanied an application for substitute consent (reg. ref. ABP-308019-20) utilised the Macauley Institute Methodology to provide a transparent and easy to follow method for estimating the impacts of the Derrybrien Wind Farm on the carbon dynamics of surrounding peatlands. Although the previously submitted rEIAR differed in scope from the current application, the fundamental characteristics of the Project are the same. As such, the outputs from the climate assessment, as presented in the previous rEIAR, remain relevant and applicable for understanding the likely carbon dynamics associated with the Project. As such, the results from the Macauley Institute carbon calculator that was run for the previous rEIAR are presented in Table 10-23 below. Previous guidance produced by Scottish Natural Heritage in 2003 had been widely employed to determine carbon payback in the absence of any more detailed methods.

The Macauley Institute methodology states that the total volume of peat impacted by the construction of a wind farm is strongly correlated to the extent of the peatland affected by drainage at a site. Therefore, in calculating the carbon loss/saving of the Project, carbon losses associated with

constructing a wind farm on peatland environments were included. The peat slide which occurred at the wind farm site resulted in large quantities of peat being displaced, estimated at 450,000m^3 which it is assumed resulted in complete decay of this peat and release of the stored carbon back into the atmosphere. Additionally, the peat slide area was afforested (estimated at 25ha) and the carbon sequestration potential of the standing forest and its stored carbon would also have been lost. The carbon losses as a result of the manufacture, transportation and erection of the proposed turbines were included in the carbon loss calculations for the Project.

The development of the wind farm entailed the felling of approximately 222ha of forestry within the wind farm site. The remaining forestry on site was not felled. Carbon losses as a result of felling were included in the carbon loss calculations for the Project. Please note, the felling associated with the Project and quantified in Table 10-23 below was not subject to a replanting requirement as due to its age profile, much of the forestry estate had already require felling and replanting as part of the normal lifecycle of such commercial plantations. However, under the precautionary scenario, emissions associated with felling have been completed and form part of the carbon loss assessment.

For the Project, where possible, carbon emissions or losses associated with embodied carbon of materials used in the construction, operational and decommissioning phase of the Project have been identified. Embodied carbon refers to the emissions associated with procuring, mining, and harvesting raw materials, the transformation of those materials into construction products, transporting them to site, installation of these materials during a construction phase, and the subsequent replacement, removal, and disposal of these materials upon decommissioning.[22]

The full life cycle and embodied carbon of the Project turbines have been taken account of in the Macauley Institute model, determined as part of the carbon losses associated with the Project, and presented in Table 10-23 below. The emissions associated with the embodied carbon are considered using the Transport Infrastructure Ireland (TII) Carbon Tool (TII 2022)[23]. The TII Carbon Tool is customised for road and light rail projects in Ireland, using emission factors from recognised sources during the construction, maintenance and operation of TII projects in Ireland.

Section 14.1 in Chapter 14 of this rEIAR outlines traffic generation numbers relative to quantum of materials required for the Project, the details of which have been utilised to determine the emissions associated with these activities and are included in **Appendix 10-2** '*Carbon Calculations*'.

Additional carbon losses resulting from embodied carbon and associated transportation movements of the Project are included in Table 10-23 below. Please note, due to the difficulty in isolating the carbon losses associated with the Retained Development alone, for the purposes of this climate assessment, all carbon losses associated with the Project have been taken account in the following sections.

10.2.5.3 Carbon Losses and Savings Calculations

10.2.5.3.1 *Carbon Losses*

The Scottish Government online carbon calculator was used to assess the impacts of the Project in terms of carbon losses taking into account drainage, habitat improvement, forestry felling and site restoration for the Project. This information aligns with the 2020 rEIAR (reg. ref. ABP-308019-20), which sourced its data from the Macaulay Institute's carbon calculator model. The online calculator is pre-loaded with information specific to the CO_2 emissions from the United Kingdom's electricity generation plant, which is used to calculate emissions savings from proposed wind farm projects in the UK. However, due to the availability of Irish specific carbon intensity emission factors for the Irish electricity

[22] *Irish green Building Council – What is embodied carbon?* <https://www.igbc.ie/what-is-embodied-carbon/>
[23] *Transport Infrastructure Ireland Carbon Tool for Road and Light Rail Projects: User Guidance Document* https://www.tiipublications.ie/library/GE-ENV-01106-01.pdf

generation plant, the CO_2 emissions savings from the Project have been calculated separately from the online carbon calculator as set out in Section 10.5.2.4 below.

In relation to embodied carbon and associated transport movements of all other ancillary elements of the Project, the TII Carbon Tool has been utilised to assess additional carbon loss sources of the Project in regards to construction phase transport emissions and embodied carbon.

A copy of the outputs is provided as **Appendix 10-2** of this rEIAR, *'Carbon Calculations'*. Where available and relevant, site-specific information was inserted into the TII Carbon Tool, otherwise, default values were used.

The main CO_2 losses due to the Project are summarised in Table 10-23.

Table 10-23 CO_2 Losses from the Project

Origin of Losses	CO_2 Losses (tonnes CO_2 equivalent)	
	Expected	Maximum
Project		
Losses due to turbine life (e.g., manufacture, construction, decommissioning)	33,314	33,472
Losses due to backup	20,523	41,046
Losses from reduced carbon fixing potential	3,078	7,575
Losses from soil organic matter and due to leaching of dissolved and particulate organic carbon (CO_2 loss from removed)	97,502	265,817
Losses associated to forestry felling	73,392	86,754
Project Total Carbon Losses	227,809	434,664
Losses associated with embodied carbon in construction materials	4,177	4,177
Losses associated with traffic and transport movements	219	219
Traffic and Transport + Embodied Carbon Total Carbon Losses	4,396	4,396
Total Project Carbon Losses	**232,205**	**439,060**

The worksheet models and online tools calculate that the Project gave rise to 232,205 tonnes of CO_2 equivalent losses over the construction phase, operational phase and decommissioning, inclusive of the peat slide. Of this total figure, the Derrybrien Wind Farm turbines directly accounted for 33,314 tonnes, or 14%. Losses due to backup accounted for 20,523 tonnes, or 9%. Losses from reduced carbon fixing potential accounted for 1% or 3,078 tonnes. Losses from soil organic matter, i.e., CO_2 loss from disturbed soil and subsoils (inclusive of the peat slide event), equated to 97,502 tonnes, or 42%. Losses due to forestry felling (inclusive of the peat slide event) accounted for 73,392 tonnes or 32%. Losses due

to embodied carbon accounted for 4,177 tonnes or 2% and losses due to construction phase transport emissions accounted for 0.1% or 219 tonnes.

The figure of 4,177 tonnes of CO_2 arising from the embodied carbon of construction materials associated with the Project is calculated based the types of materials available in the TII Carbon tool such as, concrete, steel, cement and granular fill, and assumes that each HGV or LGV will be carrying material at its full capacity. The figure of 219 tonnes of CO_2 arising from transport movements associated with construction activities of the Project is calculated based on the assumption that material will be imported locally or from a port/city location where applicable. Details on the assumptions made for the modelling of embodied carbon and construction phase transport emissions are included in **Appendix 10-2**.

The values discussed above are based on the assumption that the hydrology of the Project and habitats within the site are not restored on decommissioning of the Derrybrien Wind Farm. As detailed in Chapter 4 of this rEIAR, the wind turbines and met mast will be dismantled and removed offsite. It is not intended to remove the concrete foundations from the ground as it is considered that its removal will be the least preferred options in terms of having potential effects on the environment. The associated foundations will be left in situ and covered with soil material. The underground electrical cabling connecting the turbines to the on-site substation will be removed from the cable ducts. The on site cabling will be left in-situ as it is considered the most environmentally prudent option, avoiding unnecessary excavation and soil disturbance. Taking into account the decommsioning proposals identified in Section 4.2.9 and Section 4.3 of Chapter 4 (which form part of the Prospective Development) the actual CO_2 losses are expected to be lower than the values detailed in Table 10-23.

10.2.5.4 Carbon Savings

According to the model described above, the Project will give rise to total losses of 232,205 tonnes of carbon dioxide.

A simple formula can be used to calculate carbon dioxide emissions reductions resulting from the generation of electricity from wind power rather than from carbon-based fuels such as peat, coal, gas and oil. The formula is:

$$CO_2 \text{ (in tonnes)} = \frac{(A \times B \times C \times D)}{1000}$$

where: A = ... The rated capacity of the wind energy development in MW

B = ... The capacity or load factor, which takes into account the intermittent nature of the wind, the availability of wind turbines and array losses etc.

C = ... The number of hours in a year

D = ... Carbon load in grams per kWh (kilowatt hour) of electricity generated and distributed via the national grid.

For the purposes of this calculation, the rated capacity of the Project is assumed to be 59.5 MW (based on 70 No. 0.85 MW turbines).

A capacity factor of 0.36 (or 36%) has been used for the Project.[24]

[24] *Eirgrid, 2022 Enduring Connection Policy 2.2 Constraints Report for Solar and Wind* <https://cms.eirgrid.ie/sites/default/files/publications/ECP-2-2-Solar-and-Wind-Constraints-Report-Area-D-v1.1.pdf>
The Proposed Project is located within the D wind region for Ireland with an associated 2020 capacity factor of 36%.

The number of hours in a year is 8,760.

A conservative figure for the carbon load of electricity generated by natural gas in Ireland was sourced from Sustainable Energy Authority Ireland's (SEAI) Energy in Ireland 2021 Report.[25] The emission factor for electricity generated in Ireland in 2023 was 296 gCO_2/kWh.[26]

The calculation for carbon savings is therefore as follows:

$$CO_2 \text{ (in tonnes)} = \frac{(59.5 \times 0.36 \times 8{,}760 \times 296)}{1000}$$

$$= 55{,}541 \text{ tonnes per annum}$$

Based on this calculation, **55,541** tonnes of carbon dioxide were displaced on a per annum from the largely carbon-based traditional energy mix by the Derrybrien Wind Farm. Over the 16-year operational lifetime of the development, therefore **888,656** tonnes of carbon dioxide will be displaced from traditional carbon-based electricity generation.

Based on Table 10-23 above, approximately 232,205 tonnes of carbon dioxide were lost to the atmosphere due to changes in the soil and ground conditions and due to the construction and operation of the Project. This represents **26%** of the total amount of carbon dioxide emissions that was offset by the Project. The 232,205 tonnes of CO_2 lost to the atmosphere due to changes in soil and ground conditions and due to the construction and operation of the Project was offset by the operational phase of the Project in approximately **50** months (4.2 years) of operation.

Contribution of the Project to Meeting Greenhouse Gas Emission Targets

While operational, the Derrybrien Wind Farm generated approximately 121,500 MWh of renewable electricity – displacing circa 55,541 tCO_2eq annually from thermal electricity generation as stated above. The first national carbon budget programme proposed by the CCAC, approved by Government and adopted by both Houses of the Oireachtas in April 2022 comprises three successive 5-year carbon budgets (Section 10.2.3.2). The total emissions allowed under each budget are shown in Section 1.2.4 of **Appendix 10-1** above. The Derrybrien Wind Farm contributed a beneficial reduction to the first carbon budget period of approximately +0.03%.

The production of renewable electricity contributed to meeting Ireland's obligations under the Renewable Energy Directive (Section 10.2.3.1), to decarbonising the Energy Sector and to achievement of the Government's ambitious targets set in the Government's Climate Action Plan.

Since the Project has been determined to be unauthorised development by An Bord Pleanála and following receipt of an enforcement notice from Galway County Council, Gort WFL is obligated to decommission the wind farm and associated grid connection. Once the Prospective Development has been completed, the Retained Development will not contribute to meeting any of Ireland's greenhouse gas emission targets

[25] *Energy in Ireland 2021 Report (2021)* <https://www.seai.ie/sites/default/files/publications/Energy-in-Ireland-2021_Final.pdf>
[26] *SEAI have published the 2020 emission factor for electricity generation in Ireland as 296 gCO2/kWh..*

10.2.6 Likely Significant Effects and Mitigation Measures Implemented

10.2.6.1 'Do-Nothing' Scenario

Under the do-nothing scenario, the Derrybrien Wind Farm Development would remain in-situ in its current state i.e., as an unauthorised windfarm development the ceased commercial electricity generation in February 2022. No decommissioning works would be undertaken. The infrastructure would continue to degrade over time

Under the do-nothing scenatio, greenhouse gas emissions, e.g. carbon dioxide (CO_2), carbon monoxide and nitrogen oxides associated with construction vehicles and plant would not arise. Since the Derrybrien Wind Farm is not currently operational it is not currently contributing to a reduction in Ireland's greenhouse gas emissions. Under the "Do-Nothing" scenario this would not change. The effect on climate would therefore be neutral.

10.2.6.2 Construction Phase Impacts (2003-2006)

Project

Greenhouse gas emissions from the construction of the Project arose from the carbon losses associated with the turbine lifecycle (manufacture, construction, transport, operation and decommissioning), changes in peat carbon and forest felling activities resulting in loss of stored carbon and sequestration. This includes the wind farm itself and grid connection (Overhead line and Agannygal substation).

The lifecycle of wind turbines, (manufacture, construction activities, operation and decommissioning) requires energy and fuel use, giving rise to greenhouse gas emissions. The development of a wind farm on peatland will result in the loss of stored carbon back into the atmosphere within the footprint of the wind farm itself and indirectly from drainage associated with the wind farm construction. Works which lead to peat material drying out, directly through excavation or indirectly through drainage will result in full decay of the dried peat with release of the stored carbon as CO_2. This impact was short-term and slight only, given the quantity of greenhouse gases that was emitted to the atmosphere, and was restricted to the duration of the construction phase. It should be noted that the site had been previously drained for purposes other than renewable energy development, i.e., both turbary and afforestation which would have led to previous carbon losses from bare peat areas.

Peat Slide

The peat slide which occurred at Derrybrien resulted in large quantities of peat being displaced, estimated at 450,000 m^3 which it is assumed resulted in complete decay of this peat and release of the stored carbon back into the atmosphere. Additionally, the peat slide area was afforested (estimated at 25ha) and the carbon sequestration potential of the standing forest and its stored carbon would also have been lost. This impact was long-term and moderate, given the quantity of greenhouse gases that were emitted to the atmosphere, and was restricted to the duration of the construction phase.

Mitigation

- Construction staff were trained how to inspect and maintain construction vehicles and plant to ensure good operational order while onsite, thereby minimising any emissions that arise.
- All plant and materials vehicles were stored in dedicated areas (onsite). Machinery was switched off when not in use.

- Turbines and construction materials were transported to the site on specified routes only, unless otherwise agreed with the Planning Authority.
- The expected waste volumes generated onsite were not large enough to warrant source segregation at the site. Therefore, all wastes streams generated onsite were deposited into a single waste skip which was covered.
    - This waste material was transferred to a licensed /permitted Materials Recovery Facility (MRF) by a fully licensed waste contractor where the waste was sorted into individual waste streams for recycling, recovery or disposal.
    - The MRF was local to the Project to reduce the emissions associated with vehicle movements
- A Construction and Environmental Management Plan (CEMP) was in place throughout the construction phase.

Residual Effects

The residual effects of greenhouse gas emissions arising from the construction phase of the Project had a short-term moderate negative effect. However, once emitted to the atmosphere, the greenhouse gas emissions that arose from construction phase activities will have a direct permanent moderate negative effect on Climate.

However as stated in Section 10.2.5.4 above, after approximately 50 months (4.2 years) of operation, the Derrybrien Wind Farm had fully paid back the carbon cost of constructing the wind farm.

Significance of Effects

Based on the assessment above, the Project did not result in any significant effects on climate.

10.2.6.3 Operation and Maintenance Phase Impacts (2006-2022)

Project

The Project generated energy from a renewable source. As detailed in Section 10.5.2.4 above, the Project displaced carbon dioxide from fossil fuel-based electricity generation, over the proposed 16-year lifespan of the Derrybrien Wind Farm. For the purposes of this rEIAR, a rated output of 0.85MW per turbine has been chosen to calculate the anticipated power output of the Project, which would result in an estimated output of 49.5MW, displacing approximately 55,541 tonnes of carbon dioxide per annum from traditional carbon-based electricity generation. This will have a long-term significant positive impact on climate.

Some potential long-term slight negative impacts that may have occurred during the operational phase of the Project are the release of carbon dioxide to the atmosphere due to maintenance and monitoring activities and the removal of carbon fixing vegetation and habitat, as well as peat reinstatement and associated drainage. Furthermore, as part of the Macauley Institute Carbon Calculator allowances were made for what is termed 'backup power'. The extra capacity needed for backup power generation is currently estimated to be 5% of the rated capacity of the wind plant if wind power contributes more than 20% to the national grid[27]; in the case of the Project this was approximately 1.8% Because wind generated electricity is inherently variable, accompanying backup power is required to stabilise the supply to the consumer.

[27] *Dale, Lewis & Milborrow, David & Slark, Richard & Strbac, G.. (2004). Total cost estimates for large-scale wind scenarios in UK. Energy Policy*

Mitigation

- Ensured that all maintenance and monitoring vehicles were maintained in good operational order while onsite, and, when stationary, were required to turn off engines thereby minimising any emissions that arose.

Residual Effect

The Project displaced carbon dioxide from fossil fuel-based electricity generation, over the proposed 16-year lifespan of the Derrybrien Wind Farm. The wind farm became fully operational in 2006 and would have been displacing circa 55,541 tonnes of carbon dioxide annually from fossil fuel generation plant through the generation of circa 121,800 MWh annually of clean renewable electricity to the grid throughout the duration of its 16-year operational life. When considering these greenhouse gas emissions within the context of the national Electricity Sector Emissions Ceilings detailed in Section 10.2.3.2 above and Section 1.2.4 in **Appendix 10-1**, Carbon Budget 1 (2021-2025) has an Electricity Sector budget of 40 MtCO2eq; during the first carbon budget period the Derrybrien Wind Farm contributed a beneficial reduction to the first carbon budget period of approximately +0.03%.

Therefore, while there will be greenhouse gas emissions associated with the operation of the Project, this was offset by the operation of the Project within the 16-year operational life and the Project resulted in a benefit reduction of the first carbon budget period of approximately +0.03%.

Therefore, there will be an indirect long-term moderate positive effect on climate as a result of the operational phase of the Project.

Significance of Effects

Based on the above assessment there will be no significant effects.

10.2.6.4 Ceased Operation Phase Impacts (2022-Present)

Since the operation of the Derrybrien Wind Farm ceased, only very minor greenhouse gas emissions have arisen from maintenance of the wind farm from a very small number of vehicle emissions associated with such activities as well as the continued emittance of carbon dioxide from previously disturbed peatland.

As the wind farm is no longer operational, it no longer generates renewable electricity, and its carbon displacement potential no longer exists.

Mitigation

- Ensured that all maintenance and monitoring vehicles were maintained in good operational order while onsite, and, when stationary, were required to turn off engines thereby minimising any emissions that arose.

Residual Effect

After the cessation of the operational phase of the Project in 2022, the Project has had a direct short-term imperceptible negative effect. However, once emitted to the atmosphere, the greenhouse gas emissions that have arisen after the cessation of the operational phase will have a direct permanent imperceptible negative effect on Climate.

Significance of Effects

Based on the above assessment there are no significant effects.

10.2.6.5 Impacts of Retained Development

Once the Prospective Development is complete (decommissioning of above ground structures), the remaining elements of the Project (the Retained Development) will result in greenhouse gas emissions due to the continued emissions of greenhouse gases from the disturbed and drained peatlands. This will have a short-term imperceptible negative effect on climate. However, once emitted to the atmosphere, the greenhouse gas emissions arising from the disturbed and drained peatlands of the Retained Development will have a permanent imperceptible negative effect on Climate.

10.2.7 Cumulative and In-Combination Effects

Potential cumulative effects on climate between the Retained Development and other relevant developments (including the Prospective Development) were also considered as part of this assessment. Once the Prospective Development is complete (decommissioning of above ground structures), the remaining elements of the Project (the Retained Development) will result in greenhouse gas emissions due to the continued emissions of greenhouse gases from the disturbed and drained peatlands; however, this will have an imperceptible negative effect on climate.

Given the limited of emissions of greenhouse gasses that will result from the Retained Development there will be no significant cumulative effects on climate resulting from the Prospective Development in-combination with the Retained Development.

10.2.8 Conclusion

The Project resulted in the emission of approximately 232,205 tonnes of CO_2. Based on the annual renewable electricity production of Derrybrien Wind Farm and the estimated annual carbon fossil fuel electricity generation displacement saving the carbon costs required circa 4.2 years of operation to offset. When operational, the Derrybrien Wind Farm produced circa 121,500 MWh of renewable electricity annually, continuing to displace fossil fuel generators on the system – reducing greenhouse gas emissions and avoiding the need to import fossil fuel and its associated costs. Therefore, the overall effect of the Project on climate is long-term moderate and positive.

11. NOISE AND VIBRATION

11.1 Introduction

11.1.1 Chapter Scope

This chapter provides an assessment of the potential noise and vibration effects in relation to the g Derrybrien Wind Farm Development Decommissioning Project - Retained Development as described in Chapter 4 Project Description to this rEIAR (Section 4.3).

This chapter includes the assessment of:

- Impacts which have already occurred during construction phase.
- Impacts which have already occurred during the operational phase.
- Impacts which have occurred and are occurring once operations had ceased.
- Impacts which are likely to occur as a result of the Retained Development.

11.1.2 Statement of Authority

This chapter of the EIAR has been prepared by Mike Simms (Principal Acoustic Consultant), who holds a BE and MEngSc in Mechanical Engineering and is a member of the Institute of Acoustics (MIOA) and of the Institution of Engineering and Technology (MIET). Mike has worked in the field of acoustics for over 20 years. He has extensive experience in all aspects of environmental surveying, noise modelling and impact assessment for various sectors including, wind energy, industrial, commercial and residential.

Some examples previous noise chapters for wind farms, prepared by Mike Simms are:

- Ballivor Wind Farm, Co Meath;
- Brackyn Wind Farm, Co Westmeath;
- Cahermurphy Wind Farm, Co Clare;
- Drumlins Park Wind Farm, Co Monghan;
- Glenard Park Wind Farm, Co Donegal;
- Cush Park Wind Farm, Co Offaly;
- Knocknamork Wind Farm, Co. Kerry; (tip height extension application);
- Knockranny Wind Farm, Co. Mayo.

11.1.3 Fundamentals of Acoustics

A sound wave travelling through the air is a regular disturbance of the atmospheric pressure. These pressure fluctuations are detected by the human ear, producing the sensation of hearing. To take account of the vast range of pressure levels that can be detected by the ear, it is convenient to measure sound in terms of a logarithmic ratio of sound pressures. These values are expressed as Sound Pressure Levels (SPL) in decibels (dB).

The human audible range of sounds expressed in terms of Sound Pressure Levels (SPL) is 0 dB (for the threshold of hearing) to 120 dB (for the threshold of pain). In general, a subjective impression of doubling of loudness corresponds to a tenfold increase in sound energy which conveniently equates to a 10 dB increase in SPL. It should be noted that a doubling in sound energy (such as may be caused by a doubling of traffic flows) increases the SPL by 3 dB.

The frequency of sound is the rate at which a sound wave oscillates is expressed in Hertz (Hz). The sensitivity of the human ear to different frequencies in the audible range is not uniform. For example, hearing sensitivity decreases markedly as frequency falls below 250 Hz. In order to rank the SPL of various noise sources, the measured level has to be adjusted to give comparatively more weight to the frequencies that are readily detected by the human ear. The 'A-weighting' system defined in the international standard, BS ISO 226:2003 Acoustics. Normal Equal-loudness Level Contours has been found to provide the best correlations with human response to perceived loudness. SPLs measured using 'A-weighting' are expressed in terms of dB(A).

An indication of the level of some common sounds on the dB(A) scale is presented in Figure 11-1.

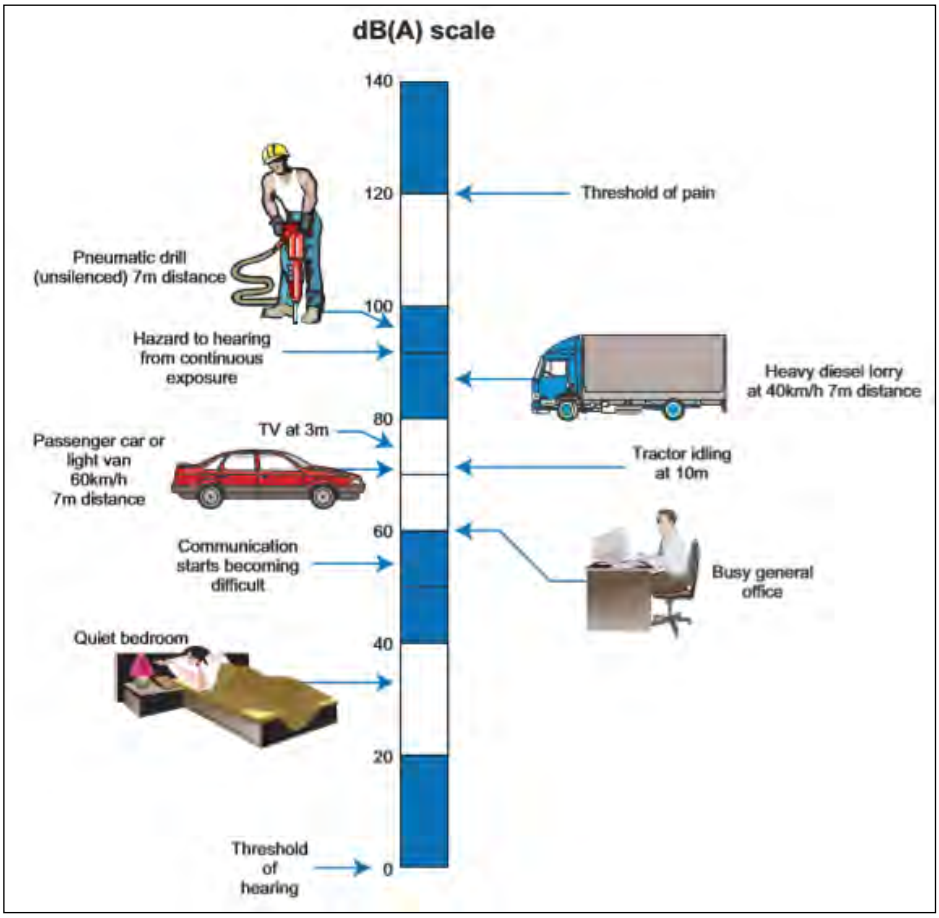


Figure 11-1 The level of typical common sounds on the dB(A) scale (National Roads Authority (NRA) Good Practice Guidance for the Treatment of Noise during the Planning of National Road Schemes (NRA, 2014)

11.1.4 Relevant Guidance

In the preparation of this chapter the author has had regard to the following guidance:

- *EPA Guidelines on the Information to be contained in Environmental Impact Statements*, (EPA, 2022).
- *Wind Energy Development Guidelines for Planning Authorities*, Department of the Environment, Heritage, and Local Government, 2006 (the Guidelines), with cognisance of *Draft Revised Wind Energy Development Guidelines* 2019 Department of Housing, Local Government and Heritage (the draft Guidelines).
- *The Assessment and Rating of Noise from Wind Farms*, Department of Trade, and Industry (UK) Energy Technology Support Unit (ETSU) (1996).

- *A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise* (IOAGPG) (2013).
- British Standard BS 5228-1:2009+A1:2014 *Code of practice for noise and vibration control on construction and open sites – Noise*.
- British Standard BS 5228-2:2009+A1:2014 *Code of practice for vibration control on construction and open sites – Vibration*.
- British Standard BS 7385 – *Evaluation and measurement for vibration in buildings – Part 2: Guide to damage levels from groundborne vibration* (BSI, 1993).
- *ISO 1996: 2017: Acoustics – Description, measurement, and assessment of environmental noise*.

11.2 Methodology

The assessment of impacts has been undertaken with reference to appropriate guidance documents relating to noise and vibration for the construction, operational, ceased operational, and decommissioned phases associated with the Derrybrien Wind Farm Development.

The general methodology relating to wind farm noise assessments is summarised as follows:

- Review of appropriate guidance to identify appropriate noise and vibration criteria for the construction, operational, ceased operational, and decommissioned phases.
- Characterise the receiving environment through noise surveys at various locations in the receiving environment of the Project.
- Undertake predictive noise calculations to assess the potential impacts associated with the construction, operational ceased operational, and decommissioned phases of the Retained Development project at Noise Sensitive Locations (NSLs).
- Evaluate the potential noise and vibration impacts and describe the effects.
- Specify mitigation measures to reduce, where necessary, the identified potential noise and vibration impacts from the proposed project.
- Describe the significance of the residual noise and vibration effects associated with the proposed project, including cumulative effects.

The following sections review best practice guidance that is commonly adopted in relation to developments such as the one under consideration here. The relevant guidance documents are listed below and are discussed where relevant in the various sections of this chapter.

- *EPA Guidelines on the Information to be contained in Environmental Impact Statements*, (EPA, 2022).
- *Wind Energy Development Guidelines for Planning Authorities*, Department of the Environment, Heritage, and Local Government, 2006 (the Guidelines), with cognisance of *Draft Revised Wind Energy Development Guidelines* 2019 Department of Housing, Local Government and Heritage (the draft Guidelines).
- *The Assessment and Rating of Noise from Wind Farms*, Department of Trade, and Industry (UK) Energy Technology Support Unit (ETSU) (1996).
- *A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise* (*IOA* GPG) (2013).
- British Standard BS 5228-1:2009+A1:2014 *Code of practice for noise and vibration control on construction and open sites – Noise*.
- British Standard BS 5228-2:2009+A1:2014 *Code of practice for vibration control on construction and open sites – Vibration*.
- British Standard BS 7385 – *Evaluation and measurement for vibration in buildings – Part 2: Guide to damage levels from groundborne vibration* (BSI, 1993).
- ISO 1996: 2017: *Acoustics – Description, measurement, and assessment of environmental noise*.

11.2.1 Construction Phase (2003-2006)

It is necessary to refer to the construction phase as part of the assessment of impacts which have already occurred during the construction phase of Derrybrien Wind Farm.

11.2.1.1 Construction Noise

There is no published statutory Irish guidance relating to the maximum permissible noise level that may be generated during the construction phase of a project. Local authorities normally control construction activities by imposing limits on the hours of operation and may consider noise limits at their discretion.

In the absence of specific noise limits, appropriate criteria relating to permissible construction noise levels for a development of this scale may be found in the British Standard British Standard BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Noise.

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. This then sets a threshold noise value that, if exceeded, indicates a significant noise impact is associated with the construction activities.

Table 11-1 sets out the values which, when exceeded, potentially signify a significant effect at the facades of residential receptors as recommended by BS 5228 – 1. These levels relate to construction noise only.

Table 11-1 Example Threshold of Potential Significant Effect at Dwellings

Assessment category and threshold value period ($L_{Aeq,T}$)	Threshold value, in decibels (dB)		
	Category A Note A	Category B Note B	Category C Note C
Night-time (23:00 to 07:00hrs)	45	50	55
Evenings and weekends Note D	55	60	65
Daytime (07:00 – 19:00hrs) and Saturdays (07:00 – 13:00hrs)	65	70	75

Note A Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are less than these values.

Note B Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are the same as category A values.

Note C Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are higher than category A values.

Note D 19:00 – 23:00 weekdays, 13:00 – 23:00 Saturdays and 07:00 – 23:00 Sundays.

It should be noted that this assessment method is only valid for residential properties. The following method should be followed:

For the appropriate period (e.g. daytime) the ambient noise level is determined and rounded to the nearest 5dB. In this instance, with the rural nature of the site, all properties in the vicinity of the development have ambient noise levels in the range of 40 to 50 dB L_{Aeq}. Therefore, all properties will be afforded a Category A designation.

See Section 11.4.2 for the detailed assessment in relation to this site. If the specific construction noise level exceeds the appropriate category value (e.g. 65dB $L_{Aeq,T}$ during daytime periods) then a significant effect is deemed to occur.

The construction noise guidance was also applied in relation to works associated with the peat slide. In relation to peat slide works that would have been carried out on a 24 hour basis, the relevant construction noise criteria for a potential significant effect for night-time would have been 45dB $L_{Aeq,1hr}$ and for evening and weekends the relevant threshold would have been 55dB $L_{Aeq,1hr}$.

11.2.1.2 Construction Vibration

Vibration standards come in two varieties: those dealing with human comfort and those dealing with cosmetic or structural damage to buildings. With respect to this development, the range of relevant criteria used for building protection is expressed in terms of Peak Particle Velocity (PPV) in mm/s.

Guidance relevant to acceptable vibration within buildings is contained in the following documents:

- BS 7385 – "Evaluation and measurement for vibration in buildings – Part 2: Guide to damage levels from groundborne vibration" (1993).
- BS 5228 – "Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration" (2009+A1:2014).

BS 7385 states that there should typically be no cosmetic damage if transient vibration does not exceed 15 mm/s at low frequencies rising to 20 mm/s at 15 Hz and 50 mm/s at 40 Hz and above. These guidelines relate to relatively modern buildings and should be reduced to 50% or less for more critical buildings.

BS 5228 recommends that, for soundly constructed residential property and similar structures that are generally in good repair, a threshold for minor or cosmetic (i.e. non-structural) damage should be taken as a peak particle velocity of 15 mm/s for transient vibration at frequencies below 15 Hz and 20 mm/s at frequencies above than 15 Hz. Below these vibration magnitudes minor damage is unlikely, although where there is existing damage these limits may be reduced by up to 50%. In addition, where continuous vibration is such that resonances are excited within structures the limits discussed above may need to be reduced by 50%.

Allowable vibration (in terms of peak particle velocity) at the closest part of sensitive property to the source of vibration, at frequencies presented in Table 11-2:

Table 11-2 Allowable Vibration at Properties

Frequency	Allowable vibration (in terms of peak particle velocity)
Less than 10Hz	8 mm/s
10 to 50Hz	12.5 mm/s
50 to 100Hz (and above)	20 mm/s

The construction vibration guidance will also be commented upon in relation to works associated with the peat slide.

11.2.2 Operation and Maintenance Phase (2006-2022)

Although commercial electricity generation at the Derrybrien Wind Farm Development ceased in 2022, it is necessary to refer to the operational phase as part of the assessment of impacts which have already occurred during that phase. There were no direct noise emissions resulting from the Retained Development during the Operation and Maintenance Phase.

During the operation of the Derrybrien Wind Farm the wind turbine noise levels were directly determined through measurement at NSL Ref. R35. The measurements and analysis were carried out according to guidance in IOAGPG Supplementary Guidance Note 5: Post Completion Measurements (July 2014). This noise compliance survey involved the installation of a sound level meter at R35 and logging measured noise levels in terms for an extended period from 10 September 2018 to 30 October 2018. Noise levels measured over 10-minute intervals were correlated with wind speed data in accordance with the guidance to assess the operational noise compliance of the wind turbines at this location.

The peer-reviewed research outlined in the proceeding sections supports that there are no direct negative health effects on people with long term exposure to wind turbine noise in the environment. For further details of potential health impacts associated with the Proposed Project refer to Chapter 5 of the EIAR.

11.2.2.1 Comments on Human Health Impacts

The following sections review a set of peer-reviewed publications in relation to human health effects due to wind turbine noise.

11.2.2.1.1 *The National Health & Medical Research Council*

The relevant Australian authority on health issues, the National Health and Medical Research Council (NHMRC), conducted a comprehensive independent assessment of the scientific evidence on wind farms and human health, the findings are contained in the NHMRC Information Paper: *Evidence on Wind Farms and Human Health* 2015, this report concluded:

> *"After careful consideration and deliberation, NHMRC concluded that there is no consistent evidence that wind farms cause adverse health effects in humans. This finding reflects the results and limitations of the direct evidence and also takes into account the relevant available parallel evidence on whether or not similar noise exposure from sources other than wind farms causes health effects".*

11.2.2.1.2 *Health Canada*

Health Canada, Canada's national health organisation, released preliminary results of a study into the effect of wind farms on human health in 2014[1]. The study was initiated in 2012 specifically to gather new data on wind farms and health. The study considered physical health measures that assessed stress levels using hair cortisol, blood pressure and resting heart rate, as well as measures of sleep quality. More than 4,000 hours of wind turbine noise measurements were collected and a total of 1,238 households participated.

No evidence was found to support a link between exposure to wind turbine noise and any of the self-reported illnesses. Additionally, the study's results did not support a link between wind turbine noise

[1] *Health Canada 2014, Wind Turbine Noise and Health Study: Summary of Results. Available at* https://www.canada.ca/en/health-canada/services/environmental-workplace-health/noise/wind-turbine-noise/wind-turbine-noise-health-study-summary-results.html

and stress, or sleep quality (self-reported or measured). However, an association was found between increased levels of wind turbine noise and individuals reporting of being annoyed.

11.2.2.1.3 New South Wales Health Department

In 2012, the New South Wales (NSW) Health Department provided written advice to the NSW Government that stated existing studies on wind farms and health issues had been examined and no known causal link could be established.

NSW Health officials stated that fears that wind turbines make people sick are 'not scientifically valid'. The officials wrote that there was no evidence for 'wind turbine syndrome', a collection of ailments including sleeplessness, headaches and high blood pressure that some people believe are caused by the noise of spinning blades.

11.2.2.1.4 The Australian Medical Association

The Australian Medical Association published a position statement, Wind Farms and Health 2014[2]. The statement said:

> *"The available Australian and international evidence does not support the view that the infrasound or low frequency sound generated by wind farms, as they are currently regulated in Australia, causes adverse health effects on populations residing in their vicinity. The infrasound and low frequency sound generated by modern wind farms in Australia is well below the level where known health effects occur, and there is no accepted physiological mechanism where sub-audible infrasound could cause health effects."*

11.2.2.1.5 Journal of Occupational and Environmental Medicine

The review titled *Wind Turbines and Health: A Critical Review of the Scientific Literature* was published in the Journal of Occupational and Environmental Medicine, 2014. An independent review of the literature was undertaken by the he Department of Biological Engineering of the Massachusetts Institute of Technology (MIT). The review took into consideration health effects such as stress, annoyance, and sleep disturbance, as well as other effects that have been raised in association with living close to wind turbines. The study found that:

> *"No clear or consistent association is seen between noise from wind turbines and any reported disease or other indicator of harm to human health."*

The report concluded that living near wind farms does not result in the worsening of the quality of life in that region.

11.2.2.1.6 Summary

The peer-reviewed research outlined in the preceeding sections supports that there are no direct negative health effects on people with long term exposure to wind turbine noise in the environment. For further details of potential health impacts associated with the Proposed Project refer to Chapter 5 of the EIAR.I

[2] *Australian Medical Association, 2014, Wind farms and health. Available at https://ama.com.au/position-statement/wind-farms-and-health-2014*

11.2.3 Ceased Operation Phase (2022 – Present)

As described in Chapter 4, during the Ceased Operation Phase, the turbines have been maintained by the turbine supplier to ensure the site remains safe, while in a prolonged non-operational state.

Noise effects due to the ceased operations have been scoped out of the assessment as no operational mode occurred and no electricity generation took place, there were therefore no noise sources or related effects.

11.2.4 Retained Development

As described in Chapter 4, the features of the Retained Development, to remain *in situ in* perpetuity after the Prospective Development has been completed are listed below:

- At-ground and below-ground structures/features associated with the Derrybrien Wind Farm Development.
- Offsite development constructed in response to the peat slide in 2003.

There are no noise or vibration sources associated with the Retained Development, therefore there are no noise or vibration effects at any NSL.

11.3 Receiving Environment

This section outlines the Noise level surveys undertaken in 2018 and 2019 in close proximity to the Derrybrien Wind Farm Development.

11.3.1 Derrybrien Wind Farm Development Noise Surveys (2018)

11.3.1.1 Preliminary 35dB(A) Noise Contour

In relation to the Derrybrien Wind Farm Development, the procedure for selection of baseline noise monitoring locations (as espoused in IOA GPG) is to identify NSLs within the 35dB(A) noise prediction contour and to select appropriate monitoring positions within this zone.

Preliminary noise modelling at turbine rated power was undertaken to establish the 35dB (A) zone and appropriate monitoring positions were selected.

The results of preliminary noise modelling indicate that in a worst-case scenario, down-wind noise levels are in the range 29 to 35dB at 40 no. NSLs and a noise level of c.39.6dB(A) predicted at a long-term derelict property (R39).

For context, Figure 11-2 illustrates the noise-sensitive locations in the context of the wind turbine locations; presents he noise monitoring locations considered in relation to the wind farm aspect of the Project.

There are three NSLs that fall within the 35 – 38dB noise contour, R35, R36 and R37, each with a calculated noise level of the order of 35dB L_{A90} (see Figure 11-4). Note: All predictions and contours presented in this assessment consider the impact of the Derrybrien Wind Farm Development along with the of Sonnagh Old wind farm located to the north.

As Location R35, R36 and R37 are neighbouring properties, a single baseline noise monitoring location at R35 was selected to cover these dwellings using the IOA GPG principle of a 'proxy'. An additional location was selected at R21 to establish noise levels at a dwelling approximately 1.4km to the west of R35, where a worst-case down-wind noise level of 31.6dB L_{A90} was predicted.

In upwind conditions i.e., conditions whereby wind is blowing from the residences towards the turbines, at turbine rated power, the results of the preliminary noise model indicated that noise levels will be 19dB $L_{A90,10m}$ at R21 and 24dB at R36 (see Figure 11-5).

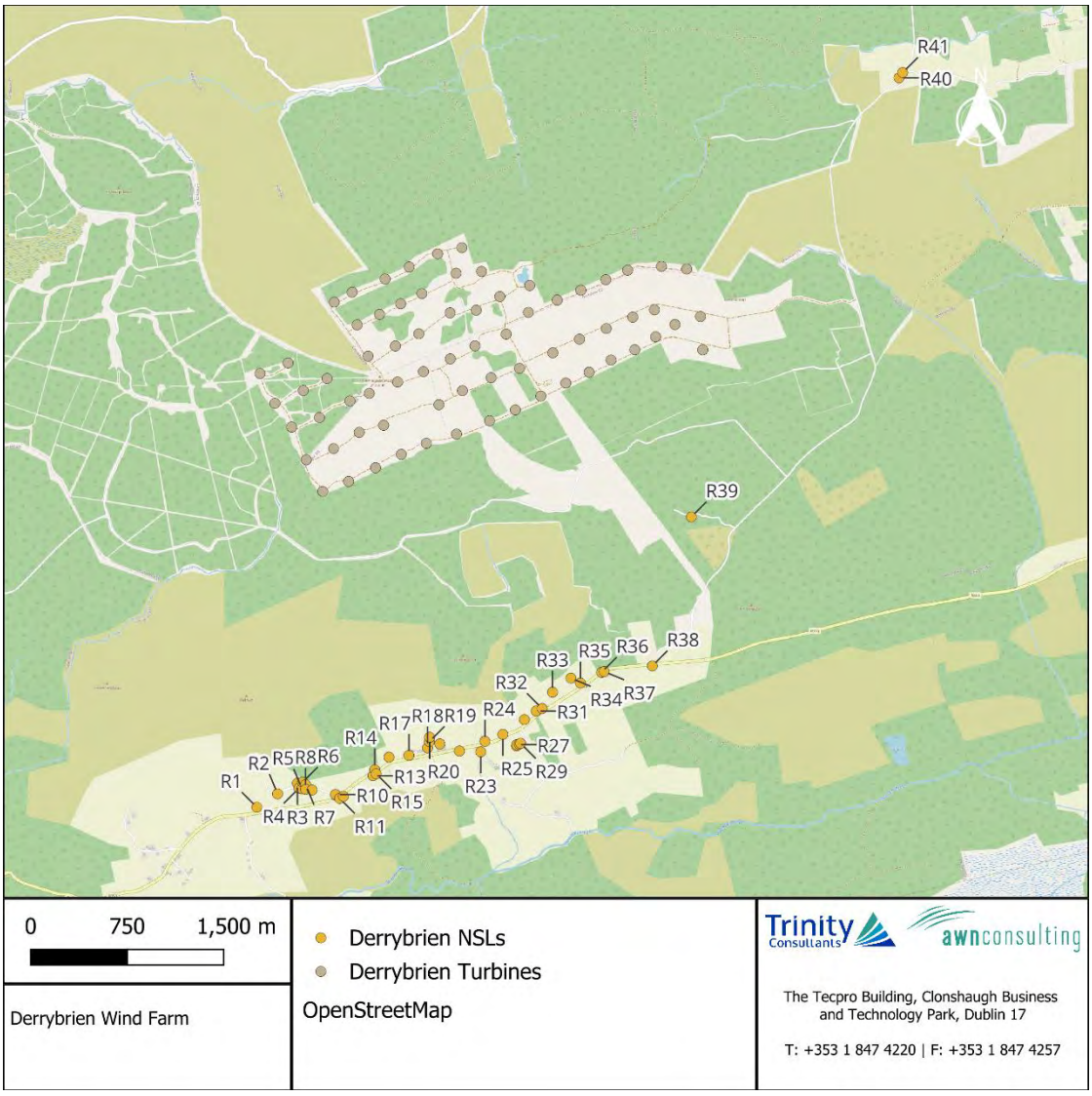


Figure 11-2 Derrybrien Wind Farm – Noise-sensitive Locations

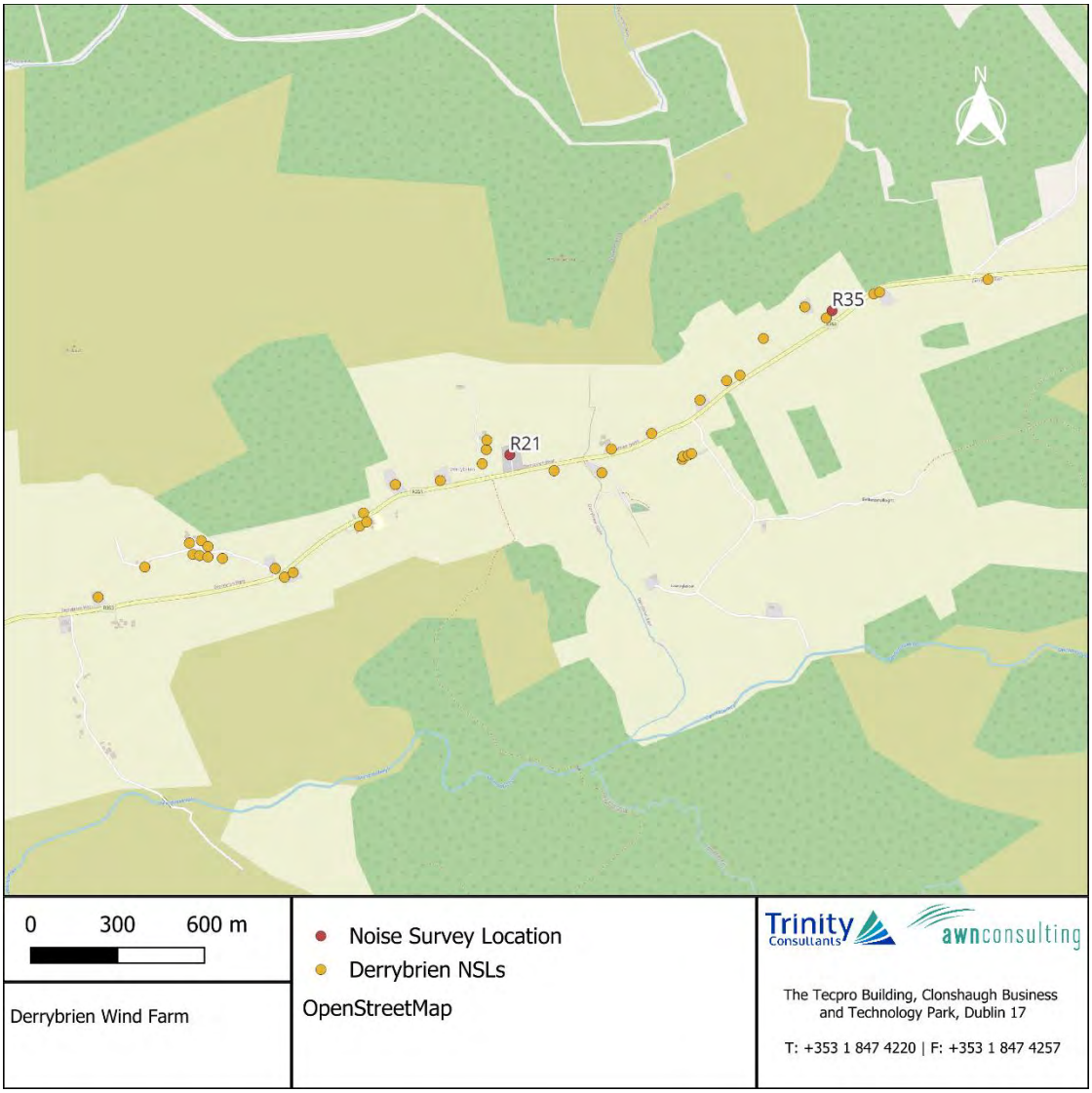


Figure 11-3 Derrybrien Wind Farm - Unattended Noise Monitoring Locations

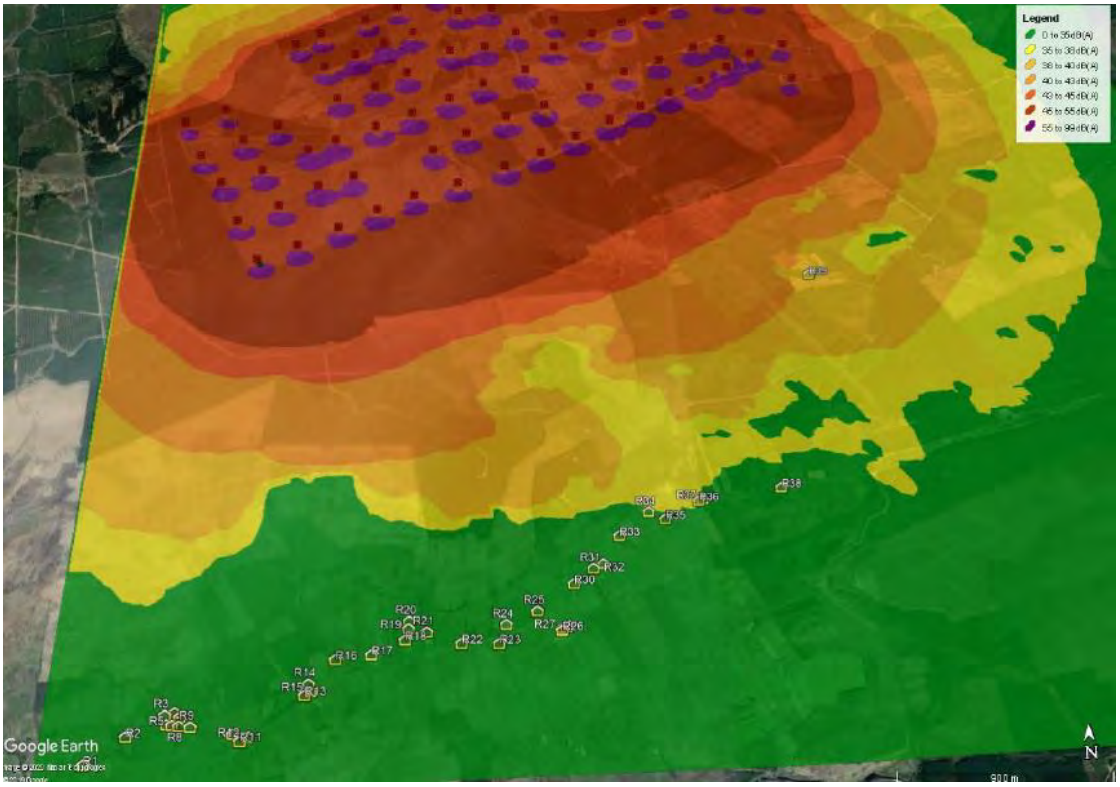


Figure 11-4 Preliminary 35dB Noise Contour, ≥8m-s Wind Speed, Omni-directional (i.e. downwind to all dwellings)

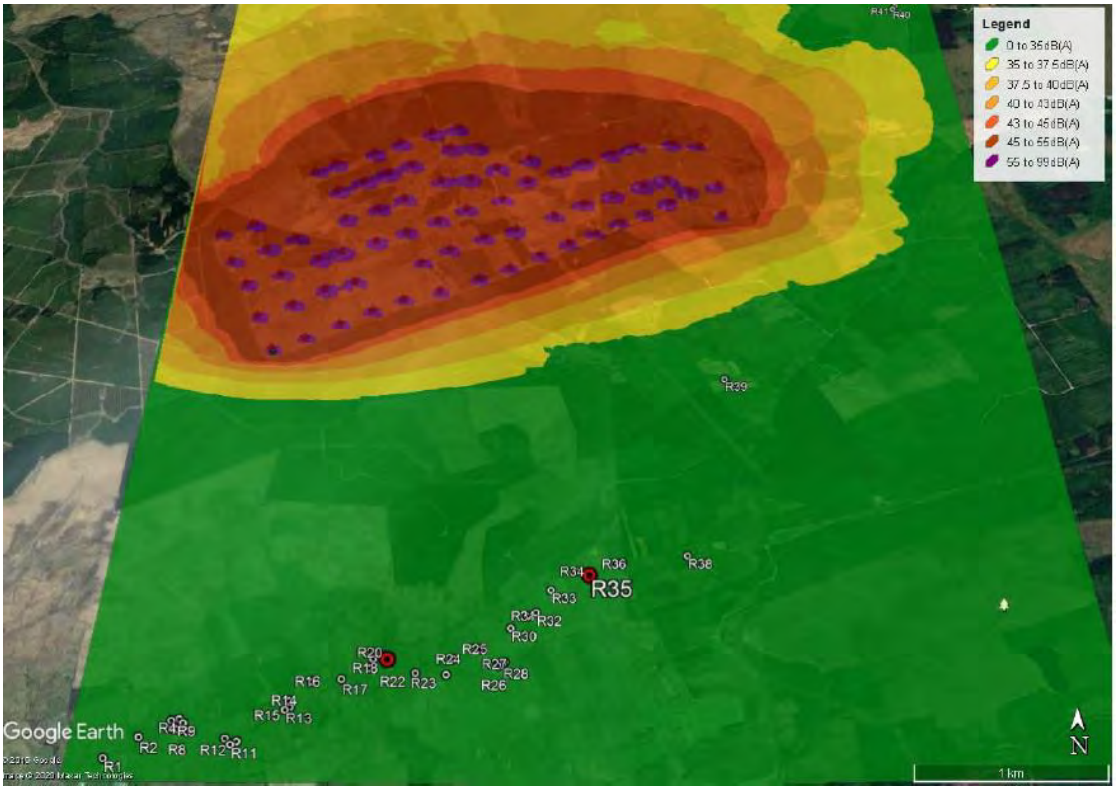


Figure 11-5 35dB Noise Contour, ≥8m/s Wind Speed, Upwind to R21 and R35 (i.e., Southerly Winds)

11.3.1.2 Derivation of baseline background noise levels

For guidance, reference has been made to the IOA Good Practice document (IOA GPG). This document provides various methods for the derivation of suitable background noise levels where the

proposed wind farm is within an area acoustically affected by an already operational wind farm. The approach adopted here is to apply wind directional filtering to the measured data in order to assess background noise data when it is not influenced by the existing turbines e.g. upwind of the receptor. This approach is supported by guidance in the IOAGPG.

Based on the results of the preliminary noise modelling therefore the following approach to data collection for the noise impact assessment is provided:

- Due to the distance from the site to the nearby NSLs, preliminary noise modelling indicates that baseline noise can be established at the two monitoring locations in upwind conditions (i.e. wind blowing broadly southerly). Upwind conditions are calculated as 150 to 215 degrees from north to the monitoring location R21 and 115 to 200 degrees from north to the monitoring location R36. The selected degrees from north are selected in accordance with Section 2.1.7 of the *IOA* GPG Supplementary Guidance Note 5.
- Operational noise levels can be established at monitoring locations in downwind conditions (i.e. wind blowing broadly northerly). Downwind conditions are calculated as 300 to 20 degrees from north to the monitoring location R36. The selected degrees from north are selected in accordance with Section 2.1.7 of the IOA GPG Supplementary Guidance Note 5.

11.3.1.3 Choice of Measurement Locations

The selected locations for the noise monitoring are outlined in the following sections. Figure 11-6 and Figure 11-7 illustrate the siting of the noise monitoring installations. Coordinates for the noise monitoring locations and met mast location are detailed in Table 11-3.

Table 11-3 Measurement Location Coordinates

Location	Coordinates - ITM	
	Easting	Northing
R21	559,080	701,931
R35	560,193	702,429

Figure 11-6 Location R21

Figure 11-7 Location R26

Noise sources were noted to be local road traffic, distant road traffic, local farm machinery and activity and other anthropological sources. Wind generated noise in local foliage was noted to be contributing to the background noise at both locations and in general at all dwellings in the locality.

It is considered that the background noise monitoring locations give a robust picture of background noise levels experienced at typical residential noise sensitive locations surrounding the site.

11.3.1.4 Measurement Periods

Noise measurements were conducted at each of the monitoring locations over the following periods:

Table 11-4 Noise Measurement Periods

Locaion	Start Date	End Date
R21	10:00hrs 10th September 2018	12:30hrs on 2nd November 2018
R35	10:20hrs 12th September 2018	13:00hrs on 2nd November 2018

A sufficient variety of wind speed and weather conditions were encountered over the survey periods quoted above. Figure 11-7 illustrates the distributions of wind speed and wind direction at standardised 10m height wind speed, over the survey period detailed in Table 11-4.

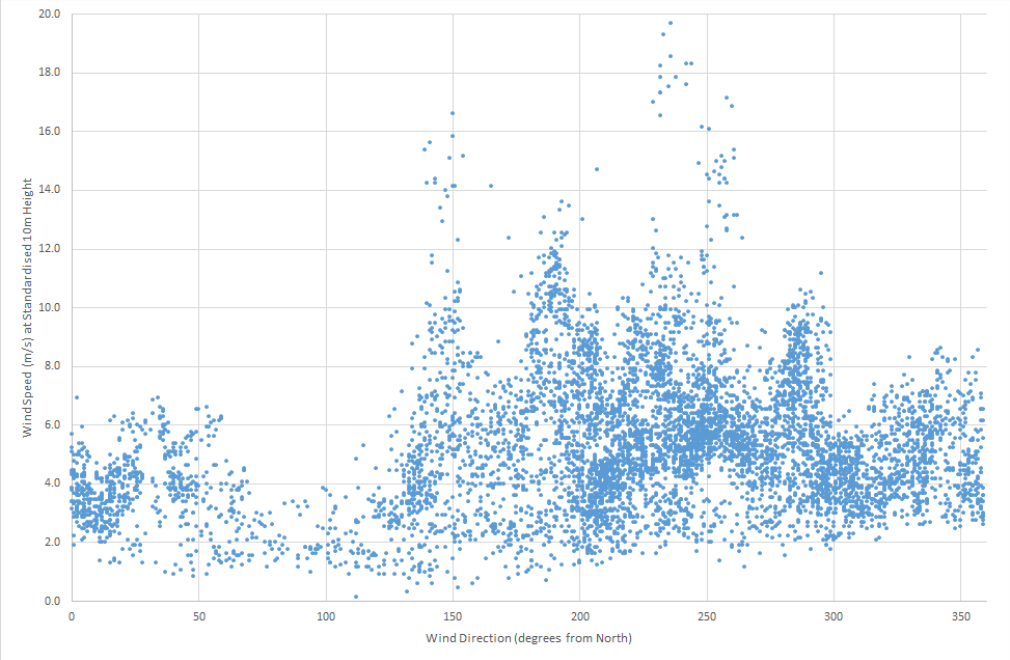


Figure 11-8 Distributions of Wind Speeds & Direction during the Survey

11.3.1.5 Personnel and Instrumentation

AWN Consulting installed and removed the noise monitors at all locations. The following instrumentation was used at the various locations:

Table 11-5 Instrumentation

Locaion	Equipment	Serial Number
R21	Brüel & Kjaer 2250	3010911
R35	Brüel & Kjaer 2250	2818081

Before and after each phase of the monitoring survey noise measurement equipment was check calibrated using a Brüel & Kjær type 4231 Sound Level Calibrator. A copy of the relevant calibration certification for the instrument is presented in Appendix 11-1.

Rain fall was monitored and logged using a Texas Electronics Rainfall Sensor, Model TR 525. The rainfall data allows for the identification of periods of rainfall so that they can be removed from the noise monitoring data sets, in line with best practice, when calculating the prevailing background noise levels at the various locations. The rain fall monitor was located on site for the duration of the survey.

Wind speed and directional data was obtained from an existing meteorological mast installed in the vicinity of the study area, at a height of 49 metres.

11.3.1.6 Procedure

Sample periods for the noise measurements were 10-minutes during both the daytime and night-time periods. The $L_{A90,10min}$ results were saved to the instrument memory for later analysis. Survey personnel noted potential primary noise sources contributing to noise build-up during the installation and removal of the sound level meters from site (e.g. identified significant noise sources in the area such as local traffic or farm yard activities).

11.3.1.7 Consideration of Wind Shear

As part of a robust wind farm noise assessment due consideration should be given to the issue of wind shear. It is standard procedure to reference noise data to standardised 10 metre wind speed. The issue of wind shear has been considered in this assessment and followed relevant guidance as outlined in the IOA GPG. This guidance presents the following equations in relation to the derivation of a standardised wind speed at 10m above ground level:

Equation A

Shear Exponent Profile:

$$U = U_{ref} \times (H \div H_{ref})m$$

Where:

U	calculated wind speed.
U_{ref}	measured wind speed.
H	height at which the wind speed will be calculated.
H_{ref}	height at which the wind speed is measured.
m	shear exponent.

Equation B

Roughness Length Shear Profile:

$$U_1 = U_2 \times [(\ln(H_1 \div z))/ (\ln(H_2 \div z))]$$

Where:

H_1	the height of the wind speed to be calculated (10m)
H_2	the height of the measured wind speed.
U_1	the wind speed to be calculated.
U_2	the measured wind speed.
z	the roughness length.

Note: A roughness length of 0.05m is used to standardise hub height wind speeds to 10m height in the IEC 61400-11:2003 standard, regardless of what the actual roughness length seen on a site may have been. This 'normalisation' procedure was adopted for comparability between test results for different turbines.

As outlined previously, wind speed and direction data was obtained from an on-site meteorological mast. Any reference to wind speed in the following sections of this chapter should be understood to be the 10m height standardised wind speed reference unless otherwise stated.

11.3.1.8 Results

The results of the background noise monitoring programme are extensive in nature. The raw data sets are not included in this document but are kept on file, along with the measured and derived[3] wind speeds for the survey period.

The following sections present an overview and statistical analysis of the noise monitoring data obtained from the survey programme at each location for both daytime and night-time periods.

[3] *Derived to a height of 10m above ground based on guidance contained within Institute of Acoustics Acoustic IOA GPG, Supplementary Guidance Note (SGN) 4: Wind Shear, July 2014*

The results presented in the following sections refer to the noise data collated during 'quiet periods' of the day and night as defined in the IOA GPG. These periods are defined as follows:

- All evenings from 18:00 to 23:00hrs.
- Saturday afternoons from 13:00 to 18:00hrs.
- All day Sunday from 07:00 to 18:00hrs.
- Night is defined as 23:00 to 07:00hrs.

The data sets have been filtered to remove issues such as the dawn chorus and the influence of other atypical noise sources. An example of atypical sources would be short, isolated periods of raised noise levels attributable to local sources, agricultural activity, boiler flues, operation of gardening equipment etc.

11.3.1.8.1 *Location R21*

Daytime Period

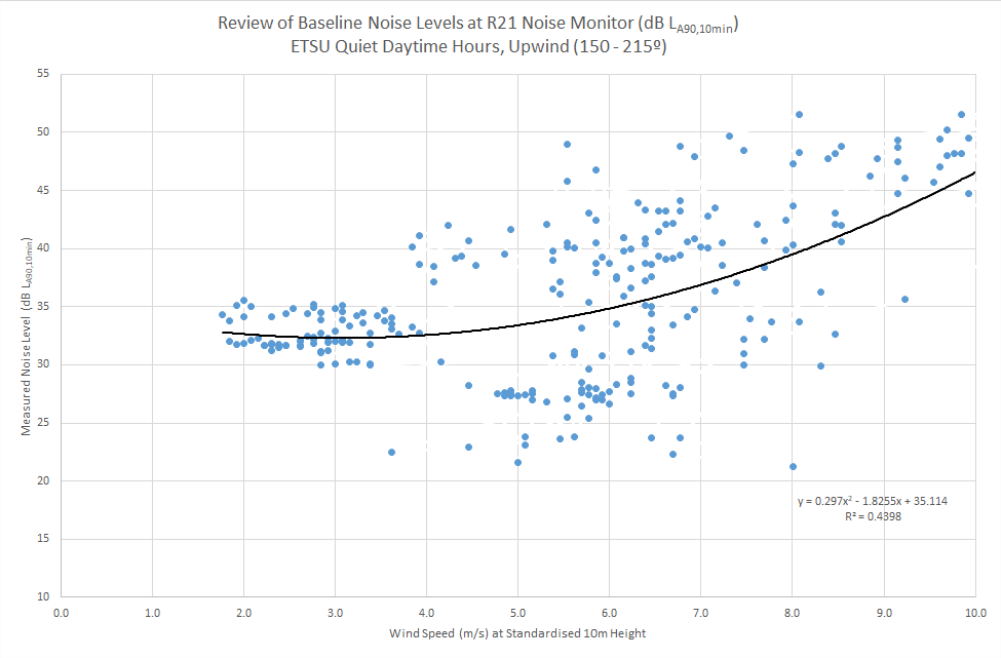


Figure 11-9 Baseline Noise Levels $L_{A90,\,10\,min}$ dB – Location R21 – Daytime Period

Night-time

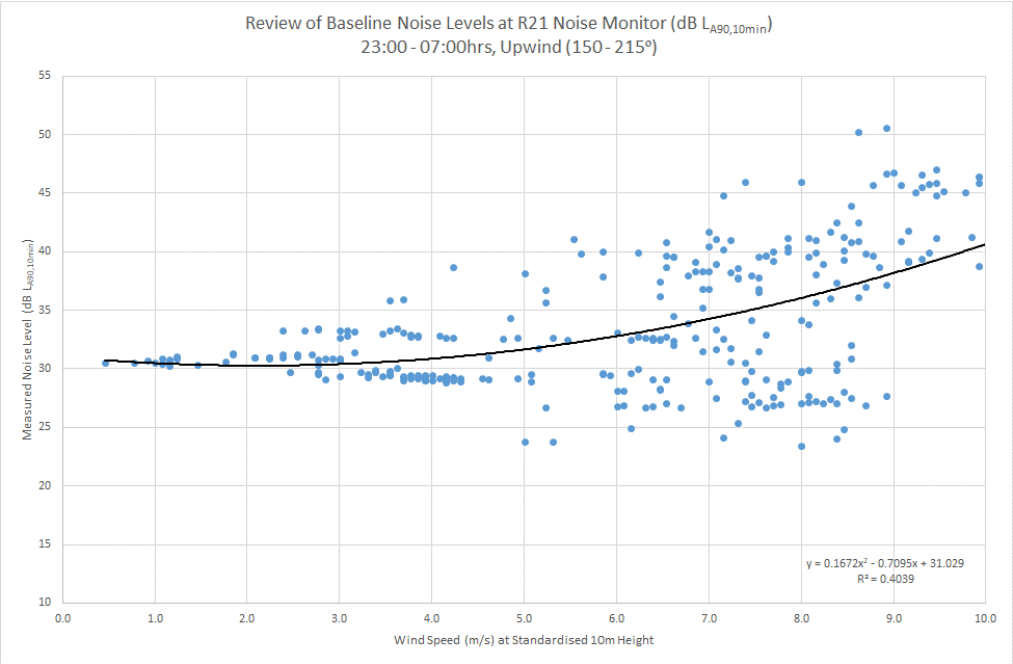


Figure 11-10 Baseline Noise Levels $L_{A90,\ 10\ min}$ dB – Location R21 – Night-time Period

11.3.1.8.2 Location R36

Daytime Period

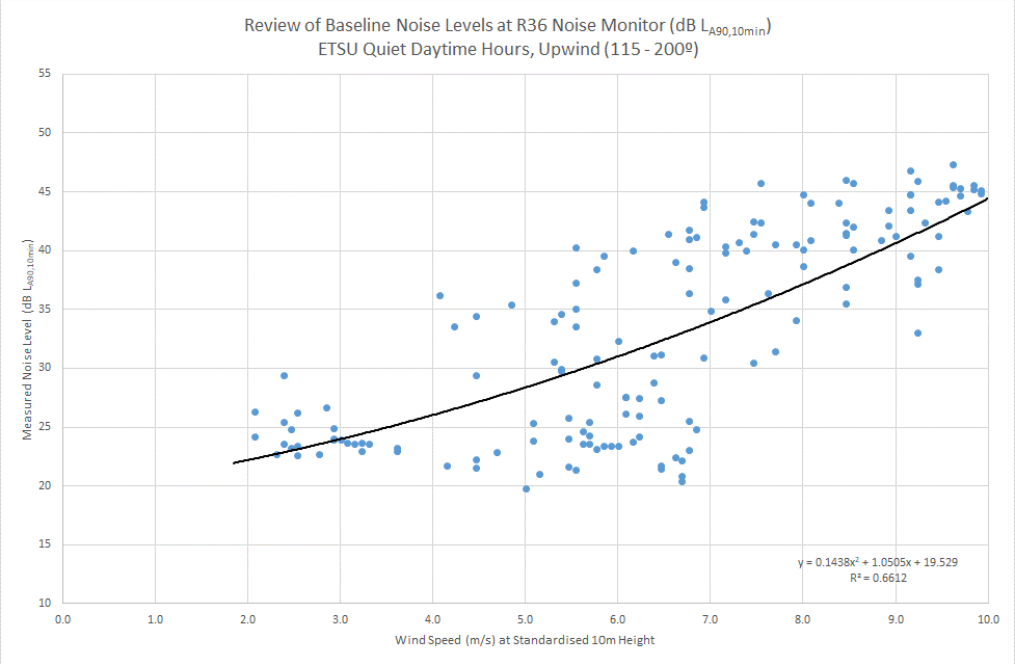


Figure 11-11 Baseline Noise Levels $L_{A90,\ 10\ min}$ dB – Location R36 – Daytime Period

Night-time

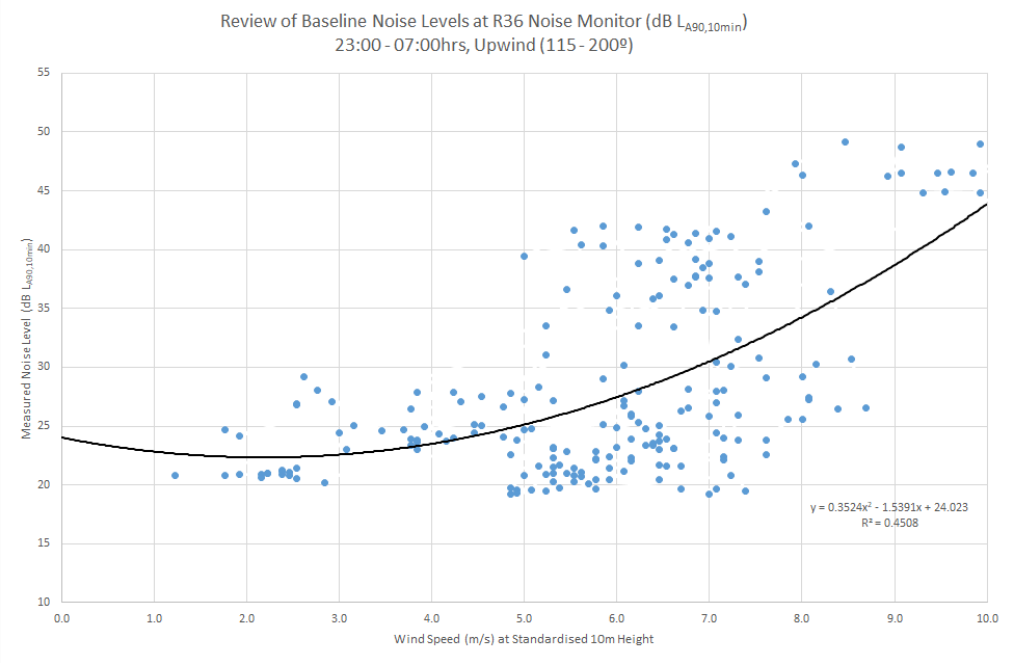


Figure 11-12 Baseline Noise Levels $L_{A90,\ 10\ min}$ dB – Location R36 – Night-time Period

11.3.1.8.3 Summary of 2018 Results

Table 11-6 presents the various derived $L_{A90,10min}$ baseline noise levels for each of the monitoring locations for daytime quiet periods and night-time periods, in upwind conditions. These levels have been derived using regression analysis carried out on the directional data sets in line with best practice guidance.

Table 11-6 Derived Levels of $L_{A90,\ 10\ min}$ for Various Wind Speeds (Upwind) for 2019 with turbines

NSL Ref	Period	Noise Level, $L_{A90,\ 10\ min}$ (dB) at various Wind Speeds at Standaridsed 10m Height Above Ground (m/s)						
		4	5	6	7	8	9	10
R21	Day	32.6	33.4	34.9	36.9	39.5	42.7	46.6
	Night	30.9	31.7	32.8	34.3	36.1	38.2	40.7
R35	Day	26.0	28.4	31.0	33.9	37.1	40.6	44.4
	Night	23.5	25.1	27.5	30.5	34.3	38.7	43.9

The noise levels presented above are measured under upwind conditions (i.e. when the wind is blowing from the direction of the two dwellings to the turbines). Noise modelling has been used to verify that there is minimal influence from operational turbines on baseline values under these conditions as illustrated in Figure 11-5.

Additional corrections have also been applied to the measured baseline values to account for any potential small influence from operational turbine noise on the baseline data-sets. These corrections (as per *IOA* GPG Section 5.2.3) consist of the logarithmic subtraction of the noise model results during upwind conditions, from the measured baseline noise levels.

Table 11-7 Location R21 Corrected $L_{A90,\ 10\ min}$ Baseline Noise Levels: Daytime under Upwind Condition

NSL Ref	Period	Noise Level, $L_{A90,\ 10\ min}$ (dB) at various Wind Speeds at Standaridsed 10m Height Above Ground (m/s)						
		4	5	6	7	8	9	10
R21 Day	Measured Baseline (with Turbines)	32.6	33.4	34.9	36.9	39.5	42.7	46.6
	Noise Model Prediction (Turbines Only)	16.7	16.7	16.7	18.5	18.9	18.9	18.9
	Corrected Baseline Values (Turbines Removed)	32.4	33.3	34.8	36.8	39.5	42.7	46.6

Table 11-8 Location R21 Corrected $L_{A90,\ 10\ min}$ Baseline Noise Levels: Night-time under Upwind Conditions

NSL Ref	Period	Noise Level, $L_{A90,\ 10\ min}$ (dB) at various Wind Speeds at Standaridsed 10m Height Above Ground (m/s)						
		4	5	6	7	8	9	10
R21 Night	Measured Baseline (with Turbines)	30.9	31.7	32.8	34.3	36.1	38.2	40.7
	Noise Model Prediction (Turbines Only)	16.7	16.7	16.7	18.5	18.9	18.9	18.9
	Corrected Baseline Values (Turbines Removed)	30.7	31.5	32.7	34.1	36.0	38.1	40.6

Table 11-9 Location R36 Corrected $L_{A90,\ 10\ min}$ Baseline Noise Levels: Daytime under Upwind Conditions

NSL Ref	Period	Noise Level, $L_{A90,\ 10\ min}$ (dB) at various Wind Speeds at Standaridsed 10m Height Above Ground (m/s)						
		4	5	6	7	8	9	10
R36 Day	Measured Baseline (with Turbines)	26.0	28.4	31.0	33.9	37.1	40.6	44.4
	Noise Model Prediction (Turbines Only)	21.8	21.8	21.8	23.6	24.0	24.0	24.0
	Corrected Baseline Values (Turbines Removed)	24.0	27.3	30.5	33.5	36.9	40.5	44.4

Table 11-10 Location R36 Corrected $L_{A90,\ 10\ min}$ Baseline Noise Levels: Night-time under Upwind Conditions

NSL Ref	Period	Noise Level, $L_{A90,\ 10\ min}$ (dB) at various Wind Speeds at Standaridsed 10m Height Above Ground (m/s)						
		4	5	6	7	8	9	10
R36 Night	Measured Baseline (with Turbines)	23.5	25.1	27.5	30.5	34.3	38.7	43.9
	Noise Model Prediction (Turbines Only)	21.8	21.8	21.8	23.6	24.0	24.0	24.0
	Corrected Baseline Values (Turbines Removed)	18.6	22.4	26.1	29.5	33.8	38.6	43.8

The corrected baseline noise data is used to derive noise limits for noise sensitive locations.

11.3.2 Derrybrien Wind Farm Development Noise surveys (2019).

Attended noise monitoring was completed at five locations as in Figure 11-13.

Locations NML1, NML2 and NML3 were selected in order to give a representation of the noise environment of the Derrybrien substation and the Borrow Pit/Quarry adjacent to Barrage 1 utilised during works completed following the peat slide on the site. Locations NML4 and NML5 were selected to be representative of the nearest noise sensitive locations to the Agannygal Substation.

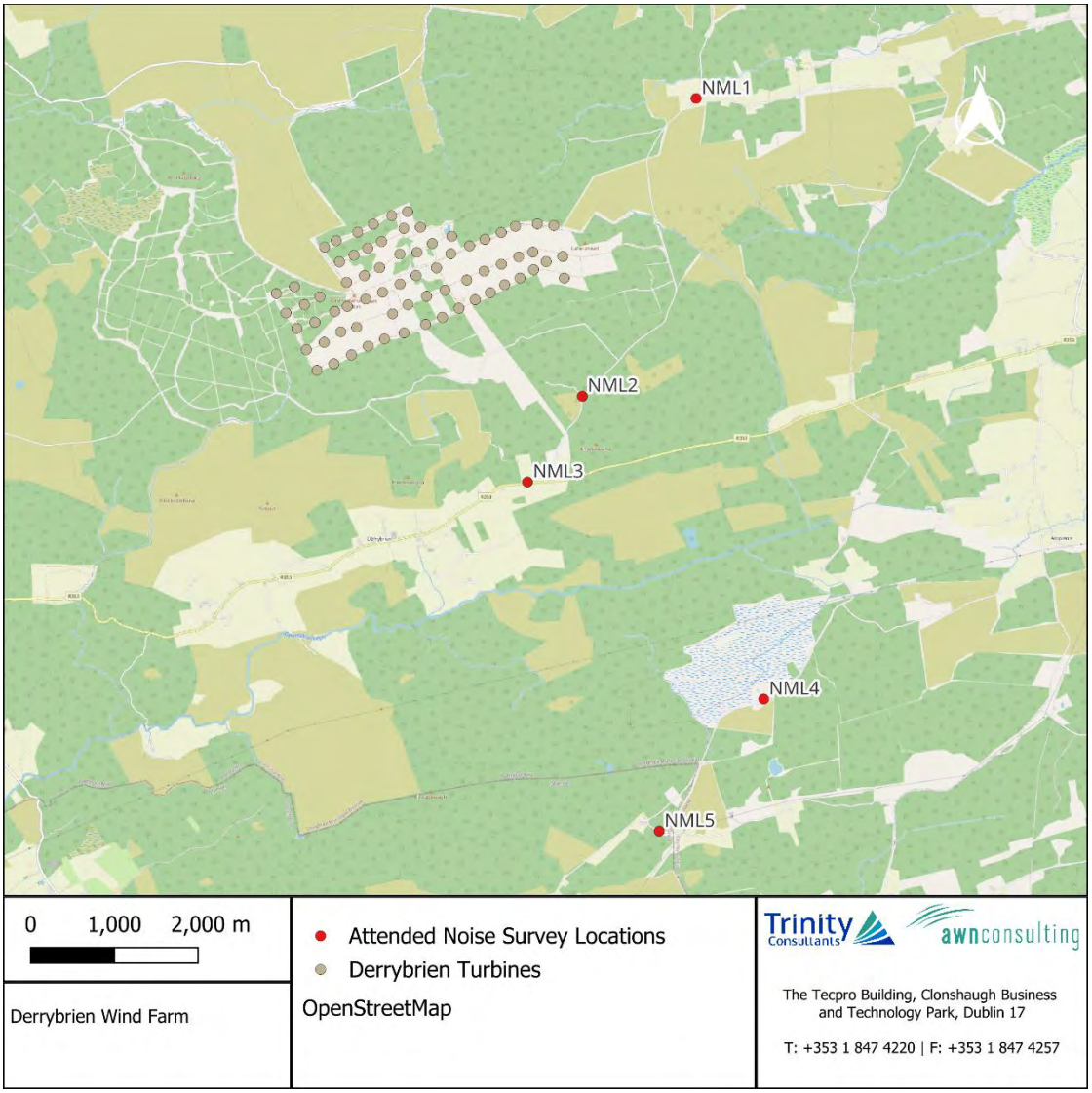


Figure 11-13 Attended Noise Monitoring Locations

11.3.2.1 Personnel & Instrumentation

AWN conducted the measurements during the survey. The noise measurements were conducted using a Brüel & Kjær Type 2250 Sound Level Meter (S/N 2818091). The measurement apparatus was check calibrated both before and after the measurement survey using a Brüel & Kjær Type 4231 Sound Level Calibrator.

11.3.2.2 Procedure

Measurements were conducted at NML 1 to 5 on a cyclical basis. Sample periods for the noise measurements were 15 minutes during all survey periods. The results were noted onto a Survey Record Sheet immediately following each sample and were also saved to the instrument memory for later analysis where appropriate. Survey personnel noted all primary noise sources contributing to noise build-up.

11.3.2.3 Results

11.3.2.3.1 *Location NML1*

Ambient (i.e. L_{Aeq}) daytime and night-time noise levels at this location were dictated by occasional road traffic movements, occasional distant residential construction noise, running water, wind generated noise in local foliage and birdsong. Background noise levels were typically dictated by wind generated noise in local foliage. Noise levels were in the range of 36 to 49dB $L_{Aeq,15min}$ and of the order of 31dB $L_{A90,15min}$ during daytime periods and between 35 and 45dB $L_{Aeq,15min}$ and the order of 34dB $L_{A90,15min}$ during night-time periods. The slightly higher ambient noise levels were due to a car passing nearby the monitoring position during the monitoring period. The slightly higher background levels noted during night-time periods at this location were due to slightly higher wind speeds and associated wind generated noise noted during night-time periods compared to the daytime.

Table 11-11 Review of Noise Monitoring at Locations NML1

Period	Date Time	Measured Noise Levels (dB re. $2x10^{-5}$ Pa)		
		L_{Aeq}	L_{Amax}	L_{A90}
Night	30/10/2019 22:52	45	67	34
Night	30/10/2019 23:58	35	50	34
Day	31/10/2019 11:06	36	60	31
Day	31/10/2019 12:09	39	61	31
Day	31/10/2019 13:12	49	77	31

11.3.2.3.2 *Location NML2*

Ambient (i.e. L_{Aeq}) daytime and night-time noise levels at this location were dictated by occasional road traffic movements, running water, wind generated noise in local foliage and birdsong. Background noise levels were typically dictated by wind generated noise in local foliage. Noise levels were in the range of 35 to 53dB $L_{Aeq,15min}$ and 28 to 35dB $L_{A90,15min}$ during daytime periods and between 35 and 49dB $L_{Aeq,15min}$ and the order of 35dB $L_{A90,15min}$ during night-time periods. The slightly higher ambient noise levels were due to a car passing nearby the monitoring position during the monitoring period. The slightly higher background levels noted during night-time periods at this location were due to wind speeds and associated wind generated noise noted during night-time periods compared to the daytime.

Table 11-12 Review of Noise Monitoring at Locations NML2

Period	Date Time	Measured Noise Levels (dB re. 2x10-5 Pa)		
		L_{Aeq}	L_{Amax}	L_{A90}
Night	30/10/2019 23:14	36	52	35
Night	31/10/2019 00:20	36	56	35
Day	31/10/2019 11:28	53	80	35
Day	31/10/2019 12:30	35	56	28

Period	Date Time	Measured Noise Levels (dB re. 2x10-5 Pa)		
		L_{Aeq}	L_{Amax}	L_{A90}
Day	31/10/2019 13:33	49	75	28

11.3.2.3.3 Location NML3

Ambient (i.e. L_{Aeq}) daytime and night-time noise levels at this location were dictated by occasional road traffic movements, distant forestry activity (i.e. chainsaws), running water, wind generated noise in local foliage and birdsong. Background noise levels were typically dictated by wind generated noise in local foliage. Noise levels were in the range of 47 to 55dB $L_{Aeq,15min}$ and 27 to 29dB $L_{A90,15min}$ during daytime periods and between 33 and 34dB $L_{Aeq,15min}$ and the order of 31dB $L_{A90,15min}$ during night-time periods. The slightly higher ambient noise levels were due to a car passing nearby the monitoring position during the monitoring period. The slightly higher background levels noted during night-time periods at this location were due to slightly higher wind speeds and associated wind generated noise noted during night-time periods compared to the daytime.

Table 11-13 Review of Noise Monitoring at Locations NML3

Period	Date Time	Measured Noise Levels (dB re. 2x10-5 Pa)		
		L_{Aeq}	L_{Amax}	L_{A90}
Night	30/10/2019 23:34	33	46	31
Night	31/10/2019 00:38	34	53	31
Day	31/10/2019 11:46	55	82	29
Day	31/10/2019 12:49	49	77	27
Day	31/10/2019 14:01	47	71	27

11.3.2.3.4 Location NML4

Ambient (i.e. L_{Aeq}) daytime and night-time noise levels at this location were dictated by occasional road traffic movements, dogs barking, wind generated noise in local foliage and birdsong. Background noise levels were typically dictated by wind generated noise in local foliage. Noise levels were in the range of 30 to 48dB $L_{Aeq,15min}$ and the order of 21dB $L_{A90,15min}$ during daytime periods and the order of 38dB LAeq,15min and 28dB $L_{A90,15min}$ during night-time periods. The slightly higher ambient noise levels were due to passing cars nearby. the monitoring position during the monitoring period. The slightly higher background levels noted during night-time periods at this location were due to increased wind speeds and associated wind generated noise noted during night-time periods compared to the daytime.

Table 11-14 Review of Noise Monitoring at Locations NML4

Period	Date Time	Measured Noise Levels (dB re. 2x10-5 Pa)		
		L_{Aeq}	L_{Amax}	L_{A90}
Night	31/10/2019 01:24	38	64	28
Day	31/10/2019 14:30	48	77	21

Period	Date Time	Measured Noise Levels (dB re. 2x10-5 Pa)		
		L_{Aeq}	L_{Amax}	L_{A90}
Day	31/10/2019 15:15	30	53	21
Day	31/10/2019 15:53	39	65	21

11.3.2.3.5 Location NML5

Ambient (i.e. LAeq) daytime and night-time noise levels at this location were dictated by distant road traffic movements, wind generated noise in local foliage and birdsong. Background noise levels were typically dictated by wind generated noise in local foliage. Noise levels were in the range of 33 to 37dB $L_{Aeq,15min}$ and 25 to 28dB $L_{A90,15min}$ during daytime periods and the order of 40dB $L_{Aeq,15min}$ and 36dB $L_{A90,15min}$ during night-time periods. The slightly higher ambient noise levels were due to a car passing nearby the monitoring position during the monitoring period. The slightly higher background levels noted during night-time periods at this location were due to increased wind speeds and associated wind generated noise noted during night-time periods comparted to the daytime.

Table 11-15 Review of Noise Monitoring at Locations NML5

Period	Date Time	Measured Noise Levels (dB re. 2x10-5 Pa)		
		L_{Aeq}	L_{Amax}	L_{A90}
Night	31/10/2019 01:50	40	51	36
Day	31/10/2019 14:55	34	57	28
Day	31/10/2019 15:34	37	56	25
Day	31/10/2019 16:13	33	59	26

11.4 Likely Significant Impacts

11.4.1 Do Nothing Scenario

In the Do Nothing scenario, the Derrybrien Wind Farm Development would remain in-situ in its current state i.e., as an unauthorised windfarm development the ceased commercial electricity generation in February 2022. No decommissioning works would be undertaken. The infrastructure would continue to degrade over time. There would be no on-going noise effects under the do-nothing scenario.

11.4.2 Construction Phase Impacts (2003-2006)

11.4.2.1 Construction Phase 1 – June 2003 to October 2003

A variety of items of plant were used for the purposes of site preparation, construction of turbines, substations, borrow pit operation, grid connection and other site works.

There would have been vehicular movements to and from the site that will make use of existing roads. Due to the nature of these activities, there would have been a potential for generation of significant levels of noise.

It is possible to predict typical noise levels using guidance set out in British Standard BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Noise. In this instance, the noise-sensitive locations surrounding the site are located at varying distances with the closest occupied noise sensitive located approximately 2.1km from the nearest turbine location. There is a derelict, uninhabited building (R39) some 1.2km from the nearest turbine location. This has been included in the construction noise assessment to consider a worst case assessment although it is understood it was not occupied during the duration of the construction works associated with the Project and remains derelict at the time of the preparation of this assessment.

Several indicative sources that would be expected on a site of this nature have been identified and noise predictions of their potential impacts prepared to nearby houses. The assessment is considered representative of a worst-case scenario, with construction noise at slightly lower levels at properties at a further distance from the works.

11.4.2.1.1 Wind Turbine Bases / Hard standings

Table 11-16 outlines the noise levels associated with typical construction noise sources assessed in this instance along with typical sound pressure levels and spectra from BS 5228 – 1.

Table 11-16 Typical Wind Farm Turbine Construction Noise Emission Levels

Item (BS 5228 Ref.)	Activity/Notes	Plant Noise Level at 10m Distance ($dB L_{Aeq,T}$)	Predicted Noise Level at 1,300m ($dB L_{Aeq,1hr}$)	Predicted Noise Level at 2,100m ($dB L_{Aeq,1hr}$)
HGV Movement (C.2.30)	Removing spoil and transporting fill and other materials.	79	37	33
Tracked Excavator (C.4.64)	Removing soil and rubble in preparation for foundation.	77	35	31
Piling Operations (C.12.14)	Standard pile driving.	88	46	42
General Construction (Various)	All general activities plus deliveries of materials and plant.	70 – 84	42	38
Dewatering Pumps (D.7.70)	If required.	80	38	34
JCB (D.8.13)	For services, drainage and landscaping.	82	40	36

Item (BS 5228 Ref.)	Activity/Notes	Plant Noise Level at 10m Distance ($dB L_{Aeq,T}$)	Predicted Noise Level at 1,300m ($dB L_{Aeq,1hr}$)	Predicted Noise Level at 2,100m ($dB L_{Aeq,1hr}$)
Vibrating Rollers (D.8.29)	Road surfacing.	77	35	31
Total Construction Noise (cumulative for all activities)			49	45

The predicted noise levels from construction activities are in the range 35 to 46dB $L_{Aeq,1hr}$ at the nearest derelict, uninhabited house (R39), with a total construction noise level of approximately 49dB $L_{Aeq,1hr}$.

At the nearest occupied dwelling (e.g. R35) the predicted construction noise levels are in the range 31 to 42dB $L_{Aeq,1hr}$ with a total construction noise level of approximately 45dB $L_{Aeq,1hr}$.

The predicted noise levels are below the construction noise criterion identified in Section 11.2.1.1 (i.e. 65dB $L_{Aeq,1hr}$) which indicates that the wind farm construction did not give rise to significant noise impact. It is understood construction works of the Project were carried out during daytime hours.

Due to the distance of the construction works from noise sensitive locations significant vibration impacts would not have been imperceptible and would have been significantly below levels where cosmetic or structural damage would occur. In terms of these construction activities, the associated likely effect was Direct, Negative, Slight and Short-term.

11.4.2.1.2 *Internal Wind Farm Roads & Temporary Roads*

New internal roads and temporary roads were constructed for the Project. Review of the road layout has identified that the nearest NSL to any point along the roads is assumed to be 100m to such activities to present a worst-case assumption. The majority of noise sensitive locations are at significantly greater distances to those reviewed here therefore any associated noise impacts would have been further reduced in these instances.

Table 11-17 outlines the typical construction noise levels associated with the works for this element of the construction. Calculations have assumed an on time 66% for each item of plant i.e. 8-hours over a 12 hour assessment period.

Table 11-17 Indicative Noise Levels from Construction Plant at Various Distances from the Road Works

Item (BS 5228 Ref.)	Activity/Notes	Noise Level, ($dB L_{Aeq,1hr}$)			
		100 m	200 m	300 m	400 m
HGV (C.2.30)	Removing spoil and transporting fill and other materials.	50	44	40	37
Tracked Excavator	Removing soil and rubble in	54	48	44	41

Item (BS 5228 Ref.)	Activity/Notes	Noise Level, (dB $L_{Aeq,1hr}$)			
		100 m	200 m	300 m	400 m
(C.4.64)	preparation for foundation.				
Vibrating Rollers (D.8.29)	Road surfacing.	48	42	38	35
Total Construction Noise (cumulative for all activities)		56	51	46	43

At the nearest noise sensitive location, the predicted noise levels from construction activities are of the order of 56 dB $L_{Aeq,1hr}$. In all instances the predicted noise levels at the nearest NSLs are below the appropriate criteria outlined in Section 11.2.1.1 (Category A - 65 dB $L_{Aeq,1hr}$ during daytime periods). As these works progressed along the route the worst-case predicted impacts would have reduced. It is envisioned that they would have occurred at the closest position to the nearest NSL for no more than 2 to 3 days.

Due to the distance of these aspects of the construction works from noise sensitive locations significant vibration effects would not have been likely to occur. With respect to the EPA's criteria for description of effects, the potential worst-case associated effects at the nearest noise sensitive locations associated with this aspect of the construction phase are Direct, Negative, Slight and Temporary.

The above effects should be considered in terms that the effect would have been variable, and that this assessment considers the locations of the greatest potential impact.

11.4.2.1.3 *Borrow Pits*

To inform this aspect of the proposal, a comparative noise assessment has been prepared and is outlined in the following paragraphs. Two situations have been considered as follows:

- Scenario A Blasting operation.
- Scenario B Rock breaking operation.

In terms of these activities please note the following:

- A mobile crusher would have operated on site for both options.
- In Scenario B that two rock breakers would have been in use on site during daytime periods.
- For the purposes of this assessment, we have assumed the plant was working in the vicinity of the borrow pits location indicated in Figure 11-14 .
- The closest noise sensitive location to a borrow pit is circa of 1,200m. (R39).
- Table 11-18 outlines the assumed noise levels for the plant items as extracted from BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Noise.
- It is assumed that no more than 1 blast occurred in a single working day.

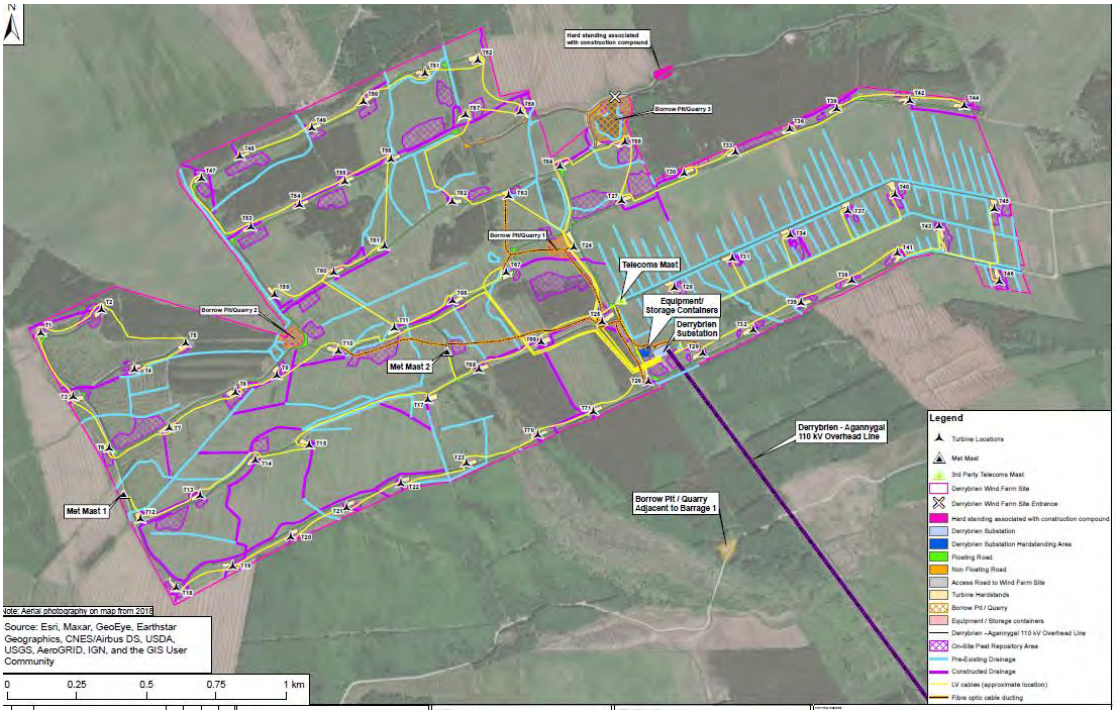


Figure 11-14 Borrow Pit Locations

Table 11-18 Typical Borrow Pit Plant Noise Emissions

Item (BS 5228 Ref.)	dB Lw Levels per Octave Band (Hz)								dB(A)
	63	125	250	500	1k	2k	4k	8k	
Crusher C1.14	121	114	107	108	103	99	94	87	110
Rock Breaker C9.11	119	117	113	117	115	115	112	108	121

A noise model has been prepared to consider the expected noise emissions from typical borrow pit works. A percentage on-time of 66% has been assumed for the noise calculations. The worst-case predicted noise levels from operation of all combinations of borrow pits have been prepared at the NSL with the greatest potential impact for this aspect of the construction phase (i.e. R39 – an unoccupied property). This scenario is based on operation of the nearest borrow pit at some 1,200m distance. The predicted noise contour from the borrow pit operations is presented in Figure 11-15. which illustrates the construction noise contour associated with the borrow pit activities. The closest noise sensitive properties fall within the 35 to 45dB $L_{Aeq,1hr}$ contour with other locations having predicted noise levels less than 35dB $L_{Aeq,1hr}$ associated with them in relation to borrow pit operations.

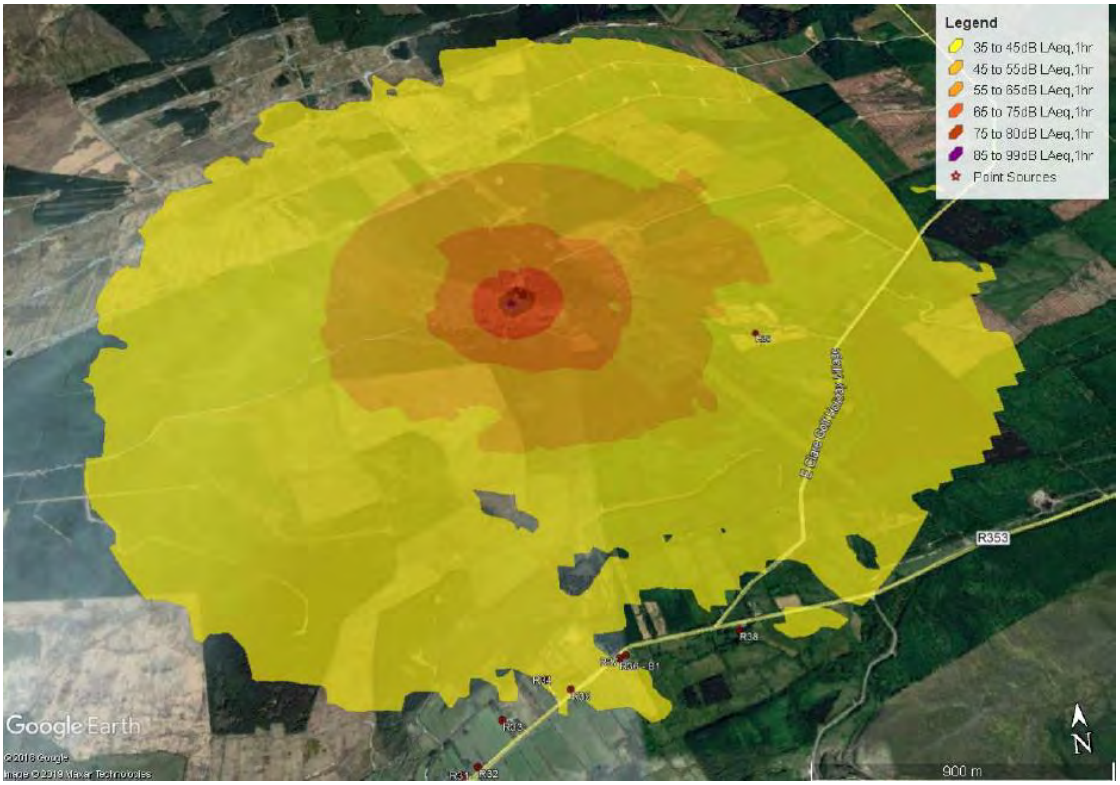


Figure 11-15 Borrow Pit – Construction Noise Contour

The predicted noise levels are below the construction noise criterion identified in Section 11.2.1.1 (i.e., 65dB $L_{Aeq,1hr}$) which indicates that this aspect of construction activity did not give rise to any significant noise impacts. It is understood construction works of the Project were carried out during daytime hours. It is noted that the predicted levels of construction noise at the nearest noise sensitive properties are below the evening, night-time and weekend criteria outlined in Section 11.2.1.1 also. It is accepted that the individual blast events would be audible at some locations. With respect to the EPA's criteria for description of effects, the potential worst-case associated effects at the nearest NSL associated with borrow pit activity during the construction phase are Direct, Negative, slight and temporary.

The above effects should be considered in terms that the effect is variable, and that this assessment considers the locations of the greatest potential impact.

Due to the distance of the construction works from sensitive locations significant vibration impacts would not have been expected even with isolated blasting events. Vibration from this aspect of construction activities would be imperceptible and would be significantly below levels where cosmetic or structural damage would occur.

11.4.2.1.4 Grid Connection & Overhead Lines

The grid connection for the site requires the connection route to pass from within the site boundary, across private lands, along sections of public road to connect with the Agannygal substation.

Construction activities are assumed to have been carried out during normal daytime working hours (i.e. weekdays 0700 – 1900hrs and Saturdays 0700 – 1300hrs).

Table 11-19 outlines the noise levels associated with typical construction noise sources for the grid connection works, with noise sensitive locations assumed to be situated some 50m from the works along the route of the overhead line. Also presented in the table are the calculated noise levels at varying distances which reflect further distant NSLs.

Table 11-19 Indicative Noise Levels from Construction Plant at Nearest NSL from the Grid Connection Works

Item (BS 5228 Ref.)	Predicted Noise Level, (dB $L_{Aeq,1hr}$) at distance (m)			
	50	100	200	500
Wheeled loader (C2.28)	55	50	44	38
Tracked excavator (C2.8)	50	44	38	32
Dozer (C2.13)	57	52	46	40
Dump truck (C2.30)	58	53	47	41
Road Roller (C2.30)	55	49	43	37
HGV Movements (20 per hour)	39	33	27	21
Total Construction Noise	65	59	53	47

At the nearest distance assessed, the predicted total construction noise levels from overhead line construction activities are of the order of 65dB $L_{Aeq,T}$, which just comply with the significance threshold of 65dB $L_{Aeq,1hr}$. As these works progressed at distances further from NSLs along the route the worst-case predicted impacts would have reduced as demonstrated above. It is envisioned that they would have been at the closest position to the nearest NSLs for no more than 2 to 3 days. It should be noted the nearest distance from the overhead ling to an occupied dwelling is 380m. Predicted construction noise levels at such a distance are comfortably within the significance threshold of 65dB $L_{Aeq,1hr}$.

With respect to the EPA's criteria for description of effects, the potential worst-case associated effects at the nearest NSL associated with borrow pit activity during the construction phase are described as negative, slight and temporary.

The above effects should be considered in terms that the effect would have been variable and that this assessment considered the locations of the greatest potential impact.

11.4.2.1.5 Substations

Table 11-20 outlines the noise levels associated with typical construction noise sources assessed in this instance along with typical sound pressure levels from BS 5228 – 1. The closed noise sensitive location to substation (i.e. Agannygal installation) is some 520 from the works at the substation. Table 11-20 outlines the noise levels associated with typical construction noise sources for these works.

Table 11-20 Indicative Noise Levels from Construction Plant at Various Distances from the Road Works

Item (BS 5228 Ref.)	Activity/Notes	Plant Noise Level at 10m Distance (dB $L_{Aeq,1hr}$)	Predicted Noise Level at 550m (dB $L_{Aeq,1hr}$)
HGV (C.2.30)	Removing spoil and transporting fill and other materials.	79	45

Item (BS 5228 Ref.)	Activity/Notes	Plant Noise Level at 10m Distance (dB $L_{Aeq,1hr}$)	Predicted Noise Level at 550m (dB $L_{Aeq,1hr}$)
Tracked Excavator (C.4.64)	Removing soil and rubble in preparation for foundation.	77	43
General Construction (Various)	All general activities plus deliveries of materials and plant.	70-84	50
Dewatering Pumps (D.7.70)	If required.	80	46
JCB (D.8.13)	For services, drainage and landscaping.	82	48
Vibrating Rollers (D.8.29)	Road surfacing.	77	45
Total Construction Noise (cumulative for all activities)			54

The predicted noise levels from construction activities are in the range 43 to 45dB $L_{Aeq,1hr}$ at the nearest noise sensitive locations, with a total construction noise level of approximately 54dB $L_{Aeq,1hr}$.

The predicted noise levels are below the construction noise criterion identified in Section 11.2.1.1 (i.e. 65dB $L_{Aeq,1hr}$) which indicates that the construction of substations did not give rise to significant noise effects. It is understood construction works of the Project were carried out during daytime hours.

Due to the distance of the construction works from noise sensitive locations significant vibration impacts would not have been perceptible and would have been significantly below levels where cosmetic or structural damage would occur. In terms of these construction activities, the associated likely effect was Direct, Negative, Slight and Temporary.

11.4.2.2 Works associated with peat slide 2003/2004

In terms of construction works associated with the peat slide event it is considered that construction of the various barrages illustrated on Figure 11-16 and the extraction of required material from borrow pit 3 within the wind farm site and the borrow pit adjacent to barrage 1 require comment in this instance.

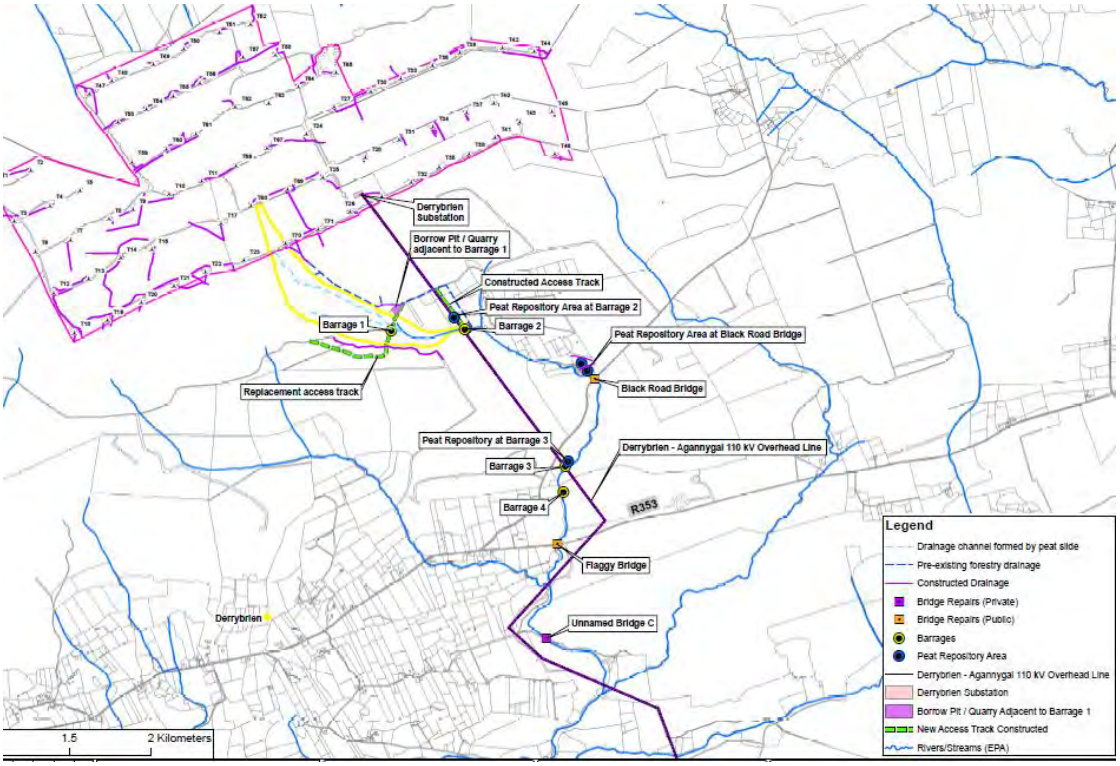


Figure 11-16 Peat Slide Barrage Locations

Assuming an excavator operating at each of the barrages at the same time (i.e. a worst-case assumption) and works are ongoing at the borrow pit adjacent to barrage 1 construction noise levels have been predicted to the nearest noise sensitive locations. The predicted noise contour from the peat slide operations is presented in Figure 11-17. which illustrates the construction noise contour associated with the borrow pit activities. The closest noise sensitive properties fall within the 35 to 45dB LAeq,1hr contour with other locations having predicted noise levels less than 35dB LAeq,1hr associated with them in relation to borrow pit operations. The only exception to this statement relates to Locations R38 and R39 which fall within the 45 to 55dB LAeq,1hr contour. The predicted noise levels are below the construction noise criterion identified in Section 11.2.1.1 (i.e. 65dB $L_{Aeq,1hr}$) which indicates that these construction activities did not give rise to significant noise impact. It is noted that the predicted levels of construction noise at the nearest noise sensitive properties are below the evening, night-time and weekend criteria outlined in Section 11.2.1.1 also.

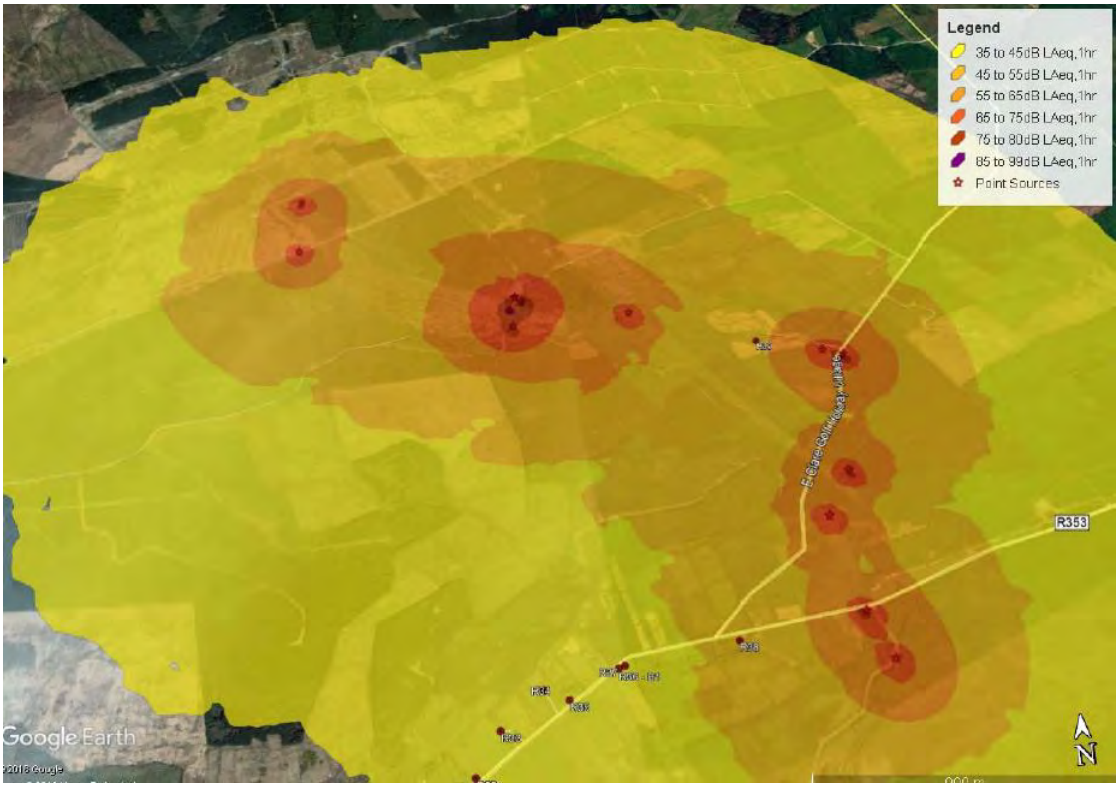


Figure 11-17 Peat Slide Works – Construction Noise Contour

With respect to the EPA's criteria for description of effects, the potential worst-case associated effects at the nearest NSL associated with works related to the peat slide activity during the construction phase are Negative, Slight and Temporary.

Due to the distance of the works from sensitive locations significant vibration impacts would not have been expected. Vibration from this aspect of construction activities would be imperceptible and would be significantly below levels where cosmetic or structural damage would occur.

11.4.2.3 Construction Vibration

Due to the distance of the proposed works from sensitive locations vibration effects are not likely at any NSL. The vibration effects were Direct, Neutral, Imperceptible and Short-term.

11.4.2.4 Construction Phase 2 – 2004 to 2006

The noise and vibration effects determined for Phase 1 of the construction are also representative of Phase 2. i.e., the remainder of the construction period after the peat slide works.

11.4.2.5 Construction Phases Mitigation Measures

As no significant effects were identified, there was no need for exceptional mitigation measures in respect of construction noise or vibration. A number of general measures were implemented in order to follow good construction practice:

- Plant used onsite during the construction phase was maintained in a satisfactory condition and in accordance with manufacturer recommendations. In particular, exhaust silencers were fitted and operating correctly at all times.
- Machinery not in active use was shut down.

11.4.2.6 Construction Phases Residual Effects

The following table lists the elements of the works assessed and summarises the findings. No significant effects were identified. The findings of the assessment are summarised in Table 11-21.

Table 11-21 Summary of Noise assessment of Construction Phase 1

Element of Works	Quality	Significance	Duration
Wind Turbine Bases and Hard Standings	Negative	Slight	Short-term
Internal Wind Farm Roads & Temporary Roads	Negative	Slight	Temporary
Borrow Pits	Negative	Slight	Temporary
Grid Connection & Overhead Lines	Negative	Slight	Temporary
Substations	Negative	Slight	Temporary
Vibration generating activities	Neutral	Imperceptible	Short-term

11.4.3 Operation and Maintenance Phase Impacts (2006 – 2022)

During the operational phase of the Derrybrien Wind Farm, wind turbine noise levels were directly determined through measurement at NSL Ref. R35. The measurements and analysis were carried out according to guidance in *IOA*GPG *Supplementary Guidance Note 5: Post Completion Measurements* (July 2014). The analysis determined that the Derrybrien Wind Farm Development was operating within the noise criteria. The noise and vibration effects were therefore direct, negative, not significant and long-term.

11.4.4 Ceased Operation Phase Impacts (2022-Present)

No wind farm noise has been generated during this phase, therefore there has been no noise or vibration effects from the Retained Development. The noise and vibration effects were neutral, imperceptible and long-term.

11.4.5 Impacts of Retained Development

The full description of elements to remain in situ, the Retained Development, is included in Chapter 4. There are no noise-generating elements of the Retained Development, therefore there are no noise or vibration effects. The noise and vibration effects are neutral, imperceptible and long-term.

11.4.6 Cumulative and In-Combination Effects

11.4.6.1 Cumulative Effects which have occurred during construction and operation

In relation to the construction phase, there were no other developments of scale at that time that were likely to have given rise to a significant cumulative noise or vibration impact.

In relation to the operational phase (2006 to 2022), the Sonnagh Old Wind farm was also operational during the noise compliance survey discussed in Section 11.4.3 above. As the determination of both analyses was that the wind turbine noise levels, predicted and measured, were within the wind turbine noise criteria, the cumulative effect are negative, not significant and long-term.

11.4.6.2 Cumulative Effects with the "Prospective Development"

The Prospective Development refers to the decommissioning of Derrybrien Wind Farm Development which is the subject of a concurrent separate application.

As there are no noise or vibration effects associated with the Retained Development, there is no potential for cumulative noise or vibration effects with the Prospective Development.

11.4.6.3 Cumulative Impacts with other developments.

Similarly, as there are no noise or vibration effects associated with the Retained Development, there is no potential for cumulative noise or vibration effects with other developments.

11.5 Conclusion

During the construction phase, due to the distance of the construction works from noise sensitive locations, significant vibration impacts would not have been perceptible and would have been significantly below levels where cosmetic or structural damage would occur. In terms of these construction activities, the associated likely effect was negative, slight and temporary. Due to the distance of the construction works from noise sensitive locations there were no significant noise effects during the construction phase. Residual effects were, at worst, negative, slight, and short-term.

During the operational phase of the Derrybrien Wind Farm, wind turbine noise levels were directly determined through measurement at NSL Ref. R35. The analysis determined that the Derrybrien Wind Farm was operating within the noise criteria. There was no noise generated by the Retained Development during the Operation and Maintenance Phase of the Derrybrien Wind Farm. There were no vibration effects during the Operation and Maintenance Phase.

No wind farm noise has been generated during the ceased operational phase, therefore there has been no noise or vibration effects from the Retained Development. There are no noise-generating elements of the Retained Development, therefore there are no noise or vibration effects.

As there are no noise or vibration effects associated with the Retained Development, there is no potential for cumulative noise or vibration effects with other developments.

12. CULTURAL HERITAGE

12.1 Introduction

12.1.1 Chapter Scope

This chapter assesses potential impacts on the known and potential cultural heritage resource resulting from the Project as described in Chapter 4 (Project Description). The tangible elements of the cultural heritage resource can be divided into the archaeological resource comprising sites and monuments dating from the prehistoric period to the post-medieval period and the architectural heritage resource, encompassing standing structures and sites of cultural importance often dating to the post-medieval and modern periods. The intangible elements of the cultural heritage resource include assets such as local placenames, language, folklore, traditions and historical associations. The study area reviewed as part of this assessment is detailed in Section 12.2.1.

12.1.2 Statement of Authority

This chapter was prepared by Tony Cummins, Senior Archaeologist with John Cronin and Associates. Mr Cummins holds B.A. and M.A. degrees in archaeology (University College Cork (UCC) 1992/1994) and has accumulated thirty years industry experience. He has been approved as a licence eligible archaeologist by the National Monuments Service and has extensive experience in the preparation of archaeological, architectural and cultural heritage assessments for renewable energy projects.

12.1.3 Relevant Legislation

This chapter has been prepared in accordance with the requirements of European Union Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment (the 'EIA Directive') as amended by Directive 2014/52/EU. The requirements of the following legislation are complied with:

- Directives 2011/92/EU and 2014/52/EU on the assessment of the effects of certain public and private projects on the environment, including Circular Letter PL 1/2017: Implementation of Directive 2014/52/EU on the effects of certain public and private projects on the environment (EIA Directive).
- S.I. No. 349 of 1989: European Communities (Environmental Impact Assessment) regulations and subsequent amendments; and S.I 600 of 2001 Planning and Development Regulations and subsequent amendments, on the assessment of the effects of certain public and private projects on the environment.
- S.I. No. 296 of 2018: European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018 which transposes the provisions of Directive 2014/52/EU into Irish law.
- Historic and Archaeological Heritage and Miscellaneous Provisions Act 2023
- National Monuments Act 1930 (as amended).
- Planning and Development Act 2000 (as amended).
- The Heritage Act 1995 (as amended).
- National Cultural Institutions Act (1997).

The management and protection of the cultural heritage resource in Ireland is achieved through a framework of international conventions and national laws and policies. This framework was established in accordance with the provisions of the 'European Convention on the Protection of the Archaeological Heritage' (the Valletta Convention) and the 'European Convention on the Protection of Architectural

Heritage' (Grenada Convention). Both of these conventions were ratified by the Republic of Ireland in 1997. While there is no current national legislation providing legal protection for the Irish intangible heritage resource it is noted that the UNESCO Convention for the Safeguarding of the Intangible Cultural Heritage, 2003, which seeks to safeguard and promote awareness of this element of cultural heritage, was ratified by Ireland in 2015.

The administration of national policy in relation to archaeological heritage management is the responsibility of the National Monuments Service (NMS) which is currently based in the Department of Housing, Local Government and Heritage.

The Historic and Archaeological Heritage and Miscellaneous Provisions Act 2023 was signed into law on October 13th, 2023. The Department of Housing, Local Government and Heritage circulated a guidance document[1] in relation to this Act in November 2023 which provides an overview of its current status, and this is summarised hereafter. While the Act is now law most of its provisions will not enter into force until the Minister has made one or more "Commencement Orders". This means that section 7 of the Act (which provides for the repeal of the National Monuments Acts 1930 to 2014 and related legislation) has not commenced . Accordingly, the National Monuments Acts 1930 to 2014 and other legislation which section 7 of the Act will, when it comes into force, repeal, remain fully in force as they stood on 13th October and will continue to do so for the time being. The Act contains transitional provisions which will, if necessary, enable certain aspects of the existing National Monuments Acts 1930 to 2014 to continue in operation notwithstanding their repeal post-commencement of the Act while successor provisions are being brought fully into operation. This includes provisions enabling the Record of Monuments and Places to continue to have effect pending the establishment of the new Register of Monuments (see section 48 of the Act). A commencement order made on 31st May 2024 which related to the Architectural Heritage (National Inventory) and Historic Monuments (Miscellaneous Provisions) Act 1999 (other than section 5), has come into operation.

The National Monuments Act of 1930, and its Amendments, therefore, currently remain the primary means of ensuring the satisfactory protection of the archaeological resource. They include a number of provisions that are applied to secure the protection of archaeological monuments. These include the designations of nationally significant sites as National Monuments, the Register of Historic Monuments, the Record of Monuments and Places, the Sites and Monuments Record, and the placing of Preservation Orders and Temporary Preservation Orders on endangered sites.

Section 2 of the National Monuments Act, 1930 defines a National Monument as 'a monument or the remains of a monument the preservation of which is a matter of national importance'. The State may acquire or assume guardianship of examples through agreement with landowners or under compulsory orders. The prior written consent of the Minister is required for any works at, or in proximity to, a National Monument in the ownership or guardianship of the State, the Minister or a local authority, or those which are subject to a Preservation Order. There are no National Monuments or archaeological sites with Preservation Orders located within the study area.

The National Monuments (Amendment) Act, 1994 made provision for the establishment of the Record of Monuments and Places (RMP) which comprises the known archaeological sites within the State. The RMP, which is based on the earlier Register of Historic Monuments (RHM) and Sites and Monuments Record (SMR), provides county-based lists of all recorded archaeological sites with accompanying maps. All RMP sites receive statutory protection under the National Monuments Act 1994 and the National Monuments Service (NMS) must be given two months' notice in advance of any work proposed at their locations. There is one recorded, levelled archaeological site located within the wind farm site and there are eleven examples within the surrounding study area. The recorded and potential cultural heritage resource within a study area encompassing the wind farm site, including the peat slide remedial works, and the surrounding lands extending for 3km in all directions from its boundary, was

[1] *https://www.archaeology.ie/news/enactment-of-historic-and-archaeological-heritage-and-miscellaneous-provisions-act-2023-and*

reviewed. These recorded archaeological sites are listed in Table 12-5 and their inventory descriptions, as published by the Archaeological Survey of Ireland, are provided in **Appendix 12-1**.

The conservation principles of care and protection of architectural heritage and the facilitation of the listing of significant buildings of architectural heritage merit are set out in Part IV of the Planning and Development Act (2000). This requires planning authorities to maintain a Record of Protected Structures (RPS) of structures with special architectural, historical, archaeological, artistic, cultural, scientific, social or technical interest, to be included in their Development Plans. Any changes that materially affect the character of a protected structure require planning permission. A protected structure also includes the land and other structures within its curtilage. While the notion of curtilage is not defined by legislation, the Architectural Heritage Protection Guidelines for Local Authorities (Department of Arts, Heritage and the Gaeltacht 2011), describes it as the parcel of land immediately associated with a structure and which is (or was) in use for the purposes of the structure. There are no Protected Structures located within the substitute consent application boundary. There are two Protected Structures located within the surrounding study area and these are identified in Section 12.3.3 of this chapter. In addition, local authorities must provide for the preservation of places, groups of structures and townscapes of architectural heritage significance within their administrative areas through the designation of Architectural Conservation Areas (ACAs). There are no ACAs located within the study area.

The National Inventory of Architectural Heritage (NIAH) was established to record architectural heritage structures within the State. While inclusion in the NIAH does not provide statutory protection to a structure it is intended to advise local authorities on compilation of their Record of Protected Structures. The NIAH also includes a Designed Landscapes and Historic Gardens Survey which comprises a non-statutory, desk-based survey of such features. There are no NIAH-listed structures or lands located within the planning application boundary. There are three NIAH-listed structures within the surrounding study area, and these are identified in Section 12.3.3 of this chapter.

The County Galway Development Plan 2022-2028 includes a number of policy objectives in relation to the protection of the cultural heritage resource within the county. In relation to the archaeological resource, these include policy objectives such as the protection of recorded archaeological sites and their settings and visual amenity (Policy Objective ARC 4). The Plan also includes an objective that developments in the immediate vicinity of Recorded Monuments should be sensitively designed and sited in order to not detract from the monument or its visual amenity (Policy Objective ARC 9).

The Development Plan includes a number of policy objectives in relation to the protection of the architectural heritage resource, and its associated attributes, within the county including the protection of Protected Structures (Policy Objective AH 2), structures listed in the National Inventory of Architectural Heritage (Policy Objective AH 3), Architectural Conservation Areas (Policy Objective AH 4) and vernacular heritage (Policy Objective AH 6), local names (Policy Objective AH 7), designed landscapes (Policy Objective AH 10) and traditional building skills (Policy AH 13).

The Development Plan also contains a number of policy objectives in relation to the protection of the cultural heritage resource within the county including the protection and promotion of cultural heritage assets and the intangible cultural heritage resource (Policy Objective CUH 1), special places of historical interest (Policy Objective CUH 2) and the promotion and protection of local placenames (Policy Objective CUH 3). While the Site is not located within the County Galway Gaeltacht area, sections of the grid connection and turbine delivery routes do extend into the boundary of this area. The Development Plan includes a policy objective to protect the linguistic and cultural heritage of the Gaeltacht and to promote the Irish language (Policy Objective CUH 4).

12.1.4 Relevant Guidance

This chapter was prepared having regard, where relevant, to guidance contained in the following documents:

- Environmental Protection Agency (2022): Guidelines on the Information to be contained in Environmental Impact Assessment Reports.
- Department of Arts, Heritage and Gaeltacht (2011) Architectural Heritage Protection: Guidelines for Planning Authorities.
- Department of Arts, Heritage, Gaeltacht and the Islands (1999) Framework and Principles for the Protection of Archaeological Heritage.
- Office of the Public Regulator (2022) A Guide to Architectural Heritage.
- Office of the Public Regulator (2021) Archaeology in the Planning Process.
- International Council on Monuments and Sites (ICOMOS) (2011) Guidance on Heritage Impact Assessments for Cultural World Heritage Properties.

12.2 Methodology

12.2.1 Zone of Influence

There are no professional guidelines which define the extent of zones of influences or study areas required to assess the effects of the decommissioning of wind farm developments on the cultural heritage resource. The extent of the study areas used for this assessment are, therefore, informed by the years of experience and professional judgement of the specialist and are considered suitable for the assessment of potential effects on the cultural heritage resource.

The recorded and potential cultural heritage resource within a study area encompassing the wind farm site, including peat slide remedial works, and the surrounding lands extending for 3km in all directions, was reviewed. The extent of this study area was chosen in order to compile a comprehensive cultural heritage baseline for the location of the wind farm in order to inform the assessment of potential direct or indirect decommissioning effects on any cultural heritage constraints within its environs. A study area extending for 100m from either side of the Derrybrien-Agannygal 110kV Overhead line, Agannygal substation, and reinstatement works for the Ennis- Shannonbridge 110kV Overhead line was also reviewed to determine if the decommissioning of the grid connection has the potential to result in any direct or indirect effects on the locations and settings of any nearby cultural heritage constraints. Given the current absence of published guidance on the identification and/or assessment application of 'Zone of Influence' relevant to the cultural heritage resource, a rationale has been adopted that aimed to address the assessment of potential sensitivities of known constraints within the study area that may extend beyond their immediate settings or interact with constraints within the wider landscape, e.g., National Monuments and archaeological monuments that possess ritual alignments or which rely on intervisibility with other monuments as part of their setting.

12.2.2 Desktop Study

The assessment presents the results of a desktop study of relevant published sources and datasets undertaken in order to identify all recorded and potential archaeological, architectural and other cultural heritage sites/features/areas within the study area. The principal sources reviewed for the assessment of the recorded archaeological resource were the Sites and Monuments Record and the Record of Monuments and Places. The relevant Records of Protected Structures and the National Inventory of Architectural Heritage were consulted for assessing the locations of designated elements of the architectural heritage resource.

Other sources consulted as part of the desktop study included the following:

- Archaeological Inventory of County Galway, Vol. 1: West Galway: This publication presents summary descriptions of the recorded archaeological sites within this area of the county and relevant entries are included within the chapter. In addition, the current national online database resources pertaining to recorded sites were reviewed on the National Monuments Service's Historical Environment Viewer.
- Heritage Council of Ireland Map Viewer: This online mapping source collates various cultural heritage datasets provided by, among others, the National Monuments Service, the National Museum of Ireland, Local Authorities and the Office of Public Works.
- Topographical Files of the National Museum of Ireland: These files comprise paper and digital records of known information on Irish artefacts, including their discovery locations. The file archive is stored in the museum premises in Kildare Street, Dublin and was inspected as part of the assessment.
- Database of Irish Excavation Reports: This online database contains summary accounts of archaeological site investigations carried out in Ireland (North and South) from 1970 to present.
- Literary Sources: Various published sources were consulted in order to assess the archaeological, historical, architectural heritage and folklore record of the study area.
- Cartographic Sources: A review of available historic cartographic sources was undertaken, and these included the 17th-century Down Survey and various map editions published by the Ordnance Survey from the mid-19th century onward. Relevant extracts from the reviewed cartographic sources are provided within Section 12.3 of this chapter.
- Aerial and Satellite imagery: A review of available online imagery (Tailte Éireann, Google Earth and Bing Maps) of the study area was undertaken in order to review the extent of modern interventions and to ascertain if any traces of unrecorded archaeological sites were visible.
- Irish National Folklore Collection: A review was undertaken of transcribed material from the National Folklore Collection archive which has been digitised and published online at www.duchas.ie.
- UNESCO World Heritage Sites and Tentative List: There are two designated World Heritage sites in Ireland (Brú na Bóinne, Co. Meath and Sceilg Mhichíl, Co. Kerry) and a number of other significant examples have been included in a Tentative List (2022) that has been put forward by Ireland for inclusion. None of these designated or tentative sites are located within County Galway.

12.2.3 Site Walkover

The study area and surrounding study area were inspected in August 2018, October 2019 and February 2024 and were assessed in terms of historic landscape, land use, vegetation cover, presence and potential for previously undetected archaeological and architectural heritage sites. No difficulties were encountered during the inspections. The results of the site inspections are detailed in Section 12.3.5 and extracts from the photographic record are presented in **Appendix 12-2**.

12.2.4 Scoping and Consultation

A response to a scoping request was received from the Department of Housing, Local Government and Heritage on 6th November, 2024. The Department noted that the information provided was not sufficiently detailed to allow for a full assessment of the archaeological implications of this proposal, however the Department notes that an Archaeological Impact Assessment (AIA) is scoped into the proposed Environmental Impact Assessment (EIA) process as part of the overall Cultural Heritage Impact Assessment of the proposed development and will be carried out by John Cronin & Associates.

The supplied methodology indicates that this will incorporate a detailed desktop study and field inspection. In this regard, this Department awaits the results of the Cultural Heritage Impact Assessment (CHIA) and full Environmental Impact Assessment Report (EIAR) for the scheme before commenting further.

This EIAR chapter comprises a CHIA for the purposes of assessing the impact of the Prospective Development on Cultural Heritage.

12.2.5 Impact Assessment Methodology

Please refer to Chapter 1 of the rEIAR for details on the impact assessment methodology (EPA, 2002, 2003, 2015, 2017 and 2022). In addition to the above methodology the following summaries the methodological approach applied to the assessment of impacts on the cultural heritage resource.

The duration of effects is assessed based on the following criteria:

- Momentary (seconds to minutes).
- Brief < 1 day.
- Temporary <1 year.
- Short-term 1-7 years.
- Medium Term 7-15 years.
- Long Term 15-60 years.
- Permanent > 60 years.
- Reversible: Effects that can be undone through remediation or restoration.

The quality of an effect on the cultural heritage resource can be positive, neutral or adverse:

- Positive: a change which improves the quality of the cultural heritage environment, (e.g., increasing amenity value of a site in terms of managed access, signage, presentation or high-quality conservation/restoration and re-use of an otherwise vulnerable derelict structure).
- Neutral: no change or effects that are imperceptible, within the normal bounds of variation for the cultural heritage environment.
- Adverse Effect: a change which reduces the quality of the cultural heritage resource, (e.g., visual intrusion on the setting of an asset, physical intrusion on features/setting of a site).

The types of effect on the cultural heritage resource are described as follows:

- Direct Effect – where a cultural heritage site is physically located within the footprint of the EIA Development, which will result in its complete or partial removal.
- Indirect Effect – where a cultural heritage site or its setting in the landscape is located within the environs of the EIA Development.
- Cumulative Effect -The addition of many minor or insignificant effects, including effects of other projects, to create larger, more significant effects.
- 'Do-nothing Effects' - The cultural heritage environment as it would be in the future should the Project not be carried out.
- 'Worst-case' Effects - The effects arising from a Project in the case where mitigation measures substantially fail.
- Indeterminable Effects - When the full consequences of a change in the environment cannot be described.
- Irreversible Effects - When the character, distinctiveness, diversity or reproductive capacity of an environment is permanently lost.

- Residual Effects - The degree of environmental change that will occur after the proposed mitigation measures have taken effect.
- No predicted Effects: where the proposed development will not adversely or positively affect a cultural heritage site.

The magnitude of effect is based on the degree of change, incorporating any mitigation measures, on a cultural heritage asset and can be negative or positive. The magnitude is ranked without regard to the value of the asset according to the following scale: High; Medium; Low and Negligible and Unknown and has been informed by criteria published in the International Council on Monuments and Sites *Guidance on Heritage Impact Assessments for Cultural World Heritage Properties* (ICOMOS 2011) (Table 12-1).

The evaluation of the values of cultural heritage assets used for the purposes of assessment is not intended as definitive, but rather an indicator which contributes to a wider judgment based the individual circumstances of each asset. The value of all known or potential assets that may be affected by development are ranked according to the following scale: Very High; High; Medium; Low and Negligible. The factors for assessing the value of cultural heritage assets provided in Table 13.2 have regard to the ICOMOS *Guidance on Heritage Impact Assessments for Cultural World Heritage Properties* (ICOMOS 2011, 14-17). This guidance is intended as indicative and is used in combination with a consideration of the condition/preservation; documentary/historical significance, group value, rarity, visibility in the landscape, fragility/vulnerability and amenity value of the cultural heritage assets on a case-by-case basis. The significance of effects is then assigned based on the combined evaluation of effect magnitude and asset significance can be described as Profound, Very Significant, Significant, Moderate, Slight, Not Significant or Imperceptible (Tables 12-3 and Table 12-4).

Table 12-1 Criteria for assessment of magnitude of impact (PER ICOMOS 2011)

Level	Description
High	Most or all key archaeological or architectural materials affected such that the resource is totally altered. Comprehensive changes to setting. Comprehensive changes to setting. Changes to most or all key historic landscape elements, parcels or components; extreme visual effects; fundamental changes to use or access; resulting in total change to historic landscape character. Major changes to area that affect Intangible Cultural Heritage activities or associations or visual links and cultural appreciation.
Medium	Changes to many key archaeological or historic building materials/elements such that the resource is clearly/significantly modified. Considerable changes to setting that affect the character of the archaeological asset. Changes to the setting of a historic building, such that it is significantly modified. Change to many key historic landscape elements, parcels or components, visual change to many key aspects of the historic landscape, considerable changes to use or access, resulting in moderate changes to historic landscape character. Considerable changes to area that affect the Intangible Cultural Heritage activities or associations or visual links and cultural appreciation.

Level	Description
Low	Changes to key archaeological materials/historic building elements, such that the resource is slightly altered/slightly different. Slight changes to setting of an archaeological monument. Change to setting of a historic building, such that it is noticeably changed. Change to few key historic landscape elements, parcels or components slight visual changes to few key aspects of historic landscape; slight changes to use or access; resulting in limited change to historic landscape character. Changes to area that affect the Intangible Cultural Heritage activities or associations or visual links and cultural appreciation.
Negligible	Very minor changes to key archaeological materials or setting. Slight changes to historic building elements or setting that hardly affect it. Very minor changes to key historic landscape elements, parcels or components; virtually unchanged visual effects; very slight changes to use or access; resulting in very small change to historic landscape character. Very minor changes to area that affect the Intangible Cultural Heritage activities or associations or visual links and cultural appreciation.

Table 12-2 Guidance criteria for assessment of values of cultural heritage assets

Level	Description
Very High	World Heritage Sites (including Tentative List properties). Sites, buildings or landscapes of acknowledged international importance. Intangible associations with individuals or innovations of global significance.
High	Nationally designated sites, buildings and landscapes of significant quality, rarity, preservation and importance. Undesignated assets of the quality and importance to be designated. Assets that can contribute significantly to acknowledged national research objectives. Archaeological Landscapes with significant group value. Intangible associations with individuals or innovations of national significance.
Medium	Designated or undesignated assets that can contribute significantly to regional research objectives, including buildings that can be shown to have exceptional qualities in their fabric or historical associations. Conservation Areas and historic townscapes containing buildings that contribute significantly to its historic character. Intangible associations with individuals or innovations of regional significance.

Level	Description
Low	Assets compromised by poor preservation and/or poor survival of contextual associations. Assets of limited value, but with potential to contribute to local research objectives. Historic Townscape or built-up areas of limited historic integrity in their buildings and settings. Intangible associations with individuals or innovations of local significance.
Negligible	Assets with very little or no surviving archaeological interest. Landscapes with little or no significant historical interest. Buildings or urban areas of no architectural or historical note; buildings of an intrusive character.
Unknown	Assets whose importance has not been ascertained. Buildings with some hidden (i.e., inaccessible) potential for historic significance.

Table 12-3 Description of impact significance (PER EPA 2022)

Level	Description
Imperceptible	An effect capable of measurement but without significant consequences.
Not Significant	An effect which causes noticeable changes in the character of the environment but without significant consequences.
Slight	An effect which causes noticeable changes in the character of the environment but without affecting its sensitivities.
Moderate	An effect that alters the character of the environment in a manner that is consistent with existing and emerging baseline trends.
Significant	An effect which, by its character, magnitude, duration or intensity alters a sensitive aspect of the environment.
Very Significant	An effect which, by its character, magnitude, duration or intensity significantly alters most of a sensitive aspect of the environment.
Profound	An effect which obliterates sensitive characteristics.

Table 12-4 Significance of impacts matrix (PER EPA 2022)

Magnitude of Impact	**High**	Not Significant/ Slight	Moderate/ Significant	Significant/ Very Significant	Very Significant/ Profound
	Medium	Not Significant	Slight	Moderate/ Significant	Significant/ Very significant
	Low	Not Significant/ Imperceptible	Slight/ Not Significant	Slight	Moderate
	Negligible	Imperceptible	Not Significant/ Imperceptible	Not Significant/ Slight	Slight
		Negligible	**Low**	**Medium**	**High**
		Value/Sensitivity of the Asset			

12.2.6 Limitations/Difficulties Encountered

No difficulties were encountered during the compilation of this chapter.

12.3 Receiving Environment

12.3.1 Archaeological and Historical Context

12.3.1.1 Introduction

The following section presents summary details of the main periods within the Irish archaeological record with references to the recorded archaeological sites located within the study area. Datasets have been interrogated and retrieved from State Body organisations and are considered accurate and current per publicly available information, including the National Monuments Service's online Historic Environment Viewer[2] and the Database of Irish Excavations Reports[3] . The dating framework used for each period of the archaeological record is based on the Guidelines for Authors of Reports on Archaeological Excavations published by the National Monuments Service[4]

In summary, there are eleven recorded archaeological sites located within the 3km study area around the wind farm (Figure12-1). These are listed below (Table 12-5) and their published Archaeological Survey of Ireland descriptions are presented in **Appendix 12-1**. There are no Preservation Orders assigned to any of these sites, and none have been designated as National Monuments in State Care. The nearest National Monument in State Care to the wind farm site is Isert Kelly Castle (Nat. Mon. ref. 272) which is located approximately 9.7km to the northwest. There are no recorded archaeological sites with visual alignment attributes, such as megalithic tombs or stone circles, located within the study area. The locations of World Heritage Sites (Ireland) and the 2022 Tentative List of World Heritage Sites submitted by the Irish State to UNESCO were also reviewed and none are located within the environs of the study area.

[2] www.archaeology.ie
[3] www.excavations.ie
[4] https://www.archaeology.ie/sites/default/files/media/publications/excavation-reports-guidelines-for-authors.pdf

The recorded archaeological sites located within the study area comprise the recorded location of a levelled cashel (GA124-001—), which is within the wind farm site, a children's burial ground (GA115-007—), an enclosure (GA124-004—), a monumental structure (GA124-006—), two boundary mounds (GA124-009— and GA124-010—), a church site (GA124-013—) and a burial ground (GA124-005—) with an associated bullaun stone (GA124-005001-). Two other recorded sites within the study area have been reclassified as 'redundant records' by the Archaeological Survey of Ireland having been found upon inspection to be non-archaeological in origin (see Table 12-5 and **Appendix 12-1**). There is a notable paucity of recorded archaeological sites within the upland areas of Slieve Aughty when compared with the surrounding lowlands and this may reflect the poorer agricultural quality of this upland area combined with the development of peats that has the potential to obscure unrecorded, sub-surface archaeological sites.

The recorded location of the cashel site (GA124-001—) within the wind farm is adjacent to an access road in the northwest quadrant of the property. There are no surface remains of this site and the Archaeological Survey of Ireland records that it may have been destroyed by the forestry plantation that occupied its location prior to the construction of the wind farm. This site was not included in the RMP for Co. Galway published in 1997 and is not indicated as an archaeological site on the RMP map dated to the same year. The site is also not included in the archaeological assessment reports associated with the wind farm development in the late 1990s and the 2000s. The current online description of the site was uploaded to the National Monument Service's online Historic Environment Viewer in 2015 indicating that it was added to the SMR following construction of the wind farm. There are no other recorded archaeological sites located within 300m of the planning boundary.

There are no recorded archaeological sites located within the study area extending for 100m from either side of the grid connection route to Agannygal substation. The nearest recorded archaeological monument to this route is an enclosure (GA124-004—) located approx. 1.2km to the west of the overhead line. There are also no recorded archaeological sites located within the section of the study area extending 100m from either side of the Ennis- Shannonbridge 110kV Overhead line reinstatement works. There are no recorded archaeological sites located within 1km of the footprint of the peat slide, barrages and other remediation measures. The nearest example is a burial ground (GA124-005—) which is located approx. 1.9km to the southwest of Barrage 4 and 2.1km south of the peat slide area.

Table 12-5 Recorded archaeological sites with 3km of wind farm site

Monument No.	Classification	Townland	ITM E	ITM N	Distance from planning boundary
GA115-007—	Children's burial ground	BOHABOY	559265	707027	1,200m
GA124-001—	Cashel	KILBEG, BOLEYNEENDORRISH, DERRYBRIEN WEST, TOORMACNEVIN	558604	704783	Adjacent
GA124-003—	Redundant record	DERRYBRIEN EAST	560664	702452	350m
GA124-004—	Enclosure	DERRYBRIEN EAST	559959	701558	1,110m
GA124-005—	Burial ground	DERRYBRIEN EAST	559523	701748	1,340m

Monument No.	Classification	Townland	ITM E	ITM N	Distance from planning boundary
GA124-005001-	Bullaun stone	DERRYBRIEN EAST	559523	701748	1,340m
GA124-006—	Monumental structure	DERRYBRIEN NORTH	561505	705505	310m
GA124-008—	Redundant record	DERRYBRIEN WEST	558078	701714	2,220m
GA124-009—	Boundary mound	BOLEYNEENDORRISH, GORTADRAGAUN	555320	705676	2,424m
GA124-010—	Boundary mound	GORTADRAGAUN, KNOCKOURA	555276	704791	2,330m
GA124-013—	Church	DERRYBRIEN WEST	559131	701888	1,680m
GA115-021—	Field boundary	DRUMMIN	564007	707618	1,890m

Figure 12-1 Locations of recorded archaeological sites and designated architectural heritage structures within study area

12.3.1.2 Prehistoric Periods

Until recent years the earliest recorded evidence for human settlement in Ireland dated to the Mesolithic period (7000–4000 BC) although recently discovered evidence of a butchery marks on c.12,500-year-old bear bone recovered from a cave site in Co. Clare suggests that humans were present on the island during the earlier Palaeolithic period. While the Mesolithic period hunter-gatherers did not construct any settlements or monuments that leave any above ground traces, their presence in an area can often be identified by scatters of worked flints in ploughed fields, shoreline shell middens and traces of temporary occupation sites occasionally uncovered during ground works. The archaeological record indicates that these nomadic groups tended to favour coastal, lake and river shorelines which provided a transport resource as well as a source for elements of their varied diet. The Neolithic period (4000-2400 BC) in Ireland began with the arrival and establishment of agriculture as the principal form of economic subsistence, which resulted in more permanent settlements within farmlands created within areas of cleared forestry. As a consequence of the more settled nature of agrarian life, new site-types, such as substantial rectangular timber houses and various types of megalithic tombs, as well as new artefacts, including pottery, begin to appear in the archaeological record during this period.

Metalworking arrived in Ireland with the advent of the Bronze Age period (c. 2400–500 BC) and saw the introduction of a new artefactual assemblage, including metal and ceramic objects, to the island. This period was also associated with the construction of new monument types such as standing stones, stone rows, stone circles and burnt mounds/fulachta fia. The development of new burial practices

during this period also saw the construction of funerary monuments such as cairns, barrows, boulder burials and cists. The arrival of iron-working technology in Ireland saw the advent of the Iron Age (600 BC – 400 AD). This period has traditionally been associated with a Celtic 'invasion' but recent archaeological evidence points instead to a gradual acculturation of the Irish Bronze Age communities following centuries of contacts with Celtic-type cultures in Europe. Relatively little was known about Iron Age settlement and ritual practices in Ireland until recent decades when the corpus of evidence has been greatly increased by the discovery of sub-surface sites dating to this period during archaeological investigations in advance of development projects. While there are no positively identified prehistoric sites located within the study area it does contain two boundary mounds (GA124-009— & GA124-010—) which may conceivably date from any period from prehistory onward.

The topographical files of the National Museum of Ireland (NMI) record the discovery of a number of potential prehistoric artefacts, including the notable six stranded amber necklace recovered from the Derrybrien area (NMI ref. 1954:11:1-448), within townlands in the study area which attest to human activity in the area during prehistory. A partial NMI dataset published on the Heritage Council of Ireland online mapping service[5] indicates the find location of the necklace within a now forested area located c.400m to the east of the planning boundary, but the potential exists that this is an indicative location.

Table 12-6 Recorded archaeological artifacts discovered in study area

Monument No.	Classification	Townland
1954:11:1-448	Derrybrien North	During turf-cutting on his bog in June 1954, Mr. Joseph McHugo of Derrybrien discovered a large number of amber beads and a gold clasp which he considered to be ancient because of their position at the bottom of the bog which had not been cut. (Td. Derrybrien North, par, Killeenadeema, bar. Loughrea, Co. Galway, OS 6", 124, 23.5cm. N 39.5 cm W). The find was made in an upland bog covering the slope of a hill in the Slieve Aughty mountain region near the 600-foot contour, the highest point registered in the vicinity being 1,207 feet. At the find spot the depth of the part was 30 to 35 cm, overlying bedrock with some loose gravel stones in between. The gold fragment and all the beads were collected and acquired by the National Museum.
1968:0017-18	Derrybrien South	Two polished stone axe heads. The first example was a flat triangular stone measuring 13cm long by 7.84cm in maximum width at the cutting edge,

[5] https://www.heritagemaps.ie/WebApps/HeritageMaps/index.html

Monument No.	Classification	Townland
		3cm at the butt and 2.1cm at the centre. A fragment of the butt of a second example was also recovered and measured 7.3cm long, 4.3cm wide and 1.6cm thick.
1965:81	Doonally	A bronze leaf sword with a dark green patina which is described in the file as being in fair condition although missing the tang and butt. The blade measured 41cm long with a maximum width of 2.7cm and had a pointed, oval section. The possible location of a rivet hole was indicated by an indentation on one side. This object was sourced from the Grierson Museum in Dumfries, Scotland with a recorded provenance in Doonally townland.

12.3.1.3 Early Medieval Period

This period began with the introduction of Christianity in Ireland and continued up to the arrival of the Anglo-Normans during the 12th century (c. 400–1169 AD). The establishment of the Irish church was to have profound implications for political, social and economic life and is attested to in the archaeological record by the presence of church sites, associated places for burial and holy wells. The early medieval church sites were morphologically similar to ringforts but are often differentiated by the presence of features such as church buildings, graves, stone crosses and shrines. This period saw the emergence of the first phases of urbanisation around the large monasteries and the Hiberno-Norse ports. However, the dominant settlement pattern of the period continued to be rural-based in sites such as ringforts, which comprise roughly circular enclosures delimited by roughly circular earthen banks formed of material thrown up from a concentric external ditch, and stone-built equivalents known as cashels which are concentrated in western counties. These monuments comprise one of the most numerous site-types in the Irish landscape and their early medieval names – rath/lios/dun - still form some of the most common place-name elements in the country. Archaeological excavations indicate that the majority comprised enclosed farmsteads with internal buildings and may be potentially have associated external field systems, stockades, barns, mills and drying kilns. The study area is located within the Slieve Aughtry region which according to tradition was named after Eachtra of the Tuath De Danann who was granted lands in the area by Fergus of Connacht as a wedding gift. The region around Gort was associated with Guaire Aidne Mac Colmáin, a 6th-century king of Connacht, and then with the 7th-century kingdom of the Uí Fiacrach Aidhne.

The study area contains the recorded location of a levelled cashel site (GA124-001—) which is located within the planning boundary. The Archaeological Survey of Ireland description of this site, which was uploaded to the Historic Environment Viewer in 2015, records that there were no surface traces of this monument visible when the area was inspected and that it may have been levelled during the creation of the forestry plantation (**Appendix 12-1**). The recorded location of this site is named 'Cashlaundrumlahan' on historic OS maps, which may refer to the summit of the hill of the same name which is at the labelled location and no trace of an enclosure is depicted on these cartographic sources.

The description also records that, according to local information, a 'double wall' once existed here but it was destroyed when the area was forested and that, while no visible surface trace survives, a curving trackway in this area may respect the circuit of the monument. As previously noted, this site was not included in the RMP for Co. Galway published in 1997 and is not indicated as an archaeological site on the SMR mapping dated to the same year. The site is also not included in the lists of archaeological monuments within the environs of the development presented in the archaeological assessment reports prepared as part of the planning applications for the wind farm in the late 1990s and the 2000s. The curving trackway referred to in the ASI description was created during the construction phase of the wind farm and it appears that this location was added to the SMR following the construction phase. The archaeological monitoring of ground works during the construction phases of the wind farm did not reveal any archaeological features at its recorded location, which comprised the location of a borrow pit, and there are also no references to the location in the Database of Irish Excavation Reports.

The surrounding 3km study area outside the planning boundary contains an enclosure site (GA124-004-—), which may potentially form the remains of an unclassified ringfort or cashel, and this is located c.2.78km to the south of the wind farm. The study area also contains a church site (GA124-013—) located approx. 2km to the south of the wind farm which is now occupied by the 19th-century St Patrick's Church. The presence of a bullaun stone (GA124-005001-) within a graveyard (GA124-005—) located approx. 400m to the southeast of this church is indicative of the presence of early ecclesiastical activity within that area.

12.3.1.4 Late Medieval, Post Medieval and Early Modern Periods

The arrival and conquest of large parts of Ireland by the Anglo-Normans in the late 12th century broadly marks the advent of the Irish high medieval period which continued to c.1400 and was followed by the late medieval period which extended to c.1550. These periods saw the continuing expansion of Irish urbanisation as many of the Viking port towns developed into international trading centres.By the 15th century the native Irish chieftains and lords began to construct tower houses as fortified residences within their landholdings and many towns and villages began to develop as local trading centres. The study area is located 12.7km north north east of Gort town, which was the principle residence of Sir Roger O'Shaughnessy, Lord of Kineal Aedh, during the 16th century. There are no recorded archaeological sites definitively dated to these periods located within the study area.

The centuries following 1550 are referred to as the post-medieval period, which is generally considered to continue into the middle of the 19th century and the period thereafter is described as early modern. The 16th and 17th centuries were a turbulent time in Irish history with periods of war-shed between the 1560s-1603 and then during the Cromwellian Wars 1649–53 which resulted in the extensive dispossession of forfeited Gaelic lands. The Down Survey was compiled during the 17th century as part of the Cromwellian Plantation and shows that in 1641, the majority of the lands (in what was then referred to as the 'Derybrine Mountain' area) were classified as unprofitable. An agricultural boom in the late 18th and early 19th centuries saw a rise in prices for both tillage and dairy produce which resulted in landlords investing in extensive land improvement works within their holdings to increase land productivity. This included extensive enclosure of open lands into bounded field systems many of which survive to the present-day. The settlement pattern throughout much of the Irish rural landscape was greatly affected by de-population during the famine period in the middle of the 19th century.

The post-medieval period saw the development of high and low status stone houses throughout the Irish countryside and rural settlement clusters at this time typically consisted of single-storey thatched cottages with associated farm buildings while two-storey farmhouses became more common during the 19th century. Remote uplands areas, including landscapes similar to that occupied by the wind farm, may also contain the remains of post-medieval features such as booley huts and small fields or stockade enclosures associated with seasonal agricultural practices that may not always be depicted on historical maps. It is likely that the extensive 20th century forestry plantation within the study area would have removed traces of any such features on the Derrybrien hillsides. The Tithe Applotment Books of 1825 list thirteen families in the Derrybrien area indicating that the general area was sparsely populated at

that time. Further details on the context of the study area during the post-medieval and early modern periods are presented in the review of historical cartographic sources (Section 12.3.2).

The study area contains a monumental feature known locally as the 'Earl's Chair' (GA124-006—) which was an early 19th-century folly feature associated with the Earl of Clanrickarde. Its recorded location is within an area of commercial forestry located at a distance of 310m outside the east end of the planning boundary. It has also been recorded that the remains of the feature now survive as a cluster of flat slabs with only one set upright and its location marked the convergence of five separate landholdings (Fitzpatrick 2004). Local tradition records that the feature was used by the Earl as a vantage point for surveying his lands in the area and that a popular fiddle tune entitled 'The Earls Chair' was composed by a local musician, Packie Moloney, as he rested on the rock (Fuller 2014). A children's burial ground (GA115-007—) of potential post-medieval date is located in Bohaboy townland at a distance of approx. 1.2km to the north of the planning boundary. While these types of burial ground are often associated with the 19th-century Famine period this example is present on the 1st edition 6-inch map, which labels it as 'Knockalaghta Graveyard', demonstrating that it pre-dated the 1840s famine and may potentially indicate the presence of an earlier ecclesiastical site at this location. The following descriptions of the Derrybrien area and the Parish of Killeenadeema were published in the 1830s (Lewis 1837).

> *DERRYBRIEN, an extra-parochial place, in the barony of LOUGHREA, county of GALWAY, and province of CONNAUGHT, about 9 miles (S.) of Loughrea; containing 907 inhabitants. It consists of a range of mountains of the same name, extending from Gort to Woodford, and partly separating the southern part of the county from Clare: there is a good road over them from Woodford to Gort. Here is a R. C. chapel, dependent on that of Killeenadeema.*
>
> *KILLEENADEEMA, or KILNADEEMA, is a parish, in the barony of LOUGHREA, county of GALWAY, and province of CONNAUGHT, 3 miles (S. by W.) from Loughrea; containing 3554 inhabitants. This parish comprises a considerable portion of the Derrybrian mountains and contains 1854 statute acres applotted under the tithe act. It is a vicarage, in the diocese of Clonfert, with the greater portion of the rectory united, together forming part of the union of Loughrea; the remainder of the rectory is appropriate to the deanery of Clonfert ; .... In the R. C. divisions it is the head of a union or district, comprising also the parish of Kilteskill, and containing chapels at Kildeema, Derrybrian, and Ayle, About 210 children are educated in three public schools, to each of which the Earl of Clancarty contributes £(?)5 annually, and about 120 are taught in two private schools.*

12.3.1.5 Previous Archaeological Assessments

An Environmental Impact Statement (EIS) prepared for the wind farm development in 1997 contains an archaeological assessment which was prepared by Matt Hodd[6]. This noted that a cairn indicated within the wind farm site on historic OS maps appeared to have been removed by forestry works. The assessment concluded that while no extant traces of archaeological sites or features were identified within the forestry that occupied the proposed wind farm site, ground works during the construction phase would have the potential to impact on any unrecorded, sub-surface archaeological sites that may exist within the landholding. The assessment, therefore, recommended that an archaeologist be employed to monitor the construction phase of the wind farm. The grants of planning permission for the wind farm development issued by Galway County Council and An Bord Pleanála included conditions requiring archaeological monitoring of ground works during the construction phase.

6 http://gccapps.galwaycoco.ie/ViewPlanningDocuments/ViewPDF?ref=781951

The Database of Irish Excavation Reports contains an entry describing licensed monitoring of the excavation of geotechnical pits within the wind farm which states that nothing of archaeological significance was identified within the investigated areas (see Table 12-7: Licence 01E0763).

While the Database does not contain any entries for the construction phase of the wind farm, consultation with the National Monuments Service's Archive Unit revealed a 2005 archaeological report prepared by Eoghan Kieran of the Moore Group describes the results of the constant supervision of ground works required for the turbine bases, hardstands and internal cables between 2004-5 (Excavation Licence 03E1069). This report provides a summary archaeological baseline context for the development area followed by a written and photographic record of the monitoring works and concludes by stating that no archaeological material, finds or features were identified within the site. The report also states that an earlier programme of archaeological monitoring associated with the initial phase of the wind farm construction was carried out. While the report on the first phase of archaeological monitoring could not be sourced, the archaeologist (Christopher Read) who undertook this work was consulted and provided a written confirmation that nothing of archaeological significance was identified in any area of the site. A report submitted by ESB International to Galway County Council as part of an extension application for the wind farm (planning ref. 05/317) lists a site archaeologist among the staff attending site works during this phase[7]. The report also states that archaeological monitoring of the construction of roads and turbine bases would continue during the proposed extension period. The National Monuments Service Archives Unit also provided a copy of a second Moore Group report which presents an archaeological assessment of the location of the peat slide and proposed remedial works at the peat depository at Black Road bridge (NMS ref. 05N0467). This assessment report concludes that no recorded archaeological sites or any potential unrecorded examples were identified within the assessed lands.

Archaeological monitoring of the construction of a wind farm development in Sonnagh Old townland, approx. 4.5km to the north of Derrybrien wind farm, as well as roadways within the proposed Kilderry wind farm approx. 3km to the west revealed nothing of archaeological significance (Table 12-7).

Table 12-7 Database of Irish Excavation Reports Entries

Townland	Excavation Licence No.	Database Entry
Derrybrien North	01E0763	The digging of eight site investigation pits in advance of a wind turbine plant across the top of Cashlaundrumlahan in the Slieve Aughty Mountains, c. 13km east of Gort, was monitored in September 2001. The pits revealed the extent and nature of the blanket bog on the mountain, but no archaeological features or artefacts were exposed. All further groundwork on site relating to the construction of the wind turbines is to be monitored. Archaeologist: Kenneth Wiggins

7 http://gccapps.galwaycoco.ie/ViewPlanningDocuments/ViewPDF?ref=789379

Townland	Excavation Licence No.	Database Entry
Sonnagh Old	02E1264	The proposed development, which consists of a substantial wind farm involving the construction of ten wind turbines and several kilometres of new access roads, is situated 8km south-west of Loughrea, Co. Galway, along a ridge of low hills that forms the northern limit of the Slieve Aughty Mountains. The site is in a large state-owned forestry planted on blanket bog 1–2m deep. There are no known monuments in the vicinity. A strategy of testing and monitoring was used to investigate the site. No archaeological features, finds or deposits were uncovered. Archaeologist: Christopher Read
Keelderry	11E0289	Planning permission was granted by An Bord Pleanála, subject to compliance with the relevant planning conditions, for a 48-turbine wind farm at Keelderry. Construction works commenced on the site in 2007 and consisted of topsoil-stripping of the road network (monitoring was undertaken by another archaeological firm). Monitoring of site investigations was undertaken over one day in 2011. No monitoring of the remainder of the groundworks took place in 2011, as an extension to the planning lifetime of the site was granted to the client. Archaeologist: Annette Quinn

12.3.1.6 Cartographic Sources

The detail on historic cartographic sources can demonstrate the nature of past settlements and land use patterns within a study area in recent centuries and may also highlight the impact of modern developments. This information can aid in the identification of the location and extent of unrecorded or partially levelled features of archaeological or architectural heritage interest. The cartographic sources examined for the study areas comprised the available 17th century Down Survey mapping (Figure 12-2), the 1st edition 6-inch OS map (published 1841) (Figure 12-3) and the 2nd edition 6-inch map (published 1920) (Figure 12-4). The area containing the wind farm is not covered by the 25-inch OS map series (surveyed 1888-1913) although a section of the lands containing the overhead line is depicted and was reviewed part of the assessment.

The study area is located in the Barony of Loughreagh and, while the 17th-century Down Survey map of this territory does not survive, it is shown as a vacant upland area on the larger scale mapping compiled as part of the survey (Figure 12-2). There were no features of archaeological or architectural heritage significance identified within the wind farm or its close environs during the inspection of the available historic OS maps. The 1st edition 6-inch map published in 1841 depicts the wind farm site and its environs as vacant upland heath with enclosed field systems located in the surrounding lowlands (Figure 12-3). The approximate recorded location of the cashel site (GA124-001—) in the northeast corner of the wind farm is indicated as 'Cashlaundrumlahan', but no enclosure indicating the presence of an archaeological site at this location is illustrated and it is possible that the label may indicate the adjacent marked summit of the hill bearing the same name. The historic OS maps of the locations of the peat slide, remedial works, overhead line,Agannygal substation and the Ennis- Shannonbridge 110kV Overhead line reinstatement works were also reviewed and no potential unrecorded archaeological or architectural heritage features were noted on the footprints of these areas or within their close environs. The consulted 2nd edition OS map of the published in 1920 indicates that the wind

farm site remained as vacant heathland during the first half of the 20th century although some field enclosures are shown extending up the hillslopes and encroach into the north end of the site (Figure 12-4).

Figure 12-2 Extract from 17th century Down Survey map with general location of study area highlighted in red

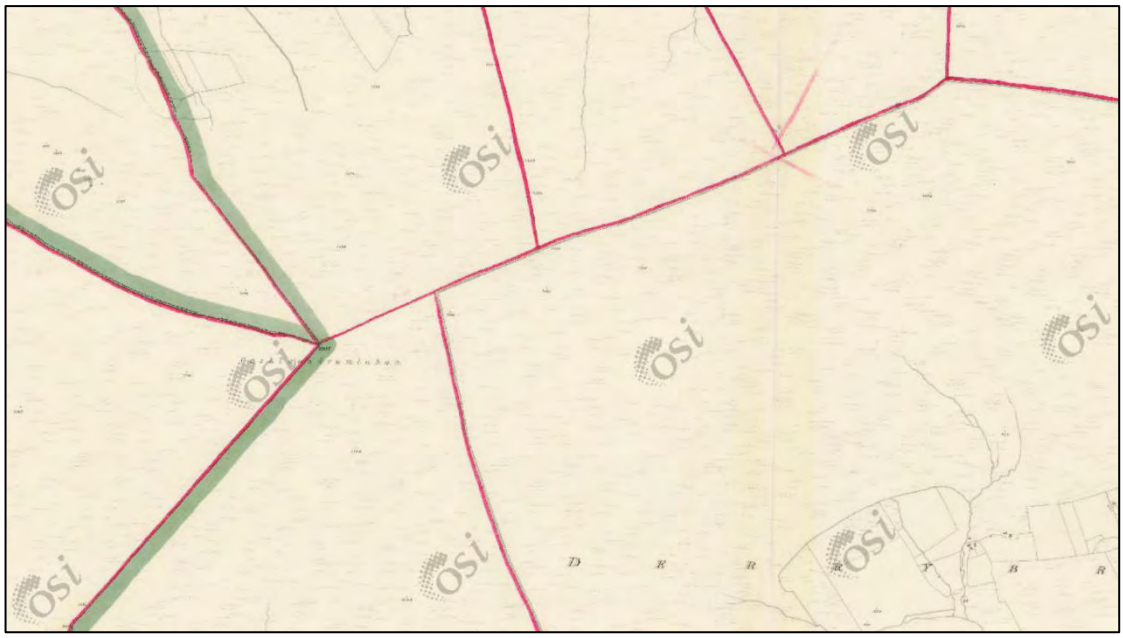


Figure 12-3 Extract from 1st edition 6-inch OS map (1841) showing location of wind farm

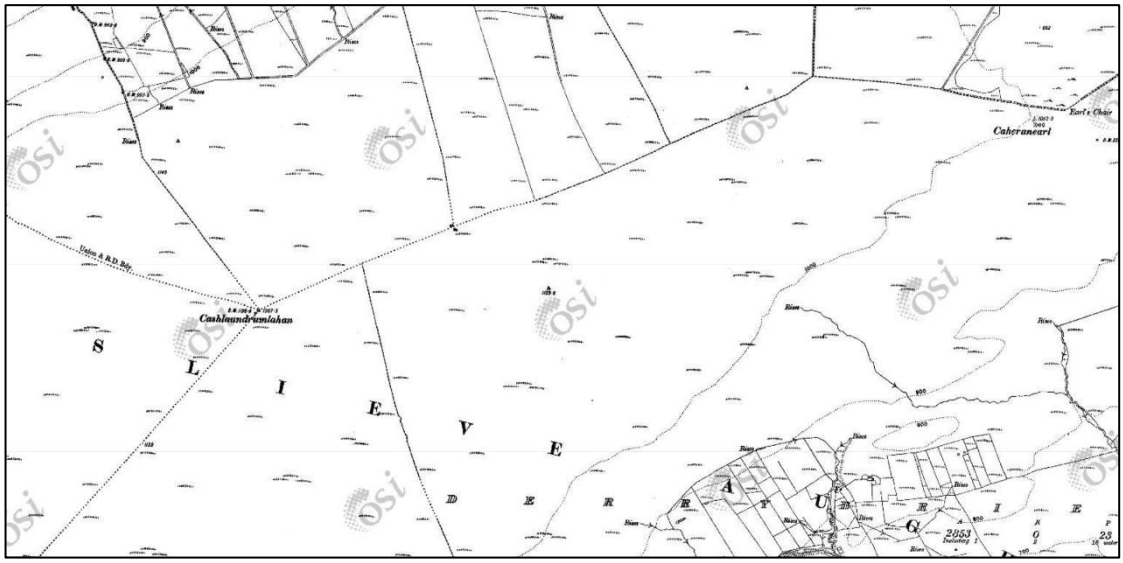


Figure 12-4 Extract from 2nd edition 6-inch OS map (1920) showing location of wind farm

12.3.2 Designated Architectural Heritage

The National Inventory of Architectural Heritage (NIAH) lists three structures within the study area. These are all located within the village of Derrybrien to the south of the wind farm and comprise St Patrick's church (NIAH 30412401), its associated gates, railings and walls (NIAH 30412403) and an 18th/19th century house (NIAH 30412403) (Figure 12-1). The church and its associated boundary features are also listed in the Record of Protected Structures published in the current County Galway Development Plan 2022-2028 (RPS refs 452/3594).

There are no built structures of any date indicated within the locations of the wind farm, peat slide, overhead line and substation shown on the consulted historical maps and no built structures pre-dating the wind farm development were noted during the site inspection of these areas.

Table 12-8 Designated architectural heritage structures with 3km study area

RPS ref.	NIAH ref.	Name/Type	ITM E	ITM N	Distance from planning boundary
n/a	30412403	House	599233	701867	1,580m
452	30212401	St. Patrick's Church	559084	701924	1,720m
3594	30412402	St. Patrick's Church Gates/railings/walls	559084	701881	1,720m

12.3.3 Undesignated and Intangible Cultural Heritage

12.3.3.1 Placename Evidence

Townlands are the smallest unit of land division in the Irish landscape and many may preserve early Gaelic territorial boundaries that pre-date the Anglo-Norman conquest. The layout and nomenclature of the Irish townlands was recorded and standardised by the work of the Ordnance Survey in the 19th century. The Irish translations of the townland names often refer to natural topographical features, but

name elements may also give an indication of the presence of past human activity within the townland. The translations of the townland names within the study area were sourced from www.logainm.ie and mainly record topographical features and associations with past landowners.

The wind farm is located within the Civil Parishes of Killeenadeema and Killinan and is in the Barony of Loughrea. Parishes comprise ecclesiastical administrative divisions originally introduced to Ireland in the 13th century and were adapted as the basis of civil divisions during 17th century land surveys. Townlands comprise the smallest unit of land division in the Irish landscape, with over 61,000 examples existing, and many may preserve early Gaelic territorial boundaries that pre-date the Anglo-Norman conquest. The layout and nomenclature of the Irish townlands was recorded and standardised by the work of the Ordnance Survey of Ireland (OSI) during the 19th century. The Irish roots of townland names often refer to natural topographical features but some may also indicate an association with archaeological sites, e.g. lios and rath are early Irish names for ringforts while kill and temple were used to refer to church sites.

The wind farm and grid connection route extend into the townlands of Derrybrien North, Derrybrien West, Derrybrien East, Boleyneendorrish, Toormacnevin, Bohaboy and Loughatorick North and the Irish origins and translations of these were sourced from the Placenames Database[8] (Table 12-9). While none of the townland names refer to archaeological sites, a number suggest the presence of native woodlands within the study area prior to the compilation of the OS maps in the 19th and 20th centuries which show the area dominated by open heathland and dispersed small field systems. The name of the hill in the west end of the wind farm, Cashlaundrumlahan ('castle of the broad ridge'), has been interpreted by the Archaeological Survey of Ireland as an indication of the former presence of a cashel site (GA124-001—) at this location.

Table 12-9 Translations of townland names

Townland	Irish Origin	Translation
Derrybrien North/West/East	Daraidh Braoin	'Breen's oak wood'
Boleyneendorrish	Buaile an Aon Dorais	'dairy of the one door'
Toormacnevin	Tuar Mhic Cnáimhín	'MacNevin's bleach or field'
Bohaboy	Botha Buí	'yellow road'
Loughatorick North	Loch an Tóraic Thuaidh	'lake of the ?'

12.3.3.2 Folklore

The School's Collection forms part of the National Folklore Collection and has been published online as part of the National Folklore Collection UCD Digitization Project[9]. It contains a number of records of stories and traditions associated with the Derrybrien area including an account of two locals encountering a group of men playing a midnight hurley match on the mountain between Derrybrien

[8] www.logainm.ie
[9] www.duchas.ie

village and Toormacnevin, which generally correlates to the general location of the wind farm site, who disappeared as they approached the match. The Collection also records stories relating to the famine period within the general area but no contains no examples that relate to the potential presence of unrecorded cultural heritage sites such as holy wells or other potential archaeological features.

12.3.3.3 Undesignated Architectural/Vernacular Heritage

The review of historical mapping sources indicates that there were no built structures at the locations of the wind farm, peat slide, remedial measures, grid connection route and Annyagal substation in the 19th century and no structures pre-dating the wind farm were noted during the site inspections of these areas. An undesignated bridge on the R353 road to the south of the wind farm, known as the Flaggy Bridge, was noted during the site inspection and is interpreted as being of local architectural heritage interest. This structure is described in the following section detailing the results of the site inspections (Section 12.3.2).

12.3.4 Site Inspections

The wind farm site, including the locations of associated off-site grid connection, peat slide and remedial works, and the surrounding study area were inspected in August 2018, October 2019 and February 2024. The wind farm is sited on a broad upland ridge, which prior to the construction of the wind farm consisted of open area of upland bog land in the eastern end and a commercial forestry plantation elsewhere. The environs of all internal elements of the wind farm development were inspected, i.e. turbines, road system, sub-station, masts and former borrow pits/quarries. A visual inspection of the grid connection and the locations of the peat slide and remedial works was also carried out during the site inspections.

The wind farm is located on the upper slopes of Cashlaundrumlahan Mountain within the Slieve Aughty range and comprises 70 wind turbines, an internal substation, three borrow pits (two infilled), two anemometers and a network of site access tracks. It occupies a gently sloping plateau aligned on a northeast to southwest axis with a summit elevation of 365mOD with a general gentle slope down towards the south. The site which commands extensive views of the landscape in all directions, especially over the lowlands to the south. The wind farm and its surrounds are characterised by upland blanket bog which in recent decades has been used for commercial forestry within the central and western parts of the site, with ongoing peat harvesting in unplanted turbary plots in the east side of the site.

It is noted that much of the wind farm, as well as the peat slide footprint and overhead line, were previously occupied by commercial forestry. The construction of the wind farm entailed the felling of approximately 222a of trees, including the removal of root networks, which was carried out by Coillte in advance of construction works. Much of the landscape around the wind farm still remain under extensive forestry plantations. A Heritage Council of Ireland archaeological study[10] of the impact of forestry plantations on known and sub-surface archaeological sites has noted that any archaeological sites, including sub-surface remains, that may have existed within modern forestry plantations are often removed or damaged by a combination of site preparation mounding works as well as the growth and subsequent removal of root networks. The study also noted the potential for greater levels of disturbance within plantations in upland peaty soils as the roots spread over a wider area in order to secure anchorage against the wind.

The location of a partially levelled 19th century folly structure known as the Earl's Chair, which is a recorded archaeological site (GA124-006—), is within an area of forestry located 310m outside the

[10] Johnson, G. 1998. *Archaeology and Forestry in Ireland.* The Heritage Council of Ireland

planning boundary. There are no visible traces of this feature from the nearest Coillte track which is 200m to the south of its location.

The location of Cashel GA124-001— exists as a level, soil-covered area flanked by an access track to the south and east which curves around its recorded location in the northwest corner of the wind farm (**Appendix 12-2**; Plate 12-10). This area was previously inspected by the Archaeological Survey of Ireland and was also inspected during the pre-development archaeological assessments of the proposed wind farm. No traces of potential archaeological features were noted in this area during any of these site inspections. No surface traces of stone spreads originating from a levelled enclosing wall or artefacts were identified during a walkover of this location undertaken as part of this assessment. The consulted site drawings of the wind farm indicate the location of Borrow Pit/Quarry 2 within the environs of this area which was subsequently infilled. There was no clear surface trace of this infilled pit feature noted during the site inspection, and it is noted that nothing of archaeological significance was identified in this area during archaeological monitoring of the construction of the wind farm.

The footprint of the wind farm turbines, roads, substation, overhead grid connection and ancillary works remains confined within the area of their original construction and, other than the remedial peat slide works, no areas of additional ground works, which may have had the potential to impact on unrecorded, sub-surface archaeological features, were noted during the inspection of the wind farm. Access roads/tracks within the site for the construction, operation and maintenance of the wind farm comprised approximately 14.6km of new floating access tracks, 0.9km of new non-floating access tracks (including access tracks rebuilt within the wind farm site at T68 and between T23 and T70 to replace sections of on-site floating roads damaged by the 2003 peat slide) and the upgrade of 2km of pre-existing floating roads. The extensive use of floating tracks across the peat surface would have likely avoided direct impacts on any potential archaeological sites or features buried beneath the peat deposits. There were localised surface repairs to some sections of tracks observed during the site inspection and these were typically confined to their existing footprint and no traces of excavations below their surfaces were noted in these areas. The wind farm contains approximately 39km open drainage channels, 27km of which were pre-existing and subject to improvement works while 12km new drains were constructed as part of the wind farm development. A visual inspection of a number of the earth-cut drain sections was carried out during the site inspection and no traces of potential buried archaeological features or deposits were noted. Localised clearance of tree regrowth within the vicinity of elements of the development has not resulted in any evident ground reduction works. The maintenance of the turbines and other elements of the wind farm development have not resulted in any evident ground works that have the potential to impact on sub-surface archaeological features. The south-facing hillslope on the footprint of the peat slide is now occupied by forestry regrowth and no traces of recent ground excavations works were noted in its vicinity (**Appendix 12-2**; Plate 12-13).

Access to the wind farm site continues to be gained from a Coillte access road via a minor public road known as the Black Road L-4214. There are no recorded archaeological sites or architectural heritage structures located along the road margins and no unrecorded examples were noted during the site inspection of this area. The small bridges on this road are of modern concrete construction with sections of recently constructed rubble masonry walling attached to the concrete slab parapets. The peat slide remedial work locations on the east and west sides of the road were inspected in advance of the works during the archaeological assessment prepared by the Moore Group and nothing of significance was identified. These locations and their environs were also inspected as part of the current assessment. The barrages comprise rock boulders set on existing ground and no potential unrecorded archaeological or architectural heritage features were noted at their locations or along their approaches from the road (**Appendix 12-2**; Plate 12-13). There are no recorded archaeological sites or designated architectural heritage structures located within the sections of the Coillte landholding impacted by access, drainage and barrage works undertaken within the vicinity of the peat slide, including a small borrow pit adjacent to Barrage 1, and the area remained under forestry at the time of inspection. A two-arch masonry road bridge, known as the Flaggy Bridge, over a stream flowing under a section of the R353 road to the southeast of the wind farm and to the south of the peat slide remedial works was also inspected (**Appendix 12-2**; Plate 12-18). While this bridge is not a Protected Structure and is not listed in

the National Inventory of Architectural Heritage, it is of potential 18th/19th century date and is of local architectural heritage significance. The structure contains round arches with tooled voussoirs, a central u-cutwater and low random rubble parapet walls. Repairs to the roadside parapet of this structure have not impacted on the underlying arches, which remain well-preserved, and have been undertaken with appropriate random rubble limestone material.

The locations of the overhead line (OHL) and Agannygal Substation were also visually appraised during the site inspections. The OHL measures c.7.8km in length and consists of 43 structures in total comprising 34 double wood pole sets and 6 angle masts, 1 intermediate mast and 2 end masts. It extends through felled sections of the forestry plantation (c. 33.1ha of felled forestry) that occupies the hillslopes extending down from the wind farm site and then continues southwards through cleared corridors within the modern forestry planted in a slightly undulating area of blanket bog land until it reaches the substation which is also within a cleared area of forestry. Apart from the footprint of the OHL structures and regrading under the 400kV line for clearance purposes, the ground levels within the felled corridor appear to have otherwise remained undisturbed during the construction of the overhead line and periodic cutting of regrowth which has not entailed root extractions. While the line extends over the Owendalulleegh River, no in-channel works were undertaken during its construction. The historic OS maps indicate that the section of the overhead line within lowlands to the south of Derrybrien were primarily composed of vacant bog land during the middle of the 19th century while small, dispersed field systems within reclaimed areas had begun to be developed by the end of that century and continued to expand into the 20th century until the area was extensively planted with the existing forestry. There are no farmyards or other built features shown on the footprint of the overhead line and substation on any of the historic OS maps and no unrecorded features were noted during the inspections. As previously noted, there are no recorded archaeological sites or designated architectural heritage structures located within the 100m wide study area centred on the overhead line and the nearest example is an enclosure site (GA124-004—) located approx. 1.2km to the west. The nearest recorded archaeological site to the substation is a chapel site (GA124-004—) which is located 1.8km to the east.

In conclusion, there were no surface traces of any potential unrecorded archaeological sites identified within the proximity of any construction areas within the wind farm site, including along the overhead line forming the grid connection to Agannygal substation, or within the peat slide area and the locations of subsequent remedial works.

12.3.5 Summary of Baseline Information

12.3.5.1 Wind farm, peat slide and remedial works

There are no extant archaeological sites or architectural heritage structures located within the wind farm site or the locations of the peat slide and remedial measures. The Archaeological Survey of Ireland records that a potential cashel site (GA124-001—) formerly located in the northwest corner of the wind farm was likely destroyed by the commercial forestry plantation prior to the commencement of the wind farm development. There were no visible traces of this monument noted during the site inspection carried out as part of the pre-development archaeological assessments of the proposed wind farm undertaken as part of the planning applications. Its recorded former location was inspected as part of the site inspections carried out as part of this assessment and no surface traces of any potential archaeological features were noted. The Database of Irish Excavation Reports does not list any entries detailing a licensed excavation of any newly discovered archaeological features at this location or in other areas of the site during the archaeological monitoring of the construction of the wind farm. The archaeologist (Christopher Read) who undertook the monitoring of the first construction phase has also provided a written confirmation to ESB that nothing of archaeological significance was identified in any area of the site during that phase. The report on the archaeological monitoring of the wind farm construction phase in 2004-5 by the Moore Group also states that no archaeological materials or features were identified within any area of the site during that phase of works.

There are no other recorded archaeological sites within 300m of the planning boundary and there are no National Monuments in State Care or archaeological sites subject to Preservation Orders located within the 3km study area. There are also no monuments with potential visual alignment attributes, such as megalithic tombs or stone circles, located within the 3km study area.

There are no designated architectural heritage structures located within the planning boundary and the nearest example is located at a distance of 1.58km from its boundary. There were no potential architectural heritage structures (whether designated or not) identified within the site during the pre-development assessments of the wind farm. In addition, no potential adverse impacts on architectural heritage, folklore or traditions were predicted during the pre-development cultural heritage assessment of the wind farm.

There are no recorded archaeological sites within 1.9km of the locations of the peat slide and the various mitigation measures subsequently enacted at its location. In addition, there are no designated architectural heritage structures within 2km of the locations of the peat slide and the mitigation measures subsequently enacted. The remedial works in the peat slide area were subject to an advance archaeological assessment and nothing of archaeological significance was noted at their locations.

Apart from the peat slide mitigation measures and localised track/drain repairs, no traces of additional ground works associated with the operational phase of the wind farm and grid connection were noted during the site inspections carried out as part of this assessment.

12.3.5.2 Overhead Line and Agannygal Substation

There are no recorded archaeological sites or architectural heritage structures located within the study area extending for 100m from either side of the OHL and Agannygal Substation. In addition, a review of the wider landscape revealed that there are no recorded archaeological sites within 1.2km of the grid connection route or within 1.8km of the location of Agannygal Substation. Much of the route of the overhead line and the location of the substation were occupied by forestry plantations prior to their construction which would have had a likely adverse effect on any potential unrecorded archaeological sites or features that may have existed within their footprints.

12.4 Likely, Significant Impacts and Mitigation Measures Implemented

12.4.1 Do-Nothing Scenario

Under the do-nothing scenario, the Derrybrien Wind Farm Development would remain in-situ in its current state i.e., as an unauthorised windfarm development the ceased commercial electricity generation in February 2022. No decommissioning works would be undertaken. The infrastructure would continue to degrade over time.

Given the baseline factors outlined in Section 12.3.5, a Do-Nothing Scenario will result in no predicted impacts on the known cultural heritage resource.

12.4.2 Construction Phase Impacts (2003-2006)

Pre-Mitigation Impact

As detailed in Section 12.3.5, there are no extant archaeological sites or architectural heritage structures located within the wind farm site, peat slide and remedial works or at the locations of the OHL and

Agannygal Substation. The Archaeological Survey of Ireland records that a potential cashel site (GA124-001—) formerly located in the northwest corner of the wind farm was likely destroyed by the commercial forestry plantation prior to the commencement of the wind farm development. This archaeological site was added to the SMR following the construction of the wind farm. There were no visible traces of this monument noted during the site inspections carried out as part of the pre-development archaeological assessments of the wind farm which were undertaken as part of the planning applications for its development. The potential existed for adverse direct impacts on any potential unrecorded, subsurface archaeological remains located within the site as a result of ground excavation works carried out during the construction phase.

Mitigation Measures

The construction of the temporary site compound areas, site access tracks, turbine foundations, turbine hardstands, substation compounds, underground low-voltage (LV) cables and ducting, borrow pits / quarries and drainage channels were subject to continuous archaeological monitoring during the construction phase and nothing of archaeological significance was identified.

Residual Impact

Given the nature of the baseline cultural heritage environment, as summarised in Section 12.3.5, it is concluded that the construction phase did not result in any residual effects on the cultural heritage resource.

Significance of Effects

Based on the assessment above, it is concluded that the construction phase resulted in **No Significant Effects** on the cultural heritage resource.

12.4.3 Operation and Maintenance Phase Impacts (2006 – 2022)

Pre-Mitigation Impact

Given the nature of the baseline cultural heritage environment, as summarised in Section 12.3.5, it is concluded that the operation and maintenance phase did not result in any likely impacts on the cultural heritage resource.

Mitigation Measures

No likely adverse effects on the cultural heritage resource which required mitigation occurred during the operation and maintenance phase.

Residual Impact

Given the nature of the baseline cultural heritage environment, as summarised in Section 12.3.5, it is concluded that the operation and maintenance phase did not result in any likely residual impacts on the cultural heritage resource.

Significance of Effects

Based on the assessment above, it is concluded that the construction phase resulted in **No Significant Effects** on the cultural heritage resource.

12.4.4 Ceased Operation Phase Impacts (2022-Present)

Pre-Mitigation Impact

Given the nature of the baseline cultural heritage environment, as summarised in Section 12.3.5, it is concluded that the ceased operation phase did not result in any likely impacts on the cultural heritage resource.

Mitigation Measures

No likely adverse effects on the cultural heritage resource which required mitigation occurred during the ceased operation phase.

Residual Impact

Given the nature of the baseline cultural heritage environment, as summarised in Section 12.3.5, it is concluded that the operation and maintenance phase did not result in any likely residual impacts on the cultural heritage resource.

Significance of Effects

Based on the assessment above, it is concluded that the ceased operation phase resulted in **No Significant Effects** on the cultural heritage resource.

12.4.5 Impacts of Retained Development

Given the nature of the baseline cultural heritage environment, as summarised in Section 12.3.5, it is concluded that the retained development will not result in any impacts on the cultural heritage resource.

12.4.6 Cumulative and In-Combination Effects

The potential cumulative impact of the Retained Development and other relevant developments has been carried out with the purpose of identifying what influence the Retained Development will have on the baseline cultural heritage environment when considered cumulatively and in combination with relevant approved, and existing projects in the vicinity of the proposed site. Due to their location and the nature of the activities, the impacts with the potential to have cumulative effects on cultural heritage are discussed below.

- Decommissioning Activity.
- Commercial forestry.
- Turbary activity.
- The Sonnagh Old Wind Farm.

The decommissioning of the wind farm will not require ground excavation works within areas of undisturbed ground and given the baseline cultural heritage environment, as summarised in Section

12.3.5, it is concluded that the decommissioning activities will not result in any likely impacts on the cultural heritage resource.

The forestry in the area was mainly planted in the 1960s and 1970s and its extent has not changed significantly since the wind farm was constructed. Much of the forestry has required felling and replanting as part of the normal life cycle of such commercial operations and it is likely that felling and replanting of the forests within the area will continue. There is one recorded archaeological site located within the surrounding forestry plantations, and this comprises a partially levelled 19th century monumental feature (GA124-006—) located c.310m outside the east end of the planning boundary. Given the distance of this feature from the planning boundary, the continuation of forestry works within its environs will not act in combination with the Retained Development to result in any likely cumulative effects.

The turbary plots within and immediately adjacent to the wind farm site have been used for low-volume seasonal peat extraction (turf cutting) for individual use as fuel with no intensive commercial peat harvesting occurring. There are no recorded archaeological sites or architectural heritage structures located within the turbary plots. The continuation of peat extraction within these plots in combination with the Project will, therefore, not result in any likely cumulative effects on the known cultural heritage resource.

Programmes of advanced archaeological testing and monitoring of construction works were carried out as part of the Sonnagh Old Wind Farm development, and these revealed nothing of archaeological significance (see Table 12-7). The continued operation of the Sonnagh Old wind farm, in combination with the Project, is not likely to result in any cumulative effects on the cultural heritage resource.

In summary, no potential cumulative or in combination impacts on the cultural heritage resource are predicted to arise.

12.5 Conclusion

Based on the assessment undertaken, it is concluded that the Retained Development, following decommissioning of Derrybrien Wind Farm Development, is not anticipated to result in any likely significant impacts on the cultural heritage resource.

13. LANDSCAPE AND VISUAL

13.1 Introduction

13.1.1 Chapter Scope

Landscape and Visual Impact Assessment (LVIA) is a tool used to identify and assess the significance of effects resulting from development on both the landscape as a resource in its own right and on people's views and visual amenity. This chapter provides an assessment of the potential landscape and visual effects of the Derrybrien Wind Farm Development Decommissioning Project – Retained Development as described in Chapter 4 Project Description.

This chapter includes the assessment of:

- Effects which have already occurred during the construction phase (2003-2006).
- Effects which have already occurred during the operational phase (2006–2022).
- Effects which have occurred and are occurring once operations had ceased (2022-Present).
- Effects which are likely to occur as a result of the Retained Development.

13.1.2 Statement of Authority

The assessment of landscape and visual effects has been carried out Evelyn Sikora, BA MPlan, MILI. Evelyn has eleven years' experience in preparing Landscape and Visual Impact Assessment Reports (LVIA) for various types of development including wind energy, solar, flood relief works, quarries, roads, greenways and other infrastructure, as well as residential and commercial and recreational developments, in both rural and urban contexts.

Declan O' Leary, MLI, MILI, Managing Director of Cunnane Stratton Reynolds also provided inputs and review/oversight of the report content. Declan O'Leary has over 30 years' experience in local development, landscape design, urban and environmental renewal. This includes master planning and design to implementation of a broad range of strategic environmental improvement schemes to industrial, highway and urban regeneration sites as well as reclamation, amenity, rural/countryside, educational and housing projects. He is experienced in working closely with community organisations and statutory agencies to deliver local environmental, social and economic development.

Declan has worked in the area of Landscape and Visual Impact Assessment (LVIA) and Landscape Planning in Ireland since 2000. He has experience of addressing landscape issues in sensitive and heritage landscapes, the development of policy to guide appropriate development in those landscapes, and the preparation of LVIA for developments in the rural and urban context including wind energy and renewables projects, roads, bridges and similar linear infrastructure. He is a Corporate Member of the Irish Landscape Institute and a Chartered member of the Landscape Institute (UK).

13.2 Methodology

13.2.1 Relevant Guidance

This chapter of this rEIAR was prepared using the assessment methodology outlined in the *Guidelines for Landscape and Visual Impact Assessment* (3rd Edition, LI/IEMA 2013, referred to as GLVIA) which is the industry standard for LVIA. Reference is also made, where relevant, to guidance contained in the following documents:

- Environmental Protection Agency (2022): *Guidelines on the Information to be contained in Environmental Impact Assessment Reports*.
- *Guidelines on the Information to be Contained in Environmental Impact Assessment Reports*, EPA, 2022).
- *Draft Advice Notes for Preparing Environmental Impact Statements* (EPA, 2015)
- *Wind Energy Guidelines for Planning Authorities, (Department of Environment, Heritage and Local Government*, 2006).
- *Draft Revised Wind Energy Development Guidelines, (Department of Housing, Planning and Local Government,* 2019).
- *Guide to Visual Representation of Wind Farms* (Scottish Natural Heritage, 2017)
- *Assessing the Cumulative Impact of Onshore Wind Energy Developments*, (Scottish Natural Heritage, 2012).

The GLVIA (3rd Edition) outlines the assessment process, which combines judgements on the sensitivity of the resource and the magnitude of the change which it will undergo as a result of the proposed development. These are then combined to reach an assessment of the importance (or significance) of the effect. This guidance is authored by the Landscape Institute in the UK and the IEMA which contains a network of members in UK and Ireland and internationally. The guidance was prepared within the parameters of relevant EU directives at the time and is updated where necessary by Landscape Institute bulletins online. The GLIVA 3rd edition is used internationally and is the industry standard for LVIA in Ireland.

Chapter 1 of the rEIAR includes details on the impact assessment methodology (EPA 2022). However, as noted in the EPA (2022) Guidelines, Section 3.7.2, while the use of the Definitions of Significance is widely used, they are general and should more specific definitions exist for a particular discipline, then these should be used.

The EPA guidance (2022) refers to the use of topic specific guidance and specifically references the GLVIA 3 in relation to professional judgement. It also recognises (at para 3.72) that:

> *"Some uncertainty is unavoidable in EIA, especially about matters that involve an element of judgement, such as assigning a level of significance to an effect. Such judgements should be explicit and substantiated rather than presented as objective fact. This is best done using agreed referable approaches, e.g. the Guidelines on Landscape and Visual Impacts Assessment provide guidance on what constitutes a severe visual effect".*

Based on the above guidance and in particular the GLVIA guidance, the following assessment criteria is used. It should be noted that the approach advocated in the GLVIA is that landscape consultants should prepare the assessment criteria suitable to the project, and the Guidelines themselves contain suggestions on how to prepare criteria.

Definitions and descriptions of sensitivity, magnitude of change and quality and longevity of effects are derived from the GLVIA. The GLVIA does not set out specific definitions of descriptions used but contains key widely used principles and case studies / examples that are intended to inform a professional's methodology, supported by their experience and judgements in relation to landscape and landscape change. These descriptions expand and complement the EPA guidelines as intended in relation to topic specific guidance.

It should be noted that there is no specific guidance on the Landscape and Visual Assessment in relation to Remedial EIARs.

13.2.2 Other Guidance

The current Development Plan for Co. Galway 2022-2028 was reviewed, along with previous Development Plans for County Galway (1997-2003; 2003-2009, 2009-2015 and 2015-2021).

13.2.3 Assessment Methodology

Assessment of Both 'Landscape' and 'Visual' Effects

Another key distinction to make in LVIA is that between landscape effects and the visual effects of development.

'Landscape' results from the interplay between the physical, natural and cultural components of our surroundings. Different combinations of these elements and their spatial distribution create distinctive character of landscape in different places. 'Landscape character assessment' is the method used in LVIA to describe landscape, and by which to understand the potential effects of a development on the landscape as 'a resource'. Character is not just about the physical elements and features that make up a landscape, but also embraces the aesthetic, perceptual and experiential aspects of landscape that make a place distinctive.

Visual effects refer to the interrelationship between people and the landscape and refer to effects on views and visual amenity as experienced by people or groups of people. The GLVIA prescribes that visual effects should be assessed separately from landscape, although the two topics are inherently linked. Visual assessment is concerned with changes that arise in the composition of available views, the response of people to these changes and the overall effects on the area's visual amenity. These are usually views which are accessible to the general public, les of LVIA.

Landscape and Visual Impact Assessment (LVIA) is a tool used to identify and assess the significance of and the effects of change resulting from development on both the landscape as an environmental resource in its own right and on people's views and visual amenity. The methodology followed for LVIA is that set out in the GLVIA 3rd Edition.

Ireland is a signatory to the European Landscape Convention (ELC) since 2002. The ELC defines landscape as 'an area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors'. This definition is important in that it expands beyond the idea that landscape is only a matter of aesthetics and visual amenity. It encourages a focus on landscape as a resource in its own right - a shared resource providing a complex range of cultural, environmental, and economic benefits to individuals and society.

The GLVIA(3rd Edition) notes that as a cultural resource, the landscape functions as the setting for our day-to-day lives, also providing opportunities for recreation and aesthetic enjoyment and inspiration. It contributes to the sense of place experienced by individuals and communities and provides a link to the past as a record of historic socio-economic and environmental conditions. As an environmental resource, the landscape provides habitat for fauna and flora. It receives, stores, conveys, and cleans water, and vegetation in the landscape stores carbon and produces oxygen. As an economic resource, the landscape provides the raw materials and space for the production of food, materials (e.g. timber, aggregates) and energy (e.g. carbon-based fuels, wind, solar), living space and for recreation and tourism activities.

The reversibility of change is an important consideration. If change must occur to meet a current need, can it be reversed to return the resource (in this case, the landscape) to its previous state to allow for development or management for future needs.

The assessment of Landscape and Visual Effects assesses the effects of the development on the landscape as a resource, and on the fabric and character of the landscape. Assessment of visual effects relates to the change in views and visual amenity experienced by groups of people. The assessment includes the review of the proposed development, desktop study, and several site visits both to the site and the wider landscape. This approach emphasises the distinction between the assessment of Landscape effects and Visual effects, which, though related, area assessed separately. The methodology employed in this assessment is as follows:

Baseline Study: A desk-based study and site visit were carried out in November 2022, January 2023 and November 2024 to establish the existing receiving environment and key landscape and visual characteristics, and to identify relevant national and local designations and polices. Protected views and other landscape designations were reviewed. Aerial imagery, OSI Discovery series mapping, CORINE

Landcover Maps (2018) were also reviewed to gather accurate information on the study area. While a wind energy development would typically use (ZTV) Maps to show proposed theoretical visibility of turbines, projects dealing with an existing wind energy development will not rely to the same extent on a ZTV, however it is still a useful tool to review the extent and nature of theoretical visibility. Therefore, an existing ZTV map representing the theoretical visibility as it now exists, is included as part of the baseline study.

Assessment of Effects: A number of tools are used to assist in the assessment of visual effects and as outlined above, ZTV maps are used in this case to represent existing theoretical visibility.

Photomontages are another tool used to assist in the assessment of visual effects of a Project or Development . In the case of the Derrybrien Wind Farm Development Decommissioning Project – Retained Development, the assessment includes: visual effects which have occurred, which are occurring, and those which are likely to occur as a result of the Retained Development. Photographs of the existing windfarm in the landscape, presented using the same methodology as for a prospective wind farm, illustrate the visual effects and are used in the assessment, along with several views without the Derrybrien Wind Farm Development, to assist in the assessment of visual effects which have occurred.

The landscape effects of the Derrybrien Wind Farm Development Decommissioning Project are assessed in Section 13.4. The nature and scale of changes to the landscape elements and characteristics are identified, and the consequential effect on landscape character and value are discussed. Trends of change in the landscape are taken into account. The assessment of significance of the effects takes account of the sensitivity of the landscape resource and the magnitude of change to the landscape which resulted from Derrybrien Wind Farm, and which is likely to result from the Retained Development.

Key Principles of GLVIA

In addition to the references in terms of the assessment of significance above, some of the key principles of the GLVIA are as follows:

Use of the Term 'Effect' vs 'Impact.'

The GLVIA advises that the terms 'impact' and effect' should be clearly distinguished and consistently used in the preparation of an LVIA.

'Impact' is defined as the action being taken. 'Effect' is defined as the change or changes resulting from those actions, e.g. a change in landscape character, or changes to the composition, character and quality of views in the receiving environment. This report focusses on these effects.

13.2.4 Assessment of Landscape Effects

13.2.4.1 Sensitivity of the Landscape Resource

The sensitivity of the landscape is a function of its land use, landscape patterns and scale, and the value placed on the landscape. The nature and scale of the development in question is also taken into account. For the purpose of assessment five categories are used to classify the landscape sensitivity of the receiving environment.

Table 13-1 Categories of Landscape Sensitivity

Sensitivity	Description
Very High	Areas where the landscape exhibits a very strong, positive character with valued elements, features and characteristics that combine to give an experience of unity, richness and harmony. The character of the landscape is such that its capacity for accommodating change in the form of development is very low. These attributes are recognised in landscape policy or designations as being of national or international value and the principal management objective for the area is protection of the existing character from change
High	Areas where the landscape exhibits strong, positive character with valued elements, features and characteristics. The character of the landscape is such that it has limited/low capacity for accommodating change in the form of development. These attributes are recognised in landscape policy or designations as being of national, regional or county value and the principal management objective for the area is conservation of the existing character
Medium	Areas where the landscape has certain valued elements, features or characteristics but where the character is mixed or not particularly strong. The character of the landscape is such that there is some capacity for change in the form of development. These areas may be recognised in landscape policy at local or county level and the principal management objective may be to consolidate landscape character or facilitate appropriate, necessary change
Low	Areas where the landscape has few valued elements, features or characteristics and the character is weak. The character of the landscape is such that it has capacity for change; where development would make no significant change or would make a positive change. Such landscapes are generally unrecognised in policy and where the principal management objective is to facilitate change through development, repair, restoration or enhancement.
Negligible	Areas where the landscape exhibits negative character, with no valued elements, features or characteristics. The character of the landscape is such that its capacity for accommodating change is high; where development would make no significant change or would make a positive change. Such landscapes include derelict industrial lands or extraction sites, as well as sites or areas that are designated for a particular type of development. The principal management objective for the area is to facilitate change in the landscape through development, repair or restoration

13.2.4.2 Magnitude of Landscape Change

The magnitude of change is a factor of the scale, extent and degree of change imposed on the landscape with reference to its key elements, features and characteristics (also known as 'landscape receptors'). Five categories are used to classify magnitude of landscape change

Table 13-2 Magnitude of Landscape Change

Magnitude	Description
Very High	Change that is large in extent, resulting in the loss of or major alteration to key elements, features or characteristics of the landscape and/or introduction of large elements considered totally uncharacteristic in the context. Such development results in fundamental change in the character of the landscape.
High	Change that is moderate to large in extent, resulting in alteration or compromise to key elements, features or characteristics, and/or introduction of large elements considered uncharacteristic in the context. Such development results in a moderate to large change to the character of the landscape.
Medium	Change that is moderate in extent, resulting in partial loss or alteration to key elements, features or characteristics of the landscape, and/or introduction of elements that may be prominent but not necessarily uncharacteristic in the context. Such development results in moderate change to the character of the landscape.
Low	Change that is limited in extent, resulting in minor alteration to key elements, features or characteristics of the landscape, and/or introduction of elements that are not uncharacteristic in the context. Such development results in minor change to the character of the landscape.
Negligible	Change that is very limited in extent, resulting in no alteration to key elements, features or characteristics of the landscape, and/or introduction of elements that are characteristic in the context. Such development results in minimal change to the character of the landscape.

13.2.5 Significance of Effects

In order to classify the significance of effects (landscape and visual – refer to Table 13-3 below), the predicted magnitude of change is measured against the sensitivity of the landscape/viewpoint, using the following guide. There are seven classifications of significance, namely: (1) imperceptible, (2) not significant, (3) slight, (4) moderate, (5) significant, (6) very significant, (7) profound. The Guidelines on the Information to be contained in Environmental Impact Assessment Reports, (EPA, 2022) is followed in respect of terminology relating to significance of effects.

Table 13-3 Guide to Classification of Significance of Effects

		Sensitivity of the Receptor				
Magnitude of Change		**Very High**	**High**	**Medium**	**Low**	**Negligible**
	Very High	Profound	Profound-Very Significant	Very Significant-Significant	Moderate	Slight
	High	Profound-Very Significant	Very Significant	Significant	Moderate-Slight	Slight-Not Significant
	Medium	Very Significant-Significant	Significant	Moderate	Slight	Not Significant
	Low	Moderate	Moderate-Slight	Slight	Not significant	Imperceptible
	Negligible	Slight	Slight-Not Significant	Not significant	Imperceptible	Imperceptible

The matrix above is used as a guide only and to illustrate the process of the assessment of landscape effects. As the GLVIA (2013) guidelines note, there is no standard approach to defining what constitutes a significant effect, and notes the relationship between the two axes, Sensitivity and Magnitude, is not linear, and the axes are likely to have different weightings. The GLVIA notes that assessor also uses professional judgement informed by their expertise, experience and common sense, to arrive at a classification of significance that is reasonable and justifiable.

The GLVIA 3rd Edition recognises (at para 2.23) that :

> *"Professional judgement is a very important part of LVIA. While there is scope for quantitative measurement of some relatively objective matters, much of the assessment must rely on qualitative judgements."*

Landscape effects are also classified as positive/beneficial, neutral or negative/adverse. Development has the potential to improve the environment as well as damage it. In certain situations, there might be policy encouraging a type of change in the landscape, and if a development achieves the objective of the policy the resulting effect might be positive even if the landscape character is profoundly changed.

13.2.6 Assessment of Visual Effects

In Section 13.4 of this report the visual effects of the wind farm are assessed. Visual assessment considers the changes to the composition of views, the character of the views, and the visual amenity experienced by visual receptors. The assessment is made for a number of viewpoints selected to represent the range of visual receptors in the receiving environment. The significance of the visual effects experienced at these locations is assessed by measuring the viewpoint sensitivity against the magnitude of change to the view resulting from the development.

13.2.6.1 Sensitivity of the Visual Receptor

Viewpoint sensitivity is a function of two main considerations- susceptibility to change and value of the view.

Susceptibility of the visual receptor to change. This depends on the occupation or activity of the people experiencing the view, and the extent to which their attention or interest is focussed on the views or visual amenity they experience at that location.

- Visual receptors most susceptible to change include residents at home, people engaged in outdoor recreation focused on the landscape (e.g. trail users), and visitors to heritage or other attractions and places of community congregation where the setting contributes to the experience.
- Visual receptors less sensitive to change include travellers on road, rail and other transport routes (unless on recognised scenic routes), people engaged in outdoor recreation or sports where the surrounding landscape does not influence the experience, and people in their place of work or shopping where the setting does not influence their experience.

Value attached to the view. This depends to a large extent on the subjective opinion of the visual receptor but also on factors such as policy and designations (e.g. scenic routes, protected views), or the view or setting being associated with a heritage asset, visitor attraction or having some other cultural status (e.g. by appearing in arts).

For the purpose of assessment five categories are used to classify a viewpoint's sensitivity.

Table 13-4 Categories of Visual Receptor Sensitivity

Sensitivity	Description
Very High	Viewers at iconic viewpoints - towards or from a landscape feature or area - that are recognised in policy or otherwise regarded as being of very high value or national value. This may also include residential viewers whose primary view is of very high value.
High	Viewers at viewpoints that are recognised in policy or otherwise designated as being of high value, or viewpoints that are highly valued by people that experience them regularly (such as views from houses or outdoor recreation features) and are valued by the local community. This would include tourist attractions, and heritage features of regional or county value, and viewers travelling on scenic routes.
Medium	Viewers at viewpoints representing people travelling at slow or moderate speed through or past the affected landscape in cars or on public transport, where they are partly but not entirely focused on the landscape, or where the landscape has some valued views. The views are generally not designated, but which include panoramic views or views judged to be of some scenic quality, which demonstrate some sense of naturalness, tranquility or some rare element in the view.
Low	Viewers at viewpoints reflecting people involved in activities not focused on the landscape e.g. people at their place of work or engaged in similar activities such as shopping, etc. The view may present an attractive backdrop to these activities but there is no evidence that the view is valued, or that it is regarded as an important element of these activities. Viewers travelling at high speeds (e.g. motorways) may also be considered of low susceptibility.
Negligible	Viewpoints reflecting people involved in activities not focused on the landscape e.g. people at their place of work or engaged in similar activities such as shopping where the view has no relevance or is of poor quality and not valued

13.2.6.2 Magnitude of Change to the View

Classification of the magnitude of change takes into account the size or scale of the intrusion of development into the view (relative to the other elements and features in the composition, i.e. its relative visual dominance), the degree to which it contrasts or integrates with the other elements and the general character of the view, and the way in which the change will be experienced (e.g. in full view, partial or

peripheral, or glimpses). It also takes into account the geographical extent of the change, the duration and the reversibility of the visual effects.

Five categories are used to classify magnitude of change to a view:

Table 13-5 Magnitude of Visual Change

Magnitude	Description
Very High	Full or extensive intrusion of the development in the view, or partial intrusion that obstructs valued features or characteristics, or introduction of elements that are completely out of character in the context, to the extent that the development becomes dominant in the composition and defines the character of the view and the visual amenity
High	Extensive intrusion of the development in the view, or partial intrusion that obstructs valued features, or introduction of elements that may be considered uncharacteristic in the context, to the extent that the development becomes co-dominant with other elements in the composition and affects the character of the view and the visual amenity.
Medium	Partial intrusion of the development in the view, or introduction of elements that may be prominent but not necessarily uncharacteristic in the context, resulting in change to the composition but not necessarily the character of the view or the visual amenity
Low	Minor intrusion of the development into the view, or introduction of elements that are not uncharacteristic in the context, resulting in minor alteration to the composition and character of the view but no change to visual amenity
Negligible	Barely discernible intrusion of the development into the view, or introduction of elements that are characteristic in the context, resulting in slight change to the composition of the view and no change in visual amenity.

Significance of Visual Effects

As for landscape effects, in order to classify the significance of visual effects, the magnitude of change to the view is measured against the sensitivity of the viewpoint, using the guide in Section 13.2.3 above.

Visual effects are also classified as beneficial/positive, neutral or negative/adverse. This is an inherently subjective exercise. Visual receptors' attitudes to development of various types varies and this affects their perception of the visual effects of wind farm, and indeed the removal of wind turbines from the landscape. This is acknowledged by the GLVIA (2013) as noted in Section 13.1.4 above. However, as noted in the GLVIA Paragraph 6.45, an 'informed professional judgement' should be made about whether the visual effects should be categorised as positive or negative (or neutral) with the criteria used in reaching this judgement clearly stated. These are listed in Section 13.2.6 below.

Several tools are used to assist the assessment of visual effects, including Zone of Theoretical Visibility (ZTV) maps, and Photomontages. These are described in Section 13.2.8 in more detail.

13.2.7 Quality and Timescale of Effects

The predicted impacts are also classified as beneficial, neutral or adverse. As noted above, this is not an absolute exercise; in particular, visual receptors' attitudes to development, and thus their response to the impact of a development, will vary. However, the methodology applied is designed to provide robust justification for the conclusions drawn. These qualitative impacts/effects are defined as:

Table 13-6 Quality of Effects.

Definition of quality of effects	Description
Adverse	Scheme at variance with landform, scale, pattern. Would degrade, diminish or destroy the integrity of valued features, elements or their setting or cause the quality of the landscape(townscape)/view to be diminished;
Neutral	Scheme complements (or does not detract from) the scale, landform and pattern of the landscape(townscape)/view and maintains landscape quality;
Beneficial	Improves landscape(townscape)/view quality and character, fits with the scale, landform and pattern and enables the restoration of valued characteristic features or repairs / removes damage caused by existing land uses.

Impacts/effects are also categorised according to their longevity or timescale:

Table 13-7 Timescale of Effects

Timescale	Description
Temporary	Lasting for one year or less
Short Term	Lasting one to seven years
Medium Term	Lasting seven to fifteen years
Long Term	Lasting fifteen years to sixty years;
Permanent	Lasting over sixty years.

A statement is made as to the appropriateness of the proposed development based on the combined assessment of the predicted landscape and visual effects. This methodology, in accordance with the various guidelines for LVIA, results in a conclusion as to the appropriateness of the proposed development based on objective assessment of its likely landscape and visual impacts.

13.2.8 Assessing Landscape and Effects in Remedial Environmental Impact Assessment Reports (rEIAR)

It should be noted that there is no specific guidance on the Landscape and Visual Assessment in relation to Remedial EIARs.

This chapter includes assessing the landscape and visual effects of:

- The Do-nothing Scenario
- Impacts which have already occurred during construction phase (2003-2006).
- Impacts which have already occurred during the operational phase (2006-2022).
- Impacts which have occurred and are occurring once operations had ceased (2022-Present Day).
- Impacts which are likely to occur as a result of the Retained Development (Post Decommissioning)

In order to assess the landscape and visual effects which have already occurred, using a baseline date of c. 1998, a number of sources of information were consulted to assist in building up a picture of the landscape change between 1998 and the present. As noted in Section 13.2.9, this presented some difficulties. While there is no photographic record available (apart from aerial imagery) for the baseline date, data sources consulted were as follows:

- CORINE land cover maps prior to construction (2000) and post construction 2006, 2012, and 2018.
- Aerial imagery (map.geohive.ie) from both prior to construction (1996-2000) and during construction (2001-2005), and post construction (2006-2012 and 2013-2018).
- Bing and Google aerial images for 2024 and Google Maps Streetview.

- References to the baseline scenario from the planning documentation relating to the Derrybrien Wind Farm Development which is referred to in the Planner's Report (Application 97/3470, An Bórd Pleanála Inspector's Report (PL 07/122803)
- Galway County Development Plans 1997, 2003-2009, 2009-2015, 2015-2021, 2022-2028
- Landscape and Landscape Character Assessment of County Galway, 2002.

As noted below, the tools used to support the assessment had to be modified to reflect the retrospective aspect of the assessment.

13.2.8.1 Tools used to support the assessment

Several tools are used to assist in the Landscape and Visual Assessment. These include:

- ZTV Maps (Zone of Theoretical Visibility) Maps.
- Visualisations

13.2.8.1.1 *ZTV Maps*

ZTV Maps are produced to indicate theoretical visibility and are based on topographical information (the data supplied uses contours at 10 metres intervals) to indicate areas which may have views of the turbines. It is important to note that these maps, though useful, have limitations as they are based on topography alone, and represent a bare-earth scenario, that is, a landscape without any structures, buildings, or vegetation. In reality many of these elements combine to screen our views of the landscape, so the ZTV maps usually represent a greater extent of visibility than in reality. This is particularly relevant in a landscape with considerable forestry planting.

It is important to note the limitations of ZTV maps which include those identified by Scottish Natural Heritage (SNH):

- ZTV maps do not include any vegetation, buildings or other structures in the landscape so are different to actual visibility.
- ZTV maps give information on the likely extent and pattern of visibility but not the nature or magnitude - and what the visual effect is likely to be.
- It is not easy to test the accuracy of a ZTV in the field, though some verification will occur during the assessment from viewpoints.

It should be noted that the last point, while usually relevant to a proposed development, is not relevant as the existence of the Derrybrien Wind Farm Project means that actual visibility can be clarified on the ground.

ZTV maps are also useful to determine potential visual receptors and viewpoints, as they show areas which will not have any visibility of the proposed development. They also show the numbers of turbines likely to be visible, and how much of each turbine is potentially visible. However, as they do not take into account the presence of vegetation of structures in the landscape, and therefore areas showing theoretical visibility on the ZTV maps will not always have visibility in reality.

As the wind farm is already existing, the description of the actual visibility of the windfarm project, and the areas covered by the ZTV, are included in the baseline, in Section 13.3. The ZTV map, in this case, is helpful as it indicates areas where there is no theoretical visibility due to landform.

13.2.8.1.2 *Visualisations*

As noted above, the visual assessment includes:

- Effects which have already occurred during the construction phase (2003-2006).
- Effects which have already occurred during the operational phase (2006–2022).

- Effects which have occurred and are occurring once operations had ceased (2022-Present).
- Effects which are likely to occur as a result of the Retained Development.

Consideration was given to the various methods of visual assessment, and it was considered using professional judgement that existing view photographs and some photomontages would be beneficial to assess the visual effects which have occurred, by taking views of the existing development, and producing certain views showing the development digitally removed. This would be a tool to assist the assessment of the visual effects which have already occurred and also inform the Cumulative assessment.

To assess the visual effects of the Retained Development, photomontages were not considered necessary, due to the nature of the development and the extremely limited visibility (consisting mainly of at ground and below ground elements).

To produce a photomontage, the proposed development is usually "placed" into the existing baseline photography using professional GIS and 3D modelling software. Once placement has been achieved, a photo-realistic render is output depicting what the proposed development will look like if built. The resulting output is a highly accurate, verifiable photomontage. Wind farm developments may follow particular guidance on this, for example Scottish Natural Heritage (SNH) guidance.

While photomontages are extremely useful in giving an impression of a proposed development, the Scottish Natural Heritage (2017) guidance notes the uses and limitations of visualisations. These include:

- Visualisations provide a tool for assessment, but should never be considered as a substitute for visiting a viewpoint in the field.
- It must be noted that photographs cannot replicate a view as seen by the human eye. They also only represent a view from a single location, at a particular time and in particular weather conditions.)
- Static visualisations cannot convey the effect of turbine blade movement.

However, the fact that the Derrybrien Wind Farm is in existence means that the viewpoints can be visited, and the turbines and some other above ground elements seen in their setting in reality.

Existing/Baseline Description

In this case, the Derrybrien Wind Farm Development is already in place so there is no 'existing' or baseline' photograph of the landscape without the turbines.

Visualisations from 17 viewpoint locations have been included, and in this case the ' baseline views' simply illustrate the landscape as it is with the Derrybrien Wind Farm Project still visible with several photomontages showing the turbines, overhead lines, and substation removed.

Therefore, using professional judgement, the description of the 'existing view are descriptions of the landscape as it currently is seen.. The description of the viewpoints does take into account that there may have been minor changes in the views- growth or removal of vegetation may have changed views, and buildings or structures may not have been present.

It should be noted that while there may have been minor changes, however the sensitivity of the viewer, and the change to the overall character of the view is what is considered relevant. Where possible, the descriptions identify any elements in the viewpoints which may have not been present circa 1998. However it is not possible to accurately describe every element in each viewpoint as it was prior to development, and the assessment of effects focusses on the overall character of the view as it is likely to have been. Any assumptions are clearly stated in the descriptions.

Viewpoints were selected from various locations throughout the study area. These photomontages were produced by Innovision and are included in the Photomontage Booklet in **Appendix 13-1**.

Magnitude of Change

This section describes the likely magnitude of change which has taken place as a result of the introduction of the Derrybrien Wind Farm Project in the landscape - into the view. In several cases (Viewpoint numbers 2,3,4, 5,6,11) a photomontage showing the development digitally removed is produced to assist in the assessment of visual effects.

Significance of Effect

The Significance of effect of the viewpoint is described. This description is based on the magnitude of change which has taken place, and the sensitivity of the receptor. This description also takes into account the 53.5 degree angle of view which would usually be prepared to represent a proposed development, but also on assessment of the turbines as they are visible at the viewpoints

It should be noted that while the baseline for assessment of effects which have occurred is circa 1998, several views (Viewpoint 1,16) from the M6 and M18 motorway overpasses are included to represent new views which were not there at the time of the wind farm construction and represent viewpoints that became available during the Operational phase (2006-2022) and are available today.

Other developments

The Cumulative effects assessment includes the proposed Sonnagh Old Wind farm in the assessment as it was permitted in 2000 and constructed around the same time to the Derrybrien wind farm project. The full list of projects considered under cumulative effects is listed in Chapter 4 and further discussed in Section 13.4.5.

The photomontages are also used to assist in the assessment of cumulative effects.

13.2.9 Limitations/Difficulties Encountered

13.2.9.1 Establishment of Baseline Landscape Environment

Difficulties were encountered in establishing exact baseline conditions for the windfarm site and wider landscape. The baseline for the Derrybrien wind farm project is c. 1998, before the wind farm was constructed. This is 27 years ago, a considerable period of time, and there were a number of difficulties in establishing an accurate picture of the landcover and landscape elements of the site environs and wider landscape in 1998.

The landcover of the wider landscape c. 1998 was difficult to establish in detail, and sources indicate a broad picture of the landscape at the time. Though certain sources were available to give information on the site and environs, including the forestry on the site, difficulties were encountered when attempting to distinguish features in the landscape which may or may not have been present.

These include buildings, and small scale changes to the landcover such as growth of trees and vegetation, which may not be evident or difficult to distinguish on aerial imagery.

It was not possible to determine accurately all of the landcover changes in the wider areas, but general trends in development were observed on the aerial images. Some difficulties were encountered in determining whether all elements in the viewpoints today were present circa 1998..

With regard to the views, and the visual baseline, there may have been views available at the time which are not available at the date of this assessment. Where assumptions are made with regard to the baseline, these are clearly stated. In the assessment of the viewpoints, it is not possible to accurately state whether screening would have been similar at the time of the baseline. Any assumptions made are clearly stated. Several site visits to the study area were carried out in 2016, as well as October 2018, July and November 2019, November 2022 ,January 2023 and November 2024.

The landscape and visual baseline, described in Section 13.3, was established through desktop study of Development Plans and their supporting documents for County Galway, produced in 1997, 2003, 2009 and 2015 and contain designations, policies, and maps and aerial imagery which provide information on the baseline c. 1998.

The Planner's Report (Application 97/3470, An Bórd Pleanála Inspector's Report (PL 07/122803) were referred to for information regarding the baseline c.1998.

However, it should be noted that is the benefit of a retrospective assessment it that allows the assessor to understand exactly how the development has been assimilated into the landscape.

The information gaps noted above are not considered to be such as to affect the robust assessment of the landscape and visual effects of the project.

13.3 Receiving Environment

It should be noted that the references to the character of the landscape prior to the construction of the Derrybrien Wind Farm Development Project (circa 1998) are based on sources mentioned in Section 13.2.9.1 above, but is not expected to form a complete representation of every aspect of the receiving environment at that time.

This section describes the character of the landscape, as it is today with references to the character of the landscape prior to the construction of the Derrybrien Wind Farm Project, (including the Retained Development). This is based on site visits to the receiving environment, study of the CORINE maps from 2000-2012 and 2018 and aerial imagery from 2000 to the present.

This section also identifies the visual receptors and concludes with a summary of the landscape values of the area. This includes visual receptors relevant to the 1998 baseline, as well as some viewing locations which were not present at the time (locations along the M6 and 18 motorway).

13.3.1 Landscape Character and Visual Amenity

13.3.1.1 Landform – Topography and Drainage

13.3.1.1.1 *Wider Landscape*

Derrybrien Wind Farm Development is located in the Slieve Aughty Mountains in southeast Galway.

Figure 13-1 below (reproduced in **Appendix 13-2** at full size) shows the study area and broad topography.

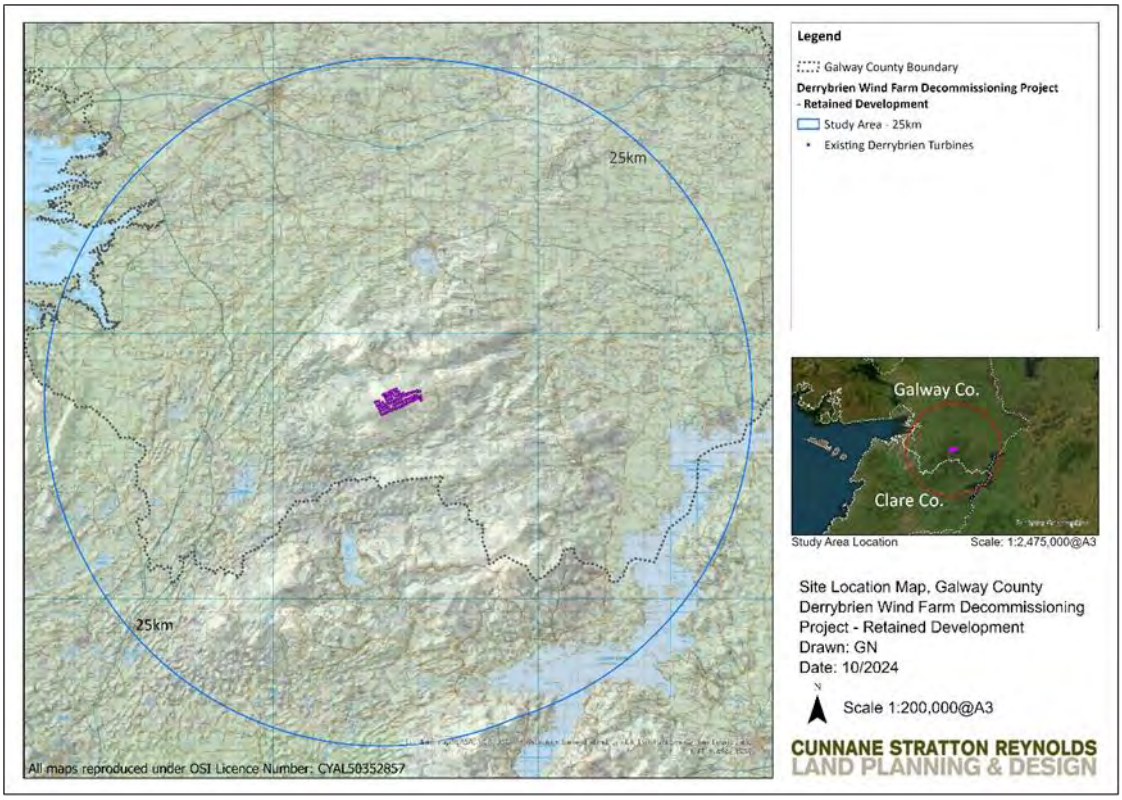


Figure 13-1 Study area and topography of wider landscape

The eastern part of Co. Galway has a simple underlying geology. This area is mostly underlain by more recently deposited Carboniferous limestone, which erodes more evenly forming the typical lowland topography of the midlands. The only significant variation in this part of the county is the Slieve Aughty Mountains in the southeast (extending into Co. Clare), where an inlier of Devonian sandstones and conglomerates projects through the limestone, forming an upland landscape. As a result of the bedrock geology, the Slieve Aughty Mountains are lower and less dramatic in landform than the uplands of Connemara which are typified by the Twelve Bens. The highest peak in the Slieve Aughtys (in Co. Galway) is Cushlaundrumlahan at 365m which is within the wind farm site. The Slieve Aughty peaks are rounded, and the slopes are shallow compared to the steep-sided and pointed profiles of the Connemara mountains.

Plate 13-1 Slieve Aughty mountains viewed from the north: A lower rounded profile is visible

In the wider landscape, to the west of the Slieve Aughties, and east of the more sparsely covered Karst Burrren landscape, the Burren Lowlands is the name given to the low-lying lands around Gort which are more open in nature with fewer areas of tree cover and where rivers mainly flow underground. South of this area, the low rounded limestone form of the Burren Hills are found approximately 20 kilometres to the west.

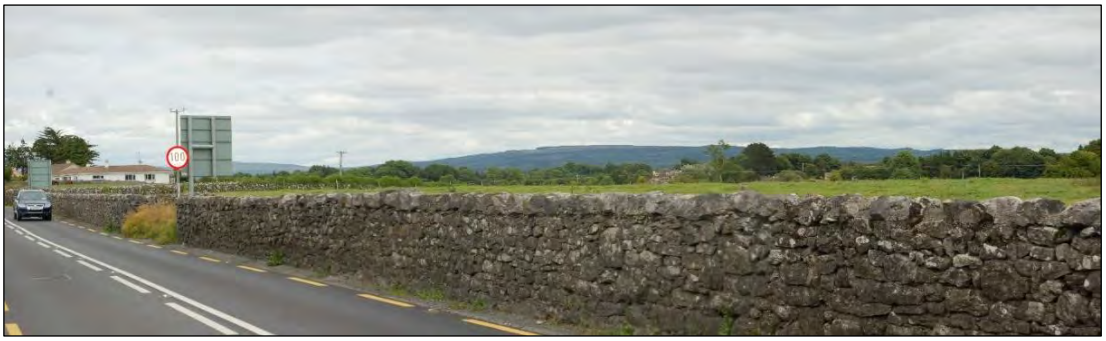


Plate 13-2 Slieve Aughty mountains and Derrybrien wind farm from R458 north of Gort.

Several lakes lie within the wider study area, Lough Rea and Lough Cutra and Lough Graney approximately 10 kilometres to the north, southwest and south (of the existing turbines) respectively, with Lough Atorick approximately 9 kilometres to the southeast. Lough Derg lies approximately 20 kilometres to the east of the existing wind farm.

13.3.2 Site and Immediate Vicinity

Derrybrien Wind Farm Development is in the northern part of the Slieve Aughty range east of the peak of Cushlaundrumlahan. This is a linear mountain, aligned approximately SW-NE, with a relatively flat, rounded top and gently sloping sides. It is a monolithic landform feature, with no outlying ridges or peaks. Due to its limited height and undramatic landform, as an upland feature it is unremarkable in appearance. Figure 13-2 (in reduced format below and full size in **Appendix 13-3**) shows the topography within close proximity of the existing Derrybrien Wind Farm:

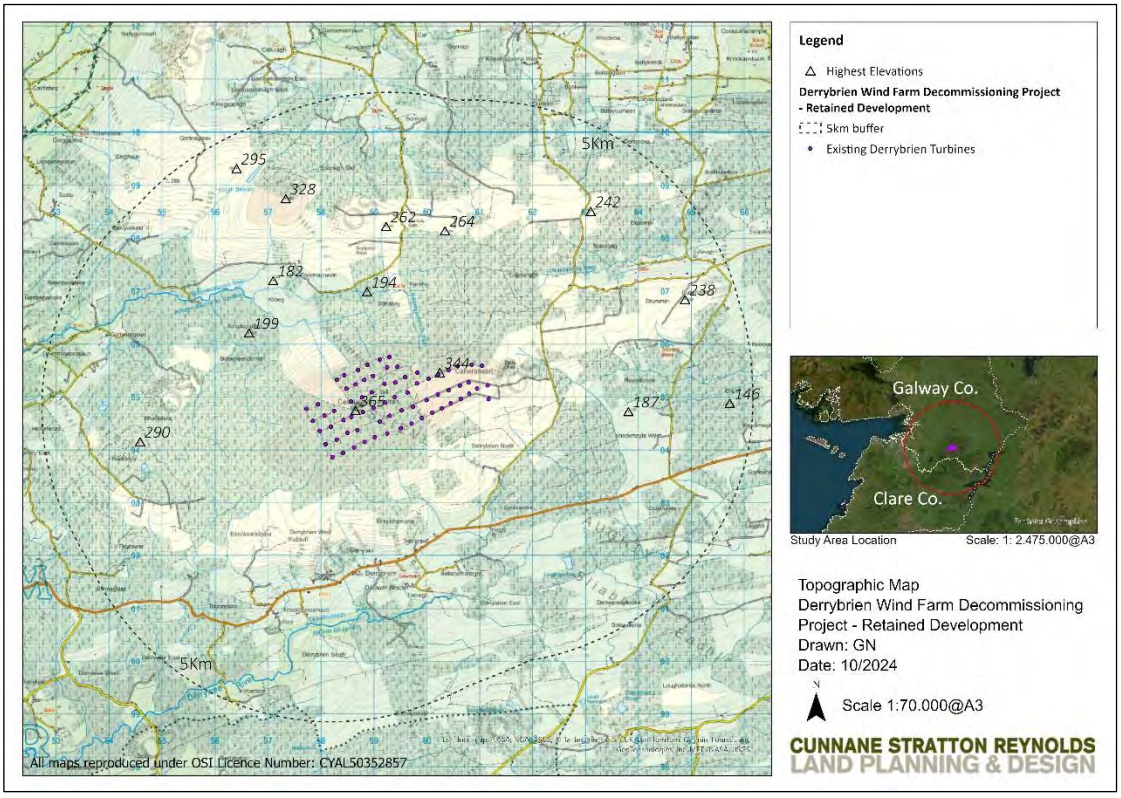


Figure 13-2: Topographical context of Derrybrien site and immediate vicinity.

Just over 3 kilometres to the northwest, there is a similar but smaller landform lying parallel, where Sonnagh Old Wind Farm is located, with a peak of 328 metres, separated from Casheldrumlahan by river valley in which the Boleyneendorish River flows.

To the south there is a broad, flat upland valley through which the Owendallleegh and Bleach Rivers flow, and beyond that the Slieve Aughty range extends into Co. Clare. These features, the Sonnagh Old peak and the upland valley and peaks to the south further diminish the presence of Cushlaudrumlahan in the landscape as they buffer the mountain from the surrounding lowlands.

As noted above the highest peak in the Slieve Aughtys (in Co. Galway) is Cushlaundrumlahan at 365m which lies within the Derrybrien wind farm site itself, where the turbines are oriented SW-NE, in rows along the landform. As noted above, the landcover is a mosaic of coniferous forestry and open peatland, the juxtaposition of these evident on the aerial images and landcover mapping.

13.3.3 Land Use and Landcover

Landcover – Vegetation

The variations in geology and topography between the uplands of Co. Galway translate into variations in land use capability. The CORINE Land cover map (the most recent version is the 2018 update) below shows the major variations in land use across the county. The Connemara uplands have very limited potential for both agriculture and forestry; they are predominantly covered by peat bog. In contrast, the Slieve Aughty Mountains have one of the largest concentrations of coniferous forest in the country (ref. Atlas of the Irish Rural Landscape, p.125) with areas of peatland interspersed as seen in Figure 13-3, the CORINE Landcover Map for the site and surrounds. Purple shading indicates peat bog. Dark green indicates coniferous forest. Light green indicates transitional woodland scrub. Yellow indicates pastureland. This map is included in reduced format here and at A4 in **Appendix 13-4**.

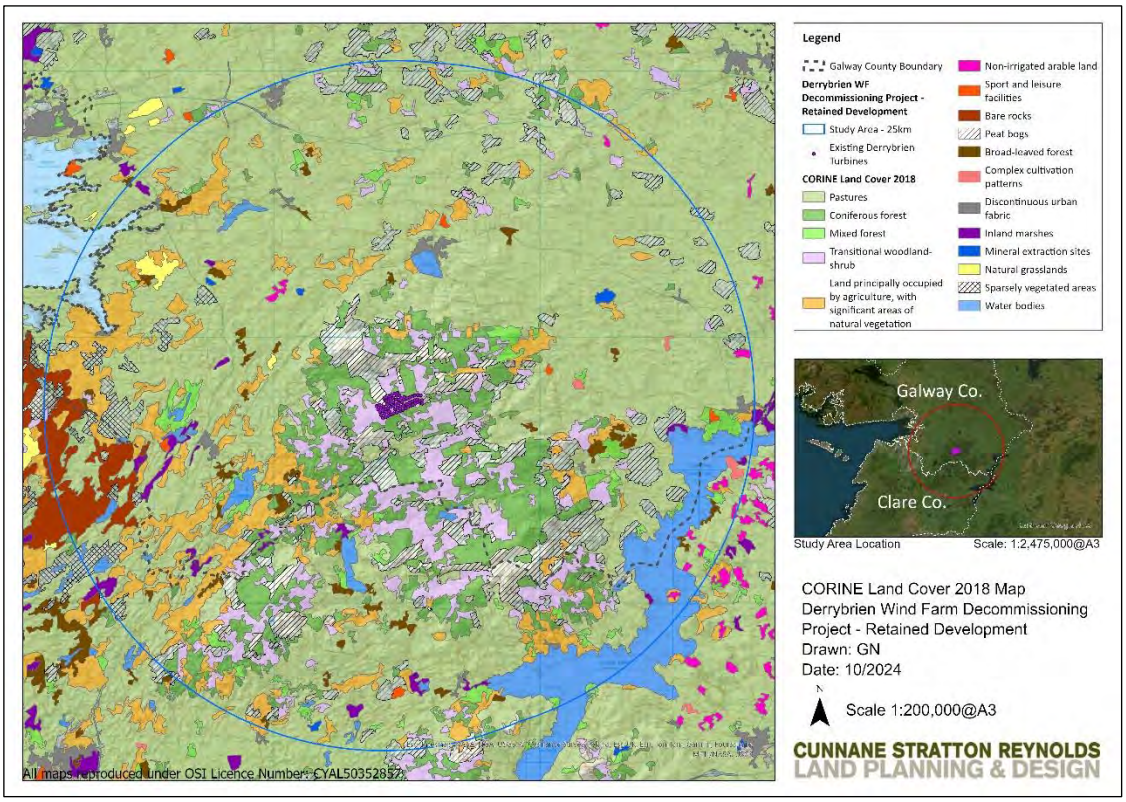


Figure 13-3 EPA CORINE Landcover Map (2018) of study area

In the wider landscape, the undulating plains surrounding the Slieve Aughty Mountains are today largely covered by grassland. The fields which today are of various size and shapes are divided by a wide variety of boundary features including fences, stone walls, hedgerows, treelines and belts of deciduous woodland.

13.3.3.1 Site and Immediate Vicinity

Plate 13-3 View towards coniferous forestry from R353 southwest of Derrybrien

The forest cover is one of the defining characteristics of the Derrybrien area and the Slieve Aughty Mountains generally. This was also the case c. 1998, as seen on aerial imagery and from the documents available describing the landscape at that time. At an elevation of approximately 100m above sea level around the flanks of the mountains, land use transitions from predominantly pastoral agriculture to predominantly forestry. In views towards the mountains the large, angular, dark coloured plantations are prominent, often blanketing the landscape and giving the horizon line a jagged profile (see Plates 13-3 above and 13-4 and 13-5 below). In views from within the uplands the plantations often block lateral views from the roads, generating a high degree of visual enclosure in particular along the R353 and the Black Road.

The Planner's Report (Application 97/3470, and An Bórd Pleanála Inspector's Report (PL 07/122803) refers to previous planning documentation which refers to the extensive afforestation in the area. The practice of planting trees in large angular blocks which are interspersed with areas of bogland is evident today and was evident at that time.

Aerial photography from 2000 clearly shows areas of coniferous plantation, in geometric forms, and areas of bog on the site and immediate surrounds. Some of forestry would have been less mature than it is now. The site of the windfarm project on the 2000 aerial image was composed of open bog to the east of the site, dense coniferous plantation to the centre of the site and what appears to be immature plantations to the west of the site. The immediate surrounds of the site were covered by a mosaic of coniferous forestry and open bogland. The nearest areas of agricultural lands with small scale field patterns, appear to be to the south and south east near Derrybrien village. Large tracts of coniferous forestry are indicated on Figure 13-4 below (and in full size in **Appendix 13-5**) on the CORINE (2018) Landcover map. Some change between the 2000 and 2018 CORINE Land cover maps are mainly changes related to forestry, with some areas of coniferous forestry in 2000 categorised as Transitional Woodland scrub in 2018.

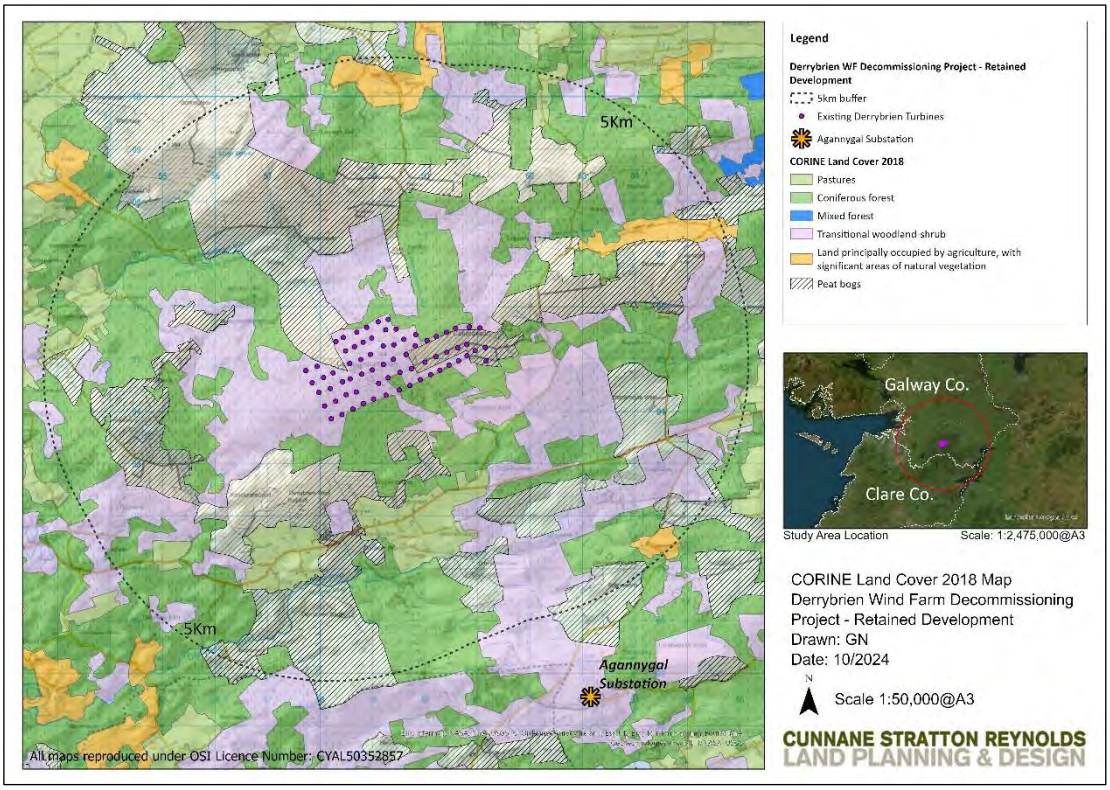


Figure 13-4: CORINE Landcover map of immediate vicinity.

Turf cutting within and immediately adjacent to the site is evident today and signs of turf cutting contribute further to the impression of a 'working landscape'. On the site of the windfarm, turf cutting occupies an area of approximately 67ha on the east of the site, though only a small area of this may be visible from the public (Black) road.

Plate 13-4 Views of coniferous forestry from the R353 near of the Flaggy Bridge south of the Derrybrien turbines

Plate 13-5 View from Black Road where blocks of plantations screen views

Along the Black Road, however, which increases in elevation as one travels northeast, the road rises in elevation and contrasting open views of the surrounding bogland, coniferous forestry and wind turbines are available.

Current aerial photography clearly shows areas of coniferous plantation, in geometric forms, and areas of bog on the site and immediate surrounds. The immediate surrounds of the site are covered by a mosaic of coniferous forestry and open bogland. The nearest areas of agricultural lands with small scale field patterns, appear to be to the south and southeast near Derrybrien village.

Within the uplands the forest would have generated a high degree of visual enclosure as is evident today, though some felling and replanting would have occurred since 1998. Comparison of aerial imagery from 1996-2000 and 2013-2018 on the Geohive website (https://www.arcgis.com/apps/webappviewer/index.html?id=3ae19cc156bf4706a929304bf8fcc4f6 shows that the plantations along the Black Road were present prior to the construction of Derrybrien Wind Farm, while the Google Streetview imagery along the Black Road and vicinity is dated from 2009 and shows several mature plantations along with some younger plantations.

Plate 13-6: Mosaic of Bogland, forestry and wind turbines from the Black Road

The route of the overhead line which connects to the Agannygal substation lies to the south of the wind farm. The land cover along the route of the overhead line is similar to that of the site, with a contrast between the mosaic of open bogland and large areas of coniferous plantation and this appears to have been the landcover prior to the construction of the wind farm as depicted in historical aerial images. Consequently, views vary between a high degree of enclosure and open areas with views of the wider landscape. At three main locations (Black Road, R353 and the local road south of R353 towards Flagmount) where the overhead line crosses the public road are the overhead lines visible at close proximity as shown below:

Plate 13-7 Derrybrien-Agannygal overhead line crossing the Black Road and Plate 13-8 Overhead line at Loughatorick North

The existing 400kVMoneypoint-Woodland overhead line with its steel pylons is a prominent feature today, which crosses the local road south of the R353 between Derrybrien Wind Farm and the Agannygal substation.

Plate 13-9: Moneypoint-Wooddlands overhead line crosses the local road at Loughatorick North

This area is also sparsely settled, and would have been prior to the development of the Derrybrien Wind Farm Development..

The location of the substation at Agannygal (seen in Plate 13-10 below) was previously a dense block of coniferous forestry with a large area of open bog or moorland to the east. While some felling of the forestry was carried out during construction of the substation, the land to the west remains open moorland. Additional felling of the majority of the forestry around the substation is evident from aerial imagery from between 2013 and 2018 (as shown on the GeoHive website) and a small section felled between 2018 the present.

Plate 13-10 View of Agannygal substation and overhead line at Loughatorick North

Open bogland and coniferous forestry was present in the landscape around the Agannygal substation. Today (2024) the forestry is partly felled, increasing visibility.

13.3.4 Transport and Settlement

At an elevation of approximately 100m above sea level around the flanks of the Slieve Aughty Mountains the landscape transitions from one dominated by pastoral agriculture, with a typical dispersed rural settlement pattern, to an upland landscape dominated by forestry and peatland. The upland above 100m is generally very sparsely populated, except for local pockets of agricultural land where there may be clusters of farmhouses. The area has a remote character.

As the Derrybrien Wind Farm Development is located on the upper slopes of Cashlaundrumlahan at an elevation of around 300m and above, it is well removed from the settled agricultural landscape of the surrounding plains and is separated from areas of concentrated settlement and transport routes by a buffer of forest and peatland.

The nearest village is Derrybrien, over 2km from the site while the town of Gort lies 12.8km to the west.

The Black Road, from which the wind farm is currently accessed, in a narrow, remote local road, and can be accessed via minor public roads from Loughrea, a distance of approximately 10 km.

The Regional Route R353 (also a scenic route) connecting Gort to Ballynakill and on to Portumna runs approximately 3.1km south of the windfarm where it joins the Black Road. This road runs through extensive tracts of forestry in particular to the east of Derrybrien, and is also remote in character with few scattered houses west of the village of Derrybrien. The route is similarly remote to the east of Derrybrien as far as the village of Ballinakill.

13.3.5 Landscape, Visual Amenity and Wind Energy Policy

This section includes relevant policies, ranging from policy which was in place prior to the construction of the wind farm, (prior to 2006) to current policies. Sections 13.3.3.5.1 refers to policy prior to the wind farm construction, while Section 13.3.5.2 and subsequent sections refer to policy development and

present day policies. This provides a historic context for the precedent whereby wind farm developments in this location have been deemed acceptable. This section also details the evolving wind energy policy on the site. The statutory plan for the area is the Galway County Development Plan (GCDP), which is reviewed and updated on a six yearly cycle.

13.3.5.1 Galway County Development Plan (GCDP) 1997-2003

The plan in place at the time of the original planning assessments was the GCDP 1997-2003. Applications to extend the duration of the original permissions were made in September 2003, following the adoption of the GCDP 2003-2009.

Wind Energy Policy

The GCDP 1997 contained no statement of policy on renewables or wind energy development other than Objective no 13 in Chapter 7, Rural Areas. Objective no 13 (p. 60, GCDP 1997-2003 stated:

> *"The Planning Authority will require that windfarm development comply with the Department of Environment Guidelines, particularly the policy statement at Subsection 3.2 (Page 5) and also the main considerations set out in Section 4 e.g. Visual Amenity, Noise, Electromagnetic Interference and other environmental factors."*

Wind Farm Development Guidelines for Planning Authorities, 1996

The Guidelines referred to in Objective 13 were the Wind Farm Development Guidelines for Planning Authorities, 1996 (hereafter referred to as the Guidelines), which were in force at the time. This is a ten-page document prepared in anticipation of an increase in planning applications for wind farm projects which was expected to result from various national policy documents encouraging development of alternative energy sources.

Wind Farm Development Guidelines for Planning Authorities, 1996 - Section 4

The GCDP 1997 also refers specifically to Section 4 of the Guidelines. Subsection 4.8 discusses visual impact, noting that it is 'among the more important considerations to be taken into account in arriving at a decision on a particular application': Section 4.8, p. 7, (Wind Farm Development Guidelines for Planning Authorities) states that:

> *" Wind turbines are tall and their prominence is emphasised by the movement of the rotors. Visual impact must be assessed with their particular and unusual characteristics in mind. Visual impact is influenced by:*
>
> - *form and characteristics of the landscape;*
> - *Design and colour;*
> - *The existing skyline;*
> - *Layout of the turbines;*
> - *Number and size of turbines."*

Subsection 4.9 of the Guidelines sets out further considerations regarding visual impact:

> *"Assessment of visual impact should have regard to both immediate visual impact and views from a distance (especially from any adjacent areas of high landscape quality). Turbines should not dominate landscape features, especially views designated in the Development Plan as views of special amenity or interest which it is necessary to preserve and views from adjacent areas subject to national or international designation or designated in the Development Plan as being of high landscape quality. Turbines should not be prominent when seen against an elevated skyline background from public roads, towns or village centres."*

The GCDP 1997's reference to the Guidelines indicates that the County Council accepted the necessity of wind energy development in principle, and the need to facilitate wind farm development where the

resource existed, and significant constraints/sensitivities were not a factor. In subsections 2.3-2.4 the Guidelines state:

> *"The use of wind for power generation requires that turbines be located in areas with significant wind energy resource. Areas of high wind energy tend to be upland and/or coastal...*
>
> *"The western and north-western parts of the country have the greatest wind resource, in terms of average speeds. However there may be constraints on development in these areas such as inaccessibility, lack of energy infrastructure, excessive winds, and extensive areas of high visual amenity."*

By its reference to the Guidelines the GCDP 1997 accepted that wind farms would be located in upland areas in the county. It also recognised that the particular characteristics of wind turbines – their dimensions and the movement of the rotors – inevitably result in landscape and visual impacts where they are installed.

The GCDP required that site selection, and the consideration of impacts, take account of the strength of the wind resource and availability of grid access, compatibility with other land uses including housing and recreation, landscape character, the impact on landscapes and views designated for protection, and other natural and cultural designations.

Galway County Development Plan 1997 - Scenic Amenity Areas

The GCDP 1997 defined Scenic Amenity Areas (SAA) as follows:

> *"landscapes, which contain natural features such as mountains, hills, moorlands, woodlands, vegetation and areas of water, including coastlines, and which exhibit a significant degree of visual and aesthetic interest."*

All of the upland landscapes, coastal areas and lakes of significant scale in the county were designated as SAAs. Two categories of SAA were identified, for the purpose of policy implementation, as follows:

- Category 1: Outstanding Scenic Amenity Area (OSAA). These areas contained dramatic landscape features of the highest scenic quality and visual interest. Many of these areas were of an 'unspoilt' character. The Connemara mountains and coastline were designated OSAA. No areas in the eastern part of the county (east of Galway City) were designated OSAA.
- Category 2: High Scenic Amenity Area (HSAA). These areas were defined as areas of lesser scenic quality than Category 1 areas. These areas included parts of the Lough Derg shoreline, South Connemara, and the Slieve Aughty Mountains.

The site fell into a Category 2 High Scenic Amenity Area (HSAA) as shown in Figure 13-4 Scenic Amenity Areas as shown below:

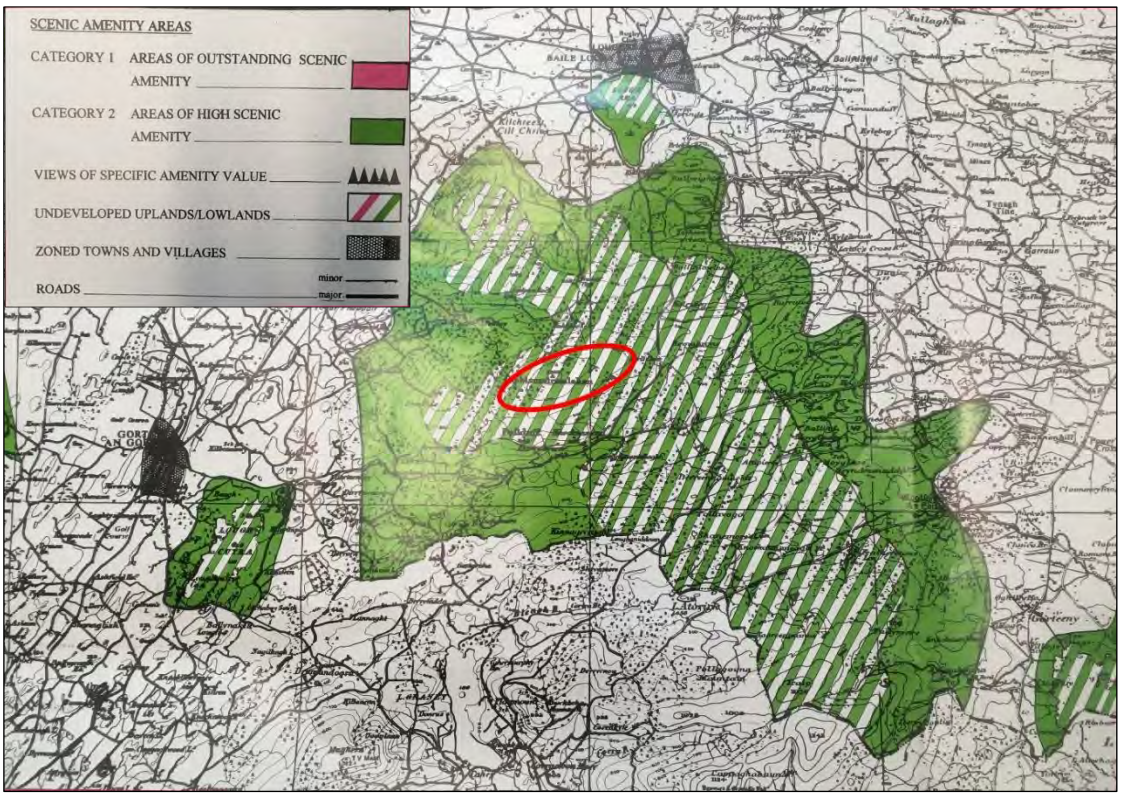


Figure 13-5 High Scenic Amenity Area *Source: 1997-2003 Galway County Development Plan*

The Development Control Objectives within these areas (both OSAA and HSAA) were:

> "*To restrict development which would detract from the amenity value of the zoned areas in the relevant maps, where such development would be visually inappropriate and out of character, or could not be satisfactorily blended into its surroundings.*"

Both categories of SAA were subdivided into four subcategories. The Derrybrien Wind Farm Project site would appear to have fallen within the subcategory 2B, Undeveloped Mountain Areas (Blanket Bog), for which 'Permissible Development' was identified as 'None other than essential or directly related to current use'. Category 2B is the most relevant, and this is deduced as the site is a mixture of forest and bogland but this is, and was at the time, underlain by blanket bog and is not a lowland area or Karst area, an undeveloped bog road or undeveloped limestone karst as in categories 2C, 2E and 2F.

This table is reproduced below (see Table 13-8). As noted in the Planner's Report (Application 97/3470 refers to the location of the area in an 'undeveloped upland region'.

Table 13-8: Galway County Development Plan 1997: Policies on Development in Scenic Amenity Areas

Category	Sub-Category	General Description	Permissible Development
1.OSAA	1A	Developed Areas	Residential Development
	1B	Undeveloped Mountain Areas (Blanket Bog)	None other than essential or directly related to current use
	1C	Undeveloped Lowland Areas (Blanket Bog)	None other than essential or directly related to current use
	1D	Undeveloped Bog Roads	None other than essential or directly
2. HSAA	2A	Developed Areas	Residential Development

Category	Sub-Category	General Description	Permissible Development
	2B	Undeveloped Mountain Areas (Blanket Bog)	None other than essential or directly related to current use
	2C	Undeveloped Lowland Areas (Blanket Bog OR Karst Limestone)	None other than essential or directly related to current use
	2E	Undeveloped Bog Roads	None other than essential or directly related to current use
	2F	Undeveloped Limestone Karst	None other than essential or directly related to current use

It should be noted that Commercial, Industrial and Community facilities development was permitted in all subcategories – including the site area's HSAA 2B subcategory - only if it was essential, and had no acceptable alternative location.

> *"The Planning Authority will permit Commercial, Industrial and Community Facilities development which would not be out of character with, and which can be satisfactorily assimilated into the landscape. Such development shall include only development which is essential to the overall socio-economic development of the area, and which has no alternative location which would be acceptable to the Planning Authority."*

Galway County Development Plan 1997 - Views and Prospects of Specific Amenity Value

The GCDP 1997 included a policy on views and prospects of special/specific amenity value. (See Figure 9-4 – GCDP 1997 Scenic Amenity Areas above) The Development Control Objective for this designation was:

> *"To restrict development which would impair Views and Prospects of Special Amenity Value or Special Interest which are considered necessary to be preserved and particularly those indicated on the zoning maps."*

These views were designated in urban areas only. There were no 'Views of Specific Amenity Value' (as defined identified on the map legends) on the Scenic Amenity Areas Maps anywhere in south or east Galway. This policy was thus not relevant to the site.

Galway County Development Plan 1997 - Areas of Recreational Amenity

The GCDP 1997 identified Areas of Recreation amenity as National and public parks, walking routes, pony trekking routes, golf courses, fishing areas, beaches and inland areas for swimming, and sites for water sports. Lough Rea, 10km to the north of the site and Lough Cutra 12km to the south west were the closest designated Areas of Recreational Amenity to the site. The Slieve Aughty Mountains were not so designated.

County Development Plan 1997: Natural Heritage Areas (NHAs) and Candidate Special Areas of Conservation (cSAC)

In 1997, there were a number of proposed Natural Heritage Areas and candidate Special Areas of Conservation. There was some overlap between the two designations. Sonnagh Bog, some 2km to the north was designated as both a pNHA and cSAC, as were the Peterswell Turlough, 8km north-west, Slieve Aughty Bog, some 6km to the south-east, and the Loughatorick South Bog, due south of that, 13 km from the site. Other cSACs were Lough Coy, 9km to the west; and Pollagoona Bog over the Clare border at a distance of approximately 7km to the south. Both Lough Rea (8km north) and Lough Cutra (9km south-west) were pNHAs.

13.3.5.2 Galway County Development Plan 2003-2009 – Wind Energy Development and Landscape Policy

The site was no longer designated as a High Scenic Amenity Area (HSAA) from 2003 onwards.

The GCDP was revised in 2003 and it incorporated a statement of wind energy development policy), informed by Landscape Character Assessment of County Galway carried out in 2001-2002 (hereafter referred to as the Assessment.) This would have represented the landscape baseline prior to the construction of the project and is an important source of information.

The Assessment comprised desktop studies, backed up by fieldwork and GIS mapping. The assessment includes mapping of the County's Landscape Value, Sensitivity, Focal Points and Views, and Wind Farm Potential. The Assessment identified 25 character areas within the County. The location of the Derrybrien Wind Farm project is located within LCA 6 Slieve Aughty Mountains. This was described as follows:

> *The landscape is mountainous with areas of both coniferous and deciduous woodland. The landscape is wild, natural and scenic. Long distinct (sic) glimpse views are available through the trees towards the lower ground in the surrounding areas.*

Landscape Value, Sensitivity and Focal Points/Views were also mapped in the Landscape Character Assessment.

The vicinity of the project was indicated as of 2 Medium Landscape Value out of a possible 4 categories, from Class 1 Low to Class 4 Outstanding. Landscape Sensitivity in the vicinity of the project was indicated as Class 2 Moderate (out of a possible 5 categories from Class 1 Low to Class 5 Unique.)

The Assessment also mapped the Enclosure by Forestry (see Figure 13-5 below) of the County, and this shows extensive areas of enclosure in the vicinity of the project.

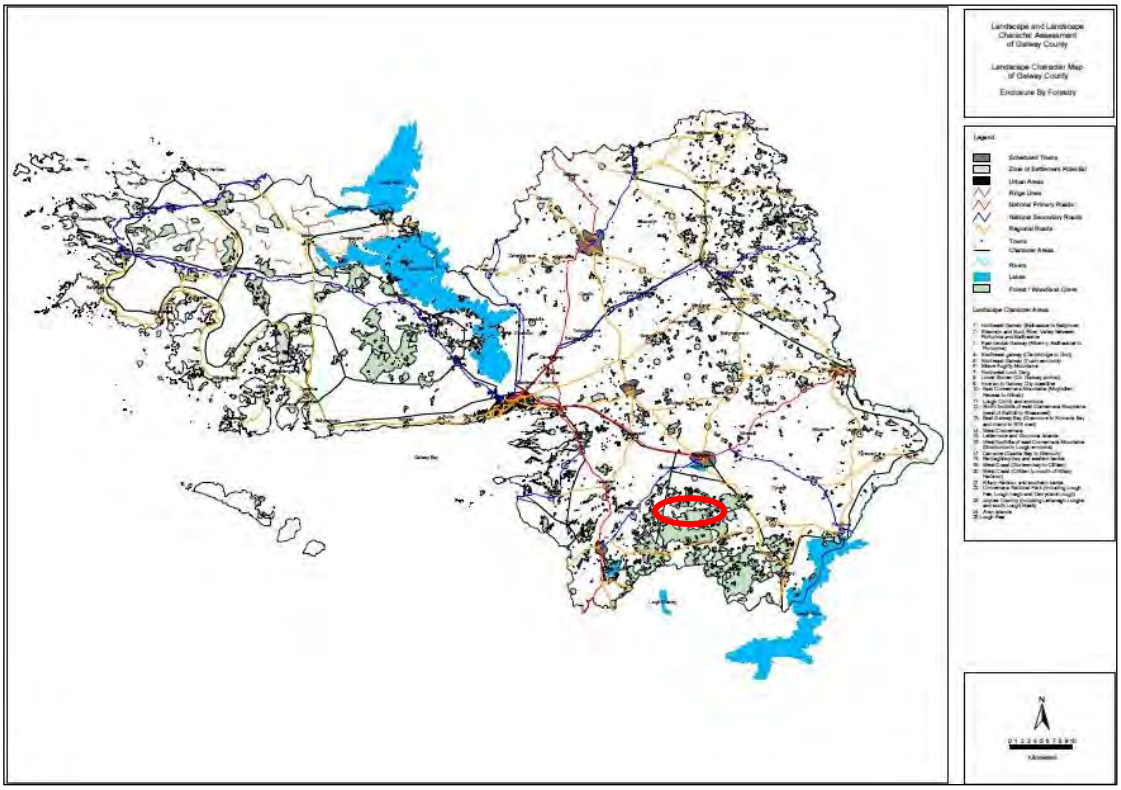


Figure 13-6 Enclosure by Forestry form the 2003 Landscape Character Assessment

The Assessment goes on to state the following in relation to the Slieve Aughty Mountains LCA in relation to the landscape and wind farm potential:

> *The Slieve Aughty Mountains area potentially has adequate wind resource for wind farm development and has an acceptable landscape sensitivity class i.e. class 3 high. Views within this area are generally restricted by existing woodland, which would also restrict visibility towards the proposed turbines thus reducing the size of the zone of visual influence. There are no areas of unique sensitivity in the surrounding landscape with high scenic quality therefore visual intrusion of scenic views is unlikely as a result of wind farm development. However mitigation of visual impacts is required to minimise any long distance views.*

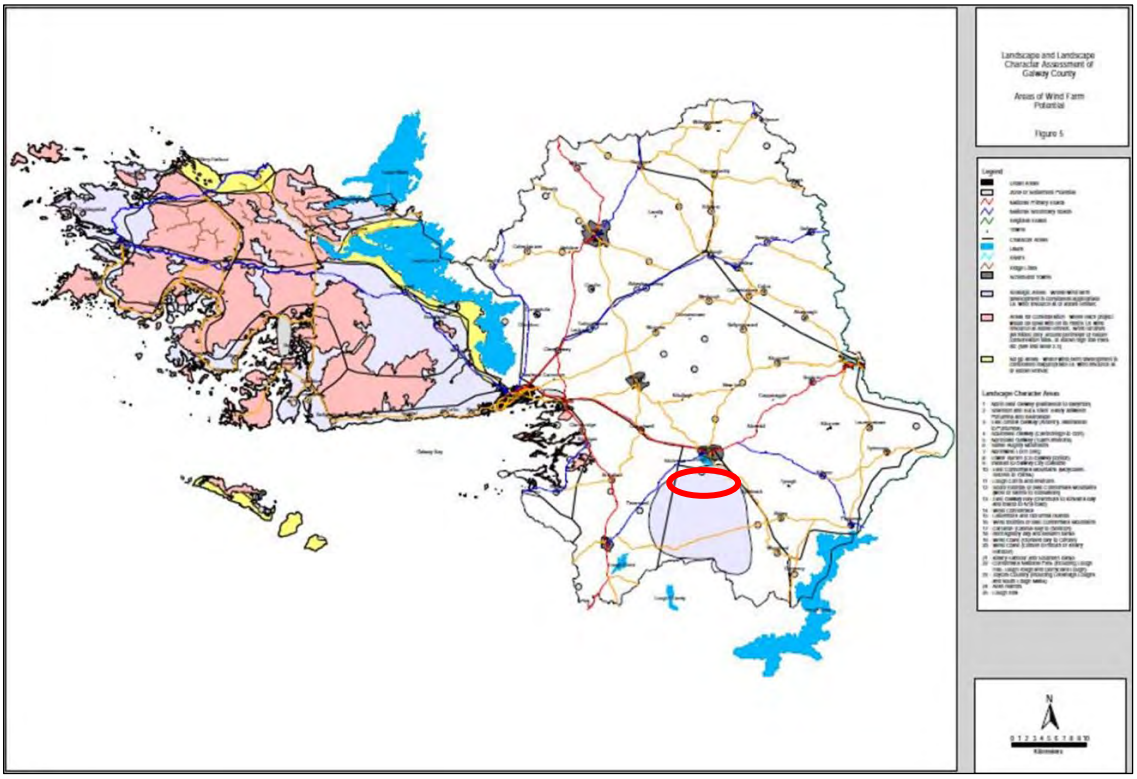


Figure 13-7 Areas of Wind Farm Potential (Source Galway County Development Plan 2003-2009)

A protected view was identified in the direction of Derrybrien Wind Farm Development from the lakeshore at Lough Rea, approximately 10 kilometres distant.

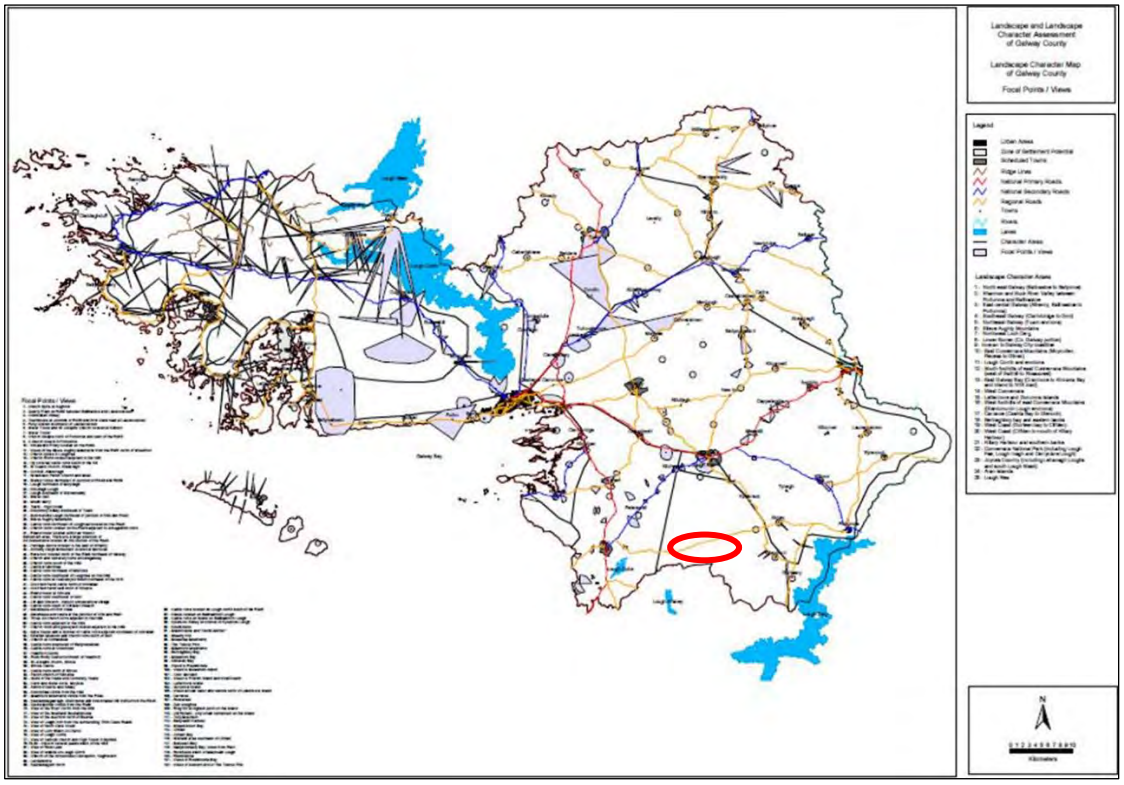


Figure 13-8 Protected Views *(Source Galway County Development Plan 2003-2009)*

It was the stated policy of Galway County Council to facilitate wind energy development, in the Slieve Aughty Mountains (identified as a Strategic Area in the Landscape Character Assessment), mindful of the associated landscape and visual effects. The other Strategic Area was located northwest of Galway City with some smaller areas designated in parts of Connemara.

The following policies in relation to landscape are of relevance.

> **Policy 105** "*Include landscape Sensitivity Ratings as an important factor in determining development uses in areas of the county.*"
>
> **Policy 106** "*Afford protection to views of amenity value.*"
>
> **Policy 107** "*Protect designated areas as both environmental resources and economic assets.*"
>
> **Policy 108** "*Preserve the character of the landscape where, and to the extent that, in the opinion of the Planning Authority, the proper planning and sustainable development of the area requires it, including the preservation of views and prospects and the amenities of places and features of natural beauty or interest.*"

13.3.5.3 Galway County Development Plan 2009-2015 – Wind Energy Development and Landscape Policy

The 2009-2015 Plan carried forward the Landscape Character Assessment as a Supporting Document. The Assessment was not amended. The site remained indicated on Map IS1 (as shown in Figure 9-11) as a Strategic Area for wind energy until the Wind Energy Strategy (WES) was published and the Plan varied to include it.

The Plan noted that the provision of electricity generation from wind energy would be subject to development control standards, including the following relevant to landscape:

2. Landscape Areas: "Be located in the landscape areas shown suitable for such development (Map IS1), subject to visual and environmental impact assessment, including consideration of designated environmental sites".

4. Landscape Sensitivity: "Avoid where possible interconnecting with the electricity grid either overground or underground across the landscape where sensitivity rating is Class 5 – Unique".

Map IS1 is included in Figure 13-9 below.

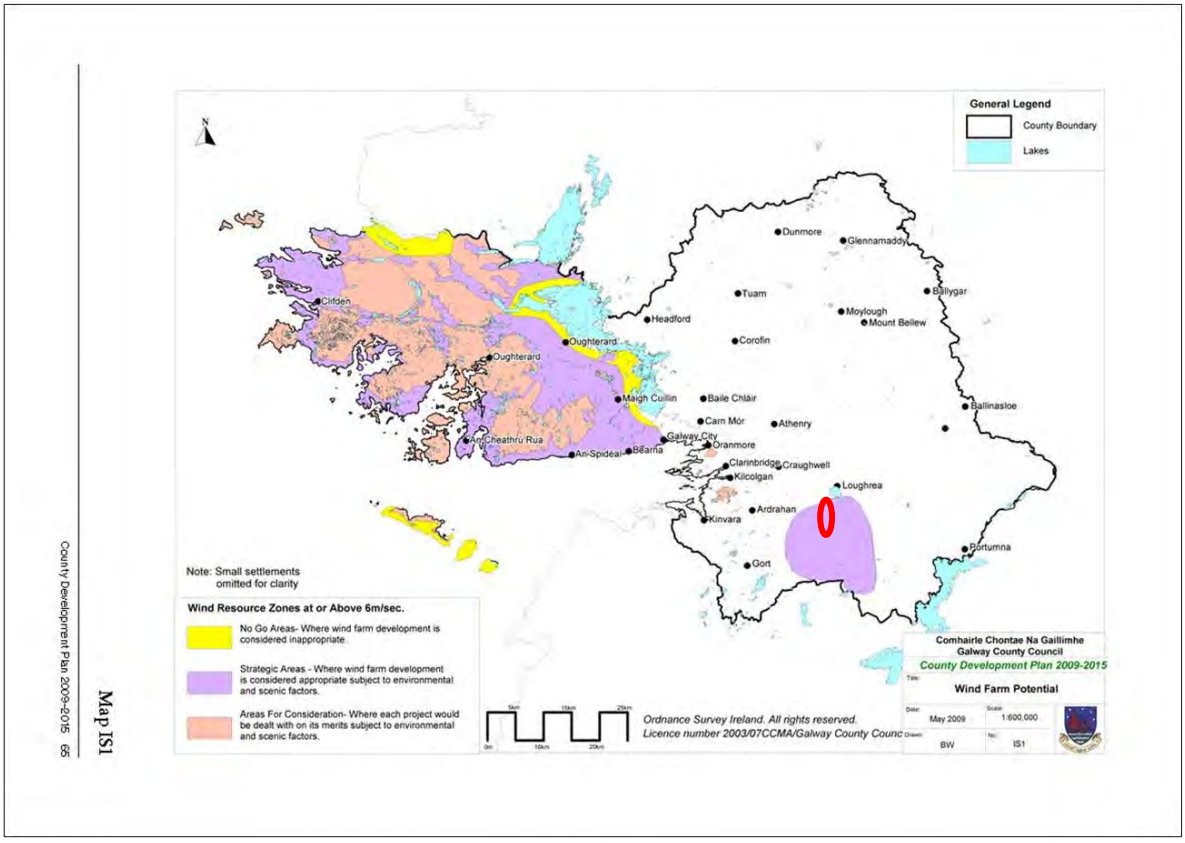


Figure 13-9 Map IS1 showing site as Strategic Area for Wind Energy (Source Galway County Development Plan 2009-2015)

This shows the subject site designated as a Strategic Area, prior to the adoption of the WES outlined below.

The GCDP 2009- 2015 reiterated the classification of landscape value (Medium, from possible ratings of Low, Medium, High, Outstanding) and landscape sensitivity (Moderate, from possible ratings of Low, Moderate, High, Special, Unique). It also retained the previously identified Views and Prospects. As previously the Derrybrien Wind Farm Project was in an area relatively free of recognised views and prospects, with the only protected view that from the shore at Loughrea.

Variation to 2009-2015 Galway County Development Plan – Galway County Wind Energy Strategy 2011

In 2011, Galway County Wind Energy Strategy (WES) was published. This contained revised and updated areas of wind farm potential which were identified in the 2009-2015 Plan. It was adopted as a variation to the 2009-2015 Development Plan.

The WES took into account the existing Wind Resource zones as identified in the Landscape Character Assessment. Considerations included landscape and visual considerations, the need to achieve greater energy security, national and international commitments regarding reductions in greenhouse gases, promotion of renewable energy, protection of areas of high biodiversity and other environmental considerations.

The WES designated four categories – Strategic Areas, Acceptable in Principle, Open for Consideration and Not Normally Permissible. There was just one Strategic Area identified in the county, located in LCA 10 northwest of Galway City.

It should be noted that the WES lists the Derrybrien Wind Farm Project, and the nearby Sonnagh Old wind farm, as operational.

Map WE-5B of the WES shows that a large proportion of the Slieve Aughty range (including the Derrybrien Wind Farm project) designated as a Special Protection Area (SPA). Under the WES, the Slieve Aughty LCA was no longer designated a Strategic Area for new wind energy development and it appears that this was largely due to the statutory nature designation and also to topography. Table WE10 in the WES (Landscape Capacity for Wind Energy Development in Landscape Character Areas) notes the following in relation to the Slieve Aughty Mountains LCA:

> *Small in OC – Limited capacity due to large areas with statutory nature designation and elevated nature of hill slopes. Small pocket in northwest may provide limited opportunities for small cluster of wind turbines.*

13.3.5.4 Galway County Development Plan 2015-2021 – Wind Energy Development and Landscape Policy

The 2011 WES was updated (with minor updates) and included as Appendix IV of the t Galway County Development Plan 2015-2021. The Strategic Areas remain the same, and the Slieve Aughty LCA designations are unchanged, with the area still designated as SPA. The Landscape Character Assessment was updated slightly and is a supporting document to the Plan, but the text regarding the Slieve Aughty LCA remains unchanged.

The Landscape Value and Landscape Sensitivity of LCA 6 Slieve Aughty in the Assessment remain unchanged, with the site located in an area of Class 2 Medium Landscape Value out of a possible 4 categories, from Class 1 Low to Class 4 Outstanding. Landscape Sensitivity in the vicinity of the project is indicated as Class 2 Moderate (out of a possible 5 categories from Class 1 Low to Class 5 Unique.) These are illustrated in Map LCM1 and LCM 2 of the current Development Plan.

The protected view from the shoreline at Loughrea remains the only protected view in the vicinity approximately 10 kilometres north of the Derrybrien Wind Farm Project. This is illustrated on Map FPV 1 of the Development Plan. With regard to landscape policies, the following policies currently apply:

Policy LCM 1 *– Preservation of Landscape Character: "Preserve and enhance the character of the landscape where, and to the extent that, in the opinion of the Planning Authority, the proper planning and sustainable development of the area requires it, including the preservation and enhancement, where possible of views and prospects and the amenities of places and features of natural beauty or interest."*

Objective LCM 1 *– Landscape Sensitivity Classification : "The Planning Authority shall have regard to the landscape sensitivity classification of sites in the consideration of any significant development proposals and, where necessary, require a Landscape/Visual Impact Assessment to accompany such proposals. This shall be balanced against the need to develop key strategic infrastructure to meet the strategic aims of the plan, and having regard to the zoning objectives of serviced development land within the Galway Metropolitan Areas".*

Objective LCM 2 *– Landscape Sensitivity Ratings: "Consideration of landscape sensitivity ratings shall be an important factor in determining development uses in areas of the County. In areas of high landscape sensitivity, the design and the choice of location of proposed development in the landscape will also be critical considerations."*

Objective LCM 3 *– Open/Unfenced Landscape "Preserve the status of traditionally open/unfenced landscape. The merits of each case will be considered in light of landscape sensitivity ratings and views of amenity importance"*

Objective LCM4 *– Review of the Landscape Character Assessment: "On adoption of the National Landscape Strategy for Ireland 2015-2025, the Planning Authority shall facilitate the development of the National Landscape Character Assessment prior to reviewing the County Landscape Character Assessment."*

13.3.5.5 Galway County Development Plan 2022-2028

The Galway County Development Plan contains a number of landscape related policies and objectives, and also includes a Landscape Character Assessment. The Landscape Character Assessment (first carried out in 2003) is part of the 2022-2028 Development Plan, (Appendix 4) and has been updated in this version of the Plan

A policy relating to protected views is also included, however these are detailed in the Landscape Character Assessment. The policy states:

- ***Policy PVSR1 Protected Views and Scenic Routes****: Preserve the protected views and scenic routes as detailed in Maps 8.3 and 8.4 from development that in the view of the Planning Authority would negatively impact on said protected views and scenic routes. This shall be balanced against the need to develop key infrastructure to meet the strategic aims of the plan.*

Landscape Character

From review of the updated LCA, contained in Appendix 4 of the Development Plan, the methodology, the identification of the Landscape Character Areas, the categories of Landscape Sensitivity and the identification of scenic routes and protected views, have also been updated.

The LCA identifies Landscape Regions, which divided the County into 4 main areas, of which the subject site is include in the South Galway Region. These Regions are then sub-divided into Landscape Types, (Section 2 of the document) which describes the landscape of the Slieve Aughties as a distinctive landscape type as follows:

> *Slieve Aughty Landscape - distinctive uplands of the Slieve Aughty Mountains define the much of Galway's southern boundary with County Clare.*

Figure 13-10 is an extract from the LCA showing the extent of the Landscape Type which extends from Woodford in the east to a little south of Loughrea to the north, and to the Clare County Boundary to the south, extending to the higher ground west of Gort.

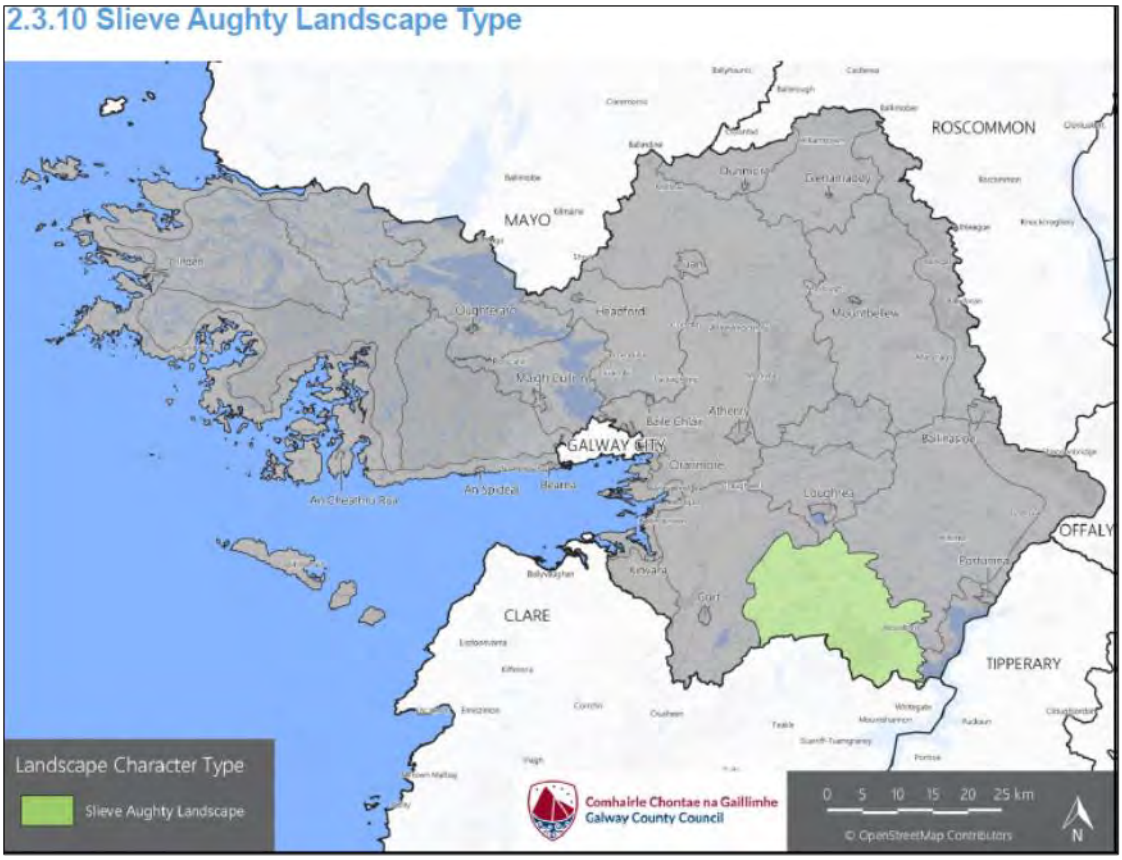


Figure 13-10 Slieve Aughty Landscape Character Type *Source: Galway County Landscape Character Assessment 2022*

Text which accompanies the above Figure notes the following description:

> *Sandstone geology creates the distinctive uplands of the Slieve Aughty Mountains that define much of Galway's southeast boundary with County Clare. Agriculture and settlement are less intensive in this landscape and the higher elevations are largely used for coniferous forestry interspersed with remnants of the area's original blanket bogs. The latter contains a concentration of wind farms that have a locally dominant visual effect on these landscapes. There are expansive views from unenclosed elevations which are regionally valued as a recreational resource.*

The above description complements the findings of the site visit in terms of landcover, however the description of the pattern of and visual effects of the windfarms is not accurate in our view. There are two wind farms in the area, Derrybrien and Sonnagh Old.

The text goes on to state that under the heading 'Sensitivity', this area has: *Low sensitivity to change.*

In Section 3 of the LCA, Landscape Types are sub-divided into Landscape Units. However the entire Slieve Aughty LCA is the same as the Slieve Aughty Landscape Unit.

A more detailed description is included (p40) of the LCA as follows:

> *This is a distinctive landscape that occur along the upland southern boundary with County Clare. Much of this landscape is sparsely populated, with few roads. It contains extensive areas of coniferous forestry interspersed with residual areas of unplanted blanket bog. These areas extend from south of Lough Rea, Co.Galway to Scarriff in Co.Clare. There are many small and medium sized lakes in the area, most notably Lough Graney and Lough Atorick, and many important rivers rise in this area, including the Owendalulleegh and Graney. The Slieve Aughty Mountains are mainly comprised of Old Red Sandstone.*

Large windfarms have recently been developed in this area - which creates a locally distinctive appearance and character. The elevation of these landscapes offers many panoramic views across the plains to the north and east. This scenery coupled with the low levels of settlement and extensive areas of semi-natural landcover creates conditions that are increasingly valued for tourism and recreation.

Figure 13-11 below (reduced format) shows the Slieve Aughty Landscape Unit along with the surrounding Landscape Units of Kilchreest basin unit (purple, to the west), South Lough Rea to the north, Kilcrow Basin Unit to the east, with the Clare County boundary to the west. A full-size version of this Figure is included in **Appendix 13-6**.

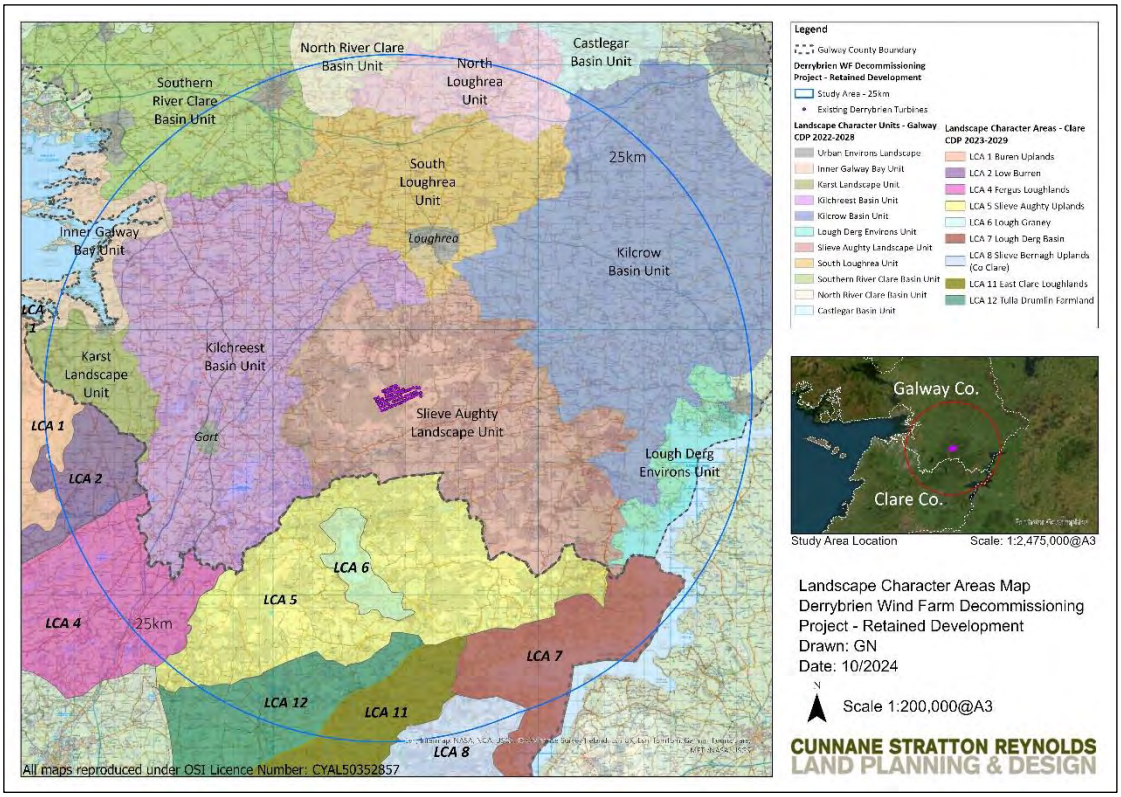


Figure 13-11 Extract from LCA showing site and landscape units

In the above Figure, the Slieve Aughty Landscape Character Unit is identified, and is described as:

Largely un-occupied and un-enclosed. Mosaic of large forestry plantations and residual blanket bog areas. Large windfarms are visually dominant in places.

As noted above the Derrybien and Sonnagh Old are the two windfarms in existence, Derrybrien with 70 turbines and Sonnagh Old with 8 turbines.

Landscape Sensitivity

Landscape Sensitivity for each Landscape Character Area, or Unit, is also defined in the LCA. There are four categories of landscape sensitivity:

- Iconic: Unique landscape with high sensitivity to change.
- Special: High sensitivity to change.
- High: Elevated sensitivity to change.
- Low: Unlikely to be adversely affected by change.

The LCA notes that sensitivity is 'a landscape's capacity to absorb new development, without exhibiting a significant alteration of character or change of appearance is referred to as its 'sensitivity'. This is similar to the GLVIA (2013) definition of susceptibility, one of the two factors which contribute to sensitivity.

Importantly, the LCA does also note, as stated in the GLVIA, that the sensitivity depends on the type of development, which, it notes, may have 'greater or lesser impacts on the visual quality and character' depending on the details of the project design and the specific characteristics of the site and its context.

Figure 13-11 below shows the site location on the Landscape Sensitivity Map, with the site (and the whole of the Slieve Aughty Landscape Character Area considered Special sensitivity, as is the coastal landscape at Kinvara and outside the study area, much of the Connemara landscape. This is, however, not consistent with the description of the sensitivity Slieve Aughty Landscape Unit referred to above, which is referring to the same geographical area and which is referred to as 'Low sensitivity'.

The surrounding remaining Landscape within the 20 kilometre study area in Co Galway is all within the Category Low sensitivity on Figure 13-12.

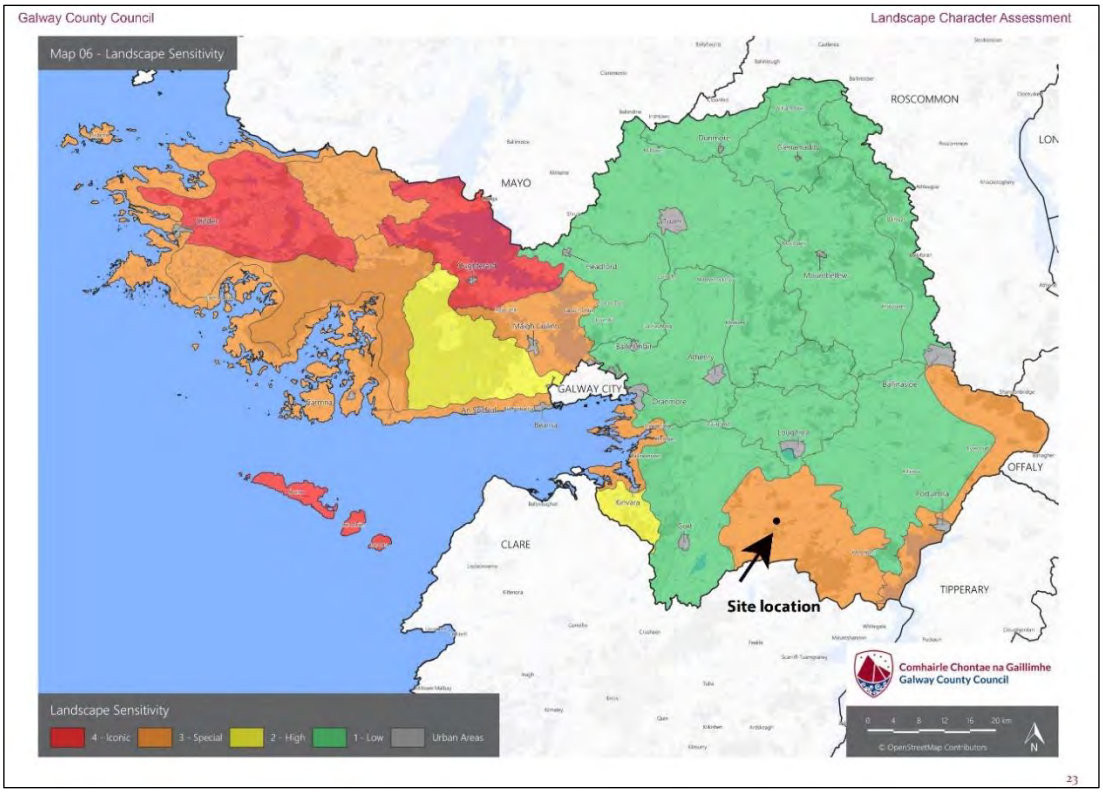


Figure 13-12 Site Location and Landscape Sensitivity

Scenic Routes and Protected Views

Sections 6 and 7 of the LCA also contains a map and list of scenic routes and protected views. There are no protected views in the Slieve Aughty landscape unit, but there are some views within the wider study area.

These are illustrated on Figure 13-13 which is included in reduced format below and at full size in **Appendix 13-7**).

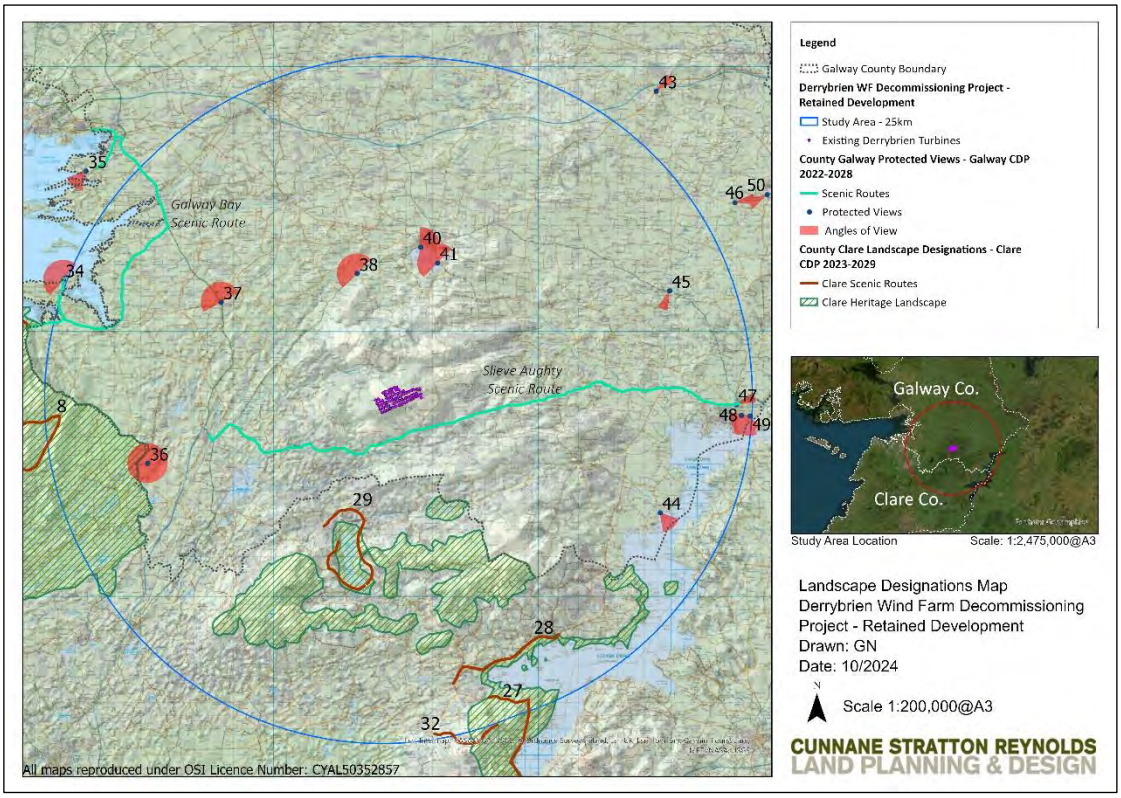


Figure 13-13 Landscape and Visual designations in Co. Galway and Co. Clare

There are several protected views in the wider study area, and these are listed as follows:

- 36 Kilmacduagh Ecclesiastical Complex.
- 37 Ardrahan Church and ruins.
- 38 Kilchreest Church ruins and graveyard.
- 40 Corry's Field Walk.
- 41 Loughrea Swimming Area.
- 45 Killimor Old Graveyard (although just on the 20km boundary the view is towards the southeast of the study area.

These views were reviewed and the view direction indicated on the map indicates that none of the views are towards the site of the Derrybrien Wind Farm Project apart from View 36 which is illustrated as a panoramic view. However views to the east from View 36 at Kilmacduagh complex are screened by intervening farm and dwellings to the east of the site, and the ZTV shows only intermittent theoretical visibility (see Section 13.3.3.6 below). However the views 40 and 41 from Loughrea, while indicated to the east and north-west respectively, are at the lake shore at Loughrea which has open views to the Slieve Aughty hills and to the site, so this is included in the selection of viewpoints.

The map of scenic routes (see Figure 13-13 above) includes just one scenic route in the Slieve Aughties, the Slieve Aughty Scenic Route, along the R352 between Gort and Portumna, which passes south of the Derrybrien Wind Farm and north of Agannygal substation. Viewpoint 6 is located along this route. A further scenic route (Galway Bay Scenic Route) passes towards the western edge of the study area but is at a distance from the site.

13.3.5.6 Clare County Development Plan 2023-2029

Though the wind farm site and Agannnygal substation are both in Co. Galway, the study area extends into the northern uplands of County Clare. Certain parts of the uplands to the south of Derrybrien and Agannygal are designated as areas of Heritage Landscape, including Lough Graney, Lough Atorick itself, and the peaks of Maghera, Pollaguna and Knockbeha mountains.

A section of the R461 and a number of local roads surrounding Lough Graney are designated Scenic Routes. These designations are illustrated on Figure 13-13 above. This area is represented by Viewpoints 11 (towards Agannygal, from the Clare/Galway County boundary), 13 and 14.

13.3.6 Visual Receptors

South of the Site – Derrybrien, the R353 and the Slieve Aughty Uplands

The ZTV which represents the theoretical visibility of the existing wind farm, is referred to below and included in Figure 13-14. This is included at full size in **Appendix 13-8** and in reduced format below.

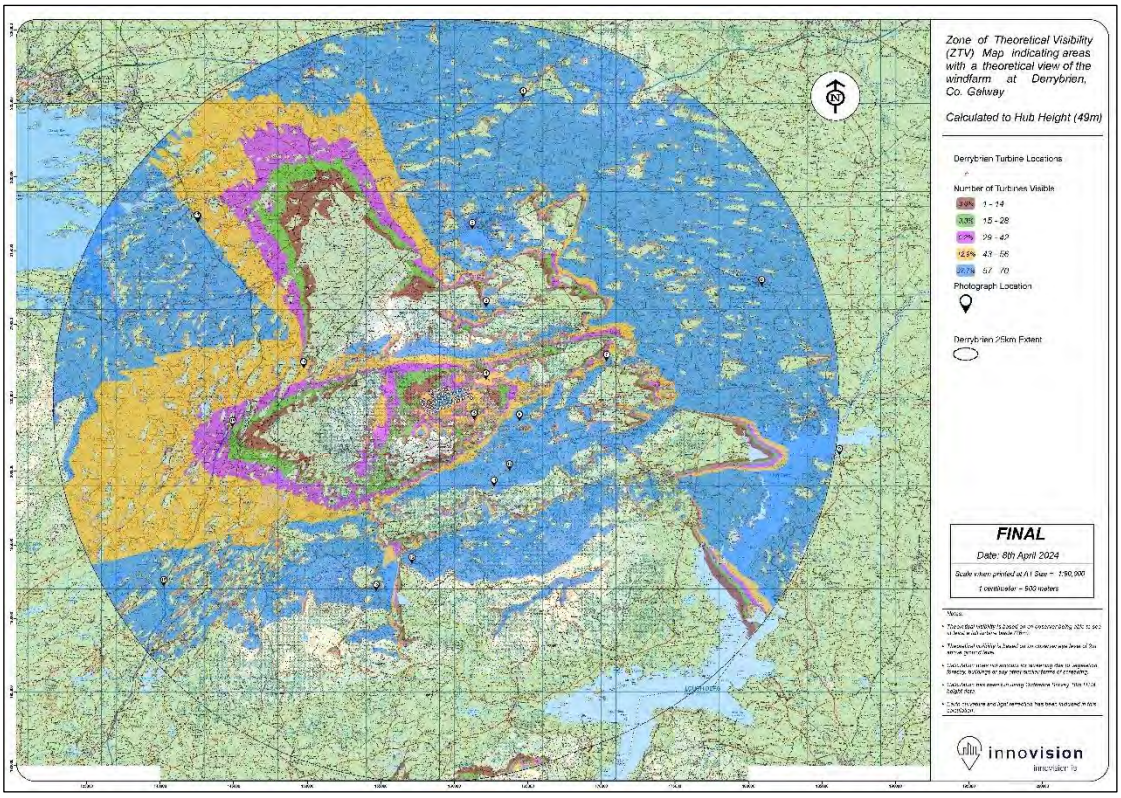


Figure 13-14 ZTV Map of existing Derrybrien turbines

The nearest houses to the site are in the village of Derrybrien some 2km to the south. A derelict house is now visible to the southeast of the site (and is visible in Viewpoint 5) and it appears that this was not occupied prior to construction of the wind farm.

Derrybrien is a low density, scattered linear settlement along the R353 on the lower slope of Cashlaundrumlahan, where there is a strip of marginal agricultural land on the south-facing slope. Due to the local topography (the convex slope above Derrybrien) the village falls outside of the Zone of Theoretical Visibility (ZTV) of the wind farm, i.e. the turbines are not visible from most of the houses, the former national school and the church that comprise Derrybrien. Aerial imagery shows a very minor increase in dwellings in the vicinity, with some buildings along the road to the west of the church that were not present in 1998. These would be outside the ZTV and so have no visibility of the turbines. This includes the nearest house to the windfarm, at a distance of just over 2km, at Derrylaur.

The nearest road to the south of the site is the R353. This is the east-west aligned regional road connecting Gort to Portumna across the Slieve Aughty Mountains and passing through Derrybrien. As it passes through the village the road is outside of the wind farm's ZTV. This road is designated a Scenic Route in the current Galway County Development Plan 2022-2028.

Plate 13-11 Dense coniferous forestry along R353 west of Derrybrien

To the west of Derrybrien the R353 descends from the uplands to the plains following a winding path through a landscape with near blanket forest coverage as shown in Plate 13-10 above. The road is outside of the wind farm's ZTV for most of its length to the west of Derrybrien. However, travelling east towards Derrybrien, for a short stretch between Bunnaglass and Tooravoola, the wind farm can be glimpsed. It appears that the landcover in this area and views remain similar to the pre-development scenario, albeit the roadside trees would have been less mature and some recent felling is evident near Bunnaglass.

To the east of Derrybrien the R353 follows a straight path across a part-forest, part-peatland covered upland plain. There are some open views to the open bogland and coniferous plantations to the south and some areas enclosed by forestry.

Plate 13-12 The R353 east of Derrybrien looking towards Flaggy Bridge

The Flaggy Bridge lies on the R353 just east of the junction with the Black Road. Peat and debris from the peat slide would have been temporarily visible from here, but no trace of the slide or the temporary barrage (now removed) is evident. The present view is shown in Plate 13-12 below:

Plate 13-13 View north from Flaggy Bridge on the R353 east of Derrybrien

Further east, the road then descends towards Ballynakill and the junction of the R353 with the R351.

Ballynakill is situated at lower elevation and is therefore mostly outside of the wind farm's ZTV. To the west of Ballynakill travelling towards Derrybrien along the R353 the wind farm is occasionally visible through gaps in roadside vegetation. There are some open views in the vicinity of what is locally known as Wasteland cross, to the east of the site. There do not appear to have been large scale changes to landcover in this area since c. 1998, which appears on the aerial images from 2000 as a mixture of forestry blocks and open bogland areas. The presence of forestry between the road and the wind farm indicates the likelihood that these views could change over the forestry cycle (felling and replanting). Some roadside vegetation today provides partial screening to some of the turbines. Viewpoint 6 shows the view from this vicinity where there are views to the wind farm but partly screened by roadside vegetation.

Beyond Derrybrien and the R353 the sparsely settled forest and peatland covered Slieve Aughty upland landscape extends for some distance south, into Co. Clare. A local road traverses this landscape (a broad upland plain), aligned roughly NE-SW, connecting the R353 to Lough Graney which lies 11km to the south west of the site. Along its route this local road passes through the townlands of Cloghvoley, Derreenamucka, Loughatorick North and Slievanore. There are a small number of houses dispersed along this road, variously surrounded by conifer plantations and peat bog. The landcover remains similar, with the plantations relatively mature in comparison to the pre-development baseline date , where they appear from the aerial images to be recently planted. Views towards the wind farm site may have been more open than they are today. One new residence near the junction with the R353 was observed. Views of the wind farm are afforded from the road and some of the houses where forestry does not screen views.

The Agannygal substation is visible across an area of bog, from a short section of the local road, in the townland of Loughatorick North as shown below in Plate 13-14. Views from the south are also available. Overall, the views of the substation are localised.

Plate 13-14 Agannygal substation (visible from the local road to the west) is located in an area which was forested

The substation is set within an area of bogland interspersed with coniferous forestry landcover. Today, an area of peatland is located to the west of the substation, while the forestry in the immediate vicinity of the substation has been partly felled since 1998, on inspection of the 2017 GeoHive aerial view, and 2020 Google maps aerial view. The substation is likely to have been more screened from view before the felling took place.

The Moneypoint-Woodford 400kV line traverses this road, which would have been visible prior to the development of the windfarm project, while the Ennis – Shannonbridge overhead line traverses the road further south, near the Bleach River. Today, the 110kV overhead line connecting the Derrybrien wind farm with the Agannygal substation also traverses this landscape. The large scale forestry and 400Kv overhead line would have created a somewhat industrial character to parts of this landscape prior to the introduction of the Derrybrien-Agannygal overhead line as shown in Plate 13-8 above.

Further south, the East Clare Way follows the local roads encircling Lough Graney. The wind farm is visible from the most elevated sections of the waymarked way.

East of the Site – The Black Road, Ballynakill, the R351, Portumna, the N65 and Lough Derg

The nearest public road to the wind farm site is known locally as 'the Black Road'. This is a single lane, relatively remote local road aligned roughly north-south, crossing the ridge of Cashlaundrumlahan and connecting Derrybrien and the R353 to Loughrea to the north. The Black Road passes some 1km to the east of the wind farm. (It was partially blocked during the peat slide in 2003.) Plate 13-14 below shows the access road (which was adjacent to a peat repository area), now heavily vegetated. Views of the peat slide would have been visible from here, but today the view is of a track with dense vegetation on both sides.

Plate 13-15 View from Black Road towards the turbines and location of the peat; peat repository area here to right of view

There are no occupied houses along the Black Road in the vicinity of the wind farm, and this was the case prior to the existence of the Project. Today, the nearest house along this road is an isolated farmhouse near the junction with another local road in the townland of Coppanagh some 2.2 km to the north east of the nearest turbine. The dwelling faces southeast and glimpses of blade tips are available from the road just south of the dwelling. This is a quiet local road, with a strongly remote character, with open views from the higher ground, an area of open moorland which appears relatively unchanged, and the lower ground, to the east of the wind turbines dominated by forestry, based on review of aerial imagery.

Plate 13-16 Enclosure by forestry along Black Road

Plate 13-17 Open bogland allowing views along Black Road

Comparison of the aerial images shows some felling and replanting has occurred, particularly east of the Black Road, and plantations which were young prior to the wind farm construction have matured.

To the east of the Black Road the largely unpopulated forest and peatland covered upland landscape extends for some 5km, down the slope of the mountains towards the village of Ballynakill and nearby Curra West on the R351. The loose cluster of houses comprising Ballynakill is largely outside of the wind farm's ZTV. Views of the wind farm from the R351 are similarly blocked by the intervening topography except for a short stretch of the road in the area of Curra West.

To the east of the R351 an undulating agricultural landscape extends to the shore of Lough Derg, 18km to the east of the site. Portumna is the nearest large town east of the site. It is some 23km distant on the

northern shore of Lough Derg. Due to landcover there are no views of the wind farm from Portumna, but from the far side of Lough Derg in Co. Tipperary (e.g. Terryglass) the wind farm is visible in the distance.

The N65 National Road follows an arcing route north west from Portumna to Loughrea. It traverses an undulating rural landscape and passes through the village of Killimor.

North of the Site – Sonnagh Old, Loughrea and Environs,

To the north of the site the forest and peat covered upland landscape extends for several kilometres, with a local road (over 'Francis Gap') and forest tracks providing access. However, there are no houses in this area. A linear mountain, smaller but similar in shape to Cashlaundrumlahan lies parallel to the north. Today, the Sonnagh Old wind farm is located on this ridge however c. 1998 the Sonnagh Old turbines would not have been present.

Beyond Sonnagh Old, on the outer northern slopes of the Slieve Aughtys the topography breaks up into a complex hilly landscape where coniferous forestry has largely replaced the marginal grassland. The village of Killeenadeema is at the centre of this landscape, between the mountains and Lough Rea. The area is accessed by a complex pattern of local roads. There is a relatively dense distribution of houses - including urban-generated housing - along the roads, particularly towards the north around Lough Rea.

The town of Loughrea is located to the north of the lake. The urban area spreads around the northern shoreline behind a corridor of open space which includes parkland with footpaths, a playground, a shoreline parking area and viewpoint. In views across the lake from the houses and open space around the shoreline the Slieve Aughtys form the horizon with the Derrybrien and Sonnagh Old wind farms visible, but as noted neither wind farm was present in the 1998 baseline scenario. The town of Loughrea has expanded to the north, and the bypass road constructed since the pre- development baseline.

An undulating agricultural landscape extends to the west, north and east of Loughrea. Several national and regional roads follow radial routes from the town through this landscape. There is widespread dispersed rural housing along the road network which is also evident on the aerial photos from 2000. The undulating topography and mature hedgerows, tree lines and patches of forest generate a high degree of visual enclosure in this area.

In the present, from elevated locations where there is no foreground vegetation, views of the distant mountains and the wind farms (Derrybrien and Sonnagh Old) are afforded. However, these views prior to the windfarm construction would have been views to the distant uplands without any turbines.

Today, the M6 motorway passes on an east-west alignment some 7km to the north of Loughrea, and 18km north of the site. This is the main transport route from Galway City, carrying a large volume of traffic through the wind farm's ZTV. However this road was not constructed in 1998 (the pre-development baseline date) , and therefore this would not have been included in the list of potential visual receptors at the time. (Currently there are distant views of the Derrybrien turbines at the N18/M6 interchange.)

West of the Site – Gort, the R380 (and M18)

The forested upland landscape extends for several kilometres to the west of the site before falling away towards a wet lowland landscape characterised by drumlins and marginal grassland. The R380 passes at the foot of the western slopes of the Slieve Aughty Mountains, linking Loughrea to Gort which lies some 12km to the west of the site. Much of the landscape east of the R380 is outside of the wind farm's ZTV the western convex slopes of the mountains hiding the turbines from view.

Today, much of the section of road from Gort to just south of Peterswell has visibility of the turbines. Also at present, the M18 also passes through Gort linking Galway City and Ennis to the south in Co. Clare. The M18 between Limerick and Gort opened in 2010, while the M18 from Gort to Tuam was constructed between 2015 and 2018 and thus would not have been part of the pre-development baseline 1998.

To the northwest of Gort lies Coole Park, which is a well-known Nature Reserve and the former home of Lady Gregory which is currently managed by the NPWS and is a visitor attraction. Visibility of the Derrybrien turbines is not possible, and would not have been considered likely prior to the development, due to the heavily wooded nature of the site. (They are, however, visible from the M18 motorway overpass on the access road into Coole Park). Northeast of Gort, approximately 10 kilometres west of the Derrybrien turbines, lies Thoor Ballylee, known for its connection with WB Yeats, which is just within the ZTV. The Derrybrien turbines are not visible from the base of the tower due to screening, but views of both Sonnagh Old and Derrybrien turbines are available from the rooftop battlements.

At a distance of approximately 9.6 kilometres, the turbines are visible but not a major element in the view, and the panoramic nature of the views also includes views west to the Burren Hills as well as woodlands. The Sonnagh old turbines (a distance of approximately 9.2km) are also visible from the rooftop as shown in Plate 13-17 below.

Plate 13-18 View of distant Derrybrien turbines from the Thoor Ballylee tower roof

Lough Cutra lies approximately 13.7 km to the southwest and lies within the Zone of Theoretical Visibility. Lough Cutra Demesne (a private castle and estate) lies to the west of the lake. While visibility from the public road adjacent to the demesne is blocked by heavy screening, there may be some visibility of the distant turbines from open areas within the demesne. The mature nature of the screening indicates that this was the case before construction of the development.

The lowland rural landscape west of the Slieve Aughtys is relatively sparsely populated compared to the plains to the north and east, except along the main road corridors and in Gort. This would have been similar in the pre-development baseline environment.

Further west, the ZTV shows visibility in the Burren Lowlands, west of Gort, however the turbines are at some distance from the viewers in this area and are visible, but not prominent.

Plate 13-19 View from Burren Lowlands near Cappacasheen, Co. Clare, approximately 20km west of the Derrybrien turbines

In summary, the R353 passes through Derrybrien 2km to the south of the site but due to the local topography, and vegetation cover, the wind farm cannot be seen from most of the village and the road. The site is surrounded on all sides by a belt of almost completely un-populated upland forest and peatland landscape several kilometres in breadth, forming a buffer between the wind farm and the agricultural landscape on the surrounding plains. These plains form part of the midlands basin and extend for tens of kilometres to the east and north, as well as to the coast of Galway to the west. There are numerous visual receptors in this vast area, but the Slieve Aughtys (and the Derrybrien turbines) are not a prominent feature in any views except from close up. There are several towns in these plains, notably Loughrea, Gort and Portumna, where there are concentrations of visual receptors, but no major urban areas.

13.3.7 Summary of Baseline Information

13.3.7.1 Summary of Landscape Character and policy development

Based on the description (past and present) of the receiving environment and analysis of previous and current landscape and visual amenity policy in Section 13.1, the landscape and visual amenity characteristics and values can be summarised as follows:

- The northern part of the Slieve Aughty Mountains (that part of the range in Co. Galway, comprising Cashlaundrumlahan and the parallel unnamed ridge in the townland of Sonnagh Old) is an upland landscape of relatively small scale and undramatic landform compared to other mountain ranges in Co. Galway and across Ireland.
- The uplands (as well as the Derrybrien turbines) are visible from a very wide area of the surrounding plains (where local variations in topography and vegetation do not block the view in places) but are unremarkable in form and scale. They generally feature as a broad, low, round-topped landform on the horizon, with limited visual presence.
- The Slieve Aughtys have one of the largest concentrations of coniferous forest in Ireland. On the upper slopes the plantations are interspersed with large areas of peat bog (exploited in places for turf cutting) and transitional woodland scrub. On the mid slopes of the mountains there is near blanket forest cover, transitioning to marginal grassland lower down the slope. This is a typical marginal mountain mosaic landscape type – a 'working' upland landscape.

- The Slieve Aughty Mountains, being an upland landscape, were identified as a High Scenic Amenity Area in the GCDP 1997. However, in comparison to the other uplands in the county (the Connemara Mountains), the Slieve Aughtys are not renowned for their scenery or recreation amenity. The Landscape Character Assessment which informed the GCDP post-2003 recognised the relatively limited amenities of the area, categorising the Slieve Aughty Mountains as an area of Class 2 Medium landscape value (from a possible ranking of Low, Medium, High or Outstanding). The landscape sensitivity of the area was categorised as Moderate (from a possible ranking of Low, Moderate, High, Special or Unique). These ratings were relatively low compared to other upland areas in the county.
- The Slieve Aughty Mountains had a viable wind resource for exploitation (by the technological standards of the 1990s). The only other areas in Co. Galway with a viable resource were the Connemara uplands and the coastal areas, which were generally considered to be of higher landscape value and sensitivity and some areas had poorer access.
- When other factors are considered such as the road access across the Slieve Aughtys, the uncomplicated topography, the 'working landscape' character and the relative lack of scenic amenity and recreational use (compared to the Connemara uplands and the coastal areas), the wind resource in the Slieve Aughtys represented a development value of at least county-level significance (and given national policy at the time, the resource in the Slieve Aughtys could be considered of national importance).

13.3.7.2 Summary of Visibility and Visual Receptors

- The settlement and transport patterns in the vicinity of the site are sparse. There are no occupied houses within 2km of the wind farm. The nearest village is Derrybrien, some 2km from the site, and the majority of the houses in and around the village have no view of the wind farm due to the local topography and vegetation cover.
- There are a small number of rural houses on the fringes or outside of Derrybrien (to the south), Ballynakill (to the east) and along the local road to the south of the site, which do have views of the wind farm. There are also views afforded from stretches of the Black Road that passes to the east of the site, where local topography and vegetation does not screen the view. There are no dwellings along the route of the overhead line. The nearest dwellings to the Agannygal substation are just over 500 metres to the west and to the east of the substation, with intervening vegetation evident between the properties and the substation.
- There is a belt of unpopulated, forest-covered landscape several kilometres wide around the west, north and east of the site on the outer slopes of the mountains. This limits the number of visual receptors of the development.
- The wind farm site is visible from a vast area of agricultural plains to the west, north and east of the Slieve Aughtys, where local topography and vegetation does not screen the view. There is a pattern of dispersed rural settlement along the network of local roads throughout this area. The area is also traversed by several regional and national roads carrying large volumes of traffic (including the M6, M18, N65 and R380). Additionally, the uplands (and the wind farm) are visible from parts of Lough Derg (towards the eastern shore) some 20km to the east.
- The ZTV was extensively ground-truthed to assess actual visibility and potential visual receptors. Coole Park and Thoor Ballylee were visited to assess visual effects. Views from Coole Park are screened by trees, with a glimpse of turbines only on the motorway overpass east of Coole Park entrance. No views of the turbines are available from the trails or grounds of Thoor Ballylee, or indeed the windows of the cottage or tower, with distant views are available from the battlements as represented by Plate 13-18. A viewpoint 14 (Cuilmore) is located at a similar distance from the proposed turbines.
- As noted above, a small section of the Burren National Park is within the 25km ZTV (approximately 21 km from the nearest at its closest point and no clear views of the turbines are available from the public roads within the ZTV. Similarly, the protected view 36 at Kilmacduagh was visited, and no views of the development.

- The site is far from any large centres of population. The nearest town is Loughrea, some 10km to the north. The wind farm appears - and is clearly visible - in views from the public open space and buildings around the shoreline of Lough Rea.
- The wind farm is not visible from the centre of other large towns in the area, Gort to the west and Portumna to the east. Galway City is some 35km to the north west.

13.3.7.3 Summary of Baseline Information (Changes in the baseline environment 1998-2020)

In summary, today, due to the upland location of the wind farm, and the surroundings of extensive forestry, there are few houses and roads in its immediate vicinity. This is likely to have been the case in 1998.

From the review of aerial imagery, Development Plans and Planners' reports associated with the Derrybrien Wind Farm project applications, the area in the vicinity of the site appears to have undergone little change. The cyclical nature of forestry and small scale turbary activities are likely to have been ongoing in the vicinity of the site. Following the peat slide, a number of measures were undertaken, but these are assessed in Section 13.4.1 and not part of the baseline.

Landscapes are constantly changing, and there have been some changes in the receiving environment. Much of the land on the site and in the immediate vicinity is covered in coniferous forestry, and this results in changes over time as there is a continuing cycle of felling and re-planting.

Aerial imagery shows that between 2000 (prior to construction) and 2005, felling occurred outside the site boundary to the west of the site, and some smaller areas to the southeast of the site. Between 2005 and the more recent aerial images, felling is indicated in several areas between the turbines and the Black Road to the east. Felling directly to the west of the site was carried out between 2016 and 2018.

Thus, views can change, in some cases relatively dramatically, when trees are felled, and as forestry grows up, other views may be obscured. This forestry cycle is likely to continue.

Other changes in the wider landscape include the construction of the M6 motorway between Ballinasloe and Oranmore (opened in 2017) and the M18 motorway (constructed between 2015-2017). These motorways and some associated access roads have also opened up new viewing opportunities not available in 1998 (views from both the M6 and M18 are represented in the set of photomontages). It should however be noted that visual receptors on motorways, travelling at high speeds, are not usually regarded as highly sensitive, as they do not tend to be focussed on their surrounds.

There was an increase in dwellings in the wider landscape, but very few in the immediate vicinity of the site – one dwelling noticed in the Derrybrien vicinity which is outside the ZTV. Settlements including Gort, and Loughrea showed an increase in dwellings since 1998 as noted above.

13.4 Likely, Significant Impacts and Mitigation Measures Implemented

The following section describes the likely significant impacts of the Do-nothing scenario for the Derrybrien Wind Farm Development. This section also includes the significant impacts associated with each phase the project between 2003 - Present Day as well impact associated with Retained Development (Post Decommissioning).

For sections 13.4.2 – 13.4.5, landscape and visual effects are described separately. As set out in Section 13.2, Landscape effects are a combination of the landscape value and susceptibility while visual effects are a combination of visual receptor sensitivity and the value of the view. Each section includes a description of the magnitude of change and the significance of the effect.

13.4.1 Do-Nothing Scenario

In the Do-Nothing scenario, the Derrybrien Wind Farm Development would remain in situ in its current state – i.e., an unauthorised windfarm development that ceased commercial electricity generation in February 2022. No decommissioning works would be undertaken. The infrastructure would continue to degrade over time.

The trends in the vicinity of the site and in the wider landscape – including commercial forestry, which involves a cycle of felling and re-planting, turbary, and agriculture, are expected to continue.

13.4.2 Construction Phase Effects (2003-2006)

All effects, apart from the works associated with the peat slide, in relation to the development are considered direct effects – that is, effects that result directly from the development itself, as defined in relation to landscape and visual effects by the GLVIA (3rd edition, Section 3.22.)

13.4.2.1 Construction – Phase 1

13.4.2.1.1 *Landscape Effects*

Landscape Sensitivity

The landscape sensitivity of the receiving environment can be classified as Low to Medium. This sensitivity applies to all stages of the assessment which are described below as set out in Section 13.2.4:

Low: Areas where the landscape has few valued elements, features or characteristics and the character is weak. The character of the landscape is such that it has capacity for change; where development would make no significant change or would make a positive change. Such landscapes are generally unrecognised in policy and where the principal management objective is to facilitate change through development, repair, restoration or enhancement

Medium: Areas where the landscape has certain valued elements, features or characteristics but where the character is mixed or not particularly strong. The character of the landscape is such that there is some capacity for change in the form of development. These areas may be recognised in landscape policy at local or county level and the principal management objective may be to consolidate landscape character or facilitate appropriate, necessary change.

The topography of the Slieve Aughty Mountains (the northern part of the range in Co. Galway) is unremarkable in scale and form. The land use mix is dominated by coniferous forestry. The settlement pattern is sparse. Although scenic in the sense that the landscape was and is relatively remote, free of built elements and afforded long range prospects over the surrounding plains in places, (and though designated as HSAA prior to construction of the wind farm), the Slieve Aughty Mountains, do not appear widely renowned for their scenic amenity and did not appear to attract widespread recreational use. The landscape value would be considered to be Medium, and the susceptibility to the type of development of wind turbines would be considered Medium to High. These characteristics of the landscape generate the medium sensitivity rating.

Magnitude of Landscape Change

This initial construction phase of the wind farm involved vegetation clearance, including tree felling along the site tracks, as well as along the turbine bases, at the Derrybrien substation located within the windfarm site. Also carried out were activities including the construction of access roads, set up of construction compound, and extraction of rock from borrow pits/quarries. Civil works were carried out to construct some of the turbine foundations and access tracks. A peat slide occurred during October 2003 and works were halted on the wind farm site.

The magnitude of change can be described at various scales, including changes taking place in the vicinity of the site, and those which are apparent at the wider landscape scale. While the peat slide would be considered a high magnitude of change in the immediate vicinity of the windfarm site, this is regarded as a

localised change. When considered at the wider 'landscape scale' – the scale at which the landscape effects of wind farms and other infrastructure development in rural areas are generally considered – this occurrence on its own represented a Low to Negligible magnitude of change.

Significance of Landscape Effect

Overall, the construction phase activities (and including the peat slide) would be considered a **Moderate, adverse effect** on the landscape, but one that is temporary in duration. The construction phase activities would be most evident at the local scale, in the site and immediate vicinity.

The peat slide however would be considered as having been locally Significant from a landscape perspective in the short term. On a wider landscape scale, the landscape effects would be considered Not Significant.

Over time, and at the present day, the areas affected by the works have largely re-vegetated and integrated into the landscape. The resulting effects are that, today, some of these areas that have re-vegetated are difficult to distinguish from the surrounding areas. The effects are less legible in the landscape than the ongoing forestry operations in the vicinity. The medium and long term landscape effects can be considered Not Significant to Slight.

13.4.2.1.2 *Visual Effects*

The visual effects at construction stage would have been relatively localised due to the low proportion of visual receptors in the area. Visual effects would be caused by machinery in and around the site, and the associated felling. Forestry activities already ongoing in the area and on the site, would include felling activity at certain times.

The visual effects of the peat slide appear to have been localised, as it was visible from the Black Road and also a section of the R353, where the peat was observed flowing across the Black Road and at Flaggy Bridge on the R353. Visual receptors would have been road users and considered Low-Medium sensitivity.

Magnitude of Visual Change

Section 13.4.2 below contains descriptions of 17 no. photomontages listed in Table 13.10 which were taken when the wind farm was operational. During construction, only viewers at viewpoints in close proximity to the site (Viewpoints 4,5 on the Black Road and potentially viewpoint 6) would have experienced visual effects. Visual effects in the June-October period would have been localised and of Low to Medium magnitude of change, due to the tree felling and beginning of construction of the turbine bases and access tracks, however locally of a High magnitude of change for a short period of time as a result of the peat slide. The peat slide would have been visible along parts of the Black Road near the Black Road Bridge, and the R353 near Flaggy Bridge.

Significance of visual effect

The construction activities and the peat slide would have been resulted in Moderate, adverse visual effects (resulting from a Low-Medium sensitivity and a magnitude of change ranging from Low-Medium to High) but extremely localised and not visible from the viewpoints in the wider landscape. This would have been a temporary to short term visual effect on receptors in the vicinity of the site and in particular the Black Road area. However, in the medium to long term the visual effects would have lessened, and at present the areas visible from the Black Road and R353 have re-vegetated and assimilated with the surrounding landscape.

13.4.2.2 Works associated with peat slide 2003/2004

These effects are considered indirect as they are described as 'a consequential change resulting from the development' as defined in the GLVIA (3rd Edition).

13.4.2.2.1 *Landscape Effects*

Landscape Sensitivity

As noted above, the landscape sensitivity of the receiving environment can be classified as Low to Medium. This sensitivity applies to all stages of the assessment.

Magnitude of Landscape Change

A series of works were taken following the peat slide, and are detailed in Chapter 2. The main elements relevant to this section include several Barrages, peat repositories, the construction of an access track, some tree felling and removal of built up peat. Repairs were also undertaken to several bridges. Barrages 1,2,3,4 remain in situ, while four barrages were removed within a few months of the peat slide. The magnitude of landscape change resulting from these works would have been be very localised and would constitute a Low-medium magnitude of change.

Significance of Landscape Effect

The significance of the landscape effect resulting from a Low-Medium sensitivity Low-Medium magnitude of change, is considered to have been temporary to Short term, locally **Slight to Moderate** landscape effects. These effects would be considered to range from neutral to adverse in quality.

13.4.2.2.2 *Visual Effects*

The visual effects of the peat slide appear to have been localised, as it was visible from the Black Road and also a section of the R353, where the peat was observed flowing across the Black Road and at Flaggy Bridge on the R353. Visual receptors would have been road users and considered Low-Medium sensitivity.

Magnitude of Visual Change

The visual effects of the works described above would have been localised (to the vicinity of the Black Road and near the Flaggy Bridge. This is considered a Low-Medium of change, and visible in the immediate vicinity of the site.

Significance of visual effect

This is considered a temporary to short term **Slight, adverse** visual effect on receptors in the vicinity of the site, resulting from a Low-Medium receptor sensitivity and a Low-Medium magnitude of change There would not be any visual effects from the wider landscape and visual effects would only be discernible in Views 7, 10 and possibly 13 of the 16 views. The 16 views are included in the table in Section 9.4.1.4 below.

13.4.2.3 Construction – Phase 2

Magnitude of Landscape Change

The main clear felling areas on the windfarm site took place from the second half of 2004. The remaining turbine hardstands and access tracks as well as underground cabling, drainage and other elements specified in the project description (Chapter 2) were completed and the turbines installed, electrical cabling and the substation and other works were completed. Works were also carried out which included public road upgrade works (mainly to the Black Road). Felling was also carried out along the overhead line route and the construction of the Agannygal substation and the overhead line was completed.

This phase involved the movement of machinery on site and along the route of the overhead line and at the locations of the off-site works. On the windfarm site, the extraction of material from the on-site borrow pits/quarries which would have resulted in noise and dust. These activities would have resulted in a localised, High magnitude of change to the landscape; however it is noted that the site of the Project was heavily forested and commercial forestry activities were ongoing at the time.

Significance of Landscape Effect

The landscape effects of the construction Phase 2 (resulting from a Low-Medium sensitivity combined with a locally High magnitude of change) is considered to be **Moderate**, **adverse** visual effects. The effects are considered to have been Temporary and localised.

13.4.2.4 Visual Effects

Magnitude of Visual Change

Section 13.4.2 below contains descriptions of 17 no. photomontages listed in Table 13.10, which were taken when the wind farm was operational. These are used to assist in assessing the visual effects at the construction, operational, ceased operational stages. The main description of the viewpoints is included in Section 13.4.3.2 below with the visual effects across the Project phases included in the relevant sections. During the construction phase, only viewers at viewpoints in close proximity to the windfarm site (Viewpoints 4,5 and possibly 6) as well as viewers in the vicinity of the overhead line and Agannygal substation (Viewpoint 11) would have experienced visual effects.

Visual receptors near the Agannygal substation and the vicinity of the overhead line are relatively few and would have included residents in the vicinity, and those travelling along the local road to the west of the substation, and the access road. Tree felling was carried out to facilitate construction of the substation and the overhead line which would have allowed certain views.

Visual effects would have been localised and of Low to Medium magnitude of change due to the tree felling and construction of the remaining elements of the wind farm, overhead line, substation and off-site works.

Significance of visual effect

Table 13-9 below summarises visual effects on viewpoints during construction (Phase 1 and 2, including the works undertaken following the Peat Slide). These effects would have been Temporary in nature. However, it is noted that visual effects as a result of the peat slide are not represented by the viewpoints but is discussed above in 13.4.2.2

Table 13-9 Viewpoints at Construction Stage

No.	Viewpoint Location	Visual Receptor Sensitivity	Magnitude of Change	Significance of Effect
4	View from the Black Road at Coppanagh.	Medium	Low - Medium	Moderate-adverse
5	Viewpoint 10 – View from the Black Road at Derrybrien North.	Low-Medium	Medium	Moderate, adverse

6	View from the R353 at Cloghvoley/Knockmoyle West	Medium-High	Low	Not Significant-Slight, adverse
11	View from local road at Loughatorick	Medium	Low-Medium	Slight-Moderate, adverse

The construction activities would have resulted in Slight to Moderate, adverse visual effects. The effects on the receptors in the vicinity of the turbines is relatively localised and not visible from the viewpoints in the wider landscape. This would be considered a temporary to short term visual effect. The visual effects of the construction phase of the Agannygal substation are considered to have been Slight, adverse visual effect but these visual effects are localised, and it is not visible over a wide area. The visual effects of the construction phase of the overhead line is also considered a Slight, adverse visual effect.

13.4.3 Operation and Maintenance Phase Effects (2006 – 2022)

Following construction, the wind farm was commissioned in early 2006. The Operational Phase effects described below assess the effects of the introduction of the Derrybrien Wind Farm Project into the landscape.

13.4.3.1 Landscape Effects

Magnitude of Landscape Change

The magnitude of landscape change which resulted from the development can be classified as **Moderate**.

A high magnitude of change can be described as follows (refer to Table 13-2):

> *Change that is moderate in extent, resulting in partial loss or alteration to key elements, features or characteristics of the landscape, and/or introduction of elements that may be prominent but not necessarily uncharacteristic in the context. Such development results in moderate change to the character of the landscape.*

A wind farm of 70 no turbines in a grid formation, with associated works (access roads, and overhead line and Agannygal substation etc.), was introduced an upland landscape characterised by large areas of extensive coniferous forestry with tracts of open bogland.

The Derrybrien Wind Farm project would have represented a high magnitude of change. The large scale of the Slieve Aughty Mountains (in lateral extent as opposed to height) and the extensive pre-existing use of the landscape for timber production and ongoing forestry operations would have lowered the magnitude of change. The existing 400kV line from Moneypoint to Woodland which traverses the road south of the R353, also reduces the magnitude of change in this area as it already contains a large scale electricity transmission line. It should also be noted that the heights of the constructed turbines are considerably lower than the turbine heights which are commonly proposed today.

Significance of Effects

Measuring the magnitude of change against the sensitivity of the landscape resource (using the guidance outlined in Section 13.2.5), **the significance of the landscape effects of the wind farm can be classified as Moderate** (level 4 out of a possible range of 1 Imperceptible, 2 Not Significant, 3 Slight, 4 Moderate, 5 Significant, 6 Very Significant, 7 Profound).

The effects can be considered **Neutral**. The landscape is a multi-faceted resource, with cultural, environmental and economic values. The development had both positive and negative effects on all three of these facets, but the negative effects were experienced very locally.

In conclusion, the Derrybrien Wind Farm Development has been successfully assimilated into the 'working landscape' (a typical marginal mountain mosaic landscape) of the Slieve Aughty Mountains. The landscape in the vicinity of the site is characterised by a mosaic of areas of open moorland with occasional views of the surrounding plains, and enclosed areas dominated by coniferous plantations. While the development of the windfarm changed the character of the landscape, no valued elements or features were lost.

Following the commissioning of the wind farm, no other landscape and visual effects have occurred in relation to the continued operation of the wind farm. However it should be noted that off-site felling was carried out to the west of the site, between 2016 and 2018, as noted in Chapter 2, Section 2.6.4. This was done in order to optimise productivity of the wind farm. However these areas had been scheduled for felling in 2015 as part of Coillte's routine felling programme, and have been replanted.

13.4.3.2 Visual Effects

Zone of Theoretical Visibility

The first step in selecting viewpoints is the usually the preparation of a Zone of Theoretical Visibility (ZTV) map. This identifies the area (up to a defined distance from the site – in this case 25km) from which the turbines can theoretically be seen based on topography, i.e. all areas where the turbines are not blocked from view by the landform. Though the Derrybrien wind farm project is already in existence, the viewpoints were selected from site visits and also with reference to the wind farm's ZTV. The ZTV is shown in reduced format in Section 13.3.6 (Figure 13-14) and at full size in **Appendix 13-8**, The theoretical and actual visibility is described in Section 13.3.

Viewpoint SelectionThe viewpoints were selected to represent the key categories of visual receptors (e.g. the local community around Derrybrien; the wider rural community around the Slieve Aughty Mountains; settlements in the area; recreation areas, users of affected regional and national transport routes, etc.). The selection of viewpoints also sought to ensure that locations in all directions around the site, and at various distances from the site, were considered. Views which showed clear views of the existing turbines, the overhead line and Agannygal substation were included.

A selection of viewpoints represents the following viewers, including viewpoints at various elevations, distances and contexts in the landscape of the study area as advised in the Scottish Natural Heritage (2017) guidance. These include:

- Viewers in the local Derrybrien community and on local roads.
- Viewers in the wider Slieve Aughty and Burren Lowlands landscape.
- Viewers on Scenic Routes and at Protected Views.
- Viewers at amenity and recreational locations.
- Viewers in local towns and villages.
- Viewers on Regional and National Roads.

Assessment of the visual effects on these representative locations allows for broad conclusions to be drawn as to the overall visual effect which has taken place of the operation of the Derrybrien Wind Farm Project on visual amenity in the receiving environment. As well as aerial photography, imagery from Google Maps Streetview in the immediate vicinity of the site dates from 2009 and is an indication of visual baseline conditions at that time.

To inform consideration of the visual effects at all stages of the wind farm on the receiving environment, 17 no. viewpoints were selected for detailed assessment. These are contained in the Photomontage Booklet in **Appendix 13-1**. The operational visual effects of the wind farm are described below. The 17 no. viewpoints are shown on Figure 13-15 which is reproduced at full size in **Appendix 13-9**.

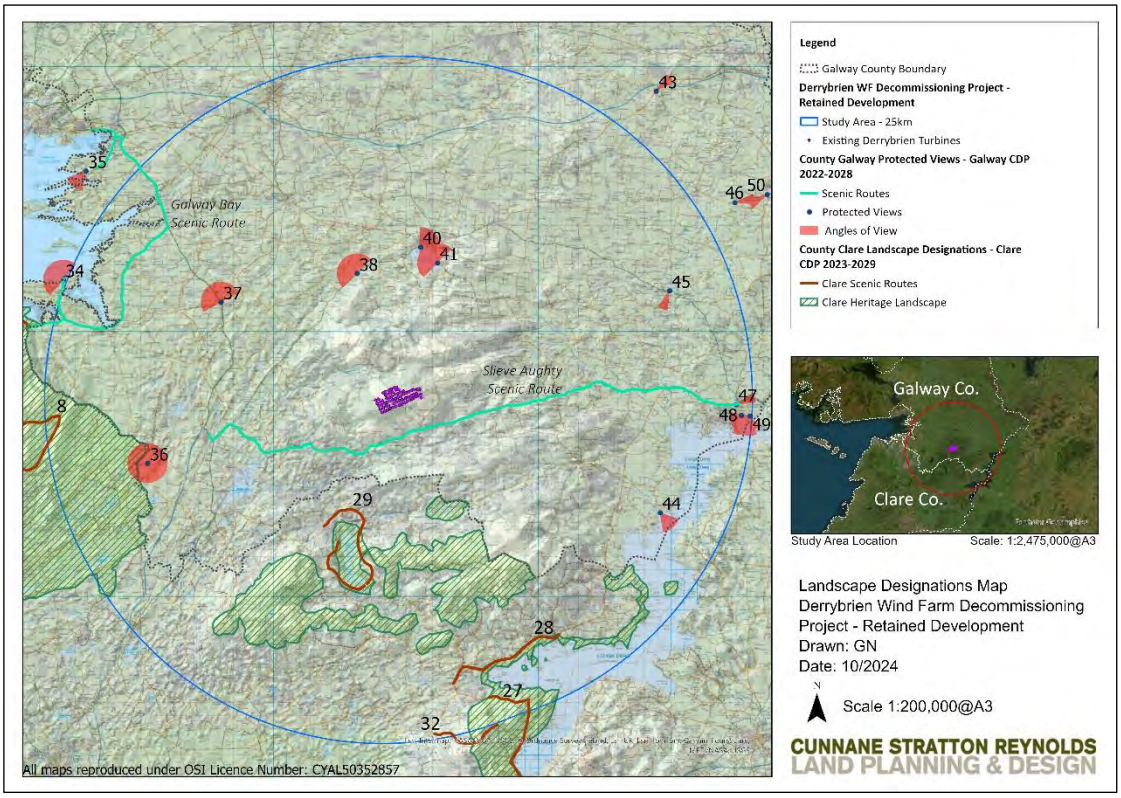


Figure 13-15 Viewpoints 1-17

To screen any potential visual effects from the Burren National Park, a ZTV was extended to 25km from the Derrybrien Wind Farm Project, as per the DoEHLG (2006) guidance. The Park boundary lies beyond 20 kilometres and a very small section is within the ZTV, and while showing theoretical visibility, was reviewed and no clear views of the Derrybrien turbines were available from the public road.

The viewpoints are as follows:

Table 13-10: Viewpoints 1-17

Viewpoint	Description	Approximate Distance from Derrybrien wind farm project (nearest turbine)
1	View from the R350(at M6 motorway overpass) near Caraunmore	20.3 kilometres north
2	View from the shore of Lough Rea	11 kilometres north
3	View from the local road at Curhoor, south of Kileenadeema	5.7 kilometres northwest
4	View from the Black Road at Coppanagh,	1.3 kilometres east
5	View from the Black Road at Derrybrien North, wind farm	1.5 kilometres southeast
6	View from the R353 (Scenic Route) at Cloghvoley/Knockmoyle west	3.6 kilometres southeast
7	View from the Regional Road R351 at Derrygarriff,	9.5 kilometres east
8	View from the road at Garryadd, Killimor	21.2 kilometres northeast

Viewpoint	Description	Approximate Distance from Derrybrien wind farm project (nearest turbine)
9	View from the harbour at Terryglass, Co. Tipperary	25 kilometres east
10	View from the local road at Loughatorick North	5.5 kilometres southeast Derrybrien
11	View from local road at Loughatorick	6.2 kilometres south
12	View from the local road (and East Clare Way) at Corlea Beg,	10.2 kilometres south
13	View from the R461 (Scenic Route) at Doorus East, Co. Clare	12.5 kilometres southwest
14	View from the N66 in the townland of Cuilmore, near Peterswell	8.3 kilometres northwest
15	View from the Regional Road R458 on the northern outskirts of Gort	12.9 kilometres west
16	View from M18 motorway overpass) between Gort and Crusheen at Monreagh	21.4 kilometres southwest
17	View from the N18 national route at Caherpeak East, south of Kilcolgan.	19.5 kilometres northwest

Photomontages

The photomontage booklet (**Appendix 13-1**) shows the 17 viewpoints as 'Existing Views' based on images captured in 2022, to assist in assessing the operational phase visual effects.

Visualisations are a tool to assist in the assessment of visual effects.

From the 17 viewpoint locations, a selection of 6 images from mainly close up but with some more distant viewpoints (from up to approximately 10km from the site), numbers VP2,3,4, 5,6,11, were produced which show a variety of views without the turbines, the Overhead line and the Agannygal substation. These viewpoints, which have open views of the site, were selected to depict photomontage views to show the likely visual effects which have already taken place, assisting in assessment of the views prior to the introduction of the turbines.

For the more distant views, the assessment of the visual effects of the removal of turbines is much more straightforward without the need for photomontages.

Technical information accompanying the photomontages is contained in this booklet. Viewpoints locations are shown on the ZTV map in **Appendix 13-8** as well as on the Viewpoint map in Figure 13-12 above.

Viewpoint 1: View from the R350(at M6 motorway overpass) near Caraunmore, approximately 20.3 kilometres north of the Derrybrien wind farm site (nearest turbine).
Existing View This view shows the motorway overpass in the foreground, with the motorway embankment and several dwellings seen to the right of the view. A stand of mature trees is seen to the left with several fields behind. In the background, the Slieve Aughty uplands form a backdrop to the right, behind the dwellings while they are partly screened to the left of the view. The hills appear as a broad, low, undulating upland landscape in the distance, with the forest cover barely discernible. The uplands are not dramatic in form or scale and do not constitute a key element of the view. The existing Derrybrien turbines are visible in a distant cluster on the distant hill to the centre of the view, with some screened by vegetation. The separate cluster of Sonnagh Old turbines is seen to the right of the view, some also partly screened by the trees. Both are barely discernible.
Visual Receptor Sensitivity The sensitivity of the viewpoint is Low-Medium as set out in Table 13.4. The view is experienced by those travelling along the motorway overpass at moderate speeds and views from the road have no particular valued feature or characteristic.
Magnitude of Change The introduction of the turbines into this view would have been the addition of a very distant, barely discernible element in the view, resulting in very little change to the view. The existing Sonnagh Old turbines would not have been visible to the right of the view. The turbines are not tall by modern standards and therefore do not dominate the upland, or any other element of the view. The turbines are tightly clustered; but the grid-pattern is not apparent. The overhead line and Agannygal substation are not visible in this view. The magnitude of change is considered Negligible.
Significance of Effect The wind farm is a visible but a relatively inconspicuous element in this view. As outlined in Table 13-3, a combination of Low-Medium receptor sensitivity and Negligible magnitude of change as a result of the addition of the turbines is likely had an **Imperceptible and neutral** visual effect.

Viewpoint 2 – Lough Rea Shoreline, Loughrea, approximately 11 kilometres north of the Derrybrien wind farm
Existing View The view from the northern shoreline of Lough Rea is dominated by the lake. There is a fringe of vegetation around the distant shoreline, interspersed with agricultural fields, beyond which an undulating agricultural landscape rises up to forested hills. These are the Slieve Aughty uplands which form the backdrop to the view and the horizon. The uplands are modest in form and scale, dark coloured, and the horizon line is made uneven by the forest cover. The uplands are less prominent and of lesser value in the view than the broad expanse of the lake, the shoreline and the woodland fringe and farmland on the far side of the lake. The Derrybrien turbines are currently visible in the distance along the ridge. The turbine cluster is broad and densely arranged across a distinct hill within the upland. However, in the context of the panoramic view across the lake they occupy a small part of the overall view. The separate Sonnagh Old turbine cluster is smaller and less dense but slightly more prominent being closer to the viewer and located on a more prominent hill.
Visual Receptor Sensitivity The sensitivity of the receptor is High as it is a view with high scenic qualities and an area valued for outdoor recreation. (The location is in 2024, recognised as a protected view in the Galway LCA, though the view is in a slightly different direction).

Magnitude of Change
In the context of the panoramic view across the lake, though visible, the turbines they occupy a small part of the overall view and are at some distance, though the lake in the foreground and middleground may result in them appearing slightly closer. As noted above, the lake is the key feature in the view, with the uplands forming the backdrop, and while the introduction of the turbines would have been a noticeable element in the view, by today's standards they are low in height and well-located in a tight cluster. The magnitude of visual change is considered Low-Medium.

Significance of Effect
The magnitude of change is considered LowMedium and the visual effects of the wind farm on views from the Lough Rea shoreline are considered Slight- Moderate (see Table 13-3 which outlines the significance of effect for a Low magnitude of change and High visual receptor sensitivity). The introduction of a dense cluster of infrastructural elements to the previously simple, valued composition, has detracted from the visual amenity, with some stacking of turbines visible. The quality of the effect is therefore adverse.

Viewpoint 3 – View from the local road at Curhoor, south of Kileenadeema, approximately 5.7 kilometres northwest of Derrybrien wind farm.

Existing View
The view is taken from a local road to the north of Derrybrien, which connects the Slieve Aughty uplands with Loughrea. This is a relatively remote landscape of outlying hills between the uplands and the lowland agricultural area to the north.
In this view the foreground is occupied by a mixture of scrub and rough grassland, which rises to a considerable belt of coniferous forest in the background which extends across the view. This coniferous forest largely screens the bulk of the uplands to the south as well as the lower parts of the existing Derrybrien turbines, some of which are visible in a cluster among the tree tops, but many others are screened by the forestry (evident when compared with the wireframe drawing). The low, rounded crest of Cushlaundrumlahan is almost completely screened by through the trees. To the right of the view, the Sonnagh Old turbines are visible in a cluster and appear slightly more prominent.

Visual Receptor Sensitivity
The sensitivity of the receptor is considered Low to Medium. Viewers would be travelling at relatively slow speeds along this narrow rural road. The landscape is heavily disturbed by abandonment of agriculture and the transition to forestry. There are no particularly valued features and there is a relative absence of buildings.

Magnitude of Change
Today, the extent of the turbines is limited by the forestry, and the turbines which are visible appear among the trees. The magnitude of change has changed over time, but Google Maps Streetview images of this area form 2009 indicate that the fuller extent of the Derrybrien turbines would have been visible, and while the coniferous forestry, (both the mature clumps to the left of the view and the more distant forestry along the width of the view) though younger, were present at that time. The magnitude of change that initially took place is considered Medium. The turbines would have initially been visible over a considerable extent of the view, and although not dominant.

Significance of Effect
The magnitude of change would is considered Medium and a Low-Medium visual receptor sensitivity would combine to create a Slight-Moderate visual effect (as outlined in Table 13-3) and is considered neutral.

Viewpoint 4 – View from the Black Road at Coppanagh, approximately 1.3 kilometres east of the Derrybrien wind farm
Existing View This viewpoint is from the Black Road, a local road just east of the windfarm. This represents one of the more open views of the turbines, at a high point of the road from where there are also panoramic views over the lower lying landscape to the east. This view shows a relatively open view with an expanse of heath or bogland in the foreground, and conifer plantations in clumps to the rear of the image. The turbines are clearly visible in rows, and the grid pattern is evident, with clumps of coniferous forestry obscuring the bases of some of the towers. The turbines occupy a considerable proportion of the view. This location is open and elevated. The area has a remote feel with heath and coniferous forestry the main elements.
Visual Receptor Sensitivity The sensitivity of the visual receptor at this viewpoint is considered Medium. The road is a remote, quiet road, which travels over an elevated position, with open and expansive views over the surrounding low-lying landscape to the east and southeast and has a strong sense of remoteness. The views of the expansive bogland as well as the views in other directions have some scenic value.
Magnitude of Change The turbines are clearly visible from this location however the closer turbines are clustered towards the centre of the view. The coniferous forestry already introduces an element of height. The introduction of turbines added new element to the simple view of open moorland and coniferous plantation and they occupy a large proportion of the view, However, the addition of the turbines did not obstruct valued views, or have any effect on the extensive views in this location are to the east where long distance views are available. The magnitude of change that took place is considered Medium.
Significance of Effect The visual effect is considered Moderate and adverse (a result of a Medium sensitivity and Medium magnitude of change as per Table 13-3). The turbines and forestry combined to increase clutter in the view and contrast with the simplicity of the moorland, shown in the photomontage view without the turbines. However but the limited height of the turbines ensured that they were not overly dominant even in close proximity.

Viewpoint 5 – View from the Black Road at Derrybrien North, approximately 1.5 kilometres southeast of the Derrybrien wind farm
Existing View This viewpoint is from the Black Road, a local road just east of the windfarm, at the most open view of the lower section of this road. This view shows a relatively open foreground landscape with an expanse of heathland, with some deciduous tree clumps and also some clumps of conifers. A derelict dwelling is seen to the left of the image. A densely planted coniferous plantation is seen to the background of the view. The contrast between the large swathes of coniferous forestry in the background (and recently felled and planted areas areas) and the more simple texture of the open moorland is evident. The turbines occupy a medium to large extent (approximately half) of the baseline image and are visible against the skyline. The wireframe view however shows that a considerable number of turbines are screened by the forestry. Several poles of the Overhead line are just visible to the left of the image, partly screened by the forestry.
Visual Receptor Sensitivity This is a second view from the Black Road, representing the viewers along the road just north of the junction with the R353. Visual receptor sensitivity is considered to be Low to Medium at this location. It should be noted that the road is a quiet, remote road with few receptors, however the view has some scenic qualities – the contrast of open moorland and forestry.
Magnitude of Change The magnitude of change of the view that has occurred is considered High, as the turbine blades are clearly visible from this location and over a large extent of the view and were, at the time, a new element in the landscape. The turbines are mainly seen behind the coniferous plantation, which creates a somewhat cluttered view. Google Streetview images indicate that the forestry was lower in 2009 and the turbines towers were less screened than at present, and the Overhead line was likely to be more prominent. The growth in the forestry has slightly reduced the visual effects.
Significance of Effect The visual effect which has taken place is considered Moderate (a result of a Low-Medium receptor sensitivity and a High magnitude of change) and adverse/negative in quality.

Viewpoint 6 – View from the R353 (Scenic Route) at Cloghvoley/Knockmoyle west, approximately 3.6 kilometres southeast of the Derrybrien wind farm
Existing View This viewpoint is from the road (and currently scenic route) from Derrybrien to Balllynakill and to Woodford at an elevated location. In this view, which is partially screened by roadside vegetation, a field in the foreground gives way to extensive coniferous plantations, and some moorland. The land begins to rise away from the viewer, and towards the ridge where the wind turbines are located. The turbines are visible against the skyline, though some are obscured from the view by foreground vegetation. They are not a key element of this view. (It should be noted that several images were captured but all views were affected to some extent by intervening foreground vegetation, and this view was the clearest).
Visual Receptor Sensitivity This is a view from the R353 which is currently designated a Scenic Route, and though the view itself is not considered to be of high scenic value, it is designated, and the character of the surrounding landscape and the relative remoteness of the surroundings would result in a Medium-High visual receptor sensitivity. However, this was not designated during the majority of the Operational phase of the windfarm. Therefore, at that stage visual receptor sensitivity would have been considered Medium.
Magnitude of Change The magnitude of change that has taken place during of the operational phase is considered Low. Though relatively close to the windfarm, the turbines are partly hidden by the intervening roadside vegetation. (Much of this vegetation is evergreen and the view was taken in the winter, representing the most open view). While the turbine blades are visible from this location, they are not dominant, and do not appear tall. They are seen against a backdrop of coniferous forestry.
Significance of Effect The visual effect that has taken place is considered to be **Slight, neutral** (as outlined in Table 13-3, resulting from the Medium sensitivity and Low magnitude of change .

Viewpoint 7 – View from the Regional Road R351 at Derrygarriff, approximately 9.5 kilometres east of the Derrybrien wind farm.
Existing View This view is taken from the R351 between Loughrea and Woodford, east of the Derrybrien wind farm. The view shows a gently undulating landscape, with agricultural fields, deciduous tree clumps and hedges in the foreground, along with a dwelling to the left of the view. Larger swathes of trees – both deciduous and coniferous – are seen in the middle ground. The Slieve Aughty uplands form a long, low backdrop, and are covered in coniferous plantation with areas of open bog land, while scattered buildings are visible on the unforested lands on higher ground to the right of the image. The Derrybrien turbines are visible in a tight cluster along the ridgeline but are a minor overall component in this view.
Visual Receptor Sensitivity The visual receptor sensitivity at this viewpoint is considered Low to Medium.
Magnitude of Change The magnitude of change as a result of the introduction of the Derrybrien turbines into this view is considered Low. Though the turbines are visible, they are not tall and occupy a limited proportion of the view in a dense cluster and are at some distance from the viewer.
Significance of Effect The visual effect that has occurred is considered **Not Significant, neutral** effect (as outlined in Table 13-3, resulting from a Low-medium sensitivity and a Low magnitude of change).

Viewpoint 8- View from the road at Garryadd, Killimor, approximately 21.1 kilometres northeast of the nearest turbine
Existing View In this view, (representing views from in and around the village) a dwelling and rear garden are visible in the foreground. Some outlying houses are prominent in the middle-distance protruding above the hedgerow vegetation. To the rear of the buildings, The Slieve Aughty uplands form the backdrop to this view, a broad, low, undulating upland landscape in the distance. Although forming the horizon in an otherwise low-lying landscape the uplands are not dramatic in form or scale and do not constitute a key element of the view, with views obstructed by the intervening buildings. The Derrybrien turbines, and the Sonnagh Old turbines in a separate cluster, are barely discernible in the distance occupying parts of broad upland. Although numerous turbines are visible, they are distant and of limited extent in the view, The wind farm is discernible but an inconspicuous and element in the view.
Visual Receptor Sensitivity The visual receptor sensitivity at this viewpoint is considered Low-Medium. Receptors include some residents in the area; however, the site is at some distance from the viewer.
Magnitude of Change The Derrybrien turbines are distant and of limited spatial extent and prominence in the view, but numerous turbines are visible. The linear/grid arrangement of the turbines is apparent from the wireframe view, and some visual stacking occurs. The turbines appear small and do not dominate the upland, or any other element of the view by their height. As noted above, the turbines at present are a barely perceptible distant element which occupy a limited proportion of the view at a distance of over 20km. The magnitude of change which has occurred as a result of the introduction of the turbines in this view is considered Negligible.
Significance of Effect The visual effect is considered **Imperceptible and neutral**,(as outlined in Table 13-3, resulting from a Low-Medium sensitivity and a Negligible magnitude of change.

Viewpoint 9 - View from the harbour at Terryglass, Co. Tipperary, approximately 25 kilometres from the nearest turbine
Existing View This view represents the view over Lough Derg from the harbour at Terryglass. Some boats at the mooring, and deciduous trees are visible to the left of the view, but the open expanse of water is the main feature of the view. The lake is defined by a backdrop of the lakeshore vegetation to the right of the view, and the distant and gently sloping Slieve Aughty hills in the centre of the view. The Derrybrien turbines are barely discernible as a distant element in the view, along the ridge in the centre of the image and occupy a very small proportion of the view. The Sonnagh Old turbines are also visible to the right of the Derrybrien turbines and are also difficult to discern.
Visual Receptor Sensitivity The visual receptor sensitivity at this location is considered to be High due to its scenic qualities and popular location for tourists and those using the marina facilities for leisure.
Magnitude of Change The magnitude of change considered to have taken place is Negligible to Low. As noted above, the turbines at present are a barely perceptible distant element which occupy a limited proportion of the view at a distance of over 25km.
Significance of Effect The visual effect is **Not Significant to Slight and neutral,** (as outlined in Table 13-3, resulting from a High receptor sensitivity and a Negligible magnitude of change).

Viewpoint 10 - View from the local road at Loughatorick North, approximately 5.5 kilometres southeast of the nearest turbine
Existing View The view shows a hedgerow which borders a large tract of open moorland or bog. In the middleground, a swathe of coniferous forestry is visible, along with the steel pylons of the Moneypoint-Woodford overhead line which extend across the view. The ground falls (to the Owendalulleelagh river valley) before rising away from the viewer towards a ridge of higher ground. This higher ground in the background of the view is covered by extensive coniferous plantations interspersed with some areas of bog land. The Derrybrien turbines are visible along the ridge, occupying almost half of the horizontal extent of the view. They are visible but not a key or dominant element of the view. The clearing in the coniferous forestry near the centre of the view indicates the route of the overhead line connecting the windfarm to the Agannygal substation.
Visual Receptor Sensitivity This view represents a local road, which has a remote character, with a strong sense of naturalness in places, which traverses the Slieve Aughty uplands south from the R353 towards the Co. Clare boundary. Viewers would be travelling at slow speeds. The visual receptor sensitivity at this location is considered Medium.
Magnitude of Change The magnitude of change as a result of the addition of the Derrybrien turbines and overhead line (in the distance, in the centre of the view) is considered Low- Medium. The uplands in the background of the view would have been covered in forestry at the time, and while this was lower in height the overall view would have been similar as to today. The turbines do occupy a large horizontal extent of the view but are relatively low in height and appear in the distance. The steel pylons were in place prior to the construction of the Derrybrien turbines and they add an industrial element to the landscape, while the areas has been considerably modified by the large scale forestry.
Significance of Effect The visual effect that has taken place is considered Slight-Moderate, neutral effect (as outlined in Table 13-3, resulting from a Medium sensitivity and Low-Medium magnitude of change).

Viewpoint 11 - View from local road at Loughatorick , approximately 6.2 kilometres south of the Derrybrien wind farm and 0.58 kilometres from the Agannygal Substation
Existing View The view shows an expanse of bogland in the foreground with occasional trees or shrubs. In the middle ground, swathes of conifers are visible across the view and a line of timber electrical poles run across the view. These connect to a substation to the centre of the view, with several steel lattice poles and a small building adjacent to the substation structures are evident, set within a clump of coniferous trees. The land slopes gently from left to right in the foreground, while in the distance, a mainly forested ridge of higher ground is visible to the centre right of the view.
Visual Receptor Sensitivity This view represents a local road, which has a remote character, with a strong sense of naturalness in places, which traverses the Slieve Aughty uplands south from the R353 towards the Co. Clare boundary. Viewers would be travelling at slow speeds. The visual receptor sensitivity at this location is considered Medium.
Magnitude of Change The addition of the substation complex and a new overhead line to connect to the Derrybrien wind farm would likely have resulted in a Low-Medium magnitude of change. The 1996-2000 Geohive aerial image shows the location of the substation was covered in coniferous forestry which was felled to facilitate construction while further forestry north of the substation was felled between 2013 and 2018. Therefore the view would have shown the coniferous forestry extending more to the right of the view, however this has changed over time and while the Ennis-Shannonbridge overhead line and poles were visible, they would have been a relatively small element of the view. The photomontage view showing the landscape without the substation, to assist with assessing the visual effects as a result of the addition of the development, and overhead line shows a simpler, less cluttered view, with the foreground bogland and backdrop of hills remaining the key elements in the view and its composition. The magnitude of change that has occurred is considered Low-Medium.
Significance of Effect The visual effect that has occurred is considered Slight-Moderate, and adverse in nature.

Viewpoint 12 - View from the local road (and East Clare Way) at Corlea Beg, approximately 10.2 kilometres south of the nearest turbine
Existing View This is an open, expansive view. The view shows grassland in the foreground, which slopes away from the viewer, towards a valley which is covered in a mixture of coniferous and broadleaf trees but dominated by conifers. Areas of open moorland are also visible, which contrast with the forestry, with stretches of open fields also seen in the middle ground. The land rises towards the long, low ridge in the background where the Derrybrien turbines are visible in the distance. The turbines appear in a staggered linear formation along the ridge, and occupy a limited proportion of the overall view, appearing distant, small in scale, and not as a key element of the view. Being seen on the ridgeline, some turbines are difficult to distinguish from the background sky (note that this would change depending on the weather conditions). The overhead line is not visible in this view.
Visual Receptor Sensitivity This view represents viewers on a local road, just above a track which runs through two fields in the foreground, which is part of the East Clare Way, a waymarked trail. The view is expansive, and the view has some scenic qualities, and visual receptor sensitivity is considered High.
Magnitude of Change The turbines occupy less than half of the photomontage view (which shows the scenario without the turbines, to assist with assessment of the view prior to development) and appear as distant features in the view. Their introduction into the view would have been noticeable but not considered to alter the overall character and composition of the view. The magnitude of change is considered Low to Medium.
Significance of Effect The visual effect is considered to be and **Slight and neutral,** as a result of a High sensitivity and a Low-Medium magnitude of change as outlined in Table 13-3.

Viewpoint 13 - View from the R461 (Scenic Route) at Doorus East, Co. Clare, approximately 12.5 kilometres southwest of the nearest turbine
Existing View This view represents a view from the road over an undulating landscape. Thie view shows a considerable amount of low lying coniferous and deciduous tree cover in the foreground and middleground, with a glimpse of Lough Graney in the centre of the view. The land rises to the right and left of the image, away from the lake, where a patchwork of small fields and buildings are visible. In the distance, in the centre of the view, the low ridge of the Slieve Aughty mountains is visible, with the uneven profile of the coniferous plantation also evident to the right. The Derrybrien turbines are just visible along the skyline and occupy a relatively limited extent of the view. It is noted that fewer of the turbines appear discernible than those in the wireframe, due to weather conditions.
Visual Receptor Sensitivity The visual receptor sensitivity is considered Medium to High. This is a currently designated scenic route however it is not certain that this was case in the period 2006-2022. However, it is a road in a remote location with occasional scenic views over Lough Graney and extensive woodland in the foreground.
Magnitude of Change The magnitude of change as a result of the introduction of the turbines is considered Low. The Derrybrien turbines are just visible along the skyline and occupy a relatively limited extent of the view. The turbines are distant elements, and low in height.
Significance of Effect The visual effect that has taken place is considered **Slight, neutral** visual effect as a result of a Medium-High sensitivity and a Low magnitude of change as outlined in Table 13-3.

Viewpoint 14 View from the N66 in the townland of Cuilmore, near Peterswell approximately 8.3 kilometres northwest of the nearest turbine
Existing View This view shows a view from the roadside, across relatively a flat, low lying agricultural field bounded by a hedgerow in the foreground. Tree clumps and scattered buildings are visible in the middle ground, while the Slieve Aughty hills are seen in the background. These hills, which have a long and relatively low profile, are clearly seen above the surrounding low-lying land. The hills are covered with a mosaic of dark coloured coniferous forestry and light-coloured tracts of bogland. The Derrybrien turbines are visible near the centre of the image and are visible as a row against the skyline and conifer plantation is seen the foreground of the turbines. The turbines are low, however they are less prominent that would be expected at this distance, partly due to the weather and light conditions. To the left of the image, the Sonnagh Old turbines are largely screened by intervening vegetation.
Visual Receptor Sensitivity This view represents the stretch of N66 road between Gort and the Peterswell junction, along a stretch of road which in general has good visibility of the Derrybrien turbines. Viewers would be travelling a moderate speed along this road, which has no scenic designations, or highly scenic qualities. The sensitivity of the visual receptor is considered Low to Medium.
Magnitude of Change The magnitude of change resulting from the addition of the turbines is considered Low. The turbines are currently visible, (depending on weather conditions) but in no way dominant and do not occupy an extensive proportion of the view.
Significance of Effect The visual effect which has occurred is considered **Slight and neutral,** as a result of a Low-Medium sensitivity and a Low magnitude of change as outlined in Table 13-3.

Viewpoint 15- View from the Regional Road R458 on the northern outskirts of Gort, approximately 12.9 kilometres west of the nearest turbine
Existing View This view shows an open field adjacent to the R458, with a low stone wall bounding a large, gently sloping field in the foreground. A hedgerow in the middle ground divides the field from another large open field. Clumps of deciduous trees, hedgerows and scattered buildings are visible in the middle ground, which again is flat or gently undulating. In the background, a long ridge of high ground is visible, which dips slightly and rises again to the left of the image. The Derrybrien turbines are visible in the distance on the ridge in the centre of the image and appear as a distant cluster with relatively limited spatial extent, partly hidden by the topography, as shown in the wireframe. The turbines and appear along a ridge which has both areas of coniferous forestry interspersed with areas of open moorland. The Sonnagh Old turbines should be partly visible on the ridge to the left of the image, however due to weather conditions are difficult to discern.
Visual Receptor Sensitivity This view represents viewers travelling on a Regional road at moderate speeds, which is not designated or particularly scenic. The visual receptor sensitivity is considered Low - Medium.
Magnitude of Change While the turbines are visible, they are a low, distant component of the view and occupy a very limited extent of the view. The magnitude of change is considered Low.
Significance of Effect The visual effect which has occurred is considered **Not Significant, neutral** as a result of a Low-Medium sensitivity and a Low magnitude of change as outlined in Table 13-3..

Viewpoint 16 - View from M18 motorway overpass between Gort and Crusheen at Monreagh (approximately 21.4 kilometres southwest of the nearest turbine)
Existing View The view shows the M18 motorway to the left of the view, and a road which passes over this (from where the view is taken)(to the right of the view. It is noted that this motorway and overpass was built during the period 2006-2022 but was not in evidence prior to construction of the Derrybrien Wind Farm Project. To the right and left of the motorway, open fields are visible, with well-defined hedgerows, while to the centre and right of the view, the foreground and middle ground are occupied by deciduous trees with few scattered buildings visible. Two steel pylons are visible to the left of the view, carrying overhead wires. The backdrop to the view is formed by the Slieve Aughty hills seen in the centre of the view, and from this view they are only barely higher than the trees in the foreground. The Derrybrien turbines are seen to the centre of the view, on the higher ground, while the Sonnagh Old turbines are visible to the left of the view in a smaller cluster. In these weather conditions, the light allows the turbines to be discerned, though they are very distant elements in the view. The spatial spread as well as the height of the Derrybrien turbines is very limited form this view, and they appear as distant element in the view which may be even less obvious depending on weather conditions. Some screening is provided by intervening vegetation.
Visual Receptor Sensitivity The sensitivity of the viewpoint is Low to Medium. Viewers are on a motorway overpass and the presence of the motorway in the view lessens the value of the view, while there are some elevated views over the rural landscape.
Magnitude of Change The wind farm is a visible but inconspicuous element in this view with a limited spatial spread as well as very limited height. The introduction of the turbines likely resulted in a Negligible magnitude of change, and neutral in quality.
Significance of Effect The visual effects which have occurred are considered to be **Imperceptible and neutral** as a result of a Low-Medium sensitivity and a Negligible magnitude of change as outlined in Table 13-3.

Viewpoint 17 - View from the R458 Regional Route at Caherpeak East, south of Kilcolgan.
Existing View The view shows a road in the foreground, with relatively flat open fields to both sides. A stone wall and silage bales are visible to the right of the view. To the left, a building, fields, stone walls and clumps of vegetation are visible. A steel pylon and a shed are visible in the centre of the view. In the distance, the Slieve Aughty hills are visible as a long, low ridge in the centre of the view. The Derrybrien turbines are just barely visible in the distance along the ridge of higher ground, The spatial spread of the turbines is limited, and the turbines are not tall by modern standards and therefore do not dominate the upland, or any other element of the view. To the left of the view, the Sonnagh Old turbines are more easily discerned, but still a distant, albeit smaller cluster of turbines.
Visual Receptor Sensitivity The sensitivity of the viewpoint is Low to Medium. Viewers from the road would have some focus on their surroundings, travelling at medium speeds along the Regional Road. The view has no particular valued features, and the view has some pleasant rural elements combined with more industrial aspects.
Magnitude of Change The removal of the Derrybrien turbines will have a barely perceptible effect on this view, as they are currently distant elements which are not easily discerned. The magnitude of change is considered Negligible.
Significance of Effect The magnitude of change which resulted from the development is considered Negligible and the receptor sensitivity was Low-Medium. As outlined in Table 13-3, the resulting visual effects of the operational phase are considered to have been **Imperceptible, and neutral** in quality. .

The visual effects which have occurred between 2006-2022 at the above viewpoints are summarised below in Table 13-11 below:

Table 13-11: Summary of visual effects at Viewpoints 1-17

Viewpoint	Description	Visual Receptor Sensitivity	Magnitude of Change	Operation and Maintenance Visual Effects
1	View from the R350(at M6 motorway overpass) near Caraunmore	Low-Medium	Negligible	Imperceptible, neutral
2	View from the shore of Lough Rea	High	Low-Medium	Slight-Moderate, adverse
3	View from the local road at Curhoor, south of Kileenadeema	Low-Medium	Medium	Slight-Moderate, neutral
4	View from the Black Road at Coppanagh,	Medium	Medium	Moderate, adverse
5	View from the Black Road at Derrybrien North, wind farm	Low-Medium	Medium	Moderate, adverse
6	View from the R353 (Scenic Route) at Cloghvoley/Knockmoyle west	Medium	Low	Slight, neutral
7	View from the Regional Road R351 at Derrygarriff,	Low-Medium	Low	Not Significant, neutral
8	View from the road at Garryadd, Killimor	Low-Medium	Negligible	Imperceptible, neutral.
9	View from the harbour at Terryglass, Co. Tipperary	High	Negligible to Low	Not Significant to Slight, neutral
10	View from the local road at Loughatorick North	Medium	Low-Medium	Slight-Moderate, neutral
11	View from local road at Loughatorick	Medium	Low-Medium	Slight-Moderate, adverse
12	View from the local road (and East Clare Way) at Corlea Beg,	High	Low-Medium	Slight, neutral.
13	View from the R461 (Scenic Route) at Doorus East, Co. Clare	Medium to High	Low	Slight, neutral

14	View from the N66 in the townland of Cuilmore, near Peterswell	Low -Medium.	Low	Slight, neutral.
15	View from the Regional Road R458 on the northern outskirts of Gort	Low -Medium.	Low	Not Significant, neutral
16	View from M18 motorway overpass) between Gort and	Low -Medium.	Negligible	Imperceptible, neutral
17	View from the N18 national route at Caherpeak East, south of Kilcolgan.	Low -Medium.	Negligible	Imperceptible, neutral

13.4.4 Ceased Operation Phase Effects (2022-Present)

13.4.4.1 Landscape and Visual Effects

The ceased operation of the wind farm did not to give rise to any additional landscape or visual effects.

Activities in the vicinity of the site including forestry, agriculture and turf cutting are expected to continue, and assessed under Cumulative effects.

13.4.5 Effects of Retained Development

The full description of elements to remain in situ, the Retained Development, is included in Chapter 4.

These include a number of elements on the windfarm site itself (such as reinforced concrete foundations for the turbines, and other elements as well as approximately 17.5km of access tracks, hardstands, as well as underground cabling). Other elements on the windfarm site include the 3 borrow pits and naturalised peat repository areas.

Elements to remain in situ along the route of the Agannygal-Derrybrien overhead line include concrete foundations - for the various pole sets and masts, and for the Agannygal substation. The third set of elements to remain in situ are related to the Emergency Response measures which were carried out in relation to the peat slide (barrages, an access track, peat repository areas). The Cumulative Effects combined with the Retained Development are addressed in Section 13.4.6.

13.4.5.1 Landscape Effects

Landscape Sensitivity

Landscape sensitivity is as set out in Section 13.2.4 as ranging from Low-Medium.

Magnitude of Change

The elements which are to remain on the site of the existing Derrybrien windfarm are likely to result in No Change to a Negligible magnitude of change, consistent with the change that has been observed over time in relation to the gradual re-vegetation of areas such as the borrow pits, peat repository areas and barrages. This is expected to continue.

While there is no change proposed to the elements to be retained in situ themselves, it is likely that natural regrowth will continue, and regrowth of previously felled areas will occur although the long-term uses of the site are not known. Natural regrowth is also likely on the concrete foundations and hardstand, over time. Borrow pits 1 and 2 have re-vegetated and Borrow pit 3 has flooded. The access roads which provide access to the forestry will continue to be used, resulting in no change. Underground elements such as cabling will result in no change to the landscape.

In relation to the works carried out following the peat slide (barrages, access track, peat repository areas), the retention of these in situ will not result in any changes. Over time, and at the present day, the areas affected by the works have largely re-vegetated and integrated into the landscape. The resulting effects are that, today, some of these areas that have re-vegetated are difficult to distinguish from the surrounding areas and this is expected to continue. The effects are less legible in the landscape than the ongoing forestry operations in the vicinity.

Significance of Effect

The landscape effects as a result of the Retained Development can be considered as No effect (for those underground elements) to Imperceptible, where elements continue to be covered by vegetation. The quality of the effect is considered neutral.

13.4.5.2 Visual Effects

As set out in Section 13.2.8, consideration was given to the various tools which assist in visual assessment, and it was considered (using professional judgement) that while existing view photographs and some photomontages showing the view without the development would be beneficial to assess the visual effects which have occurred, the same approach is not needed to assess the visual effects of the Retained Development.

To assess the visual effects of the Retained Development, photomontage were not considered necessary, due to the nature of the development (at ground or below ground) and the extremely limited visibility (consisting mainly of at ground and below ground elements).

Visual Receptor Sensitivity

Visual Receptors in relation to the Retained Development are much fewer, as the majority of the elements which make up the Retained Development are no longer perceptible from public areas. There are only several locations where elements of the Retained Development is in close proximity to public areas and therefore close to potential visual receptors.The main potential visual receptors would be those travelling along the Black Road and the R353 at the Flaggy Bridge as well as some on the local road from the R353 which travels close to the Agannygal substation, south to Flagmount.

Magnitude of Change

The elements of the Retained Development on the windfarm site itself are not visible from the public areas. The turbine foundations, hardstands and access roads are hidden from the closest public road, the Black Road. The viewpoints illustrated in the Photomontage Booklet do not show elements of the Retained Development as they are screened from view as by their nature they are underground.

Below ground elements associated with the Derrybrien-Agannygal overhead line are currently screened from even locations in close proximity along the Black Road – where the overhead line crosses the road in close proximity to a set of wooden poles (see Plate 13-7 in Section 13.3.3) – and also where the overhead line pole is located adjacent to the R353 west of Flaggy Bridge and another location on the road towards Lough Atorick.

The elements remaining as a result of the peat slide (barrages, peat repositories) are now re-vegetated and are not distinguishable, as noted in the baseline. Overall, the magnitude of change is considered No change to Negligible where vegetation will continue to grow.

Significance of Effect

The significance of effect is considered No effect to Imperceptible, as vegetation growth continues, and neutral in quality.

13.4.6 Cumulative and In-Combination Effects

Cumulative impacts are defined by the GLVIA (2013) and guidance on cumulative assessment of windfarms SNH (2012) as the additional changes caused by a proposed development in conjunction with other similar developments. Though the SNH guidance (2012) focuses on cumulative effects of other wind farms, the GLVIA notes that the assessment can include other types of developments to give a more complete picture of the likely significant cumulative effects.

In this case, cumulative effects are defined as the additional effect of the project in conjunction with other existing and/or approved developments, both windfarm and non-windfarm developments.

A list of Cumulative projects is listed in Chapter 4, and all of these projects were considered in terms of cumulative landscape and visual effects. Several additional projects are referred to here, in terms of Cumulative Effects which have occurred.

One of the most relevant projects from an LVIA perspective includes the nearby 9 turbine wind farm, (Sonnagh Old), a 9-turbine wind farm, commissioned in 2004, approximately 3.5 kilometres northwest of the Derrybrien turbines. The construction of Sonnagh Old coincided with the construction of the Derrybrien wind farm project in 2003-05. A Cumulative ZTV Map is included in **Appendix 13-10**.

The assessment also considers some projects which can be described as land use activities which were (and are) ongoing in the immediate vicinity of the site, including the extensive existing coniferous forestry operations in the vicinity of the site, and small-scale peat extraction which has been carried out to the east of the site. These activities have also been considered in the description of the baseline environment in Section 13.3.

There are other relevant developments, which can be described as existing infrastructure, also in existence prior to the Derrybrien wind farm project construction, which include a number of overhead transmission lines. These include the existing Moneypoint-Woodlands 400kV overhead transmission line which is located approximately 5 kilometres southeast of the Derrybrien turbines, and approximately 3 kilometres northwest of the Agannygal 110kV substation. The other line is the existing Ennis-Shannonbridge 110kv line which lies further south of the Moneypoint-Woodford line and was split into two circuits following the construction of the Agannygal substation. These developments are also included in the baseline description in Section 13.3. A small quarry may have been present just off the R353 southeast of the site.

A subsequent set of projects of an infrastructural nature were carried out after the construction of the Derrybrien Wind farm project. Those in the vicinity of the site included a sand quarry at Cloghvoley, while in the wider landscape, the M18 motorway section between Gort and Tuam was completed, as well as a power station at Tynagh, Co. Galway approximately 14.5 kilometres northeast of the site and associated grid connection.

The remaining cumulative projects listed fall into a category of projects which are either outside the study area as indicated on the ZTV maps, or of such a nature that they are not considered to have given rise to cumulative landscape and visual effects. These include the pre-existing Gort Regional Water supply scheme, as well as the Local OPW Flood Relief Scheme Gort, flood relief works at Kiltartan, and the temporary flood relief works at Kinvara.

Following a desktop review of the Galway County Council online planning portal there have been no new development consent applications within c. 2km of the existing turbine infrastructure lodged in the last 5 years.

The Gort Lowland flood relief scheme is in progress, and the final proposals have not been submitted. The information available to date indicates that the closest works will be more than 9 kilometres from the nearest existing turbine.

13.4.6.1 Cumulative Effects which have occurred

This section refers to the Cumulative effects which have occurred during these phases:

- Construction phase (2003-2006)
- Operation and Maintenance phase (2006-2022)

Magnitude of Cumulative Landscape Change

The magnitude of change to the landscape resulting from Derrybrien wind farm and all associated elements, in conjunction with the other projects is described at various scales. At a local level, on the site, an area of disturbed peat was identified in April 2020, adjacent to a turbary plot, at the eastern side of the wind farm. This area of disturbed peat was approximately 0.25 ha. The area of turf cutting is considerably larger at approximately 67ha. The cumulative effect of this would have been Negligible and very localised at both construction and operational phases.

The forestry and overhead lines were already part of the pre-development landscape baseline c. 1998, and the Derrybrien wind farm project and the Sonnagh Old turbines were introduced in an area where there were some elements (i.e. electricity transmission lines and intensive forestry) which can be described as large scale and industrial in nature already evident in the working rural upland landscape. The Agannygal substation was located along the route of an existing 110kV line and in an area where the two transmission lines are evident.

Within 5-7 kilometres of the site, ongoing, extensive forestry and turf cutting operations, as well as larger infrastructural elements including the Sonnagh Old windfarm, and the existing overhead lines to the south, are considered to have contributed to a Medium magnitude of change during the construction and operational phase. The Keelderry wind farm was not built and so is not considered further in this section.

On a wider scale, further developments (in addition to the wind farm) included the M18 motorway, the presence of a limestone quarry at Ballynakill to the east, and the Tynagh power station are located further from the site. These lie within 9 and 13 kilometres from the site and though these increase the evidence of human activity in the landscape, the effects are more localised and do not result in a high magnitude of change to the wider landscape character. While the motorway increased accessibility to the wider landscape, it did not affect the relatively remote nature of the Derrybrien area. The magnitude of change to the wider landscape as a result of these projects is considered Low to Medium.

Significance of Cumulative Landscape Effect

As stated in Section 13.4.2.1.1, the sensitivity of the landscape is considered Low to Medium. The cumulative landscape effect which has occurred as a result of the Derrybrien windfarm and its associated elements, in conjunction with the other developments referred to above, is considered to have a Slight to Moderate Cumulative effect on the character of the landscape. The presence of the overhead lines had already introduced elements of infrastructure to the landscape, and the forestry operations have been ongoing in the area and are on a large scale. Small scale quarries and localised turf cutting are other resource-based activities.

The 400kV and 110kV lines are not in close proximity to the turbines but they are an existing element of the electricity network and close to the Agannygal substation. The Derrybrien wind farm project (along with the Sonnagh Old turbines) has added a larger scale element of wind energy to a working landscape which is relatively remote, but the character of the areas remains defined by the undulating topography, and the extensive conifer plantations which provide a sense of enclosure, contrasting with the occasional open areas of moorland.

Magnitude of Cumulative Visual Change

It should be noted that some of the cumulative projects listed above have not given rise to cumulative visual effects. These include the flood relief works and Gort water supply scheme, as well as the Ballynakill quarry which has very localised and minimal visual effects.

The Tynagh power station also gives rise to very localised visual effects. The turf cutting which has been observed to take place to the east of the windfarm site appears to have been small in scale and by its nature, is not visually obtrusive, as can be the case when large scale industrial extraction occurs. These elements noted above are likely to have resulted in a Negligible magnitude of change.

Other elements are more relevant when discussing visual effects. The cumulative effect of the Derrybrien turbines and associated elements, in conjunction with the Sonnagh Old windfarm and existing 400kV and 110kV transmission lines and the continuing forestry operations would have varied depending on the viewpoint. However the most evident of these elements in the viewpoints, are the Sonnagh Old turbines. The forestry operations were, and still are, ongoing in the landscape, but likely to change on a cyclical basis. The most dramatic change would have resulted from areas of clear felling. The 400kV transmission line is not a feature evident in the viewpoints. The visual effect of the Agannygal substation and the transmission lines is evident in the immediate vicinity of the substation (and as illustrated in Viewpoint 11) and not on a wider landscape scale.

The Sonnagh Old turbines are visible from many of the more distant viewpoints, to the north, east and west of the site as illustrated in the Photomontage Booklet (**Appendix 13-1**). Guidance (GLVIA 2013) refers to different types of cumulative effects, namely combined and sequential visibility. Combined visibility, where the viewer sees the other development in the same view as the Derrybrien Wind Farm Development , is the most common in this case.

Viewpoints closest to the site (Views 4,5) do not have visibility of the Sonnagh Old turbines, so views are generally from some distance. Viewpoints to the south (6, 10,12,13,) do not have visibility of the Sonnagh Old turbines.

Views of Sonnagh Old turbines are available from Viewpoints such as Lough Rea (1 and 3) to the north. The two windfarms appear as distinct clusters and are distinctive. They do not appear 'stacked' from any of the viewpoints and the scale and height is comparable. and other more distant views from Viewpoint to the west (16) and east (9) however in many of these views they are a barely discernible distant object.

The magnitude of change therefore varies from No change, to a Low change in many cases, and in the closest of views would be considered a Medium magnitude of change.

The Cumulative ZTV map included in **Appendix 13-10** illustrated that theoretical visibility of both windfarms is mainly in areas to the east, west and north of both windfarms (shaded green). South of the Derrybrien turbines, there are almost no areas with visibility of the Sonnagh Old turbines as well as the Derrybrien turbines. The photomontages also illustrate the actual visibility of both windfarms. Theoretical visibility of both windfarms is shown north of the Derrybrien turbines, but this is a remote area with sparse population and few roads.

13.4.6.2 Cumulative Effects which have occurred- Ceased Operational Phase (2022-Present)

No additional cumulative effects have occurred during this period, with the land uses of forestry and turbary and activities, identified above, ongoing.

13.4.6.3 Cumulative Effects which are likely to occur with the "Prospective Development".

While this LVIA has assessed the effects of this development in its totality, (the above and below ground elements) the Cumulative Effects which are likely to occur is the Retained Development (retention of the

below ground elements and other elements as outlined in Chapter 4) as well as the Prospective Development which is the proposed decommissioning of the above ground elements (turbines, substation, overhead line and Agannygal substation) and other elements as set out in Chapter 4.

13.4.6.3.1 *Landscape Effects*

Landscape Sensitivity

Landscape sensitivity is as set out in Section 13.2.4 as ranging from Low-Medium. However, sensitivity to the Retained Elements is negligible as they are already in place.

Magnitude of Change

As set out in Section 13.4.5 above, the landscape effects likely as a result of the Retained Development can be considered as No effect (for those underground elements) to Imperceptible, where elements will continue to be covered by vegetation as time progresses. The quality of the effect is considered neutral.

When the Prospective Development is carried out, during the decommissioning of the above ground elements, the landscape effects will result mainly from the Prospective Development activities which however are likely to result in some slight glimpses of the Retained Development in certain areas.

As noted in Section 13.5.2.1.2 of the EIAR for the Prospective Development,

> *'changes to the windfarm site and immediate vicinity as a result of the enabling works will involve vegetation clearance, and some levelling, in the vicinity of the elements to be removed.*
>
> *During the process of decommissioning (expected to be approximately 24 months), demolition and removal of the above ground elements will necessitate plant and equipment entering and exiting from the site during this period. This will result in a localised change to the landscape character, which is remote, and relatively tranquil. (It is noted however that during certain phases of forestry growing, felling activities would also take place.) This is likely to have a Medium magnitude of change on the landscape character. The effects on the landscape fabric, or physical landscape would be Low as the removal of scrub and low vegetation would be expected to re-grow once the activities have ceased and natural re-generation of vegetation would be expected...*
>
> *The process of decommissioning of the Agannygal substation is likely to require less vegetation clearance but some limited clearance is likely to take place to facilitate the temporary compound. The magnitude of change is also considered Medium.*
>
> *The most pronounced change (as a result of the Prospective Development) will be to the landscape character of the site and immediate surrounds, where the turbines and overhead line will not now be visible. The removal of the turbines and overhead line will be most pronounced in the vicinity of the site, where there are clear views such as to the east of the site along the Black road, along the R353 where visibility occurs, while the village of Derrybrien will not undergo any changes to its landscape character or setting. Some areas therefore will undergo a Medium magnitude of change to the landscape character.'*

As part of the Retained Development, turbine bases and hard stands, as well as foundations for the Overhead Line are to remain in situ, these may be temporarily exposed by the Prospective Development. However, in the short term, it is expected a certain amount of natural re-growth is also possible around the turbine bases, and other areas of hard standing. Therefore, the Prospective Development combined with the Retained Development will result in a Negligible to Low magnitude of change.

In relation to the overhead line and Agannygal substation, similarly, while the concrete foundations of the substation will be exposed by the Prospective Development, re-vegetation of the concrete foundations is likely over time with a Negligible magnitude of change.

Significance of Cumulative Landscape Effect

The landscape effect resulting from the combination of the Retained Development along with the Prospective Development will result varying effects throughout the study area, but mainly perceptible in the site and immediate surrounds of the windfarm, overhead line and Agannygal substation where the decommissioning process will be carried out in close proximity to the Retained Development below ground elements which may temporarily become evident in the local landscape. Effects range from to Negligible to Low magnitude of change during the decommissioning (the Prospective Development) and this will result in a Not Significant to Slight cumulative landscape effect. The effect is considered short term to temporary and is mainly as a result of the works associated with the Prospective Development. There are no medium-to long term cumulative effects.

13.4.6.4 Visual Effects

Visual Receptor Sensitivity

As noted above, the main locations where the viewers have potential close-up views of elements the Retained Development from the public road are very few. Potential visibility is concentrated on three main locations, where the elements of the Retained Development relating to the Overhead Line, are presently screened by vegetation but may be affected by works associated with the Prospective Development.

Magnitude of Change

The works proposed by the Prospective Development, which are to remove the Overhead line and poles in these areas noted above, may result in temporary vegetation clearance around these locations, and consequently disturbance around the foundations of the pole sets/masts. Should this arise, it is likely to be temporary to short term in duration, as the concrete foundations are expected to re-vegetate over time and appear similar to what they are today.

The elements associated with the Derrybrien-Agannygal overhead line may be glimpsed from the Black Road – where the overhead line crosses the road in close proximity to a set of wooden poles (see Plate 13-7 in Section 13.3.3). As a result of the Prospective Development, the retained concrete foundation may be visible for a short time should vegetation be cleared as a result of the Prospective Development but it likely to re-vegetate. Similarly, where the pole set is close to the R353 west of Flaggy Bridge and along the road at Lough Atorick, (Plate 13-8) the concrete foundations which are now screened with vegetation may be briefly visible as a result of the Prospective Development but again is likely to re-vegete over time.

Significance of Effect

The significance of effect resulting from the Retained Development with the Prospective Development are considered to be Temporary to Short -term, Not Significant to Slight effects at these locations. The visual effects will be extremely localised and in the medium-long term are expected to re-vegetate and result in Imperceptible neutral visual effects.

13.5 Mitigation

There are no specific landscape and visual mitigation measures required.

13.6 Conclusion

As set out in the Chapter Scope (Section 13.1.1), this chapter assesses both effects which have occurred as a result of the Derrybrien Wind Farm Project, the conclusion focuses on the Retained Development and the effects which are likely to occur.

The Retained Development is the continued presence of a number of elements (listed fully in Chapter 4 of the rEIAR) which are already present in the landscape and visual environment.

These include a number of elements on the windfarm site itself (such as reinforced concrete foundations for the turbines, and other elements as well as approx. 17.5km of access tracks, hardstands, as well as underground cabling). Other elements on the windfarm site include the 3 borrow pits and naturalised peat repository areas.

Elements to remain in situ along the route of the Agannygal-Derrybrien overhead line include concrete foundations - for the various pole sets and masts, and for the Agannygal substation. The third set of elements to remain in site are related to the Emergency Response measures which were carried out in relation to the peat slide (barrages, an access track, peat repository areas).

As noted above, the continued presence of the Retained Development by itself is judged to result in No effect to Imperceptible landscape effects, with visual effects considered No effect to Imperceptible, as vegetation growth continues. The effects are considered neutral in quality. This will not give rise to Significant landscape or visual effects.

In terms of cumulative effects, the main effects will be those combined with Prospective Development. This will result in a a Not Significant to Slight cumulative landscape effect. The effect is considered short term to temporary and is mainly as a result of the works associated with the Prospective Development. Cumulative visual effects are expected to be Temporary to Short -term, Not Significant to Slight effects at the locations where the works will likely expose foundations for the overhead line poles, as well as the presence of machinery at these locations. The visual effects will be extremely localised and in the short-medium term are expected to re-vegetate and result in Imperceptible neutral visual effects

14. MATERIAL ASSETS

Material Assets are defined in the 'Advice Notes for Preparing Environmental Impact Statements' (EPA, Draft 2015) as "resources that are valued and that are intrinsic to specific places" and in the 'Guidelines on the Information to be contained in Environmental Impact Assessment Reports' (EPA, 2022) as "built services and infrastructure. Traffic is included because in effect traffic consumes roads infrastructure."

Material Assets may be either of human or natural origin. The cultural assets of Archaeology and Cultural Heritage are addressed in Chapter 12 of this remedial Environmental Impact Assessment Report (rEIAR). Economic assets of natural heritage include non-renewable resources such as minerals or soils, and renewable resources such as wind and water. These assets are addressed in Chapter 8: Land, Soils and Geology, Chapter 9: Hydrology and Hydrogeology, Chapter 10: Air and Climate. Tourism and amenity resources, which are also considered material assets, are addressed in Chapter 5: Population and Human Health. Waste management which is also considered under the heading of material assets by the above EPA documents, is summarised in Section 5.4.8 of **Appendix 4-2** of the rEIAR.

This chapter of the rEIAR addresses the likely significant effects of the Retained Development on transportation infrastructure (Section 14.1 Traffic and Transport) and on Telecommunications, Aviation, and Other Material Assets (Section 14.2), which are economic assets of human origin. This chapter of the rEIAR has been prepared in accordance with the requirements of the EIA legislation and guidance outlined in Section 1.7 of Chapter 1 of this EIAR.

14.1 Traffic & Transportation

14.1.1 Introduction

14.1.1.1 Chapter Scope

This chapter presents the Traffic and Transport assessment of the potential for impacts or effects arising from the Retained Development as described in the Project Description (Chapter 4). The assessment identifies the potential effects and proposes the mitigation measures to be put in place to reduce/eliminate those effects. The assessment criteria were scoped with the Galway County Council.

14.1.1.2 Statement of Authority

This section of the rEIAR has been prepared by the following staff of TOBIN Consulting Engineers:

Viswas Kutty (Project Engineer Roads and Transportation) holds a B. Tech in Civil Engineering and M.S in Transportation Engineering from Wayne State University, Michigan, USA. He is a Member of Engineers Ireland and has over 17 years' of experience in transportation planning and traffic engineering. He has extensive experience in preparation of EIAR and EIS for environmental projects including Wind Farms.

14.1.1.3 Assessment Timeframes

Effects are considered over a range of timeframes which have been broken down for clarity as follows:

Effects which have occurred: Effects associated with the construction phase of the project are outlined by Section 14.1.4.1.

Effects which have occurred: Effects occurred during the operation, ceased operation and maintenance phase of the project are outlined by Section 14.1.4.2.

Effects which are likely to occur: Potential effects associated with the Retained Development of the project are outlined by Section 14.1.5.1.

14.1.1.4 Assessment Area

Effects are considered for the three main constituents of the Project: the wind farm site and associated discrete ancillary works locations, the grid connection site and associated discrete ancillary works locations together with locations where works were undertaken in response to the peat slide. For the purposes of this chapter the assessment area also includes the surrounding road / transport network including the following:

- Coillte entrance road to Derrybrien Wind Farm from the Black Road.
- Entrance to Agannygal Substation from an unnamed local road; referred to throughout this document as Unnamed Local Road A.
- Local access / haul routes including those used by personnel and those used in the delivery of plant, materials and turbine components.
- Upgrade / repair works locations including roads and bridges.
- The general surrounding traffic and transport network.

Figure 14-1 below illustrates the location of the wind farm generally, including the immediately surrounding transport network and key features of the Project which relate to traffic and transport.

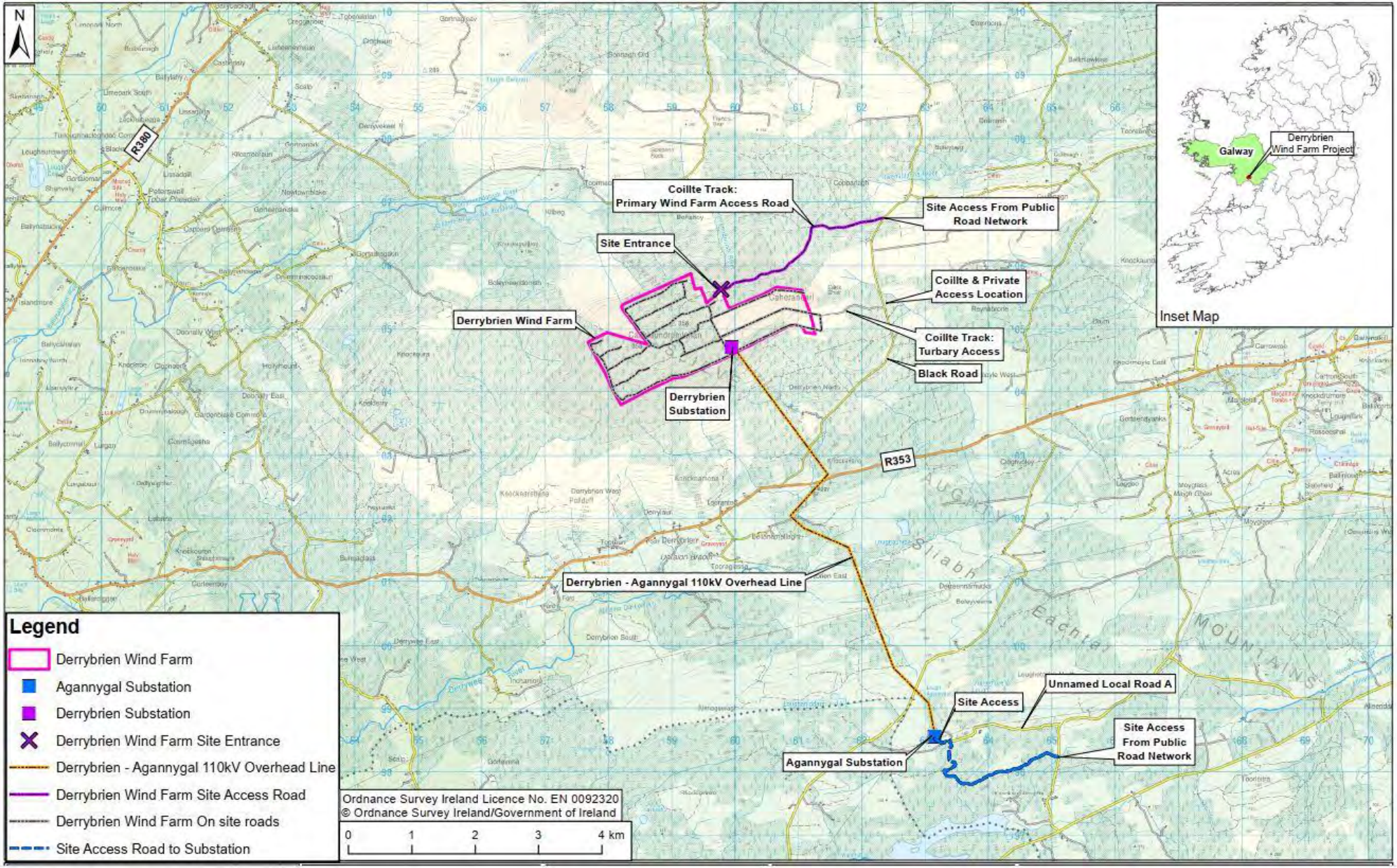


Figure 14-1 Site Context (Source rEIAR July 2020)

14.1.1.5 Relevant Guidance

The following relevant standards have been used in the preparation of this chapter:

- Environmental Protection Agency (2022): Guidelines on the Information to be contained in Environmental Impact Assessment Reports.
- Traffic and Transport Assessment Guidelines (TII PE-PDV-02045 May 2014).

14.1.2 Methodology

14.1.2.1 Scoping and Consultation

Scoping is a process of deciding what information should be contained in an rEIAR and what methods should be used to gather and assess that information.

Scoping with Galway County Council (GCC) Roads Department was undertaken on January 30th, 2023. The following elements of the Derrybrien Wind Farm Decommissioning Project were discussed.

- Site works at the site access junctions
- Haul route for abnormal load traffic

The main items identified in the scoping included:

- A need to assess the traffic impact associated with the decommissioning stage.
- No Road Safety Audit was required as the site access is existing and is currently operating as an operational access.

14.1.2.2 Impact Assessment Methodology

The assessment methodology undertaken for this assessment is summarized as follows:

- Review of appropriate guidance to identify appropriate assessment pathways for the Retained Development.
- Historical project documentation was reviewed, including factual data and primary records that informed the rEIAR Chapter 14 – Roads, Traffic & Transport (Document No: QS-000280-01-r460-001-000, July 2020) – Derrybrien Wind Farm Project.[1]

As noted in subsequent sections (see Section 14.1.2.4) no traffic data is available for the pre-construction or project construction phases. Accordingly, a Traffic & Transport Assessment (TTA) has not been undertaken and this assessment comprises a qualitative assessment. It is not anticipated that a TTA would alter the findings of this impact assessment.

A conservative approach has been taken for the impact assessment in particular with respect to the durations of some of the civil and electrical works. This conservative assessment has been undertaken with input from members of the construction team who were on site during construction of the works and estimates based on industry experience. The text and tables included in this chapter which set out information relating to vehicle movements, personnel and durations have been prepared with the use of the following sources:

[1] *This assessment does not rely on the conclusions of the 2020 rEIAR. Instead, relevant data and records have been independently reviewed and incorporated into this assessment, where appropriate.*

- Construction stage records including, but not limited to, claims documents, meeting minutes, site reports and correspondence.
- Input from ESB personnel who were involved in the delivery of the Project.

14.1.2.3 Categorisation of Impact & Effect

Figure 3.4 of the Environmental Protection Agency (EPA) Guidelines (2022) shows the typical classifications of the significance of effects which should be classified and addressed accordingly.

Table 3.4 of the same EPA Guidelines (2022) provides defined terms for the description of effects. Where relevant, throughout this chapter, effects have been described using these terms as they relate to quality of effect, degree of significance, extent, context, probability, duration and frequency.

Throughout this chapter, following the characterization of impacts, an assessment of the environmental significance of their effects, as they relate to roads, traffic and transport, is made. As recommended by Section 3 of the Transport Infrastructure Ireland (TII) Traffic and Transport Assessment (TTA) Guidelines, the assessment identifies both positive and negative impacts. In that regard significance is a concept related to the weight that should be attached to effects. For the purpose of this assessment 'significant effect' is an effect that either supports or undermines the operation of the roads and transport environment and the traffic experienced in that environment. A significant effect is simply an effect that is sufficiently important to require assessment and reporting so that the decision maker is adequately informed of the environmental consequences of permitting a project.

14.1.2.4 Difficulties Encountered

In assessing effects which have occurred, by its nature, this remedial Environmental Impact Assessment Report (rEIAR) is assessing those effects many years after the project construction. As a result, there may be both undocumented instances of minor effects which are not captured by this rEIAR in addition to gaps in the historical data available.

Difficulties were encountered in relation to the following:

- Assessing the precise number of vehicles required to transport felled trees off-site during construction and operation of the wind farm. A conservative assessment forms the basis for the impacts outlined by section 14.1.4.1 in this regard.
- Identifying the exact materials volumes associated with the construction of the OHL.
- Identifying the exact access locations and routes utilised during the construction of the OHL. The assessment is based on input from members of the construction team and the proposed decommissioning strategy for the OHL which is considered similar in nature to the construction phase.
- Identifying the exact routes for the transportation of abnormal loads, including turbine components, to the wind farm.
- Very minor quantities of materials may have been sourced from locations other than those identified herein. No information on these locations was available beyond handwritten records with limited specifics. However, it is not anticipated that their inclusion would alter the impact assessment contained herein.
- Traffic survey data is unavailable for many of the surrounding roads (refer Section 14.1.2). The absence of traffic data and a TTA is not considered necessary for a robust assessment of traffic impacts nor would one be expected to change the outcome of this impact assessment.
- For the cumulative assessments, limited information is available in relation to the extent that other development utilised the road network within the same timeframe as the Project construction and operational phases.

- Difficulties were encountered in sourcing details relating to temporary barrages (A, B, C & D), installed as a result of the peat slide during construction but no longer in place. Information on the size of the barrages, material volumes used and how the barrages were accessed was unavailable. However, the absence of this information is not anticipated to alter the impact assessment herein.
- In the years between the baseline date for the purposes of this rEIAR and present day a number of transport network upgrades have been undertaken in the vicinity of the project. While major network changes are considered it is acknowledged that minor changes may have also occurred which are not described by this chapter. These changes are not expected to have led to lead to significant impacts, by the very nature that they are relating to minor network upgrades / modifications.

14.1.3 Receiving Environment

The baseline for assessment of environmental effects represents the position prior to the commencement of development.

The following sections identify some of the key features of the receiving environment surrounding the project in its baseline condition; describing the receiving environment both at that baseline and at present day.

The Road Safety Authority online database was referred to in order to assess available road safety statistics in the area of the Project. However, no significant history of road collisions is illustrated.

14.1.3.1 Coillte Track – Primary Wind Farm Access Road

The wind farm site is accessed from a Coillte access road via a minor public road known as the Black Road L-4214 (approximately 3.1 km from the wind farm to the Black Road/Coillte junction). The track was used during construction and operation activities to date and is expected to continue to be used for access for the decommissioning of the project.

In its baseline condition the Coillte forest track comprised an un-surfaced track typically of 2.9 m width comprising a make-up of crushed limestone and crushed rock material. The image provided by Plate 14-1 illustrates the track after upgrades which were undertaken as part of the Project. No image could be sourced for the track prior to the upgrades.

Plate 14-1 Coillte Track to Wind Farm: Northbound (Captured November 2019 - Source: rEIAR July 2020)

Coillte Track – Primary Wind Farm Access: Traffic Volumes

The track is not a public road and before construction of the Project commenced was used primarily by Coillte staff in relation to the management of the forestry in the area. It is assumed that traffic volumes were low and did not include general public usage.

14.1.3.2 Coillte Track – Turbary Lands Access Road

An existing Coillte owned track running in an east west direction from Black Road at its eastern end is also illustrated by Figure 14-1. This track provides access to turbary lands located in the vicinity of the wind farm. The track was upgraded during construction of the project and provided access for some haulage during construction in addition to access for turbary land users.

The road is typically less than 3 m in width. The image provided by Plate 14-2 illustrates the track prior to upgrades which were undertaken as part of the wind farm project while Plate 14-3 illustrates the track in November 2019.

Plate 14-2 Coillte Track to Turbary Lands: Eastbound (Captured September 2003 - Source: rEIAR July 2020)

Plate 14-3 Coillte Track to Turbary Lands: Eastbound (Captured November 2019 - Source: rEIAR July 2020)

Coillte Track – Turbary Lands Access: Traffic Volumes

This Coillte track is also not a public road and again, before construction of the Project, the track was used primarily by Coillte staff or turbary rights land users. It is assumed that traffic volumes were low and did not include general public usage, other than the access to turbary plots.

14.1.3.3 Black Road

Black Road provides the main access route to the wind farm on the public road network. The road generally runs in a north south direction between the R353 at its southern end and Killeenadeema village (south of Loughrea) at its northern end. During construction it formed a link on the haulage route for the project.

In its baseline condition Black Road comprised a narrow, surfaced road, with verges and access gates along its length used for two-way vehicle passing. It was, and remains, a two-way unmarked road. Plate 14-4 is an image of Black Road circa. August 2003 and Plate 14-5 illustrate Black Road in November 2019.

Plate 14-4 Black Road circa (Captured August 2003 - Source: rEIAR July 2020)

Plate 14-5 Black Road: Northbound (Captured November 2019 - Source: rEIAR July 2020)

Black Road: Traffic Volumes

Black Road comprises a road on the public network. It is primarily used for local access however the area surrounding Black Road is primarily rural with very little housing / development. There are no permanent traffic counters on the road and no traffic surveys were undertaken for the Project. Based on

the July 2020 rEIAR report, both the construction and operational periods for the wind farm, traffic volumes were observed to be very low on the road.

14.1.3.4 R353 Regional Road

The R353 regional road also formed a link on the haulage route during construction of the Project. The road generally runs in an east west direction between Gort (western end) and its intersection with the R352 (eastern end), just west of Portumna. Along its length the R353 passes through Derrybrien village.

In its baseline condition the R353 comprised a two-lane two-way surfaced road with line markings. Based on the July 2020 rEIAR report, no posted speed limit was observed. Plate 14-6 illustrates the R353 at its intersection with Black Road.

Plate 14-6 R353: Westbound (Captured November 2019 - Source: rEIAR July 2020)

R353: Traffic Volumes

The R353 comprises a road on the public network. It provides the main access between Gort and Portumna. Based on the July 2020 rEIAR report both the construction and operational periods for the wind farm traffic volumes were observed to be low on the R353, albeit volumes are higher than those experienced on local roads including Black Road.

14.1.3.5 R476 Regional Road

The R476 regional road also formed a link on the haulage route during construction of the Project. The road generally runs in a north south direction between the N85 (southern end) and Lisdoonvarna (northern end). The R476 was used during haulage as far as Corofin village, where it intersected the R460, during the construction of the Project.

In its baseline condition the R476 comprised a one-lane two-way surfaced road with line markings in a rural environment. Plate 14-7 illustrates the R476 in the northbound direction, south of Corofin.

Plate 14-7 R476: Northbound (Captured February 2020 - Source: rEIAR July 2020)

R476: Traffic Volumes

The R476 comprises a road on the public network. It provides the main access between Ennis and Corofin / The Burren. It should be noted that there are no permanent traffic counters on this road and no traffic surveys were undertaken for this road.

14.1.3.6 R460 Regional Road

The R460 regional road also formed a link on the haulage route during construction of the Project. The road generally runs in a south west to north east direction between the R474 at Miltown Malbay (western end) and Gort (eastern end). The R460 was used during haulage from Corofin village, where it intersected the R476, towards Gort, during the construction of the Project.

In its baseline condition the R460 comprised a one-lane two-way surfaced road with line markings in a rural environment. Plate 14-8 illustrates the R460 in the westbound direction, west of Gort.

Plate 14-8 R460: Westbound (Captured February 2020 - Source: rEIAR July 2020)

R460: Traffic Volumes

The R460 comprises a road on the public network. It provides the main access between west Co. Clare and Gort. Traffic volumes are observed to be low on this road.

14.1.3.7 N18 National Primary Road (Now R458)

The N18 national primary road also formed a link on the haulage route during construction of the project. The N18 formed part of the national road network managed by the National Roads Authority (NRA) during the baseline period and throughout construction of the project. After the construction of

the M18 motorway, described by Section 14.1.3.9, the N18 was downgraded to the R458 (regional road) and is since under the management of Galway County Council (GCC).

All construction delivery traffic for the project arrived at the local road network via the N18 national primary road although it should be noted that personnel movements may have travelled from the Loughrea direction on the Black Road.

The N18 (now R458) is located to the west of the wind farm and generally runs in a southwest to northeast direction between Gort (southern end) and Loughrea (northern end). In its baseline condition the N18 comprised a two-lane two-way surfaced road with line markings. Plate 14-9 illustrates R458.

Plate 14-9 N18 (now R458): Southbound (Captured November 2019 - Source: rEIAR July 2020)

N18: Traffic Volumes

During the baseline and construction of the Project the N18 comprised a national road on the public network managed by the NRA. During construction, it formed part of the main access road between Galway and Limerick and a link on the haul route for the project.

NRA traffic data from 2003 is available online at: (https://web.nra.ie/TrafficCounterData/html/N18-06.htm)

Data for the years between 2003 and 2006 inclusive is provided in Table 14-1 below for a traffic counter location on the N18, 6 km south of Gort.

Table 14-1. NRA Gort N18-06 Traffic Data

Data	2003	2004	2005	2006
AADT	9009	9408	10258	10856
% HGV	9.8%	9.7%	10.6%	9.6%
Coverage	364 days	364 days	343 days	126 days

14.1.3.8 Upgrades to the N18

Between January 2015 and September 2017 construction of the M18 motorway took place between Oranmore and Gort as part of the overall Gort to Tuam scheme. This resulted in the N18 being retained as the R458 regional road while the newly constructed M18 became the primary route between Galway and Limerick.

In that period the NRA was also replaced by TII, the present-day authority for the national roads network, which includes the M18.

The M18 now serves as the primary road from which access is and will be taken, onto the national, regional and local road network, for the ongoing operation of the wind farm and its ultimate decommissioning.

For the purposes of this rEIAR:

- The N18, prior to the undertaking of the M18 construction, is considered for the impact assessment documented by Section 14.1.4.
- The M18 is considered for the impact assessment documented by Section 14.1.4.

14.1.3.9 M18 Motorway

The M18 motorway, managed by TII, serves as the nearest major road from which traffic related to the ongoing and future operation of the wind farm, and its ultimate decommissioning, will travel before / after connecting to the national, regional and local roads immediately surrounding the project.

The M18 is located to the west of the wind farm and generally runs in a north – south direction connecting to the M17 and M6, east of Galway, at its northern end and the N18 and N19, south east of Ennis, at its southern end.

The M18 comprises a four-lane two-way motorway. It has a speed limit of 120 km / hr. Plate 14-10 illustrates the M18.

Plate 14-10 M18: Southbound (Captured November 2019 - Source: rEIAR July 2020)

M18: Traffic Volumes

The M18 comprises a national road on the public network. TII has a permanent traffic counter (reference TMU N18 024.0 N) between Ardrahan / Kilcolgan and Gort with summary data per Table 14-2 below.

Table 14-2. TII TMU N18 024.0 N Traffic Data

Data	2017	2018	2019
AADT	11064	12476	13928
% HGV	5.4%	5.4%	2.5%
Coverage	24.4%	99.7%	82%

Provided for clarity Figure 14-2 below highlights the N18 alignment (baseline condition) in addition to the M18 alignment (present day).

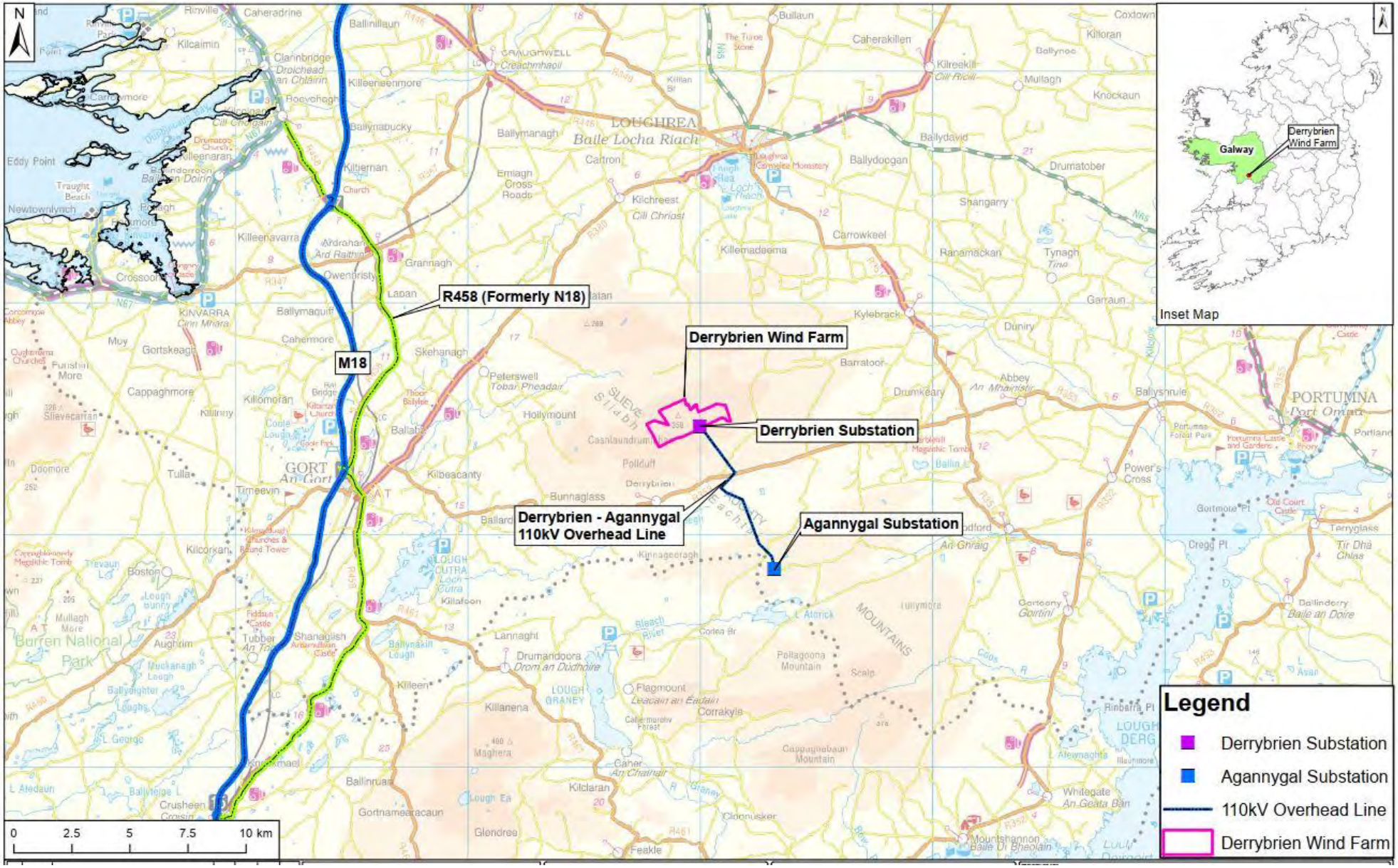


Figure 14-2 N18 & M18 Alignment (Source rEIAR July 2020)

14.1.3.10 Unnamed Local Road A

Agannygal Substation is located to the north of Unnamed Local Road A, as illustrated by Plate 14-11. While access to the substation is from this road only a short section of the road is used by vehicles associated with the project with an existing Coillte track providing the majority of the access route to the substation, as outlined by Section 14.1.3.11. The local road generally runs in an east west direction connecting to other local roads; in County Clare at its western end and in County Galway at its eastern end.

This public road provides local access only. While no traffic survey data is available, based on a site visit, this road experiences extremely low volumes of traffic.

Plate 14-11 Unnamed Local Road A (Captured November 2019 - Source: rEIAR July 2020)

Unnamed Local Road A: Traffic Volumes

This public road provides local access only. While no traffic survey data is available, based on the July 2020 rEIAR report, this road experiences extremely low volumes of traffic.

14.1.3.11 Coillte Track – Agannygal Substation Access

The site of the Agannygal Substation was primarily accessed during construction via a Coillte access track. This track was upgraded as part of the overall project to provide this access. The track generally runs in a north-west to south-east direction connecting to minor local roads at both western and eastern ends.

The track comprises a narrow, two-way, unsealed, unmarked road as illustrated by Plate 14-12.

Plate 14-12 Coillte Track to Substation (Captured November 2019 - Source: rEIAR July 2020)

Coillte Track – Agannygal Substation Access: Traffic Volumes

The track does not comprise a road on the public network and before the project construction it was, and continues to be, used solely by Coillte staff in relation to the management of the forestry in the area in addition to ESB Networks staff in relation to ongoing substation maintenance. While no traffic survey data is available, based on the July 2020 rEIAR report, this track experiences extremely low volumes of traffic; only those relating to Coillte staff usage.

14.1.4 Likely, Significant Impacts and Mitigation Measures Implemented

14.1.4.1 Construction Phase Impacts (2003 –2006)

This section identifies the effects which occurred during the construction of the Project between circa June 2003 and March 2006, excluding activities relating to the offsite works associated with the peat slide which are dealt with by Section 14.1.4.1.2.

Traffic and transport effects during this period were associated with the following aspects of the Project:

- General project requirements.
- Site preparation works.
- Civil works.
- Electrical works.
- Wind turbines.

Timeframes for each of the above project phases are generally outlined in **Appendix 14-1**.

General Project Requirements

Personnel Movements

Table 14-3 identifies the number of construction personnel who attended the project site during the overall construction period. The number of personnel below represents peak conditions and during many periods, personnel numbers would have been lower than those shown below.

Table 14-3. Construction Personnel – General

Phase & Personnel	Peak Personnel Numbers
All construction phases – Gort	Approximately 4 – 10
Coillte tree felling	Up to 10
Civil works contractors	Up to 60
Electrical works contractors	Up to 30
Wind turbine supply & installation	Up to 50

Personnel movements were fairly evenly distributed across the Project duration of 34 months. As tree felling and civil works' personnel numbers reduced on site, numbers increased in relation to electrical and wind turbine works.

Most construction workers arrived at the project site compound, OHL works' locations or Agannygal substation in private / developer vehicles during construction. There was no readily available public transport to serve the project site given its rural location. Personnel arriving at the site used both the haul routes as identified by Figure 14-3 and the Black Road from the Loughrea direction.

Assuming a vehicle occupancy rate of 1.25 for the peak scenario (i.e. when the highest personnel numbers were present on the project; 160 in total from Table 14-3) equates to approximately 128 vehicles arriving to and departing from the project site each working day; resulting in maximum total daily movements of 256 on the local network. This represents a maximum, conservative scenario and in reality, numbers experienced would be lower; typically, in the order of 72 vehicles approaching site per day or 144 movements.

The N18 experienced average daily flows as follows (2003 volumes, refer National Roads Authority (NRA) historical counter data at:

https://web.nra.ie/TrafficCounterData/html/N18-06.htm):

- 4509 northbound vehicles; and
- 4502 southbound vehicles.

An additional volume of approximately 128 vehicles (i.e. approximately 2.8% of one- way daily traffic movements) in the peak construction scenario is unlikely to have resulted in a significant effect on the N18, due to the high existing traffic levels experienced on this national road.

However, effects on Black Road and the surrounding local road network would have differed given the low baseline levels which existed on those roads during construction. The baseline condition on local roads consisted of much lower levels of traffic, whereby additional traffic volumes would have had a more significant effect on road users however they are considered to have resulted in **short-term, negative, moderate effects.**

Figure 14-3 Haul Routes – General (Source rEIAR July 2020)

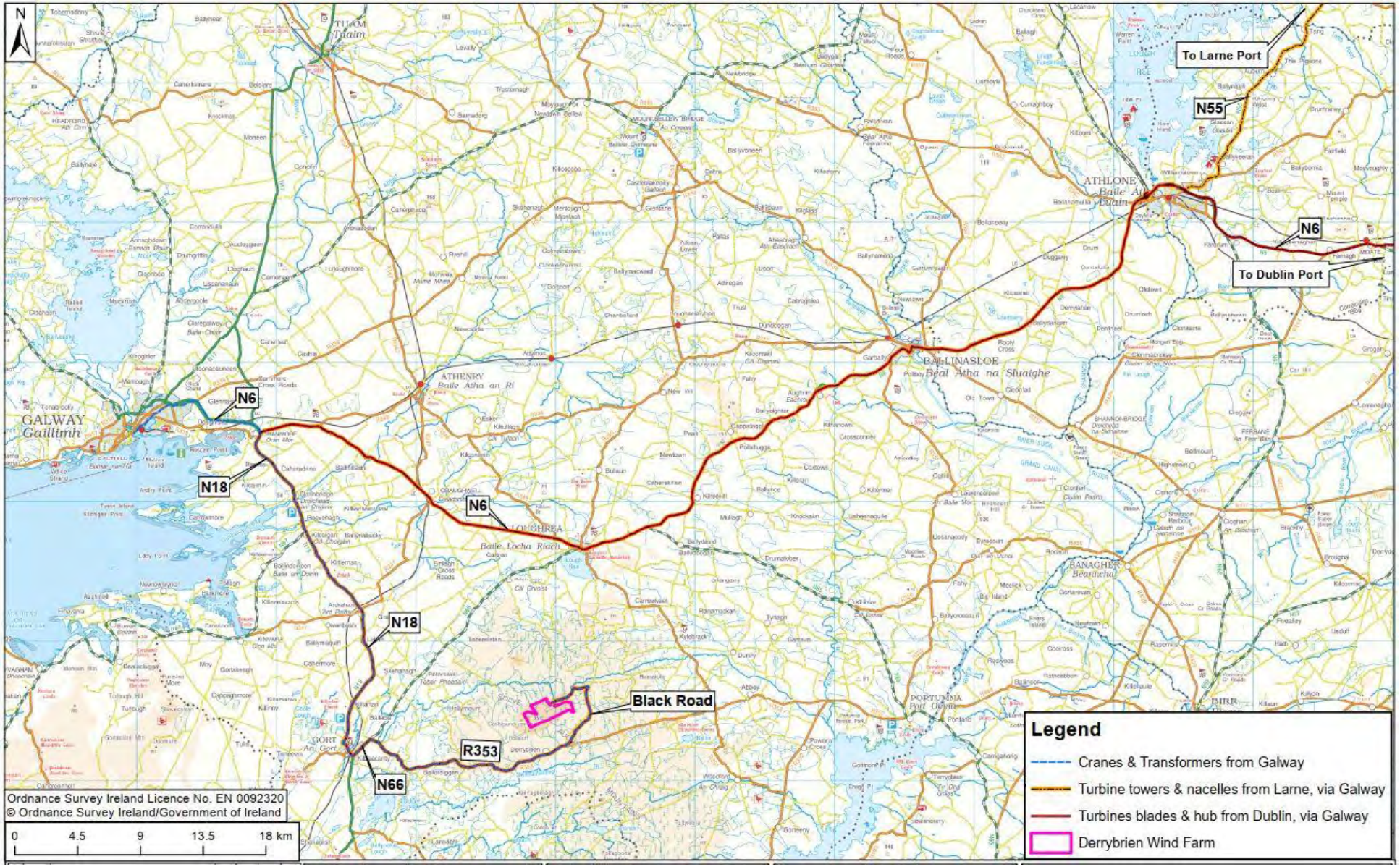


Figure 14-4 Haul Routes – Turbines (Source rEIAR July 2020)

Plant Movements

Table 14-4 below identifies the key plant which were utilized during construction.

Table 14-4. Typical Plant – Civil & Electrical

Plant	Plant (Cont'd)
Harvesters	Flatbed Trailer
Forwarders	JCB
Timber Lorries	3-axle Heavy Goods Vehicles (HGV's)
Excavators (10 tonne to 50 tonne)	4-axle HGV's
Crusher	Personnel 4WD vehicles
Front Loader	Lighting Generator
Dumper	Mobile Pump
Dozer	Air Compressor
Roller	Mobile Concrete Pump (intermittent only)
Tractor & Bowser	Mobile Crane (intermittent only)
Rotary Core	

All of the above plant was transported to the site on the haul routes illustrated by Figure 14-3. Movements associated with the delivery of plant to the site were low and typically involved a single trip to site and a single trip away from site with the exception of timber hauliers. As a result, movements of plant equipment are considered unlikely to have had a significant effect on any of the haul routes identified. Movements of plant would have been concentrated at the start and end of construction activities.

Material & Equipment Imports

Table 14-5 identifies the material and equipment imported to the Project and their sources while the haul routes used for deliveries, including abnormal loads associated primarily with the turbines are illustrated by Figure 14-3 and Figure 14-4.

It should be noted that much of the rock material required by the project was sourced at onsite borrow pits with internal vehicle movements only, thereby minimizing the impacts associated with rock material import.

Movements of HGV's were spread across the 34-month construction period. The following summarizes the maximum daily movements at peak periods during the project calculated using the information in Table 14-5:

Peak HGV movements occurred in July 2005; although it should be noted that only slightly smaller peaks also occurred in August – September 2003, and over the longer period of July 2004 – September 2005. Assuming a single month duration the following occurred:

- Maximum average daily deliveries of approximately 15 (rounded up) HGV's.
- Maximum daily movements of approximately 30 (rounded up) HGV's.
- Approximately 1.2 HGV's per hour (2.5 HGV 2-way movements) during the maximum peak period for HGV deliveries.

Abnormal load deliveries were spread across a 6-month period. Both in order to minimize impact to the local network and for safety reasons the majority of movements took place outside of peak periods, overnight, along the majority of the route. Once abnormal loads reached Derrybrien Village on the

R353 they were parked until the hours of daylight at which point, they then travelled to site via the R353 and Black Road.

The following summarizes the maximum daily movements at peak periods during the project calculated using the information in Table 14-5:

Peak abnormal movements occurred between April and September 2005.

- Maximum average daily deliveries of approximately 3 (rounded up) abnormal loads.
- Maximum daily movements of approximately 5 (rounded up) abnormal vehicles.

The above maximum values are conservative estimates based on the information available at the time of writing and are subject to the difficulties identified by Section 14.1.2.4. The actual daily volumes would be expected to be lower.

During peak HGV deliveries effects are expected to have resulted in **short-term, negative, moderate effects** on the immediately surrounding local road network. During abnormal deliveries impacts are expected to have resulted in **short-term, negative, moderate effects** on the immediately surrounding local road network.

There were isolated occurrences of disruption as a result of incidents during the transportation of abnormal loads. Specifically, as a result of an incident in June 2005 a blade transport trailer blocked Black Road for a brief duration during which diversions were in place. While this would have led to a temporary significant effect, no significant effects are deemed to have occurred due to an isolated disruption of this type.

Table 14-5. Total Material Movements – Civil & Electrical (Including Wind farm, OHL, Substation components)

Materials	Source	Appropriate No of Deliveries	Approximate Dates	Approximate Duration
Tree Felling – moved off-site by trailers	Wind farm site, OHL & Agannygal substation	6690	May 2003 – Sep 2005	Approx. 29 months
Rock & Crushed Stone	Brehony Quarry (Ballinakill) Goode Quarry (Ardrahan) Whelan's Quarry (Ennis)	<400	June – Sep 2003 & July 2004 – Sep 2005	Approx. 19 months
Concrete	Goode Quarry (Ardrahan) Whelan's Quarry (Ennis) Esker Readymix (Galway)	1000	Aug – Sep 2003 & July 2004 – Sep 2005	Approx. 17 months
Steel	Lydons of Galway	40	Aug – Sep 2003 & July 2004 – Sep 2005	Approx. 17 months
General Civil Materials	Assumed to be from Galway direction	35	Between June – Sep 2003 & July 2004 – Dec	Approx. 23 months
Unit Transformers		14	April 2005 – Aug 2005	Approx. 5 months
Electrical Switchgear & General Electrical /		34	Between July 2005 – August 2005	< 1 month
Cabling		7	April 2005 – May 2005	Approx. 2 months
Approximate Total HGV's (Incl trailers for tree felling)		8220		
Approximate Total HGV Movements		16440		
Derrybrien Substation Transformer	Assumed to be from Galway direction via N18	1	May 2005	< 1 month
Turbine Towers	Larne Port Assumed to be from Galway direction via N18	140	April 2005 – Sep 2005	Approx. 6 months
Nacelle		70		

Materials	Source	Appropriate No of Deliveries	Approximate Dates	Approximate Duration
Generator / Hub	Dublin Port Assumed to be from Galway direction via N18	70		
Turbine Blades	Dublin Port Assumed to be from Galway direction via N18	140		
Crane Deliveries	Assumed to be from Galway direction via N18	6	Assumed April 2005	Approx. < 1 month
Approximate Total Abnormal Loads		**427**		

Site Preparation Works

Tree Felling

During construction of the Project, excluding works associated with the peat slide, approximately 222 ha of tree felling took place within the main wind farm site, along the route of the OHL and at the Agannygal Substation site.

Much of the felled trees were left in-situ or reused on site during construction. Information on the number of trailers which were used in the removal of trees could not be sourced for this assessment. However, a conservative assessment has been undertaken in order to estimate the numbers in Table 14-5 for this activity. This assessment has identified approximately 10 trailers removed felled trees off-site, per day.

Impacts associated with the removal of felled trees from site are captured by the overall HGV movements described earlier in this section.

Civil Works

Roads at Wind Farm Site & Agannygal Substation Site

Existing roads / tracks were upgraded, and new roads were constructed within the wind farm site, over the course of construction. In addition, a new section of road was also constructed from Unnamed Local Road A to Agannygal Substation, on Coillte lands, as part of the project. These works primarily took place between June 2003 and September 2003 and did not impact significantly on public road, traffic or transport. Materials associated with these works were typically sourced from on-site borrow pits with any effects associated with imported materials considered previously in this section.

Ancillary Works – Roads

The following roads were upgraded off-site on the public road network:

Localized road widening at Crooked Bridge on the R353.

Approximately 5.1 km of public road upgrades comprising the following:

- 5 km of road upgrade works to Black Road involving the widening of the road to provide a minimum effective width of 4 m on straights and 4.5 m on bends.
- 0.08 km of road upgrade works to the Unnamed Local Road A public road which formed the haul route to Agannygal Substation.

The bellmouth at the intersection of the Black Road and the Coillte track providing access to the wind farm was widened. The above locations are illustrated by Figure 14-5.

Widening works at Crooked Bridge on the R353 involved the excavation and removal of small amounts of material over a length of approximately 60 m with an average width of 3 m. Subsequently, the materials removed were replaced with hardcore and double surface dressing. Works were undertaken in order to accommodate the transportation of oversize loads to the project site. A conservative estimate is that works are likely to have been of a maximum duration of less than 1 month. Effects are unlikely to have been significant in relation to these works.

Black Road upgrade works included widening the road within existing roadside boundaries, strengthening of the existing road, the construction of lay-bys and remedial works to sections of the existing road. These works were undertaken intermittently over the course of the construction phase of the Project. Traffic management measures were agreed with GCC in relation to the works. Effects on the public during the upgrading of Black Road were **temporary, negative and moderate**.

Upgrade works to Unnamed Local Road A involved resurfacing works to approximately 80 m of the existing road. A conservative estimate is that works are likely to have been of a duration of less than maximum 1 month. Effects are unlikely to have been significant in relation to these works and are considered **temporary, negative and slight**.

In addition to the works to Black Road itself the bellmouth at the entrance to the wind farm (intersection of Black Road and Coillte Track) was also upgraded including widening and hedge trimming. A conservative estimate is that works are likely to have been of a maximum duration of less than 1 month. Effects are unlikely to have been significant in relation to these works. Users of the access road include Coillte personnel and Project staff and disruptions during these works did not generally affect members of the public; effects are considered **not significant**.

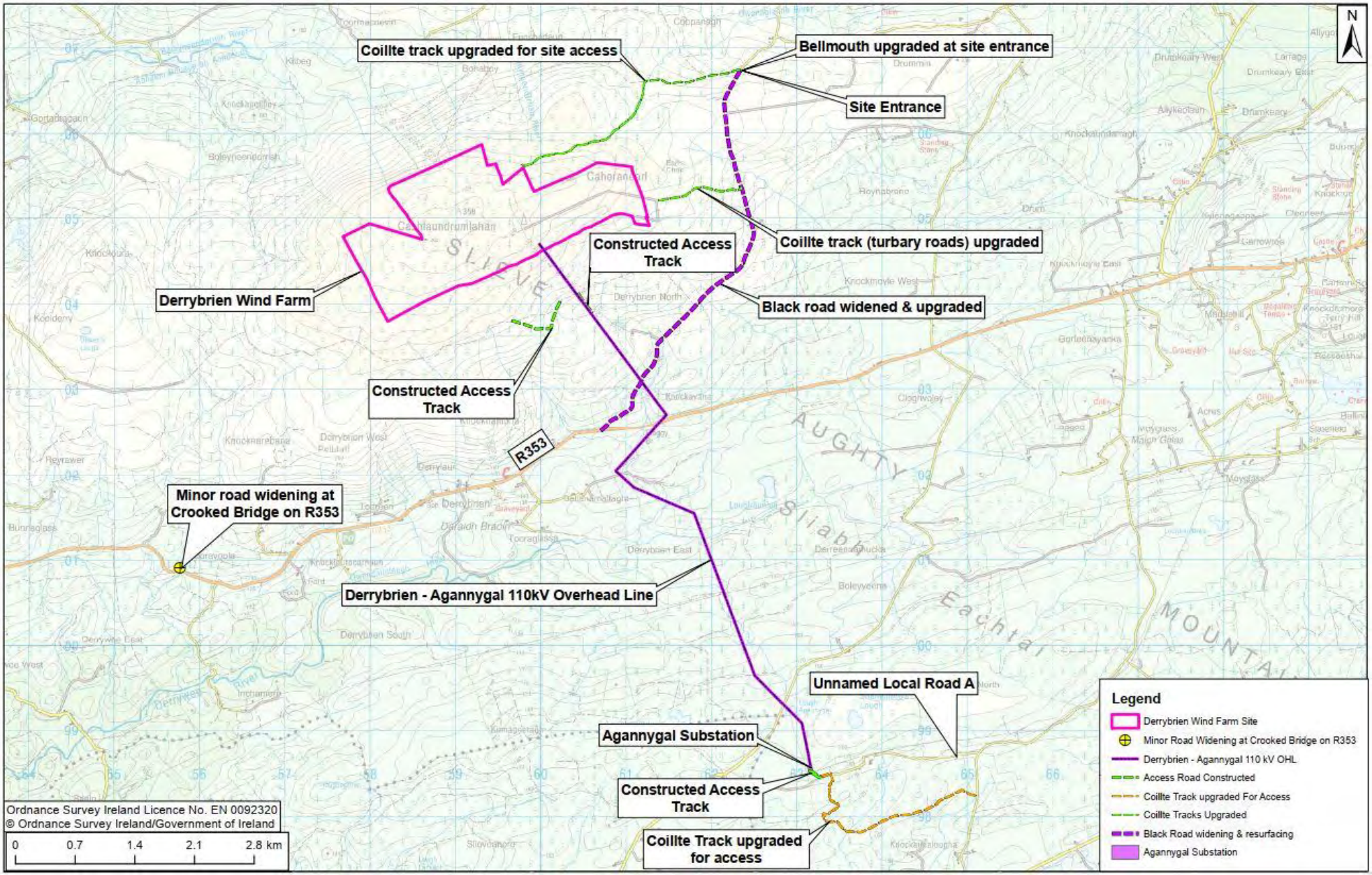


Figure 14-5 Road Upgrades (Source rEIAR July 2020)

Ancillary Works – Bridges

In order to facilitate the Project, works were undertaken to the following three bridges on Black Road involving strengthening of the bridges and surfacing works for an effective width of 4 m and the replacement of the bridge parapets:

- Bridge at 562240.1, 705630.7 (ITM) (Unnamed Bridge A);
- Bridge at 561836.7, 704082.8 (ITM) (Unnamed Bridge B); and
- Bridge at 561367.3, 703601.7 (ITM) (Black Road Bridge).

The location of the bridge upgrade works is illustrated by Figure 14-6.

During the upgrade works to the above bridges local access was largely maintained with traffic management in place. For short durations (less than 2 hours) during critical periods a temporary diversion was in place however local access was retained, with delays, as requested by road users. Works are understood to have taken place over short durations. Local road users are likely to have experienced **temporary, slight, negative effects** as a result of these upgrade works.

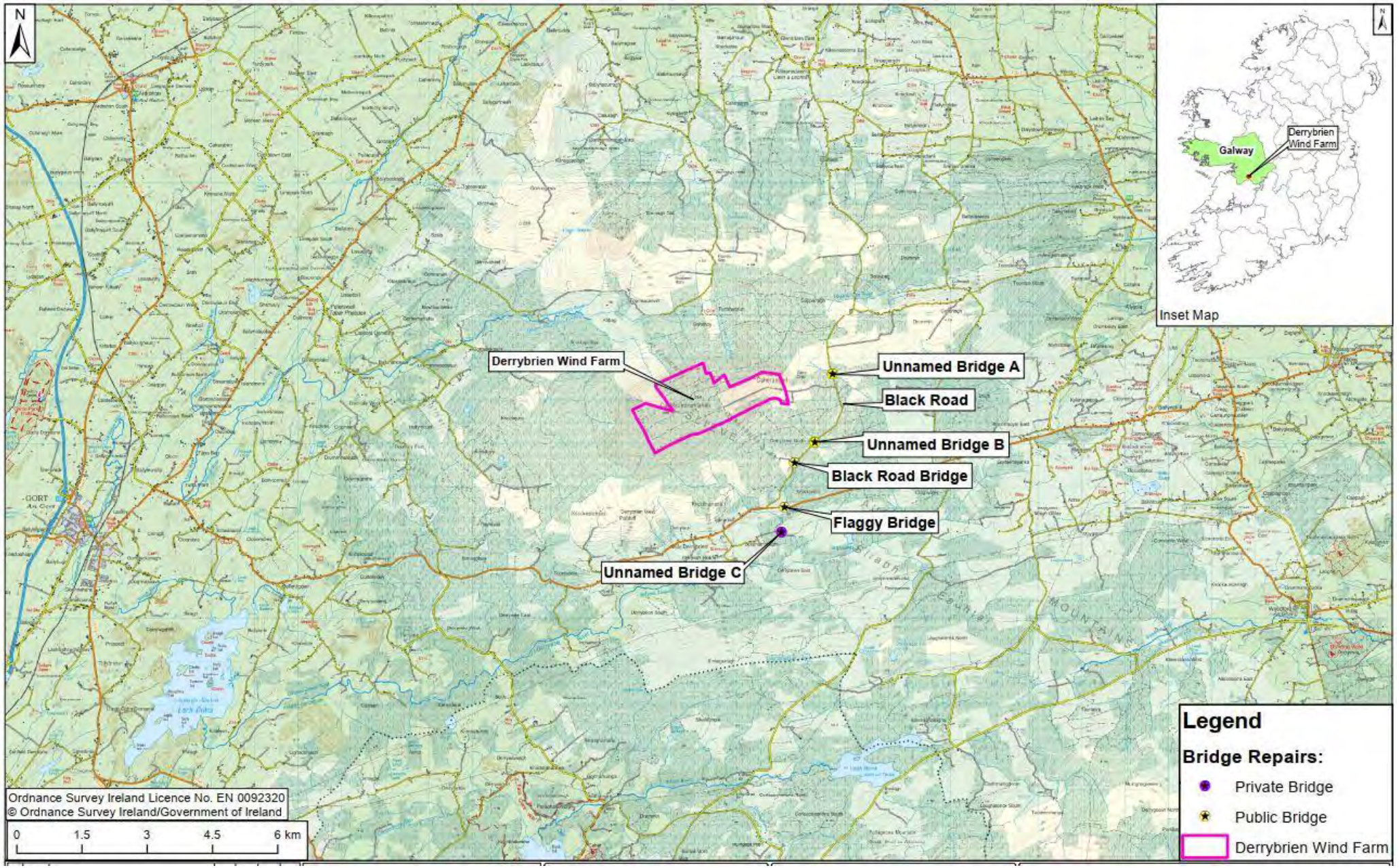


Figure 14-6 Bridge Upgrades (Source rEIAR July 2020)

Turbine Foundations & Hardstands

Materials deliveries associated with the construction of the turbine foundations and hardstands are included in Table 14-5 while peak movements associated with these deliveries, and resulting impacts, have been outlined previously in this section.

Agannygal & Derrybrien Substation Foundation, & OHL Foundations

Similarly, materials associated with the construction of the substation foundations and foundations for OHL angle masts are also included in Table 14-5 while peak movements associated with these deliveries, and resulting impacts, have been outlined previously in this section.

Electrical Works

Grid Connection

On-site electrical works included the following:

- Construction of new Derrybrien Substation within wind farm site boundary.

Off-site electrical works included the following:

- Construction of new Agannygal Substation.
- Construction of OHL between Derrybrien Substation and Agannygal Substation including tie in works to the existing 110kV Ennis – Shannonbridge OHL.

Impacts associated with the construction of the Derrybrien Substation and foundations for OHL angle masts have been captured previously as they relate to personnel, plant and material movements.

In addition, during the construction of the OHL and Agannygal Substation there were impacts associated with increased traffic movements for personnel, the import of materials along the route of the OHL and the export of felled trees in order to clear the route of the OHL. Again, these impacts have been captured previously in this section where they relate to personnel movements, plant movements and materials import.

Difficulties were encountered in finding information on the access locations used from the public road network for the construction of these works. Figure 14-7 and Figure 14-8 illustrate the access locations identified for the decommissioning of the OHL and it is assumed, for the purposes of this assessment, that those same locations were used during construction.

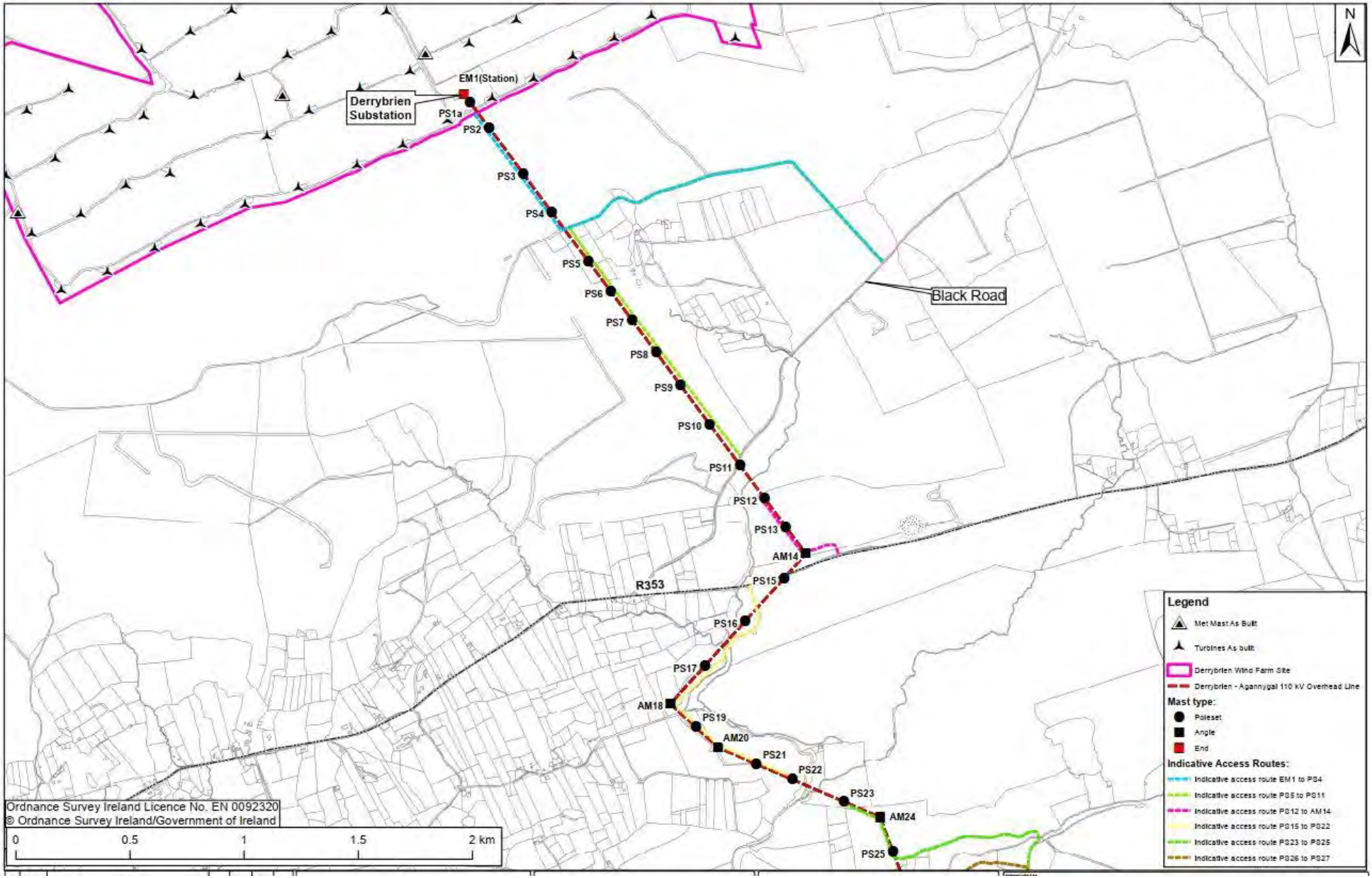


Figure 14-7 OHL Access Locations Sheet 1 (Source rEIAR July 2020)

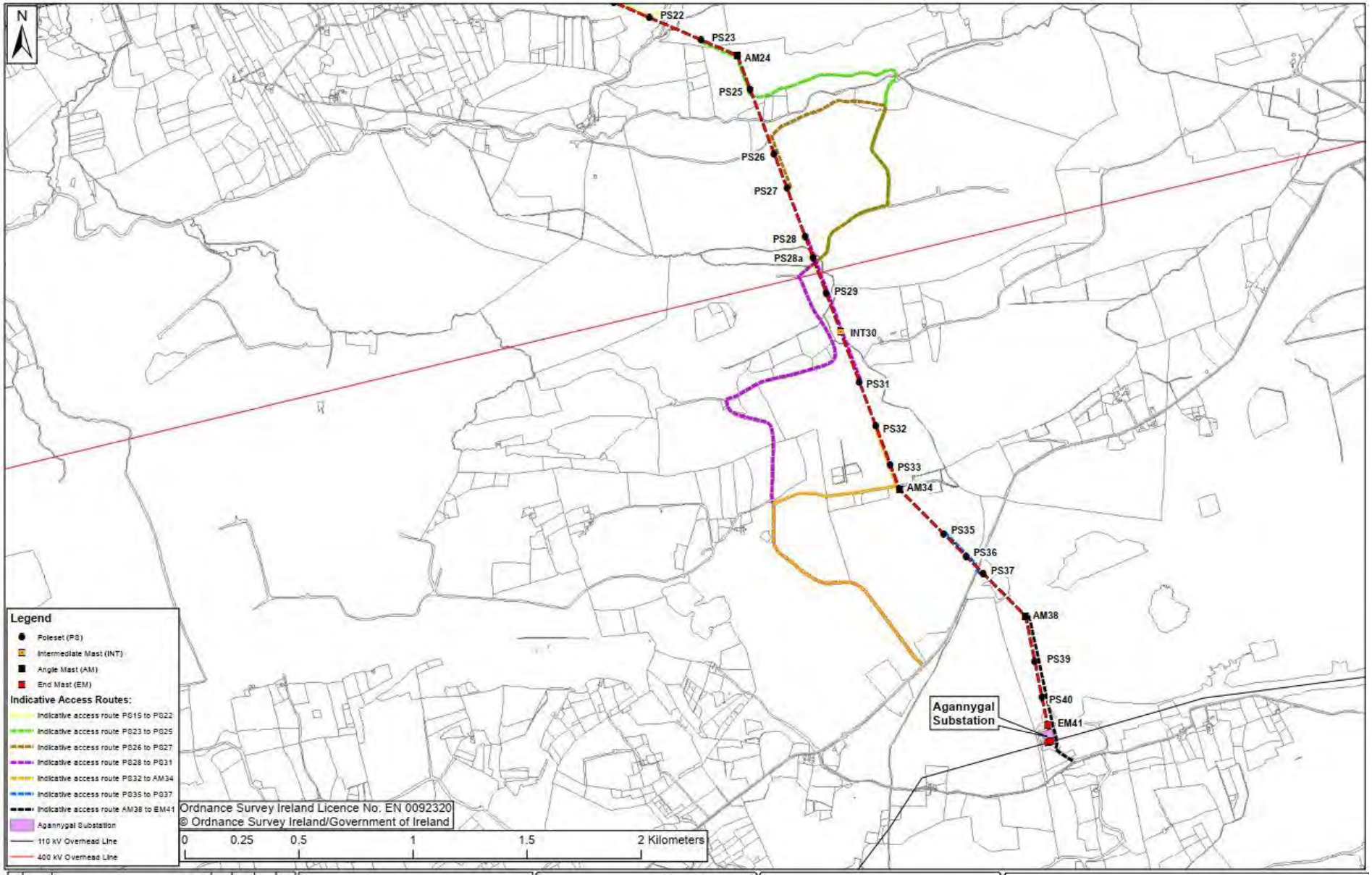


Figure 14-8 OHL Access Locations Sheet 2 (Source rEIAR July 2020)

Mitigation Measures

During the construction of the Project, the following mitigation measures were implemented in order to reduce significant effects relating to roads, traffic and transport:

- Significant volumes of construction materials were sourced on-site thereby reducing effects on the surrounding transport network in relation to material movements to the site.
- Deliveries of abnormal loads were undertaken in the hours of darkness as much as possible in order to minimise effects on road users and effects experienced by them.

Residual Impact

During the construction phase of the project, as a result of the design mitigation to use on site material as much as possible, effects relating to material movements to/ from the site were reduced. In addition, the movement of abnormal loads overnight as much as possible minimized disturbance to local road users.

During project construction, both slight and moderate, negative effects were experienced due to a number of activities on the surrounding roads, traffic and transport network. When considering these various moderate effects cumulatively, in particular those associated with material movements and public road works, effects are considered to be as follows:

- **During peak construction stages, where maximum vehicle movements were experienced, short-term, significant, negative effects were experienced by users of the local network in the immediate vicinity of the Project.**
- **Beyond the local network, short-term, imperceptible, negative effects were experienced by users of the national network.**

Significance of Effects

No significant effects are identified for the construction phase of the Project.

14.1.4.1.2 *Offsite Peat Slide Works: Oct 2003 – end 2005*

Construction works halted on 16$_{th}$ October 2003 when a peat slide occurred. Following the peat slide project resources were redirected in response to the slide. This section identifies the impacts which occurred during the response to the peat slide, between circa October 2003 and the end of 2005.

Traffic and transport impacts during this period were associated with the following:

- Temporary closure of local and regional roads during the response to the peat slide.
- Movement of materials between on-site and off-site borrow pits / quarries to the location of barrages and the construction of barrages.
- New access track (approximately 293 m long) to Barrage No. 2.
- Replacement of existing track adjacent Barrage No. 1 (approximately 830 m long).
- Repairs to Black Road Bridge and Flaggy Bridge, both located on public roads.
- Tree felling at repositories.
- Bridge repairs on private land.

Figure 14-9 illustrates details / features referred to by the impact assessment as documented by this section.

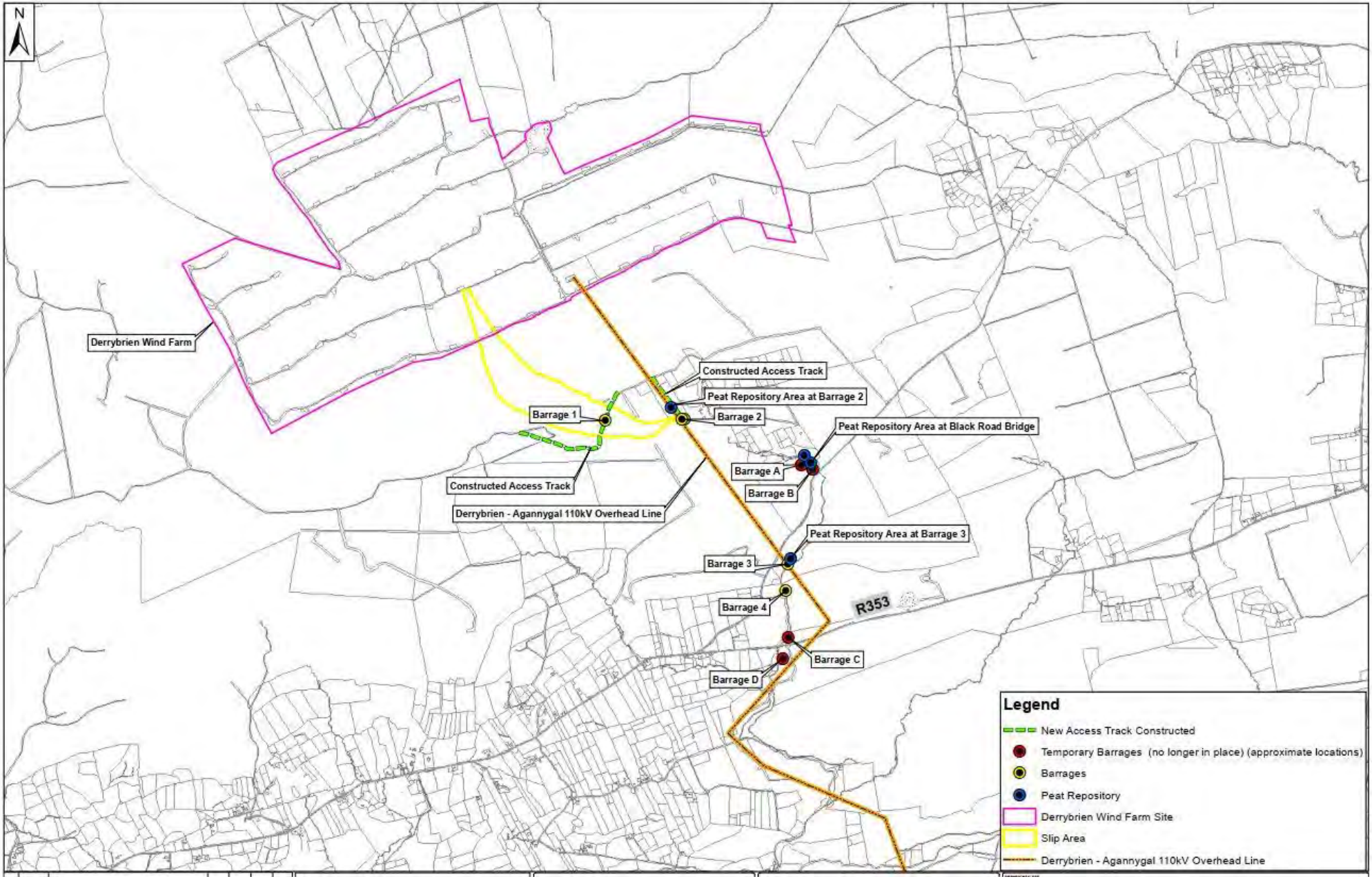


Figure 14-9 Roads Used & Tracks Built to Undertake the Response of the Peat Slip Works (Source rEIAR July 2020)

Temporary Road Closures

As a result of overtopping at both Black Road Bridge and the Flaggy Bridge on the R353 there were temporary road closures on both the Black Road and the R353 regional road while materials were removed from road surfaces.

The durations of these closures were approximately < 2 weeks on the R353 and approximately 1 month on the Black Road, during which time diversions were in place. Effects are considered to have been **temporary, negative and significant** in relation to these works.

Movements of Materials & Personnel

In response to the peat slide, construction workers who were previously located at the main wind farm site were mobilised instead to the various works locations illustrated on Figure 14-9. Movements were via the local road network and Black Road, similar to those during construction up to October 2003. As a result, there was no significant change in impact associated with the mobilisation of materials and plant to the location of peat slide response works rather than the main Project works.

In addition to Project personnel small numbers of other personnel, including staff from GCC, assisted in the response works through both the provision of plant and personnel and the management of the public road network impacted by the peat slide.

Vehicle movements also took place associated with materials required for the construction of barrages and plant utilised for the works. Materials were transported both from the main wind farm site and from borrow pits. Plant arrived at the works sites primarily from the main wind farm site.

Numbers of personnel, and typical plant types, are per those listed in Section 14.1.4.1 of this chapter. The volumes of materials and associated vehicle numbers are provided in Table 14-6.

Table 14-6. Approximate Material Volumes

Location	Approx. Quantities / Volumes	Material Source	Approx. Vehicles Numbers *assuming dumper
Barrage 1	900 m^3	Borrow Pit adjacent Barrage 1	91
Replacement access track to Barrage 1	830 m long track 4.5 m width Approx. 3,735 m3 materials	Borrow Pit adjacent Barrage 1 & wind farm site	376
Barrage 2	650 m^3	Borrow Pit adjacent	65
Track to Barrage 2	293 m long track 4 m width Approx. 1,172 m3 rock materials	Borrow Pit / Quarry 3 on Wind Farm site	118
Barrage 3	350 m^3	Borrow Pit adjacent	35
Barrage 4	300 m^3	Unknown but likely local	30

**Material volumes are not significant and despite source being unknown the route to site are likely to have been similar to those considered elsewhere by this chapter, with no overall change to impact assessment.*

By November 2003, the majority of the barrages were constructed. Immediate response works lasted approximately 1.5 months. While users of the Black Road would have experienced temporary intensification of vehicle volumes during this period, given the absence of residential properties on the

local roads surrounding Barrage 1 and Barrage 2 effects are considered to have been **temporary, negative, slight** in the locality of the specific works sites during this time.

Beyond November 2003, until approximately November 2005, there were intermittent works carried out at various barrages, peat repositories and drainage / cleaning works. These intermittent works are not considered to have resulted in significant effects.

In August 2005 response works were again undertaken following heavy rains. These works were very localized in order to improve drainage and again resulted in only **temporary, negative, slight** effects on the local network.

New Access Track

An access track was constructed in order to facilitate access for the construction of Barrage No. 2 in response to the peat slide. Materials used for construction of the access track were sourced from a borrow pit within the wind farm site.

Effects as a result of this construction were **temporary, negative and slight** at the time of construction, beyond which neutral effects occurred.

Replacement of Existing Access Track

An existing access track was replaced in order to facilitate access for the construction of Barrage No. 1 in response to the peat slide. Materials used for building the access track were sourced from the borrow pit adjacent Barrage 1 and the on-site wind farm borrow pits.

Again, effects as a result of this construction were **temporary, negative, slight** at the time of construction, beyond which **neutral effects** occurred.

Bridge Repairs – Public Roads

As a result of the peat slide over-topping was experienced at both Black Road Bridge on the Black Road (561367.49, 703601.55 ITM) and Flaggy Bridge on the R353 (561137.3483, 702585.7451 ITM). This over-topping resulted in damage to bridge parapets and temporarily prevented vehicle movements on both roads at the impacted locations.

Clearance works were undertaken in order to remove peat and to replace damaged parapets and walls at these locations. Both as a result of the peat-slide itself and the clean-up works, both roads were closed for durations of approximately 1-2 weeks. Diversions and road closures were managed by GCC during this period. However, if required, local access was facilitated with some delays experienced by users of local routes. **Temporary, negative, significant** effects were experienced during these events.

Plate 14-13 illustrates these works at Flaggy Bridge.

Plate 14-13 R353 Repair Works post Peat Slide (Source: rEIAR July 2020)

Tree Felling at Repositories

Approximately 25 ha of trees were felled as a result of the peat slide. The resulting impacts relating to traffic and transport would have been associated with the traffic movements for the removal of those trees.

Movements were via the local road network and Black Road, similar to those during the construction to October 2003. Although there may have been a temporary local intensification of vehicles movements associated with the felling there was no significant change in overall effect associated with the removal of trees from the site.

Bridge Repairs – Private Lands

Repair works were also undertaken at Unnamed Bridge C (561069.97, 702004.2172 ITM, also identified on Figure 14-6) including repairs to bridge parapets and deck slab. During these works' effects were limited to those experienced by the private landowner and deemed to be temporary significant at individual level, but with no impact/effect to the general public.

Residual Impact

During the response to the peat slide, negative effects on the surrounding roads, traffic and transport network resulted in the following effects:

- **Temporary, significant, negative effects were experienced by users of the local network in the immediate vicinity of the Project.**
- **Beyond the local network, temporary, imperceptible, negative effects were experienced by users of the national network.**

Significance of Effects

No significant effects are identified during the offsite peat slide works of the Project.

14.1.4.2 Operation and Maintenance Phase Impacts –2006 –2022

This section identifies the effects which occurred during the operation and maintenance of the wind farm between March 2006 and 2022. Roads, traffic and transport effects during the operational period are associated with the following aspects of the Project:

- General Operation & Maintenance Requirements
- Remedial Works to Wind Farm Site Roads
- Repair Works to Surrounding Road Network, associated with the Wind Farm
- Electrical Works

Specific works undertaken, aside from routine operation and maintenance.

General Operation & Maintenance Requirements

Personnel Movements

During project operation, personnel movements to and from the site typically comprised those associated with wind farm, substation and OHL maintenance activities.

Vestas staffing accounts for a team of approximately 4-6 people on site. In addition, there have been occasional requirements for ESB personnel at Derrybrien and/or Agannygal Substation and at the windfarms site These personnel travelled to and from the site in either private vehicles or Light Goods Vehicles (LGV's).

Volumes were low and likely to have resulted in **long-term, imperceptible** effects.

Plant Movements – to Wind Farm Site

Plant movements associated with the operation of the wind farm project to date include those required for road repairs, turbine / other component maintenance and plant associated with cutting back of tree regrowth.

Any plant transported to the site would be per the haul routes illustrated previously. Movements are infrequent and likely to have resulted in **long-term, imperceptible** effects.

Material Movements

Material movements during its operational phase are primarily associated with the following material movements:

- General waste management.
- Repair works to on-site access tracks requiring geogrid, crushed rock and granular blinding.
- Maintenance and repair of on-site drainage.
- On-site tree management; note that felled trees are not typically removed from site.
- Tree felling to the west and immediately adjacent to the site.
- Upgrade to turbine control systems requiring delivery of 7.6 km of new fibre- optic cable.
- Minor clearing of debris from barrages.

Any material movements to / from the site would again be per the haul routes illustrated previously. Most movements were infrequent and would have resulted in **not- significant** effects.

Movements associated with tree felling during operations are described below, assuming felling occurred across an 18-month period. The exact dates of felling activities are unknown; however, it is

known that they occurred generally over a three- year period but outside of the April to August window. An assumption that felling would have occurred for six months of each of those three years has been assumed for the assessment herein.

The following summarizes the maximum daily movements as a result of felling:

- Maximum average daily removals of approximately 7 flatbeds / trailers.
- Maximum daily movements of approximately 14 flatbeds / trailers.

These movements would have resulted in **short-term, negative, slight effects** on the immediately surrounding local road network.

Remedial Works to Wind Farm Site Roads

In 2014 remedial works were undertaken to the site roads within the wind farm site. These road improvement works entailed:

- Filling potholes with class 6F2 granular material;
- Placing of geogrid reinforcement; and
- Placing of approximately 150 mm crushed rock capping material and 10mm granular blinding.

In addition to the above general maintenance works road improvement works were undertaken to widen an existing floating road over culverts at Turbines T10, T24, T35, T50, T66.

In 2017 approximately 7.6 km of new fibre-optic cable was installed on-site. In addition to typical trench and burial activities the works included the placement of 75 mm diameter galvanized pipe at five on-site road crossings to lay the cable under floating roads.

Effects associated with the above were largely associated with the importation of materials and personnel / plant movements. Works were typically temporary in duration and with **not-significant** effects.

Repair Works to Surrounding Road Network, Associated with the Wind Farm

In 2012 remedial works were undertaken to Black Road consisting of the following at approximately 10 locations:

- Surface works comprising filling of pot holes.
- Edge repairs comprising replacement of tar strips at road edge.

Works were required due to road deterioration as a result of non-wind farm traffic. Works were undertaken in order to facilitate safe access to the site by cranes, in the event that this would be required.

These works did not result in significant effects.

Electrical Works

The operational phase routine inspection and maintenance along the OHL resulted in some cutting back of tree regrowth along the route of the OHL. Cut materials were left in-situ on the ground and not removed off-site. General maintenance activities were also intermittently undertaken at Agannygal Substation.

Impacts associated with the above were largely associated with movement of personnel / plant. Works were typically temporary in duration with no effects leading to significant effects.

Residual Impacts

Overall, during operation of the project, effects on the surrounding roads, traffic and transport network resulted in the following effects, both negative and positive:

- **Negative effects which occurred on the surrounding network resulted in short-term, negative, slight effects.**
- **Slight, long-term, positive effects were experienced by road users as a result of the infrastructure improvements made to roads and bridges during the construction phase.**

Significance of Effects

No significant effects are identified for the operational and maintenance phase of the Project.

14.1.4.3 Ceased Operation Phase Impacts (2022-Present)

This section identifies the effects which are likely to occur during the ceased operation period (2022 – present). The commercial electricity generation at the site was ceased by Gort Wind Farms Ltd in February 2022 and the turbines have been maintained by the turbine supplier to ensure the site remains safe for a prolonged non-operational state.

Potential effects on roads, traffic and transport during the ceased operational phase are likely to be not significant or negative.

Significance of Effects

No significant effects are identified for the ceased operational phase of the Project.

14.1.4.4 Impacts of Retained Development

This section identifies the effects which are likely to occur as a result of the Retained Development. The Retained Development strategy considered herein comprises proposed retention in situ (i.e access tracks, hard stands, concrete foundations, underground cables, barrages, peat repositories and borrow pits).

Potential effects on roads, traffic and transport as a result of Retained Development activities are likely to be not significant or negative.

Civil Works

The majority of civils works undertaken during the construction of the project (e.g. access tracks, turbine hardstands) are proposed to remain in-situ during Retained Development.

Residual Impacts

In summary, during Retained Development, effects on the surrounding roads, traffic and transport network are likely to result in the following effects:

- **Effects which are likely to occur on the local network in the immediate vicinity of the project are expected to be none as there will be no traffic movements due to Retained Development.**

- **Beyond the local network, effects which are likely to occur on the national network are expected to be temporary, imperceptible, and negative.**

However, the following positive effects are also likely to occur as a result of the improvements made to public infrastructure:

- **Slight, long-term, positive effects were experienced by road users as a result of the infrastructure improvements made to roads and bridges during the construction phase.**

14.1.5 Cumulative and In-Combination Effects

During all phases of the Project, cumulative effects may have occurred in association with other projects / works in the area, or projects with the same receiving environment as the Project.

In assessing these potential cumulative effects, and as described by Section 14.1.2.4, difficulties were encountered in sourcing historical information in relation to these other projects. The details provided below have been sourced primarily from planning files.

In addition to those detailed below there are a number of other projects / activities identified where no detail on cumulative effect is provided herein in the absence of any potential opportunity for cumulative effects, relating to roads, traffic and transport. This includes the Gort Regional Water Supply Scheme, the Flood Relief Schemes and the M18 Motorway Upgrade.

Effects associated with the Prospective Development works are typically expected to be temporary in duration with no effects leading to significant effects.

Projects / activities which are considered relevant to this chapter of the rEIAR are outlined in further detail below.

Sonnagh Old Wind Farm

Sonnagh Old Wind Farm ("Sonnagh Old"), including the associated 38kV OHL, is also located within the Slieve Aughty Mountains, to the north of the Derrybrien Wind Farm. Sonnagh Old was commissioned a year before Derrybrien Wind Farm in 2004. It is understood that construction of the two projects did overlap in the years 2003 and 2004.

In accordance with the Traffic Management Plan (TMP) for the Sonnagh Old project, all deliveries to the site would arrive from the Loughrea (north) direction. As such the haul routes for the project differed from those used for the Derrybrien Wind Farm project.

Given the absence of overlap in haul routes, and despite the overlap in construction periods, it is not considered that there were any cumulative effects on roads, traffic and transport as a result of the Sonnagh Old Wind Farm project.

Further, construction personnel travelling to both sites from either the Gort or Loughrea direction would only have experienced very short shared distances for travel, to both project locations, resulting in imperceptible cumulative effects.

Keeldeery Wind Farm (2000 & 2009 – 2010)

Keeldeery Wind Farm, located approximately 3 km to the west of Derrybrien Wind Farm, was granted planning permission in early 2000s. Circa. 2007 internal access roads were constructed on site. A later application for an extension to the planning permission was granted. In addition, a further application

and subsequent appeal (in 2009 and 2010) for the redesign of the Keeldeery Wind Farm was ultimately refused and the project was never fully constructed.

The activities which were undertaken at Keeldeery Wind Farm would have coincided with the operational phase of Derrybrien Wind Farm. Cumulative effects which may have occurred would relate to the undertaking of these civil works within the Keeldeery site (neutral impacts) and the movement of personnel, plant and equipment for the undertaking of these works. Those movements may have resulted in cumulative effects on the surrounding transport network.

The level of these effects is difficult to determine as no traffic effects are included in the original Environmental Impact Statement (EIS) for the wind farm. However, given the different access roads which were likely to have been used for Keeldeery Wind Farm and the relatively low volumes of traffic associated with the works undertaken at Keeldeery Wind Farm, the cumulative effect is not expected to have been significant and effects do not differ from those outlined by Section 14.1.3.10.

Tynagh Power Station (2003_2004)

Permission was granted in 2003 for the construction of the Tynagh Power Station, in a location at Tynagh Mines, east of Loughrea between Loughrea and Portumna in Co. Galway. In 2004 / 2005 construction of the power station took place, coinciding with the construction of the Derrybrien Wind Farm.

The Environmental Impact Statement (EIS) prepared for the power station stated a maximum effect as follows, which would result in a cumulative effect when considered in conjunction with the Derrybrien Wind Farm Development Project:

During construction:

- Peak workforce of 350 – 400 personnel arriving to / from the site in peak periods.
- 10 HGV arrivals and departures per hour during peak activities.

During operation:

- Permanent workforce of approximately 54 personnel in addition to temporary shift workers.
- Peak movements equate to 56 light vehicles in the evening peak.
- Direction of travel of light vehicles split with 78% of traffic travelling north towards the N65 and 22% travelling south towards the Lisheen junction.
- Direction of travel of HGV's split with 90% of traffic travelling north towards the N65 and 10% travelling south towards the Lisheen junction.
- The EIS does not identify any significant impacts in relation to roads and traffic as a result of either construction or operation stage.

Given the location of the project and the absence of any significant overlap in haulage routes it is not considered that there were any cumulative effects on roads, traffic and transport as a result of the Tynagh Power Station project.

Bridge Repair Works (2005 / 2006)

In approximately 2005 / 2006 (exact date unknown), works were undertaken at Beagh Bridge (547806.9145, 700644.977 ITM). Works comprised remediation efforts to this privately-owned bridge, on private lands.

Works were minor and temporary in nature and did not result in themselves in significant effects nor when considered cumulatively with the overall Derrybrien Wind Farm project.

Cloghvoley Sand Extraction (Approx. 2008 onwards)

Cloghvoley sand extraction activities relate to a GCC permission (refer 08/1664) for sand extraction at a site located at Cloghvoley, to the south-east of Derrybrien Wind Farm. Permission was granted in May 2008.

From an assessment of aerial photos, it is evident that the permitted activities have commenced; although the date of commencement was unknown at the time of writing this chapter.

In accordance with the planning files, traffic generated as a result of the project is in the order of 8-10 loads per day. This traffic would travel on the R353; although in which direction is unclear from the documents on file.

The operational activities at Cloghvoley Sand Extraction would have coincided with the operational phase of Derrybrien Wind Farm. Cumulative effects which may have occurred would relate to cumulative traffic movements on the R353 as a result of both projects.

Given the low levels of traffic proposed as part of the Cloghvoley project and the low movements associated with the operation of Derrybrien Wind Farm the cumulative effect is not expected to have been significant and the impact assessment does not differ from that contained within Section 14.1.3.10.

Ballinakill Quarry Extension (2015)

In 2015 an extension was sought for the Ballinakill Quarry, located to the south east of the wind farm with access onto the R353. The EIS for the quarry extension stated a maximum impact as follows, which would result in a cumulative impact when considered in conjunction with the Derrybrien Wind Farm project:

- 40 HGV's generated by the quarry on the R353.
- EIS states that 50% of these HGV's would move in a westbound direction.
- Results in 40 daily movements in the peak quarry operational scenario, on the R353 to the west of the quarry.
- Light vehicle movements are extremely low.
- EIS notes that the above movements are not likely to impact on the carrying capacity of the R353.

During the operation of the Derrybrien Wind Farm Project (the Project) the above movements, combined with the movements as a result of the Project itself, would not alter the impact assessment carried out herein at Section 14.1.4.6 Neither the effects associated with the operation of Ballinakill Quarry or the Project are classified as significant, and therefore the cumulative effects are also not considered to result in significant effects.

Ballinakill Quarry Extension (2018)

In 2018, a further extension was sought for the Ballinakill Quarry. The EIAR for the 2018 quarry extension stated a maximum impact as follows, which would result in a cumulative effect when considered in conjunction with the Derrybrien Wind Farm project:

- 44 HGV's generated by the quarry on the R353.
- EIAR states that 50% of these HGV's would move in a westbound direction.

- Results in 44 daily movements in the peak quarry operational scenario, on the R353 to the west of the quarry.
- EIS notes that the above movements are not likely to impact on the carrying capacity of the R353.

During the operation of the Derrybrien Wind Farm Project (the Project) the above movements, combined with the movements as a result of the Project itself, would not alter the impact assessment carried out herein at Section 14.1.4.2 Neither the effects associated with the operation of Ballinakill Quarry or the Project are classified as significant, and therefore the cumulative effects are also not considered to result in significant effects.

Moneypoint – Oldstreet 400 kv OHL (circa. 2020 / 2021)

At the time of writing the Moneypoint – Oldstreet OHL refurbishment works had commenced, although they halted in Q1 2020 due to construction workplace restrictions.

Refurbishment works coincide with the operational phase of Derrybrien Wind Farm. Given the relatively low levels of activity on the OHL refurbishment project, which primarily comprises maintenance activities (painting etc.), minor parts replacement and access provisions for same, but ultimately no significant replacement of overall structures, no cumulative significant effects are anticipated as a result of the two projects.

Coillte Quarry

A Coillte owned quarry, located to the south-east of Derrybrien Wind Farm east of the junction of the R353 and Black Road, has been operating periodically for an unknown period.

Accepted as being post-1964 (introduction of the Planning Acts) documents in relation to quarry registration were submitted to GCC in April 2005 by Coillte – the site owners.

The overall extraction area of the quarry is relatively small (1.3 hectares) with activity described as 'periodic'. Operating hours are 7 am to 6 pm weekdays and 7 am to 1 pm on Saturdays.

Traffic movements are again described as 'periodic' and quantified as 15 to 20 loads for forest road repairs – although the frequency of those works is not specified.

The operational activities at the quarry may have coincided with the both the construction and operational phases of Derrybrien Wind Farm. Cumulative effects which may have occurred would relate to cumulative traffic movements on the R353 as a result of both projects.

Given the seemingly low levels of traffic described as part of the quarry project the cumulative effect is expected to have largely related to Derrybrien Wind Farm activities and the impact assessment does not differ from that contained within Section 14.1.3.10.

Turbary within and Immediately Adjacent to Wind Farm Site

An area of approximately 83 ha of land occupies the eastern part of the wind farm site. Of this approximately 15ha had been converted to forestry lands having been planted prior to the project development and subsequently felled by Coillte. The remaining circa 67ha are drained turbary lands. Turbary lands also extend immediately beyond the site to the east covering an area of approximately 15ha.

Extents of activities at these sites are relatively unknown during the construction period for the project aside from evidence that activities were not intense. Accordingly, during construction, it is not

anticipated that any significant effects arose relating to roads, traffic and transport as a result of the cumulative effects of turbary activities and wind farm activities.

Since 2012 mechanical cutting of the turf has been undertaken and there has been an increase in the number of plots where mechanical turf cutting has been carried out, in addition to continued traditional methods of turf cutting including the use of a sausage machine. However, despite this change in approach to harvesting, in relation to roads, traffic and transport, it is still considered unlikely that anything aside from minor cumulative effects, albeit non-significant, would have been experienced in the surrounding area.

Peat Extraction

Aside from activities associated with turbary rights (see Section 14.1.6) no other peat extraction activities subject to a development consent have been identified within the vicinity of the Project. Accordingly, no cumulative effects are identified in this regard.

Adjacent Coniferous Forestry Plantations

The extent of forestry in the area surrounding the Project has not changed appreciably since prior to Project construction. However, both ongoing felling and planting are features of the ongoing maintenance of the surrounding area, based on the age profile of much of the forestry estate may be subject to felling in the coming decade. These activities are not expected to coincide with the anticipated Project decommissioning (upon receipt of grant for this application) and therefore no significant cumulative effects are anticipated in that regard. Some minor cumulative effects may occur should minor felling and planting activities impact on the same receiving network as the ongoing operation of the Project. However, given the non-significant nature of the Project operation it is not anticipated that this would give rise to significant effects.

Planting in Lieu of Felling on Wind Farm Site

Planting, in compensation for felling undertaken on the wind farm site, was carried out at lands in County Tipperary and County Roscommon. The planting locations are over 50 km and 80 km respectively from the wind farm site and are not physically connected to the project site.

Planting occurred between 2003 and 2008. The distance between the wind farm site and the planting locations mean that there is no significant overlap in routes to either location and no cumulative effects were likely to have been experienced during activities.

14.1.5.2 Cumulative effects which are occurring

There are no known significant cumulative effects occurring.

14.1.5.3 Cumulative effects which are likely to occur

At the time of ultimate decommissioning a Traffic Management Plan will be prepared which will include proposals to manage any cumulative effects resulting from potential coinciding of decommissioning activities with any other activities proposed in the area at that time.

14.1.6 Conclusion

As outlined by Section 14.1.2.2 this chapter comprises a qualitative assessment of the impact of the Derrybrien Wind Farm project in relation to roads, traffic and transport.

The construction of the Derrybrien Wind Farm project and its operation to date have resulted in significant effects on the surrounding roads, traffic and transport network. However, those significant effects were typically temporary or short-term in nature.

There were no changes to roads or junction layouts, or implications on public transport networks as a result of the Project.

The impacts which were experienced to date were not dissimilar to those typical of a project of this scale in that they were primarily as a result of the movements of personal vehicles, abnormal loads and HGV's during the construction of the project. Some potential effects were avoided through the use of on-site borrow pits and resources (e.g. trees felled used for access track construction).

During the operational period effects were considered not-significant or positive; the same is likely for ongoing operation of the Project.

Effects associated with the ultimate decommissioning of the wind farm are similar in type, although to a lesser extent, than those experienced in construction. However, a number of mitigation measures are proposed in order to reduce the impact of decommissioning activities, reducing likely negative effects to temporary, moderate.

The only long-term effects associated with the Retained Development are **positive effects** associated with infrastructure upgrades.

14.2 Telecommunications, Aviation, and Other Material Assets

This section of the rEIAR assesses the likely significant effects of the Retained Development on telecommunications, aviation, and other material assets. Section 14.2.3 describes the receiving environment as it relates to material assets in the vicinity of the site and the potential for effects on those assets. Section 14.2.4 presents an assessment of the likely significant effects (and mitigation measures proposed). This section of the Material Assets chapter considers other utilities or built services in the area such as electricity supply and transmission, water, gas and underground telecommunications.

14.2.1 Introduction

14.2.1.1 Chapter Scope

The purpose of this section of the rEIAR is to determine the potential for impact on material assets such as electricity supply and transmission, water, gas and underground telecommunications by the Retained Development during the construction, operation and ceased operational phase and to determine the residual effects once mitigation, where required, has been implemented.

14.2.1.2 Statement of Authority

This section of the rEIAR has been prepared by Morgan Valvik and reviewed by Thomas Blackwell, both of MKO. Morgan is an Environmental Scientist at MKO. Morgan holds an MSc in Environmental Science from Trinity College Dublin. Thomas is a Senior Environmental Consultant with MKO with over 17 years' of progressive experience in environmental consulting and in the assessment of environmental documents for renewable energy developments, including the assessment of likely significant effects on material assets. Thomas holds a BA (Hons) in Geography from Trinity College Dublin and a M.Sc. in Environmental Resource Management from University College Dublin.

14.2.1.3 Relevant Guidance and Legislation

General Guidance used for the preparation of the rEIAR is available in Chapter 1 Introduction. The Material Assets section of this EIAR is carried out in accordance with the 'EIA Directive' Directive 2011/92/EU as amended by Directive 2014/52/EU) and having regard, where relevant, to guidance and policy documents referred to in Chapter 1 of this EIAR. Consideration has also been given to the guidance documents listed below:

- Draft Air Corps Wind Farm/Tall Structures Position Paper (August 2014).
- Irish Wind Energy Association (2012) Best Practice Guidelines for the Irish Wind Energy Industry.
- ESB Networks (2019) Code of Practice for Avoiding Danger from Overhead Electricity Lines.

14.2.2 Methodology

The assessment of likely significant effects on material assets telecommunications and aviation uses the standard methodology and classification of impacts as presented in Section 1.7.3 of Chapter 1 of this rEIAR. The project description is provided in Chapter 4.

A scoping and consultation exercise was conducted with telecommunications operators and aviation authorities, in line with EPA guidelines, and the 'Best Practice Guidelines for the Irish Wind Energy

Industry' (Irish Wind Energy Association, 2012), which provides a recommended list of telecommunications operators for consultation.

A full description of the scoping and consultation exercise is provided in Chapter 2 of this rEIAR.

14.2.2.1 Site Walkover

A site visit was undertaken on 6th July 2022. The visit included Derrybrien Wind Farm site, Agannygal Substation and various locations along the Project overhead line (OHL).

14.2.2.2 Scoping and Consultation

Chapter 2 Section 2.2.1 of this rEIAR describes the scoping and consultation exercise undertaken for the Retained Development. Scoping responses pertinent to this chapter are discussed below. Relevant copies of scoping responses are provided in **Appendix 2-1**.

Uisce Éireann

Uisce Éireann provided a response to a data request which was received on the 21st of October 2024, specifically seeking information on water distribution and sewer networks at the Project site. The result of this response indicates that there are no underground water or sewerage networks within the footprint of the site.

Irish Aviation Authority

The Irish Aviation Authority provided a response to a Scoping request which was received on the 4th of October 2024 which stated that the Authority has no specific requirements for incorporation into the scoping. The response further outlined that:

- 'When the formal planning application is submitted to An Bord Pleanála, the Authority will provide the general observations in relation to notification with at least 30 days of any proposed cranes for the decommissioning of the wind farm.
- When the process of decommissioning is complete, Irish Aviation Authority would request that the developer advise the Authority which will allow for the steps to be taken to remove the decommissioned wind farm from the aeronautical datasets and charts in due course.'

14.2.2.3 Impact Assessment Methodology

The assessment of likely significant effects on material assets telecommunications and aviation uses the standard methodology and classification of impacts as presented in Section 1.7.3 of Chapter 1 of this rEIAR.

14.2.2.4 Limitations/Difficulties Encountered

In assessing effects which have occurred, by its nature, this rEIAR is assessing those effects many years after the project construction. As a result, there may be both undocumented instances of minor effects which are not captured by this rEIAR in addition to gaps in the historical data available.

However, despite the above, no significant difficulties were encountered in relation to material assets when undertaking this assessing.

14.2.3 Receiving Environment

The baseline for assessment of environmental effects that have occurred to date represents the position prior to the commencement of development. The baseline for assessment of environmental effects that are likely to occur as a result of the retention of the Retained Development represents current conditions at the time of writing of this rEIAR.

The following sections identify the key features of the receiving environment in its baseline condition.

14.2.3.1 Aviation

The Retained Development is not within any of the zones for which guidelines are laid down by the Irish Aviation Authority (IAA). The airports in closest proximity to the Retained Development are Galway, approximately 31 km away, and Shannon, approximately 45 km away.

The Retained Development location is outside both the aviation exclusion zone for Galway Airport and other airfields in the County. Therefore, no existing aviation services in the vicinity of the Retained Development were affected as a result of the Retained Development.

14.2.3.2 Telecommunications

There are 2 meteorological masts (anemometer) belonging to Gort Wind Farms LtdESB in the western part of the site. Vodafone placed a cell at the central mast to assist with improved phone signal at the site. The mast was installed in 2005 with the cell added at a later date to boost signal.

There is also an existing telecoms mast in the east of the site which has been *in-situ* since the 1980's. This mast is in the ownership of Line Partnership (formerly Cellcom) and includes equipment for broadband, fire service, gardai and ambulance as well as radio transmitter. This mast is unrelated to the Retained Development and pre-dates the presence of the wind farm by a significant period. No alterations to this mast took place as a result of the Retained Development.

The Maghera transmission site is located approximately 14.1 km southwest of the Derrybrien site in County Clare at a site elevation of approximately 400 m high. It is one of Raidió Teilifís Éireann (RTE) Transmission Networks Ltd (2RN) network of radio and television transmitters. The Maghera television transmitter was one of the five original Telefís Éireann main transmitters and started operation in 1963. The service area for the Maghera site is the West of Ireland, covering counties Clare and Galway, as well as parts of counties Limerick, Kerry, Cork, Tipperary and Mayo.

There are also existing telecommunications services in the surrounding area, primarily serving residential properties. No existing telecommunications services in the vicinity of the Retained Development had to be altered, reinforced or relocated as a result of the Retained Development.

14.2.3.3 Water Supply

There were no known water supplies within the Retained Development site and no existing water services in the vicinity of the Retained Development had to be altered, reinforced or relocated as a result of the Retained Development.

Derrybrien village is identified as requiring water supply. A number of private dwellings are part of groups schemes, while others are identified as having private well / rainwater harvesting systems. There are a number of schemes in the wider area which include the Gort Water Supply Scheme.

14.2.3.3.1 Sewerage Schemes and Wastewater Infrastructure

There were no known main drainage or sewerage schemes within the Retained Development site. No existing schemes in the vicinity of the Retained Development had to be altered, reinforced or relocated as a result of the Retained Development.

14.2.3.3.2 Energy Infrastructure

The following electricity distribution/ transmission lines were within the Retained Development area prior to construction:

- The existing 110kV Ennis – Shannonbridge OHL which runs in an east-west direction, located to the south of the wind farm in line with the now operational Agannygal Substation. As described by Chapter 4, some modifications were made to this OHL in support of the Derrybrien Windfarm Project.
- The existing 400kV Moneypoint – Woodlands OHL which is located to the south of the Retained Development. The Derrybrien Wind Farm grid connection crosses beneath this OHL.

In addition to the above, there are existing Low Voltage (LV) power supplies in the surrounding area, primarily serving residential properties. No existing LV power supply connections in the vicinity of the Retained Development had to be altered, reinforced or relocated as a result of the Retained Development.

In its baseline condition, the Retained Development area did not encompass any other significant energy infrastructure. The closest gas pipeline to the project is approximately 5.9 km north-east of the site at Loughrea.

14.2.3.3.3 Tourism & Recreational Infrastructure

The Retained Development is located in a remote area and not in an area of significant tourism importance, near any of the region's major tourism attractions or in an area with existing recreational infrastructure in its own right. There are no designated walking routes within or in the immediate vicinity of the Retained Development.

Additional information is provided in Chapter 5 Population and Human Health, in relation to potential effects of the Retained Development as they relate to the tourism and socioeconomic aspects on population and trends in tourism numbers/employment in the region.

14.2.3.3.4 Land Use

Prior to the construction of Derrybrien Wind Farm, the site had been historically used for commercial conifer forestry over the central and western parts of the site and turf cutting in turbary plots on the eastern side. Land use along the grid connection route and at Agannygal substation was also dominated by commercial forestry.

Prior to the peat slide and response works the upper slopes of Cashlaundrumlahan Mountain, where the slide originated, were used for forestry which extended downslope to above the Black Road Bridge where some agricultural grass land is present. Below the Black Road Bridge there is a mix of forestry and agricultural land. The mix of forestry and agricultural land is typically classed as transitional woodland (scrub) by the Environmental Protection Agency (EPA) Corine mapping dataset.

14.2.4 Likely, Significant Effects and Mitigation Measures Implemented

14.2.4.1 Construction Phase Impacts (2003-2006)

This section identifies the effects on material assets which occurred during the construction of the project between circa June 2003 and March 2006.

14.2.4.1.1 Water *Supply*

Pre-Mitigation Impact

During construction, potable water was supplied by a proprietary bottled water supplier.

Non-potable water was supplied via wells established on-site. During early mobilisation to site, non-potable water was temporarily provided through the use of a bowser with water imported to site. However, this was only for a short duration in the context of the overall construction period.

During the construction phase, the peat slide generated a very large volume of peat solids and debris which entered the Owendalulleegh River during a period of heavy rains.

In the period after the peat slide the colour of the treated water in the Gort Water Supply increased, although the supply periodically registered very high colour levels at that time of year in any case. Galway County Council also reported an increase in the frequency of the back-wash cycle for the rapid sand filters in the treatment plant which was probably due to an increase in suspended solids in the surface water source caused by the peat slide. This persisted at the time for several weeks. However, at no time was the supply interrupted. The raw water sources currently supplying the town remain essentially the same as in 2003. The effect on the water supply treatment process was a slight negative of temporary duration. Furthermore, it should be noted that no effects were reported on the Group water supply scheme in Derrybrien.

Mitigation Measures

The offsite measures to minimise the impact of the peat slide included the installation of a 10 no. barrages, two within the wind farm boundary with the remaining eight, (of which four remain in place) along the route of the slide on Coillte land between the wind farm and Flaggy Bridge on the R353.

Following the initial peat slide mitigation measures, the contractor was instructed to carry out further precautionary drainage measures as follows:

- Improvement of drainage in the slide area of the wind farm, clearance of obstructions and release of any visibly trapped water and construction of silt traps.
- Cleaning out of 3 no. gorges (pre-existing narrow steep-sided streams adjacent to offsite repositories) including construction of areas locally from available materials (trees, brash, boulder clay, etc.) to store removed peat, removal of sidecasting of the removed peat, provision of silt traps as necessary and possible reduction of rock barrage.

Residual Impact

Effects on the ground water resource as a result of the extraction of water from wells during construction are considered to have been short-term, negative, and not significant.

The effect on the water supply throughout the peat slide period would have been slight, negative and temporary. The remedial works (including the construction of barrages along the peat slide course) significantly reduced the potential for longer term effects.

Significance of Effects

The effect of the water supply, as a material asset, throughout the construction phase would have been not significant.

14.2.4.1.2 *Sewerage Schemes and Wastewater Infrastructure*

During construction, temporary toilet facilities were provided at the construction compound in the form of a self-contained toilet block with a temporary holding tank for managing sewage and wastewater discharges. In addition, various temporary portaloo facilities were distributed around the site. These toilet facilities were removed upon completion of the works.

There was no connection to public sewer network during construction and accordingly no effect on public sewer network as a result of the construction of the project.

14.2.4.1.3 *Energy Infrastructure*

Pre-Mitigation Impact

During construction, diesel powered electrical power generator(s) were utilised onsite to facilitate construction.

There was no connection to the electricity network during construction and accordingly no effect on the network as a result of the construction of the Retained Development. Additionally, no known significant effects occurred in relation to energy infrastructure, including gas pipelines, as a result of the Retained Development.

The use of natural non-renewable fuel in diesel fuelled generators is considered to have been a short-term, not significant, negative effect.

Mitigation Measures

Oils were stored in enclosed containers within the wind farm construction site compound. The diesel supply tank to the temporary electrical generator supplying the site compound was double skinned.

Spill kits were available and used to deal with minor oil/fuel spills on site. Drip trays were used during refuelling of machinery.

Residual Impact

The use of natural non-renewable fuel in diesel fuelled generators is considered to have been a short-term, not significant, negative effect.

Significance of Effects

There were no significant effects on energy infrastructure as a result of the Retained Development.

14.2.4.1.4 *Telecommunications*

Pre-Mitigation Impact

Communications during construction was primarily by way of mobile phones and two way radios. There was no fixed connection to private telecommunications services during construction and accordingly no effect on public telecommunications services as a result of the construction of the Retained Development.

Effects associated with the minor increase in telecommunications demand as a result of mobile use during Retained Development construction are considered to be short-term, imperceptible, neutral effects.

Mitigation Measures

None required.

Residual Impact

Effects associated with the minor increase in telecommunications demand as a result of mobile use during Retained Development construction are considered to be short-term, imperceptible, neutral..

Significance of Effects

There were no significant effects on telecommunications as a result of the Retained Development.

14.2.4.2 Operation Phase Impacts (2006 – 2022)

14.2.4.2.1 *Water Supply*

Pre-Mitigation Impact

2 no. non-potable water supplies were sourced from wells at two locations for the project operational phase, one at Derrybrien Substation and the other at Agannygal Substation.

There is no operational requirement for water associated with the Retained Development aside from that related to site staff use. Personnel attendance at the wind farm site during the operational phase was low Approximately 4-6 people were present on site on a given day, in addition to occasional requirements for personnel at Agannygal Substation and Gort Windfarms Ltd management staff or their representatives. Therefore, water demand was accordingly low.

At the Retained Development site, potable water is provided by a commercial supplier in the form of 10 litre drums. At Agannygal Substation potable water is brought by staff attending site at any given time. There was no connection to public services during operation.

The extraction of ground water on ground water resource as a result of the operation of the Retained Development was minimal and effects are considered to be long-term, imperceptible, negative.

Mitigation Measures

None required. The extraction of ground water on ground water resource as a result of the operation of the Retained Development was minimal.

Residual Impact

The extraction of ground water on ground water resource as a result of the operation of the Retained Development was minimal and effects are considered to be long-term, imperceptible, negative.

Significance of Effects

There was an Imperceptible effect on water supply from the Retained Development during the operational phase.

14.2.4.2.2 *Sewerage Schemes and Wastewater Infrastructure*

The welfare facilities in the control building of Derrybrien Substation consist of one toilet and two sinks. An Envirocare P6 sewage treatment plant unit caters for the wastewater generated in these facilities. Similar facilities are provided at Agannygal Substation.

There was no connection to public sewer services during operation and accordingly no impact or effect on public sewerage and wastewater infrastructure arose.

14.2.4.2.3 *Telecommunication Services*

Communications during operation were primarily by way of mobile phones. However, in addition Agannygal Substation is fitted with an Eir phone line. At Derrybrien Substation services are by way of wireless broad band connection. Effects associated with the minor increase in telecommunications demand at both substations as a result of Retained Development operation are considered to be long-term, imperceptible, neutral in this regard.

14.2.4.2.4 *Energy Infrastructure*

During operation electrical power on the wind farm site was provided by way of a house load connection from Derrybrien Substation. A backup supply is provided to both Derrybrien Substation and Agannygal Substation by way of a diesel generator.

There was no connection to electricity network during operation and accordingly no impact on electricity network as a result of project site operations. Effects related to on-site electricity use are considered neutral.

During operation of the wind farm, significant effects did occur in relation to energy infrastructure, as a result of the Project. These effects were associated with the increased level of renewable generation (circa 121,800 MWh of electricity annually) as a direct consequence of the operation of the wind farm and resulted in long-term, significant, positive effects.

14.2.4.3 Ceased Operation Phase Impacts (2022-Present)

14.2.4.3.1 *Water Supply*

Personnel attendance at the Retained Development site during the ceased-operational phase is low. Therefore, water demand is accordingly low.

At the Retained Development site, potable water is provided by a commercial supplier in the form of 10 litre drums. At Agannygal Substation potable water is brought by staff attending site at any given time. There is no connection to public services.

As there is no connection to public services and staff presence on the site during the ceased-operational phase is minimal, there is no significant effect on water supply.

14.2.4.3.2 *Sewage Schemes and Wastewater Infrastructure*

The welfare facilities in the control building of Derrybrien Substation consist of one toilet and two sinks. An Envirocare P6 sewage treatment plant unit caters for the wastewater generated in these facilities. Similar facilities are provided at Agannygal Substation.

There is no connection to public sewer services during the ceased-operational phase and accordingly no effects on public sewerage and wastewater infrastructure.

14.2.4.4 Impacts of Retained Development

There will be no impacts or effects on material assets as a result of the retention in perpetuity of the Retained Development.

14.2.4.5 Cumulative and In-Combination Effects

Chapter 2 of this rEIAR describes the methodology used in compiling the list of projects considered in the assessment of cumulative effects, and provides a description of each project, including its current status. There will be no cumulative effects relating to the Retained Development and surrounding projects in relation to Material Assets. This is because the Retained Development will have no significant effects on Material Assets once mitigation measures are implemented. During the development of any large project that holds the potential to effect telecoms or energy infrastructure the Developer is responsible for engaging with all relevant Telecoms Operators to ensure that the proposal will not interfere with television or radio signals, or other infrastructure. In the event of any potential impact, the Developer for each individual project is responsible for ensuring that the necessary mitigatory measures are in place. Therefore, as each project is designed and built to avoid negative effects arising, a cumulative effect cannot arise.

14.2.5 Conclusion

The Retained Development had no significant effects on aviation, telecommunications, utilities, or other built infrastructure in the construction, operational, or non-operational phase. In addition, the Retained Development will have no effects on aviation, telecommunications, utilities, or other built infrastructure during and after the decommissioning of the Derrybrien Wind Farm Development.

14.3 Resource and Waste Management

14.3.1 Introduction

This section of the rEIAR identifies, describes, and assesses the likely significant effects of the Retained Development- (as described in Chapter 4) on Resource and Waste Management.

14.3.1.1 Relevant Legislation

Resource and waste management takes place in a policy and legislative framework. A review of relevant legislation, policy and best practice guidance was undertaken to inform the impact assessment and recommended mitigation.

The primary legislative instruments that govern waste management in Ireland and applicable to the Retained Development are:

- Waste Management Act 1996 as amended.
- Environmental Protection Agency Act 1992 as amended.
- Litter Pollution Act 1997 as amended.
- Planning and Development Act 2000 (as amended)

One of the guiding principles of European waste legislation, which has in turn been incorporated into the Waste Management Act 1996 as amended and subsequent Irish legislation, is the principle of "Duty of Care". This implies that the waste producer is responsible for waste from the time it is generated through until its legal recycling, recovery or disposal (including its method of disposal). As it is not practical in most cases for the waste producer to physically transfer all waste from where it is produced to the final destination, appropriately licenced waste contractors will be employed to physically transport waste to the final destination. Following on from this is the concept of "Polluter Pays" whereby the waste producer is liable to be prosecuted for pollution incidents, which may arise from the incorrect management of waste produced, including the actions of any contractors engaged (e.g. for transportation and disposal/recovery/recycling of waste).

It is therefore imperative that the Developer ensures that the waste contractors engaged by demolition and construction contractors are legally compliant with respect to waste transportation, recycling, recovery and disposal. This includes the requirement that a contractor handle, transport and recycle/recover/dispose of waste in a manner that ensures that no adverse environmental impacts occur as a result of any of these activities.

A collection permit to transport waste must be held by each waste contractor which is issued by the National Waste Collection Permit Office (NWCPO). Waste receiving facilities must also be appropriately permitted or licensed. Operators of such facilities cannot receive any waste, unless in possession of a Certificate of Registration (COR) or waste permit granted by the relevant Local Authority under the Waste Management (Facility Permit & Registration) Regulations 2007 and Amendments or a Waste or Industrial Emissions Licence granted by the EPA. The COR / permit / licence held will specify the type and quantity of waste able to be received, stored, sorted, recycled, recovered and/or disposed of at the specified site.

14.3.1.2 Waste Management Policy Context

14.3.1.2.1 *National Level*

'Changing Our Ways', Policy Statement 1998

The Irish Government issued a policy statement in September 1998, '*Changing Our Ways'*, which identified objectives for the prevention, minimisation, reuse, recycling, recovery and disposal of waste in Ireland. The target for construction and demolition (C&D) waste in this report was to recycle at least 50% of C&D waste within a five-year period (by 2003), with a progressive increase to at least 85% over fifteen years (i.e. 2013).

In response to the Changing Our Ways report, a task force (Task Force B4) representing the waste sector of the already established Forum for the Construction Industry, released a report entitled *'Recycling of Construction and Demolition Waste*' concerning the development and implementation of a voluntary construction industry programme to meet the Government's objectives for the recovery of C&D waste.

A Waste Action Plan for a Circular Economy, 2020

In September 2020, the Irish Government published a policy document outlining a new action plan for Ireland to cover the period of 2020-2025. This plan, '*A Waste Action Plan for a Circular Economy*' (WAPCE), replaces the previous national waste management plan, '*A Resource Opportunity*' (2012), and was prepared in response to the 'European Green Deal' which sets a roadmap for a transition to an altered economical model, where climate and environmental challenges are turned into opportunities.

The WAPCE sets the direction for waste planning and management in Ireland up to 2025. This reorientates policy from a focus on managing waste to a much greater focus on creating circular patterns of production and consumption. Other policy statements of a number of public bodies already acknowledge the circular economy as a national policy priority.

The policy document contains over 200 measures across various waste areas including circular economy, municipal waste, consumer protection and citizen engagement, plastics and packaging, construction and demolition, textiles, green public procurement and waste enforcement.

One of the first actions to be taken was the development of the Whole of Government Circular Economy Strategy 2022-2023 '*Living More, Using Less'* (2021) to set a course for Ireland to transition across all sectors and at all levels of Government toward circularity and was issued in December 2021. It is anticipated that the Strategy will be updated in full every 18 months to 2 years.

Circular Economy and Miscellaneous Provisions Act 2022

The Circular Economy and Miscellaneous Provisions Act 2022 was signed into law in July 2022. The Act underpins Ireland's shift from a "take-make-waste" linear model to a more sustainable pattern of production and consumption, that retains the value of resources in our economy for as long as possible and that will to significantly reduce our greenhouse gas emissions. The Act defines Circular Economy for the first time in Irish law, incentivises the use of recycled and reusable alternatives to wasteful, single-use disposable packaging, introduces a mandatory segregation and incentivised charging regime for commercial waste, streamlines the national processes for End-of-Waste and By-Products decisions, tackling the delays which can be encountered by industry, and supporting the availability of recycled secondary raw materials in the Irish market, and tackles illegal fly-tipping and littering.

14.3.1.2.2 Regional Level - Connacht-Ulster Waste Management Plan 2015 – 2021

The Retained Development is located in the Local Authority area of Galway County Council (GCC). The Connacht-Ulster Waste Management Plan 2015 – 2021, published in May 2015, is the current regional waste management plan for the GCC area. This plan replaces the previous Connacht region plan due to changing National policy and changes being enacted by the Waste Framework Directive (2008/98/EC).

The Regional Plan sets out the strategic targets for waste management in the region and sets a specific target for C&D waste of "70% preparing for reuse, recycling and other recovery of construction and demolition waste" (excluding natural soils and stones and hazardous wastes) to be achieved by 2020.

The Galway County Development Plan 2022 – 2028 sets out a number of policies for Galway County in line with the objectives of the regional waste management plan. The plan identifies supporting the implementation of the regional waste management plan as one of the Council's policies. Other waste policy which is relevant to the Retained Development are included in Table 16-1, below.

Table 14-7 Waste Management Policy Objectives from Galway County Development Plan 2022 – 2028

Policy Objectives Waste Management	
WM 1	**Connacht and Ulster Waste Management Plan 2015-2021**
Support the implementation of the Connacht and Ulster Waste Management Plan 2015-2021 or any updated version of this document within the lifetime of the plan.	
WM 2	**Requirements for Waste Management**
Support and promote the circular economy principles, prioritising prevention, reuse, recycling and recovery, and to sustainably manage residual waste. New developments will be expected to take account of the provisions of the Waste Management Plan for the Region and observe those elements of it that relate to waste prevention and minimisation, waste recycling facilities, and the capacity for source segregation.	
WM 3	**Waste Recovery and Disposal Facilities**
Support and facilitate the provision of adequate waste recovery and disposal facilities for the county.	
WM 4	**Waste Legalisation**
To require that all waste disposal shall be undertaken in compliance with the requirements of the Environmental Protection Agency and relevant Waste Management Legislation.	
WM 5	**Construction and Environmental Management Plans**
Construction Environment Management Plans (CEMP) shall be prepared in advance of the construction of relevant projects and implemented throughout. Such plans shall incorporate relevant mitigation measures which have been integrated into the Plan and any lower tier Environmental Impact Statement or Appropriate Assessment. CEMPs typically provide details of intended construction practice for the proposed development, including: (a) location of the sites and materials compound(s) including area(s) identified for the storage of construction refuse; (b) location of areas for construction site offices and staff facilities; (c) details of site security fencing and hoardings;	

Policy Objectives Waste Management
(d) details of on-site car parking facilities for site workers during the course of construction; (e) details of the timing and routing of construction traffic to and from the construction site and associated directional signage; (f) measures to obviate queuing of construction traffic on the adjoining road network; (g) measures to prevent the spillage or deposit of clay, rubble or other debris; (h) alternative arrangements to be put in place for pedestrians and vehicles in the case of the closure of any public right of way during the course of site development works; (i) details of appropriate mitigation measures for noise, dust and vibration, and monitoring of such levels; (j) containment of all construction-related fuel and oil within specially constructed bunds to ensure that fuel spillages are fully contained (such bunds shall be roofed to exclude rainwater); (k) disposal of construction/demolition waste and details of how it is proposed to manage excavated soil, including compliance with 2006 Best Practice Guidelines on the Preparation of Waste Management Plans for Construction and Demolition Projects, Department of the Environment, Heritage and Local Government; (l) a water and sediment management plan, providing for means to ensure that surface water runoff is controlled such that no silt or other pollutants enter local water courses or drains;
WM 6 Waste Management
To continue to meet the duties under the Waste Management (certification of historic unlicensed waste disposal and recovery activity) Regulations 2008, including those in relation to the identification and registration of closed landfills.
WM7 Recycling Infrastructure
To provide for the provision of recycling infrastructure throughout the county where it is considered necessary and support the provision of additional recycling infrastructure throughout the county.
WM 8 Sustainable Waste Management Practices
Promote and facilitate communities to become involved in environmental awareness activities and community based recycling initiatives or environmental management initiatives that will lead to local sustainable waste management practices.
WM 9 Separate Collection of Waste
Encourage and support the provision of separate collection of waste in accordance with the requirements of the Waste Management (Food Waste) Regulations 2009, the Waste Framework Directive Regulations, 2011 and other relevant legislation.
WM10 Landfill Sites
a) Galway County Council will put in place a plan during the lifetime of the 2022- 2028 Galway County Development Plan for Poolboy Landfill in Ballinasloe to deal with remediation of the Poolboy Landfill site to a standard consistent with the end use of Poolboy Landfill and adjacent lands to open space/ park amenity area for community use including community sustainable energy/ climate action measures. b) Galway County Council will put in place a plan during the lifetime of 2022-2028 Galway County Development Plan for Kilconnell Landfill to deal with the remediation of the Kilconnell Landfill site to a

Policy Objectives Waste Management
standard consistent with the end use of Kilconnell Landfill to open space / park amenity area for community use including community sustainable energy/ climate action measures.

14.3.1.3 Relevant Guidance

The Environmental Protection Agency (EPA) of Ireland issued *'Best Practice Guidelines for the Preparation of Resource & Waste Management Plans for Construction & Demolition Projects*' (the guidelines) in November 2021. These guidelines replace the previous 2006 guidelines issued by The National Construction and Demolition Waste Council (NCDWC) and the Department of the Environment, Heritage and Local Government (DoEHLG) in 2006. The guidelines provide a practical approach which is informed by best practice in the prevention and management of C&D wastes and resources from design to construction of a project, including consideration of the decommissioning of a project.

Other guidelines followed in the of this Chapter of the rEIAR include *'Construction and Demolition Waste Management – a handbook for Contractors and Site Managers'*, published by FÁS and the Construction Industry Federation in 2002 and the previous guidelines, *'Best Practice Guidelines for the Preparation of Waste Management Plans for Construction and Demolition Projects'* (2021).

These guidance documents are considered to define best practice for C&D projects in Ireland and describe how C&D projects are to be undertaken such that environmental impacts and risks are minimised and maximum levels of waste recycling are achieved.

The Institute for Environmental Management and Assessment (IEMA) published *the "IEMA guide to: Materials and Waste in Environmental Impact Assessment"* in 2020. This document provides guidance on the assessment of the environmental impacts and effects of materials and waste as part of the EIA process. The principals and approaches outlined in the IEMA guide have been applied to the assessments contained in this chapter.

14.3.2 Methodology

The assessment of likely significant effects on waste and uses the standard methodology and classification of impacts as presented in Section 1.7.3 of Chapter 1 of this rEIAR.

14.3.2.1 Scoping and Consultation

The scope for this section of the rEIAR has also been informed by consultation with statutory consultees, bodies with environmental responsibility and other interested parties. This consultation process is outlined in Section 2.2 of this rEIAR. The following consultees made reference to waste matters in their responses:

Department of Transport

The Department of Transport responded to Scoping on the 24th of October 2024, in which it stated that they consider it important that the examination of the proposal should include consideration of Waste and Turbine Removal. The Department outlined that all abnormal loads associated with the project should be kept to minimal dimensions and weights to minimise the impact on the public road network.

14.3.2.2 Limitations/Difficulties Encountered

In assessing effects which have occurred, by its nature, this rEIAR is assessing those effects many years after the project construction. As a result, there may be both undocumented instances of minor effects which are not captured by this rEIAR in addition to gaps in the historical data available. These limitations have been taken into account during this assessment process.

14.3.3 Receiving Environment

The baseline for assessment of environmental effects that have occurred to date represents the position prior to the commencement of development. The baseline for assessment of environmental effects that are likely to occur as a result of the retention of the Retained Development represents current conditions at the time of writing of this rEIAR.

The following sections identify the key features of the receiving environment in its baseline condition.

14.3.3.1.1 *Waste Management Services*

There were no EPA-licensed or local authority-authorised waste facilities or activities located within the rEIAR Site Boundary at the time of the commencement of the Project and there are none located within the rEIAR Site Boundary at the time of writing. The closest, authorised municipal waste facility (City Bin Co.) is located approximately 28.6km to the northwest of the Retained Development.

14.3.4 Likely, Significant Impacts and Mitigation Measures Implemented

14.3.4.1 Construction Phase Impacts (2003-2006)

This section identifies the effects on resource and waste management which occurred during the construction of the project between circa June 2003 and March 2006.

14.3.4.1.1 *Waste Management Services*

Pre-Mitigation Impact

There are no EPA-licensed or local authority-authorised waste facilities or activities located within the Site boundary. Waste generated included general construction waste, packaging materials, and mixed municipal waste from site welfare facilities. Construction waste was placed in dedicated skips in the substation compounds and disposed of to a licensed /permitted Materials Recovery Facility (MRF) by a fully licensed waste contractor where the waste was sorted into individual waste streams for recycling, recovery or disposal.

The construction phase gave rise to very limited amounts of hazardous wastes such as oil, diesel fuel, chemicals, paints, preservatives etc, as well as mixed municipal waste. Packaging, cables, cardboard. This was a short-term negative imperceptible effect on waste management facilities.

Mitigation Measures

The waste volumes generated on-site from the Retained Development were deposited into a single waste skip. This waste material was transferred to a Materials Recovery Facility (MRF) by a fully licensed waste contractor where the waste was sorted into individual waste streams for recycling, recovery or disposal.

Residual Impact

The residual effect of the construction phase activities for the Retained Development had a Short-term Direct, Imperceptible Negative effect on waste management services.

Significance of Effects

There was no significant negative effect on resource and waste management from the Retained Development during the construction phase.

14.3.4.2 Operation Phase Impacts (2006 – 2022)

14.3.4.2.1 *Waste Management Services*

Pre-Mitigation Impact

The nature of the Retained Development is such that it did not have significant potential for generating large amounts of waste during the operational phase. Only small amounts of waste are generated on site. Waste was managed by the turbine contractor Vestas.

Table 14-8 Typical waste arisings-operational phase

Waste	Source	Typical Quantities
Commercial Waste	General waste	One to four 12 cubic yard (cy) collections /month
Dry Recyclables	Packaging	One to four 12 cubic yard (cy) collections /month
Oil contaminated material	Oil rags, filter materials, etc.	500 kg/year
Waste Oil	Gearboxes	2500 litres/year
Oil Filters	Replacement of oil filters	700 kg/year

Mitigation Measures

All wastes have been managed in accordance with applicable legislation. This waste material was transferred to a Materials Recovery Facility (MRF) by a fully licensed waste contractor where the waste was sorted into individual waste streams for recycling, recovery or disposal.

Residual Impact

As the volume of waste generated was relatively low and the management practices employed were consistent with relevant waste legislation and best practice standards at the time, the residual effect of the operational phase activities for the Retained Development was a Short-term Imperceptible Negative effect on waste management services.

Significance of Effects

There was no significant negative effect on waste management services from the Retained Development during the operational phase.

14.3.4.3 Ceased Operation Phase Impacts (2022-Present)

14.3.4.3.1 *Waste Management*

Pre-Mitigation Impact

Small amounts of waste are being produced during the ceased-operational phase as a result of maintenance works and the small presence of staff on site.

The effect of the ceased-operational phase for the Retained Development is Short-term Imperceptible Negative.

Mitigation Measures

All wastes are managed in accordance with applicable legislation. This waste material is transferred to a Materials Recovery Facility (MRF) by a fully licensed waste contractor where the waste is sorted into individual waste streams for recycling, recovery or disposal.

Residual Impact

As the volume of waste generated is relatively low and the management practices employed are consistent with relevant waste legislation and best practice standards, the residual effect of the ceased-operational phase for the Project is Short-term Imperceptible Negative on waste management services.

Significance of Effects

There is no significant effect on waste management services from the Project during the ceased-operational phase.

14.3.4.4 Impacts of Retained Development

The Retained Development will not involve any ongoing activity and will not give rise to waste generation or the use of materials. There will be no effects on waste and resource management as a result of the retention in perpetuity of the Retained Development.

14.3.4.5 Cumulative and In-Combination Effects

Chapter 2 of this rEIAR describes the methodology used in compiling the list of projects considered in the assessment of cumulative effects, and provides a description of each project, including its current status. There will be no cumulative effects relating to the Retained Development and surrounding projects in relation to Resource and Waste Management. This is because the Retained Development will have no effects on Resource and Waste Management.

14.3.5 Conclusion

The Retained Development had no significant effects on resource and waste management, in the construction, operational, or non-operational phase. In addition, the Retained Development will have no effects on waste and resource management.

15. VULNERABILITY OF THE PROJECT TO MAJOR ACCIDENTS AND/OR NATURAL DISASTERS

15.1 Introduction

15.1.1 Scope of Chapter

This section of the remedial Environmental Impact Assessment Report (rEIAR) describes the potential and actual effects on the environment arising from the vulnerability of the Derrybrien Wind Farm Development Decommissioning Project – Retained Development (as detailed in Chapter 4) to risks of major accidents and/or natural disasters, as well as the potential of the Project (or Retained Development) itself to cause potential major accidents and/or natural disasters. It has been completed in accordance with the guidance set out by the Environmental Protection Agency (EPA) in '*Guidelines on Information to be contained in Environmental Impact Statements'* (EPA, 2022) and the European Commission in relation to Environmental Impact Assessment of Projects (Directive 2011/92/EU, as amended by 2014/52/EU), namely '*Guidance on the preparation of the Environmental Impact Assessment Report'.*

The assessment of the vulnerability of the Project to major accidents and natural disasters is carried out in compliance with the EIA Directive as amended. Article 3(2) of the Directive states that the:

> *'effects referred to in paragraph 1 on the factors set out therein shall include the expected effects deriving from the vulnerability of the project to risks of major accidents and / or disasters that are relevant to the project concerned.'*

In addition, Annex IV of the EIA Directive states that the EIAR shall contain::

> *"A description of the expected significant adverse effects of the project on the environment deriving from the vulnerability of the project to risks of major accidents and/or natural disasters which are relevant to the project concerned."*

The objective of this assessment, as set out in Recital 15 of the EIAR Directive, is to ensure that appropriate precautionary actions are taken for those projects,

> *"...because of their vulnerability to major accidents and/or natural disasters, are likely to have significant adverse effects on the environment".*

Based on the requirements of the EIA Directive, this chapter seeks to determine:

- The relevant major accidents and/or natural disasters, if any, that the Project could be vulnerable to.
- The potential for these major accidents and/or natural disasters to result in likely significant adverse environmental effect(s).
- The measures that were put in place, that are in place, or need to be in place, to prevent or mitigate the likely significant adverse effects of such events on the environment.
- The measures that were put in place, that are in place, or need to be in place, to prevent or mitigate the likely significant adverse effects of such events on the environment.

15.1.2 Statement of Authority

This section of the EIAR has been prepared by Morgan Valvik, and reviewed by Thomas Blackwell, all of MKO. Morgan is a Environmental Scientist at MKO. Morgan holds an MSc in Environmental Science from Trinity College Dublin. This section of the EIAR has been reviewed by Thomas Blackwell, a Senior Environmental Consultant with MKO with over 17 years' of progressive experience in environmental consulting and in the assessment of environmental documents for renewable energy developments. Thomas holds a BA (Hons) in Geography from Trinity College Dublin and a M.Sc. in Environmental Resource Management from University College Dublin.

15.1.3 Relevant Legislation

The rEIAR is prepared in accordance with the requirements of European Union Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment (the 'EIA Directive') as amended by Directive 2014/52/EU. The requirements of the following legislation are complied with:

- European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2001 – 2018.
- Directives 2011/92/EU and 2014/52/EU on the assessment of the effects of certain public and private projects on the environment, including Circular Letter PL 1/2017: Implementation of Directive 2014/52/EU on the effects of certain public and private projects on the environment (EIA Directive).
- S.I. No. 349 of 1989: European Communities (Environmental Impact Assessment) regulations and subsequent amendments (S.I. No. 84 of 1995, S.I. No. 352 of 1998, S.I. No. 93 of 1999; S.I. No. 450 of 2000; S.I No. 538 of 2001); S.I. No. 30 of 2000 the Planning and Development Act, 2000; and S.I 600 of 2001 Planning and Development Regulations and subsequent amendments, on the assessment of the effects of certain public and private projects on the environment.
- Planning and Development Act, 2000, as amended.
- S.I. No 296 of 2018: S.I. No. 296 of 2018: European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018 which transposes the provisions of Directive 2014/52/EU into Irish law.
- The Heritage Act 1995, as amended.

An assessment of the following key elements was undertaken in accordance with the EIA Directive as amended:

- The vulnerability of the Retained Development to potential accidents and/or disasters.
- The Retained Development's potential to cause major accidents or disasters which pose a risk to the environment.

The information relevant to major accidents and/or disasters to be included in the EIAR is set out in paragraph 8 of Annex IV of the EIA Directive as follows:

> *"(8) A description of the expected significant adverse effects of the project on the environment deriving from the vulnerability of the project to risks of major accidents and/or disasters which are relevant to the project concerned. Relevant information available and obtained through risk assessments pursuant to Union legislation such as Directive 2012/18/EU of the European Parliament and of the Council or Council Directive 2009/71/Euratom or relevant assessments carried out pursuant to national legislation may be used for this purpose provided that the requirements of this Directive are met. Where appropriate, this description should include*

measures envisaged to prevent or mitigate the significant adverse effects of such events on the environment and details of the preparedness for and proposed response to such emergencies".

15.1.3.1 Relevant Guidance Documents

This chapter has been prepared in accordance with the following guidance:

- European Commission. (2017). *Environmental Impact Assessment of Projects – Guidance on the preparation of Environmental Impact Assessment Reports.*
- Environmental Protection Agency. (2022). *Guidelines on the Information to be Contained in Environmental Impact Assessment Reports.*
- Department of Environment, Heritage and Local Government (2010) *A Guide to Risk Assessment in Major Emergency Management.*
- Environmental Protect Agency (2014) *Guidance on Assessing and Costing Environmental Liabilities.*
- Department of Defence (2020) *A National Risk Assessment for Ireland.*
- HSE Emergency Management Area 2 Crisis Management Team Major Emergency Plan: Covering Geographical Areas of Counties Galway, Mayo and Roscommon May 2022).

15.2 Assessment Methodology

The following sources of information and literature pertinent to the area were used in the preparation of this section:

- Census of Ireland.
- *Regional Spatial and Economic Strategy*, published by the Northern and Western Regional Assembly on 23 January 2020.
- Galway County Development Plan (as varied).
- Galway County Council Website.

Major accidents and natural disasters are hazards which have the potential to affect the Project and consequently have potential impacts on the environment. These include accidents during construction, operation, or decommissioning caused by operational failure and/or natural hazards. The assessment of the risk of major accidents and/or disaster considers all factors defined in the EIA Directive that have been considered in this rEIAR, i.e., population and human health, biodiversity, land, soil (peat stability), water, air and climate and material assets, cultural heritage and the landscape.

15.2.1 Categorisation of the Baseline Environment

A desk-study has been completed to establish the baseline environment for which the proposed risk assessment is being carried out. This will influence both the likelihood and the impact of a major accident or natural disaster. Local and regional context has been established prior to undertaking the risk assessment to develop an understanding of the vulnerability and resilience of the area to emergency situations.

Further detail on the baseline environment is provided in Section 15.3.

15.2.2 Impact Assessment Methodology

15.2.2.1 Introduction

This assessment is focused on an understanding that the construction of the Derrybrien Windfarm Development has been completed. The Project will be decommissioned in line with the methodologies and measures prescribed in the EIAR that accompanies the planning application for the decommissioning of the wind farm (Prospective Development).

Current EIA practice already includes an assessment of some potential accidents and disaster scenarios such as pollution incidents to ground and watercourses as well as assessment of flooding events and peat instability. These are described in detail in the relevant rEIAR assessment chapters (Refer to Chapters 8 to 9 for further detail).

Sources of pollution with the potential to cause significant environmental pollution and associated negative effects such as bulk storage of hydrocarbons or chemicals, storage of waste, management of flammable material, etc. were avoided due to mitigation measures as set out in the Environmental Impact Statement prepared as part of the original application (Planning Ref. 97/3470). Therefore, there was an inherently low level of environmental risk associated with major accidents and/or natural disasters impacting the Project and causing environmental damage from environmental pollution due to hydrocarbons or other synthetic materials.

There is low potential for significant natural disasters to occur at the Project locations. Ireland is a geologically stable country with a mild temperate climate. The potential natural disasters that may occur are therefore limited to issues such as landslides, flooding, and fires. These are described in the sections below.

Major industrial accidents involving dangerous substances pose a significant threat to humans and the environment; such accidents can give rise to serious injury to people or serious damage to the environment, both on- and off-site of the accident. The Project site is not regulated or connected to or close to any site regulated under the Control of Major Accident Hazards Involving Dangerous Substances Regulations, i.e., SEVESO sites, and so there are no potential effects from this source.

In October 2003, during the construction of the wind farm, a large peat slide occurred. The slide originated within the wind farm site boundary to the south of the site. In the aftermath of the peat slide, engineering measures were implemented. These comprised containment and stabilisation works to minimise effects on lands, receiving watercourses and the local road network. During this period – October 2003 to June 2004, construction works on the wind farm itself were suspended. From June 2004 to March 2006, the construction of the wind farm and the grid connection (comprising both the overhead line and Agannygal substation) were completed. Derrybrien Wind Farm was commissioned between September 2005 and March 2006 and commenced commercial operations in March 2006. The wind farm was in operation until 2022 after An Bord Pleanála refused substitute consent for the Project.

It is necessary to highlight that the extent of the peat slide which occurred on the Derrybrien Wind Farm in 2003, which would be considered large (c. 25 Ha), was not a consequence of the activity alone that was being undertaken at the time; the combination of local site conditions where the peat was loaded and downslope of that location have been identified as contributory factors to the failure and extent.

No peat failures occurred during the operation and maintenance phase of the wind farm. The Retained Development has low potential to cause natural disasters or major accidents in the form of peat instability. The Site has been subject to several stability assessments. Ground investigations were carried out during the construction stage of the wind farm in 2004/2005, after the peat slide, to supplement the

original investigations for the wind farm prior to construction, which were completed in 2001. A summary of these assessment reports are included as in Chapter 8 of this rEIAR.

Current EIA practice already includes an assessment of some potential accidents and disaster scenarios, such as pollution incidents to ground and surface-watercourses, as well as assessment of flooding events. These are described in the relevant rEIAR assessment chapters (Refer to Chapters 5 to 13 for further details).

This assessment is focused on an understanding that the Retained Development will include structures to be retained in situ and in perpetuity of part of the existing development once the Prospective Development works have been completed. Therefore, the overall vulnerability of the Retained Development to risks of major accidents and natural disasters is considered low.

15.2.2.2 Site-Specific Risk Assessment Methodology

A site-specific risk assessment identifies and quantifies risks focusing on unplanned, but possible and plausible events occurring during the Derrybrien Wind Farm Development Decommissioning Project – Retained Development. The approach to identifying and quantifying risks associated with the Project by means of a site-specific risk assessment is derived from the EPA '*Guidance on Assessing and Costing Environmental Liabilities'* document[1]. The following steps were taken as part of the site-specific risk assessment:

- Risk identification.
- Risk classification, likelihood and consequence.
- Risk evaluation.

15.2.2.2.1 *Risk Identification*

Risks have been reviewed through the identification of reasonably foreseeable risks in consultation with relevant contributors to this rEIAR (refer to *Statements of Authority* in Chapters 5 to 14 of this rEIAR). The identification of risks has focused on non-standard but plausible incidents that have or could occur at or as a result of the Project during all phases of the Project.

In accordance with the European Commission EIAR Guidance (EC, 2017), risks are identified in respect of the projects:

1. *Potential to cause accidents and/or disasters.*
2. *Vulnerability to potential disaster/accident.*

15.2.2.2.2 *Risk Classification*

Classification of Likelihood

After identifying the potential risks, the likelihood of occurrence of each risk has been assessed. An analysis of safety procedures and proposed environmental controls was considered when estimating likelihood of identified potential risks occurring. Table 15-1 defines the likelihood ratings that have been applied.

The approach adopted has assumed a 'risk likelihood' where one or more aspects of the likelihood description are met.

[1] *EPA (2014) Guidance on assessing and costing environmental liabilities. Available at https://www.epa.ie/publications/compliance--enforcement/licensees/reporting/financial-provisions/EPA_OEE-Guidance-and-Assessing-WEB.pdf*

Table 15-1 Classification of Likelihood (Source: Department of Environment, Heritage and Local Government, 2010)

Ranking	Likelihood	Description
1	Extremely Unlikely	May occur only in exceptional circumstances; once every 500 or more years
2	Very Unlikely	Is not expected to occur; and/or no recorded incidents or anecdotal evidence; and/or very few incidents in associated organisations, facilities or communities; and / or little opportunity, reason or means to occur; may occur once every 100-500 years.
3	Unlikely	May occur at some time; and /or few, infrequent, random recorded incidents or little anecdotal evidence; some incidents in associated or comparable organisation's worldwide; some opportunity, reason or means to occur; may occur once per 10-100 years.
4	Likely	Likely to or may occur; regular recorded incidents and strong anecdotal evidence and will probably occur once per 1-10 years
5	Very Likely	Very likely to occur; high level of recorded incidents and/or strong anecdotal evidence. Will probably occur more than once a year.

Classification of Consequence

The consequence rating assigned to each risk has assumed that all proposed mitigation measures and/or safety procedures have failed to prevent the major accident and/or disaster. The consequence of the impact if the event occurs has been assigned as described in Table 15-2.

The consequence of a risk to/from the Prospective Development has been determined where one or more aspects of the consequence description are met, i.e., risks that have no consequence have been excluded from the assessment.

Table 15-2 Classification of Impact (Source: DoEHLG, 2010)

Ranking	Likelihood	Impact	Description
1	Minor	Life, Health, Welfare. Environment. Infrastructure. Social.	Small number of people affected; no fatalities and small number of minor injuries with first aid treatment. No contamination, localised effects. <€0.5M Minor localised disruption to community services or infrastructure (<6 hours).
2	Limited	Life, Health, Welfare. Environment. Infrastructure. Social.	Single fatality; limited number of people affected; a few serious injuries with hospitalisation and medical treatment required. Localised displacement of a small number of people for 6-24 hours. Personal support satisfied through local arrangements.

Ranking	Likelihood	Impact	Description
			Simple contamination, localised effects of short duration. €0.5-3M Normal community functioning with some inconvenience.
3	Serious	Life, Health, Welfare. Environment. Infrastructure. Social.	Significant number of people in affected area impacted with multiple fatalities (<5), multiple serious or extensive injuries (20), significant hospitalisation. Large number of people displaced for 6-24 hours or possibly beyond; up to 500 evacuated. External resources required for personal support. Simple contamination, widespread effects or extended duration. €3-10M Community only partially functioning, some services available.
4	Very Serious	Life, Health, Welfare. Environment. Infrastructure. Social.	5 to 50 fatalities, up to 100 serious injuries, up to 2000 evacuated. Heavy contamination, localised effects or extended duration. €10-25M Community functioning poorly, minimal services available.
5	Catastrophic	Life, Health, Welfare. Environment. Infrastructure. Social.	Large numbers of people impacted with significant numbers of fatalities (>50), injuries in the hundreds, more than 2000 evacuated. Very heavy contamination, widespread effects of extended duration. >€25M Serious damage to infrastructure causing significant disruption to, or loss of, key services for prolonged period. Community unable to function without significant support.

Risk Evaluation

Once classified, the likelihood and consequence ratings have been multiplied to establish a 'risk score' to support the evaluation of risks by means of a risk matrix.

The risk matrix sourced from the DoEHLG *Guide to Risk Assessment in Major Emergency Management (*and as outlined in Table 15-3) indicates the critical nature of each risk. This risk matrix has therefore been applied to evaluate each of the risks associated with the Project. The risk matrix is colour coded to provide a broad indication of the critical nature of each risk:

- The red zone represents 'high risk scenarios.'
- The amber zone represents 'medium risk scenarios.'
- The green zone represents 'low risk scenarios.'

Table 15-3 Classification of Impact (Source: DoEHLG, 2010)

		Consequence Rating				
		1. Minor	2. Limited	3. Serious	4. Very Serious	5. Catastrophic
Likelihood Rating	5. Very Likely					
	4. Likely					
	3. Unlikely					
	2. Very Unlikely					
	1. Extremely Unlikely					

15.3 Project Hazard Analysis

The HSE *Emergency Management Area 2 Crisis Management Team Major Emergency Plan May 2022* outlines several hazard categories which may have the potential to lead to a major emergency in Area 2- Galway, Roscommon and Mayo. The hazard categories include Natural, Transportation, Technological and Civil. The hazard categories, types and subtypes, and their relevance to the Project, are listed below in Table 15-4.

Table 15-4 HSE Emergency Plan hazard types (HSE Area 2 Crisis Management Team Major Emergency Plan May 2022)

Natural Hazards			
Category	**Type**	**Subtype**	**Relevance to the Project**
Meteorological	Storm / Gale Both coastal and inland areas can be affected by high winds	Both coastal and inland areas can be affected by high winds	Poor driving conditions Loss of infrastructure Flooding Falling Trees
	Heavy Snow	Blizzards- Poor visibility	Poor Driving conditions Loss of infrastructure
	Severe Cold / Frost extremes of Temperature	Icy Roads /Impassable Roads Hypothermia	Poor Driving Conditions Public Health Risk

		Freezing of Supply Network	
	Thunder & Lightening Dense/ Persistent Fog Heat Wave /Drought	Road Traffic collisions	Loss of Infrastructure Poor driving conditions Public Health Risk
Hydrological	Flooding	Coastal / Inland	Potential for flooding
	Heavy Rain		May lead to flooding in Low Lying areas or areas with poor drainage
Geological	Landslide		Peat Instability
	Forest / Wilderness fire - Air Pollution		Majority of Project Site and some of surrounding area is forested.
Transportation Hazards			
Category	**Type**	**Subtype**	**Project Hazard**
Aviation	Aircraft Collision /Loss	Mid Air and Land	Not Applicable
Road	Multiple Road Traffic Collision		Public Roads via which construction staff and materials access the site.
	Hazmat		Fuel Transport to/from site
	Bridge		Not Applicable
Water	Inland Water ways	Pleasure Craft/Cruises Pollution from above	Not Applicable
	Coastal	Car Ferry/ passenger Ferries	Not Applicable
Technological Hazards			
Category	**Type**	**Subtype**	**Project Hazard**
Industrial Accidents	Explosions		Damage to Infrastructure Personal Injuries/ fatalities
	Petrochemical Fires		Personal Injuries, severe burns/ fatalities Air Pollution
	Industrial Fires	LPG Tank Fire	Not Applicable

	Fluid/ Fuel Emission		Refuelling on site
Explosions	Domestic	Natural Gas explosion	Not Applicable
	Bomb		Not Applicable
	LPG		Not Applicable
Fires			Air Pollution
Building Collapse			Not Applicable
Hazardous substance		Accident at site	Not Applicable
		Transportation accident	Hazmat on roads
		Weapons	Not Applicable
	Biological	Leak/Weapons	Not Applicable
	Radiological	"Dirty Bomb"	Not Applicable
		Industrial Accident	Not Applicable
		Health facilities	Not Applicable
Pollution/Contamination	Air/Water Pollution		Fire Sediment-laden Water Run Off Fuel/hydrocarbon spill/leak
Civil Hazards			
Category	Type	Subtype	Project Hazard
Major Crowd Safety	(Movement, crushing etc.)	Pop Concerts Sports Events Fireworks displays Air shows	Not Applicable
Loss of Critical Infrastructure	Energy and Power Supply	Electricity	Disconnection from the national grid
		Fuel Oil	Not Applicable
		Communications	Telecom operators, mobile phone networks
Food Situation Crisis		Food Contamination Drought	Not Applicable

Water Supply		Shortage/ Contamination Freezing /Flooding	Not Applicable
Epidemics and pandemic		Communicable diseases	Not Applicable
Animal Disease		Foot & Mouth Avian Influenza	Not Applicable
Terrorism	Bombs	Car-bombs	Not Applicable
		Bombs in buildings	Not Applicable
		Fire-bombing	Not Applicable
	CBRNE		Not Applicable
	Disruption	Bomb scares	Not Applicable

The risks which are most relevant to this assessment are described in the sections that follow.

15.3.2 Meteorological

Ireland has a temperate, oceanic climate, resulting in mild winters and cool summers. The Project site in southeast Galway, approximately 20 km east of the Atlantic Coastline. The dominant influence on Ireland's climate is the Atlantic Ocean. As a consequence, Ireland does not suffer from the extremes of temperature experienced by many other countries at similar latitude. The hills and mountains, many of which are near the coasts, provide shelter from strong winds and from the direct oceanic influence.

The Met Éireann weather station at Shannon Airport, Co. Clare, is the nearest weather and climate monitoring station to the optimised development site that has meteorological data recorded for the 30-year period from 1981-2010. The monitoring station is located approximately 45 kilometres southwest of the site. The wettest months are October and December, and April is usually the driest. July is the warmest month with a mean daily temperature of 16.4° Celsius.

The windier part of the year lasts for 5.5 months, from 11 October to 27 March, with average wind speeds of more than 18 kilometres per hour. The windiest month of the year at Shannon Airport is January, with an average hourly wind speed of 19 kilometres per hour. The calmer time of year lasts for 6.5 months, from 27 March to 11 October. The calmest month of the year at Shannon Airport is August, with an average hourly wind speed of 15.2 kilometres per hour.

The following forecasting and weather warning systems are available and will be used on a daily basis at the site to direct proposed construction activities:

- General Forecasts: Available on a national, regional and county level from the Met Eireann website (www.met.ie/forecasts). These provide general information on weather patterns including rainfall, wind speed and direction but do not provide any quantitative rainfall estimates.
- Weather Warning or Advisories: Met Éireann's main suite of warnings are issued by the duty forecaster between 10am and midday and are updated as necessary as new information becomes available. In general, warnings will not be issued more than 60-

hours ahead of the expected adverse weather but advisories on potential hazards are issued up to a week in advance. The three warning categories are:
    - Yellow: Not unusual weather. Localised danger.
    - Orange: Infrequent. Dangerous/disruptive.
    - Red: Rare. Extremely dangerous/destructive.
- MeteoAlarm: Alerts to the possible occurrence of severe weather for the next 2 days. Less useful than general forecasts as only available on a provincial scale.
- 3-hour Rainfall Maps: Forecast quantitative rainfall amounts for the next 3 hours but does not account for possible heavy localised events.
- Rainfall Radar Images: Images covering the entire country are freely available from the Met Eireann website (www.met.ie/latest/rainfall_radar.asp). The images are a composite of radar data from Shannon and Dublin airports and give a picture of current rainfall extent and intensity. Images show a quantitative measure of recent rainfall. A 3-hour record is given and is updated every 15 minutes. Radar images are not predictive.
- Consultancy Service: Met Eireann provide a 24-hour telephone consultancy service. The forecaster will provide interpretation of weather data and give the best available forecast for the area of interest.

15.3.3 Hydrological

As discussed in Chapter 9 of the rEIAR, a Flood Risk Assessment (FRA) in line with The Planning System and Flood Risk Management - Guidelines for Planning Authorities (OPW, 2009) has been conducted for the Derrybrien Wind Farm Decommissioning Project areas. The FRA was carried out as part of the assessment of the overall Project to provide an overview of the potential flood risks to the Project areas and to assess the impact of the decommissioning project on flood risk downstream (see **Appendix 9-1**).

A desktop review of historic flooding was undertaken primarily using OPW website www.floodinfo.ie. The 'Past Flood Events' dataset forms a record of all available flood records held by the OPW, all local authorities and other relevant state organisations such as the EPA and the Department of Communications, Climate Action and Environment. There were no mapped reports of recurring flooding within the Project areas and there is no significant risk of flooding within the Project area due to the elevated nature of the majority of the Project area relative to the surrounding area. The nearest area downstream affected by flooding in the catchment which drains the north side of the wind farm site is 15 km downstream at Ballylee on the Streamstown River. The nearest area downstream affected by flooding in the catchment draining the south side of the wind farm is over 20 km downstream close to Gort.

The FRA concludes that most of the Project areas are not within floodplains and lie within Flood Zone C (Low risk of flooding) as defined by the guidance document to Planning Authorities in relation to Flood Risk Management. Furthermore, the existing flood risk in the downstream catchment has not been increased by the existing windfarm infrastructure and is not expected to be increased by the Retained Development.

15.3.4 Peat Stability

A comprehensive and robust Peat Stability Assessment was undertaken for the Retained Development and used to inform the Assessment of Alternative Decommissioning Options and subsequent design process for the Derrybrien Wind Farm Development Decommissioning Project. Peat stability risk assessments have been carried out for the following elements of the Project:

- Derrybrien Wind Farm and associated ancillary works.

- Grid connection comprising Derrybrien-Agannygal 110 kV Overhead Line and Agannygal Substation connecting into the Shannonbridge – Ennis 110 kV Overhead Line and associated ancillary works.
- Works undertaken in response to the peat slide and associated ancillary works.

The peat stability assessments have been carried out in accordance with the best practice guidelines given in "Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Projects, published by the Scottish Government Energy Consent Unit (2nd Edition, April 2017)". The best practice guidelines identify a number of techniques that can be used to assess peat stability, and a number of these techniques were used in assessing peat stability at the site.

The best practice guidelines give no preferred technique but note that whatever techniques are employed should be clearly explained and incorporate consideration of the likelihood of instability and the consequences should it occur. Details of the techniques employed are provided in Chapter 8 of this rEIAR and associated appendices.

The assessment of the conditions in 1998 forms the baseline condition for the Retained Development. It should also be recognised that the purpose of the Peat Stability Risk Assessment (PSRA) is to identify where there are compounding risk factors that lead to a higher risk of peat instability so that appropriate mitigation measures can be implemented to ensure that the risk of peat instability can be reduced to an acceptable level for each site activity.

For this assessment, the wind farm site has been split up into 71 No. representative zones corresponding to sections of the site around the turbines and access tracks on peat. The peat stability risk assessment identifies 38 No. zones across the site where the Likelihood of a peat slide, prior to mitigation measures, is characterised as **Very Possible (L=4) or Likely (L=5)**. These zones are located in areas across the site where there are compounding risk factors in relation to peat stability, including, for example:

- Deposits of deep (3-6 m) and relatively deep (2-3m) weak peat (cu ≈ 5 kPa) with low Factor of Safety (FoS) for infinite slope stability analyses.
- Areas of intermediate slope angles of 3-5° in close proximity to a convex break in slope to slope angles >5°.
- Zones that are in the broad valleys directly upslope from the rivers and streams downslope from the perimeter of the wind farm site.
- Zones of deep peat with poor drainage and ponded surface water at the head of a watercourse, or along the edges of the terraces on the north side of the site.
- Areas adjacent to the previous slide that have similar site characteristics.

In the remaining 33 No. zones across the site the Likelihood of a peat slide, prior to mitigation measures would be characterised as **Possible (L=3)** or **Low (L=2)**, which would require early or regular attention with appropriate mitigation measures to reduce the risk of peat instability or to manage the risk on site.

As set out in Chapter 8 of this rEIAR, the methodology that was used in this case for the baseline peat stability risk assessment was developed after the peat slide at the site of the Derrybrien Wind Farm, based on research and guidelines published as a result of the slide. The methodology has also been calibrated by the peat slide at the Derrybrien site, as well as by peat slides that occurred on the site of other wind farm projects on upland blanket bogs in Ireland since 2003. Therefore, while it is consistent with current best practice guidelines and is representative of the conditions on the Derrybrien wind farm site, it represents a level of assessment that far exceeds that which would have been carried out for the site in 1998 or at the time of construction in 2003 when the construction industry's general knowledge of failures on peat slopes was very limited.

Although the baseline PSRA identifies that there are areas of the Derrybrien wind farm site that had a high baseline risk of peat instability, this was prior to the implementation of appropriate mitigation

measures and, based on the conclusions in Chapter 8, it would not be considered an abnormal or exceptional risk for a wind farm project on an upland blanket bog in Ireland where the risk is appropriately managed.

The design and construction mitigation measures that were successfully implemented on the Derrybrien site after the 2003 peat slide enabled the project to be completed without any further incidents of peat instability. Furthermore, many of these mitigation measures are now standard measures that are commensurate with the geotechnical risk of a peat slide and are routinely implemented on similar sites across Ireland and the UK where there could be a high risk of peat instability on upland blanket bogs. However, they would not have been standard practice at the time of construction on the Derrybrien Wind Farm in 2003.

Please see Chapter 8 Geology and Soils for more details.

15.3.5 Traffic

According to Chapter 14, the construction of the Derrybrien Wind Farm Development project and its operation to date have resulted in significant impacts on the surrounding roads, traffic and transport network. However, those significant impacts were typically temporary or short-term in nature. Furthermore, there were no changes to roads or junction layouts, or implications on public transport networks as a result of the Project. The impacts which were experienced to date were not dissimilar to those typical of a project of this scale in that they were primarily as a result of the movements of personal vehicles, abnormal loads and heavy goods vehicles (HGV's) during the construction of the project. Some potential impacts were avoided through the use of on-site borrow pits and resources (e.g. trees felled used for access track construction). During the operational period impacts were considered not significant or positive; the same is likely for the ceased operation of the Project. There will be no impacts on material assets as a result of the retention in perpetuity of the Retained Development.

Please see Chapter 14 Material Assets for details.

15.3.6 Industrial Accident

The Project is not connected to or in close proximity of any site regulated under the Control of Major Accident Hazards Involving Dangerous Substances Regulations (SEVESO sites), therefore no significant effects associated with major industrial accidents involving dangerous substances are anticipated. Petrochemical fires and fires from fuel emissions, leakages and spillages could occur causing personal injury, structural damage and forest fires.

15.3.7 Critical Infrastructure

The following power generation facilities are located in the general area

- Sonnagh Old Wind Farm (constructed circa 2004) located approximately 2.5km north northwest of Derrybrien Wind Farm which comprises nine Vestas V 25 850 turbines. Sonnagh Old was granted planning permission in October 2000 (GCC Reg. Ref. 00/3234) and constructed in 2003-2005.
- Tynagh Generating Station, which is over 10km from the Derrybrien site, is a gas fired power station which was permitted after the Derrybrien Project. As noted in Chapter 1, Tynagh Generating Station was granted planning permission in 2003 and constructed in 2004-2005.

The electricity network in the vicinity of the site in 1998 includes the following transmission lines:

- Moneypoint - Oldstreet 400kV overhead line (OHL).

- Ennis - Shannonbridge 110kV OHL.

There are distribution and low voltage overhead line connections throughout the area.

15.3.8 Contamination

The Project had the potential to cause contamination and pollution of groundwater and surface water from potential release of hydrocarbons, earthworks and excavations on site. These impacts are addressed in detail in Chapter 9, Hydrology as they are not related to either the vulnerability of the project to natural disasters or major accidents nor the potential for the project to cause natural disasters or accidents. Indirect impacts associated with major accidents and / or natural disasters on contamination are considered in this chapter.

There is record of one spill taking place during Project construction when a concrete lorry overturned on the main turbary access track on the eastern side of the wind farm site. The contents of the lorry required washing out by Gort Fire Brigade before the lorry could righted onto the road using a Hyundai 360 tracked excavator. The contractor, after initially unsuccessfully attempting to flush out the concrete from the bottle of the lorry, excavated a hole in the bog into which the concrete was flushed and subsequently removed. The drains in the vicinity were blocked to prevent runoff from the immediate area.

There have been two known past incidents of oil-spills on the wind farm, in 2017 and 2019 respectively. In the first such incident, a spill kit was deployed around the base of turbine T56 before oil reached ground and the leak was subsequently stopped. In the second incident, a bleed screw was left not fully tightened after a service was carried out on T5. This caused 150 litres of oil to leak from the gearbox with some of it leaking down the side of the wind turbine tower and getting to the ground. Vestas technicians contained the spill using the contents of the spill kit.

Please see Chapter 9 Hydrology for details.

15.3.9 Health and Safety

Construction of the Project necessitated the presence of a construction site and travel on the local public road network to and from the Site. Construction sites and the machinery used on them pose a potential health and safety hazard to construction workers if site rules are not properly implemented. This could have had in a worst-case scenario, potential significant permanent negative effect on health and safety. A number of Contractor construction related incidents, which resulted in injury to workers on site or to incidents with potential to cause injury, occurred during the construction period. None of the incidents resulted in permanent health injuries to the various contractor(s) work force or to members of the public. To mitigate against serious accident and health impact the site operated under Health & Safety Plans.

A peat slide occurred in October 2003 which resulted in the damage to public roads, road bridges, and private access bridges. One private house, which was unoccupied at the time, was cut off by the peat slide. However, no injury or loss of life occurred. In the aftermath of the peat slide there was significant anxiety in the population in Derrybrien regarding their health, wellbeing and safety related to the slide which had occurred and the potential for additional peat slides to occur.

Machinery and vehicles, such as vehicles of contractors and employees who worked during the operational phase or during the non-operational phase (for monitoring or maintenance works) posed a potential health and safety risk to the employees of the Derrybrien Windfarm. Vehicles entering and exiting the subject site also posed a potential risk to members of the public. However, Derrybrien Wind Farm operated a Safety Management System (SMS) which met the requirements of OHSAS 18001. There were no significant effects to health and safety associated with the Project.

15.4 Risk Assessment

This section outlines the possible risks associated with the Derrybrien Wind Farm Development Decommissioning Project – Retained Development including the works undertaken during all phases of the Project.

These risks have been assessed in accordance with the relevant classification as outlined in Table 15-1 and Table 15-2.

As outlined in Section 15.2.3.2.2, the consequence rating assigned to each potential risk assumes that all proposed mitigation measures and safety procedures have failed to prevent the major accident and/or disaster.

15.4.1 Likely Significant Effects

15.4.1.1 Do-Nothing Scenario

Under the do-nothing scenario, the Derrybrien Wind Farm Development would remain in-situ in its current state i.e., as an unauthorised windfarm development the ceased commercial electricity generation in February 2022. No decommissioning works would be undertaken. The infrastructure would continue to degrade over time.

In the do-nothing scenario there is no potential for Major Accidents or Natural Disasters as the site is stable and no works are ongoing.

15.4.1.2 Assessment of Effects During Construction

A risk register has been developed which contains all potentially relevant risks identified during the construction works of the Project. Risks specific to the Prospective Development have been identified and are presented in Table 15-5. The construction phase of the Project has been completed. As such, no potential of future risks in this phase are identified and any risks that may have occurred are known.

Table 15-5 Risk Register – Construction Phase

Risk ID	Potential Risk	Possible Cause
Potential vulnerability to disaster risks		
A	**Severe Weather** Risk to construction activity on site.	Extreme weather- periods of heavy rainfall, taking into account climate change and strong winds.
B	**Flooding** High levels of surface water on site.	Extreme weather- periods of heavy rainfall, taking into account climate change and strong winds.

Risk ID	Potential Risk	Possible Cause
Potential to cause accidents and / or disasters.		
C	**Peat Stability** Movement of peat within the site during construction works.	Excessive loading of peat and/or poor drainage in an area of where the combination of the contributory factors results in a likely peat slide of scale.
D	**Traffic Incident** Collisions onsite and offsite with vehicles involved in construction of Project.	Driver negligence or failure of vehicular operations on site roads. Traffic Management Plan not implemented.
E	**Contamination** Discharge or spillage of fuel, chemical solvents into watercourse or percolated to groundwater.	Fuel spillage during delivery to site. Failure of fuel storage tank or tanks in plant and machinery and vehicles. Drainage and seepage water resulting from infrastructure works.

These risks have been assessed in accordance with the relevant classification (Refer to Table 15-1 and Table 15-2) and the resulting risk analysis is given in Table 15-6. The risk register is based upon risks associated the Project.

15.4.1.3 Assessment of Effects During Operation

Risks specific to the operation of the Project have been identified and presented in Table 15-6.

Table 15-6 Risk Register – Operational Phase

Risk ID	Potential Risk	Possible Cause
Potential vulnerability to disaster risks		
A	**Severe Weather** Risk to construction activity on site.	Extreme weather- periods of heavy rainfall, taking into account climate change and strong winds.
B	**Flooding** High levels of surface water on site.	Extreme weather- periods of heavy rainfall, taking into account climate change and strong winds.

Risk ID	Potential Risk	Possible Cause
C	**Fire** Forestry / Bog / Gorse Fire	Extreme weather- strong winds, prolonged dry weather; spread of fire from adjacent Coillte forests and access tracks, deliberate setting on fire of vehicles on Coillte access track to site.
Potential to cause accidents and / or disasters.		
D	**Traffic Incident** Collisions onsite and offsite with vehicles involved in construction of Project.	Driver negligence or failure of vehicular operations on site roads. Traffic Management Plan not implemented.
E	**Industrial Accident**- Fire, gas explosion	Equipment or infrastructure failure. Fuel leaks. Employee negligence.
F	**Peat Stability** Movement of peat within the site during construction works.	Excessive loading of peat and/or poor drainage in an area of where the combination of the contributory factors results in a likely peat slide of scale.
G	**Small aircraft hazard**	Derrybrien Wind Farm is located on the highest peak in the Slieve Aughty Mountains. Poor visibility due to poor weather and low cloud cover could result in aircraft collision with turbines.

15.4.1.4 Assessment of Effects During Ceased-Operation

Risks specific to the ceased-operation phase of the Project have been identified and presented in Table 15-7.

Table 15-7 Risk Register – Ceased-Operation Phase

Risk ID	Potential Risk	Possible Cause
Potential vulnerability to disaster risks		
A	**Severe Weather** Risk to construction activity on site.	Extreme weather- periods of heavy rainfall, taking into account climate change and strong winds.
B	**Flooding** High levels of surface water on site.	Extreme weather- periods of heavy rainfall, taking into account climate change and strong winds.
C	**Fire** Forestry / Bog / Gorse Fire	Extreme weather- strong winds, prolonged dry weather; spread of fire from adjacent Coillte forests and access tracks, deliberate setting on fire of vehicles on Coillte access track to site.
Potential to cause accidents and / or disasters.		
D	**Small aircraft hazard**	Derrybrien Wind Farm is located on the highest peak in the Slieve Aughty Mountains. Poor visibility due to poor weather and low cloud cover could result in aircraft collision with turbines.

15.4.1.5 Assessment of Effects from Retained Development

Once the decommissioning works are complete (i.e. the Prospective Development), the Retained Development will include the structures to be retained in situ and in perpetuity of part of the existing development – including at- and below-ground structures such as turbine and other foundations; and development associated with historic peat slide events that occurred during construction such as barrages, peat repositories, on-site borrow pits / quarries etc. There will be no risks of major accidents or natural disasters specific to the Retained Development.

15.4.1.6 Assessment of Effect – Summary

Table 15-8 Risk Assessment

Risk ID	Potential Risk	Environmental Effect	Likelihood Rating	Consequence Rating				Basis of Consequence	Did hazard arise? (Y/N)
				Human Welfare	Environment	Infrastructure	Social		
Construction Phase									
A	Severe Weather	Illness or loss of life. Sedimentation of nearby watercourse. Damage to, or depletion of aquatic habitats and species.	3	1	1	2	2	The risk of severe weather conditions during the construction works would have resulted in a minor consequence in that 'small number of people would be affected' should a severe weather occur, with 'no fatalities and a small number of minor injuries with first aid treatment'. No contamination, localised effects.	N
B	Flooding	Illness or loss of life. Sedimentation of nearby watercourse. Damage to, or depletion of	2	1	1	1	1	The risk of flooding during the construction works was a minor consequence in that 'small number of people would be affected' should a severe weather occur, with 'no fatalities and a small number of minor injuries with first aid treatment'	N

Risk ID	Potential Risk	Environmental Effect	Likelihood Rating	Consequence Rating				Basis of Consequence	Did hazard arise? (Y/N)
				Human Welfare	Environment	Infrastructure	Social		
		aquatic habitats and species.						No contamination of environment (e.g. watercourses), localised effects.	
C	Peat Stability	Movement of peat within the site. Damage to, or depletion of aquatic habitats and species.	4	1	4	3	2	A peat slide occurred during the construction phase of the Project. Having regard to the environment, the effect was 'heavy contamination, localised effects or extended duration.'	Y
D	Traffic Incident	Injury or loss of life.	3	1	1	1	1	Having regard to on-site speed limits and vehicular movements, a 'small number of people would have been affected' should a vehicular collision had occurred, with 'no fatalities and small number of minor injuries with first aid treatment.'	
E	Contamination	Damage to, or depletion of aquatic habitats and species.	2	1	1	1	1	The risk of a fuel spillage or impact on surround drainage during the construction would result in a limited consequence in that there would be 'a limited number of people affected' with	

Risk ID	Potential Risk	Environmental Effect	Likelihood Rating	Consequence Rating				Basis of Consequence	Did hazard arise? (Y/N)
				Human Welfare	Environment	Infrastructure	Social		
								'localised effects of short duration' through the use of bunded containment areas and proposed drainage mitigation measures during construction. Simple contamination of environment (e.g. watercourses), localised effects of short duration.	
Operational Phase									
A	Severe Weather	Illness or loss of life. Sedimentation of nearby watercourse. Damage to, or depletion of aquatic habitats and species.	3	1	1	2	2	The risk of severe weather conditions during the operation of the wind farm would have resulted in a minor consequence in that 'small number of people would be affected' should a severe weather occur, with 'no fatalities and a small number of minor injuries with first aid treatment'. No contamination, localised effects.	N
B	Flooding	Illness or loss of life.	2	1	1	1	1	The risk of flooding during the operational phase was a minor consequence in that 'small	N

Risk ID	Potential Risk	Environmental Effect	Likelihood Rating	Consequence Rating				Basis of Consequence	Did hazard arise? (Y/N)
				Human Welfare	Environment	Infrastructure	Social		
		Sedimentation of nearby watercourse. Damage to, or depletion of aquatic habitats and species.						number of people would be affected' should a severe weather occur, with 'no fatalities and a small number of minor injuries with first aid treatment' No contamination of environment (e.g. watercourses), localised effects.	
C	Forestry / Bog / Gorse Fire	Potential to impact on the environment (carbon cost, noise, water quality transport etc.).	4	3	3	2	2	Given the amount of vegetation (fuel) in the area surrounding the wind farm there is a risk of fire in the area. If a fire did encroach on the windfarm it could lead to significant economic costs, loss of renewable energy generation available to the State, loss of carbon displacement with potential to impact on the environment (carbon cost, noise, water quality transport etc.).	Y
D	Traffic Incident	Injury or loss of life.	3	1	1	1	1	Having regard to on-site speed limits and vehicular movements, a 'small number of people would have been affected' should a vehicular collision had occurred, with 'no fatalities and small	Y

Risk ID	Potential Risk	Environmental Effect	Likelihood Rating	Consequence Rating				Basis of Consequence	Did hazard arise? (Y/N)
				Human Welfare	Environment	Infrastructure	Social		
								number of minor injuries with first aid treatment.'	
E	Industrial Accident -Fire/Gas explosion.	Illness or loss of life. Damage to, or depletion of habitats and species. Impacts on ambient air quality.	3	1	2	2	2	Should a fire/explosion occur at the site, a limited consequence in that there would be 'a limited number of people affected' with 'localised effects of short duration' due to the nature of the Project and the limited fuel storage at the site that could result in any such incident. There will be 'normal community functioning' in the area with 'some inconvenience'. Simple contamination of environment (e.g. watercourses), localised effects of short duration.	N
F	Peat Stability	Movement of peat within the site. Damage to, or depletion of aquatic habitats and species.	3	1	4	3	2		N

Risk ID	Potential Risk	Environmental Effect	Likelihood Rating	Consequence Rating				Basis of Consequence	Did hazard arise? (Y/N)
				Human Welfare	Environment	Infrastructure	Social		
G	Small aircraft hazard	Localised impacts to terrestrial and aquatic habitats only of short duration.	2	3	2	2	2	A small aircraft collision with the turbines could lead to potential injuries and fatalities occurring. It would cause damage to infrastructure on the wind farm likely up to 3 Million euros. In terms of the environment, ' this would give rise to localised impacts to terrestrial and aquatic habitats only of short duration	N
Ceased Operational Phase									
A	Severe Weather	Illness or loss of life. Sedimentation of nearby watercourse. Damage to, or depletion of aquatic habitats and species.	3	1	1	2	2	The risk of severe weather conditions during the ceased operational phase would result in a minor consequence in that 'small number of people would be affected' should a severe weather occur, with 'no fatalities and a small number of minor injuries with first aid treatment'. No contamination, localised effects.	N/A – ongoing

Risk ID	Potential Risk	Environmental Effect	Likelihood Rating	Consequence Rating				Basis of Consequence	Did hazard arise? (Y/N)
				Human Welfare	Environment	Infrastructure	Social		
B	Flooding	Illness or loss of life. Sedimentation of nearby watercourse. Damage to, or depletion of aquatic habitats and species.	2	1	1	1	1	The risk of flooding during the ceased operational phase was a minor consequence in that 'small number of people would be affected' should a severe weather occur, with 'no fatalities and a small number of minor injuries with first aid treatment' No contamination of environment (e.g. watercourses), localised effects.	N/A - ongoing
C	Forestry / Bog / Gorse Fire	Potential to impact on the environment (carbon cost, noise, water quality transport etc.).	3	3	3	2	2	Given the amount of vegetation (fuel) in the area surrounding the wind farm there is a risk of fire in the area. If a fire did encroach on the windfarm it could lead to significant economic costs, loss of renewable energy generation available to the State, loss of carbon displacement with potential to impact on the environment (carbon cost, noise, water quality transport etc.).	N/A - ongoing
D	Small aircraft hazard	Localised impacts to terrestrial and aquatic habitats	2	3	2	2	2	A small aircraft collision with the turbines could lead to potential injuries and fatalities occurring. It	N/A - ongoing

Risk ID	Potential Risk	Environmental Effect	Likelihood Rating	Consequence Rating				Basis of Consequence	Did hazard arise? (Y/N)
				Human Welfare	Environment	Infrastructure	Social		
		only of short duration.						would cause damage to infrastructure on the wind farm likely up to 3 Million euros. In terms of the environment, ' this would give rise to localised impacts to terrestrial and aquatic habitats only of short duration	

The risk assessment for each of the potential risks identified are consolidated in Table 15-9 which provides their 'risk score.' A corresponding risk matrix is provided in Table 15-10, 11, and 12, which is colour coded in order to provide an indication of the critical nature of each risk. As outlined in Section 15.2.3.2, the red zone represents 'high risk' scenarios', the amber zone represents 'medium risk scenarios and the green zone represents 'low risk scenarios.

Table 15-9 Risk Scores

Risk ID	Potential Risk	Likelihood Rating	Consequence Rating (Average)	Risk Score
Construction Works				
A	Severe Weather	3	2	6
B	Flooding	2	1	2
C	Peat Stability	4	3	12
D	Traffic Incident	3	1	3
E	Contamination	2	1	2
Operational Works				
A	Severe Weather	3	2	6
B	Flooding	2	1	2
C	Forestry Fire	4	3	12
D	Traffic	3	1	3
E	Industrial Accident -Fire/Gas explosion.	3	2	6
F	Peat Stability	2	3	6
G	Small aircraft hazard	2	2	4
Ceased Operational Works				
A	Severe Weather	3	2	6
B	Flooding	2	1	2
C	Forestry Fire	3	3	9
D	Small aircraft hazard	2	2	4

Tables 15-10 to 15-12 presents the potential risks identified during all phases of the Project. The Retained Development is not included, as there is no risks of major accidents or natural disasters associated with the Retained Development.

Table 15-10 Risk Matrix – Construction

		Consequence Rating				
		1. Minor	2. Limited	3. Serious	4. Very Serious	5 Catastrophic
Likelihood Rating	5. Very Likely					
	4. Likely			C		
	3. Unlikely	D	A			
	2. Very Unlikely	B, E				
	1. Extremely Unlikely					

Table 15-11 Risk Matrix – Operation

		Consequence Rating				
		1. Minor	2. Limited	3. Serious	4. Very Serious	5 Catastrophic
Likelihood Rating	5. Very Likely					
	4. Likely			C		
	3. Unlikely	D	A, E			
	2. Very Unlikely	B	G	F		
	1. Extremely Unlikely					

Table 15-12 Risk Matrix – Ceased Operation

		Consequence Rating				
		1. Minor	2. Limited	3. Serious	4. Very Serious	5 Catastrophic
Likelihood Rating	5. Very Likely					
	4. Likely					
	3. Unlikely		A	C		
	2. Very Unlikely	B	D			
	1. Extremely Unlikely					

The scenario with the highest risk score in terms of a major accident and/or natural disaster during the phases of the Project is identified below:

15.4.1.6.1 Construction Phase Impacts

During the Construction phase the highest risk rating is ranked as Medium associated with a potential peat slide.

Peat Slide

A large peat slide occurred during the construction of the wind farm in October 2003 the causes and features of which are discussed in Chapter 8 of this rEIAR. Prior to this event there were a number of more minor localised failures on the wind farm site during the construction phase. These failures have also been attributed to construction activities. These were relatively localised and did not extend beyond the site boundary.

The peat slide displaced peat and forestry on the slopes over an area of 25Ha that extended 1.65km downslope from Turbine T68, which slide event is considered very large (>10Ha). The majority of this slide area (≈90%) was in the Coillte coniferous forests outside the windfarm site. Two wind farm access tracks and one forestry access track were removed by the slide. The path of the peat slide debris followed a tributary stream valley (SC7b) of the Owendalulleegh River. From the source area, the peat slide debris passed down the tributary stream valley which narrows to form a steep-sided channel at about 250 m AOD before widening downslope above c.195 m AOD, which is the location of the Black Road Bridge. Below the Black Road Bridge (c.195 m AOD), the tributary stream follows a more southerly course within forestry to the Flaggy Bridge. Below the Flaggy Bridge (c.150 m AOD) the stream meanders around a number of shallow relief landforms in the floor of the Owendalulleegh River valley and is joined by further tributary streams (SC7a and SC7c) before joining the Owendalulleegh River about 1.3 km south of local road R353 (location of Flaggy Bridge).

The presence of the peat slide debris is notably reduced beyond the confluence with the Owendalulleegh River and essentially there is no reported debris deposited on the riverbanks after about 1.2 km downstream of the confluence with the Owendalulleegh River. At this location the peat slide debris would have been entirely suspended within the river water. The main road (Regional road R353) providing access to Derrybrien village from the east and the local road between Derrybrien village and Loughrea were blocked over a few days and two small road bridges were damaged. Based on anecdotal reports the R353 Regional road was closed for 5 days and the Black Rd for a period in the order of 2-3 weeks.

The damage caused to a number of bridge structures were repaired shortly afterwards.

The length of the peat debris path from the end of the source area (assuming at about 250 m AOD) to the point where the peat slide debris was entirely suspended within river water is estimated at 5.8 km. The peat slide debris basically consisted of material from the peat slide source area. The majority of the peat slide source area was outside of the wind farm site.

Health and Welfare

There were no fatalities and no injuries requiring hospitalisation caused by the peat slide. No households were evacuated. The unoccupied (derelict) house downslope of the wind farm site was within the path of the peat slide debris and the peat slide gave rise to accumulations of displaced peat around the property and over the private access road lands adjacent to the property.

The damage done to the public roads did not result in injury or death.

The potential for a peat slide of scale engulfing Derrybrien village during this period of the project is considered to be very remote considering that the area of the site which shares the sub-catchment with Derrybrien is very small in the context of the overall site.

Using the classification of likelihood in Table 15-1 and impact categorisation in Table 15-2 the peat slide is classed as Likely to occur and as a Minor impact in terms of life, health and welfare.

Environment

The impact of the peat slide on land and habitats has been assessed in Chapter 8 Soils, Geology & Land and Chapter 6 Biodiversity of the rEIAR respectively. The impact of the peat slide on aquatic environment has been assessed in Chapter 7 of the rEIAR.

The peat slide displaced peat and forestry on the slopes over an area of circa 25ha that extended 1.65km downslope from Turbine T68, which is considered a very large peat slide event (>10Ha). The majority of the peat slide area (≈90%) was in the Coillte coniferous forests outside the windfarm site. From here fluidised remoulded peat from the slide entered the valley of the stream which rises in the townland of Derrybrien North and inundated farmland down to the Black Road Bridge approximately 1.0 km downslope from the slide area where rockfill barrages were constructed to contain debris material. This was the primary run-out zone for the slide. Remoulded peat was transported further downstream along the river channel. Terrestrial habitats that were directly affected by the peat slide comprised conifer forestry (open canopy pre-thicket and mature closed canopy) and wet grassland used for agriculture (wet grassland).

The likelihood of occurrence is classed as Likely and the impact of the peat slide on land and terrestrial habitats has been assessed as Serious because, although the land and habitats have largely recovered, the extent of land affected was very large but this was of low value habitat with non-significant effects.

According to Chapter 7 Aquatic Ecology of this rEIAR,

> *'the occurrence of the peat slide, combined with the associated on- and off-site remedial measures to control it, had* ***very significant to profound, short-term, negative, and reversible*** *impacts on the riverine habitats all along the SC7(b) and SC7(d) channel from the wind farm as far as the confluence with the main channel of the Owendalulleegh and for the first 1-2 km or so of that channel below the confluence of SC7. Beyond that point, in effect for most of the remaining 16 to 17 km of the main channel of the Owendalulleegh, the impact on the riverine habitats can be described as* ***moderate, negative, short term and reversible*** *because their physical nature was not appreciably altered and the main physical damage was caused to instream aquatic plants (mainly aquatic liverworts and mosses) and owing to the build-up of peat silt and woody debris as well as increased levels of sand in slower flowing stretches. These latter effects were reported at the time to clearly diminish with distance downstream, until close to the outlet to Lough Cutra they were barely perceptible. In terms of water quality, the impact of the 2003 peat slide on the SC7(b) and SC7(d) tributaries can be described as* ***profound negative, short term and reversible****, while those on the main channel of the Owendalulleegh as being* ***significant to very significant, negative, short-term and reversible****. As reported at the time, the peat slide led to a very large fish kill involving 6 species and was particularly detrimental in terms of numbers of brown trout and stone loach. This impact can be described as* ***very significant to profound, negative and short-term*** *but has proved from repeated electrofishing results for the current study (conducted between 2011 and 2022) to be reversible. The impact is therefore classified as 'short-term' because it is likely that the population would have fully recovered within 6-7 years at most, assisted by immigration of fish from unaffected side tributaries and from the main channel*

of the Owendalulleegh upstream of the confluence of SC7 where the full range of age classes would have been present in late October 2003.'

The likelihood of occurrence is classed as Likely in Table 15-1 and using the impact categorisation in Table 15-2 the peat slide event can be categorised as Limited to Serious in terms of invertebrate water quality and general water quality impacts and Serious to Very Serious in terms of fisheries impacts.

Infrastructure

The main road (Regional road R353) providing access to Derrybrien village from the east and the local road between Derrybrien village and Loughrea was blocked over a few days and two small road bridges were damaged. Based on anecdotal reports the R353 Regional road was closed for 5 days and the Black Rd for a period in the order of 2-3 weeks.

There was no interruption of the water supply from the Gort Regional Water Supply Scheme. Nor were there any interruptions of electricity, gas or telephone services.

The peat slide gave rise to costs of just over €3 million which related to works to bridges and roads undertaken in the aftermath of the peat slide as detailed throughout the rEIAR and insurance payments to owners of private land. This excludes the project delay costs and the installation of the barrages and peat repositories. The likelihood of the peat slide is classed as Likely in Table 15-1 and categorised as a Serious impact in terms of infrastructure in terms of impact in Table 15-2.

Social

While the peat slide had a temporary negative impact on the local community requiring road detours for road users for a number of weeks, it did not result in the serious disruption of the functioning of the community or society. The likelihood of the event occurring is classed as Likely as per Table 15-1and using the impact categorisation in Table 15-2 the peat slide is categorised as having had Limited social impacts.

Vehicular Accidents

There was a Low risk of vehicular accidents on the wind farm during construction. While the risk of vehicular accidents was low, incidents did occur on site roads during the construction phase which included:

- Concrete truck overturned on the site road in September 2003. Concrete removed and truck righted. No injuries recorded.
- Ready mix concrete lorry went off a site road due to human error which was regarded as a dangerous occurrence. No injuries recorded.
- One recorded incident on a site road during 2004, which was not a collision related incident. A contractor's drilling rig, which had just arrived on site to undertake geotechnical investigation, caught fire. This was quickly extinguished. The likely cause was dried peat material on the underside of the vehicle which had adhered to the drilling rig from a previous site. No injuries recorded.

Environment

Vehicular accidents mainly lead to a temporary impact on adjacent poor-quality habitat with imperceptible effects during vehicle impact and recovery operations. The main impact occurred with the overturning of the concrete delivery vehicle. To facilitate concrete offloading and recovery of concrete a temporary pit was excavated adjacent to the site road. This would have led to a loss of a very small area of poor quality habitat.

The concrete from the overturned concrete lorry was contained in a purpose-built excavated area with blocked drainage and was removed from the location. There would have been minor impact on the surface water drains but this would not have impacted on the main receiving waters in the general area.

In accordance with the impact categorisation in Table 15-2 the impact to the environment is categorised as Minor with the risk identified as Low.

Social

Vehicular accidents occurred during construction and would have given rise to short term disruption of the local traffic network if they occurred off-site causing a minor social effect. Vehicular accidents are classed as Likely to occur as per Table 15-1 and using the impact categorisation in Table 15-2 are categorised as Minor social impacts and therefore the risk rating is Low.

Infrastructure

The impact of a vehicular accident on infrastructure if it were to occur is categorised as Minor (Table 15-2) as it would give rise to a very localised impact on infrastructure only of short duration, hence the risk is rated as Low.

15.4.1.6.2 *Operational Phase Impacts*

During the Operational phase the highest risk rating is ranked as Medium associated both with a potential peat slide or forest/bog/gorse fire.

Peat Slide

The wind farm activities have not resulted in any peat slides for the operation and maintenance phase.

During the operational phase a peat slide event is classed as Very unlikely to Unlikely to occur with Very Serious impacts on fisheries, Serious impacts on habitats and infrastructure, Limited impacts on social aspects and Minor impacts on life, health and welfare were a slide to occur. The highest risk rating during the operational phase due to a peat slide event is Medium.

Life, Health and Welfare

The potential for a peat slide of scale to engulf Derrybrien village is considered to be very remote considering that the area of the site which shares the sub-catchment with Derrybrien is very small in the context of the overall site. The impact categorisation in Table 16-2 the impact is assessed as Minor and the risk is assessed as Low.

Environment

The potential impact were a peat slide of scale to occur is assessed as Serious on water quality as it would contaminate water courses which impact would take several years to recover from and Very serious with respect to fisheries as it would likely take longer to recover fish stocks based on the ranking of impacts in Table 15-2.

Infrastructure

The potential impact were a peat slide of scale to occur is assessed as Serious based on the ranking in Table 15-2 as it would likely give rise to damage in excess of 3 million euros.

Gorse Fire

The risk of fire arising on Derrybrien site is mainly from fires spreading from adjoining lands. As such fires occasionally occur in the general area in accordance with the classification set out in Table 15-1 this has been assessed as Likely during the operational period.

A gorse fire encroached onto a small area (approximately 50m^2) of unplanted ground to the northeast of the wind farm site and came within approximately 40m of Turbine 44 in late April 2015. It is understood that scrub was being burned off a few kilometres away on unplanted land on the west side of the Black Road which got out of control, crossed over the Black Road and encroached onto the wind farm site.

Given the threat to forestry, Coillte organised a response which involved the Fire Brigade, Coillte staff and a helicopter response. The wind farm also activated its own response plan at the time. The fire on the wind farm site was put out over a 5/6hour period. Given that gorse fires have been recorded in the general area a similar fire was likely to occur in the operational period.

Life, Health and Welfare

Should a forest/gorse fire occur on the site, there is a risk that this would lead to injury and possible fatalities occurring and a Serious impact category has been assigned based on Table 15-2.

Environment

Should a fire occur on the site, this could damage either cutover bog or forestry habitat. This could also give rise to an increase in sediment entrained runoff which would flush through the river system after the initial few storm events. Therefore, a fire could lead to a Serious impact to the environment based on the ranking of impacts in Table 15-2 impact categorisation.

Infrastructure

Should a fire occur on the site it would likely result in damage to the wind farm or grid connection infrastructure and not to any external infrastructure. The impacts would be short term and have a Limited impact based on the impact categorisation in Table 15-2.

Aircraft Hazard

There has been no aircraft collision with the wind turbines. Aviation lights are provided on nine turbines, specifically T1, T18, T26, T44, T46, T47, T52, T61 and T65 to clearly mark the wind farm hazard. The Irish Aviation Authority has also been provided with the geographic coordinates of all turbines on the site. The probability of an aircraft collision is very unlikely.

Vehicular Accidents

During the operational phase from 2006 to mid-2020 a mobile crane went off a site road due to human error which was regarded as a dangerous occurrence. No injuries were recorded. Given the infrequent nature of the occurrence the probability has been assessed as unlikely.

Substation/Wind Turbine Fire

There has been no fire at the wind farm or Agannygal substation to date and no fire has occurred on a wind turbine on site either. Routine maintenance is carried out regularly on the wind farm turbines and on the substations and these are also remotely monitored. It is unlikely that either a substation or wind turbine generator fire will occur.

15.4.1.6.3 Ceased Operational Phase Impacts

During the ceased-operational phase the highest risk rating is ranked as Medium associated with a forest/bog/gorse fire.

Forest/Gorse Fire

The risk of fire arising on Derrybrien site is mainly from fires spreading from adjoining lands. As such fires occasionally occur in the general area in accordance with the classification set out in Table 15-1. However, due to the short time period of the ceased operational phase, this has been assessed as Unlikely.

Life, Health and Welfare

Should a forest/gorse fire occur on the site, there is a risk that this would lead to injury and possible fatalities occurring and a Serious impact category has been assigned based on Table 15-2.

Environment

Should a fire occur on the site, this could damage either cutover bog or forestry habitat. This could also give rise to an increase in sediment entrained runoff which would flush through the river system after the initial few storm events. Therefore, a fire could lead to a Serious impact to the environment based on the ranking of impacts in Table 15-2 impact categorisation.

Infrastructure

Should a fire occur on the site it would likely result in damage to the wind farm or grid connection infrastructure and not to any external infrastructure. The impacts would be short term and have a Limited impact based on the impact categorisation in Table 15-2.

15.4.1.6.4 Retained Development Impacts

As stated above, there will be no risks of major accidents or natural disasters specific to the Retained Development.

15.4.2 Mitigation Measures

15.4.2.1 Construction Phase Mitigation

15.4.2.1.1 Peat Slide

Mitigation measures were put in place prior to the peat slide which occurred during construction phase 1 as detailed in Chapter 8 Soils and Geology which addressed peat/site stability.

Following the peat slide, a significantly increased level of site investigation was carried out and assessments of each activity separately and in combination (using current risk assessment methodologies) were undertaken. Mitigation measures were implemented to prevent any further peat instability on the site. These broadly consisted of:

- Additional geotechnical investigations, stability analyses, testing, monitoring and geotechnical supervision during the construction stage of the project (e.g. geotechnical assessment and full-scale proof testing of floating roads);

- Changes to the site characteristics due to improved drainage and an increase in the strength of the peat under sustained dead load surcharges (i.e. the floating roads, peat repositories and material side cast areas); and
- Disposal of excavated material in designated repositories on the peat slopes where the peat stability had been assessed as having an adequate margin of safety, and in the borrow pits

Emergency Management Plan: During the construction phase, an emergency plan was in place, which:

- Identified the hazards on site
- Listed contact numbers of emergency services
- Defined the roles and responsibilities of key personnel on site
- Detailed emergency procedures in the event of specific major accidents
- Outlined the safety systems available which would reduce the impact of a major accident Site emergency procedures were updated following the peat slide.

15.4.2.2 Operational Phase Mitigation

During the Operational phase the highest risk rating is ranked as Medium associated both with a potential peat slide or forest/bog/gorse fire.

The mitigations for these risks are set out below.

15.4.2.2.1 *Peat Stability*

Mitigation for the peat stability for the Derrybrien Wind Farm site are detailed in Chapter 8. Detailed peat stability risk assessments in relation to each activity and the combined activities which have occurred to date during project operation have been undertaken.

Effective and proven risk mitigation measures are in place at the project site to reduce the likelihood of a peat slide to a low or negligible level as detailed in Chapter 8- Soils, Geology and Land.

15.4.2.2.2 *Forest/Gorse Fire*

The mitigation measures comprise:

a. Restrictions apply to burning of vegetation and DAFM national warning systems
b. The use of firebreaks

Restrictions apply to burning of vegetation.

Under Section 39(1) of the Wildlife Act, 1976, it is an offence to cut, grub, burn or otherwise destroy any vegetation growing on any land not then cultivated between 1st March and 31st August in any year. Landowners wishing to carry out legally permitted prescribed burning must notify in writing all forest owners within one mile of the wood, and the local Garda station, between 7 and 35 days in advance of the burning operation. All burning operations are required to be notified to the Fire Service before burning commences. The Forest Service of the Department of Agriculture, Fisheries and Food (DAFM) has prepared a draft Code of Best Practice in relation to prescribed burning.[2]

A National Forest Fire Risk Warning System set out fire danger rating systems, and fire suppression tactics per fire risk condition. Fire suppression tactics are identified for forest risk conditions -ranging from non-intervention to aerial firefighting.

[2] *Department of Agriculture, Food and the Marine, Prescribed Burning Code of Practice – Ireland.*

Forest Fire Danger Notices are issued by DAFM during the main wildfire risk season from February through to September. These notices provide forest owners and managers with advance warning of high forest risk weather conditions and permit appropriate readiness measures to be taken in advance of fire outbreaks. Increasing levels of preparation and vigilance are required as the risk levels scale from Green through to Red.

Firebreaks

Gort Wind Farms Ltd has removed some of the flammable vegetation over a 5m wide strip around much of the perimeter of the site to form a firebreak.

Emergency Management Plan: The hazards on site have been identified for the operational phase and procedures are in place to address them, as follows:

- Accidents.
- Fire in control room and/or switchgear room on electrical equipment.
- Fire involving wood, paper in control room or in switchgear room.
- Forest/gorse fire.
- Fire in tower.
- Landslide.

15.4.2.3 Ceased Operational Phase Mitigation

During the ceased-operational phase the highest risk rating is ranked as Medium associated with a forest/bog/gorse fire. Although peat instability is considered to be a low risk during the ceased operational phase, the same peat stability mitigation which was implemented during the operational phase also applies to the ceased-operational phase.

The mitigations for these risks are set out below.

15.4.2.3.1 *Peat Stability*

Mitigation for the peat stability for the Derrybrien Wind Farm site are detailed in Chapter 8. Detailed peat stability risk assessments in relation to each activity and the combined activities which have occurred to date during project operation have been undertaken.

Effective and proven risk mitigation measures are in place at the project site to reduce the likelihood of a peat slide to a low or negligible level as detailed in Chapter 8- Soils, Geology and Land.

15.4.2.3.2 *Forest/Gorse Fire*

The mitigation measures comprise:

c. Restrictions apply to burning of vegetation and DAFM national warning systems
d. The use of firebreaks

Restrictions apply to burning of vegetation.

Under Section 39(1) of the Wildlife Act, 1976, it is an offence to cut, grub, burn or otherwise destroy any vegetation growing on any land not then cultivated between 1st March and 31st August in any year. Landowners wishing to carry out legally permitted prescribed burning must notify in writing all forest owners within one mile of the wood, and the local Garda station, between 7 and 35 days in advance of the burning operation. All burning operations are required to be notified to the Fire Service

before burning commences. The Forest Service of the Department of Agriculture, Fisheries and Food (DAFM) has prepared a draft Code of Best Practice in relation to prescribed burning.[3]

A National Forest Fire Risk Warning System set out fire danger rating systems, and fire suppression tactics per fire risk condition. Fire suppression tactics are identified for forest risk conditions -ranging from non-intervention to aerial firefighting.

Forest Fire Danger Notices are issued by DAFM during the main wildfire risk season from February through to September. These notices provide forest owners and managers with advance warning of high forest risk weather conditions and permit appropriate readiness measures to be taken in advance of fire outbreaks. Increasing levels of preparation and vigilance are required as the risk levels scale from Green through to Red.

Firebreaks

Gort Wind Farms Ltd has removed some of the flammable vegetation over a 5m wide strip around much of the perimeter of the site to form a firebreak.

Emergency Management Plan: The hazards on site have been identified for the operational phase and procedures are in place to address them, as follows:

- Accidents.
- Fire in control room and/or switchgear room on electrical equipment.
- Fire involving wood, paper in control room or in switchgear room.
- Forest/gorse fire.
- Fire in tower.
- Landslide.

15.4.2.4 Retained Development Mitigation

There is not a high risk of any major accidents or natural disasters for the Retained Development. Therefore, no mitigation is set out.

15.4.3 Residual Effects

15.4.3.1 Construction Phase

A peat slide occurred during project construction in 2003. The peat slide resulted in displaced peat affecting land and habitats, water quality and a fish kill.

These have largely recovered as follows:

- Surveys undertaken along the peat slip areas in 2011 and 2018 have shown almost full recovery of vegetation and habitat structure throughout the land affected by the peat slide.
- Macroinvertebrate water quality had effectively fully recovered within 3-years of the peat slide.
- Fish surveys showed that the fish population structure had largely recovered within 6 years of the peat slide.

[3] *Department of Agriculture, Food and the Marine, Prescribed Burning Code of Practice – Ireland.*

Not withstanding effects on biodiversity, soils and geology, and water which are assessed in detail elsewhere in this EIAR, no significant effects arose, and therefore there were no residual effects, in terms of life, health and welfare, social or infrastructural.

15.4.3.2 Operational Phase

Effective and proven risk mitigation measures are in place to reduce the likelihood of a peat slide to a low or negligible level. No residual impacts have arisen or are predicted with respect to major accidents and disasters during the Project operational phase.

15.4.3.3 Ceased Operational Phase

No residual impacts have arisen or are predicted with respect to major accidents and disasters during the Project's ceased operational phase.

15.4.3.4 Retained Development

No residual impacts are predicted with respect to major accidents and disasters during the Retained Development.

15.4.4 Assessment of Cumulative Effects

A search in relation to projects that may have the potential to result in a cumulative impact with the Retained Development on the environment was carried out as part of the rEIAR. The Project has been considered, cumulatively with the projects set out in Chapter 2 of the rEIAR.

Following a detailed assessment of the potential for any further impact when considered cumulatively with any or all of the projects, it is not considered that significant cumulative impacts have occurred or will occur with any of the projects in any phase of the Derrybrien Wind Farm Project life.

15.4.4.1 Cumulative Impacts with the Retained Development

There is potential for cumulative impacts to occur from the Retained Development in combination with the Prospective Development with respect to peat stability. The potential cumulative impacts on peat stability are discussed in detail in Chapter 8 of this EIAR and are summarised below.

15.4.4.1.1 *Site Access Tracks*

Site access tracks will remain in-situ as part of the Retained Development. After decommissioning, no further heavy construction traffic loading will be required on the retained floating roads for the wind farm. Therefore, the probability of a failure occurring in the peat due to the residual impact of the roads is negligible so that the effect of the surcharge load on the stability of the peat will be negligible and Not Significant.

The site access tracks across the slide area at T68 and T70 are constructed as rockfill berms supported on the glacial till below the peat. Therefore, the residual impact of the berms and the effect on the stability of the underlying glacial till or rock will be negligible and Not Significant.

The floating roads adjacent to the slide area at Turbines T68 and T70 were inspected by AGL Consulting in January 2024 and there was no evidence of further instability in the peat at the edges of the slide area. Therefore, the residual impact of the slide on the peat in the area and the corresponding effect on the stability of the floating roads should be negligible and Not Significant. There will therefore be no cumulative impact on Peat Stability with the Retained Development.

15.4.4.1.2 Turbine Foundations & Crane Hardstandings

Turbine foundations and crane hardstandings will remain in-situ as part of the Retained Development. The hardstanding areas adjacent to the turbines and at the substation site are constructed of crushed rock granular rockfill supported on the glacial till or rock below the peat. Therefore, they do not apply any load on the peat and the effect of the residual impact on the stability of the underlying glacial till or rock will be negligible and Not Significant.

Furthermore, the hardstanding areas will act as a shear key preventing shear failure in the peat directly upslope from them, which is a positive residual impact with respect to site stability. The effect of the support they provide will be positive and slight to significant.

Similarly, the reinforced concrete turbine foundations are supported on rock or lean mix fill down to rock below the peat and glacial till so that they do not apply any load on the peat. Also, after the turbines are removed there will be no loading on the foundations. Therefore, the effect of the residual impact on the stability of the underlying glacial till or rock will be negligible and Not Significant.

The turbine foundations will also act as a shear key preventing shear failure in the peat directly upslope from them, which is a positive residual impact with respect to site stability. The effect of the support they provide will be Slightly Significant.

Given the positive effect of the hardstanding and turbine foundation on peat stability, there will be no cumulative impact on Peat Stability with the Retained Development.

15.4.4.1.3 Peat Repositories

The peat repositories will be left in place after decommissioning. The residual impact of the repository sites will be permanent and the effect that they will have on the stability of the peat will be Negligible and Not Significant. There will be no cumulative impact on Peat Stability with the Retained Development.

15.4.4.1.4 Borrow Pits

No work will be carried out in the borrow pits during decommissioning and it is not anticipated that there will be any deterioration or change in the condition of the pits after decommissioning. Therefore, the residual impact that they will have with respect to site stability will be imperceptible. There will be no cumulative impact on Peat Stability with the Retained Development.

15.4.4.1.5 Concrete Foundations for Polesets

The concrete foundations are supported on lean mix fill down to glacial till below the peat so that they do not apply any load on the peat. Also, after the polesets are removed there will be no loading on the foundations. Therefore, the effect of the residual impact on the stability of the underlying glacial till or rock will be Negligible and Not Significant. There will be no cumulative impact on Peat Stability with the Retained Development.

15.4.4.1.6 Concrete Foundations for Agannygal Substation

The concrete foundations are supported on a hardstand of granular fill to glacial till below the peat so that they do not apply any load on the peat. Also, after the substation buildings are removed there will be no loading on the foundations. Therefore, the effect of the residual impact on the stability of the underlying glacial till or rock will be Negligible and Not Significant. There will be no cumulative impact on Peat Stability with the Retained Development.

15.4.4.2 Turbary Activities

In consideration of the turbary/peat extraction activities on the wind farm site and immediately adjacent to the wind farm site it is understood that up until 2012 the extent of turf cutting carried out mechanically in the area is not known. However, the level of peat extraction was low and turf cutting was carried out by hand on a number of plots, normally in late Spring/early Summer.

It is understood that since 2012 a local peat cutting contractor has been retained by some of the plot owners to mechanically cut turf so there has been an increase in the number of plots where mechanical turf cutting has been carried out. 35 No. of the 136 No. turbary plots have been worked by mechanical means (hopper or saw cutting).

A PSRA has been undertaken for the turbary activities. Assuming that a peat failure could involve a very large peat slide in the worst case scenario, which is consistent with the methodology for the assessment of stability impacts for the wind farm, then:

- Where the likelihood of a peat failure is Very Possible to Likely (L=4.0 to 5.0) as a result of peat harvesting on the turbary plots without appropriate mitigation measures, then the effect of the stability impact on the peat would be High and Significant.
- Where the likelihood of a peat failure is Possible to Very Possible (L=3.5), then the effect of the stability impact on the peat would be Medium to High and Moderately Significant.

For the range of wind farm activities that occurred on the site during this period and involved surcharge loading on the peat or floating roads, the effect that surcharge loads had on the stability of the peat was Low to Very Low and only Slightly Significant. No peat failures occurred as a result of the wind farm activities during this time.

When this is compared to the significance of the stability impacts of site activities for peat extraction in the turbary plots it can be seen that, due to the increased level of mechanical extraction carried out in the area since 2012, the cumulative effect on the stability of the peat temporarily increased to Moderately Significant or Significant in the plots where the mechanical peat extraction was being carried out. The highest risk of a peat failure was at the time that the mechanical extraction works were being carried out and the effect was brief or temporary, lasting only a few days in each area. This has been rated a Very Possible to Likely in accordance with the peat stability risk assessment. Therefore, in accordance with the classification set out in Table 15-1 this has been assessed as equating to likely for these plots in the absence of mitigation. This is considered as part of this assessment of Major Accidents.

Two localised peat failures occurred during the operation phase of the wind farm in the Turbary area due to harvesting activities, the details of which are discussed in detail in Chapter 8.

It was not considered that significant cumulative impacts have occurred or will occur with any of the remaining listed projects in any phase of the Derrybrien Wind Farm Project life.

15.5 Conclusion

During the Construction phase the highest risk rating is ranked as Medium associated with a potential peat slide. During the Operational phase the highest risk rating is ranked as Medium associated both with a potential peat slide or forest/bog/gorse fire. There is not a high risk of any major accidents or natural disasters for the Ceased Operational Phase.

Based on the assessment set out in this chapter, there is no risk of the Retained Development either causing or being impacted by a major accident or natural disaster. Furthermore, given the nature of

the works proposed for the Retained Development there will likely be no significant cumulative impacts with other projects or land use activities in the vicinity of the Project.

16. INTERACTION OF THE FOREGOING

16.1 Introduction

16.1.1 Chapter Scope

The preceding Chapters of this remedial Environmental Impact Assessment Report (rEIAR) identify the potential significant environmental effects that may have occurred or may occur in the future in terms of Population and Human Health, Biodiversity (Flora and Fauna), Aquatic Ecology and Fisheries, Land, Soils and Geology, Hydrology and Hydrogeology, Air and Climate, Noise and Vibration, Cultural Heritage, Landscape and Visual, Material Assets (Roads and Traffic, Telecommunications and Aviation), Risk of Major Accidents and Disasters and Waste, as a result of the Project as described in Chapter 4 of this rEIAR. However, for any development with the potential for significant environmental effects there is also the potential for interaction between these potential significant effects. The result of interactive effects may exacerbate the magnitude of the effects or improve them or have a neutral effect.

Matrixes for all phases of the Project are presented in Table 16-1 to 16-4 below to identify potential interactions of impacts between the various aspects of the environment already assessed in this rEIAR. The matrix highlights the potential for the occurrence of positive, neutral or negative effects arising from the Derrybrien Wind Farm Development Decommissioning Project - Retained Development. The matrix is symmetrical, with each environmental component addressed in the chapters of this rEIAR being placed on both axes of a matrix, and therefore, each potential interaction is identified twice. In Section 16.3 below, the potential interactions between each environmental component have been discussed in order of the relevant chapters of the rEIAR. Once a potential interaction between two environmental components has been discussed, i.e., Population & Human Health and Hydrology and Hydrogeology, the interaction will not be discussed again in the following relevant section, i.e. Hydrology and Hydrogeology and Population & Human Health in the Hydrology and Hydrogeology section.

Table 16-1 Construction Interaction Matrix

	Population, Human Health	Biodiversity	Aquatic Ecology & Fisheries	Land, Soils & Geology	Hydrology & Hydrogeology	Air & Climate	Noise & Vibration	Landscape & Visual	Cultural Heritage	Material Assets	Major Accidents	Waste
Population, Human Health												
Biodiversity												
Aquatic Ecology & Fisheries .												
Land, Soils & Geology												
Hydrology & Hydrogeology												
Air & Climate												
Noise & Vibration												
Landscape & Visual												
Cultural Heritage												
Material Assets												
Major Accidents												

Legend:				
	Potential Positive Effect:			
	Potential Neutral Effect:			
	Potential Negative Effect:			
	No Interacting Effect:			

Table 16-2 Operation Phase Interaction Matrix

	Population, Human Health	Biodiversity	Aquatic Ecology & Fisheries	Land, Soils & Geology	Hydrology & Hydrogeology	Air & Climate	Noise & Vibration	Landscape & Visual	Cultural Heritage	Material Assets	Major Accidents	Waste
Population, Human Health												
Biodiversity												
Aquatic Ecology & Fisheries .												
Land, Soils & Geology												
Hydrology & Hydrogeology												
Air & Climate												
Noise & Vibration												
Landscape & Visual												
Cultural Heritage												
Material Assets												
Major Accidents												

Legend:		
	Potential Positive Effect:	
	Potential Neutral Effect:	
	Potential Negative Effect:	
	No Interacting Effect:	

Table 16-3 Ceased-Operation Phase Interaction Matrix

	Population, Human Health	Biodiversity	Aquatic Ecology & Fisheries	Land, Soils & Geology	Hydrology & Hydrogeology	Air & Climate	Noise & Vibration	Landscape & Visual	Cultural Heritage	Material Assets	Major Accidents	Waste
Population, Human Health												
Biodiversity												
Aquatic Ecology & Fisheries .												
Land, Soils & Geology												
Hydrology & Hydrogeology												
Air & Climate												
Noise & Vibration												
Landscape & Visual												
Cultural Heritage												
Material Assets												
Major Accidents												

Legend:				
	Potential Positive Effect:			
	Potential Neutral Effect:			
	Potential Negative Effect:			
	No Interacting Effect:			

Table 16-4 Retained Development Interaction Matrix

	Population, Human Health	Biodiversity	Aquatic Ecology & Fisheries	Land, Soils & Geology	Hydrology & Hydrogeology	Air & Climate	Noise & Vibration	Landscape & Visual	Cultural Heritage	Material Assets	Major Accidents	Waste
Population, Human Health												
Biodiversity												
Aquatic Ecology & Fisheries .												
Land, Soils & Geology												
Hydrology & Hydrogeology												
Air & Climate												
Noise & Vibration												
Landscape & Visual												
Cultural Heritage												
Material Assets												
Major Accidents												

Legend:					
	Potential Positive Effect:				
	Potential Neutral Effect:				
	Potential Negative Effect:				
	No Interacting Effect:				

The potential for interaction of effects has been assessed throughout this rEIAR as part of the impact assessment process. While the work on all parts of the rEIAR was not carried out by MKO, the entire project and all the work of all sub-consultants was reviewed by the company. This rEIAR was edited

and collated by MKO as an integrated report of findings from the impact assessment process, by all relevant experts, and impacts that potentially interact have been assessed in detail in the individual chapters of the rEIAR above and summarised in Section 16.3 below.

Where any potential negative effects have been identified during the assessment process, these effects have been avoided or reduced by design and the mitigation measures, as presented throughout the rEIAR and highlighted in Section 16.3.1 below.

16.1.2 Statement of Authority

This section of the EIAR has been prepared by Morgan Valvik and reviewed by Thomas Blackwell, of MKO. Morgan Valvik (MEnvSc, BSc) joined MKO's Environmental Team in 2023. She holds an MSc in Environmental Science from Trinity College Dublin. Thomas is a Senior Environmental Consultant with MKO with over 17 years' of progressive experience in environmental consulting and in the assessment of environmental documents for renewable energy developments. Thomas holds a BA (Hons) in Geography from Trinity College Dublin and a M.Sc. in Environmental Resource Management from University College Dublin.

16.1.3 Relevant Legislation

The Interactions of the Foregoing chapter of this rEIAR is carried out in accordance with legislation and guidance referred to in Chapter 1 of this rEIAR.

16.1.4 Relevant Guidance

The assessment methodology has followed the guidance set out in Section 3.7.6 of the EPA Guidelines on the information to be contained in Environmental Impact Assessment Reports (2022) 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. This is typically accompanied by brief text describing the interactions. Further coverage of this is provided in the Advice Notes."*

16.2 Methodology

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.

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

16.2.1 Limitations/Difficulties Encountered

No significant difficulties were encountered in the preparation of the Interaction of the Foregoing chapter of this rEIAR.

16.3 Receiving Environment

For the purposes of this assessment, the baseline environment against which likely significant effects and impacts have been assessed has been taken as 1998. The baseline environment is from the period prior to the construction of Derrybrien Wind Farm.

16.3.1 Impact Interactions of Project During the Construction Period (2003 to 2006)

16.3.1.1 Population and Human Health

Population and Human Health and Noise

As identified in Chapter 5 (Population and Human Health) Section 5.6.2.8 of this rEIAR, 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 11 Noise and Vibration indicates that construction noise levels were well within the applicable noise criteria for construction and was not significant.

The noise effects that occurred during the construction phase were negative, imperceptible to slight, direct and temporary to short-term. No significant effect to population and human health as a result of noise was identified.

Population and Human Health, Land Soil 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 5 Section 5.6.2.3.

Prior to construction of Derrybrien Wind Farm Development, the site had been previously used for commercial conifer forestry over the central and western parts of the site, and turf cutting in turbary plots on the east side.

The peat slide displaced peat and forestry on the slopes over an area of 25Ha that extended 1.65km downslope from Turbine T68, which slide event is considered very large (>10Ha). However, forest plantation in the adjacent area has not changed appreciably since prior to project construction and prior to construction represented and currently represents over 50% of land use in the immediate vicinity of wind farm. Due to its age profile, much of the forestry estate has, over the last number of years and will over the next decade, require felling. Current land use in the wider landscape comprises of forestry, agricultural practices and residential/ commercial activities.

There was no significant effect on land use/activities due to the construction phase of the Project; therefore, there was no significant effect on population and human health.

Population and Human Health, and Aquatic Ecology

The effects of the peat slide on the supply of drinking water for the Gort Regional supply were described in Chapter 7, section 7.4.2 and considered in the assessment of effects on human health in Chapter 5 Section 5.6.2.10.

As set out in Chapter 7, in the period after the peat slide the colour of the treated water in the supply increased, although the supply periodically registered very high colour levels at that time of year in any case. Galway County Council also reported an increase in the frequency of the back-wash cycle for the rapid sand filters in the treatment plant which was probably due to an increase in suspended solids in the surface water source caused by the peat slide. This persisted at the time for several weeks. However, at no time was the supply interrupted. The raw water sources currently supplying the town remain essentially the same as in 2003. The effect on the water supply treatment process was a slight negative of temporary duration.

The residual effect on human health resulting from potential water quality changes during the construction phase – including those associated with the peat slide – is assessed as indirect, negative, not significant, and temporary.

Population and Human Health, Major Accidents and Natural Disasters

The effects of the peat slide were described in detail in Chapter 8, Land, Soils and Geology and also discussed in Chapter 15 Major Accidents. The effects of the peat slide on population and human health was considered in Chapter 5 Section 5.6.2.6.

There was an imperceptible negative, direct, short-term effect on health and safety as none of the incidents reported during the construction phase of the Project, including the peat slide, resulted in permanent health injuries to the various contractor(s), work force, or to members of the public.

Population and Human Health, and Traffic and Transport

During the construction phase, interactions between construction traffic vehicle movements and the local population occurred – particularly during peak construction and peat slide response works. The effects of these were considered in Chapter 5 Section 5.6.2.9 and Chapter 14.

As set out in Chapter 14, during project construction, both slight and moderate, negative effects were experienced due to a number of activities on the surrounding roads, traffic and transport network. This gave rise to a minor inconvenience to local road users. As described in Chapter 14 Roads, Traffic and Transport, traffic management measures were agreed with Galway County Council (GCC) in relation to the works and implemented during the works in order to reduce significant effects. Although a potential for injury or accident to occur existed on local roads, diversions were put in place to ensure avoidance of the impacted road network and no significant effect on human health associated with Traffic and Transport occurred as a result of the peat slide.

Population and Human Health, and Hydrology

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 9, 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 5 Population and Human Health Section 5.6.2.10. The residual effect on human health resulting from potential water quality changes during the construction phase – including those associated with the peat slide – is assessed as indirect, negative, not significant, and temporary. Mitigation measures, including sediment control, drainage

improvements, and adjustments to the water treatment process, ensured the protection of the public water supply and prevented any adverse health outcomes.

Effects from the potential to increase flood risk in terms of affecting the local population was considered in the Flood Risk Assessment accompanying Chapter 9. No significant effect was identified.

Population and Human Health, and Air and Climate

Potential dust and exhaust emission sources during the construction phase of the Project included construction works and vehicle and plant movements. Potential interactions between population and human health and air quality arising from the construction phase of the Project – including dust and vehicle emissions from construction works and the peat slide – were assessed in Chapter 10 (Air and Climate) and Chapter 5 (Population and Human Health) Section 5.6.2.7.

Effects on human health from exhaust emissions and dust associated with construction activities and machinery are considered to have been short-term, direct, imperceptible and negative due to the distance from the works to the nearest sensitive receptors, as well as the implementation of standard construction-phase controls. No significant effects relating to the interaction of impacts occurred.

16.3.1.2 Biodiversity

Biodiversity and Population and Human Health

Construction works can cause disturbance to birds within surrounding areas. This arises from noise and the physical presence of humans, machinery etc. The effects are described in Chapter 6 Section 6.4.2.2.4.

As set out in Chapter 6 Section 6.4.2.2.4, the principal residual adverse effect from the construction works was the loss of an estimated 0.7 ha of cutover bog, which would have provided nesting and/or foraging habitat for various upland bird species, including hen harrier and red grouse. This is considered as a long-term negative slight effect at the International level of importance as it relates to hen harrier.

The removal of approximately 222 ha of conifer forest to facilitate the project is considered a significant positive impact of long-term duration for birds, as conifer forest is a non-native habitat and had replaced the natural peatland habitats. With the clearance of conifer plantation, habitats of value to upland bird species, including hen harrier, have been allowed to become re-established on the areas outside the construction footprint.

Biodiversity and Hydrology

Effects to drainage as a result of the peat slide is described in Chapter 9 (Hydrology). The potential for such drainage changes on terrestrial ecology were considered and assessed in Chapter 6 (Biodiversity). As set out in Chapter 6 (Biodiversity) Section 6.4.3, it is considered that drainage works associated with the peat slide had a neutral impact on terrestrial habitats as it is unlikely that the works caused a noticeable change to the ecological value of the affected habitat. The felling of conifer forestry as a result of quarrying associated with barrage dam building is considered to be a negligible impact (no significant effect) as the area affected represents a very small fraction of the habitat type. The affected habitat, conifer forestry, is of low ecological value.

Drainage works associated with the wind farm development had the potential to alter the hydrology of the habitats in proximity to the drainage network. Surveys of hydrologically dependent habitats (upland blanket bog, dystrophic lake and associated flush) undertaken post construction demonstrate that the construction of the wind farm did not have a negative effect on these habitat types. Similarly, the area

of intact upland blanket bog adjacent to the northern boundary was not affected by drainage as no new drainage was developed in proximity to this area.

Areas of cutover bog were impacted by drainage prior to the construction phase of the wind farm development. Apart from very localised drainage effects surrounding turbine bases and hard stand areas there is no indication that the habitat has changed since the development of the wind farm. These localised drainage effects are considered to have had a minor negative long term effect (no significant effect) on the cutover bog.

Biodiversity and 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 6 Section 6.4.2.2.4. The effect on breeding birds due to construction related activities 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.

Biodiversity and Landscape

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 6) Section 6.4.4.2.6.

The removal of much of the plantation forest on site (c.255 ha) without replanting has allowed the subsequent development of habitats that are suitable for a range of bird species including species typical of unplanted upland areas, including hen harrier, meadow pipit and red grouse. While the regenerating bog/heath vegetation is prone to invasion by self-seeded conifers, the majority of the site is still a largely open landscape (though with time, the self-seeded conifers are likely to become dominant in some sectors). The replacement of non-native conifer plantation with an open sward is considered a positive impact of long-term duration for birds, resulting in a significant positive effect.

Biodiversity and Land, Soils, and 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 8 Land, Soils and Geology. The impacts from these have been assessed in the Biodiversity Chapter 6 and are as a significant positive effect in the long term.

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. 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 which resulted in no significant effect extending to the Black Road Bridge, with slight 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.

Biodiversity and 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 Chapter 6 Biodiversity Section 6.4.2.2.4. Road widening and bridge upgrade works undertaken to facilitate increased construction traffic has also been assessed. The effects were not significant.

16.3.1.3 Aquatic Ecology and Fisheries

Aquatic Ecology and 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 7 Aquatic Ecology. Moderate, adverse but temporary to short-term impacts were identified as having occurred.

In terms of the peat slide, significant changes in land use occurred with the loss of vegetative cover and movement of large quantities of peat, sediment and debris into the drainage and river channels. These effects were considered in Chapter 7 Aquatic Ecology. The effects of the peat slide on aquatic ecology, in terms of water quality and fisheries is considered in Chapter 7 Section 7.4.2. The resulting water quality impacts ranged from very significant negative (short-term) near the source, to significant or moderate negative effects farther downstream. The impact on fish is described as locally significant, negative and short-term in the immediate impact area and very significant or significant, negative and short-term in the main Owendalulleegh River channel.

Aquatic Ecology and Water

Drainage from the site construction locations is considered in detail in Chapter 7 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 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.

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 7 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.

Aquatic Ecology and 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 7 Aquatic Ecology. Effects of construction traffic giving rise to direct impact on aquatic ecology and indirectly through site generated sediment load were also considered. As set out in Chapter 7 Section 7.7, the main impacts from these activities were confined to the small headwater streams draining the wind farm site itself and took the form of a slight negative, not significant, temporary to short term, reversible effect on biological water quality locally, all of which was likely to have reversed within 12 to 24 months of the wind farm's commissioning in 2006.

Aquatic Ecology and Major Accidents

Consideration has can been given to the effects of the peat slide, described in Land Soils and Geology in Chapter 8 on the aquatic ecology. Chapter 7 Section 7.4.2.4 describes effect of the peat slide on aquatic ecology.

16.3.1.4 Hydrology & Hydrogeology

Hydrology & Hydrogeology and Land, Soils and Geology

The interactions between hydrology and land, soils, and geology relating to the construction phase were considered in Chapter 8 and Chapter 9.

As set out in Section 8.8 of Chapter 8, additional drains were constructed to provide drainage for the turbine foundations, which was a design requirement, and to improve the control of groundwater and surface runoff in areas of poor drainage and high water-table. Drainage has an adverse effect on peat where the groundwater table is lowered. However, the impact of the drains would be localised, and the site had already been degraded by drainage for forestry and turbary plots. Therefore, the effect of the direct impact of the improved drainage on the peat has been assessed as slightly significant.

16.3.1.5 Landscape and Visual

Landscape and Visual, and Land, Soils and Geology

The interactions between land, soils, and geology and the landscape and visual effects during the construction phase were considered in the Landscape and Visual Chapter, Chapter 13 Section 13.4.2. The landscape and visual effects were primarily localised, short term and ranged from moderate to slight in nature. The peat slide however would be considered as having been locally Significant from a landscape perspective in the short term. On a wider landscape scale, the landscape effects would be considered Not Significant.

16.3.1.6 Air and Climate

Air and Climate and Hydrology

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 10 Section 10.2.6.2.

The residual effects of greenhouse gas emissions arising from the construction phase of the Project had a short-term moderate negative effect. However, once emitted to the atmosphere, the greenhouse gas emissions that arose from construction phase activities will have a direct permanent moderate negative effect on Climate.

Air and Climate and Land, Soil, and Geology

The interaction of impacts on air quality and climate arising from land use change and, construction activities were considered in Chapter 10 (Air and Climate) Section 10.2.6.2. No significant effects 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 a short-term moderate negative effect. However, once emitted to the

atmosphere, the greenhouse gas emissions that arose from construction phase activities will have a direct permanent moderate negative effect on Climate.

16.3.2 Impact Interactions of Project During the Operational Period (2006 to 2022)

16.3.2.1 Population and Human Health

Population and Human Health and Noise

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 11 (Noise and Vibration) considered the assessment of effects of noise on Population and Health in Section 11.2.2.1. No negative effect was identified.

Population and Human Health and Air and Climate

The positive effects on population and human health during the operational phase of the Project due to associated reductions in greenhouse gas emissions and its impact on climate change, has been assessed in Chapter 5 Section 5.6.3.3.3.

The associated reduction in greenhouse gas emissions and key air pollutants such as nitrogen oxides and particulate matter resulting from the operation of the Derrybrien Wind Farm had indirect positive effects for population and human health. These air quality improvements contribute to the overall reduction of ambient pollutant concentrations associated with respiratory and cardiovascular illnesses, as recognised by the World Health Organization and the Environmental Protection Agency. Therefore, the effect on human health during the operational phase of the Derrybrien Wind Farm Development was positive, indirect, moderate, and long-term.

Population and Human Health and Traffic and Transport

The interaction of impacts on population and human health arising from traffic and transport during the operational phase were considered in the Chapter 5 Section 5.6.3.3.

Machinery and vehicles, such as vehicles of contractors and employees who worked during the operational phase posed a potential health and safety risk to the employees of the Derrybrien Windfarm. Vehicles entering and exiting the subject site also posed a potential risk to members of the public. The risks associated with operational vehicles and machinery were direct, long-term, and slight in nature. However, due to the implementation of a comprehensive Safety Management System and the absence of recorded incidents, the residual effect is assessed as direct, negative, long-term, and imperceptible.

16.3.3 Impact Interactions of Project During the Ceased Operational Phase (2022 to present)

16.3.3.1 Human Health

Human Health and Traffic and Transport

The interaction of impacts on population and human health arising from traffic and transport were considered in the Chapter 5 Section 5.6.4.1.

Machinery and vehicles, such as vehicles of contractors and employees who are on site during the non-operational phase pose a potential health and safety risk to the employees of the Derrybrien Wind Farm Development. Vehicles entering and exiting the subject site also pose a potential risk to members of the public. The health and safety risks associated with the traffic associated with the non-operational phase of the Project are considered to be slight, direct, negative, and short-term.

16.3.3.2 Air and Climate

Air and Climate and Traffic and Transport

The interaction of impacts on air quality and climate arising from traffic and transport were considered in Chapter 10 (Air and Climate) Section 10.2.6.4. Since the operation of the Derrybrien Wind Farm ceased, only very minor greenhouse gas emissions have arisen from maintenance of the wind farm from a very small number of vehicle emissions associated with such activities

After the cessation of the operational phase of the Project in 2022, the Project has had a direct short-term imperceptible negative effect. However, once emitted to the atmosphere, the greenhouse gas emissions that have arisen after the cessation of the operational phase will have a direct permanent imperceptible negative effect on Climate.

Air and Climate and Land, Soil, and Geology

The interaction of impacts on air quality and climate arising from land, soil, and geology were considered in the Chapter 10 (Air and Climate) Section 10.2.6.4. Since the operation of the Derrybrien Wind Farm ceased, only very minor greenhouse gas emissions have arisen from the continued emittance of carbon dioxide from previously disturbed peatland.

16.3.3.3 Hydrology

Hydrology & Hydrogeology and Land, Soils, and Geology

The interaction of impacts arising from land, soil, and geology on hydrology were considered in the Chapter 8 (Land, Soils, and Geology) Section 8.4.1.3. The improved drainage network that was constructed on the site for the wind farm is a Permanent and Sustained impact on groundwater levels that has had a positive stability impact on the peat relative to the baseline conditions on site in 1998, prior to construction. The effect of the drainage improvements on the stability of the peat has been assessed as Medium, and of Moderate significance.

16.3.4 Impact Interactions of Project During the Retained Development

16.3.4.1 Air and Climate

Air and Climate, and Land, Soils, and Geology

The interaction of impacts on air quality and climate arising from land, soil, and geology were considered in the Air and Climate Chapter 10 Section 10.2.6.5. Once the Prospective Development is complete (decommissioning of above ground structures), the remaining elements of the Project (the Retained Development) will result in greenhouse gas emissions due to the continued emissions of greenhouse gases from the disturbed and drained peatlands. This will have a short-term imperceptible negative effect on climate. However, once emitted to the atmosphere, the greenhouse gas emissions arising from the disturbed and drained peatlands of the Retained Development will have a permanent imperceptible negative effect on Climate

16.3.4.2 Land, Soils, and Geology

Land, Soils, and Geology, Biodiversity , and Hydrology & Hydrogeology

The interaction of impacts on air land, soils, and geology arising from biodiversity were considered in the Land, Soils, and Geology Chapter 8 Section 8.7.1. No further maintenance will be carried out on the drains after decommissioning. Therefore, in the long-term the efficiency of the drains could reduce if they become clogged by vegetation over time, which would result in a partial gradual restoration of groundwater levels on the site.

Any reduction in the efficiency of the drainage network after decommissioning is expected to be minor and to occur gradually over time so that the positive long-term post-decommissioning effect on the stability of the peat will still be medium to low and slightly significant relative to the baseline conditions prior to construction.

16.3.4.3 Aquatic Ecology

Aquatic Ecology, Land Soils and Geology, and Hydrology & Hydrogeology

The interaction between land, soils, and geology and hydrology, with relevance to aquatic ecology is considered in Chapter 7 (Aquatic Ecology) Section 7.4.1.

As set out in Chapter 7, following completion of the Prospective Development (decommissioning) there will be ever diminishing levels of residual suspended solids leaving the areas where ground disturbance occurred, owing to consolidation and revegetation of disused, retained features with a corresponding gradual increase in the level of on-site attenuation of peak run-off. Given the low to negligible residual risk of peat failure associated with retained elements (as set out in Chapter 8 Land Soils and Geology), there is low residual risk of excessively contaminated runoff arising and therefore no likely significant effects on water quality and downstream fisheries habitats .

16.4 Conclusion

Where any potential interactive negative impacts have been identified in the above, a full suite of appropriate mitigation measures has already been included in the relevant sections (Chapters 5-16) of the rEIAR. The implementation of these mitigation measures will reduce or remove the potential for

these effects. Information on residual effects, and their significance, is also presented in each relevant chapter.

17. SCHEDULE OF MITIGATION AND CONCLUSION

17.1 Introduction

17.1.1 Chapter Scope

All mitigation measures relating to the Derrybrien Windfarm Development Decommission Project - Retained Development are set out in the relevant chapters of the rEIAR and associated documents submitted as part of this planning application.

All mitigation measures undertaken to date during the construction, operation and ceased operation phases of the Project to date are outlined in Table 17-1 below. Mitigation measures proposed for the Retained Development are outlined in Table 17-2. The mitigation measures have been grouped together according to their environmental field/topic and are presented under the following headings:

- Population and Human Health.
- Biodiversity.
- Land, Soils, and Geology.
- Hydrology and Hydrogeology.
- Air Quality and Dust Control.
- Noise and Vibration.
- Cultural Heritage.
- Material Assets.
- Major Accidents and Natural Disasters.
- Resource and Waste Management.

The mitigation proposals for the Retained Development in Table 17-2 provides an easy to audit list that can be reviewed and reported. The proposal for site inspections and environmental audits are set out in the outline Construction and Environmental Management Plan (oCEMP) which is included as Appendix 4-3 of this rEIAR. The tabular format in which the information below is presented, can be further expanded upon during the course of the project to provide a reporting template for site compliance audits.

17.2 Mitigation Measures

Table 17-1 Mitigation Measures – Implemented to Date

Ref. No.	Ref. Heading	Ref. Location	Mitigation Measure
Construction Phase			
Population and Human Health			
MM1	Health and Safety	Chapter 5 Section 5.4.2.6	The Project was constructed in accordance with all relevant Health and Safety Legislation, including: › Safety, Health and Welfare at Work Act 2005 (No. 10 of 2005); › Safety, Health and Welfare at Work (General Application) (Amendment) Regulations 2016 (S.I. No. 36 of 2016); › Guidelines on the Procurement, Design and Management Requirements of the Safety, Health and Welfare at Work (Construction) Regulations 2006; › Safety, Health and Welfare at Work (Work at Height) Regulations 2006 (S.I. No. 318 of 2006).
MM2	Noise	Chapter 5 Section 5.4.2.8	The Irish Planning Institute Wind Energy Guidelines (1995) recommended that wind farms should be located a minimum distance of 500m from existing dwellings although it is stated that this distance may vary from site to site. The nearest turbine was constructed about 2000m from the nearest occupied dwelling, well outside recommendations.
MM3	Traffic and Transport	Chapter 5 Section 5.4.2.9	› Some potential impacts were avoided through the use of on-site borrow pits and resources (e.g. trees felled used for access track construction). › Significant volumes of construction materials were sourced on-site thereby reducing impacts on the surrounding transport network in relation to material movements to the site. › Deliveries of abnormal loads were undertaken in the hours of darkness as much as possible in order to minimise impacts on road users and effects experienced by them. › Diversions were put in place to ensure avoidance of the impacted road network.

Ref. No.	Ref. Heading	Ref. Location	Mitigation Measure
MM4	Pollution of Water Supply	Chapter 5 Section 5.4.2.10	Concrete wash-out areas were established for the purpose of capturing washout water from ready-mix concrete lorries. All concrete lorries delivering ready-mix concrete to the site were required to wash-out their vehicles at these specific wash-out points upon completion of their concrete deliveries and prior to exiting the site. Spill kits were available and used to deal with any minor or localised oils and / or fuels from the machinery in operation at the site and the re-fuelling of that machinery. Drip trays were used during refuelling. The offsite measures to minimise the impact of the peat slide included the installation of a 10 no. barrages, two within the wind farm boundary with the remaining eight, (of which four remain in place) along the route of the slide on Coillte land between the wind farm and Flaggy Bridge on the R353. Following the initial peat slide mitigation measures, the contractor was instructed to carry out further precautionary drainage measures as follows: › Improvement of drainage in the slide area of the wind farm, clearance of obstructions and release of any visibly trapped water and construction of silt traps. › Cleaning out of 3 no. gorges (pre-existing narrow steep-sided streams adjacent to offsite repositories) including construction of areas locally from available materials (trees, brash, boulder clay, etc.) to store removed peat, removal of sidecasting of the removed peat, provision of silt traps as necessary and possible reduction of rock barrage. › Re-establishment of the original stream and access road at Black Road Bridge to include construction of areas to store removed peat from available materials (trees, brash, boulder clay, etc.), removal and side casting of the removed peat, provision of silt traps as necessary.
Biodiversity (Terrestrial Ecology)			
MM5	Off-site Peat slide Works	rEIAR Chapter 6 Section 6.4.3	Emergency measures were undertaken to address significant impacts arising from the peat slide in 2003. These emergency measures, which mainly involved the installation of barrages and creation of repositories for peat material, largely related to the safeguarding of downstream water quality and reducing the risk of further peat slides.

Ref. No.	Ref. Heading	Ref. Location	Mitigation Measure
MM6	Bats	rEIAR Chapter 6 Section 6.4.3.3	In relation of the peat slide, the damage of three bridges may have resulted in the loss of potential roosting features for bats. Bat Conservation Ireland provides guidance for planners, engineers and developers on appropriate mitigation for the loss of roosting opportunities in bridges stating: *"Ready-made roosting boxes or tubes are available and can be easily inserted into structures to provide roosting sites for bats. Where natural crevices are not available or cannot be retained, a bat tube should be attached to the structure. Ensure that the bat tube is located at sufficient height (at least 1m) above winter flood waters to prevent residing bats from being drowned. Bat boxes are also available for attachment to mature trees or buildings"(BCI, 2010)* A minimum of two bat boxes will be fixed to Black Road Bridge (Bridge C) and Flaggy Bridge. Two boxes will also be placed on Black Road Bridge (Bridge B) rather than Slattery's Bridge.
			Land, Soils, and Geology
MM7	Mitigation of Stability Impacts	rEIAR Chapter 8 Section 8.6.2.1.2	***Construction Management and Supervision*** › The civil works were carried out by an experienced earthworks and civil contractor – Ascon Ltd. (now BAM Civil). › The works were carried out under the supervision of ESBI engineers with experience of construction for wind farms on upland blanket bogs in Ireland. ***Site Access Tracks*** › A basal layer of brash and small trees and 1-2 layers of geogrid reinforcement were incorporated into the design of the floating roads to minimise the thickness of granular rockfill used to construct the roads, and to spread the dead load of the road evenly over the surface of the intact peat. › On the north side of the site the access track between Turbines T50 and T47 was originally aligned along the north side of the turbines – in close proximity to the edge of the steep slopes on that side of the site. At an early stage in construction the track was re-aligned to the south side of the turbines to move it further back from the edge of the steep slopes.

Ref. No.	Ref. Heading	Ref. Location	Mitigation Measure
			Spoil Management › Peat and glacial till excavated from the turbine foundations sidecast on the intact peat slopes adjacent to the excavations was spread out over the surface of the peat, generally to a depth of 0.5-1.5 m, to minimise the dead load surcharge and distribute it over a wide area. › The live load surcharge from construction plant operating on the peat slopes was minimised through a combination of long reach excavators operating on the access tracks, and LGBP (low ground-bearing pressure) wide-tracked excavators operating on the peat. ***Stability of Peat Excavations at Turbine Foundations*** Wherever possible the temporary peat slopes at the turbine foundations were battered back to a stable temporary slope angle of 1V:1H or flatter. Where the sides of the excavations were unstable in deep weak peat, rockfill was backfilled up against the slopes as temporary support. ***Drainage*** Some improvements were carried out to the existing drainage network on the site to clear out blocked drains, to relieve groundwater levels in areas of deep peat, and to prevent ponding of surface runoff in areas where the access roads and turbines were constructed. Culverts were also installed under the new site access tracks to preserve the existing hydrology. ***Borrow Pits*** Borrow pits were opened up on the site to extract rock and process it into the granular rockfill that was used to construct the site access tracks and crane hardstandings. Blasting was only carried out in Borrow Pit No.3, near the site entrance. The blasting was carried out by an experienced licensed professional and charge delays were used to minimise blast-induced vibrations.

Ref. No.	Ref. Heading	Ref. Location	Mitigation Measure
			Tree Felling Tree felling works were carried out by experienced specialist subcontractors under the management of Coillte. The trees were felled and gathered using specialised forestry equipment comprised of a wide-tracked hydraulic excavator fitted with a harvesting attachment and 8-12 tonne rubber-tyred forwarders that have been widely used in commercial conifer forests on upland blanket bogs in Ireland. › In areas of soft peat the contractors placed timber brash and trimmed branches along the access routes of the harvesters and forwarders through the forest to spread out the concentrated live load surcharge under the tracks or tyres of the machines.
MM8	Mitigation of Direct Impacts	rEIAR Chapter 8 Section 8.6.2.2.1	***Mitigation of Direct Impacts*** During the second phase of construction in 2004/2005, Turbine T16 and a 475 m long section of floating road between Turbines T15 and T17 were omitted from the scope of work on the project as a precautionary measure out of concerns for site stability in the area, which was close to where the peat slide occurred in October 2003 and had similar topography and ground/groundwater conditions. The sections of partially completed floating roads that had been constructed between T15 and T17 at the time of the slide were closed and abandoned.
MM9	Wind Farm Site: Construction Phase (2003-2006) – After the October 2003 Peat Slide	rEIAR Chapter 8 Section 8.6.2.2.2	***Instrumentation and Monitoring*** 4 No. clusters of instrumentation were installed to monitor groundwater levels and ground movements in the peat around the perimeter of the site near Turbines T2, T18, T34 and T49/50. At each location: › 3 No. vibrating-wire push-in piezometers were installed to provide a continuous record of daily and seasonal groundwater level fluctuations [12 No. total]. › 3-4 No. electronic tiltmeters provided a continuous record of any downslope movement or creep in the peat at the sensor locations [15 No. total].

Ref. No.	Ref. Heading	Ref. Location	Mitigation Measure
			The electronic sensors were connected to a central logger unit in each area. The logger units were fitted with GSM cards to allow remote access to the data, which was downloaded regularly to a central server. The tiltmeters were set up with an automated alarm system to alert wind farm technical representatives of incidents of peat movement that exceeded pre-defined limits for rapid response. ***Geotechnical Supervision and Certification*** The level of geotechnical supervision for the civil works contract was significantly increased for the second phase of construction on the site in 2004/2005. AGL Consulting were appointed by the main contractor Ascon Ltd. (now BAM Civil) to provide geotechnical analysis, design, supervision and inspection services for the project from October 2003 and the end of the civil works in 2005. The scope of services included: › An assessment of the peat slide, including walkover surveys, specialised sampling and testing of the peat, stability analyses and computer modelling. › Specification, supervision and reporting of supplemental geotechnical investigations on the site. › Slope stability analyses for all of the floating roads. › Identification and assessment of suitable peat repository sites. › Inspection of full-scale load testing on the floating roads. › Assessment and monitoring of the impact of blast-induced vibrations on peat. › Periodic site inspections and attendance at progress meetings by a Geotechnical Director. › Full-time on call office-based technical support. › Review and certification of the Contractor's Method Statements. Engineers from ESB International had a full-time presence on site to supervise the civil works, manage the Permit to Work scheme, and coordinate with the mechanical/electrical sub-contractors. Geotechnical engineers from ESBI also carried out extensive supplemental ground investigations to establish the depth and strength of the peat across the site to assess the potential

Ref. No.	Ref. Heading	Ref. Location	Mitigation Measure
			impact of tree felling operations on peat stability. They also carried out site inspections, reviewed Contractor's design submittals and attended project meetings. Applied Ground Engineering Consultants (AGEC) provided geotechnical services to ESBI between October 2003 and the end of the civil works contract in 2005 including: › An appraisal of site stability after the peat slide, with detailed walkover surveys, supplemental ground investigations (peat probing and in-situ vane shear testing), and slope stability analyses. › Review of technical submittals from the Contractor, including certified method statements and reports for additional geotechnical investigations, site stability analyses, and in-situ testing. › Periodic site inspections and attendance at project meetings. ***Supplemental Geotechnical Investigations*** Comprehensive supplemental geotechnical investigations were carried out after the peat slide in October 2003 to characterise the depth and material characteristics of the peat, glacial till and bedrock across the site, as well as the groundwater levels in the peat. In general, the scope of the supplemental investigations included: › A desk study review of aerial photography – including 3D stereoscopic imaging. › Detailed walkover surveys and inspections by suitably qualified and experienced geotechnical engineers. › Aerial LiDAR surveys, satellite GPS surveys, and in-situ slope angle measurements with a hand-held Abney Level to characterise the site topography. › Extensive peat probing, in-situ vane shear testing, undisturbed sampling and specialised laboratory testing to characterise the depth, strength and material characteristics of the peat. › Rotary coring at the remaining turbine foundations to determine the strength of the cohesive glacial till overburden below the peat and the depth to competent rock. › Installation of manual and electronic piezometers in the peat to monitor groundwater levels.

Ref. No.	Ref. Heading	Ref. Location	Mitigation Measure
			Analysis and Testing of the Floating Roads The mitigation measures for the floating roads on the peat consisted of: › Supplemental investigations. › Stability analyses. › Full-scale serviceability and proof load tests on the working roads. › A trial load test on a test section of floating road. › Remedial works to improve the performance of sections of the floating roads. › Site controls. › Modifications to the site access tracks in the vicinity of the slide. ***Assessment of the Excavations for the Turbine Foundations & Crane Hardstandings*** The mitigation measures for the excavation of the turbine foundations and crane hardstanding areas consisted of: › Supplemental investigations. › Stabilisation measures and temporary works designs for the side slopes around the perimeter of the excavations. › Review and certification of the Contractor's Method Statements. ***Spoil Management & Disposal – Peat Repository Sites*** After the peat slide strict controls were placed on the disposal of peat and glacial till excavated from the turbine foundations, crane hardstanding areas, substation site, borrow pits and anemometer masts. The heavier glacial till was segregated from the peat and stored in the borrow pits so that it was not placed on the intact peat slopes. The majority of the excavated peat was stored to a maximum depth of 1.0 m in designated repository areas on the intact peat slopes in suitable areas of flat or gently sloping ground on the site. A small volume of the peat was stored within rockfill bunds in Borrow Pits BP-2 and BP-3. The additional mitigation measures that were implemented for the peat repository sites on the slopes included:

Ref. No.	Ref. Heading	Ref. Location	Mitigation Measure
			› Desk studies and walkover surveys. › Supplemental investigations. › Stability analyses. › Geotechnical certification. › Site control measures. ***Tree Felling*** The following monitoring and risk mitigation measures were implemented for the felling of the trees that were remaining on the site after the slide: › Extensive geotechnical investigations comprised of peat depth probes, in-situ vane shear tests, slope angle measurements, piezometers and undisturbed gouge auger core sampling were carried out across the site by ESB International to assess the stability of the peat on the site for the tree felling operations. › Site stability analyses were carried out in order to inform the appropriate felling methodology for various areas across the site. › The trees were left in place in areas that were considered unsuitable for the mechanical harvesting and forwarding equipment. › Where clear felling was permitted the works were carried out by experienced specialist subcontractors under the management of Coillte. › The trees were felled and gathered using specialised equipment that has been widely used in commercial conifer forests on upland blanket bogs in Ireland. › In areas of soft peat, the contractors placed timber brash and branches under the harvester tracks to spread out the concentrated live load surcharge on the surface of the peat. › Where the trees were too small for the harvesting machinery, the trees were felled by hand. Some of the larger trees in these areas were felled with a light machine harvester, formed into windrows and left in place on the slopes.

Ref. No.	Ref. Heading	Ref. Location	Mitigation Measure
			Rock Blasting in Borrow Pit No.3 Blasting was carried out in Borrow Pit No.3 (BP3) to extract the rock that was processed into granular fill for the construction of the floating roads, and the hardstanding areas for the crane pads, substation and anemometer masts. The following monitoring and mitigation measures were implemented to confirm that the large peat slide that occurred in 2003 was outside the range of the blast-induced vibrations from the borrow pit, and that the peak particle velocity and acceleration of the vibrations were within acceptable limits: › The blasting was carried out by a suitably qualified fully licensed professional. › The pattern, sequence, timing and maximum instantaneous charge of the blasts were designed to minimise blast-induced vibrations on the slopes around the perimeter of the borrow pit. › Vibration monitoring was carried out on the site for the blasts. › AGL Consulting carried out a comprehensive review of the blast monitoring records to establish threshold limits for the Peak Particle Velocity (PPV) and Peak Particle Acceleration (PPA) of the blast-induced vibrations, and to establish the radius of impact for the blasting. › Glacial till excavated from the site was used to construct a berm along the face of the peat at the top of the rock slope around the perimeter of the borrow pit to act as a shear key to prevent a localised peat slide inundating the pit where the surrounding slopes were sloping down towards the pit. ***Drainage*** The following risk mitigation measures were also implemented for the drainage works: › Wherever possible, minor drainage works were carried out by hand to avoid machine or equipment loading on the peat. › Where mechanical excavators were required the works were carried out using wide-tracked LGBP 10-13 tonne excavators suitable for working directly on the peat. › The peat excavated from the trenches was sidecast on the adjacent intact peat slopes and spread out to depths typically <0.5 m.

Ref. No.	Ref. Heading	Ref. Location	Mitigation Measure
			› Where large culverts were constructed at road crossings over the main watercourses on the site all of the peat was excavated out from under the culverts and granular surround to avoid surcharge loading on the peat. ***Cable Trenching & Ducting*** The following risk mitigation measures were implemented for the cable trenching and ducting: › The alignment of the cable trenches were designed to follow the shortest, most direct route across the site to the control building with the minimum number of road crossings. › Most of the cable trenches were aligned alongside the site access tracks so that the cable spools could be transported along the floating roads, minimising construction traffic on the intact peat slopes. › The cable trenches in the peat were excavated using wide-tracked LGBP 10-13 tonne excavators suitable for working directly on the peat. › To minimise the impact of the road crossings on the floating roads the new ducts were pushed horizontally through the peat under the roads to avoid having to open up a trench across the road, which would cut through the geogrid reinforcement. › The works were carried out by specialist sub-contractors who were experienced with similar work for wind farms on upland blanket bogs in Ireland.
MM10	Grid Connection: Construction Phase (2003-2006)	rEIAR Chapter 8 Section 8.6.3.1	***Tree Felling*** › Tree felling works were carried out by experienced specialist subcontractors under the management of Coillte. The trees were felled and gathered using specialised forestry equipment comprised of a wide-tracked hydraulic excavator fitted with a harvesting attachment and 8-12 tonne rubber-tyred forwarders that have been widely used in commercial conifer forests on upland blanket bogs in Ireland. › In areas of soft peat the contractors placed timber brash and trimmed branches along the access routes of the harvesters and forwarders through the forest to spread out the concentrated live load surcharge under the tracks or tyres of the machines.

Ref. No.	Ref. Heading	Ref. Location	Mitigation Measure
			Site Access Track › In a single area of deep peat along the route of the OHL, a temporary floating access was constructed in order to provide access to AM38, around 600m north of the Agannygal substation. In this instance existing trees were felled and placed to form a 'floating road' mat of timber on the OHL corridor for access to the mast location. This mat of timber would spread the dead load of the road evenly over the surface of the intact peat. o For the remainder of the grid connection, access to the masts was from existing roads and forestry tracks. Construction for access to masts consisted of removal and disposal locally of peat (less than 1m typically) and tree stumps/brash to competent material to allow access for tracked excavators and dumpers and a rough terrain crane.
MM11	Peat Slide and Response Works: Construction Phase (2003-2006) – After the October 2003 Peat Slide	rEIAR Chapter 8 Section 8.6.4.1.1	In order to restrict the movement of the slide material, which was essentially peat, a series of barrages were constructed. These were constructed between the wind farm project site boundary and downslope of the Flaggy Bridge on the R353 local road. The permanent barrages (1-4) comprised coarse rock fill which was placed onto competent ground.
MM12	Peat Slide and Response Works: Construction Phase (2003-	rEIAR Chapter 8 Section 8.6.4.1.2	***Construction of Floating access tracks to Barrages 1 and 2*** An access track 830m in length was constructed from an existing Coillte forest track in order to access the location of barrage 1 and replace the Coillte access track removed by the slide. The access track comprised a western and eastern section. The access track to the west of barrage 1 was constructed as a floating track on peat. The eastern access track was founded on competent ground.

Ref. No.	Ref. Heading	Ref. Location	Mitigation Measure
	2006) – After the October 2003 Peat Slide		A floating access track 300m in length was constructed from an existing Coillte forest track in order to access the location of barrage 2. The floating access track was constructed on peat. Both access tracks were designed to the appropriate standards and constructed using low pressure bearing pressure excavators when working on peat or were constructed from the existing section of track. Construction of these tracks was closely monitored to ensure that no peat stability issues arose. ***Construction of Barrages to Restrict the Movement of Material*** In order to restrict the movement of the slide material, which was essentially peat, a series of barrages were constructed. These were constructed between the wind farm project site boundary and downslope of the Flaggy Bridge on the R353 local road. The permanent barrages (1-4) comprised coarse rock fill which was placed onto competent ground, which avoided any loading of peat. ***Construction of Repositories to Store Slide Material*** The majority of the peat was stored to a maximum depth of 1.0 m in designated repository areas on the intact peat slopes in suitable areas of flat or gently sloping ground on the site. **Site controls** were implemented on site for the use of the peat repository areas, i.e.: › The boundaries of the approved repository sites were clearly marked out on site with survey tape between probe locations. › The depth of excavated peat that was placed in the site was strictly limited to 1.0 m and no temporary stockpiling was permitted on the peat slopes. ***Construction Traffic on Intact Peat*** Construction traffic was required to pass over intact peat during the construction of some of the barrages, peat repositories and other construction activities. In general, construction machines that trafficked over particularly deeper peat would have been light

Ref. No.	Ref. Heading	Ref. Location	Mitigation Measure
			or low ground bearing pressure (LGBP) wide-tracked machines suitable for working on the peat. The risk of a peat slide under such machines loading would be limited.
			Hydrology and Hydrogeology
MM13	Felling of Forestry	rEIAR Chapter 8 Section 9.4.1.2	The methodology agreed for carrying out felling between ESBI and Coillte included the requirement that existing drains be regularly inspected and maintained. Immediately following clearance of plots on site, the drainage in that area was to be evaluated and any required drainage works carried out. The suitability of new drain designs for the terrain of any given felling area was also to be re-evaluated on site following felling. Silt traps were installed along all newly constructed drains before they entered any pre-existing drainage systems or watercourses and were subject to regular maintenance. Drainage discharges were monitored for suspended solids content to determine the effectiveness of silt traps. All available records of this monitoring noted no cause for concern.
MM14	Suspended Solids – Wind Farm, OHL Route and Grid Connection	rEIAR Chapter 8 Section 9.4.1.3	At each turbine base during construction, in cases where water ponded in the excavation, this was removed using 4-inch or 6-inch mobile pumps and pumped to a nearby existing drain, often over ground on existing vegetation. Any silt resulting from this pumped water was captured by both existing vegetative matter and constructed straw bales which connected into the local existing drainage. When the turbine bases were completed, a buried drain was installed around the turbine bases, the outlets of which were connected into the surface drainage network. Given that the new drainage for each of the turbines would not have been inserted until completion of the turbine foundations, the risk of significant washout of solids was minimised.
MM15	Hydrocarbons and Cement	rEIAR Chapter 9 Section 9.4.1.4	A number of mitigation measures were put in place to address the risk to both surface and groundwater. Concrete wash-out areas were established for the purpose of capturing wash-out water from ready-mix concrete lorries. All concrete lorries delivering ready-mix concrete to the site were required to wash-out their vehicles at these specific wash-out points upon completion of their concrete deliveries and prior to exiting the site. Spill kits were available and used to deal with any minor or localised oils and / or fuels from the machinery in operation at the site and the re-fuelling of that machinery. Drip trays were used during refuelling.

Ref. No.	Ref. Heading	Ref. Location	Mitigation Measure
MM16	Offsite peat slide works: October 2003 – March 2006	rEIAR Chapter 9 Section 9.4.1.6	The offsite measures to minimise the impact of the peat slide included the installation of a 10 no. barrages, two within the wind farm boundary with the remaining eight, (of which four remain in place) along the route of the slide on Coillte land between the wind farm and Flaggy Bridge on the R353.
MM17	Drainage Diversions	rEIAR Chapter 9 Section 9.4.1.8	Following the initial peat slide mitigation measures, the contractor was instructed to carry out further precautionary drainage measures as follows: › Improvement of drainage in the slide area of the wind farm, clearance of obstructions and release of any visibly trapped water and construction of silt traps. › Cleaning out of 3 no. gorges (pre-existing narrow steep-sided streams adjacent to offsite repositories) including construction of areas locally from available materials (trees, brash, boulder clay, etc.) to store removed peat, removal of sidecasting of the removed peat, provision of silt traps as necessary and possible reduction of rock barrage. › Re-establishment of the original stream and access road at Black Road Bridge to include construction of areas to store removed peat from available materials (trees, brash, boulder clay, etc.), removal and side casting of the removed peat, provision of silt traps as necessary.
Air and Climate			
MM18	Construction Phase Impacts (2003-2006)	rEIAR Chapter 10 Section 10.1.4.2	› Dust suppression measures were implemented on site to minimise the potential nuisance caused by dust at the nearest sensitive receptors and on sensitive eco systems. Water misting was used as required if particularly dusty activities were necessary on site during dry and/or windy conditions. › All site related traffic had speed restrictions on un-surfaced roads. › Regular inspection of the site was undertaken to examine dust measures and their effectiveness. › All plant and materials vehicles were stored in dedicated areas (on site). › Turbines and construction materials were transported away from the site on specified haul routes only.

Ref. No.	Ref. Heading	Ref. Location	Mitigation Measure
			› The agreed haul route roads adjacent to the site was regularly inspected for cleanliness and cleaned as necessary. › The Site access roads were checked regularly for damage/potholes and repaired as necessary. › The transport of construction materials which had the potential to generate dust was undertaken with tarpaulin cover or similar, where necessary.
MM19	Construction Phase Impacts (2003-2006)	rEIAR Chapter 10 Section 10.2.6.2	› Construction staff were trained how to inspect and maintain construction vehicles and plant to ensure good operational order while onsite, thereby minimising any emissions that arise. › All plant and materials vehicles were stored in dedicated areas (onsite). Machinery was switched off when not in use. › Turbines and construction materials were transported to the site on specified routes only, unless otherwise agreed with the Planning Authority. › The expected waste volumes generated onsite were not large enough to warrant source segregation at the site. Therefore, all wastes streams generated onsite were deposited into a single waste skip which was covered. o This waste material was transferred to a licensed /permitted Materials Recovery Facility (MRF) by a fully licensed waste contractor where the waste was sorted into individual waste streams for recycling, recovery or disposal. o The MRF was local to the Project to reduce the emissions associated with vehicle movements › A Construction and Environmental Management Plan (CEMP) was in place throughout the construction phase.
Noise and Vibration			
MM20	Construction Phase Mitigation Measures	rEIAR Chapter 11	As no significant effects were identified, there was no need for exceptional mitigation measures in respect of construction noise or vibration. A number of general measures were implemented in order to follow good construction practice:

Ref. No.	Ref. Heading	Ref. Location	Mitigation Measure
		Section 11.4.2.5	› Plant used onsite during the construction phase was maintained in a satisfactory condition and in accordance with manufacturer recommendations. In particular, exhaust silencers were fitted and operating correctly at all times. › Machinery not in active use was shut down.
			Cultural Heritage
MM19	Construction Phase Impacts (2003-2006)	rEIAR Chapter 12 Section 12.4.1	The construction of the temporary site compound areas, site access tracks, turbine foundations, turbine hardstands, substation compounds, underground low-voltage (LV) cables and ducting, borrow pits / quarries and drainage channels were subject to continuous archaeological monitoring during the construction phase and nothing of archaeological significance was identified.
			Material Assets
MM20	Construction Phase Impacts (2003 –2006)	rEIAR Chapter 14 Section 14.1.4.1	During the construction of the Project, the following mitigation measures were implemented in order to reduce significant effects relating to roads, traffic and transport: › Significant volumes of construction materials were sourced on-site thereby reducing impacts on the surrounding transport network in relation to material movements to the site. › Deliveries of abnormal loads were undertaken in the hours of darkness as much as possible in order to minimise impacts on road users and effects experienced by them.

Ref. No.	Ref. Heading	Ref. Location	Mitigation Measure
MM21	Water Supply	rEIAR Chapter 14 Section 14.2.4.1.1	The offsite measures to minimise the impact of the peat slide included the installation of a 10 no. barrages, two within the wind farm boundary with the remaining eight, (of which four remain in place) along the route of the slide on Coillte land between the wind farm and Flaggy Bridge on the R353. Following the initial peat slide mitigation measures, the contractor was instructed to carry out further precautionary drainage measures as follows: › Improvement of drainage in the slide area of the wind farm, clearance of obstructions and release of any visibly trapped water and construction of silt traps. › Cleaning out of 3 no. gorges (pre-existing narrow steep-sided streams adjacent to offsite repositories) including construction of areas locally from available materials (trees, brash, boulder clay, etc.) to store removed peat, removal of side-casting of the removed peat, provision of silt traps as necessary and possible reduction of rock barrage.
MM22	Energy Infrastructure	rEIAR Chapter 14 Section 14.2.4.1.3	Oils were stored in enclosed containers within the wind farm construction site compound. The diesel supply tank to the temporary electrical generator supplying the site compound was double skinned. Spill kits were available and used to deal with minor oil/fuel spills on site. Drip trays were used during refuelling of machinery.
MM23	Waste Management Services	rEIAR Chapter 14 Section 14.3.4.1.1	The waste volumes generated on-site from the Retained Development were deposited into a single waste skip. This waste material was transferred to a Materials Recovery Facility (MRF) by a fully licensed waste contractor where the waste was sorted into individual waste streams for recycling, recovery or disposal.

Ref. No.	Ref. Heading	Ref. Location	Mitigation Measure
			Major Accidents and Natural Disasters
MM24	Construction Phase Mitigation	rEIAR Chapter 15 Section 15.4.2.1.1	Following the peat slide, a significantly increased level of site investigation was carried out and assessments of each activity separately and in combination (using current risk assessment methodologies) were undertaken. Mitigation measures were implemented to prevent any further peat instability on the site. These broadly consisted of: › Additional geotechnical investigations, stability analyses, testing, monitoring and geotechnical supervision during the construction stage of the project (e.g. geotechnical assessment and full-scale proof testing of floating roads). › Changes to the site characteristics due to improved drainage and an increase in the strength of the peat under sustained dead load surcharges (i.e. the floating roads, peat repositories and material side cast areas); and › Disposal of excavated material in designated repositories on the peat slopes where the peat stability had been assessed as having an adequate margin of safety, and in the borrow pits Emergency Management Plan: During the construction phase, an emergency plan was in place, which: › Identified the hazards on site › Listed contact numbers of emergency services › Defined the roles and responsibilities of key personnel on site › Detailed emergency procedures in the event of specific major accidents Outlined the safety systems available which would reduce the impact of a major accident Site emergency procedures were updated following the peat slide.

Ref. No.	Ref. Heading	Ref. Location	Mitigation Measure
Operational Phase			
Population and Human Health			
MM25	Health and Safety	rEIAR Chapter 5 Section 5.4.3.2	Derrybrien Wind Farm operated a Safety Management System (SMS) which met the requirements of OHSAS 18001. Derrybrien Wind Farm operated an emergency procedure. This covered procedure in event of accidents, lone working, persons falling into water, forest/gorse fire, fire in wind turbine towers and procedure in event of landslide. Contact details are provided for emergency services, including the local authority and An Garda Síochána.
MM26	Accidents and Natural Disasters	rEIAR Chapter 5 Section 5.4.3.3	› Mitigation measures were implemented which included instrumentation and monitoring of the site, geotechnical supervision of maintenance works and site inspections, maintenance, repair of infrastructure, as well as drainage improvement and maintenance.
MM27	Water Quality Impacts	rEIAR Chapter 5 Section 5.4.3.3.2	An Envirocare P6 sewage treatment plant unit caters for the wastewater generated in these facilities. It is regularly serviced under a maintenance contract with Environmental Services. At Agannygal Substation wastewater is adequately treated by a Biocycle wastewater treatment system before discharge off site.
MM28	Air Quality	rEIAR Chapter 5 Section 5.4.3.3.3	› Ensured that all maintenance and monitoring vehicles were maintained in good operational order while onsite, and, when stationary, were required to turn off engines thereby minimising any emissions that arose.

Ref. No.	Ref. Heading	Ref. Location	Mitigation Measure
			Biodiversity
MM29	Impact on Winter Bird Species	rEIAR Chapter 6 Section 6.4.4.2.9	Any required significant maintenance works, such as track repairs or cutting of trees (as in 2018-19), were done outside of the bird breeding season so as to avoid disturbance to nesting birds.
			Land, Soils, and Geology
MM30	Mitigation of Stability Impacts	rEIAR Chapter 8 Section 8.6.2.3.1	***Instrumentation and Monitoring*** › Between 2006 and 2012 ESBI continued to monitor groundwater levels and movement in the peat at the clusters of electronic piezometers and tiltmeters installed near Turbines T2, T18, T34 and T49/50. › The instruments were decommissioned in 2014 as some of them showed signs of malfunction. It was considered that they had been in place for a sufficient period of time to ensure that they were exposed to a range of environmental conditions on the site, and they did not indicate any evidence of peat instability. › In May 2005, 7 No. monitoring points were established on the peat within the slide area for long-term monitoring of movement and settlement of the disturbed peat. The ITM coordinates and level of the monitoring points were recorded periodically by GPS surveys between 2005 and 2020. ***Geotechnical Supervision and Inspections*** › Gort Windfarms Ltd. (GWL) appointed a site manager who was responsible for coordinating and managing the operation of the wind farm and the maintenance of the turbines and site infrastructure. His responsibilities included regular site inspections and managing health and safety for the operation and maintenance of the wind farm, including co-ordinating and supervising access to the turbines for the large mobile cranes. › ESBI engineers carried out regular periodic geotechnical inspections of the site between 2005 and 2020 to assess maintenance requirements for short and long-term stability. The majority of the recommendations in the reports relate to maintenance works on the site access roads and site drainage which were incorporated into the maintenance programme for the site.

Ref. No.	Ref. Heading	Ref. Location	Mitigation Measure
			AGL Consulting were appointed by ESB International to provide geotechnical support services periodically over the operation and maintenance phase of the project between 2011 and 2020, including: › Site inspections and walkover surveys by Senior Geotechnical Engineers and Geotechnical Directors (2011, 2014 & 2018). › Inspection and certification of full-scale proof load tests on the floating roads in 2011, 2014 and 2018. › Geotechnical analysis and design services for the upgrade of the floating roads in 2014, including a site-wide Peat Stability Risk Assessment. › Site supervision and office-based technical support services during construction stage of the 2014 civil contract to upgrade the floating roads, including a review and certification of the Contractor's Method Statements. ***Maintenance and Repair of the Site Access Tracks*** The following design, construction & operational risk mitigation measures were implemented for the main roads upgrade contract in 2014, which accounts for the majority of the works that were carried out on the floating roads on the site between 2006 and 2020. › In 2011 all of the site access tracks were inspected by a geotechnical engineer from AGL Consulting and full-scale proof load tests were carried out on the floating roads to assess the nature and extent of the upgrade works that would be required, and to verify the capacity and stability of the floating roads under the design crane load prior to designing the upgrade works. › For continuity of geotechnical risk management, the geotechnical engineer for AGL Consulting who carried out the 2011 inspections and the design for the 2014 upgrade works was the same person who evaluated the design and stability of the roads for the Contractor after the peat slide during the construction stage of the project in 2003/2004 – Mr. Conor O'Donnell. › To minimise the additional load on the peat where the floating roads were upgraded: o The roads were reinforced with an additional layer of geogrid to reduce the thickness of granular capping material required; o The thickness of the capping material was limited to 150 mm; and

Ref. No.	Ref. Heading	Ref. Location	Mitigation Measure
			○ The coarse granular capping material was surfaced with a nominal 20 mm thick blinding layer of fine gravel in lieu of a thicker layer of granular subbase material (Clause 804) that would normally be used. › The additional dead load on the floating roads was designed to be within the factor applied to the live load surcharge in the stability analyses [i.e. <30% of characteristic (unfactored) live load surcharge]. › Stability analyses were carried out to demonstrate that the additional load had only a minor impact on the factor of safety against bearing capacity or shear failure in the peat under the roads, and that the difference (<5-10%) was proportional to the increase in undrained shear strength that would have already occurred in the underlying peat as it consolidated (compressed) under the weight of the roads since they were constructed in 2003-2005; › The construction stage traffic and live load surcharges were also restricted so that the combination of the temporary live load surcharge and the increased dead load on the road did not exceed the design live load surcharge for the floating roads. › A Peat Stability Risk Assessment (PSRA) was carried out in advance of construction in accordance with industry best practice guidelines to characterise the risk of peat instability across the site during the 2014 road upgrade works. › Construction stage risk mitigation measures were incorporated into the Geotechnical Risk Register for the works on site, including: ○ Designated access routes for construction plant and machinery. ○ Limits on the maximum size of plant that could be used on the roads, particularly in areas where there was a higher risk of peat instability. ○ A requirement to stockpiling granular fill materials in the crane hardstanding areas to avoid concentrated loading on the floating roads. ○ Restrictions on the way in which the fill was tipped and spread on the roads to minimise dynamic impact loads and to avoid concentrated static loads from temporary piles of rockfill that exceeded the design surcharge load of the road. ○ Compaction by static rolling only. › During construction full-time supervision of the works was carried out jointly by geotechnical engineers from AGL Consulting and ESB International to ensure that the works complied with the specification and that the specified risk mitigation measures were implemented on site. › A certification procedure was implemented for the review and approval of the Contractor's method statements to certify that reasonable skill and care was taken in ensuring that appropriate measures were implemented to mitigate against the risk of

Ref. No.	Ref. Heading	Ref. Location	Mitigation Measure
			peat instability during construction. The Geotechnical Approval Certificates were issued by AGL Consulting and signed by a Director of the company. › On completion of the works, full scale proof load tests were successfully carried out on the upgraded roads, to verify the capacity of the roads under the design crane load using a mobile crane loaded with additional ballast. ***Maintenance/repair of turbines*** › The following design, construction & operational risk mitigation measures were implemented for the maintenance and repair of the turbines on the site: › All heavy lifting operations involving mobile cranes were carried out from the hardstanding areas adjacent to the turbines so that the loads were adequately supported on the glacial till and rock below the peat. › Steel bearing plates were used to reduce the bearing pressure under the crane outrigger pads to prevent any localised bearing failure on the hardstanding areas. › The capacity of the floating roads to support the design load for the mobile cranes carrying out maintenance at the turbines was verified by full-scale proof loading at the end of the construction period in 2005, after the roads were upgraded in 2014, and again in 2018, when the narrow turbary road was also re-tested. › The comprehensive upgrade programme that was carried out on the floating roads in 2014 improved the condition and performance of the sections of roads that had deteriorated significantly since they were constructed in 2005. › The number of crane mobilisations to site during the operation and maintenance period between October 2005 and Q2 2020 was minimised by combining maintenance work on turbines, wherever possible. › The smallest size and of mobile crane with sufficient capacity for the required maintenance lifting loads was mobilised to the site; for example, based on an audit of crane movements between 2005 and 2018, which is representative of the typical operations on site to date: o Approximately 80% of the 86 No. crane operations on the site were carried out using a 100-tonne crane (e.g. the Liebherr LTM 1100-5.2 which is 2.75 m wide and has a total travelling weight of 60 tonnes on 5 axles, with a maximum axle load of 12 tonnes/axle). o All but one of the remaining operations were carried out using a 130-tonne crane (e.g. the Liebherr LTM 1130-5.1 which is also 2.75 m wide and has a total travelling weight of 60 tonnes on 5 axles, with a maximum axle load of 12 tonnes/axle).

Ref. No.	Ref. Heading	Ref. Location	Mitigation Measure
			○ 1 No. operation at Turbine T17 in July 2018 required the larger 200 tonne Liebherr LTM 1200-5.1 mobile crane, which is 3.0 m wide and has a total travelling weight of 60 tonnes on 5 axles, with a maximum axle load of 12 tonnes/axle. ○ In comparison, the design crane load for the floating roads is the 300 tonne Grove GMK6300 All-Terrain crane, which is 3.0 m wide and has a total travelling weight of 72 tonnes on 6 axles with a maximum axle load of 12 tonnes/axle. › All of the cranes were stripped of any unnecessary additional ballast when travelling across the floating roads to the turbine sites. › The cranes were transported across the site under the direct supervision of the ESB site maintenance manager. › The cranes were driven directly to the required turbine using the shortest route across the floating roads, avoiding unnecessary turns at tight junctions where there was a risk of going off the road, or sections of floating roads that were in poor condition prior to the 2014 roads upgrade programme. › The mobile cranes were driven slowly and steadily across the floating roads within the specified site speed limit of 5 km/hr. All intermediate stopping points were on crane hardstandings adjacent to turbines, not on the roads. › Where necessary, steel plates were placed along on the edges of the floating roads to facilitate access around tight bends where there was a risk of excessive deflection on a soft verge. › Strict restrictions were placed on access for cranes along the narrow 3.0-3.5 m wide turbary road between Turbines T25 and T45. ***Maintenance/repair of Derrybrien substation and control building*** The following design, construction & operational risk mitigation measures were implemented for the maintenance and repair of the substation and control building: › All maintenance operations were carried out from the hardstanding area around the substation and control building which was designed to support the loads from the vehicles and equipment on the glacial till below the peat. › All of the vehicles and equipment were driven directly to the substation site across the minimum length of floating road. › The dead weight and axle loads of the vehicles and equipment was kept to a minimum and the loads were within the design crane load that was verified by the proof load tests that were carried out on the floating roads.

Ref. No.	Ref. Heading	Ref. Location	Mitigation Measure
			› Trucks that were used to bring materials or large equipment such to the substation were escorted along the roads by the ESB site maintenance manager. › The vehicles were driven slowly and steadily across the floating roads within the specified site speed limit of 15 km/hr. ***Drainage Improvements*** The primary negative impact of the drainage improvements was the occasional localised temporary loading on the peat slopes by mechanical excavators used to clear out, deepen or realign existing drains. The following risk mitigation measures were implemented to mitigate the effect of the loading on the stability of the peat: › Wherever possible, minor maintenance works and drain clearing was carried out by hand to avoid machine or equipment loading on the peat. › Where mechanical excavators were required the works were carried out using wide-tracked low ground bearing pressure 10-13 tonne excavators suitable for working directly on the peat. › Where significant excavations were required the excavated peat and mineral soil was removed to a secure material disposal area to avoid side-casting the material on the peat adjacent to the drain. › Where culverts were widened at road crossings all of the peat was excavated out from under the rockfill used to widen the road to avoid surcharge loading on the peat. › The inspections used to assess the requirements for maintenance and improvement works to the drainage network were typically carried out over the wetter months in winter or early spring when groundwater levels on the site were higher and drainage issues would have been more apparent. › The drainage improvement works were prioritised so that: o Only priority work to improve the drainage at the turbine foundations was carried out urgently in the winter or early spring. o All other general maintenance and drainage improvement works on the site were carried out during the drier summer months when there would be a lower risk of peat instability on the site. › Poor drainage is a recognised contributory risk factor for peat slides. Therefore, as such, the drainage improvement would in itself be a significant risk mitigation measure for site stability during the operation and maintenance of the wind farm. ***Cable Ducting***

Ref. No.	Ref. Heading	Ref. Location	Mitigation Measure
			The main work that was carried out on the cables and ducting on the site of the wind farm between October 2005 and Q2 2020 was the installation of the new ducting and fibre-optic cables for the upgrade of the turbine control systems in September 2017. The following risk mitigation measures were implemented for the works: › The length of new cable ducts that had to be installed on the site was minimised by optimising the layout of the ducts to combine clusters of fibre-optic cables on different circuits into the same duct. In this way it was possible to reduce the total length of new ducts to 2.55 km to house 7.6 km of fibre-optic cables. › The alignment of each of the ducts follows the shortest, most direct route across the site to the control building and the number of road crossings was minimised. › The ducts were installed using a mole-plough capable of installing the ducts directly into the peat without the need for open-trench excavation and backfilling. › The mole-plough was a low ground-bearing tracked machine suitable for working directly on the peat. › To minimise the impact of the road crossings on the floating roads the new ducts were pushed horizontally through the peat under the roads to avoid having to open up a trench across the road, which would cut through the geogrid reinforcement. › The manholes were constructed on the glacial till below the peat to avoid any loading on the peat. › The works were carried out by personnel that were experienced with similar work for wind farms on upland peat bogs in Ireland. ***Forestry – Tree Topping*** › No commercial forestry planting or felling was permitted on the wind farm site during the operation and maintenance period between October 2005 and Q2 2020. › In September/October 2018, tree topping was carried out for a distance of 10 m either side of the access track in selected areas around the site. The following risk mitigation measures were implemented for the works: › The tree-topping works were limited to clearing small trees (typically conifers <4-5 m high) and shrubs that had re-grown naturally within areas that had been cleared during the construction of the wind farm. › The tree topping was carried out using a light 10 tonne wide-tracked excavator with a saw head attachment, which is a specialist low-ground bearing pressure forestry machine suitable for working directly on the peat. › All of the trimmed vegetation was cut and left in place on the peat slopes with no additional handling, which minimises machine movements and loading on the peat.

Ref. No.	Ref. Heading	Ref. Location	Mitigation Measure
			› The works were carried out at the end of the drier summer months when the risk of peat instability on the site is lower. › The tree topping works were scheduled on a priority basis as part of a multi-year annual maintenance plan under the supervision of the ESB site maintenance manager. No unscheduled works were carried out. ***Forestry – Timber Stockpiling*** In the 2017, Geotechnical Inspection Report by ESBI it was noted that stockpiles of timber that had been felled outside the wind farm site had been stockpiled on the peat near Turbine T6. Therefore, the following measures were implemented to mitigate the impact of the live load surcharge on the peat: › The timber stockpile was removed shortly after it had been reported. › No further timber stockpiling was permitted on the site.
MM31	Grid Connection: Operation & Maintenance Phase (2006-2022)	rEIAR Chapter 8 Section 8.6.3.2.1	***Maintenance/repair of Agannygal substation and control building*** The following design, construction & operational risk mitigation measures were implemented for the maintenance and repair of the substation and control building: › All maintenance operations were carried out from the hardstanding area around the substation and control building which was designed to support the loads from the vehicles and equipment on the glacial till below the peat. ***Forestry – Tree Topping*** In 2018 and 2019, tree topping was carried out along the route of the OHL to trim back some of the small trees that had re-established naturally on the slopes where clear felling had taken place. The following risk mitigation measures were implemented for the works: › The tree-topping works were limited to clearing small trees (typically conifers <4-5 m high) and shrubs that had re-grown naturally within areas that had been cleared during the construction of the grid connection.

Ref. No.	Ref. Heading	Ref. Location	Mitigation Measure
			› The tree topping was carried out using a light 10 tonne wide-tracked excavator with a saw head attachment, which is a specialist low-ground bearing pressure forestry machine suitable for working directly on the peat. › All of the trimmed vegetation was cut and left in place on the peat slopes with no additional handling, which minimises machine movements and loading on the peat.
MM32	Peat Slide and Response Works: Operation & Maintenance Phase (2006-2022)	rEIAR Chapter 8 Section 8.6.4.2.1	The following design, construction & operational risk mitigation measures were implemented for the maintenance of barrages 1 and 2: › All maintenance operations were carried out from the access tracks adjacent to the barrages which were designed to support the loads from the vehicles and equipment on the glacial till below the peat.
Hydrology and Hydrogeology			
MM33	Drainage Issues	rEIAR Chapter 9 Section 9.4.2.1.2	Regular maintenance has been carried out as necessary since commissioning of the wind farm. Drainage inspections are carried out monthly and following heavy rainfall or snow events. In addition to this, periodic geotechnical inspections have identified drainage maintenance issues which generally involve localised clearing out and maintaining sections of site drains.
MM34	Water Quality - Hydrocarbons	rEIAR Chapter 9 Section 9.4.2.1.3	The released hydrocarbons would have the potential to percolate to ground or contaminate surface water runoff from the substation if not properly managed. To mitigate this hydrological risk, a pump sump is provided with a float switch outside the transformer bund. This is a proprietary pump that only allows water discharge to take place when no oil is detected. This is connected to a BMS (Butler Manufacturing Services) Ltd. PIF Class 1 Full Retention Oil Separator which discharges to a wind farm drain outside the substation boundary. This provides an adequate treatment prior to discharge to the wind farm drainage network. Regular inspections are carried out to ensure this system is in correct working order.

Ref. No.	Ref. Heading	Ref. Location	Mitigation Measure
			Air and Climate
MM35	Operation and Maintenance Phase Impacts (2006-2022)	rEIAR Chapter 10 Section 10.2.6.3	Ensured that all maintenance and monitoring vehicles were maintained in good operational order while onsite, and, when stationary, were required to turn off engines thereby minimising any emissions that arose.
MM36	Waste Management Services	rEIAR Chapter 14 Section 14.3.4.2.1	All wastes have been managed in accordance with applicable legislation. This waste material was transferred to a Materials Recovery Facility (MRF) by a fully licensed waste contractor where the waste was sorted into individual waste streams for recycling, recovery or disposal.
			Major Accidents and Natural Disasters
MM37	Operational Phase Mitigation	rEIAR Chapter 15 Section 15.4.6.2	***Peat Stability*** › Mitigation for the peat stability for the Derrybrien Wind Farm site are detailed in Chapter 8. Detailed peat stability risk assessments in relation to each activity and the combined activities which have occurred to date during project operation have been undertaken. › Effective and proven risk mitigation measures are in place at the project site to reduce the likelihood of a peat slide to a low or negligible level as detailed in Chapter 8- Soils, Geology and Land.

Ref. No.	Ref. Heading	Ref. Location	Mitigation Measure
			Forest/Gorse Fire › The mitigation measures comprise: a. Restrictions apply to burning of vegetation and DAFM national warning systems b. The use of firebreaks Restrictions apply to burning of vegetation. Under Section 39(1) of the Wildlife Act, 1976, it is an offence to cut, grub, burn or otherwise destroy any vegetation growing on any land not then cultivated between 1st March and 31st August in any year. Landowners wishing to carry out legally permitted prescribed burning must notify in writing all forest owners within one mile of the wood, and the local Garda station, between 7 and 35 days in advance of the burning operation. All burning operations are required to be notified to the Fire Service before burning commences. The Forest Service of the Department of Agriculture, Fisheries and Food (DAFM) has prepared a draft Code of Best Practice in relation to prescribed burning. A National Forest Fire Risk Warning System set out fire danger rating systems, and fire suppression tactics per fire risk condition. Fire suppression tactics are identified for forest risk conditions -ranging from non-intervention to aerial firefighting. Forest Fire Danger Notices are issued by DAFM during the main wildfire risk season from February through to September. These notices provide forest owners and managers with advance warning of high forest risk weather conditions and permit appropriate readiness measures to be taken in advance of fire outbreaks. Increasing levels of preparation and vigilance are required as the risk levels scale from Green through to Red. **Firebreaks** Gort Wind Farms Ltd has removed some of the flammable vegetation over a 5m wide strip around much of the perimeter of the site to form a firebreak.

Ref. No.	Ref. Heading	Ref. Location	Mitigation Measure
			Emergency Management Plan: The hazards on site have been identified for the operational phase and procedures are in place to address them, as follows: › Accidents. › Fire in control room and/or switchgear room on electrical equipment. › Fire involving wood, paper in control room or in switchgear room. › Forest/gorse fire. › Fire in tower. › Landslide.
Ceased Operational Phase			
Population and Human Health			
MM38	Health and Safety	rEIAR Chapter 5 Section 5.4.4.1	Derrybrien Wind Farm operates a Safety Management System (SMS) which meets the requirements of OHSAS 18001. Derrybrien Wind Farm operates an emergency procedure. This covers procedure in event of accidents, lone working, persons falling into water, forest/gorse fire, fire in wind turbine towers and procedure in event of landslide. Contact details are provided for emergency services, including the local authority and An Garda Síochána.
Land, Soils, and Geology			
MM39	Wind Farm Site: Ceased Operation Phase (2022-2024	rEIAR Chapter 8.6.2.4	Following the decision by An Bord Pleanála to refuse substitute consent for the wind farm in February 2022 there have been no commercial operations at the wind farm. This has had significant mitigating effects on the impact of the wind farm on soils, geology and land, i.e.:

Ref. No.	Ref. Heading	Ref. Location	Mitigation Measure
			› The turbines were turned off to cease electricity generation and the blades were feathered to the wind to reduce the wind loads on the turbine and foundations. › Only essential maintenance has been carried out on the turbines with minimal loading from mobile cranes, trucks or commercial vehicles on the floating roads. › No other wind farm related activities have been carried out on the site.
MM41	Grid Connection: Ceased Operation Phase (2022-2024)	rEIAR Chapter 8 Section 8.6.3.3	***Maintenance/repair of Agannygal substation and control building*** › The following design, construction & operational risk mitigation measures were implemented for the maintenance and repair of the substation and control building: › All maintenance operations were carried out from the hardstanding area around the substation and control building which was designed to support the loads from the vehicles and equipment on the glacial till below the peat.
Air and Climate			
MM42	Ceased Operation Phase Impacts (2022-Present)	rEIAR Chapter 10 Section 10.1.4.4	All site related traffic had speed restrictions on un-surfaced roads.
MM43	Ceased Operation Phase Impacts (2022-Present)	rEIAR Chapter 10 Section 10.2.6.4	Ensured that all maintenance and monitoring vehicles were maintained in good operational order while onsite, and, when stationary, were required to turn off engines thereby minimising any emissions that arose.

Ref. No.	Ref. Heading	Ref. Location	Mitigation Measure
			Material Assets
MM44	Waste Management	rEIAR Chapter 14 Section 14.3.4.3.1	All wastes are managed in accordance with applicable legislation. This waste material is transferred to a Materials Recovery Facility (MRF) by a fully licensed waste contractor where the waste is sorted into individual waste streams for recycling, recovery or disposal.

Table 17-2 Proposed Mitigation Measures

Ref. No.	Ref. Heading	Ref. Location	Mitigation Measure	Audit Result	Action Required
			Retained Development		
			Land, Soils and Geology		
MM45	Wind Farm Site: Post-Decommissioning (The Retained Development)	rEIAR Chapter 8 Section 8.6.2.6	The primary mitigation measure that will be used to mitigate the post-decommissioning impact of the Retained Development is in the compilation and handover of the **Safety File** for the site to the landowner by Gort Windfarms Ltd. Among other information, the Safety File for the site will include: › Construction records from the decommissioning works to confirm compliance with the design and specifications for the works.		

Ref. No.	Ref. Heading	Ref. Location	Mitigation Measure	Audit Result	Action Required
			› Design and as-built construction details for all the elements of the windfarm that have been left in place after decommissioning (the Retained Development), including: o The reinforced concrete bases for the turbines and anemometer masts. o All of the site access tracks including the floating roads on the peat. o The crane hardstanding areas adjacent to the turbines. o The hardstanding area for the substation and control building. o All of the de-energised and disconnected LV electrical cables and fibre-optic cables that are direct-buried in the peat between the turbines and in ducts below the roads. o The construction phase peat repository sites and material sidecast areas. o The construction phase borrow pits. o The site drainage network. › Records of significant maintenance works that have been carried out on the retained elements of the project, including the 2014 upgrade of the floating roads and the 2017 fibre-optic upgrade of the turbine control systems. › Reports on all the full-scale serviceability and proof load tests that have been carried out on the floating roads across the site, which includes the design criteria for the maximum axle loads and live load surcharges from the mobile cranes that govern the capacity of the roads. › Records of all the site investigation works and in-situ tests that were carried out for the project during construction and over the operational and maintenance phase of the project.		

Ref. No.	Ref. Heading	Ref. Location	Mitigation Measure	Audit Result	Action Required
			› Results of stability analyses that have been carried out for the floating roads and peat repository sites. › Geotechnical stability report for the wind farm site including the Peat Stability Risk Assessment (PSRA) for the site and design/construction mitigation measures that have been implemented to mitigate the risk of peat instability for the wind farm activities. › Peat Stability Risk Assessment for the turbary area on the east side of the site, including mitigation measures that have been recommended to manage the risk of peat instability due to mechanical peat harvesting in that part of the site.		
MM46	Wind Farm Site: Post-Decommissioning (The Retained Development)	rEIAR Chapter 8 Section 8.6.3.5	The primary mitigation measure that will be used to mitigate the post-decommissioning impact of the Retained Development is in the compilation and handover of the **Safety File** for the site to the landowner by Gort Windfarms Ltd.		
Aquatic Ecology					
MM47	Monitoring	rEIAR Chapter 7 Section 7.4	During the Prospective Development and for a period of 2 years after its completion, Q-value monitoring be undertaken annually during the May to September period at the following sites on the tributaries and rivers of Owendalulleegh and Boleyneendoorish catchments (as the principal drainage catchments for the Project): Sites O1, O3A, O5, O5A, O7C, O7, O10, B3, B4, B5, OHL1.		

Ref. No.	Ref. Heading	Ref. Location	Mitigation Measure	Audit Result	Action Required
			Electrofishing surveys will be conducted at Sites O5, O5A and O6 in the year that the Prospective Development commences and again on one occasion in the 2-year period following its completion. This will add to the body of fisheries data for the SC7 sub catchment that was affected by the 2003 peat slide and has several fish migration barriers (natural rock outcrops and Forestry Culvert) that are of concern to IFI but are unrelated to the project.		

17.3 Conclusion

This rEIAR has considered the full life-cycle of the Retained Development, including the peat slide event which occurred and the works which took place in response to this. The rEIAR concludes that, while there were significant effects on the environment these effects were short-lived, and that there are no actual or likely significant effects on the environment ongoing, or likely to result from the proposed retention of items of development in situ.

In terms of significant effects on the environment, as is set out in detail in the rEIAR, the most significant effect – the peat slide – has been substantially remediated, and all other potential significant effects have been, or can be remediated by the measures set out in the rEIAR and summarised in the table of mitigation measures set out above. The rEIAR concludes that the proposed Retained Development will not result in any significant adverse effects on the environment either individually or in combination with other projects.

In terms of the adverse effects on the integrity of any European site, as clearly set out in the rNIS, while mitigations measures are set out, there are no such adverse effects requiring remediation. The rNIS which accompanies the application for Substitute Consent concludes that the project has not had and will not have - with the continued implementation of mitigation measures – adverse effects on the integrity of any European site resulting from the carrying out of the development or the proposed retention of items of development in situ.

This rEIAR and the rNIS conclude that the project (including the Retained Development) has not adversely affected nor is likely to adversely affect the integrity of any European site, either individually or in combination with other plans and projects.

GLOSSARY

Hydrology

AA: Appropriate Assessment

AAR: Average Annual Rainfall

ADAS: Agricultural Development and Advisory Service

AEP: Annual Exceedance Probability

BGL: Below Ground Level

CFRAMS: Catchment Flood Risk Assessment and Management Studies

DDF: Depth Duration Frequency

DECLG: Department of the Environment, Community and Local Government

DEM: Digital Elevation Model

DEFRA: Department for Environment, Food and Rural Affairs

EC: European Commission

EEA: European Environment Agency

EEC: European Economic Community

ED: Electoral Division

EIA: Environmental Impact Assessment

EIAR: Environmental Impact Assessment Report

EMP: Engineering and Major Projects

EPA: Environmental Protection Agency

ER: Effective Rainfall

ESB: Electricity Supply Board

EU: European Union

FRA: Flood Risk Assessment

FSU: Flood Studies Update

GCC: Galway County Council

GIS: Geographic Information System

GPA: Guidelines for Planning Authorities

GSI: Geological Survey of Ireland

Ha: Hectares

HA: Hydrometric Area

HEFS: High-End Future Scenario

IH: Institute of Hydrology

IFI: Inland Fisheries Ireland

IPPC: Integrated Pollution Prevention and Control

ITM: Irish Transverse Mercator

LAP: Local Area Plan

LIDAR: Light Detection and Ranging

MIEI: Member of Institute of Engineers Ireland

MRFS: Mid-Range Future Scenario

NHA: National Heritage Area

NRA: National Roads Authority

OHL: Overhead Line

OPW: Office of Public Works

OSI: Ordnance Survey Ireland

PE: Potential Evapotranspiration

Pl: Poor Aquifer except for Local zones

PS: Pole set

QBAR: Mean Annual Flood Flow

QMED: Median Annual Flood Flow

RBD: River Basin District

RBMP: River Basin Management Plan

SAAR: Standard Average Annual Rainfall

SAC: Special Area of Conservation

SC: Subcatchment

SEA: Strategic Environmental Assessment

ShRFB: Shannon Regional Fisheries Board

TII: Transport Infrastructure Ireland

WFD: Water Framework Directive

WMU: Water Management Unit

Noise and Vibration

Ambient: Total noise environment at a location, including all sounds present.

A-weighting: Weighting or adjustment applied to sound level to approximate the non-linear frequency response of the human ear. Denoted by the suffix A in parameters such as LAeq T, LAF10 T, etc.

Background level: A-weighted sound pressure level of residual noise exceeded for 90% of time interval T. Denoted LAF90 T.

Decibel (dB): Unit of noise measurement scale. Based on a logarithmic scale and cannot be simply added or subtracted. A 3 dB difference is the smallest change perceptible to the human ear; a 10 dB difference is perceived as a doubling or halving of sound level.

Emissions: Noise originating from a source under consideration, spreading spherically, hemispherically, or

otherwise into the surrounding environment.

Fast response: 0.125 seconds response time of a sound level meter to changing noise levels. Denoted by the suffix F in parameters such as LAF10 T, LAF90 T, etc.

Interval: Time period T over which noise parameters are measured. Denoted by T in LAeq T, LAF90 T, etc.

LAeq T: Equivalent continuous sound pressure level during interval T, representing the average A-weighted noise level of the ambient noise environment.

LAF90 T: Sound pressure level exceeded for 90% of interval T. Often used to quantify background noise or describe continuous/steady sources in fluctuating environments.

Noise sensitive location: Any dwelling, hotel, hostel, health facility, educational establishment, place of worship, entertainment venue, or area of high amenity that requires an absence of nuisance noise for its proper

Residual level: Noise level remaining when a specific source is absent or does not contribute to the ambient.

Sound pressure: Deviation above ambient atmospheric pressure due to a passing sound wave. The human ear detects sound pressure, and thus acoustic parameters are based on it. Sound pressure level is the ratio of measured sound pressure to a reference value.

Soundscape: Acoustic environment as perceived, experienced, or understood by listeners, taking context into account.

Specific level: LAeq T level produced by a specific noise source under consideration during interval T, measured directly or by estimation or calculation.

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