10 SOILS AND GEOLOGY

10.1 INTRODUCTION

This chapter assesses the potential likely effects on the land, soils and geology environment of the Project. This includes all elements within the Redline Boundary, **Figure 1.2**, the Wind Turbines, Onsite Substation, Site Access Roads, Turbine Hardstands, Permanent Spoil Storage and all site infrastructure. This Chapter also provides a description of the work required along the Grid Connection (GC) route and the Turbine Delivery Route (TDR). Where adverse effects are predicted, the chapter identifies appropriate mitigation strategies therein. The assessment will consider the potential effects during the following phases of the Project:

- Construction of the Project
- Operation of the Project
- Decommissioning of the Project (final phase)

The Project refers to all elements of the application for the construction, operation and Decommissioning of the proposed Carrigeen Renewable Energy Development (**Chapter 2: Project Description**).

This chapter of the EIAR is supported by Figures provided in **Volume III** and by the following Appendix document provided in **Volume IV** of this EIAR:

- **Figures A1 & A-1 – Solid Geology**
- **Figures A2 & A2-1 – Superficial Geology**
- **Figures A3 & A3-1 – Groundwater Features, Karst, Springs and Abstraction Points**
- **Figures A4 & A4-1 – Landslide Susceptibility**
- **Figure A5 – Recorded Landslide Events**
- **Figure A6 – Active Quarries and Mineral Occurrences**
- **Figure A7 – Geological Audited and Unaudited Sites**
- **Figures A8 & A8-1 – Groundwater Vulnerability**
- **Figures A9 & A9-1 – Groundwater Resources/ Bedrock Aquifer Potential**
- **Figures A10 & A10-1 – Bedrock Aggregate Potential**
- **Figure SD1 – Proposed Spoil Deposition and Floated Track Arrangements**

- **Appendix 10.1 – Preliminary Site Investigation Report**
- **Appendix 10.2 – Borrow Pit Assessment**

- **Appendix 10.3 – Peat Landslide Hazard Assessment**

This assessment should be read in conjunction with:

- **Chapter 6: Biodiversity**
- **Chapter 9: Aquatic Ecology**
- **Chapter 11: Hydrology and Hydrogeology**
- **Chapter 16: Material Assets and Other Issues**

A Construction Environmental Management Plan (CEMP) is also appended to the EIAR in **Appendix 2.1**. This document will be further developed and agreed with the local authority at the pre-construction phase, once a contractor has been appointed. The CEMP will cover the construction of the Project. It will include all of the mitigation recommended within the EIAR. (Refer to **Section 1.2** of **Chapter 1: Introduction** of the EIAR for Defined Terms associated with this chapter).

10.1.1 Assessment Structure

In line with the EIA Directive (Directive 2014/52/EU)[1], current EPA Guidelines on the information to be contained in Environmental Impact Assessment Reports (2022), S.I. No. 296/2018 - European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018S.I. and Institute of Geologists of Ireland (IGI) (2013) Guidelines for the Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements; the structure of this soils and geology chapter is as follows:

- Details of the assessment methodology utilised for desk and field studies, in the context of legal and planning frameworks.
- Description of baseline conditions at the site.
- Identification and assessment of effects to soils and geology associated with the Project, during the construction, operational and Decommissioning phases of the Project.
- Mitigation measures to avoid or reduce the effects identified.
- Identification and assessment of residual impact of the Project considering mitigation measures.
- Identification and assessment of cumulative effects, if and where applicable.

[1] Refers to Directive 2011/92/EU of the European Parliament and of the Council of 13 December 2011 on the assessment of the effects of certain public and private projects on the environment as amended by Directive 2014/52/EU.

10.1.2 Development Description

10.1.2.1 Wind Farm Site

Permission is being sought by the Applicant for the construction of 11 No. Wind Turbines, an Onsite Substation, installation of c. 17.5km 110kV cable connecting onsite substation to the Flagford 220kV substation (the Grid Connection), Site Access Roads, and other ancillary works. Temporary accommodation requirements at locations along the TDR are not included in the planning application but are assessed as part of the EIAR.

The Project will comprise:

- 11 no. wind turbines with an overall turbine tip height of 185m, turbine hub height of 103.5m, and rotor blade diameter of 163m and a meteorological mast with a height of 30m, and subsequent decommissioning of the wind turbines and meteorological mast, following a 35 year operational life from the date of full commissioning of the wind turbines;
- Associated wind turbines and meteorological mast foundations and hardstanding areas,
- A 110kV substation compound (Including control buildings (with a combined floor area of 594m2) with welfare facilities, all associated electrical plant and apparatus, security fencing, underground cabling, lightening protection poles, underground wastewater holding tank, site drainage and all ancillary works);
- Underground electrical (110kV) and communications cabling from the proposed 110kV substation to the existing Flagford 220kV substation (including joint bays, communication chambers, earth sheath links, and ancillary works along the underground electrical cabling route). This cabling route is primarily located within the public road corridor;
- Underground electrical (33kV) and communications cabling connecting the wind turbines and meteorological mast to the proposed 110kV substation;
- 6 no. temporary construction compounds (including site offices and welfare facilities,
- Junction accommodation works to facilitate construction access and turbine delivery to the site (off the existing N5 and new N5 national road, and L5642 and L1217 Local Roads), including a new temporary access road off the existing N5 to the L56402,
- Upgrade of existing roads/ tracks and provision of new site access roads, junctions and hardstand areas (including of the L1217, L56402, L5642, L56421, L56492 and L56491 Local Roads), including new gated site entrances at each junction,
- 2 no. Borrow Pits;
- Peat & Spoil Management;
- Site Drainage;

- Tree felling and vegetation removal;
- Biodiversity enhancement measures;
- Operational stage site signage; and
- All associated site development works and apparatus.

The applicant is seeking a 10 year permission and an operational period of 35 years for the wind turbines, meteorological mast and site signage from the date of full commissioning of the wind turbines. A permanent planning permission is being sought for all other works.

10.1.2.2 Land Take

The land holdings, within the Redline Boundary associated with the Wind Farm Site, consist of a combination of commercial forestry, raised bogland containing areas of peat harvesting and agricultural pasture grazing lands.

The GC and TDR consist of public roads and their verges.

10.1.2.3 Forestry Felling

Wind Turbines T1, T4, T5, T6, T7, T10, and T11 are located within commercial forestry. Consequently, tree felling will be required as part of the Project to facilitate the construction. It is estimated that c. 43.9 ha of commercial coniferous forestry will need to be clear-felled in order to provide the minimum necessary to facilitate construction of the Project and to comply with any environmental mitigation (bats in particular).

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

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

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

All construction of Site Access Roads, including the creation of buffer zones and roadside drainage, will take into consideration the appropriate edition of the following specifications, which have been developed by the Forest Service:

- Forest Protection Guidelines.
- Forestry and Water Quality Guidelines.
- Forest Harvesting and Environmental Guidelines.
- Forestry and Freshwater Pearl Mussel Requirements - Site Assessment and Mitigation Measures.
- Forest Biodiversity Guidelines.
- Forestry and The Landscape Guidelines.
- Forestry and Archaeology Guidelines.

10.1.2.4 Site Entrances

There are 5 proposed site entrances. Site entrance 1 is a new site entrance to the south-west of the Wind Farm Site located off the N5 at Leggatinty. Site entrance 4 is an existing site entrance located in the south-west of the Wind Farm Site off the N5 Ballaghaderreen to Scramogue Road at Carrigeencreeha,. Site entrance 2 is north-west of the Wind Farm Site located off the L1217 at Cloonshanville. Site entrance 3 is north-west of the Wind Farm Site located off the L1217 at Loughbally. Site entrance 5 is south-east of the Wind Farm Site located off local road at Edenan and Kinclare.

The Turbine Delivery Route and the Construction Haul Route will utilise site entrance 1 and site entrance 4 as the primary points of access.

Further information in this respect can be found in **Chapter 2: Project Description, Figure 2.3** and **Chapter 16: Traffic and Transport.**

10.1.2.5 Haul Route

It is proposed abnormal loads will use site entrance 1 and site entrance 4 as primary access points for access into the Wind Farm Site. Further information can be found in **Chapter 2: Project Description** and **Chapter 16: Traffic and Transport**.

10.1.2.6 Turbine Delivery Route

It is proposed that the Wind Turbine nacelles, tower hubs, turbine towers, and rotor blades will be landed at Galway Port from their country of origin. From there they will be transported to the Wind Farm Site via the L5048, R339, N83, N17 and N5 to the upgraded site entrances.

Temporary accommodation requirements will be required to accommodate the delivery of the Wind Turbine components. These temporary works are assessed as part of this EIAR. **Section 2.5.4 in Chapter 2: Project Description Table 2.3** details the route of the TDR along with the nature of the upgrade works required. Further details regarding these work locations on the TDR between Galway Port and the Wind Farm Site are outlined in **Appendix 16.3.**

10.1.2.7 Grid Connection (GC)

The circa c. 17.5km Grid Connection (GC) from the Onsite Substation, **Figure 2.4**, will connect to the existing Flagford 220kV Substation.

The GC will exit the Onsite Substation east onto the Local Road L-1217 travelling for approximately 3.7km before turning north onto the L-5650. While travelling along the L-5650 the route crosses the N61, the route then continues in a northeasterly direction along the L-5650, L-6019, L-600, R368 and L-1034 for 11.5km before reaching Flagford 220kV Substation.

The electricity will be transmitted as a three-phase power supply in three individual conductors, laid in separate ducts. The width of a 110kV cable trench with a trefoil formation will be 600mm and the depth of the trench approximately 1.3m. Separate ducts will also be provided within the same trench for fibre optic communications

These circuits will be laid primarily in ducts within the Public Roads using the "open dig" method installation, except for at 4 No. watercourse crossings where Horizontal Directional Drilling (HDD) methods will be employed (3 on the Grid Connection at WC01, WC05, & WC07 and 1 on the Internal Cabling). Refer to **Section 2.5.9.4 in Chapter 2: Project Description** for further details.

10.1.2.8 Borrow Pits

Two Borrow Pits will be constructed as part of the Project, as per **Figure 1.2**.

Borrow Pit BP1 will be located to the west of T6 and will extend to approximately 23,788m^2. Borrow Pit BP2 will be located to the east of T6 and to the south of T5 and will extend to 26,977m^2.

It is estimated that the Borrow Pits will provide c.240,000m^3 excavated material to provide fill for the Site Access Roads, Turbine Hardstands, upfill to Turbine Foundations and the

Temporary Construction Compounds. The Borrow Pits will be excavated only as required and where rock and fill material is available from the excavation of Turbine Foundations this material will be used first. The use of on-site Borrow Pits is expected to considerably reduce the need to transport material from off-site quarries.

Site investigation works indicate that the bedrock is overlain by 3 – 8m of overburden, is variably weathered, and initially rock weak. Details of the site investigations that were carried out and the stone type/suitability are provided in **Appendix 10.2**.

When the Borrow Pits are no longer required, they will be used for long-term storage of any surplus inert material such as peat and subsoil from the Wind Farm Site, which will be allowed to vegetate naturally and made secure using permanent stock proof fencing.

The rock will primarily be extracted from the proposed Borrow Pits using rock breaking.

10.1.2.9 Temporary Construction Compounds

Six Temporary Construction Compounds will be constructed and established upon commencement of the construction phase. The proposed location for the individual Temporary Construction Compounds are shown in **Figure 1.2** with layout details shown on **Drawing No. 6575-JOD-CGWF-XX-DR-C-0801 - 0805.** These Temporary Construction Compounds will be used as a secure storage area for construction materials and to contain temporary site accommodation units for staff welfare facilities.

A suitably bunded area within the Temporary Construction Compounds will also be used for the storage of fuel and oils. This bunded area will be lined with an impermeable membrane in order to prevent any contamination of the surrounding soils, vegetation and water table. Double protection containers / equipment will be used along with drip trays and details are included in the **CEMP**, included as **Appendix 2.1**.

During the construction phase, the maximum wastewater production is estimated to be the same as the maximum water consumption (2,000 litres per day). The Project will include an enclosed wastewater management system at the Temporary Construction Compounds capable of handling the demand during the construction phase with 80-100 construction workers on site at peak. This wastewater will be held in a holding tank and will be removed off-site weekly, by a licensed wastewater disposal company and disposed at an appropriate licenced facility.

10.1.2.10 Spoil Management

Excavated material will be retained on-site and used onsite in several ways.

Selected excavation material will be employed as construction fill, as ballast over the top of Turbine Foundations and for reprofiling and landscaping.

If spoil is surplus to requirements, it will be stored within long-term spoil repositories for reuse during Decommissioning. Long-term deposition of spoil will take place at the following locations:-

- Adjacent to turbines T2, T4, T5, T6, T7, T10 and T11
- At Borrow Pits BP1 and BP2
- Within trackside berms consisting consist of side cast soil, covered with peat, maintaining a distance of c. 5 m from the Site Access Roads and other site infrastructure.

Permanent spoil repository areas are shown on **Figure SD1**.

Any small quantities of excess spoil material that cannot be reused on the Wind Farm Site will be re-used offsite.

The quantities of spoil likely to be generated at the Wind Farm Site have been calculated by Whiteford Geoservices Ltd. and checked by Jenning O'Donovan & Partners. It is estimated that that based on site surveys, the amount of spoil predicted to be generated during construction of the wind farm infrastructure will be approximately 352,316 m^3.

A further 13,627m^3 of spoil arisings from the trench excavation for the GC will all be disposed of, off-site, to a suitably licenced facility.

Management Plan No. 4 (MP4): Spoil Management Plan, contained within the **CEMP Appendix 2.1**, contains the calculation of spoil volumes and how spoil will be managed onsite.
Excavated material for reuse and for long-term storage on-site will be managed in accordance with the **Spoil Management Plan** contained as part of the **CEMP** in **Appendix 2.1**.

10.1.3 Statement of Authority

This Chapter of the EIAR has been prepared by John Whiteford, Whiteford Geoservices Limited (WGL).

John Whiteford BSc (Hons) Geophys AMIOSH MEAGE FGS has more than 25 years of experience in the field of earth sciences, geotechnical engineering and management. His academic qualifications are a BSc with Honours in Geophysics from Edinburgh University, with memberships of The European Association of Geoscientists and Engineers and The Institute of Safety and Health.

John Whiteford has been engaged in full-time consultancy for the past 25 years and since 2000 trading as Whiteford Geoservices Limited. The company and its staff of professional and technical personnel have completed in excess 2200 contracts for clients within the Soils and Geology Assessment discipline, where they have built up a recognised level of specialist experience, particularly in the field of Wind Energy.

Working in Ireland, UK, in Europe and worldwide the company has been involved in more than 130 wind power projects of which the following are typical examples:

- 29 Turbine 101MW Yellow River Wind Farm, Killnure, Co. Offaly.
- 8 Turbine 16.8MW Sheskin Wind Farm, Bellacorrick, Co. Mayo.
- 2 Turbine 4.6MW Templederry Wind Farm, Nenagh, Co. Tipperary.
- 1 Turbine 0.9MW Clooncon East Single Turbine, Taum, Co. Galway.
- 6 Turbine 14MW Tullynamoyle 2 Wind Farm, Co. Leitrim.
- 5 Turbine 17MW Killala (Phase 1) Wind Farm, Killala, Co. Mayo.
- 5 Turbine 10MW Hornberget Wind Farm, Mala, Sweden; and
- 23 Turbine 21MW Wigton Wind Farm Phase I, Mandeville, Jamaica.

The field work and interpretative reporting was designed and executed by members of the following project team:

1. Mr Ryan Calvert BSc (Hons) Forensic Science – Technical Director. (17 years' experience).
2. Mr James Ardern BSc (Hons) Geology, Senior Project Geologist. (18 years' experience)
3. Mr Jamie Stothers – Technician. (9 years' experience).

10.2 ASSESSMENT METHODOLOGY AND SIGNIFICANCE CRITERIA

10.2.1 Assessment Methodology

The following assessments were undertaken in order to evaluate the potential effects of the Project on the soils, geology and ground stability aspects of the environment at the Wind Farm Site, the Grid Connection (GC) and the Turbine Delivery Route (TDR):

- Characterise the topographical, geological and geomorphological regime of the Wind Farm Site, the GC and the TDR from the data acquired through desk study and onsite surveys.
- Consider ground stability issues as a result of the Project, its design and methodology of construction.
- Assess the combined data acquired and evaluate any likely effects on the soils, geology and ground stability aspects of the environment.
- If effects are identified, consider measures that would prevent, mitigate or reduce the identified effects.
- Present and report these findings in a clear and logical format that complies with EIAR reporting requirements.

10.2.2 Study Area

The study area is defined as the region within which changes to the soils and geology environment associated with the Project could reasonably impact sensitive receptors. All potential effects of the Project have a limited zone of influence and for these the Study Area has been limited to 2km from the Redline Boundary, in line with the methodology outlined in the 2013 IGI Guidelines for Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements.

However, there is also the potential for the zone of influence to be greatly extended, for instance soil contamination by watercourses. In such a case effects can potentially impact receptors downstream, in excess of 2km from the Redline Boundary. For this reason, potential indirect impacts on sensitive receptors up to 10km away have been reviewed for the assessment.

10.2.3 Assessment Principles

Direct impacts or effects on geological attributes or the properties of soils and rock formations are mainly localised in the context of soils and geology (e.g., excavated soils from excavations, stored and used as back fill). However, during all phases of the works, soils and geology impacts give rise to potential sources of contamination being spread by water run-off (i.e., indirect or secondary impacts) affecting ecological and hydrological

receptors. For example: Contamination of the soils and geology by chemicals, cementitious construction material, or silt, is considered a localised impact, but should this contamination be intercepted by surface water or groundwater bodies the impact is potentially regional, depending on the environmental circumstances. Therefore, throughout this chapter references will be made to **Chapter 11: Hydrology and Hydrogeology,** for further detail and clarification on potential effects and mitigation measures proposed for the Project.

10.2.4 Relevant Legislation and Guidance

This assessment complies with the European Directive 2011/92/EU as amended by Directive 2014/52/EU which requires Environmental Impact Assessment for certain types of major development before project consent is granted. This assessment was undertaken in accordance with the following Irish legislation (transposition of the aforementioned directive):

- SI No. 600 of 2001 as amended: Planning and Development Regulations 2001 to 2023.
- Planning and Development Act 2000 to 2025

In addition to this the following planning legislation, environmental legislation relevant to geological, geotechnical, hydrological and hydrogeological aspects of the environment have been referred to:

- The Heritage Act 1995 (as amended),
- The Wildlife Acts, 2000-2022.European Union (Invasive Alien Species) Regulations 2024;Waste Management Acts 1996-2024.
- European Communities Act, 1972
- S.I. No. 547/2008 - European Communities (Environmental Liability) Regulations 2008
- S.I. No. 323/2020 European Union (Waste Directive) Regulations 2020.
- Directive 2000/60/EC, 2000 "Establishing a framework for community action in the field of water policy".

Geographically, the Wind Farm Site and Grid Connection route is located within County Roscommon and consequently, the Roscommon Development Plan (2022-2028) has also been consulted as part of the EIA process.

Other guidance documents employed to assist with the production of this assessment report are as follows: -:

- BSI (2015 + A1 2020) Code of Practice for Site Investigations - BS 5930

- CIRIA (2006) Control of Water Pollution from Linear Construction Projects – Technical Guidance
- Creighton, R. et al. (2006) Landslides of Ireland Department of Environment, Community and Local Government (DECLG) (August 2018),
- Guidelines for Planning Authorities and An Bord Pleanála on Carrying Out Environmental Impact Assessment (DHPLG, 2018).
- DHPLG (2017) Interim Guidelines for Planning Authorities on Statutory Plans, Renewable Energy and Climate Change and Wind Energy Development Guidelines 2006
- Department of Housing, Planning and Local Government (2019) Draft Revised Wind Energy Development Guidelines
- Guidance on the preparation of the EIA Report (Directive 2011/92/EU as amended by 2014/52/EU), (European Commission 2017).
- European Commission (EC) (2021) EU Soil Strategy for 2030
- Environmental Protection Agency (EPA) (2015) Advice Notes for Preparing Environmental Impact Statements – DRAFT September 2015 (Supersedes 2003 version)
- EPA (2022) Guidelines on the Information to be Contained in Environmental Impact Assessment Reports
- EPA (2022) EPA Map Viewer
- Feehan, J. and O'Donovan, G. (1996) The bogs of Ireland
- Geological Survey Ireland (GSI) Geological Survey Ireland Spatial Resources
- Gharedaghloo, B. (2018) Characterizing the transport of hydrocarbon contaminants in peat soils and peatlands
- Institute of Geologists of Ireland (IGI) (2002) Geology in Environmental Impact Statements – A Guide
- IGI (2013) Guidelines for the Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements
- Irish National Seismic Network (INSI) (2022) Recent Earthquakes
- Irish Wind Energy Association (IWEA) (2012) Best Practice Guidelines for the Irish Wind Energy Industry
- Johnston, W. (2022) Physical Landforms of Ireland
- National Roads Authority (NRA) (2008) Guidelines on Procedures for the Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes
- NPWS (2015) National Peatlands Strategy
- NPWS (2017) Best practice in raised bog restoration in Ireland

- NRA (2008) Environmental Impact Assessment of National Road Schemes – A Practical Guide – Rev 1
- NRA (2014) Guidelines for the Management of Waste from National Road Construction Projects
- Scottish Forestry Commission (2006) "Guidelines for the Risk Management of Peat Slips on the Construction of Low Volume / Low-Cost Roads Over Peat"
- Scottish Government (2017) Peat Landslide Hazard and Risk Assessment: Best Practice Guide for Proposed Electricity Generation Developments
- Scottish National Heritage (SNH) (2013) A Handbook on Environmental Impact Assessment
- Teagasc (2022) Soil Map Viewer

10.2.5 Desk Study

Desk study information has been interpreted to establish the preliminary baseline conditions within the Study Area ahead of the site investigations and has been employed for both preliminary layout design as well as for design of the site investigation works.

The desk study, consisting of a review of datasets, information, and literature resources relevant to the Wind Farm Site and Grid Connection, has been completed and includes the following sources and preliminary assessment elements:

- Analysis of Geological Survey of Ireland (GSI) Geological, Geotechnical and Geological Heritage site mapping (www.gsi.ie) – last accessed 18/06/2025
- Analysis of Geological Survey of Ireland (GSI) Groundwater, Landslides and Aggregate Potential mapping (www.gsi.ie) – last accessed 18/06/2025
- Analysis of Environmental Protection Agency (EPA) online mapping database (www.epa.ie) – last accessed 18/06/2025

This desk study analysis involved assessment of the following components within the Study Area:

- Review of Project specific maps and drawings detailing the proposed infrastructure.
- Study and assessment of the proposed locations of Wind Turbines, Site Access Roads, Onsite Substation, Permanent Met Mast, other ancillary infrastructure, TDR, Construction Haul Routes and GC relative to available data on topography and slope gradients.
- Study and assessment of the proposed locations of Wind Turbines, Site Access Roads, Onsite Substation, Permanent Met Mast, other ancillary infrastructure, TDR,

Construction Haul Routes and GC relative to available data on soils, subsoil and bedrock geology.

- Screen for the presence of peat organic soils and identify if Peat Landslide Hazard Assessment (PLHA) is applicable.
- Overlay Ordnance Survey of Ireland (OSI) 1:250,000, 1:50,000 and 1:10,560 (6") mapping with proposed layout arrangements, to identify potential geohazards ahead of walkover survey.
- Overlay Geological Survey of Ireland (GSI) Geology maps (1:100,000) to determine site bedrock and superficial soils geology together with the presence of any major faults, features or other anomalies.
- Overlay Geological Survey of Ireland (GSI) Groundwater Karst and Groundwater Wells and Springs maps (1:100,000) to determine the location of potential karst features and private / public water supplies.
- Overlay Environmental Protection Agency (EPA) and Teagasc (Agricultural Agriculture & Food Authority) Soils and Subsoil maps (1:50,000) to determine categories of soils and subsoil.
- Overlay Geological Survey of Ireland (GSI) Landslide Susceptibility maps to determine site landslide susceptibility risk classification.
- Search of the GSI landslide database for records of landslide mass movement events at and near the Study Area.
- Overlay Geological Survey of Ireland (GSI) Aggregate Potential maps (1:100,000) to determine the economic value of "site won" aggregate.

10.2.6 Field Work

10.2.6.1 Preliminary Geotechnical Investigations, Site Walk Over and Observations

After completion of the desk study, initial site walkover survey and stage 1 peat landslide hazard assessment was undertaken by John Whiteford, James Ardern and Jaime Stothers between September 2024 and 11th October 2024. These works consisted of the following activities:

- Walkover Survey reconnaissance of the main infrastructure to identify, sensitive receptors with respect to effects relating to soils and geology, as well as potential areas for spoil deposition. At this time, the site was also assessed for general stability, with a search undertaken for potential pre-failure indicators, failure preconditions and potential triggering mechanisms in relation to soil movement/failure evident at the Wind Farm Site.
- Review of bedrock outcrops, along with sub-soils and soil characterisation at proposed Wind Turbine locations.

- Screening for the presence of peat soils at the main infrastructure and on a coarse grid (100m x 100m) across the extent of the lands under client control. These works consisted of a total of 814 no. peat thickness probes (using "depthing" rods) to confirm peat thickness.
- 13 No. locations for gouge coring, in-situ shear strength testing and classification of peat soils according to von Post.

Refer to Report 2278-24A Preliminary Site Investigation Works for Construction of New Wind Turbines, Access Tracks and Associated Infrastructure, contained in **Appendix 10.1**.

Following completion of the layout design process, the main ground investigation campaign was undertaken, by John Whiteford and James Ardern, between 12th May 2025 and 6th June 2025. The purpose of these works to confirm ground conditions at the specified Wind Turbines, Permanent Met Mast, Onsite Substation, as well as average conditions for the Site Access Road network, ancillary infrastructure, Permanent Spoil Storage area, TDR and GC. These investigations consisted of both Stage 2 detailed peat landslide hazard assessment and further Site Investigation fieldwork to allow for preliminary foundation design, as follows:-

- Excavation of 12 no. trial holes (11 No. Wind Turbines and the Onsite Substation) to assess ground conditions and their variation across the Wind Farm Site, to a maximum depth of 4.50m below existing ground level. These excavations also served to provide ground truthing in respect of the GSI mapping data previously consulted.
- 23 No. Electrical Resistivity Tomography (ERT) profiles undertake, at the specific location of Wind Turbine infrastructure a maximum depth of 15m below existing ground level.
- Detailed mapping of the thickness of peat soils within the wind farm construction footprint (Wind Turbines, Turbine Hardstands, Site Access Roads, Onsite Substation, Borrow Pits, Permanent Spoil Storage areas, Internal cabling and ancillary structures). These works consisted of a total of 1695 no. additional peat thickness probes (using "depthing" rods) to confirm peat thickness.
- 27 No. extra locations for gouge coring, in-situ shear vane testing to determine undrained soil shear strength and assessment of peat decomposition, according to von Post.

As a result of the preliminary assessment, peat soils were identified as a potential risk with respect to the Project. To further assess the significance of the risk from peat stability and landslide hazard, detailed site investigations were performed as per the recommendations

contained in the Peat Landslide Hazard and Risk Assessment: Prepared for Energy Consents Unit, Scottish Government Second Edition 2017, hereinafter referred to as "the Scottish guidance".

10.2.7 Evaluation of Potential Effects

10.2.7.1 Sensitivity

Table 10.1: Criteria for Rating Site Attributes – Soils and Geology Specific

Importance	Criteria
Extremely High	Attribute has a high quality or value on an international scale.
Very High	Attribute has a high quality, significance or value on a regional or national scale.
High	Attribute has a high quality, significance or value on a local scale.
Medium	Attribute has a medium quality, significance or value on a local scale.
Low	Attribute has a low quality, significance or value on a local scale.

Table 10.2: Criteria for Rating Site Sensitivity – Soils and Geology Specific

Importance	Criteria
High Sensitivity	Attribute has a high quality, significance or value on a local or regional scale. Degree or extent of soil contamination is significant on a local or regional scale Volume of peat and/or soft organic soil underlying route is significant on a local or regional scale.
Medium Sensitivity	Attribute has a medium quality, significance or value on a local scale. Degree or extent of soil contamination is moderate on a local scale Volume of peat and/or soft organic soil underlying route is moderate on a local scale.
Low Sensitivity	Attribute has a low quality, significance or value on a local scale. Degree or extent of soil contamination is minor on a local scale Volume of peat and/or soft organic soil underlying route is small on a local scale

10.2.7.2 Magnitude

Table 10.3: Describing the Magnitude of Effects

Magnitude of Impact	Description
Imperceptible	An impact capable of measurement but without noticeable consequences.
Slight	An impact that alters the character of the environment without affecting its sensitivities.
Moderate	An impact that alters the character of the environment in a manner that is consistent with the existing or emerging trends.
Significant	An impact, which by its character, magnitude, duration or intensity alters a sensitive aspect of the environment.
Profound	An impact which obliterates all previous sensitive characteristics.

Table 10.4: Qualifying the Magnitude of Impact on Soil and Geological Attributes

Magnitude of Impact	Description	Example
Large Adverse	Results in a loss of attribute.	Removal of the majority (>50%) of geological heritage feature.
Moderate Adverse	Results in impact on integrity of attribute or loss of part of attribute.	Removal of part (15-50%) of geological heritage feature.
Small Adverse	Results in minor impact on integrity of attribute or loss of small part of attribute.	Removal of small part (<15%) of geological heritage feature.
Negligible	Results in an impact on attribute but of insufficient magnitude to affect either use or integrity.	No measurable changes in attributes.
Minor Beneficial	Results in minor improvement of attribute quality.	Minor enhancement of geological heritage feature.
Moderate Beneficial	Results in moderate improvement of attribute quality.	Moderate enhancement of geological heritage feature.
Major Beneficial	Results in major improvement of attribute quality.	Major enhancement of geological heritage feature.

10.2.7.3 Significance Criteria

Table 10.5: Weighted Rating of Significant Environmental Effects

Sensitivity (Importance of Attribute)	Magnitude of Impact			
	Negligible (Imperceptible)	**Small Adverse (Slight)**	**Moderate Adverse (Moderate)**	**Large Adverse (Significant to Profound)**
Extremely High	Imperceptible	Significant	Profound	Profound
Very High	Imperceptible	Significant / Moderate	Profound / Significant	Profound
High	Imperceptible	Moderate / Slight	Significant / Moderate	Profound / Significant

Sensitivity (Importance of Attribute)	Magnitude of Impact			
Medium	Imperceptible	Slight	Moderate	Significant
Low	Imperceptible	Imperceptible	Slight	Slight / Moderate

10.2.8 Scoping Responses and Consultation

Table 10.6: Scoping Responses and Consultation

Consultee	Type and Date	Summary of Consultee Response with Relevance to This Chapter	Addressed
Health Service Executive (HSE)	Outline of response received (letter dated 17th April 2025)	The HSE made the following observations: • The Developer should consider the findings of the High Court judgement issued in the judicial review of the Derryadd Wind Farm. (2021 IEHC 390 [20202 No. 557 JR] P. Sweetman v An Bord Pleanála), with regard to general noise considerations of noise and wind farms the judgement in [2024] IEHC 136 [2018 8457 P] MARGARET WEBSTER AND KEITH ROLLO AND MEENACLOGHSPAR (WIND) LIMITED. • It is the experience of the National Environmental Health Service Submission Report (NEHS) that impacts on human health are often inadequately assessed in EIAs in Ireland. It is recommended that the wider determinants of health and wellbeing are considered in a proportionate manner when considering the EIA. Guidance on wider determinants of health can be found at www.publichealth.ie . • The NEHS recommends that the following matters are included and assessed in the EIAR Public Consultation Population and human health Decommissioning phase of the Project Siting and location of turbines Noise & Vibration Shadow Flicker Air Quality Surface and Groundwater Quality Ancillary facilities Cumulative impacts Climate Health gain • It is recommended that early and meaningful public consultation with the local community is undertaken to ensure all potentially significant effects	All items considered during the EIA process. No implications for the EIA/Design.

Consultee	Type and Date	Summary of Consultee Response with Relevance to This Chapter	Addressed
		of the Project have been adequately addressed.	
Geological Survey of Ireland (GSI)	Outline of response received (letter dated 16th April 2025)	The GSI made the following observations: • We recommend using our various data sets when conducting the EIAR, planning and scoping processes for the Project. • Should the Project go ahead, all other factors considered, GSI would much appreciate a copy of reports detailing any site investigations carried out. The data would be redacted for confidentiality and added to GIS's national database of site investigation boreholes, implemented to provide a better service to the civil engineering sector. Data can be sent to the Geological Mapping Unit, at GeologicalMappingInfo@gsi.ie.	All items considered during the EIA process. No implications for the EIA/Design. The data sets available from the GIS website were used in this EIAR for various topics (where applicable). Any further information can be provided to the GIS upon request.

10.3 BASELINE DESCRIPTION

10.3.1 Introduction

An initial investigation of the existing land, soils and geology characteristics of the Study Area was conducted by undertaking a desk study, consultation with relevant authorities and site-based fieldwork surveys.

All data collected has been interpreted to establish the baseline soils and geology conditions within the Study Area and the significance of any potential adverse effects have been assessed. The assessment of potential soils and geology effects is detailed in **Section 10.4.**

10.3.2 Land Use

10.3.2.1 Wind Farm

Land use within the Wind Farm Site consists of blanket peat and turbary with areas of improved grassland used for agricultural pastureland and extensive areas of commercial forestry.

10.3.2.2 Turbine Delivery Route / Construction Haul Routes

The Turbine Delivery Route and Construction Haul Routes consist mainly of public roads with only short sections on private roads. Although enabling works will be undertaken at a total of 16 no. locations only 3 no. locations will require temporary land take, as follows:

- Temporary access road will be constructed between the realigned N5 and existing N5.
- Road widening will be undertaken at the junction between the realigned N5 at the L5642 junction.
- Road widening will also be undertaken in third party lands on both the L5642 and L56421 local roads.

Refer to **Chapter 2: Project Description, Table 2.3** for details.

10.3.2.3 Grid Connection

Approximately 17.5km of underground cable (the Grid Connection) will connect the Onsite Substation to the National Grid at the existing Flagford 220kV Substation. The majority of this route is located within public roads, with a short section exiting the Wind Farm Site located adjacent to the Site Access Roads. Installation works will consist of "open dig" methods to place the new 110kV circuits within a series of underground ducts either within the public road or its adjacent verges. HDD drilling will be employed at 4 no. watercourse crossings (3 on the Grid Connection at WC01, WC05, & WC07 and 1 on the Internal Cabling).

10.3.3 Topography

Analysis of topographic information indicates that the proposed Wind Farm element of the Project located between Frenchpark and Elphin, Co. Roscommon, where it occupies a predominantly flat or gently sloping lands which consist of raised peat bog, with improved lands and forestry on the fringes. The associated grid connection is located within and along the edge of public roads between the proposed Substation and Flagford 220kV Substation.

Ground elevations within the Wind Farm Site vary from 64m to 82m above sea level (Malin Head OD). Slope gradients within the majority of the Wind Farm Site are between 0 and 3 degrees to the horizontal. Ground elevations along the Grid Connection vary between 65m and 127m above sea level (Malin Head OD). Slope gradients along the Grid Route are between 0 and 6 degrees to the horizontal.

10.3.4 Bedrock Geology

According to the GSI online database, the Wind Farm Site and Grid Connection footprint is immediately underlain by the following rock formations (Refer to **Figures A1** and **A1-1)**

- Ballymore Limestone Formation – Unbedded limestones with shale partings.

- Boyle Sandstone Formation – quartz-rich sandstone with subordinate finer units.
- Croghan Limestone Formation – Thick-bedded limestones with shale and chert partings.
- Bricklieve Formation – Interbedded Limestones and calcareous shales.

The above-mentioned rock formations are soluble and are somewhat susceptible to the formation of karst features, with the risk being low to medium. Karst landscapes can be problematic for construction, as the underlying rock formations tends to be both deeply weathered and may dissolve under the action of groundwater. Resulting in features such as sinkholes, subterranean drainage systems and other potential sources of instability.

Such conditions have significance for foundation design and the stability of wind farm infrastructure. That being said, no dissolution /karst features such as sinkholes, subterranean watercourses or significant springs were recorded by GSI within the Wind Farm Site and limited evidence was observed during the site walkover surveys. Geophysical investigation carried out to screen for the presence of karst at the main infrastructure, observed significant weathering at the original location for the T6 Wind Turbine, resulting in its relocation. Refer to Figures in **Appendix 10.1**. None of the other locations recorded such features. Following the geophysical surveys and adjustment of the wind farm layout, the risk relating to karst features was re-assessed to be low. (Refer to **Figures A3** and **A3-1**).

Karst features are present along the GC, however due to their limited depth and limited scale of the construction works, the risk is considered I**mperceptible** and **Not Significant.**

10.3.5 Seismic Activity

Faults and other discontinuities can be associated with groundwater pathways as well as seismic movement and will be considered for the purpose of detailed design. However, the Irish landmass is one of the least seismically active regions in the World, where no significant earthquakes (ML ≥ 5.4) have been recorded since records began.

The most significant seismic event recorded in Ireland by the British Geological Survey was a low energy, 3.70 magnitude seismic event, that occurred on 11th January 1951 within the Irish Sea, more than 100km from the Wind Farm Site. In light of the above an assessment has been made with regard to the likely effects from such seismic activity. This has determined that any ground movement recorded can be expected to be negligible with respect to the Project proposed; where Peak Ground Accelerations can be expected to be

in the order of 0.02g[2]. Such ground accelerations are considered to be **Imperceptible** and **Not Significant**.

10.3.6 Soils and Subsoils

Superficial soils (**Figures A2** and **A2-1**) present within the Redline Boundary largely consists of cut-over raised peat, likely overlying sands and gravels, boulder clay (glacial till), or weathered rock. The superficial soils along the GC are predominantly boulder clay (glacial till) with short stretches of raised peat.

10.3.6.1 Peat Depths

A Peat Landslide Hazard Assessment (PLHA) (refer to **Appendix 10.3**) for the Wind Farm Site was carried out by John Whiteford (WGL). A total of 2,386 no. peat probes were undertaken during multiple phases of fieldwork undertaken in 2024 and 2025.

The results of these peat thickness measurements are given in the table below.

Table 10.7: Peat Depth Distribution by Category

Peat Depth Category (m)	Number of Survey Points	Sufficient to influence ground stability
A – Absent or Negligible (0-0.5m)	1069 (44.8%)	Unlikely
B – Shallow (0.5-2.0m)	605 (25.3%)	Likely
C – Moderately Deep (2.0-3.0m)	263 (11.0%)	Very likely
D – Deep (3.0-4.0m)	132 (5.5%)	Very likely
E– Very Deep (>4.0m)	318 (13.3%)	Very likely

10.3.6.2 Mineral Soils

A total of 12 no. hole excavations and 23 no. geophysical survey profiles were undertaken during the site investigation campaigns. The results of the investigations undertaken for the main wind farm infrastructures are summarised in **Table 10.8** and detailed further in **Appendix 10.1.**

[2] Source: British Geological Survey – Search of Earthquake Database (accessed 12-12-2025); time period 1st Jan 1000 to 23/12/2022.

Table 10.8: Summary of Sub-surface Lithology from Trial Holes at the Main Structures

Infrastructure Location	Land Use	Peat / Topsoil Thickness (m)	Competent Soil Depth (m)	Soil Type at Base of Exploratory Hole	Weak Rock Depth (m)
Turbine T1	Bogland	2.80	> 5.00 est.	Stiff, slightly silty and clayey SILT	Not found
Turbine T2	Agriculture / Forestry	1.10	3.20	Stiff, slightly silty and gravelly CLAY, with large boulders from 3.1m	Not found
Turbine T3	Bogland	2.80	> 5.00 est.	Stiff, slightly silty and clayey SILT	Not found
Turbine T4	Forestry	1.60	c. 3.50	Probable very stiff, slightly sandy, gravelly SILT containing cobbles	Not found
Turbine T5	Forestry	0.30	3.20	Very stiff gravelly CLAY containing cobbles	Not found
Turbine T6	Forestry	0.30	2.10	Stiff, slightly silty and clayey SILT	Not found
Turbine T7	Forestry	0.70	2.70	Very stiff gravelly, sandy SILT containing cobbles and boulders	Not found
Turbine T8	Bogland	2.50	>4.50	Stiff-firm, silty, gravelly, containing cobbles	Not found
Turbine T9	Bogland	1.90	4.00	Stiff gravelly, sandy SILT containing cobbles and boulders	Not found
Turbine T10	Forestry	2.90	>4.40	Stiff, slightly silty, gravely CLAY containing cobbles and boulders	Not found
Turbine T11	Forestry	0.30	1.90	Stiff, silty CLAY, containing cobbles and boulders	Not found
Substation	Forestry	0.5	2.10	Firm, gravelly, sandy SILT containing cobbles and boulders.	Not found

10.3.7 Geological Resource Importance

Review of the GSI Online Database and Google Earth Imagery data indicates that there are no active quarries within 10km of the Wind Farm Site (Refer to **Figure A6**). The closest crushed aggregate quarries / pits are as follows:

1. Roadstone Boyle Quarry (limestone aggregate) 12km to the north.
2. Hanly Quarry, Ballygarden, Co. Roscommon (limestone aggregate) 7km to the south east.

No records of shafts or adits associated with mineral exploration were observed within 10km of the site. No records of shafts or adits associated with mineral exploration have been recorded within the immediate vicinity.

According to Geological Survey Ireland (GSI), the Aggregate Potential for the rock formation underlying the Wind Farm Site is generally categorised as LOW to MODERATE, given the generally thick superficial soil cover. (Refer to **Figures A10** and **A10-1**).

Analysis of the ground investigation results confirms soils to be predominantly peat overlying natural glacial till soils. Limited significance is attached to the economic resource lost as a result of the Project. This effect will be **Not Significant**.

Other Geological resource potential relates to the quality or heritage of the geological environment. The Geological Survey of Ireland (GSI) maintains a database for known Geological Heritage Sites in Ireland. This database was accessed on 10th December 2025 and review of its published contents has determined that the following audited Geological Heritage Sites are closest to the Wind Farm Site. (Refer to **Figure A7**).

- RO022: Mid Roscommon Ribbed Moraines (c. 1km south east)
- RO026: Pollnagran (c. 1km west)
- RO025: Oweynagat (c 6km south)
- RO0004: Boyle Drumlins (c. 7km north)

RO022 Mid Roscommon Ribbed Morraines and RO026 Pollnagran Geological Sites are within the Study Area and have been taken forward for detailed assessment.

RO025: Oweynagat and RO0004: Boyle Drumlins are outside the Study Area and not considered to be hydrologically linked to the Wind Farm Site or Grid Connection. Any risk to these sites is deemed to be imperceptible.

10.3.8 Landslide Susceptibility

According to Geological Survey of Ireland (GSI) mapping, Landslide Susceptibility within the Wind Farm Site and along the Grid Connection is LOW or LOW (INFERRED) risk. (Refer to **Figures A4** and **A4-1**).

GSI also holds records of historic landslides and records two landslide events between 6km and 8km south west of the Wind Farm Site. (Refer to **Figure A5**).

Within the Wind Farm Site ground slopes are either flat or of a very low angle and, consequently, potential for natural soil movement is also considered to be low. However, since historic landslides have occurred within 10km of the Wind Farm Site this detail has been factored into the peat landslide hazard assessment.

10.3.9 Peat Landslide Hazard Assessment

A Peat Landslide Hazard Assessment (PLHA) for the site was carried out by John Whiteford (WGL) and has been identified as a potential risk on the Wind Farm Site (refer to **Appendix 10.3**).

This PLHA has determined that peat landslide hazard is moderate without mitigation. The walkover survey and subsequent site investigations confirm the presence of peat soils within the Wind Farm Site.

The maximum peat thickness encountered at the Wind Farm Site infrastructure is detailed in the table below.

Table 10.9A: Summary of Peat Thickness from Peat Probing at the Main Structures

Structure	Max Peat Thickness (m)	Peat Thickness Likely to Influence Stability?
T1	4.5	Very Likely
T2	0.7	Likely
T3	4.5	Very Likely
T4	1.6	Likely
T5	0.4	Likely
T6	1.2	Likely
T7	1.6	Likely
T8	2.2	Very Likely
T9	2.0	Likely
T10	1.8	Likely
T11	0.6	Likely
ONSITE SUBSTATION	2.0	Likely

The following table summarises the relevant hazard ranking, applicable post mitigation, to the main infrastructure at the Wind Farm Site.

Table 10.9B: Post-mitigation Determination of Peat Landslide Hazard Ranking

Infrastructure Element Considered	Post-mitigation Peat Landslide Hazard Ranking	Hazard Classification
Turbine T1	HR=9	LOW
Turbine T2	HR=2	NEGLIGIBLE
Turbine T3	HR=8.5	LOW
Turbine T4	HR=3	NEGLIGIBLE
Turbine T5	HR=1.5	NEGLIGIBLE
Turbine T6	HR=1.5	NEGLIGIBLE
Turbine T7	HR=3	NEGLIGIBLE
Turbine T8	HR=3	NEGLIGIBLE
Turbine T9	HR=3	NEGLIGIBLE
Turbine T10	HR=3	NEGLIGIBLE
Turbine T11	HR=3.75	NEGLIGIBLE
Substation	HR=3	NEGLIGIBLE

A similar assessment for the Site Access Road network similarly yielded hazard ranking following mitigation to range from **NEGLIGIBLE** to **LOW**.

10.3.10 Designated Sites

The following protected sites and contaminated lands in the vicinity of the Wind Farm Site and Grid Connection are designated according to the Government of Ireland's EPA Map Viewer,(https://gis.epa.ie/EPAMaps/) (accessed on 11th February 2026):

1. Cloonshanville Bog SAC / proposed NHA (Ref 000614)
2. Bellanagare Bog SAC / proposed NHA (Ref 000592)
3. Bellanagare Bog SPA (Ref 004105)
4. Ardagh Bog NHA (Ref 001222)
5. Bella Bridge Bog NHA (Ref 000591)
6. Cornaveagh Bog NHA (Ref 000603)
7. Tullaghan Bog (Roscommon) NHA (Ref 001652)
8. Annaghmore Lough (Roscommon) SAC (Ref 001626)

Only designated sites 1, 2 and 3 are within the Study Area and have the potential to be affected by the Project. None of the other protected sites are considered to be within the zone of influence of the Project. These sites have been considered for further detailed assessment in **Section 10.4.2.7.1** and **Section 10.4.2.7.6**.

10.3.11 Soil Contamination (Historic)

There are no known areas of existing soil contamination within the Wind Farm Site or the Grid Connection and no evidence of measurable soil contamination was observed during walkover surveys or the site investigation. As agricultural equipment is used across much of the Wind Farm Site and the Grid Connection primarily utilises the public road, it is possible that minor fuel spills and leaks have occurred locally in the past.

10.3.12 Other Sensitive Receptors

Neither the GSI or EPA record groundwater abstractions within the Wind Farm Site, the Grid Connection route, or their immediate vicinity, however potential sensitive receptors that may be affected by the Project include several minor water courses, a major water course, and drainage ditches, refer to **Chapter 11: Hydrology and Hydrogeology Section 11.7.1** for further details.

10.3.13 Site Investigations – Summary of Findings

Table 10.10 presents a summary of the findings of the Soils and Geology Baseline together with preliminary design recommendations.

Table 10.10: Summary of Site Investigation Findings and Recommendations

Element Ref:	Element Assessed at Site Investigation Stage	Summary Soil Description
1A	Typical Soil Overburden (Wind Farm)	Refer to **Table 10.8**.
1B	Typical Soil Overburden and Bedrock (Grid Connection)	TOPSOIL, Peat underlain by clay/silt at depths between <0.5m – 4m. All circuits will be laid within the superficial soils. Bedrock excavation is not anticipated, except where horizontal directional drilling is undertaken to cross 4 no. local watercourses.
2	Typical Foundation depth Overburden thickness (m) (Material to be removed during the construction phase)	T1 =10 - 12m* T2 = 3.5 – 5.0m T3 = 10 - 12m* T4 = 3.5 – 5.0m T5 = 3.5 – 5.0m T6 = 3.5 – 5.0m T7 = 3.5 – 5.0m T8 = 3.5 – 5.0m T9 = 3.5 – 5.0m T10 = 3.5 – 5.0m

Element Ref:	Element Assessed at Site Investigation Stage	Summary Soil Description
		T11 = 3.5 – 5.0 Substation = 1.5 – 2.5m *Turbine Foundation to be piled
2	Rock Type (Wind Farm)	Dark LIMESTONE rock pertaining to the Ballymore Limestones formation underlying T6, T7, T8, T9, and T11. Coarse Quartz-rich sandstone pertaining to the Boyle Sandstone Formation underlying T1, T2, T3, T4, and T5. Thick-bedded grey limestone pertaining to the Croghan Limestone Formation underlying T10 and the Substation.
3	Rock Competence (Wind Farm)	According to the geophysical survey findings the upper surface of the rock formations is competent, but at the original location for T6 deep weathering was identified resulting in its relocation.
5	Typical Depth to Non Rippable Rock	Analysis of geophysical survey data indicates depth to intact limestone varies from 4m to >18m at the main infrastructure.
6	Anticipated Wind Turbine Foundation Type	T1 = Deep Piled Foundation T2 = Gravity Base Foundation T3 = Deep Piled Foundation T4 = Gravity Base Foundation T5 = Gravity Base Foundation T6 = Gravity Base Foundation T7 = Gravity Base Foundation T8 = Gravity Base Foundation T9 = Gravity Base Foundation T10 = Gravity Base Foundation T11 = Gravity Base Foundation Substation = Strip, Pad or Raft Foundation
7	Slope Stability	T1 : FoS > 1.3 (Acceptable) T2 : FoS > 1.3 (Acceptable) T3 : FoS > 1.3 (Acceptable) T4 : FoS > 1.3 (Acceptable) T5 : FoS > 1.3 (Acceptable) T6 : FoS > 1.3 (Acceptable) T7 : FoS > 1.3 (Acceptable) T8 : FoS > 1.3 (Acceptable) T9 : FoS > 1.3 (Acceptable) T10 : FoS > 1.3 (Acceptable) T11 : FoS > 1.3 (Acceptable) Substation : FoS > 1.3 (Acceptable)
8	Karst Features	No "karst" features such as sinkholes, caves, cavities, voids or subterranean watercourses are recorded within the Site, on GSI Mapping. The Ballymore Limestone formation underlying T6, T7, T8, T9, and T11 are mildly susceptible to the formation of Karst landforms. Elsewhere T1, T2, T3, T4, and T5 were underlain by the Boyle Sandstone formation. These are less associated with Karst features. T10 and the Substation were underlain by the Croghan Limestone formation, along with the Grid Connection which was also underlaid by the Bricklieve Formation. Although no Karst features such as sinkholes, caves, cavities, voids, or subterranean watercourses were initially located during

Element Ref:	Element Assessed at Site Investigation Stage	Summary Soil Description
		the walkover survey, geophysical investigation and subsequent follow-up inspection revealed deep weathering and an unusual landform at the original location of T6, resulting in its relocation.
9	Groundwater Observations	Within the bogland the groundwater table is perched within the peat soils. The underlying mineral soils are generally weakly impermeable to impermeable.
10	GSI – Crushed Rock Aggregate Potential	According to Geological Survey Ireland, the Aggregate Potential for the Borrow Pit sites is categorised as follows: - Low to Moderate Following supplementary site investigations, the author has recommended two locations, near to turbine T6, where rock is potentially shallowest and exploitable as a borrow pit.
11	Predicted Performance of rock formations as construction aggregate	Only Medium Strong LIMESTONE rock strata (or better) have potential. This material was identified by geophysical surveying during the SI campaign and indicated to be at 4 – 8m depth at the site of the proposed Borrow Pits.

10.4 ASSESSMENT OF POTENTIAL EFFECTS

Where not specifically stated otherwise, all potential effects detailed in this section are pre-mitigation potential effects.

The significance of an effect has been determined by considering the magnitude of the impact and the sensitivity of the receptor, with the classifications assigned in accordance with the EPA Guidelines, (EPA, 2022), including **Imperceptible, Not Significant, Slight, Moderate, Significant, Very Significant** and **Profound**. (**Table 10.5**).

In considering the effects, criteria such as quality, duration, probability and type have also been considered, per the criteria detailed in Table 3.4 of the EPA Guidelines (EPA, 2022). For the purpose of this assessment, effects rates as '**Significant**' or above are considered to be **Significant** in EIA terms. Effects identified as '**Moderate**' significance or below are considered to be **Not Significant** in EIA terms.

Proposed mitigation measures for each potential effect are listed in **Section 10.6** and summaries of both the residual effect following mitigation and its significance are detailed in this section.

10.4.1 Do Nothing Impact

The "Do Nothing Effect" is the effect on the Wind Farm Site and the Grid Connection should the Project not be constructed. In this case, it is envisaged that the current land use would remain as it is now, with blanket peat, areas of semi-improved grassland and forestry, and

unaltered public road. Given the nature of the land, being generally pastureland, it is unlikely that any substantial changes in this use will occur in the future. There will still be potential for moderate adverse effects on the groundwater aquifer from contamination of soils by agricultural activities.

Assessment of existing conditions with respect to their potential effect on soils and geology are detailed in **Table 10.11**, below.

Table 10.11: Do Nothing Effect

Item	Assessed Element	Assessed Baseline Condition	Anticipated Do Nothing Effect
1	Water Regime – Response to Storm events	Combination of surface water and groundwater at site of wind farm infrastructure. Storm events will result in localised soil degradation, siltation of watercourses and localised erosion.	Do Nothing Potential Effect – Siltation of Watercourse, Soil Erosion and Degradation. Adverse, direct, moderate, site-wide / potentially regional, conforms to baseline, likely, short term.
2	Water Regime - Erosion of slopes	Current slopes within the Site are of low susceptible to soil erosion during high rainfall events.	Do Nothing Potential Effect – Soil Degradation and Failure. Adverse, direct, slight, site-wide / potentially regional, conforms to baseline, likely, short term.
3	General Soil Stability	Current slopes are low. Soils are considered to be in a state of stable equilibrium.	Do Nothing Potential Effect – Soil Failure. Adverse, direct, slight, site-wide, conforms to baseline, unlikely, short term.
4	Land Contamination	No contamination of natural soils and groundwater were encountered at The Site. Potential for activities to cause contamination remains.	Do Nothing Potential Effect: Adverse, direct, moderate, site-wide, contrasts to baseline, unlikely, long term.

10.4.2 Construction Phase Potential Effects

The Project is characterised by the construction of infrastructure necessary to complete the wind farm as described in the **Chapter 2: Project Description.**

The direct and indirect effects of the construction activities, and their expected duration are assessed further in the following sections, where the particular activities that will give rise to effects on soils and geology are listed below:

- Wind Turbine construction
- Onsite Substation construction
- Turbine Hardstand and temporary blade lay down hard stand construction.
- Temporary Construction Compounds

- Permanent Met Mast construction.
- Installation of Internal Cabling
- Installation of Grid Connection cabling
- Construction of Site Access Roads
- Permanent Spoil Storage area
- Upgrade Turbine Delivery Route

The effects on land, land use, natural resources and protected sites, as a consequence of conducting the works are also assessed in the following sections.

10.4.2.1 Compaction, Erosion and Degradation

The movement of construction traffic throughout the site has the potential to effect soils by causing soil compaction, which in turn may impact upon hydrology. Compaction occurs when soil particles are pressed together, reducing pore space.

This, therefore, has the following potential effects:

- Loss of soil structure,
- Reduction of soil fertility
- Reduction in permeability and rainfall infiltration,
- increasing the risk of surface water runoff and erosion. This reduction in permeability is known as "soil sealing"

Erosion is caused by the action of wind, climate and other weathering forces on the soil mass and can result in the following potential effects:

- Loss of soil structure,
- Reduction of soil fertility
- Vegetation loss
- Indirect siltation of water courses

The superficial soils underlying the Wind Farm Site and the Grid Connection are composed of organic peat bog mantling tills derived from limestone rock. Coupled with the fact that the site has flat or gently sloping topography, the effects of compaction will not result in a significant increase in runoff. The potential for compaction and erosion of the soil is considered to be **Short Term** with a **Small Adverse** magnitude of impact.

The potential effect is considered to be of **Moderate** significance. Mitigation measures will be adopted throughout the construction phase to reduce the occurrence of compaction,

although it should be noted that the majority of the construction work and vehicles will take place on the new tracks and crane hardstanding's and thus of a smaller footprint.

Table 10.12: Effect Summary – Compaction and Erosion

Effect Description	Type	Quality	Significance	Extent	Context	Probability	Duration / Frequency
Compaction, Erosion and Degradation	Direct	Adverse	Moderate	Site	Contrast to baseline	Likely	Short Term

10.4.2.2 Land and Land Use

176,431m^3 of peat (330,345m^3 of peat and glacial till), and 166,642m^3 of mineral soils/rock will be excavated during construction excavations and is an unavoidable consequence of the Project. This will result in an adverse effect to land capability for agriculture and commercial forestry, causing a loss of moderately productive agricultural/forestry lands. Removal of the soil (both organic topsoil and mineral soils) and bedrock is considered to be a permanent effect as it would not normally be reversed, although some reinstatement is possible after Decommissioning.

10.4.2.2.1 Land Take – Wind Farm

Construction of the wind farm will be a long-term alteration to the current land use. Although, the wind farm will have a finite lifespan and the land use will be restored following Decommissioning, there will be a loss of c. 10.8426ha (composed of agricultural lands, forestry and bogland) during construction. This loss will be reduced following construction, when lands demarcated for the construction phase, but peripheral to the infrastructure, will be returned following reinstatement.

Considering the above, the effect caused to soils and geology, by land take for the wind farm, is considered to be a **Long-term, Adverse** and **Moderate**. In EIA terms the effect is considered as **Not Significant.**

10.4.2.2.2 Land Take - Turbine Delivery Route (TDR)

Land take will occur within public roads, along with short sections of land takes within both private third-party lands, where widening and new road construction is required. This will occur at 3 no. locations. The effect of this land take is considered to be **Long-term, Adverse** and **Slight**. In EIA terms the effect is considered as **Not Significant**.

10.4.2.2.3 Land Take - Grid Connection Route (GC)

Removal of the topsoil and mineral soils (within verges) or road surfacing and mineral soils (within roads) to install cables is considered to be a temporary effect as the ground will be reinstated in a "like-for-like" fashion immediately following installation of the circuits. The effect this will have in relation to the Grid Connection is considered to be **Temporary, Adverse and Slight.** In EIA terms the effect is considered as **Not Significant**.

Table 10.13: Effect Summary – Land Use

Effect Description	Type	Quality	Significance	Extent	Context	Probability	Duration / Frequency
Land Take – Wind Farm	Direct	Adverse	Moderate	Site	Contrast to baseline	Likely	Long Term
Land Take – TDR	Direct	Adverse	Slight	Site	Contrast to baseline	Likely	Long Term
Land Take - GC	Direct	Adverse	Slight	Site	Conforms to baseline	Likely	Temporary

10.4.2.3 Subsoil and Bedrock Removal

185,064m^3 of subsoil (consisting of tills derived from limestone and other bedrock (to a much lesser degree) removal will occur during construction excavations and is an unavoidable consequence of the Project. The potential effects associated with soil and bedrock removal are as follows:

- Alteration of natural geological landforms,
- Reduction in capacity for the soils to support vegetation
- Changes in permeability and rainfall infiltration
- Alteration of topography so as to reduce slope stability

Invasive species can also be spread during the removal of soils. This is addressed in **Chapter 6: Biodiversity**. Although no invasive species were identified within the Wind Farm Site, Japanese Knotweed was recorded 1.8km from it. The ECoW will continue to monitor for invasive species, both pre-construction and during the construction stage.

Spoil generated during these operations will be selectively reused during the construction phase with any remainder stored locally within a series of spoil repositories, for reuse during the Decommissioning phase. Refer to **Chapter 2: Project Description** and the **CEMP**.

No further subsoil or bedrock removal will be required during the operational phase. During the Decommissioning phase, the soil and rock spoil will be remobilised for the purpose of land restoration.

10.4.2.3.1 Excavations

The operation of removing soils and bedrock increases the potential for contaminating soil movements to occur. Processes such as soil instability, poor spoil handling, compaction and subsidence brought about by earthworks activities, can cause a release of silt into the environment, which can adversely affect local (and potentially regional) sensitive receptors, such as watercourses and their associated flora and fauna.

Excavations will be required for most aspects of the Project including for Turbine Foundations, Turbine Hardstands, Site Access Roads, areas of widening on the TDR, Temporary Construction Compounds, Internal Cabling trenches, Onsite Substation, Grid Connection, other ancillary infrastructure and drainage. Estimates of these excavation volumes are presented in **Table 10.14** below.

Table 10.14: Estimates of Excavation Volumes

Description	Peat and Topsoil Quantity (m^3)	Subsoil and Rock Quantity (m^3)
Spoil generated during construction activities	180,879	171,436
Selected subsoil re-used as construction fill during the construction phase	N/A	58,325
Rock aggregate resource at Borrow Pits	N/A	240,000
Surplus soil to be re-used off site. (All surplus materials, with the exception of arisings from the GC, will be stored at long-term repositories for the life of the project).	0	13,627

The effects associated with general excavation works are considered to be **Long-term, Adverse** and **Significant.**

This is because of the scale of the earthworks (both in terms of depth and volume), the volume of material removed, and the size of the plant used to facilitate it. Refer to the **CEMP** in **Appendix 2.1** which details the excavation works required.

In EIA terms, the effect is considered as **Significant**.

10.4.2.3.2 Site Access Roads

Site Access Roads will be needed to accommodate the construction works and to provide access to the turbine locations for the whole life cycle of the Project. The Site Access Roads will be constructed within the firm mineral soils using unbound crushed aggregates and incorporate drainage to maintain the performance of the pavement during wet weather.

The effect associated with excavations for soil and bedrock removal for the Site Access Roads (*loss of agricultural resource, degradation of soil structure, changes to drainage, as well as increased potential for erosion*) is **Long-term**, **Adverse** and **Significant**. This is because of the scale of the earthworks (both in terms of depth and volume), the volume of material removed, and the size of the plant used to facilitate it.

In EIA terms, the effect is considered as **Significant**.

10.4.2.3.3 Turbine Foundations and Turbine Hardstands

The soil encountered at each Wind Turbine infrastructure location, during construction, is considered to be a combination of peat and glacial tills, and both granular and cohesive mineral soils. The underlying Limestone rock formation is the preferred formation for the transference of foundation loads but is unlikely to be exposed in excavations due to the significant peat thickness present. Turbines T1 and T3 will be constructed with deep piled foundation, and T2, T4, T5, T6, T7, T8, T9, T10, T11 will be constructed with standard gravity base foundations.

10.4.2.3.3.1 Bedrock Excavations at Turbine Foundations

Significant bedrock excavations will not be required for the construction of Turbine Foundations, which is generally at a depth considered to be beyond shallow excavations. Locally, some excavations may encounter rock, but this will be exceptional and highly localised. However, significant rock extraction will be undertaken at the Borrow Pits where excavations of up to 12m will be undertaken.

Any rock excavated during construction will be selectively reused as construction fill where possible.

Confirmatory construction stage ground investigations will confirm the quality and strength of the bedrock, where present. Where deep or large excavations are required in moderately strong to strong rock, heavy breakers will be deployed for this purpose. No rock blasting will be employed to remove rock.

The effects associated with excavations for soil and bedrock removal at Turbine Foundation and Turbine Hardstand areas, as well as at the Borrow Pits *(Alteration of natural geological landforms, reduction in capacity for the soils to support vegetation, changes in permeability and rainfall infiltration as well as alteration of topography so as to reduce slope stability*) are **Permanent**, **Adverse** and **Significant**.

In EIA terms, the effect is considered as **Significant**.

10.4.2.3.4 Internal Cabling Trenches

Cable trenches throughout the Wind Farm Site will be excavated to a depth of 1.2m prior to installation of cable ducts. During construction, the topsoil and mineral soils will be stored separately and any excess remaining after reinstatement will either be stored permanently on site or removed for disposal off-site.

Imported granular fill will be used to surround the cables, albeit with suitable excavated soils being reused for backfill. The effect associated with excavations for Internal Cabling *(Degradation of soil structure, changes to drainage regime and reduction in soil fertility)* are **Long-term**, **Adverse** and **Not Significant**.

In EIA terms, the effect is considered as **Not Significant**.

10.4.2.3.5 Borrow Pits

Two on-site Borrow Pits will be constructed as part of the Project, in order to extract aggregate for use during the construction phase.

The Borrow Pits will have maximum surface dimensions of 26,977m^2 (BP1) and 23,788m^2 (BP2) and will extend to a depth of 12m. The total volume of rock to be extracted from the Borrow Pits will amount to approximately 240,000m^3.

10.4.2.3.6 Turbine Delivery Route / Construction Haul Routes

The Turbine Delivery Route and Construction Haul Routes will generally use the existing public roads. However, limited widening and construction of a short stretch of new road will also be required. Details are presented in **Chapter 16: Traffic and Transport**.

Generally, the impacts associated with this will be as per the Site Access Road construction but on a very minor scale and reversible. The effects *(loss of soil ability to support vegetation, degradation of soil structure, changes to drainage and increased potential for erosion)* are **Long-term, Adverse** and **Not Significant** effects.

In EIA terms, the effect is considered as **Not Significant**.

10.4.2.3.7 Grid Connection (GC)

Approximately 17.5km Grid Connection trenches will be excavated along the route between the proposed Onsite Substation and the 220kV Flagford Substation. The trenches will primarily be located within the existing public roads or the adjacent verges, to a proposed depth of 1.30m, depending on confirmatory investigations, with a small section exiting the Onsite Substation located adjacent to Site Access Roads. Excavation of road surface, topsoil and mineral soils will be required.

All excavations arising from the Grid Connection trenches will be disposed of to a licenced waste facility. The effects associated with excavations for cable trenches (Degradation of soil structure, changes to drainage regime, reduction in soil fertility and reduced stability) are **Permanent, Adverse** and **Not Significant**.

In EIA terms, the effect is considered as **Not Significant**.

10.4.2.3.8 Temporary Construction Compound

Six Temporary Construction Compounds will be employed. The Temporary Construction Compounds will be temporary, for the duration of the construction phase. Refer to **Chapter 2: Project Description Section 2.5.12** and **Figure 1.2** for details of their locations.

The potential effects for the Temporary Construction Compounds are considered to be **Temporary, Adverse** and **Slight.** In EIA terms, the effect is considered as **Not Significant**.

10.4.2.3.9 Total Volumes of Material to be Excavated

Estimated total volumes of material to be excavated are presented in **Table 10.14.**

All of the topsoil and 58,692m^3 of the subsoil will be re-used during construction. The area around and above the Turbine Foundation will be backfilled with compacted stone or crushed rock to a minimum specific density as this acts as additional ballast on top of the finished wind Turbine Foundation. The remaining subsoil spoil will be surplus material and will be stored on-site for the duration of the Project, within Permanent Spoil Storage areas. None of the excavated spoil from within the Wind Farm Site will be disposed of off-site but will instead be reused during the Decommissioning phase to reinstate and landscape the Project at the end of its lifetime.

A general summary of all the pre-mitigation effects associated with subsoil and bedrock removal is presented in **Table 10.15.**

Table 10.15: Effect Summary – Soil and Bedrock Removal

Effect Description	Type	Quality	Significance	Extent	Context	Probability	Duration / Frequency
Soil and Bedrock Removal –Excavations	Direct	Adverse	Significant	Site	Contrast to baseline	Likely	Long Term
Soil and Bedrock Removal - Site Access Tracks	Direct	Adverse	Significant	Site	Conforms to baseline	Likely	Long Term
Soil and Bedrock Removal – Turbine and Hardstand Areas	Direct	Adverse	Significant	Site	Contrast to baseline	Likely	Permanent
Soil and Bedrock Removal – Wind Farm Site Cable Trenches	Direct	Adverse	Not significant	Site	Contrast to baseline	Likely	Long Term
Soil and Bedrock Removal – Turbine Delivery Route / Haul Route	Direct	Adverse	Not significant	Regional	Contrast to baseline	Likely	Long Term
Earthworks Activities – Grid Connection Cable	Direct	Adverse	Not significant	Site	Contrast to baseline	Likely	Permanent
Earthworks Activities – Temporary Construction Compound	Direct	Adverse	Slight	Site	Contrast to baseline	Likely	Temporary

10.4.2.4 Storage and Stockpiles

10.4.2.4.1 Overview

Spoil generated on the Wind Farm Site will be either peat, topsoil, mineral soils or rock. Suitable spoil will be re-used, where possible, as fill around infrastructure and to construct stockpiles / bunds along the edge of Site Access Roads, at the Onsite Substation and around the edges of the Temporary Construction Compounds, and for permanent reinstatement of the Temporary Construction Compounds upon completion of construction.

Removal of soil and rock during construction produces spoil that lacks the competence and stability it had before removal. Such spoil is a hazard to the wider environment where it can have the following effects on soils and geology:

- Contamination by way of siltation of watercourses.
- Loss of soil structure and fertility during stockpiling; and
- Landslide hazard, where spoil is not managed appropriately.

The handling, management and re-use of excavated spoil material is of importance during the construction phase of the Project.

Excavated spoil material will arise from all infrastructure elements of the wind farm (Turbine Foundations, Site Access Roads, Turbine Hardstands, Internal Cabling, Grid Connection etc.).

Estimated total volumes of material to be excavated are presented in **Table 10.14.**

10.4.2.4.2 Spoil Management

Within the spoil management process there is potential for a moderate adverse effect on soil due to erosion of inappropriately managed excavated materials. However, any effects from the handling of excavated materials will be managed through good site practice, as per NRA Guidelines. A robust sediment and erosion plan, greatly reduces the risk of erosion or sediment release to surface waters.

Organic matter loss can occur when wet peat or organic soils are excavated and allowed to dry in the open air. Such material is a major source of carbon, and the loss of organic matter leads to an emission source of carbon dioxide (CO_2) and nitrogen dioxide (NO_2). A Carbon Calculator can be found in **Chapter 19: Climate**, which addresses the effect of loss of carbon to the atmosphere through the drying out of organic soils excavated as part of the Project.

Excavated soil and bedrock will be re-used for the construction of Site Access Roads and as construction fill wherever suitable. No excavated soils will be taken offsite.

Any residual soils that cannot be re-used will be stored at the designated Permanent Spoil Storage areas as identified on **Figure SD1**. For further details of this and for spoil kept in stockpiles, re-used and permanently stored refer to the Spoil Management Plan, **Appendix 2.1 CEMP – Management Plan 4**.

This process of storage, stockpiling and spoil management will have a **Long-term, Adverse** and **Moderate** effect on the geology and soils associated with the Project. In EIA terms, the effect is considered as **Not Significant**.

A general summary of all the pre-mitigation effects associated with subsoil and bedrock removal is presented in **Table 10.16.**

Table 10.16: Effect Summary – Storage and Stockpiles / Spoil Management

Effect Description	Type	Quality	Significance	Extent	Context	Probability	Duration / Frequency
Earthworks Activities – Storage and Stockpiles / Spoil Management	Direct	Adverse	Moderate	Site	Contrast to baseline	Likely	Long Term

10.4.2.5 Vehicular Movement

10.4.2.5.1 Overview

Vehicle movement will occur primarily during the construction phase of the Project. Construction vehicles will include cranes, excavators, dumper trucks, concrete trucks, private cars (construction personnel). Please refer to **Chapter 16: Traffic and Transport**.

Vehicular movement causes compaction and sealing of the subsoils and has the following effects on soils and geology.

- Loss of soil structure.
- Reduction of soil fertility; and
- Reduction in permeability and rainfall infiltration.

10.4.2.5.2 Turbine Delivery Route/ Construction Haul Route and Site Access Roads

There will be no material changes to the existing public roads sections of these routes. 5,030m of new Site Access Roads will be constructed and 6,382m of existing Site Access Roads will be upgraded. This will result in compaction and sealing of the underlying soils. This effect is considered to be **Temporary, Adverse and Slight**. In EIA terms the effect is considered as **Not Significant**.

The effects of compaction associated with additional heavy vehicle movements along the turbine delivery route and haul route is considered to be **Temporary, Adverse** and **Moderate**. In EIA terms the effect is considered as **Not Significant**.

Vehicle movement along the Site Access Roads will also result in a compaction of the underlying soils. The effects associated with vehicle movements on the geology and soils along the Site Access Roads is considered to be **Permanent, Adverse** and **Moderate.** In EIA terms the effect is considered as **Not Significant.**

A summary of the pre-mitigation effects associated with vehicle movement is given in **Table 10.17.**

Table 10.17: Effect Summary – Vehicular Movement

Effect Description	Type	Quality	Significance	Extent	Context	Probability	Duration / Frequency
Vehicle Movement - Compaction, erosion and degradation of soils arising from vehicular movement along existing public and private roads	Direct	Adverse	Moderate	Localised	Conforms to baseline	Likely	Temporary
Vehicle Movement – Compaction, subsidence and settlement of newly established and upgraded Site tracks	Direct	Adverse	Moderate	Localised	Contrast to baseline.	Likely	Permanent

10.4.2.6 Peat Landslide Hazard, Ground Stability and Failure

Peat landslide, ground instability and ground failure result in the following effects on soils and geology.

- Alteration to existing geology, by removal of soils by transportation down slope and exposure of bedrock.
- Loss of soil structure.
- Reduction of soil fertility.
- Reduction in permeability and rainfall infiltration.
- Loss of or damage to existing vegetation, crops or pastureland; and
- Loss of or damage to existing structures, infrastructure and buildings and / or adverse effects in relation to their stability.

Ground instability or failure refers to a significant mass movement of a body of soil or rock that would have an adverse effect on the Project and the surrounding environment.

A Peat Landslide Hazard Assessment (PLHA) for the site was carried out by John Whiteford (WGL).

The following schedule summaries the relevant hazard ranking, pre-mitigation, to the main infrastructure at the Project:

Table 10.18: Pre-mitigation Determination of Peat Landslide Hazard Ranking

Infrastructure Element Considered	Pre-Mitigation Peat Landslide Hazard Ranking
Wind Turbine T1	MEDIUM
Wind Turbine T2	LOW
Wind Turbine T3	MEDIUM
Wind Turbine T4	LOW
Wind Turbine T5	NEGLIGIBLE
Wind Turbine T6	NEGLIGIBLE
Wind Turbine T7	NEGLIGIBLE
Wind Turbine T8	LOW
Wind Turbine T9	LOW
Wind Turbine T10	NEGLIGIBLE
Wind Turbine T11	LOW
Onsite Substation	LOW
Site Access Road from site entrance 1 to T1	MEDIUM
Site Access Road from T1 to T2	MEDIUM
Site Access Road from site entrance 3 to T4	MEDIUM
Site Access Road from T4 to T5	MEDIUM
Site Access Road from Spur to T5 and T6	LOW
Site Access Road from T6 to T7	LOW
Site Access Road from T7 to site entrance 4	LOW
Site Access Road from site entrance 5 to Onsite Substation	MEDIUM
Site Access Road from Onsite Substation to T11	MEDIUM
Site Access Road from Spur at T11 to T8	LOW

A significant amount of Site Investigation data has been acquired across the Wind Farm Site and this data provides confidence on the depth of topsoil, subsoil and subsoil type. Subsoils are logged as mineral soil glacial till deposits comprising stiff Clay/Silt overlain by Peat.

These mainly cohesive subsoils are generally not associated with ground instability or a risk of landslides, where, in this particular case, they reside on slopes of less than 3 degrees to the horizontal. Consequently, the overall landslide susceptibility has been assessed or inferred to be low within the footprint of the Project.

The walkover survey and intrusive site investigation did not record the presence of typical karst features, within the rock below the subsoils, close enough to affect ground stability. However, the geophysical surveys did identify deep rock weathering at the original location of T6 typical of "karst" features, with potential to impact stability.

An iterative design process, involving multiple stages of ground investigations, followed by Wind Turbine location and infrastructure re-design has already been completed in order to avoid poor ground conditions including karst features. Some additional confirmatory pre-construction site investigations may also be undertaken to supplement the current site investigation data, prior to detailed foundation design.

The subsurface conditions underlying the Grid Connection have also been assessed and found to consist of generally peat overlying glacial till deposits of varying consistency. No rock excavation is expected to be needed to install the circuits at the scheduled depth, where rock is known to be at much greater depth.

In light of the above, potential effects associated with ground stability and localised failure are considered to be **Long-term, Adverse** and **Significant**. In EIA terms, the effect is considered as **Significant**.

The potential effects associated with landslide hazard are considered to be **Permanent**, **Adverse** and **Significant**, In EIA terms, the effect is considered as **Significant**.

The potential effects associated with ground stability are contained in **Table 10.19** below.

Table 10.19: Effect Summary – Peat Landslide Hazard, Ground Stability and Failure

Effect Description	Type	Quality	Significance	Extent	Context	Probability	Duration / Frequency
Ground Stability and Failure - Stability issues and slope failure arising from construction activities. (Localised displacement and settlement)	Direct or Indirect / Secondary	Adverse	Significant	Localised / Potentially Regional	Contrast to baseline	Likely	Long term / Permanent
Ground Stability and Failure - Stability issues and slope failure arising from construction activities (Landslide)	Indirect / Secondary	Adverse	Significant	Localised / Potentially Regional	Contrast to baseline	Unlikely	Permanent

10.4.2.7 Soil Contamination

10.4.2.7.1 Overview

No extant contaminated soils were recorded during the Site Investigation campaign. Accidental spillage of fuels, release of chemicals or importation of contaminated materials during construction works poses a significant pollution risk, where the potential sensitive receptors such as the native soils, underlying groundwater aquifers, existing pipeline and local watercourses have the potential to be adversely affected.

The other sensitive receptors considered in respect to the particular risk from contamination are

1. RO022: Mid Roscommon Ribbed Moraines (CGS)
2. RO026: Pollnagran (CGS)
3. Cloonshanville Bog SAC / proposed NHA (Ref 000614)
4. Bellanagare Bog SAC / proposed NHA (Ref 000592)
5. Bellanagare Bog SPA (Ref 004105)

None of these are considered to be at direct risk as a result of soils and geology related effects from the Project. Indirect risk is also limited as a result of limited connectivity.

Proximity to the environmental protected areas is considered in **Chapter 11: Hydrology and Hydrogeology Section 11.4.15** and the findings therein are deemed similarly significant for soils and geology. The most sensitive indirect receptors in this respect are Lough Gara, into which several watercourses on site flow. Refer to **Chapter 11: Hydrology and Hydrogeology, Sections 11.4.6 to 11.4.16** for further details.

The overlying natural soils are considered only weakly permeable, generally thick and offer a high degree of protection to the limestone and sandstone aquifers below. However, excavation of this material will result in the generation of spoil that will lack the cohesion or competence of the in-situ soils. For the purpose of this assessment these spoil arisings are treated both as construction materials and as a potential contaminant. As a construction material spoil has the potential to become mobilised by surface water flows and to ultimately become entrained within watercourses causing siltation. As a potential contaminant spoil is a "foreign" material with the potential to alter the chemistry of, and fertility of the existing soil environment. Given the high-water table and proximity of construction watercourses, sensitivity in respect to Contamination is considered to be High, the magnitude of potential impact Significant and the nature of the impact to be Moderate Adverse.

Consequently, the weighted significance of the environmental effect on the soils and geology environment is considered to be **Indirect, Long-term, Adverse and Significant**. In EIA terms, the effect is considered as **Significant.**

The following sections present a breakdown of all other possible effects associated with the use of construction plant during the construction process.

10.4.2.7.2 Hydrocarbons

Wherever there are vehicles and plant in use, there is the potential for a direct hydrocarbon release which may contaminate the soil and subsoil. A spill also has the potential to indirectly pollute water, if the soil and subsoil act as a pathway from any source of pollution. The accumulation of small amounts of fuels and lubricants during routine plant use can also be a significant pollution risk. Hydrocarbons have a high toxicity to humans, flora and fauna including fish and if released is persistent in the environment. Large spills or leaks have the potential to result in significant or profound effects (i.e. contamination of soil, subsoils and pollution of underlying aquifers) on the geological and water environment.

Any spill of fuel and chemicals, release of silt and leaching from contaminated materials will present a **Long-term, Adverse** and **Significant** effect on the soils and geological environment associated with the Project. In EIA terms, the effect is considered as **Significant.**

10.4.2.7.3 Wastewater and Sanitation

Wastewater / sewerage effluent will arise from the Substation toilet and welfare facilities and has the potential cause contamination of the soils where it is not suitably constrained.

The effects associated with wastewater and sewerage without mitigation are considered to be **Short-term, Adverse** and **Moderate**. In EIA terms the effect is considered as **Not Significant.**

10.4.2.7.4 Construction or Cementitious Materials

A number of materials will be stored and used onsite throughout the construction phase of the Project, including imported aggregates, concrete and bentonite. Should these contaminants (in the case of cement and bentonite) be spilt they have potential to indirectly adversely impact affect water quality.

Spillages of concrete may occur during the laying of foundations required for the substation and inverter/transformer units. Contamination of surface water may also occur as a result of spillages from routine plant maintenance, improper storage or simply from accidental spillages. Should a contamination event occur, there is potential for indirect impact where surface water runoff with pollutant loads, enters drainage ditches identified within the vicinity of the Wind Farm Site and Grid Connection.

Imported aggregates will be employed as part of the construction process. Importation of materials from sources outside the Wind Farm Site have the potential to introduce contamination unless appropriate controls, such as material certification and on-site sampling and testing are undertaken. Where these are not inert, they have the potential to leach contaminants directly into the soils and indirectly, via flowing or percolating surface water, into watercourses and the groundwater aquifer.

The effects associated with construction or cementitious materials is considered to be Temporary, Adverse and Moderate. In EIA terms, the effect is considered as Not Significant.

10.4.2.7.5 General Waste

10.4.2.7.5.1 Construction Spoil

All construction spoil that cannot be re-used during the construction phase will be stored in six long term deposition areas (the Permanent Spoil Storage areas). Refer to **Chapter 2: Project Description**. Spoil identified as potentially hazardous will be promptly stored on an impermeable surface within properly bunded areas in accordance with good site practice as described in the IWEA and Scottish Best Practice Guidelines and in accordance with **Appendix 2.1**, **CEMP**. The effects associated with the use of construction materials are

considered to be **Long-term, Adverse** and **Moderate.** In EIA terms the effect is considered as **Not Significant**.

10.4.2.7.5.2 General Waste

A policy of Reduce, Reuse and Recycle will apply. All construction and operation waste materials will be correctly sorted, recycled or disposed of and follows best practice as described in the IWEA and Scottish Best Practice Guidelines and in accordance with the CEMP. The effects associated with waste materials is considered to be **Temporary, Adverse** and **Slight.** In EIA terms the effect is considered as **Not Significant**.

In summary, the Project has the potential to give rise to the following pre-mitigation soil contamination effects, shown in **Table 10.20** below:

Table 10.20: Effect Summary – Soil Contamination

Effect Description	Type	Quality	Significance	Extent	Context	Probability	Duration / Frequency
Soil and Groundwater – Pollution of Surface Water Run-off and Groundwater Bodies	Indirect / Secondary	Adverse	Significant	Localised / Potentially Regional	Contrast to baseline	Unlikely	Long term
Soil and Groundwater Contamination - Hydrocarbons	Direct or Indirect / Secondary	Adverse	Significant	Localised / Potentially Regional	Contrast to baseline	Unlikely	Long term
Soil and Groundwater Contamination – Wastewater and Sanitation	Direct or Indirect / Secondary	Adverse	Moderate	Localised / Potentially Regional	Conforms to baseline	Likely	Long-term
Soil and Groundwater Contamination – Construction and Cementitious materials	Direct or Indirect / Secondary	Adverse	Moderate	Localised / Potentially Regional	Contrast to baseline	Likely	Temporary
Waste Materials – Construction Spoil	Direct	Adverse	Moderate	Localised*	Contrast to baseline	Unlikely	Long term / Permanent
Waste Materials – General Waste	Direct	Adverse	Slight	Localised*	Contrast to baseline	Unlikely	Temporary

10.4.2.7.6 Features of Geological Heritage

The RO026 Pollnagran site and the RO022 Mid Roscommon Ribbed Moraines are within the Study Area. The latter is only within the study area because of its proximity to the GC. However, the small scale and localised nature of the works involved in the construction of the Grid Connection means that any associated soils and geology risk will be Not Significant win EIA terms.

RO025 Pollnagran is however closer to the more extensive wind farm works and has been assessed in more detail for this reason. The proximity to this site has been considered for peat landslide hazard, where adverse impact by siltation has been considered.

Due to the proximity and scale of local watercourses, the site is considered moderately significant with respect to the risk of peat landslide hazard, as well as water-borne contamination. There are potential for an **Indirect, Long-term**, **Adverse,** and **Moderate** effect as a result of contamination by hydrocarbons, chemicals or siltation.

Table 10.21: Effect Summary – Features of Geological Heritage

Effect Description	Type	Quality	Significance	Extent	Context	Probability	Duration / Frequency
Degradation of Quality of Sites of Geological Significance Importance caused by emissions / pollution from the Project	Indirect/ Secondary	Adverse	Moderate	Regional	Contrast to baseline	Unlikely	Long term

10.4.3 Operational Phase Potential Effects

The direct and indirect effects of the operational phase of the Project is assessed in the following sections.

10.4.3.1 Soil Compaction, Erosion and Degradation

No significant new excavations will be undertaken during the operational phase of the Project, so no new compaction of soils will occur. Ongoing settlement of structures, Site Access Roads, Permanent Spoil Storage areas and other infrastructure will continue to occur during the operational phase, but this is low in significance and monitored regularly. The effects are considered to be **Long-term, Adverse** and **Slight**. In EIA terms, the effect is considered as **Not Significant**.

10.4.3.2 Land Take Windfarm

No further adverse effect on land use is envisaged during the operational phase of the Project. The initial land take will be reduced following construction, when lands demarcated for the construction phase, but peripheral to the infrastructure, will be returned following reinstatement.

10.4.3.3 Soil Contamination

10.4.3.3.1 Hydrocarbons and Chemicals

Wherever there are vehicles and plant in use, there is the potential for a direct hydrocarbon release which may contaminate the soil and subsoil. Use of chemicals, such as lubricants, cleaning agents, pesticides etc. during this phase carries the same degree of risk.

Any potential spill of hydrocarbons or other chemicals will continue to present a **Long-term, Adverse, Significant** effect on the soil and geological environment. In EIA terms this is considered as **Significant.**

10.4.3.3.2 General Waste

The effects associated with waste materials is considered to be **Long-term, Adverse** and **Slight.** In EIA terms the effect is considered as **Not Significant.**

In summary, the Project has the potential to give rise to the following pre-mitigation operational effects, shown in **Table 10.22** below:

Table 10.22: Effect Summary – Operational Phase

Effect Description	Type	Quality	Significance	Extent	Context	Probability	Duration / Frequency
Soil Compaction and Subsidence	Direct	Adverse	Slight	Localised*	Contrast to baseline	Unlikely	Long-term
Land and Land Use	Direct	Adverse	Imperceptible	Localised	Contrast to baseline	Likely	Long term / Permanent
Soil Contamination – Hydrocarbons and Chemicals	Direct	Adverse	Significant	Localised	Contrast to baseline	Likely	Long term
Soil contamination - Operational Wastes	Direct	Adverse	Slight	Localised*	Contrast to baseline	Likely	Long term

10.4.4 Decommissioning of the Wind Farm

This EIAR assumes full Decommissioning of the Project will take place after 35-years (with the exception of the Grid Connection). All structures above ground level shall be demolished and removed from the site for reuse/recycling; however, Site Access Roads are likely to be retained for continued use by the landowners for agricultural purposes.

Turbine Hardstands will be remediated to match the existing landscape as closely as possible. The Decommissioning Plan (**Management Plan 6**, **Appendix 2.1 CEMP**) specifies that the Turbine Hardstands will be allowed to naturally revegetate. The habitat

that would be expected to develop is likely to fall into a mosaic of semi-natural grassland (GS).

The Grid Connection and the Onsite Substation will become an asset of the national grid under the management of ESB and EirGrid and will likely remain in place upon Decommissioning of the wind farm as required by ESB/EirGrid.

Certain aspects of activities occurring during the construction phase are anticipated to occur at reduced levels during Decommissioning, such as excavation of Turbine Foundations that will be left in situ and covered with soil for reinstatement. Site Access Roads will also remain for ongoing usage as farm tracks. In addition, the use of building materials, including concrete and aggregates will not be required.

In general, the potential effects associated with Decommissioning will be similar to those associated with construction, but of reduced magnitude because extensive excavation and wet concrete handling will not be required.

The potential environmental effect from ground disturbance, soil storage and stockpiling and contamination by fuel leaks will remain during the Decommissioning period.

A summary of these potential effects is provided in **Table 10.23**.

Table 10.23: Effect Summary – Decommissioning Phase

Effect Description	Type	Quality	Significance	Extent	Context	Probability	Duration / Frequency
Land and Land Uses	Direct	Adverse	Slight	Localised*	Contrast to baseline	Likely	Long-term
Vehicle Movement - Compaction, erosion and degradation of soils arising from vehicular movement along existing public and private roads	Direct	Adverse	Slight	Localised	Conforms to baseline	Unlikely	Long term / Permanent
Ground Stability and Failure - Stability issues and slope failure arising from construction activities. (Localised displacement and settlement)	Direct	Adverse	Slight	Localised	Contrast to baseline	Likely	Long term
Ground Stability and Failure - Stability	Direct	Adverse	Slight	Localised	Contrast to baseline	Unlikely	Long term

Effect Description	Type	Quality	Significance	Extent	Context	Probability	Duration / Frequency
issues and slope failure arising from construction activities (Landslide)							
Soil and Groundwater Contamination	Direct	Adverse	Moderate	Localised	Contrast to baseline	Unlikely	Long term
Decommissioning Spoil	Direct	Adverse	Slight	Localised*	Contrast to baseline	Likely	Short term
Waste Materials – General Waste	Direct	Adverse	Slight	Localised*	Contrast to baseline	Unlikely	Short term

10.4.5 Cumulative Effects

Soils and geology related cumulative effects of the Project with other developments in the region, as discussed in **Chapter 2: Project Description – Sections 2.3.3 and 2.3.4** relate only to the **indirect effects** that may arise due to the use of public roads as haul routes to bring construction materials to the Wind Farm Site and the cumulative effect on the use of natural resources as well as the effects on surface water and groundwater bodies.

Chapter 16: Traffic and Transport details the scenarios whereby the materials will be imported onto the Wind Farm Site and assesses the cumulative effects in this respect.

Similarly, **Chapter 11: Hydrology and Hydrogeology** details the scenarios with respect to surface water and groundwater bodies and assesses the potential for cumulative effects.

10.5 MITIGATION MEASURES AND RESIDUAL EFFECTS

10.5.1 Design Phase

With regard to the proposed Project design, the principles or risk management and best practice has been followed and will continue to be implemented as follows:

The primary mitigation measure employed has been the design of the Project in terms of locating the Wind Turbines, Site Access Roads, Permanent Spoil Storage areas and other site infrastructure on lands consisting mainly of cutover raised bog and forestry, where the soils are extensively worked and drained, so as to be remote from residential and sensitive commercial properties.

In order to reduce the impacts on geology, hydrogeology and slope stability, infrastructure has also been positioned within areas of thinner organic soils / soft ground and lower slope gradients away from designated watercourses and other sensitive features. Extensive work

has already been undertaken at the design stage to apply risk avoidance by design which has included the following:

- Peat probing to screen for the presence of peat or other organic soil deposits across the site and layout.
- Excavation of trial pits and undertaking of geophysical surveys to establish overburden and bedrock characteristics.
- Relocation and micro-siting of Wind Turbines, Turbine Hardstands, Site Access Roads and other infrastructure based on the site assessments and geotechnical assessments in order to reduce ground risk associated with the Project.
- The works have been designed and checked by geotechnical engineers, who are suitably qualified and experienced in excavation and earthworks design and construction methodologies.
- Where the construction footprint for the Project coincides with water courses, no permanent storage of spoil will be undertaken. Temporary storage will be limited to the period of construction only and scheduled to coincide with optimal annual weather conditions.
- Prior to commencement of construction works at structures in the proximity of sensitive waterbodies and Site Access Road crossing watercourses, appropriate pollution prevention arrangements will be put in place to prevent contaminated surface water run-off from construction activities entering these watercourses, other water bodies or the existing underground pipeline. Refer to **Chapter 11: Hydrology and Hydrogeology** for details.

The following will also be implemented:

- Any excavation and construction related works will be subject to a design risk assessment at detailed design stage to determine risk levels for the construction, operation and maintenance and decommissioning of the works. Identified impacts will be minimised by the application of principles of avoidance, prevention and protection. Information on residual impacts will be recorded and relayed to appropriate parties.
- A detailed method statement for each element of the works will be prepared by the Contractor prior to any element of the work being conducted.
- Given that the works comprise a sizeable proportion of excavation and earthworks, suitably qualified and experienced geotechnical personnel will be engaged on site to supervise the works.
- The Contract will require programming of the works such that earthworks are not scheduled during severe weather conditions or at times of prolonged high rainfall.

10.5.2 Construction Phase

The following sections outline appropriate mitigation measures to avoid or reduce the potential effect of the Project during the construction phase.

10.5.2.1 Construction Environmental Management Plan

A Construction Environmental Management Plan (CEMP) has been prepared for the Project and is included in **Volume IV, Appendix 2.1**. The CEMP defines the work practices, environmental management procedures and management responsibilities relating to the construction phase of the Project.

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

The CEMP will be developed further at the construction stage, on the appointment of the main contractor to the Project to address the requirements of any relevant planning conditions, including any additional mitigation measures that are conditioned and shall be submitted to the planning authority prior to the commencement of the construction phase. The CEMP will incorporate the mitigation of potential effects to land, soils and geology from the Project outlined in the following sections.

10.5.2.2 Erosion, Degradation and Soil Sealing

The Project will be constructed in a phased manner in order to reduce the potential effects of the Project on the soils and geology. Phased construction reduces the amount of open, exposed excavations at any one time, lowering the risk of compaction and reducing soil exposure to degradation.

To further mitigate against the compaction of soil at the Wind Farm Site, prior to the commencement of any earthworks, the work corridor will be demarcated, and machinery will stay within this corridor so that soils outside the work area are not damaged or suffer degradation.

Excavations will then be conducted from Site Access Roads as they are constructed in order to reduce the compaction of soft or otherwise sensitive ground.

The amount of exposed ground and soil stockpiles will also be kept to a minimum and any stockpiles in place for an extended period of time will be allowed to re-vegetate naturally.

10.5.2.3 Subsoil and Bedrock Removal

Construction of the Project will result in the removal of soils in parts of the site to facilitate excavation for the construction of Site Access Roads and Turbine Hardstands for the Wind Turbines within a competent stratum suitable for the emplacement of foundations.

Ground conditions vary across the Wind Farm Site with mineral soils and peat of varying depths and competence present. At the proposed Wind Turbine bases the excavation depth required is anticipated to be a maximum of 5.00m to a suitable bearing stratum. For Site Access Roads and Turbine Hardstands this is expected to be average 1.45m and consequently less significant.

Excavation volumes will also be minimised by the use of piled foundations for Wind Turbines T1 and T3.

One of the primary mitigation measures employed at the preliminary design stage was the minimisation of volumes of excavated overburden deposits to be exported off site. In the case of the construction of the Project, all excavated overburden will either be re-used or retained on-site for reinstatement purposes during the Decommissioning phase.

This will include:

- Use of suitable site-won material (mineral soils consisting predominantly of sands and gravels) as general fill in the construction of Site Access Roads, Turbine Hardstands and in reinstatement around Turbine Foundations.
- Surplus overburden will be re-used on site in the form of landscaping and for raised bog habitat reinstatement purposes.
- Residual surplus overburden will also be stored in raised bog habitat reinstatement areas as per the **Biodiversity Enhancement and Management Plan (BEMP)** and at the Permanent Spoil Storage areas as identified on **Figure SD1**. Refer to the **CEMP, Spoil Management Plan** for details.

Surplus overburden deposits excavated during the course of the works will be stored, for the duration of the Project, in designated Permanent Spoil Storage areas until they can be employed for site reinstatement.

Temporary stockpiles (not exceeding 2m in height) of separated soil material types will be placed adjacent to the excavation areas prior to reinstatement. These stockpiles will be shaped and sealed to prevent the ingress of water from rainfall.

10.5.2.3.1 Mitigation by Avoidance

Preliminary site investigation has allowed for selection of the most appropriate type of foundation for structures, Site Access Roads, Onsite Substation, Permanent Met Mast and other infrastructure. This in turn has allowed the extent of excavations required to be minimised and consequently, generation of excessive spoil material will be avoided.

10.5.2.3.2 Mitigation by Good Practices

Good practices, such as limiting the construction zone by demarcation and the sealing of temporary stockpiles against degradation from rainfall will be employed impacts on the soil resource.

10.5.2.3.3 Mitigation by Reduction

Apart from the measures taken in the design phase of the Project (avoiding the need for and reducing volumes of subsoils to be removed) there are no other reductive mitigation measures in terms of subsoil and bedrock removal, that is the layout of the Project minimises the impact of subsoil and bedrock removal in so far as practical, without compromising or reducing the Project itself.

10.5.2.3.4 Mitigation by Reuse

All topsoil will either be reused for landscaping purposes during the construction phase or stored on-site for reuse during the Decommissioning phase of the works.

10.5.2.4 Storage and Stockpiles

Spoil types will be treated separately. Mineral soils and topsoils / organic soils will be separated during excavation and these two types of spoil will be disposed of generally as follows:

A *Till soils will be deposited directly on top of other mineral soils. This will require the removal of peat where present to facilitate the process.*

B *Topsoils / Organic Soils will be stored separately, protected from the environment to maintain their integrity and used to reinstate the minerals soil surfaces following completion of construction works. No topsoil will be disposed of as part of the Project.*

1. Mineral soil reuse will take place at various locations within the Wind Farm Site where low surface gradients combine with minimal peat depth and sufficient distance from

sensitive receptors. These proposed Permanent Spoil Storage areas are detailed in **Chapter 2: Project Description: Drawing 6575-JOD-CGWF-XX-DR-C-0403** and the **Spoil Management Plan**, contained within the **CEMP**.

2. It is intended that spoil movements will be minimised by disposing of the material within or immediately adjacent to the construction footprint of the structure from whence it was excavated. No spoil disposal will take place within a floodplain or within 20m of a watercourse.
3. Preparation of the spoil disposal sites will involve the removal of the topsoil which will be transferred to a specific location to be stockpiled and maintained for re-use during restoration operations.
4. Spoil will be deposited, in layers of 0.50m and will not exceed a total thickness of 2.00m, unless contained by suitably designed and constrained berms.
5. Spoil will only be deposited on slopes of < 5 degrees to the horizontal and greater than 10m from the top of a cutting. The exact location of these deposition areas has been determined in consultation with the construction phase geotechnical specialist. Refer to **Figure SD1** for details.
6. Spoil disposal sites will have a regular weekly assessment, made by the construction manager or other suitably qualified individual, to ensure that stability and good condition is maintained.
7. Once disposal is complete the deposition areas will be re-vegetated with the existing upper vegetated layer removed at the commencement of disposal operations. Upon commencement of the Decommissioning / restoration phase guidance from a suitably qualified ecologist will be sought to provide a suitable methodology and programme of maintenance for the restored areas.

10.5.2.5 Vehicular Movements

Vehicular movements will be restricted to the footprint of the Project, particularly with respect to the newly constructed Site Access Roads. This ensures that machinery must be kept on tracks and will not move onto areas that are not permitted.

Vehicular traffic will be minimised through the re-use of excavated material where possible on site which will reduce the need to source material from external quarries.

As discussed previously, excavation volumes have been reduced during the design phase by avoiding areas of sensitive or soft soils and by avoiding excessive cut and fill during construction. This will result in reduced excavation volumes and therefore reduced site traffic.

Best practice as described in the IWEA and Scottish Best Practice Guidelines[3] will be applied during construction which will minimise double handling, again reducing the site traffic.

All works will be managed and conducted in accordance with the Construction Environmental Management Plan (**Appendix 2.1** of **Volume IV**), which will be updated by the civil engineering contractor and agreed prior to any works commencing.

10.5.2.6 Ground Stability

The Contractor will programme the works such that earthworks are not scheduled during severe weather conditions.

Details of the proposed methodology and mitigation measures are summarised below and are also outlined in the CEMP.

10.5.2.6.1 Earthworks Activities & Ground Stability – General Constraints and Anecdotal Evidence

Analysis of the historic conditions following soil movement indicates that the following main factors generally trigger slope failures:

1. Excessive quantities of spoil loaded onto sensitive topsoil, organic soils or sensitive soils covered sloping ground. (In such cases the gradient of the slope should be no more than 5 degrees to the horizontal). Topsoils and organic soils should always be removed prior to depositing spoil and retained for re-use as landscaping a material.
2. The angle of repose of the cut face of excavations is all too often found to be too high, sometimes 70 – 80 degrees to the horizontal. Battering back the sides of an excavation to approx. 60 degrees in clay soils and 30 degrees in granular or organic soils helps to reduce the potential for slippage, which will significantly reduce the potential for soil movement.
3. The height of any temporary stockpile or deposition area will not exceed 2m, unless suitably constrained.
4. Surface water flows will compromise most granular or cohesive soils at any slope angle and care should be taken to stop the development of such flows during construction.

[3] Irish Wind Energy Association (IWEA) (2012) Best Practice Guidelines for the Irish Wind Energy Industry, Fehilly Timoney & Company, Cork

The consequences of soil movements can be identified as damage to machinery, damage or loss of Site Access Roads, damage to site drainage, site works damaged, death or injury to personnel or degradation to the environment.

An emergency plan (refer to **CEMP, Management Plan 1**) is to be prepared and will be enacted should soil movement occur.

10.5.2.6.2 Earthworks & Ground Stability – Prevention of Landslide

Application of the following procedures will have the effect of reducing the hazard with respect to ground stability:

1. Excavated spoil will not be deposited on the down slope or up slope edges of the adjacent topsoil. This spoil will instead be deposited on the two flanks either side of the excavation (where gradient is least) and spread in such a way as to limit the surcharge pressure on sensitive topsoils.
2. The Turbine Hardstand areas surrounding the Turbine Foundations will be designed in a manner such that crane loadings can be transferred directly onto the competent strata underlying any sensitive mineral soils. In order to facilitate these works it will be necessary to undertake limited excavations. To ensure effective sidewall support during these operations the contractor will adopt an approved engineering solution (such as a suitable bracing system or other method) to maintain sidewall stability at all times.
3. Movement can often occur during or following severe rainstorm events, particularly when following a prolonged dry spell. Extra vigilance will be maintained at such times, during construction.
4. All slopes are to be regularly checked, during the construction and operational phases, for development of tension cracks, which are indicative of slope movement.
5. Method statements will be followed at all times. Where modification is required, this will be agreed by the supervising engineer.
6. Slopes will not be undercut or excavations left unsupported for periods in excess of 24 hours. Excavations are to be backfilled as soon as practicable. Excavation and filling operations shall be coordinated to minimise the time an excavation remains opened.
7. Pore water pressure within excavations should be kept low at all times by draining deliberate or intentional sumps at regular intervals. This is to prevent ponding of water within excavations which can in turn increase hydraulic heads locally and potentially lead to instability.

8. The potential for soil movement will be monitored regularly during the construction and operational phases by means of regular site visits and assessments, by a suitably qualified and experienced professional.
9. Only experienced and competent contractors will be appointed to conduct the construction works.
10. Low ground bearing pressure machinery shall be used for transport of construction materials in sensitive areas, where ground conditions dictate its requirement.
11. Construction at less sensitive areas will be completed first to allow suitable construction practices to be established before works commence in the more difficult areas.
12. Sufficient time should be allowed to conduct the works in a safe and timely manner.

The application of specific mitigation measures, as detailed in the following table, will use targeted measures to reduce peat landslide hazard to an acceptable level of significance.

Table 10.24: Peat Landslide Hazard – Specific Mitigation Measures

Infrastructure Element	Main Receptor Risk	Pre-Mitigation Hazard	Significance Extent Context Probability	Post-Mitigation Hazard
Main Structures				
T1	Minor watercourse within 200m	MEDIUM	1. The T1 location is not connected to the wider surface water drainage network. Isolated drains in cut cells are present but do not connect to flowing drains in the surrounding area. The works at T1 will be designed to maintain its isolation from the surrounding surface water drainage network and prevent connectivity to this network. 2. No construction will be undertaken during either storm or high rainfall conditions. 3. Peat faces will be directly supported at excavation location. 4. Where peat faces are to remain exposed these will be battered back to at least 45 degrees to horizontal. 5. Only low-pressure plant machinery will be employed. 6. Staff induction procedure will contain a dedicated section in relation to avoidance of the hazard of peat landslide. Regular surveillance of works, excavations, slopes and will be undertaken by a suitably qualified geotechnical engineer to ensure the continued absence of connectivity to the wider surface water drainage network. Surface water generated at the T2 location will be managed and treated as per the measures set out in **Sections 10.5.1** and **10.5.2.7**, and as per the Surface Water Management Plan (**Appendix 11.2** and **MP3** as part of the CEMP).	LOW
T2	Minor watercourse within 100m	LOW	1. No construction will be undertaken during either storm or high rainfall conditions. 2. Peat faces will be directly supported at excavation location. In order to maintain current baseline water table levels in the degraded raised bog to the west, northwest and southwest of T3 temporary interlocking corrugated sheeting (of material type used for peatland drain-blocking) will be installed into the peat in a semi-circular area along the boundary of the construction footprint at T3. This will maintain hydrology within the bog to the west.	NEGLIGIBLE

Infrastructure Element	Main Receptor Risk	Pre-Mitigation Hazard	Significance Extent Context Probability	Post-Mitigation Hazard
			The interlocking corrugated sheeting will be removed upon completion of works at the T3 location 3. Where peat faces are to remain exposed these will be battered back to at least 45 degrees to horizontal. 4. Staff induction procedure will contain a dedicated section in relation to avoidance of the hazard of peat landslide. Regular surveillance of works, excavations, slopes and the Carricknabraher River tributary to the east of T2 will be undertaken by a suitably qualified geotechnical engineer. 5. Surface water generated at the T2 location will be managed and treated as per the measures set out in **Sections 10.5.1** and **10.5.2.7**, and as per the Surface Water Management Plan (**Appendix 11.2** and **MP3** as part of the CEMP).	
T3	Minor watercourse within 500m	MEDIUM	1. The turbine and hardstand will be piled and the track up to it constructed using "floated" methods, in order to maintain the integrity and stability of the existing raised bog. 2. No construction will be undertaken during either storm or high rainfall conditions. 3. Peat faces will be directly supported at excavation location. 4. Where peat faces are to remain exposed these will be battered back to at least 45 degrees to horizontal. 5. Only low-pressure plant machinery will be employed. 6. Staff induction procedure will contain a dedicated section in relation to avoidance of the hazard of peat landslide. Regular surveillance of works, excavations, slopes and existing access track to the north of T3 and the Carricknabraher River to the north will be undertaken by a suitably qualified geotechnical engineer. Surface water generated at the T3 location will be managed and treated as per the measures set out in **Sections 10.5.1** and **10.5.2.7**, and as per the Surface Water Management Plan (**Appendix 11.2** and **MP3** as part of the CEMP).	LOW
T4	Minor watercourse within 200m	LOW	1. No construction will be undertaken during either storm or high rainfall conditions. 2. Peat faces will be directly supported at excavation location. 3. Where peat faces are to remain exposed these will be battered back to at least 45 degrees to horizontal. 4. Staff induction procedure will contain a dedicated section in relation to avoidance of the hazard of peat landslide. Regular surveillance of works, excavations, slopes and the Owennaforeesha River to the west will be undertaken by a suitably qualified geotechnical engineer. Surface water generated at the T4 location will be managed and treated as per the measures set out in **Sections 10.5.1** and **10.5.2.7**, and as per the Surface Water Management Plan (**Appendix 11.2** and **MP3** as part of the CEMP).	NEGLIGIBLE
T5	Minor watercourse within 500m	NEGLIGIBLE	1. Staff induction procedure will contain a dedicated section in relation to avoidance of the hazard of peat landslide. Regular surveillance of works, excavations, slopes and the minor stream tributary of the Owennaforeesha River to the south will be undertaken by a suitably qualified geotechnical engineer. Surface water generated at the T5 location will be managed and treated as per the measures set out in **Sections 10.5.1** and **10.5.2.7**, and as per the Surface Water Management Plan (**Appendix 11.2** and **MP3** as part of the CEMP).	NEGLIGIBLE
T6	Forestry, agricultural lands & bogland habitat	NEGLIGIBLE	1. Staff induction procedure will contain a dedicated section in relation to avoidance of the hazard of peat landslide. Regular surveillance of works, excavations, slopes and the minor stream tributary of the Owennaforeesha River to the south will be undertaken by a suitably qualified geotechnical engineer. Surface water generated at the T6	NEGLIGIBLE

Infrastructure Element	Main Receptor Risk	Pre-Mitigation Hazard	Significance Extent Context Probability	Post-Mitigation Hazard
			location will be managed and treated as per the measures set out in **Sections 10.5.1** and **10.5.2.7**, and as per the Surface Water Management Plan (**Appendix 11.2** and **MP3** as part of the CEMP).	
T7	Forestry, agricultural lands & bogland habitat	NEGLIGIBLE	1. Staff induction procedure will contain a dedicated section in relation to avoidance of the hazard of peat landslide. Regular surveillance of works, excavations, slopes and the minor stream (EPA name Tonaknick Stream) to the east will be undertaken by a suitably qualified geotechnical engineer. Surface water generated at the T7 location will be managed and treated as per the measures set out in **Sections 10.5.1** and **10.5.2.7**, and as per the Surface Water Management Plan (**Appendix 11.2** and **MP3** as part of the CEMP).	NEGLIGIBLE
T8	Minor watercourse within 500m	LOW	1. Where peat faces are to remain exposed these will be battered back to at least 45 degrees to horizontal. 2. Staff induction procedure will contain a dedicated section in relation to avoidance of the hazard of peat landslide. Regular surveillance of works, excavations, slopes and the Breedoge River to the south will be undertaken by a suitably qualified geotechnical engineer. Surface water generated at the T8 location will be managed and treated as per the measures set out in **Sections 10.5.1** and **10.5.2.7**, and as per the Surface Water Management Plan (**Appendix 11.2** and **MP3** as part of the CEMP).	NEGLIGIBLE
T9	Minor watercourse within 500m	LOW	1. No construction will be undertaken during either storm or high rainfall conditions. 2. Where peat faces are to remain exposed these will be battered back to at least 45 degrees to horizontal. 3. Only low-pressure plant machinery will be employed. 4. Staff induction procedure will contain a dedicated section in relation to avoidance of the hazard of peat landslide. Regular surveillance of works, excavations, slopes and the Breedoge River to the south will be undertaken by a suitably qualified geotechnical engineer. Surface water generated at the T9 location will be managed and treated as per the measures set out in **Sections 10.5.1** and **10.5.2.7**, and as per the Surface Water Management Plan (**Appendix 11.2** and **MP3** as part of the CEMP).	NEGLIGIBLE
T10	Forestry, agricultural lands & bogland habitat	NEGLIGIBLE	1. Staff induction procedure will contain a dedicated section in relation to avoidance of the hazard of peat landslide. Regular surveillance of works, excavations, slopes the minor stream (EPA name Tonaknick Stream) to the east will be undertaken by a suitably qualified geotechnical engineer. Surface water generated at the T10 location will be managed and treated as per the measures set out in **Sections 10.5.1** and **10.5.2.7**, and as per the Surface Water Management Plan (**Appendix 11.2** and **MP3** as part of the CEMP).	NEGLIGIBLE
T11	Minor watercourse within 100m	LOW	1. No construction will be undertaken during either storm or high rainfall conditions. 2. Where peat faces are to remain exposed these will be battered back to at least 45 degrees to horizontal. 3. Staff induction procedure will contain a dedicated section in relation to avoidance of the hazard of peat landslide. Regular surveillance of works, excavations, slopes and the minor stream (EPA name Breedoge River to the south will be undertaken by a suitably qualified geotechnical engineer. Surface water generated at the T11 location will be managed and treated as per the measures set out in **Sections 10.5.1** and **10.5.2.7**, and as per the Surface Water Management Plan (**Appendix 11.2** and **MP3** as part of the CEMP).	NEGLIGIBLE

Infrastructure Element	Main Receptor Risk	Pre-Mitigation Hazard	Significance Extent Context Probability	Post-Mitigation Hazard
SUBSTATION	Minor watercourse within 200m	LOW	1. No construction will be undertaken during either storm or high rainfall conditions. 2. Where peat faces are to remain exposed these will be battered back to at least 45 degrees to horizontal. 3. Only low-pressure plant machinery will be employed. 4. Staff induction procedure will contain a dedicated section in relation to avoidance of the hazard of peat landslide. Regular surveillance of works, excavations, slopes and the Breedoge River to the east will be undertaken by a suitably qualified geotechnical engineer. Surface water generated at the T8 location will be managed and treated as per the measures set out in **Sections 10.5.1** and **10.5.2.7**, and as per the Surface Water Management Plan (**Appendix 11.2** and **MP3** as part of the CEMP).	NEGLIGIBLE
Access Track Network				
Site entrance 1 to T1	Minor watercourse within 100m	MEDIUM	1. As per turbine T1 above.	LOW
T1 to T2 and to site entrance 2	Crosses minor watercourse	MEDIUM	1. No construction will be undertaken during either storm or high rainfall conditions. 2. Peat faces will be directly supported at excavation location. 3. Where peat faces are to remain exposed these will be battered back to at least 45 degrees to horizontal. 4. Only low-pressure plant machinery will be employed. 5. Staff induction procedure will contain a dedicated section in relation to avoidance of the hazard of peat landslide. Regular surveillance of works, excavations, slopes and the Carricknabraher River crossed by this section of proposed access track will be undertaken by a suitably qualified geotechnical engineer. Surface water generated along the proposed access track location will be managed and treated as per the measures set out in **Sections 10.5.1** and **10.5.2.7**, and as per the Surface Water Management Plan (**Appendix 11.2** and **MP3** as part of the CEMP).	LOW
Site entrance 3 to T4	Minor watercourse within 100m	MEDIUM	1. No construction will be undertaken during either storm or high rainfall conditions. 2. Peat faces will be directly supported at excavation location. 3. Where peat faces are to remain exposed these will be battered back to at least 45 degrees to horizontal. 4. Only low-pressure plant machinery will be employed. 5. Staff induction procedure will contain a dedicated section in relation to avoidance of the hazard of peat landslide. Regular surveillance of works, excavations, slopes and the Owennaforeesha River, crossed by this section of the proposed access track, will be undertaken by a suitably qualified geotechnical engineer. Surface water generated along this section of proposed access track will be managed and treated as per the measures set out in **Sections 10.5.1** and **10.5.2.7**, and as per the Surface Water Management Plan (**Appendix 11.2** and **MP3** as part of the CEMP).	LOW
T4 to T3	Minor watercourse within 200m	MEDIUM	1. No construction will be undertaken during either storm or high rainfall conditions. 2. Peat faces will be directly supported at excavation location. 3. Where peat faces are to remain exposed these will be battered back to at least 45 degrees to horizontal. 4. Only low-pressure plant machinery will be employed. 5. Staff induction procedure will contain a dedicated section in relation to avoidance of the hazard of peat landslide. Regular surveillance of works, excavations, slopes and the Owennaforeesha River, crossed by this section of the	LOW

Infrastructure Element	Main Receptor Risk	Pre-Mitigation Hazard	Significance Extent Context Probability	Post-Mitigation Hazard
			proposed access track, will be undertaken by a suitably qualified geotechnical engineer. Surface water generated along this section of proposed access track will be managed and treated as per the measures set out in **Sections 10.5.1** and **10.5.2.7**, and as per the Surface Water Management Plan (**Appendix 11.2** and **MP3** as part of the CEMP).	
Spur at T4 to T5	Minor watercourse within 500m	LOW	1. No construction will be undertaken during either storm or high rainfall conditions. 2. Where peat faces are to remain exposed these will be battered back to at least 45 degrees to horizontal. 3. Staff induction procedure will contain a dedicated section in relation to avoidance of the hazard of peat landslide. Regular surveillance of works, excavations, slopes and the Owennaforeesha River tributary, crossed by this section of the proposed access track, will be undertaken by a suitably qualified geotechnical engineer. Surface water generated along this section of proposed access track will be managed and treated as per the measures set out in **Sections 10.5.1** and **10.5.2.7**, and as per the Surface Water Management Plan (**Appendix 11.2** and **MP3** as part of the CEMP).	LOW
Spur at T5 to Spur at T7	Minor watercourse within 100m	LOW	1. No construction will be undertaken during either storm or high rainfall conditions. 2. Where peat faces are to remain exposed these will be battered back to at least 45 degrees to horizontal. 3. Only low-pressure plant machinery will be employed. 4. Staff induction procedure will contain a dedicated section in relation to avoidance of the hazard of peat landslide. Regular surveillance of works, excavations, slopes and the minor watercourse tributaries of the Owennaforeesha River, to the south of and crossed by this section of the proposed access track, will be undertaken by a suitably qualified geotechnical engineer. Surface water generated along this section of proposed access track will be managed and treated as per the measures set out in **Sections 10.5.1** and **10.5.2.7**, and as per the Surface Water Management Plan (**Appendix 11.2** and **MP3** as part of the CEMP).	LOW
Site entrance 4 to T7	Forestry, agricultural lands & bogland habitat	LOW	1. No construction will be undertaken during either storm or high rainfall conditions. 2. Where peat faces are to remain exposed these will be battered back to at least 45 degrees to horizontal. 3. Only low-pressure plant machinery will be employed. 4. Staff induction procedure will contain a dedicated section in relation to avoidance of the hazard of peat landslide. Regular surveillance of works, excavations, slopes and the minor watercourse tributary of the Owennaforeesha River, crossed by this section of the proposed access track, will be undertaken by a suitably qualified geotechnical engineer. Surface water generated along this section of proposed access track will be managed and treated as per the measures set out in **Sections 10.5.1** and **10.5.2.7**, and as per the Surface Water Management Plan (**Appendix 11.2** and **MP3** as part of the CEMP).	NEGLIGIBLE
Site Entrance 5 to Substation	Crosses minor watercourse	MEDIUM	1. No construction will be undertaken during either storm or high rainfall conditions. 2. Peat faces will be directly supported at excavation location. 3. Where peat faces are to remain exposed these will be battered back to at least 45 degrees to horizontal. 4. Only low-pressure plant machinery will be employed. 5. Staff induction procedure will contain a dedicated section in relation to avoidance of the hazard of peat landslide. Regular surveillance of works, excavations and slopes will be undertaken by a suitably qualified geotechnical	LOW

Infrastructure Element	Main Receptor Risk	Pre-Mitigation Hazard	Significance Extent Context Probability	Post-Mitigation Hazard
			engineer. Surface water generated along this section of proposed access track will be managed and treated as per the measures set out in **Sections 10.5.1** and **10.5.2.7**, and as per the Surface Water Management Plan (**Appendix 11.2** and **MP3** as part of the CEMP).	
Substation to T11	Crosses minor watercourse	MEDIUM	1. No Construction will be undertaken during either storm or high rainfall conditions. 2. Peat faces will be directly supported at excavation location. 3. Where peat faces are to remain exposed these will be battered back to at least 45 degrees to horizontal. 4. Only low-pressure plant machinery will be employed. 5. Staff induction procedure will contain a dedicated section in relation to avoidance of the hazard of peat landslide. Regular surveillance of works, excavations, slopes and the Breedoge River, crossed by this section of the proposed access track, will be undertaken by a suitably qualified geotechnical engineer. Surface water generated along this section of proposed access track will be managed and treated as per the measures set out in **Sections 10.5.1** and **10.5.2.7**, and as per the Surface Water Management Plan (**Appendix 11.2** and **MP3** as part of the CEMP).	LOW
Spur at T11 to T8	Minor watercourse within 100m	LOW	1. No construction will be undertaken during either storm or high rainfall conditions. 2. Peat faces will be directly supported at excavation location. 3. Where peat faces are to remain exposed these will be battered back to at least 45 degrees to horizontal. 4. Staff induction procedure will contain a dedicated section in relation to avoidance of the hazard of peat landslide. Regular surveillance of works, excavations, slopes and the EPA-named Runnacocka Stream to the east of this section of the proposed access track, will be undertaken by a suitably qualified geotechnical engineer. Surface water generated along this section of proposed access track will be managed and treated as per the measures set out in **Sections 10.5.1** and **10.5.2.7**, and as per the Surface Water Management Plan (**Appendix 11.2** and **MP3** as part of the CEMP).	NEGLIGIBLE

10.5.2.7 Soil Contamination

Design for the Project has been cognisant of the high sensitivity of the local and regional environment. In particular there is recognition that localised soil contamination, either from siltation, cementitious materials, hydrocarbons, the leaching of unknown contaminants from imported materials and from wastewater effluent percolation, has the potential to enter watercourses via surface water run-off and become entrained with flood waters or a rising groundwater table.

The probability for the unlikely event of contamination resulting via these mechanisms will be minimised through the application of good practice and adherence to the **CEMP**, which contains specific guidance in respect to refuelling procedures, pollution prevention and spoil management (**Appendix 2.1**).

Likewise, the importation of materials from off-site will be closely monitored to ensure that no contamination is brought onto the site from external sources. Importation of materials such as aggregates and other forms of construction materials, will be subject to "wheel washing", documented, certified, sampled and evaluated as per the requirements of the **CEMP** and Waste Management Plan (**Appendix 2.1**).

Similarly, but to a lesser degree, there is potential for adverse impact from wastewater percolation unless wastewater is constrained. The only source of wastewater production will be the welfare facilities at the substation. The normal method for dealing with effluent in this case is to design a percolation field and use this to disperse the low-level pollution throughout the groundwater body. However, to remove any potential effect on soils and geology from wastewater contamination, foul effluent will be retained within a "closed" system with all effluent being held within a bunded storage tank with a high-level alarm, drained on a regular basis and disposed of off-site at a suitable licensed facility. This will effectively break any potential pollution linkage to the wider environment.

The **CEMP** will be developed to include the checking of assets (plant, vehicles, fuel bowsers) on a regular basis during the construction phase of the Project. The purpose of this management control is to ensure that the measures in place are operating effectively, prevent accidental leakages, and identify potential breaches in the protective retention and attenuation network during earthworks operations.

Careful design of the Project has reduced the amount of site traffic required on the Wind Farm Site by reducing access tracks lengths, excavation volumes and double handling. Similarly, good site practice and a robust CEMP will also result in less traffic and a lower potential for fuel spills and leakages.

In order to guard against the risk of soil contamination, the following sections outline the specific mitigation measures that will be applied.

10.5.2.7.1 Storage of Fuels and Chemicals

As per Best Practice Guidance (BPGCS005)[4], all fuels, oils and chemicals on the Wind Farm Site will have a secondary containment system of 110% capacity and will be located more than 20m from any watercourse (i.e. outside of the watercourse buffer).

[4] Best Practice Guide BPGCS005 - Oil Storage Guidelines. Available at: http://www.envirocentre.ie/includes/documents/OilStorageBPG.pdf;

A bunded diesel bowser will be located inside a fenced off area within the Temporary Construction Compound. Other chemicals will be stored within a storage container with an accompanying Control of Substances Hazardous to Health ("COSHH") Datasheet in accordance with health and safety regulations. If generators are used on site, these shall be bunded (the bund shall be capable of containing 110% of the fuel tank's capacity). The bund shall be kept empty of water.

Where chemicals are required on site, they must be placed in an appropriate bund to prevent ground contamination. All chemicals must be stored in a correctly marked container clearly identifying the contents. Where labels are worn off, they must have a new label placed on them or the contents transferred to a correctly marked container. All safety data sheets for all chemicals will be filed on site as part of a requirement under the provisions of the CEMP.

Spill kits will be available at all work areas within machinery and at the site office. Contingency plans will be in place for dealing with a spillage should a spillage occur.

10.5.2.7.2 Refuelling

During construction, fuel and oil deliveries will take place within the designated refuelling area within the Temporary Construction Compound only. The Contractor will supervise site deliveries to ensure that the correct amount of material is delivered to the correct tank and the level is checked prior to refilling to avoid spillage.

Where refuelling of vehicles on the Wind Farm Site is necessary, the following guidelines will be strictly adhered to:

- Mobile plant will be filled in a designated area, on an impermeable surface well away from any drains
- A spill kit will be stored (and clearly marked) near refuelling areas.
- A bunded tank / bowser will be used with capacity of the bund to be 110% of the fuel storage capacity.
- Vehicles will never be left unattended during refuelling and drip trays should be located under all static plant vehicles.
- Hoses and valves will be checked regularly for signs of wear and will be turned off and securely locked when not in use.
- Vehicles will not be left running unnecessarily and low emission fuels will be used where possible.
- Diesel pumps and similar equipment will be checked regularly and any accumulated oil removed for appropriate disposal.

10.5.2.7.3 Existing Contamination and Imported Materials

The following practices will be followed in relation to the excavation and reinstatement of Wind Turbines, Turbine Hardstands, Site Access Roads, Onsite Substation, Internal cabling, Borrow Pits, topsoil stripping and any other earthworks, whenever foreign or fill materials are encountered:

- Any suspected fill or material foreign to the site will be stored separately and separated into individual component types, such as concrete, aggregate and bituminous materials.
- Prior to disposal each stockpile of material will be classified with the relevant EU Waste Code by a relevant competent individual.
- To determine the relevant contamination classification for each stockpile (**Inert**, **Contaminated Non-Hazardous** or **Hazardous**) Waste Acceptance Classification testing will be undertaken in line with EPA guidance. The frequency for these tests will be 1 suite of tests for each 100m^3 of material.
- The results of all testing and waste disposal certificates will be retained on site, by the Environmental Manager.

10.5.2.7.4 Concrete

There will be no concrete batching on the Wind Farm Site. Rather, it will be transported to the Wind Farm Site as it is required. A dedicated, bunded area will be created to cater for concrete wash-out and this will be within the onsite Temporary Construction Compound. This will be for the wash-out of the chutes only after the pour. Concrete trucks will then exit the Wind Farm Site via site entrances 1 & 4 and return to the supply plant to wash out the mixer itself. Refer to **Chapter 2: Project Description - Section 2.6.3.**

The main concrete pours at the Wind Turbine locations will be planned in advance and proposed mitigation measures will be as follows:

- Avoiding large concrete pours, for Turbine Foundations, on days when temperatures are not optimal as per (BS 8110) (EN1992-1-2) or when heavy or prolonged rainfall is forecast i.e., during a period in which a Met Éireann Status Red weather event will/has occurred.
- Providing that all concrete pour areas are dewatered prior to pouring concrete and while the concrete is curing.
- Making covers available so that areas can be covered if heavy rain arrives during the curing process which will prevent runoff of concrete which has a high pH.

The chutes wash out on-site will require a small volume of water. This water will be directed to the concrete washout area which will be a temporary lined impermeable containment area or a siltbuster type washout unit or similar. The unit catches solid concrete and filters and contains the washout liquid for pH adjustment and solid separation. The residual liquids and sediments will be disposed of at an appropriately licenced facility.

Temporary lined impermeable containment areas are usually constructed using straw bales and lined with an impermeable geotextile membrane. Refer to CEMP for details. An alternative construction method would be to dig a hole in the ground and place an impermeable geotextile membrane in the hole so that no wastewater can penetrate the cover and seep into the soil and groundwater.

10.5.2.7.5 Wastewater and Sanitation

Wastewater from the staff welfare facilities in the Onsite Substation will be collected in a sealed storage tank, fitted with a high-level alarm. This is a device installed in a fuel storage tank that is capable of sounding an alarm, during a filling operation, when the liquid level nears the top of the tank.

All wastewaters will be tankered off-site by a licensed waste collector to a suitable plant in the vicinity of the Project. There will be no onsite treatment or disposal of wastewater.

10.5.2.7.6 General Waste

All materials used on site and wastes generated on site will be reduced by good site practice and attention to the CEMP (**Sections 3.3.1.8** and **3.8** of the **CEMP** in **Appendix 2.1** of **Volume IV**). A policy of reduce, re-use and recycle will apply.

All waste will be segregated and re-used where possible or removed from site for recycling. Any waste which is not recyclable or compostable will be properly disposed to landfill. Whenever possible, excavated spoil materials will be re-used close to the area of excavation. The careful design which has been achieved will result in minimal excess soil and rock.

Excess spoil material will be separated in terms of soil type (topsoil or mineral soils) and stored within a series of Permanent Spoil Storage areas, as identified on **Figure SD1**. The locations for these Permanent Spoil Storage areas have been carefully considered in terms of ground slope and soil characteristics as well as proximity to sensitive receptors and the flood zone. In this way any potential negative effects have been minimised. Mitigation to

be applied is presented in **Sections 10.5.2.4 Storage and Stockpiles** and **10.5.2.6 Ground Stability**.

10.5.2.7.7 Pollution Prevention

Suitable protection for watercourses potentially affected by the works will be installed prior to relevant works proceeding. These measures will be in-line with EPA Pollution Prevention Guidelines. Protection measures will include:

- Plant and equipment will be stored on dedicated hard standing within the construction compound. This will minimise the risk of pollution caused by leakages occurring out of hours. Drip trays will be used where appropriate.
- All plant and equipment will use biodegradable hydraulic oil.
- Spill kits will be readily available to all personnel. The spill kits will be of an appropriate size and type for the materials held on site.
- Diesel fuel will be stored in a bunded diesel bowser which will be located within a fenced off area in the Temporary Construction Compound.
- Refuelling and maintenance of vehicles and plant will take place in designated areas.
- All other chemicals will be stored at the site compound within an appropriate storage facility along with an accompanying MDS Datasheet.
- Wastewater from the temporary staff toilets and washing facilities will be discharged to sealed containment systems and disposed via licensed contractors.
- Early seeding of lands near watercourses will be undertaken to reduce the potential for sediment runoff.

All staff on site will be made aware of the pollution prevention measures being implemented throughout the construction, operational and Decommissioning phases using appropriate toolbox talks and the site induction.

10.5.2.7.8 Emergency Response

The emergency response plan, as detailed in the CEMP, has been developed in order to deal with any emergency accidents or spills. In particular an emergency spill kit with oil boom and absorbers will be kept on site in the event of an accidental spill. All site operatives will be trained in its use. In addition, all vehicles will also contain emergency spill kits.

10.5.2.8 Construction Phase Residual Effects

The residual effects after implementation of all mitigation measures for the construction phase of the Project are presented in **Table 10.25.**

Table 10.25: Construction Phase Residual Effects Summary

Effect Description	Type	Quality	Significance	Extent	Context	Probability	Duration / Frequency
Compaction, Erosion and Degradation of Soils	Direct	Adverse	Slight (Not Significant in EIA terms)	Site	Contrast to baseline	Likely	Short Term
Land Take – Wind Farm	Direct	Adverse	Slight (Not Significant in EIA terms)	Site	Contrast to baseline	Likely	Long Term
Land Take – TDR	Direct	Adverse	Not Significant	Site	Contrast to baseline	Likely	Long Term
Land Take - GCR	Direct	Adverse	Not Significant	Site	Conforms to baseline	Likely	Temporary
Soil and Bedrock Removal –Excavations	Direct	Adverse	Slight (Not Significant in EIA terms)	Site	Contrast to baseline	Likely	Long Term
Soil and Bedrock Removal - Access Tracks	Direct	Adverse	Slight (Not Significant in EIA terms)	Site	Conforms to baseline	Likely	Long Term
Soil and Bedrock Removal – Turbine and Hardstand Areas	Direct	Adverse	Slight (Not Significant in EIA terms)	Site	Contrast to baseline	Likely	Permanent
Soil and Bedrock Removal – Wind Farm Internal Cabling Trenches	Direct	Adverse	Not significant	Site	Contrast to baseline	Likely	Long Term
Soil and Bedrock Removal – Turbine Delivery Route / Haul Route	Direct	Adverse	Not significant	Regional	Contrast to baseline	Likely	Long Term
Earthworks Activities – Grid Connection Cable	Direct	Adverse	Not significant	Site	Contrast to baseline	Likely	Long Term
Earthworks Activities – Temporary Construction Compound	Direct	Adverse	Not significant	Site	Contrast to baseline	Likely	Temporary
Earthworks Activities – Storage and Stockpiles / Spoil Management	Direct	Adverse	Slight (Not Significant in EIA terms)	Site	Contrast to baseline	Likely	Long Term
Vehicle Movement - Compaction, erosion and degradation of soils arising from vehicular movement along existing public and private roads	Direct	Adverse	Slight (Not Significant in EIA terms)	Localised	Conforms to baseline	Likely	Temporary

Effect Description	Type	Quality	Significance	Extent	Context	Probability	Duration / Frequency
Vehicle Movement – Compaction, subsidence and settlement of newly established and upgraded Access Tracks	Direct	Adverse	Slight (Not Significant in EIA terms)	Localised	Contrast to baseline.	Likely	Permanent
Ground Stability and Failure - Stability issues and slope failure arising from construction activities. (Localised displacement and settlement)	Direct or Indirect / Secondary	Adverse	Slight (Not Significant in EIA terms)	Localised / Potentially Regional	Contrast to baseline	Likely	Long term / Permanent
Ground Stability and Failure - Stability issues and slope failure arising from construction activities (Landslide)	Indirect / Secondary	Adverse	Moderate (Not Significant in EIA terms)	Localised / Potentially Regional	Contrast to baseline	Unlikely	Permanent
Soil and Groundwater – Pollution of Groundwater Aquifer	Indirect / Secondary	Adverse	Slight (Not Significant in EIA terms)	Localised / Potentially Regional	Contrast to baseline	Unlikely	Long term
Soil and Groundwater Contamination - Hydrocarbons	Direct or Indirect / Secondary	Adverse	Slight (Not Significant in EIA terms)	Localised / Potentially Regional	Contrast to baseline	Unlikely	Long term
Soil and Groundwater Contamination – Wastewater and Sanitation	Direct or Indirect / Secondary	Adverse	Slight (Not Significant in EIA terms)	Localised / Potentially Regional	Conforms to baseline	Likely	Temporary
Soil and Groundwater Contamination – Construction and Cementitious materials	Direct or Indirect / Secondary	Adverse	Slight (Not Significant in EIA terms)	Localised / Potentially Regional	Contrast to baseline	Likely	Temporary
Waste Materials – Construction Spoil	Direct	Adverse	Slight (Not Significant in EIA terms)	Localised*	Contrast to baseline	Unlikely	Long term / Permanent
Waste Materials – General Wastes	Direct	Adverse	Not Significant (Not Significant in EIA terms)	Localised*	Contrast to baseline	Unlikely	Temporary
Degradation of Quality of Sites of Sites of Designated Importance caused by emissions / pollution from the Project	Direct / Indirect	Adverse	Imperceptible (Not Significant in EIA terms)	Regional	Contrast to baseline	Unlikely	Long term

10.5.2.9 Operational Phase

It is not envisaged that the operation of the Project will result in significant impacts on the Soils and Geology regime within the Study Area, as there will be no further disturbance of overburden post construction.

The main potential residual impact during the operation phase would be the risk to groundwater from contamination from spills. Storage tanks, used to store fuel for the various items of machinery, will be self-contained and double-walled. Refuelling of maintenance vehicles will be carried out from these tanks or from delivery vehicles at designated refuelling areas. Specific mitigation measures relating to the management of hydrocarbons are as follows:

- Fuels, lubricants and hydraulic fluids for equipment used on the site will be carefully handled to avoid spillage.
- Any spillage of fuels, lubricants or hydraulic oils will be immediately contained, and the contaminated soil removed from the site and properly disposed of.
- Waste oils and hydraulic fluids will be collected in leak-proof containers and removed from the site for recycling and
- Appropriate spill control equipment, such as oil soakage pads, will be kept within the refuelling areas and in each item of plant to deal with any accidental spillage.

All wastes from the Onsite Substation, Wind Turbines and ancillary facilities will be removed by the appropriate contractor. The operational team will carry out maintenance works (to Site Access Roads, Onsite Substation, Wind Turbines and other ancillary facilities) and will put in place control measures to mitigate the risk of hydrocarbon or oil spills during the operational phase of the Project. Any vehicles utilised during the operational phase will be maintained on a weekly basis and checked daily to ensure any damage or leakages are corrected.

Spoil waste stored in the Permanent Spoil Storage areas will continue to be monitored for stability on a regular basis during the operational phase. This monitoring will check for early indications of movement such as the development of cracks, minor slippage and / or localised subsidence. Where identified, remediation actions will be taken to repair any failure and restore the integrity of the deposition area.

Due to the reduced magnitude of the effects, no additional mitigation measures are required for the maintenance and operation of the Project, over and above those incorporated into

the design of the Onsite Substation transformers and batteries, which will be bunded to protect soils against accidental leakages of oils and battery fluids.

These potential effects are limited by the size of the fuel tank of vehicles used on the site. Additional potential effects will occur in the event that a turbine needs replacement. The effects associated with this will be similar to those involved for vehicles movements during construction but much reduced.

There are no other effects relating to soils and geology during the operational phase of the Project.

10.5.2.9.1 Operational Phase Residual Effects

The potential effects on the soil and geological environment during the operational phase of the work will be mitigated through good site practice as described in the IWEA and Scottish Best Practice Guidelines as detailed in the CEMP, relating to vehicular movements, hydrocarbon controls, sustainable use of natural resources, human health etc. as discussed previously.

Overall, the residual effects from these aspects will have a **Long-term / Permanent, Adverse** and **Not Significant** residual effect on the Site. In EIA terms the residual effect is considered as **Not Significant.**

The residual effects after implementation of all mitigation measures for the operational phase of the Project are presented in **Table 10.26**.

Table 10.26: Operational Phase Residual Effect Summary

Effect Description	Type	Quality	Significance	Extent	Context	Probability	Duration / Frequency
Soil Compaction and Subsidence	Direct	Adverse	Not Significant	Localised	Contrast to baseline	Likely	Long-term
Land and Land Use	Direct	Adverse	Imperceptible (Not Significant in EIA terms)	Localised	Contrast to baseline	Likely	Long term / Permanent
Soil Contamination – Hydrocarbons and Chemicals	Direct	Adverse	Slight (Not Significant in EIA terms)	Localised	Contrast to baseline	Unlikely	Long term
Soil contamination - Operational Wastes	Direct	Adverse	Not Significant	Localised*	Contrast to baseline	Likely	Long term

10.5.3 Project Decommissioning and Restoration Phases

10.5.3.1 Decommissioning of Infrastructure

Following the permitted lifespan of the Project, Decommissioning of the infrastructure will occur or the Project may be repowered with more modern turbines, subject to a separate planning application.

The Permanent Met Mast, Internal cabling and other ancillary structures, will be removed and the areas reinstated using materials stored on site. The Wind Turbines, transformers and associated "above-ground" elements will be removed, but the Turbine Foundations will be left in-situ and reinstated.

Mitigation measures applied during Decommissioning activities will be similar to those applied during construction where relevant.

Grid Connection infrastructure including the Onsite Substation, Grid Connection and ancillary electrical equipment shall form part of the national electricity grid network and will be left in situ.

10.5.3.2 Reinstatement of Redundant Access Track and Hardstand Areas

The temporary works areas needed for the construction period such as temporary widening and temporary track required for the TDR, site compound and blade laydown areas, will be reinstated using the excavated material removed and stockpiled on site, as soon as construction activities have been completed.

At the time of Decommissioning of the Project, some of the effects associated with reinstatement of the site (excavation of access tracks) will be avoided by leaving these in place where possible. It is proposed to leave the Site Access Roads in-situ at the Decommissioning stage. IWEA state that "it may be best" to leave site tracks in-situ depending on the size and geography of the development. It is considered that leaving the access tracks in-situ will cause less environmental damage than removing and recycling them, so these elements of the construction will be retained.

Turbine Hardstands and other ancillary infrastructure will be removed and covered with overburden and topsoil material to allow for re-vegetation of the site.

Areas of excess soil and rock will be reused in order to match the surrounding land as near as possible. Drainage and slopes will be restored as close to the original ground as possible.

10.5.3.2.1 Reinstatement Phase Residual Effects

The residual effects associated with Decommissioning includes waste generation, hydrocarbon leakage and erosion of soil and rock. In general, effects will be similar to those at construction, but of a greatly reduced magnitude.

On completion of reinstatement works, it is expected that the wind farm will be returned as close to its present condition as possible. In particular, areas where local drainage has been altered will be reinstated.

Refer to **Table 10.27** for Decommissioning Phase Residual Effects.

Table 10.27: Decommissioning Phase Residual Effects Summary

Effect Description	Type	Quality	Significance	Extent	Context	Probability	Duration / Frequency
Land and Land Use	Direct	Positive	Slight (Not Significant in EIA terms)	Localised	Contrast to baseline	Likely	Long term / Permanent
Vehicle Movement	Direct	Adverse	Not Significant	Localised	Contrast to baseline	Unlikely	Long term / Permanent
Peat Landslide Hazard, Ground Stability and Failure	Direct	Adverse	Not Significant	Localised	Contrast to baseline	Unlikely	Permanent
Ground Stability and Failure - Stability issues and slope failure arising from construction activities. (Localised displacement and settlement)	Direct or Indirect / Secondary	Adverse	Not Significant	Localised / Potentially Regional	Contrast to baseline	Likely	Long term / Permanent
Ground Stability and Failure - Stability issues and slope failure arising from construction activities (Landslide)	Indirect / Secondary	Adverse	Not Significant	Localised / Potentially Regional	Contrast to baseline	Unlikely	Permanent
Soil and Groundwater Contamination	Direct or Indirect / Secondary	Adverse	Slight (Not Significant in EIA terms)	Localised	Contrast to baseline	Unlikely	Long term
Decommissioning Spoil	Direct	Adverse	Not Significant	Localised	Contrast to baseline	Likely	Long term / Permanent
General Waste	Direct	Adverse	Not Significant	Localised	Contrast to baseline	Likely	Permanent

10.6 SUMMARY OF SIGNIFICANT EFFECTS

Providing the mitigation measures outlined in this chapter are fully implemented and best practice as described in the IWEA and Scottish Best Practice Guidelines is followed on the Wind Farm Site and Grid Connection, it is expected that effects associated with the Project will not be significant.

The CEMP also includes a suitable monitoring programme which will ensure that there is rigid adherence both to the CEMP and to the mitigation measures outlined here during construction, operation and Decommissioning of the Project.

Table 10.28: Summary of Potential Effects on receiving environment from the Project in the absence of and with mitigation measures.

		Qualifying Criteria Pre-Mitigation								Qualifying Criteria with Mitigation			
Effect / Impact Description	**Phase**	**Type**	**Quality**	**Scale**	**Significance**	**Extent**	**Context**	**Probability**	**Duration / Frequency**	**Mitigation**	**Mitigation Applied**	**Quality**	**Significance**
Compaction, Erosion and Degradation of Soils	Construction	Direct	Adverse	Small Adverse	Moderate	Site	Contrast to baseline	Likely	Short term	Yes	Yes	Adverse	Slight
Land Take – Wind Farm	Construction	Direct	Adverse	Moderate Adverse	Moderate	Site	Contrast to baseline	Likely	Long term	None	No	Adverse	Slight
Land Take – TDR	Construction	Direct	Adverse	Small Adverse	Slight	Site	Contrast to baseline	Likely	Long term	None	No	Adverse	Not Significant
Land Take - GC	Construction	Direct	Adverse	Small Adverse	Slight	Site	Conforms to baseline	Likely	Temporary	None	No	Adverse	Not Significant
Soil and Bedrock Removal – Excavations	Construction	Direct	Adverse	Small Adverse	**Significant**	Site	Contrast to baseline	Likely	Long term	Yes	Yes	Adverse	Slight
Soil and Bedrock Removal – Site Access Roads	Construction	Direct	Adverse	Small Adverse	**Significant**	Site	Conforms to baseline	Likely	Long term	Yes	Yes	Adverse	Slight
Soil and Bedrock Removal – Turbine Foundations and Turbine Hardstands	Construction	Direct	Adverse	Small Adverse	**Significant**	Site	Conforms to baseline	Likely	Permanent	Yes	Yes	Adverse	Slight
Soil and Bedrock Removal – Internal Cabling trenches	Construction	Direct	Adverse	Small Adverse	Not significant	Site	Contrast to baseline	Likely	Long term	Yes	Yes	Adverse	Not significant

		Qualifying Criteria Pre-Mitigation								Qualifying Criteria with Mitigation			
Effect / Impact Description	**Phase**	**Type**	**Quality**	**Scale**	**Significance**	**Extent**	**Context**	**Probability**	**Duration / Frequency**	**Mitigation**	**Mitigation Applied**	**Quality**	**Significance**
Soil and Bedrock Removal – Turbine Delivery Route / Construction Haul Routes	Construction	Direct	Adverse	Small Adverse	Not significant	Regional	Contrast to baseline	Likely	Long term	None	No	Adverse	Not significant
Earthworks Activities – Grid Connection cable	Construction	Direct	Adverse	Small Adverse	Not Significant	Site	Contrast to baseline	Likely	Permanent	None	No	Adverse	Not Significant
Earthworks Activities – Temporary Construction Compounds	Construction	Direct	Adverse	Small Adverse	Slight	Site	Contrast to baseline	Likely	Temporary	Yes	Yes	Adverse	Not Significant
Earthworks Activities – Storage and Stockpiles / Spoil Management	Construction	Direct	Adverse	Small Adverse	Moderate	Site	Contrast to baseline	Likely	Long term	Yes	Yes	Adverse	Slight
Vehicle Movement - Compaction, erosion and degradation of soils arising from vehicular movement along existing public and private roads	Construction	Direct	Adverse	Small Adverse	Moderate	Localised	Conforms to baseline	Likely	Temporary	Yes	Yes	Adverse	Slight
Vehicle Movement – Compaction, subsidence and settlement of newly established and upgraded Site Access Roads	Construction	Direct	Adverse	Small Adverse	Moderate	Localised	Contrast to baseline.	Likely	Permanent	Yes	Yes	Adverse	Slight
Ground Stability and Failure - Stability issues and slope failure arising from construction activities. (Localised displacement and settlement)	Construction	Direct / or Indirect / Secondary	Adverse	Moderate Adverse	**Significant**	Localised / Potentially Regional	Contrast to baseline	Likely	Long term / Permanent	Yes	Yes	Adverse	Slight
Ground Stability and Failure - Stability issues and slope failure arising from construction activities (Landslide)	Construction	Indirect / Secondary	Adverse	Moderate Adverse	**Significant**	Localised / Potentially Regional	Contrast to baseline	Unlikely	Permanent	Yes	Yes	Adverse	Moderate
Soil and Groundwater – Pollution of Groundwater Aquifer	Construction	Indirect / Secondary	Adverse	Large Adverse	**Significant**	Localised / Potentially Regional	Contrast to baseline	Unlikely	Long term	Yes	Yes	Adverse	Slight
Soil and Groundwater Contamination - Hydrocarbons	Construction	Direct or Indirect / Secondary	Adverse	Large Adverse	**Significant**	Localised / Potentially Regional	Contrast to baseline	Unlikely	Long term	Yes	Yes	Adverse	Slight

		Qualifying Criteria Pre-Mitigation								Qualifying Criteria with Mitigation			
Effect / Impact Description	**Phase**	**Type**	**Quality**	**Scale**	**Significance**	**Extent**	**Context**	**Probability**	**Duration / Frequency**	**Mitigation**	**Mitigation Applied**	**Quality**	**Significance**
Soil and Groundwater Contamination – Wastewater and Sanitation	Construction	Direct or Indirect / Secondary	Adverse	Large Adverse	Moderate	Localised / Potentially Regional	Conforms to baseline	Likely	Short term	Yes	Yes	Adverse	Slight
Soil and Groundwater Contamination – Construction and Cementitious materials	Construction	Direct or Indirect / Secondary	Adverse	Large Adverse	Moderate	Localised / Potentially Regional	Contrast to baseline	Likely	Temporary	Yes	Yes	Adverse	Slight
Waste Materials – Construction Spoil	Construction	Direct	Adverse	Moderate Adverse	Moderate	Localised	Contrast to baseline	Unlikely	Long term / Permanent	Yes	Yes	Adverse	Slight
Waste Materials – General Waste	Construction	Direct	Adverse	Small Adverse	Slight	Localised	Contrast to baseline	Unlikely	Temporary	Yes	Yes	Adverse	Not Significant
Degradation of Quality of Sites of Geological Significance caused by emissions / pollution from the Project	Construction	Indirect / Secondary	Adverse	Large Adverse	Moderate	Regional	Contrast to baseline	Unlikely	Long term	No	No	Adverse	Slight
Soil Compaction and Subsidence	Operation	Direct	Adverse	Small Adverse	Slight	Localised	Contrast to Baseline	Likely	Long term	Yes	Yes	Adverse	Not Significant
Land and Land Use	Operation	Direct	Adverse	Negligible	Imperceptible	Localised	Contrast to baseline	Likely	Long term	None	No	Adverse	Imperceptible
Soil Contamination – Hydrocarbons and Chemicals	Operation	Indirect / Secondary	Adverse	Large Adverse	**Significant**	Local / Potentially Regional	Contrast to baseline	Unlikely	Long term	Yes	Yes	Adverse	Slight
Soil Contamination - Operational Wastes	Operation	Direct	Adverse	Small Adverse	Slight	Localised	Contrast to baseline	Likely	Long term	Yes	Yes	Adverse	Not Significant
Land and Land Uses	Decommissioning	Direct	Positive	Minor Beneficial	Slight	Localised	Contrast to baseline	Likely	Long term / Permanent	None	No	Positive	Slight
Vehicle Movement - Compaction, erosion and degradation of soils arising from vehicular movement along existing public and private roads	Decommissioning	Direct	Adverse	Small Adverse	Slight	Localised	Conforms to baseline	Unlikely	Long term / Permanent	Yes	Yes	Adverse	Not Significant
Ground Stability and Failure - Stability issues and slope failure arising from construction activities. (Localised displacement and settlement)	Decommissioning	Direct / or Indirect / Secondary	Adverse	Moderate Adverse	Slight	Localised	Contrast to baseline	Likely	Long term	Yes	Yes	Adverse	Not Significant

		Qualifying Criteria Pre-Mitigation								Qualifying Criteria with Mitigation			
Effect / Impact Description	**Phase**	**Type**	**Quality**	**Scale**	**Significance**	**Extent**	**Context**	**Probability**	**Duration / Frequency**	**Mitigation**	**Mitigation Applied**	**Quality**	**Significance**
Ground Stability and Failure - Stability issues and slope failure arising from construction activities (Landslide)	Decommissioning	Indirect / Secondary	Adverse	Moderate Adverse	Slight	Localised	Contrast to baseline	Unlikely	Long term	Yes	Yes	Adverse	Not significant
Soil and Groundwater Contamination	Decommissioning	Indirect / Secondary	Adverse	Large Adverse	Moderate	Localised	Contrast to baseline	Unlikely	Long term	Yes	Yes	Adverse	Slight
Decommissioning Spoil	Decommissioning	Direct or Indirect / Secondary	Adverse	Large Adverse	Slight	Localised	Contrast to baseline	Likely	Short term	Yes	Yes	Adverse	Not significant
Waste Materials – General Waste	Decommissioning	Direct	Adverse	Small Adverse	Slight	Localised	Contrast to baseline	Unlikely	Short term	Yes	Yes	Adverse	Not significant
	Note:												

10.7 REFERENCES

Geological Survey of Ireland (GSI) (ND) *Geological Survey Ireland Spatial Resources* [Online] – Available at: http://dcenr.maps.arcgis.com/apps/MapSeries/index.html?appid=a30af518e87a4c0ab2fbde2aaac3c228 [Accessed 21/11/2024].

Geological Survey of Ireland (GSI) (ND) *The role of geo-heritage: Themes* [Online] - Available at: https://www.gsi.ie/en-ie/programmes-and-projects/geoheritage/activities/background-information/Pages/Themes.aspx# [Accessed 21/11/2024].

Environmental Protection Agency, Ireland. EPA Online Data Portal. Available at: https://gis.epa.ie/EPAMaps/. [Accessed 21/11/2024].

Ordnance Survey of Ireland. Available at: https://osi.ie [Accessed 21/11/2024]

Geological Map of Ireland, 1:750,000 3rd Edition 1962.

Craig, R F. 1997. Soil Mechanics. Sixth Edition. E & FN Spon, London.

Daly, D, And Warren, W. 1994. Mapping of Groundwater Vulnerability to Pollution. Geological Survey of Ireland (Dublin) Guidelines.

British Standards Institution (BSI) (2015) + a1 2020 Code of Practice for Site Investigations.

Department of the Environment, Heritage and Local Government (DEHLG) (2006) *Wind Energy Development Guidelines* (2006).

Environmental Protection Agency (EPA) (2015) *Advice Notes for Preparing Environmental Effect Statements DRAFT September 2015*. Environmental Protection Agency, Ireland.

Environmental Protection Agency (EPA) (2017) *Guidelines on the information to be contained in Environmental Effect Assessment Reports.*

Environmental Protection Agency (EPA) (ND) *EPA Map Viewer* [Online] - Available at: https://gis.epa.ie/EPAMaps/ [Accessed 21/11/2024].

Forestry Civil Engineering Scottish Natural Heritage (FCESNH) (2010) *FLOATING ROADS ON PEAT.*

Institute of Geologists of Ireland (IGI) (2013) *Guidelines for the Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Effect Statements.*

Irish Wind Energy Association (2012). *Best Practice Guidelines for the Irish Wind Energy Association.*

IWEA/Wind Skillnet.

Lindsay, R; Bragg, O. (2005) *WIND FARMS AND BLANKET PEAT The Bog Slide of 16th October 2003 at Derrybrien, Co. Galway, Ireland*. University of East London and The Derrybrien Development Cooperative Ltd [Online].
Available at:
https://www.researchgate.net/publication/258332297_Wind_Farms_and_Blanket_Peat_-_The_Bog_Slide_of_16th_October_2003_at_Derrybrien_CoGalway_Ireland [Accessed 21/11/2024].

National Parks & Wildlife Services (NPWS) (ND) *NPWS Map Viewer* [Online] - Available at: http://webgis.npws.ie/npwsviewer/

National Roads Authority (NRA) (2008) *Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes.*

Scottish Renewables/Scottish Natural Heritage/Scottish Environment Protection Agency/Forestry Commission Scotland/Historic Environment Scotland. (Version 3, September 2015). *Good Practice during Wind Farm Construction.*

S.R.21: 2014 +A1: 2016. *Guidance on the Use of I.S. EN 13242:2002 +A1:2007 Aggregates for Unbound and Hydraulically Bound Materials for Use In Civil Engineering Work and Road Construction.*

Transport Infrastructure Ireland (TII) (2013) *Notes for Guidance on the Specification for Road Works Series NG 600 – Earthworks.*

Transport Infrastructure Ireland (TII) (2013) Specification for Road Works Series 800 - Road Pavements - Unbound and Cement Bound Mixtures CC-SPW-00800 March 2013.

von Post L., Granlund L.E., and Granlund L. (1926) *Södra Sveriges Torvtillgånger, I*. Sver.Geo.Unders. C35, 19 (2).