

Ballyfeeny Green Energy Project



Environmental Impact Assessment Report Volume II

Chapter 7 – Land Soils and Geology

September 2025

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Acronyms

<u>Term</u>	<u>Meaning</u>
GCR	Grid Connection Route
TDR	Turbine Delivery Route
WGL	Whiteford Geoservices Limited
AMIOSH	Affiliate Member of the Institute of Safety and Health
MEAGE	Member European Association of Geoscientists and Engineering
FGS	Fellow of the Geological Society of London
MW	Megawatts
EIA	Environmental Impact Assessment
LA	Local Authority
EU	European Union
DECLG	Department of Environment, Community and Local Government
DHPLG	Department of Housing Planning and Local Government
EC	European Commission
CDP	County Development Plan
GSI	Geological Survey Ireland
EPA	Environmental Protection Agency
IGI	Institute of Geologists of Ireland
INSI	Irish National Seismic Network
IWEA	Irish Wind Energy Association
NRA	National Roads Authority
NPWS	National Parks and Wildlife Service
SNH	Scottish National Heritage
DoHPLG	Department of Housing, Planning and Local Government
IFI	Inland Fisheries Ireland
SEA	Strategic Environmental Assessment
CDR	Construction Delivery Route
PLHA	Peat Landslide Hazard Assessment
OSI	Ordnance Survey of Ireland
ERT	Electrical Resistivity Tomography
T01	Turbine 1
T02	Turbine 2
T03	Turbine 3
T04	Turbine 4
T05	Turbine 5
T06	Turbine 6
kV	Kilovolts
AOD	Above ordnance datum
HDD	Horizontal Directional Drilling
ESB	Electrical Supply Board
RLB	Redline Boundary
SI	Site investigation
FoS	Factor of Safety

kPa	Kilopascal
HR	Hazard Ranking
RCDP	Roscommon County Development Plan
CEMP	Construction Environmental Management Plan
TII	Transport Infrastructure Ireland
WEDG 2006	Wind Energy Development Guidelines 2006
DRAFT WEDG 2019	Draft Wind Energy Development Guidelines 2019
EIAR	Environmental Impact Assessment Report
NHA	Natural Heritage Area
Ha	Hectares
ITM	Irish Transverse Mercator
b.g.l	below ground level
SE1	Site Entrance 1
SE2	Site Entrance 2
SE3	Site Entrance 3
SE4	Site Entrance 4
SE5	Site Entrance 5
SE6	Site Entrance 6
mBGL	Meters Below Ground Level
ECoW	Environmental Clerk of Works
MDS	Material Datasheet
CO₂	Carbon dioxide
ERP	Emergency Response Plan
DMP	Decommissioning Management Plan
COMAH	Control of Major Accident Hazards
SWMP	Surface Water Management Plan
CEA	Cumulative Effects Assessment
PSCS	Project Supervisor for the Construction Phase

7. Land, Soils & Geology

7.1 Introduction

This Chapter assesses the likely significant direct and indirect effects on land, soils and geology of the proposed Project on the receiving environment, during the construction, operation and decommissioning phases.

The proposed Project includes six no. turbines and all associated infrastructure including Turbine Foundations, Turbine Hardstands, Site Access Tracks, Wind Farm Internal Cabling, Grid Connection Route (GCR), Relay Tower, Onsite Substation and works required along the public road network for the two Turbine Delivery Route (TDR) options to facilitate the delivery of turbine components. A full description of the proposed Project is provided in **Chapter 2 - Project Description**.

The Applicant is in receipt of a notification of opinion by the Local Authority on design flexibility. The notification is provided in **Appendix 1.5 – DFR-25-1 Notification of Opinion by Local Authority**. This opinion from the Local Authority confirmed that it was *'appropriate that the proposed application be made and decided before the prospective applicant has confirmed certain details of the application'*.

Chapter 1 – Introduction, Section 1.6 Approach to Design Flexibility, outlines with respect to the notification of opinion by the Local Authority, the Applicant in this EIAR, proposes to assess three distinct Technology Options within the range outlined by the Local Authority and in accordance with the design flexibility parameters sought. **Chapter 1 – Introduction Table 1-3**, outlines the options and associated parameters that are used in the EIAR, comprising three potential turbines classified as Technology Option 1, 2 and 3. Further detail on the assessment of the Technology Options in this Chapter is provided in **Section 7.2.5**.

This chapter is supported by the following appendices:

- **Volume 4- EIAR Figures**
- **Appendix 7.1 – Soil & Geology Technical Assessment**
- **Appendix 7.2 – Preliminary Ground Investigation**

The assessment should be read in conjunction with:

- **Chapter 6 – Biodiversity**
- **Chapter 8 – Water, Hydrology (Flood Risk Assessment) and Hydrogeology**
- **Chapter 16 – Cumulative Effects**, which considers other plans and projects that may act cumulatively with the proposed Project; and

- **Chapter 17 – Inter-Related Effects**, which address the interactions between effects on different environmental aspects.

7.1.1 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 has completed in excess 2,200 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 at home, 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:

- Mr Ryan Calvert BSc (Hons) Forensic Science – Technical Director. (17 years' experience);
- Mr James Arden BSc (Hons) Geology, Senior Project Geologist. (18 years' experience); and
- Mr Jamie Stothers – Technician. (9 years' experience).

Denise Meade has reviewed this Chapter. Denise has over 20 years' experience working on both public and private sector developments. Her experience lies in the environmental co-ordination of large infrastructure projects across a range of industries including renewable energy, roads, water and wastewater. She has managed all aspects of planning applications, with a focus on the technical review and delivery of EIARs. She is a Chartered Environmentalist (CEnv) and Chartered Water and Environmental Manager (C.WEM) and hold an MSc in Applied Environmental Science and AdvDip in Planning & Environmental Law.

7.1.2 Legislation, Guidance & Policy

This assessment complies with 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 (hereafter referred to as the 'EIA Directive'), which requires Environmental Impact Assessment (EIA) for certain types of major development before development consent is granted.

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

- Planning and Development Act 2000 (as amended);
- Planning and Development Regulations 2001 (as amended);
- The Heritage Act 1995 (as amended);
- The Wildlife Acts, 1976, as amended;
- European Union (Invasive Alien Species) Regulations 2024;
- Waste Management Acts 1996, as amended;
- European Communities Act, 1972 as amended;
- S.I. No. 547/2008 European Communities (Environmental Liability) Regulations 2008;
- S.I. No. 323/2020 European Union (Waste Directive) Regulations 2020; and
- Directive 2000/60/EC establishing a framework for Community action in the field of water policy (the "**Water Framework Directive**").

All relevant guidance and reference documents consulted to assist with the production of this assessment, including the following:

- BSI (1999) 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 (2017) Interim Guidelines for Planning Authorities on Statutory Plans, Renewable Energy and Climate Change and Wind Energy Development Guidelines 2006;
- Draft Revised Wind Energy Development Guidelines (Department of Housing Planning and Local Government (DoHPLG), 2019) (hereafter referred to as Draft WEDG's 2019);
- European Commission (EC) (2021) EU Soil Strategy for 2030;
- EC, (2017) Environmental Impact Assessment of Projects – Guidance on the Preparation of the Environmental Impact Assessment Report;
- Environmental Protection Agency (EPA) (2003) Advice Notes on Current Practice in the Preparation of Environmental Impact Statements);
- Guidelines on the information to be contained in Environmental Impact Assessment Reports (hereafter referred to as the Environmental Protection Agency (EPA) Guidelines) (EPA, 2022);
- 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; and
- Scottish National Heritage (SNH) (2013) A Handbook on Environmental Impact Assessment.

7.1.3 Policy

The overarching planning policy relevant to the proposed Project is detailed in **Chapter 4 – Planning and Policy**. A **Planning Statement (Part 1)** has been provided with planning application documents.

Policies and objectives relevant to land, soils and geology in the Roscommon CDP 2022-2028 include:

- **(NH 10.8)** “Ensure that no plans, programmes, etc. or projects are permitted that give rise to significant cumulative, direct, indirect or secondary impacts on the integrity of European Sites arising from their size or scale, land take, proximity, resource requirements, emissions (disposal to land, water or air), transportation requirements, duration of construction, operation, decommissioning or from any other effects, (either individually or in combination with other plans, programmes, etc. or projects)”.

Policies and objectives relevant to land, soils and geology in the Longford CDP 2021-2027 include

- **(CPO 12.6)** “*Ensure that no plans, programmes, etc. or projects giving rise to significant cumulative, direct, indirect or secondary impacts on European Sites arising from their size or scale, land take, proximity, resource requirements, emissions (disposal to land, water or air), transportation requirements, duration of construction, operation, decommissioning or from any other effects shall be permitted on the basis of this Plan (either individually or in combination with other plans, programmes, etc. or projects). Except as provided for in Article 6(4) of the Habitats Directive; in so far as there must be – (a) no alternative solution available, (b) imperative reasons of an*

overriding public interest for the project to proceed; and (c) Adequate compensatory measures in place.”

- **(CPO 12.16)** *“Ensure that no plan, programme, or project giving rise to significant cumulative, direct, indirect or secondary impacts on European sites arising from their size or scale, land take, proximity, resource requirements, emissions (disposal to land, water or air), transportation requirements, duration of construction, operation, decommissioning or from any other effects shall be permitted on the basis of this Plan, either individually or in combination with other plans, programmes, etc. or projects.*

Policies and objectives relevant to land, soils and geology in the Leitrim CDP 2023-2029 include:

- **(NH OBJ 1)** *“To ensure that no project or programme giving rise to significant adverse, direct, indirect, secondary or cumulative impacts on the integrity of any Natura 2000 site(s), having regard to their qualifying interests and conservation objectives, arising from their size, scale, area or land take, proximity, resource requirements, emissions (disposal to land, water or air), transportation requirements, duration of construction, operation, decommissioning or from any other effects shall be permitted on the basis of this Plan (either alone or in combination with other plans or projects)”.*

7.2 Methodology

7.2.1 Scoping Responses and Consultation

Scoping and consultation have been carried out in support of the proposed Project and in line with the EIA Directive, together with the EPA Guidelines and with due regard for the *Environmental Impact Assessment of Projects: Guidance on Scoping* (European Commission, 2017).

An EIA Scoping Report was issued to 48 Statutory and non-statutory stakeholders via email in September 2024, of which 10 responded. All scoping consultation responses are provided in **Appendix 1.3 – Scoping Consultation Responses**.

Table 7-1 summarises issues raised during this consultation process and relevant to Soils and Geology.

Table 7-1: Scoping Responses and Consultation

Stakeholder Details	Type and Date	Stakeholder Comment	How comment has been addressed in the EIAR
Inland Fisheries Ireland (IFI)	21 October 2024	Comment 1 “We are concerned about soils, their structure and types around all the turbines, associated access roads and site development. In particular we have concerns about the stability of the soils and the impact that works on both the turbines and access roads will have either directly or by vibration on the stability of the soils. The IFI will be very concerned where it is proposed to construct wind turbines on peat soils especially if these peat soils are located on upland areas. Extra caution will be required to prevent deleterious discharges to waters.”	Commentary with respect to stability of soils is discussed in Section 7.3 Baseline Environment, Pages 35, 45, 46 and 52 to 55. Commentary with respect to natural soils including peat is discussed in Section 7.3 Baseline Environment, pages 25, 35, 38 to 42 and 44 to 48.
		Comment 3 “Any proposals regarding the use of borrow pits will need to be thoroughly assessed in terms of dewatering and drainage during construction and post construction to prevent any risk of pollution.”	No borrow pits are proposed.
Geological Survey Ireland (GSI)	16 October 2024	Comment 1 With reference to your letter received on the 18	GSI datasets have been used for the preparation

Stakeholder Details	Type and Date	Stakeholder Comment	How comment has been addressed in the EIAR
		September 2024, concerning the proposed Ballyfeeny Green Energy Project, we recommend using our various data sets when conducting the EIAR, SEA, planning and scoping processes for developments, plans and policies. For more detailed information on how to access this data please access 'Data and Maps' Data & Maps (gsi.ie) on our 'Geoscience for planning' webpage.	of Section 7.3 Baseline Environment .

7.2.2 Study Area

The study area is defined as the region within which changes to the soils and geology environment associated with the proposed Project could reasonably impact soils and geology receptors. All potential direct effects of the proposed Project have a limited zone of influence and for these, the study area has been identified as 1km from the Redline Boundary.

There is also however 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 1km from the Redline Boundary. For this reason, soils and geology receptors within 10km of the Redline Boundary have been included in the study area.

The TDR has also been assessed by applying a 50m buffer to the route including any nodes where temporary accommodating works are proposed.

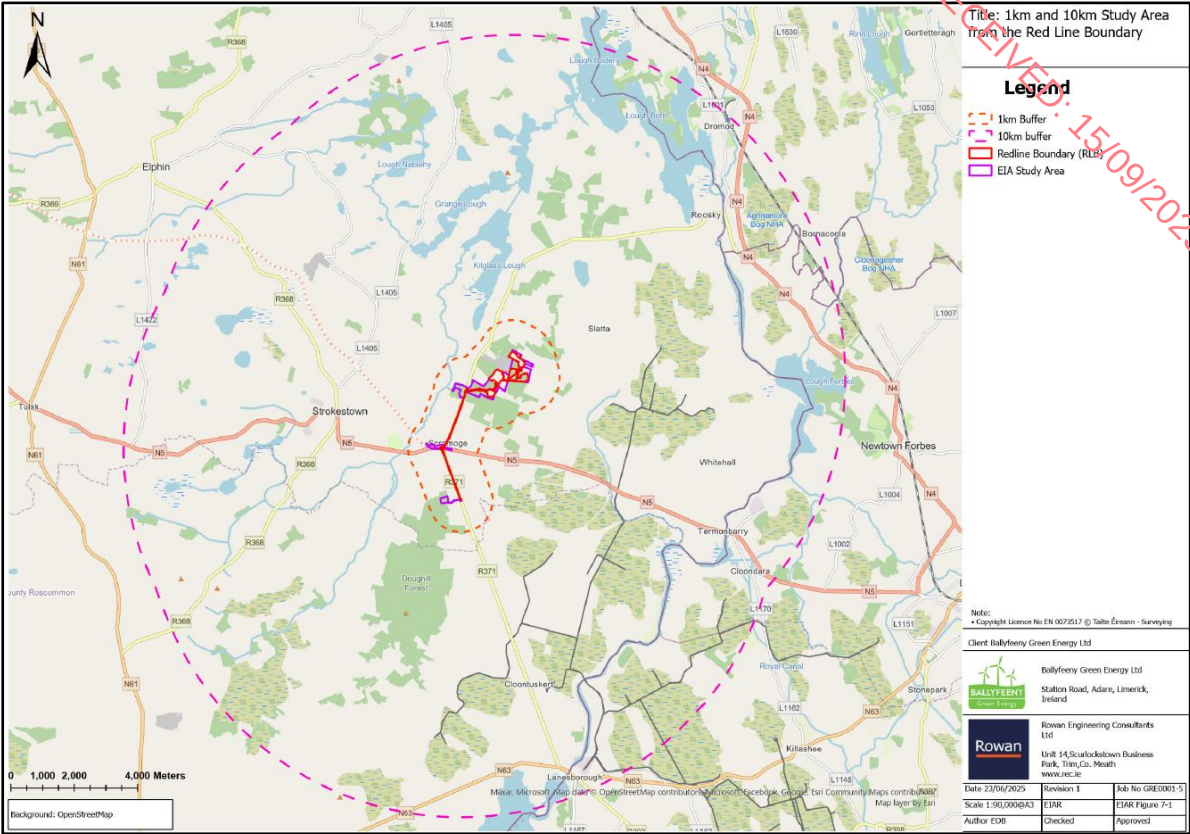


Figure 7-1: EIA Study Area (Ref: EIAR Figure 7-1 (Volume 4))

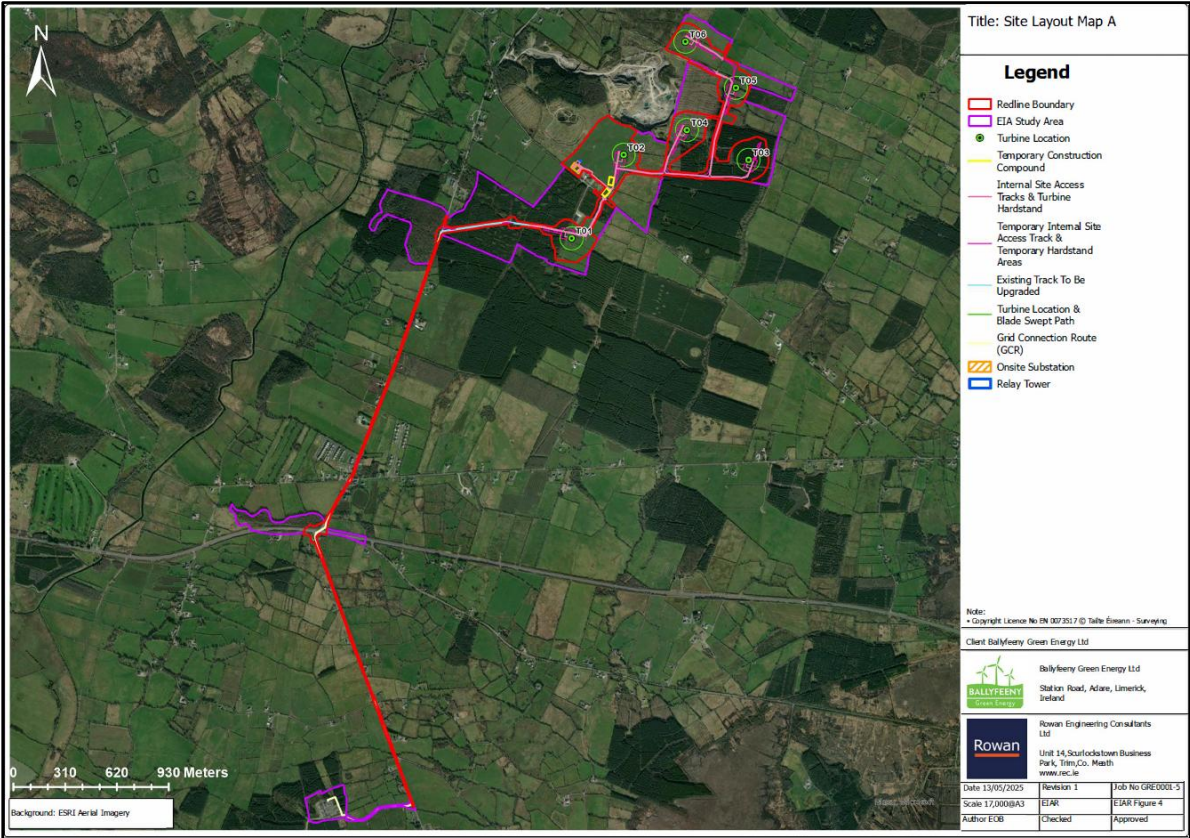


Figure 7-2: Site Layout Map A (Ref: EIAR Figure 2-2 (Volume 4))

7.2.3 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 study area, 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 01/05/2025;
- Analysis of Geological Survey of Ireland (GSI) Groundwater, Landslides and Aggregate Potential mapping (www.gsi.ie) – last accessed 01/05/2025;
- Analysis of Environmental Protection Agency (EPA) online mapping database (www.epa.ie) – last accessed 01/05/2025;
- EPA (2022) EPA Map Viewer; and
- Teagasc (2022) Soil Map Viewer.

This desk study analysis involved the following components:

- Review of proposed Project specific maps and drawings detailing the proposed Project infrastructure, two proposed TDRs and Construction Delivery Route (CDR);
- Study and assessment of the proposed locations of turbines, Site Access Tracks, Onsite Substation, Relay Tower, other ancillary infrastructure, TDR / CDR and GCR relative to available data on topography and slope gradients;
- Study and assessment of the proposed locations of turbines, Site Access Tracks, Onsite Substation, Relay Tower, other ancillary infrastructure, TDR / CDR and GCR relative to available data on soils, subsoils and bedrock geology;
- Screen for the presence of peat organic soils and identify if use of the Peat Landslide Hazard Assessment (PLHA) is required;
- 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 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 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 EPA and Teagasc (Agricultural Agriculture & Food Authority) Soils and Subsoil maps (1:50,000) to determine categories of soils and subsoil at the Site;
- Overlay 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; and
- Overlay GSI Aggregate Potential maps (1:100,000) to determine the economic value of “site won” aggregate.

7.2.4 Preliminary Geotechnical Investigations and Walkover Survey

Following completion of the desk study, an initial site walkover survey was undertaken by John Whiteford and Jaime Stothers in May 2024.

Following completion of the layout design process, ground investigations were undertaken to confirm ground conditions at the specified turbine infrastructure, Onsite Substation, as well as average conditions for the Site Access Track network, ancillary infrastructure and GCR. This ground investigation campaign was undertaken between May and June 2024.

These preliminary geotechnical works consisted of the following:

- A site visit and visual walkover assessment of the proposed wind farm infrastructure and GCR (May 2024);
- Review of bedrock outcrops, along with sub-soils and soil characterisation at proposed turbine locations (May 2024);
- Excavation of 7 No. trial holes to assess ground conditions and their variation across the proposed Project (May - June 2024);
- 3 No. Electrical Resistivity Tomography (ERT) profiles were undertaken, at the specific location of wind turbine infrastructure for T02, T04 and T06 to a maximum depth of 20m below existing ground level (May – June 2024);
- 1 No. Soakaway Test was carried out at the location of the Onsite Substation. (June 2024);
- Screening for the presence of peat soils at the main wind farm infrastructure, together with determination of soil and peat (if present) characteristics at each turbine location.

These works consisted of peat thickness probing (using “depthing” rods) (May 2024); and

- Walkover survey reconnaissance (May - June 2024) to identify soils and geology receptors with respect to effects relating to soils and geology. These surveys reviewed the position of the main wind farm infrastructure, the GCR and nodes where works are required on the TDR, 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 Site.

Further details on the geotechnical works are provided in **Appendix 7.2 – Preliminary Ground Investigation**.

Peat landslide hazard, as per the guidance contained in “Peat Landslide Hazard and Risk Assessments, Best Practice Guide for Proposed Electricity Generation Developments”: Prepared for Energy Consents Unit, Scottish Government Second Edition 2017 (the Scottish Guidance), which is considered best practice in Ireland, has been screened out as a potential effect. The preliminary screening assessment of soils, undertaken initially during the walkover survey, but later confirmed during the site investigations, did not identify the presence of peat bog at the proposed wind farm Site. Consequently, with the hazard of peat stability is not a likely significant effect with respect to the proposed Project. No further peat assessment is required.

7.2.5 Approach to Project Design

As set out in **Chapter 1 – Introduction**, under Section 32I of the Planning and Development Act 2000 (as amended), the Applicant is in receipt of an opinion on flexibility, relating to 3 no. options of Turbines. This opinion from the Local Authority confirmed that it was *‘appropriate that the proposed application be made and decided before the prospective applicant has confirmed certain details of the application’*.

The differences in the 3 no. Technology Options listed in **Chapter 1 – Introduction Table 1-3**, relates to only minor differences in the wind turbines rotor diameter, hub height and tip height, as such it is not expected to influence the significance of effects with respect to soils and geology.

The installation of the 3 no. Technology Options will be managed by one Turbine Foundation and Turbine Hardstand design. The design has been considered in this assessment in terms of potential effects on the soils and geology environment. During the operational phase, there will be no direct interaction between the turbines with the soils and geology environment.

On this basis, the assessment conclusions (i.e. the significance of effects) for land, soils and geology will not differ across the three Technology Options. The assigned significance rating is applicable to each of the Technology Options.

7.2.6 Approach to Impact Assessment

The following assessments were undertaken in order to assess the likely significant effects of the proposed Project on the soils, geology and ground stability aspects of the environment at the proposed wind farm site, the GCR and the TDR:

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

Evaluation of Potential Effects

Direct impacts or effects on geological attributes or the properties of soils and rock are mainly localised in the context of soils and geology (e.g., excavated soils from holes, stored and used as back fill). However, in many instances, soils and geology impacts give rise to the potential sources of contamination 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 8 – Water, Hydrology (Flood Risk Assessment) and Hydrogeology**, for further detail and clarification on likely significant effects and mitigation measures proposed for the proposed Project.

In line with the requirements of EPA Guidelines potential land, soils and geology related effects have been evaluated using the following criteria.

Sensitivity**Table 7-2: Criteria for Rating Importance of Identified Soils and Geological Features (Table C2 (IGI, 2013) and Box 4.1 (NRA, 2008a))**

Importance	Criteria	Typical Example
Very High	Attribute has a high quality, significance or value on a regional or national scale. Degree or extent of soil contamination is significant on a national or regional scale. Volume of peat and/or soft organic soil underlying route is significant on a national or regional scale.	Geological feature rare on a regional or national scale (NHA). Large existing quarry or pit. Proven economically extractable mineral resource.
High	Attribute has a high quality, significance or value on a local scale. Degree or extent of soil contamination is significant on a local scale Volume of peat and/or soft organic soil underlying route is significant on a local scale.	Contaminated soil on site with previous heavy industrial usage. Large recent landfill site for mixed wastes Geological feature of high value on a local scale (County Geological Site). Well drained and / or highly fertility soils. Moderately sized existing quarry or pit. Marginally economic extractable mineral resource
Medium	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.	Contaminated soil on site with previous light industrial usage. Small recent landfill site for mixed wastes Moderately drained and / or moderate fertility soils. Small existing quarry or pit. Sub-economic extractable mineral resource.
Low	Attribute has a low quality, significance or value on a local scale Degree or extent of soil contamination is minor on a local scale	Large historical and / or recent site for construction and demolition wastes. Small historical and / or recent landfill site for construction and demolition wastes.

Importance	Criteria	Typical Example
	Volume of peat and/or soft organic soil underlying route is small on a local scale.	Poorly drained and / or low fertility soils. Uneconomically extractable mineral resource.

Magnitude

Table 7-3: Criteria for Rating Soil and Geology Impact Significance (Table C4 (IGI, 2013) and Box 5.1 (NRA, 2008a))

Magnitude of Impact	Description	Example (Based on Author's Experience)
Large Adverse	Results in a loss of attribute.	Loss of high proportion of future quarry or pit reserves. Irreversible loss of high proportion of local high fertility soils. Removal of entirety of geological heritage feature. Requirement to excavate / remediate entire waste site. Requirement to excavate and replace high proportion of peat, organic soils and / or soft mineral soils beneath alignment.
Moderate Adverse	Results in impact on integrity of attribute or loss of part of attribute.	Loss of moderate proportion of future quarry or pit reserves. Removal of part of geological heritage feature. Irreversible loss of moderate proportion of local high fertility soils. Requirement to excavate / remediate significant proportion of waste site. Requirement to excavate and replace moderate proportion of peat, organic soils and / or soft mineral soils beneath alignment.
Small Adverse	Results in minor impact on integrity of attribute or	Loss of small proportion of future quarry or pit reserves.

Magnitude of Impact	Description	Example (Based on Author's Experience)
	loss of small part of attribute.	Removal of small part of geological heritage feature. Irreversible loss of small proportion of local high fertility soils and / or high proportion of local low fertility soils. Requirement to excavate / remediate small proportion of waste site. Requirement to excavate and replace small proportion of peat, organic soils and / or soft mineral soils beneath alignment.
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.

Significance Criteria

The significance of an effect was determined by considering the magnitude of potential impacts and the sensitivity of the receptor, with the classifications assigned in accordance with the EPA Guidelines (EPA, 2022). This is detailed in **Table 7-4** and **Table 7-4A**.

Table 7.4: Matrix for Determination of the Significance of Effect. Box 5.4 (NRA, 2008a)

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

Table 7-4A: Significance of effects as defined in Table 3-4 of the EPA Guidelines (EPA,2022)

Significance of Effects	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.

Effects determined to be Imperceptible, Slight and Moderate are considered to be Not Significant with respect to the EIA Directive as detailed in Section 2.3 of EPA Guidelines 2022. Significant effects are only those determined to be Significant or Profound, as detailed in **Table 7.4A**.

This interaction between the magnitude of the effect and its sensitivity is presented graphically, in **Figure 7-3**.

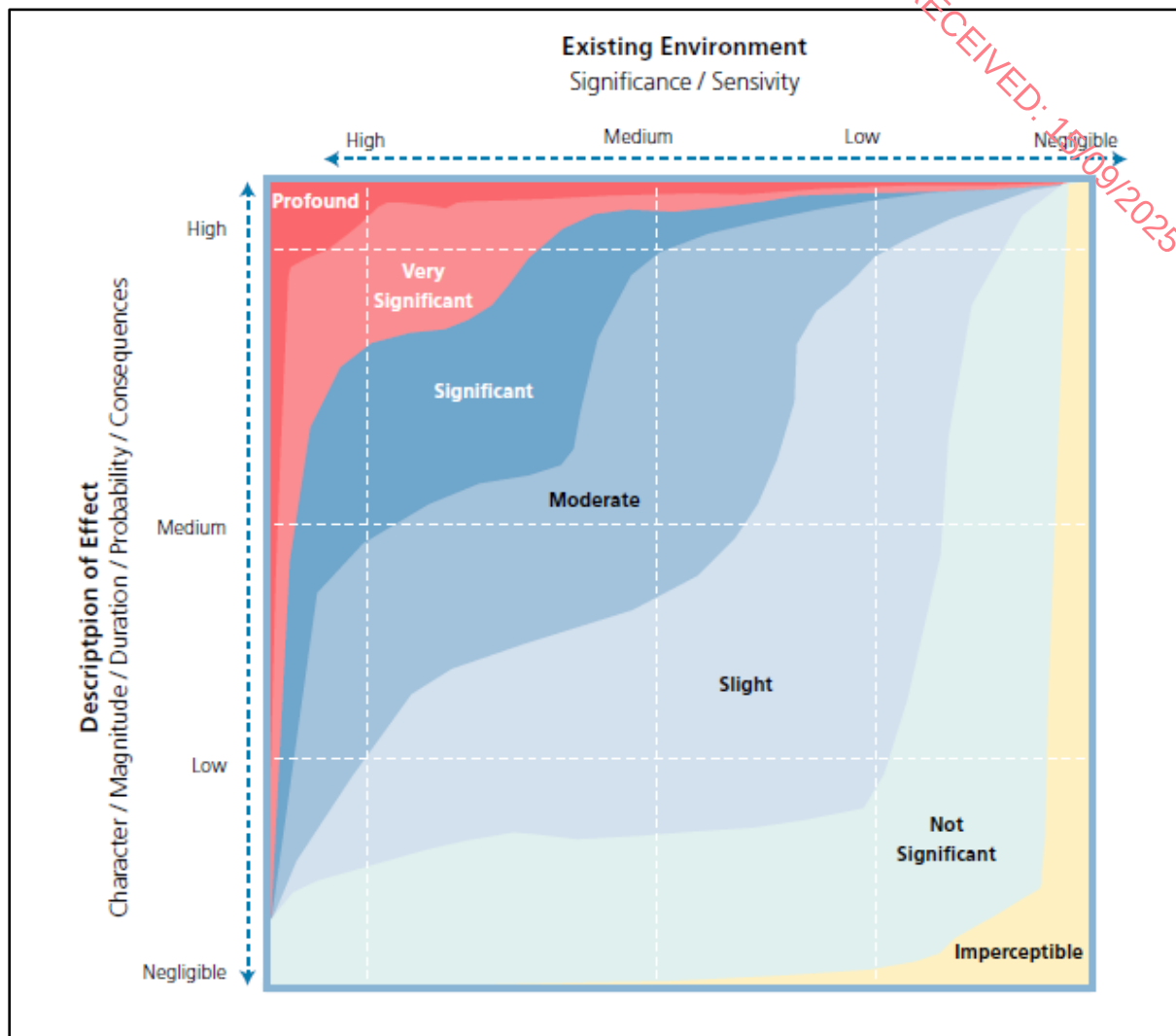


Figure 7-3 Typical Classification of the Significance of Effects (EPA, 2022).

In considering the effects, criteria such as quality, duration, probability and type were also considered. These criteria are detailed in Table 3.4 of the EPA Guidelines (EPA, 2022). As per the guidelines, all categories of these terms do not need to be used for every effect.

7.2.7 Assumptions and Limitations

Although research has been made into conditions external to this wind farm Site, no physical survey data has been collected from outside the relevant EIA Study Area for the purpose of determining peat, soil or rock stability risk. Risk to the proposed Project from natural events originating outside of the proposed wind farm Site has not been considered. Based on professional experience, any associated indirect risk is considered not likely to be significant.

This assessment solely relates to an assessment of baseline soils and geology, specifically with a view to its interaction with the Project. If soil and geology related conditions are likely to generate significant adverse effects, these have been classified and relevant mitigation recommended.

No technical difficulties arose out of the preparation of this assessment.

7.3 Baseline Environment

7.3.1 Characteristics of the Proposed Project

The natural superficial soils that mantle the study area consist predominantly of topsoil's, underlain by glacial till (mineral soils) consisting of sandy, gravelly, silts or clays. GSI mapping indicates the presence of isolated pockets of cut over raised peat bog in the region.

While ground slope ranges are generally low (less than 5 degrees to the horizontal at the location of the turbines and Onsite Substation, slopes of up to 10 degrees are present within the entire construction footprint. There are steeper slopes associated with the existing quarry faces and are often in excess of 45 degrees but located outside the proposed wind farm site boundary.

Primarily, the soils and geology scope of the proposed Project can be characterised as follows:

- Construction Zone 49.774ha (Redline Boundary);
- Peat is absent across the entire surveyed landholding. Screening peat depth = 0m;
- Six turbines with a total tip height of either 156m, 159m or 160m;
- Construction of reinforced concrete base foundations for six turbines. (Typically, circular with a foundation diameter of c.25.5m);
- Construction of Turbine Hardstand areas located beside each turbine to facilitate erection by mobile cranes. (42m x 25m);
- Construction of an Onsite Substation;
- Construction of approximately 3.9km of new Site Access Tracks and the upgrade of 0.5 km of existing internal site access tracks, having a minimum finished width of c.5.5m, of which all will consist of new traditionally constructed track
- Installation of 4,333m of Internal Wind Farm Internal Cabling from the turbines to the Onsite Substation;
- Erection of a permanent Relay Tower;
- Provision of two Temporary Construction Compounds;
- GCR from the Onsite Substation to the electricity grid network at the existing Sliabh Bawn 110kV Substation;

- TDR between Galway Port and the Site Entrance; and
- Elevations within the wind farm Site range from approximately 70m to 124m above ordnance datum (AOD).

7.3.2 Desk Study

An initial investigation of historical and existing land, soils and geology characteristics of the study area was assessed by performing a desk study and consultation with relevant authorities. This desk study was completed in May 2024. Following completion of the desk study, the soils and geology constraints determined were employed to assist with initial wind farm layout design. Refer to **Appendix 7.1 – Soils & Geology Technical Assessment**.

All data collected has been interpreted to establish the baseline soils and geology conditions within the study area.

Proposed Wind Farm Site

Land use within the Site consists of agricultural pastureland for cattle and parcels of mature private forestry. To the western side, the Site is bounded by the sub vertical quarry face of the active Ballyfeeny Rock Quarry.

A total of six site entrances/exits are proposed to service the proposed Project, four of which will be permanent and two will be temporary. Refer to **Chapter 2 – Project Description** and **Figure 7-4**. Site entrance 1 (SE1) requires an upgrade to the existing Coillte forest track, site entrances 2 (SE2) and 3 (SE3) are onto the L6018 public road with site entrances 4 (SE4) and 5 (SE5) being onto the L60498. Site entrance 6 (SE6) entrance off the L60498 connecting the main wind farm track to SE5.

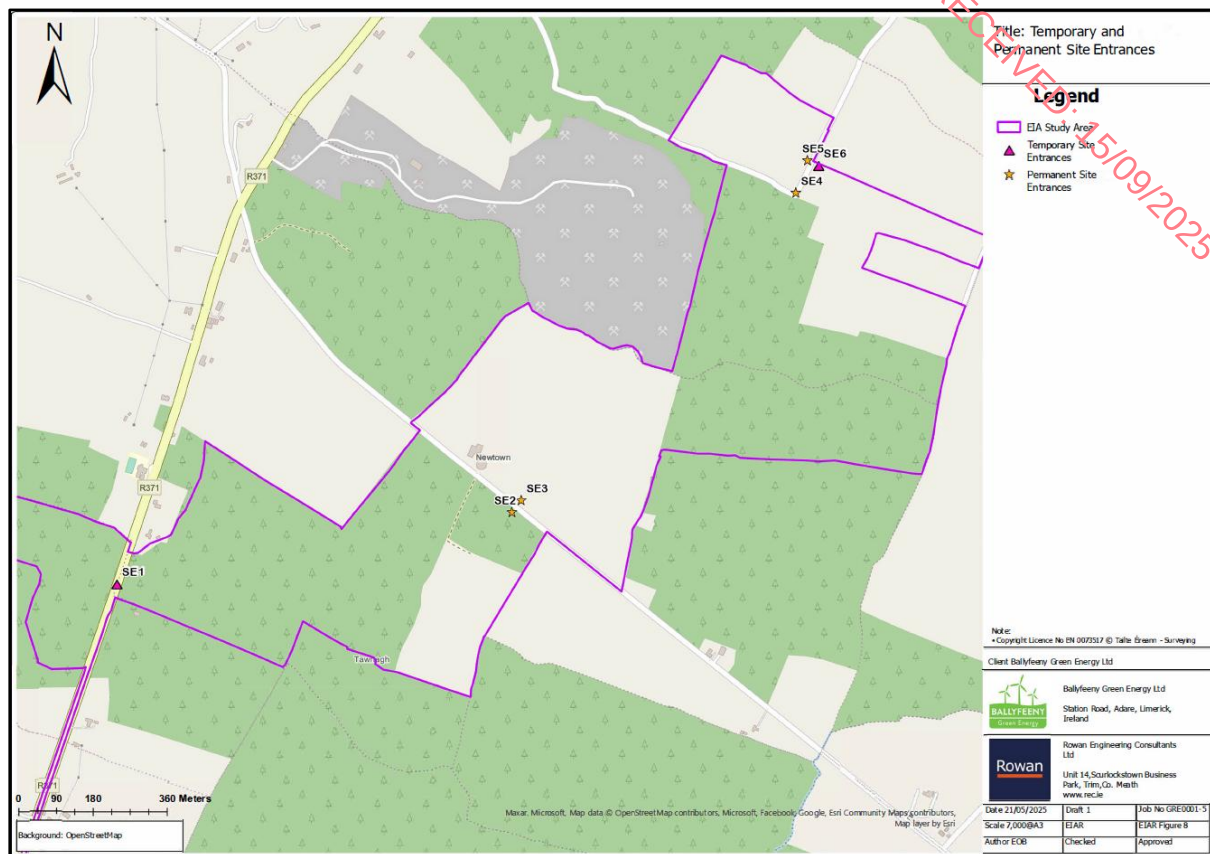


Figure 7-4: Temporary and Permanent Site Entrance Locations (Ref: EIAIR Figure 2-6 (Volume 4))

TDR

The TDR consists of two options from Galway Port to the proposed wind farm site.

TDR 1a utilises the new, but at the time of this assessment, uncompleted, N5 Ballaghadreen to Scramoge Road Scheme as part of the TDR. This option avoids bringing heavy loads through the town of Strokestown.

TDR 1b employs the alternative route through the town of Strokestown, in the unlikely event that has not been completed before turbine delivery.

Both options require localised temporary widening and stoning of grass verges and roundabouts to facilitate abnormal? load vehicle wheel over-run.

Site Entrance 6 (SE6) is a temporary site entrance that will be used for the delivery of turbine components. This entrance onto the L60498 will connect the main wind farm access track to Site Entrance 5 (SE5) (**Figure 7-4**) for a straight run through with turbine component deliveries to T06 (**Figure 7-2**).

GCR

A 5.8km GCR will connect the Onsite Substation to the existing Sliabh Bawn 110kV Substation, where it will connect to the electricity grid. On leaving the proposed wind farm Site, the route is entirely within public roads and public road verges. Installation works will consist mainly of 3 no. power ducts and 1 no. Communications duct installed within an excavated trench, typically 0.6m wide by 1.235m deep. Horizontal direct drilling (HDD) methods will be employed to cross the N5 National Road at the R371/N5 junction and under existing services where required.

Receiving Environment

The following section contains selected information obtained during the desktop study and walk over survey phases of the investigation, later confirmed by preliminary site investigation works. Refer to, **Appendix 7.1 – Soil and Geology Technical Assessment** and **7.2 – Preliminary Ground Investigation** for both reports.

Topography

Analysis of coarse topographic information indicates that the proposed Project located near Strokestown, Co. Roscommon, straddles the top and lower eastern flank of a small hill and sits on lands that generally slope to the east in the cases of turbines T02, T03, T04, T05 and T06. Lands slope to the south and east at turbine T01 and are generally flat at the Onsite Substation. Ground elevations for the wind farm Site vary from 70m to 124m at the highest point.

Land Usage

The current land usage varies across the land holdings which make up the proposed Project with agricultural use dominating, as mainly rough hill grazing for livestock. In addition, there are areas of existing coniferous forestry at Turbines T03 and T04.

The closest active quarrying operation to the Site, at Ballyfeeny Rock Quarry, is located less than 150m from the closest wind farm infrastructure at T04 and T06. The quarry currently supplies a combination of sands and gravel and crushed aggregate products at this facility.

There are 215 residential receptors, 2 community receptors, and 2 commercial receptors within a 2km radius of the turbines. In line with the WEDG 2006 and with due regard to the Draft WEDG 2019, all identified receptors are located more than 500 metres from the turbines. The closest receptor is residential receptor 35, is located c.599m west of turbine T02.

There are two protected geological areas (Mid Roscommon Ribbed Moraines RO022 & Largan Quarry RO016) within 10km of the proposed Project (**Figure 7-7**).

A review of historical mapping, courtesy of GSI and Tailte Éireann, suggests that the Site has not changed in land use from that recorded on the 6" OSI Mapping, 1832 – 1846, 6" Cassini Mapping or 25" to one-mile Mapping.

Services and Utilities

Underground services are anticipated to be present within the carriageway and verge adjacent to the site boundary and site entrances onto the L6018. ESB Networks overhead electricity cables are also along the edge of both the L6018 and L60498. Ballyfeeny Reservoir is located on lands to the north of the L6018. For further information refer to **Part 1 – Planning Drawing 23604-300 to 308** and **Chapter 14 – Material Assets**.

Solid Geology

According to the GSI online database, the wind farm Site is immediately underlain by the Finnalaghta Formation which consists of black, grey greywacke and black argillite, the Fearnaght Formation which consists of pale conglomerate and red sandstone and the Lackan Formation, Jasper rich feldspathic sandstone, is the upper most rock strata.

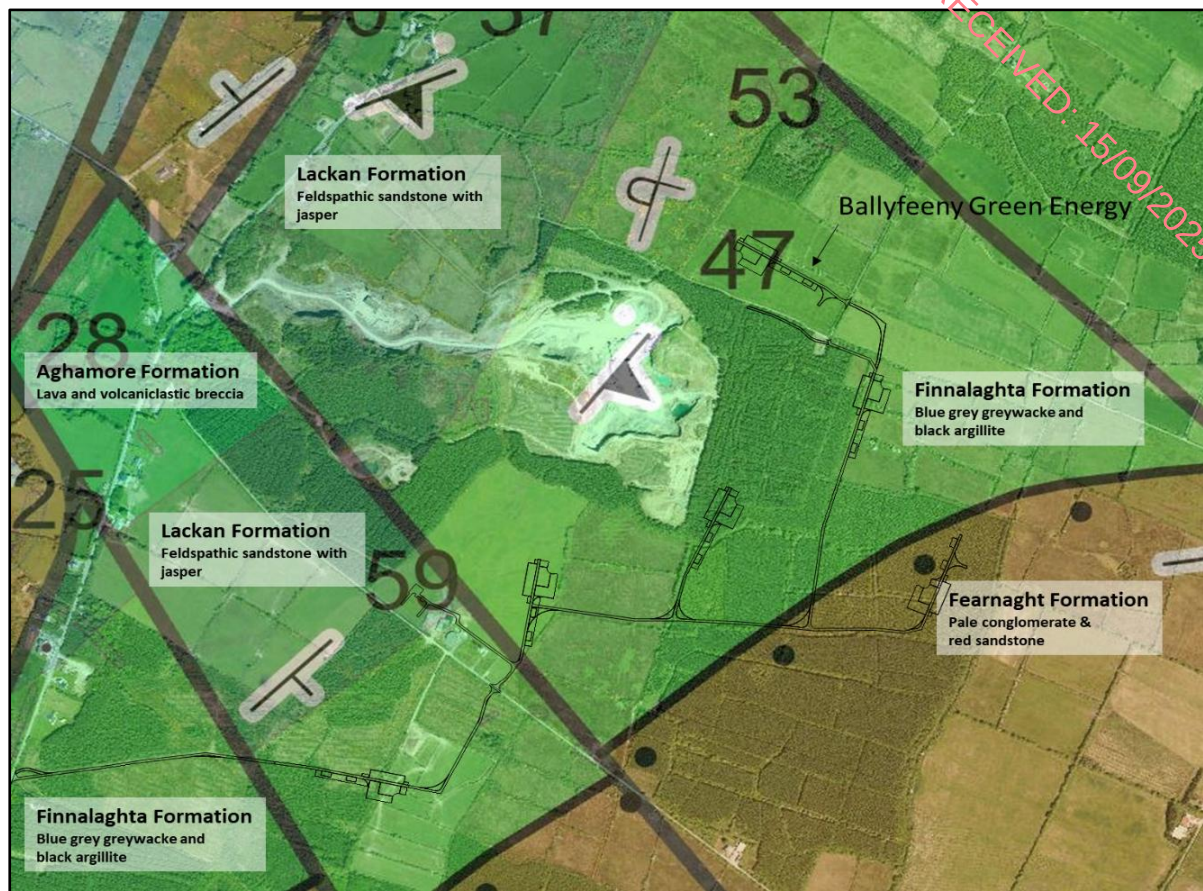


Figure 7-5: Solid Geology (Ref: EIAR Figure 7-5 (Volume 4)).

Three faults bisect the Site trending in approximately northwest – southeast and northeast to southwest directions. These faults impact the subsurface rock formation at turbines T01 and T02, along with stretches of the GCR, where they cause the bedrock to become highly fractured and weathered. These areas are also associated with higher rates of groundwater flow. Close to the eastern boundary and trending northeast to southwest a thrust fault can also be seen to impact the subsurface in the vicinity of T06.

Although, internationally, faults can often be associated with an increased hazard of ground movement, Ireland is located within a region of extremely low tectonic activity which is well removed from other regions of significant seismic activity. The risk of adverse seismic ground movement during the lifetime of the Project is imperceptible and not significant.

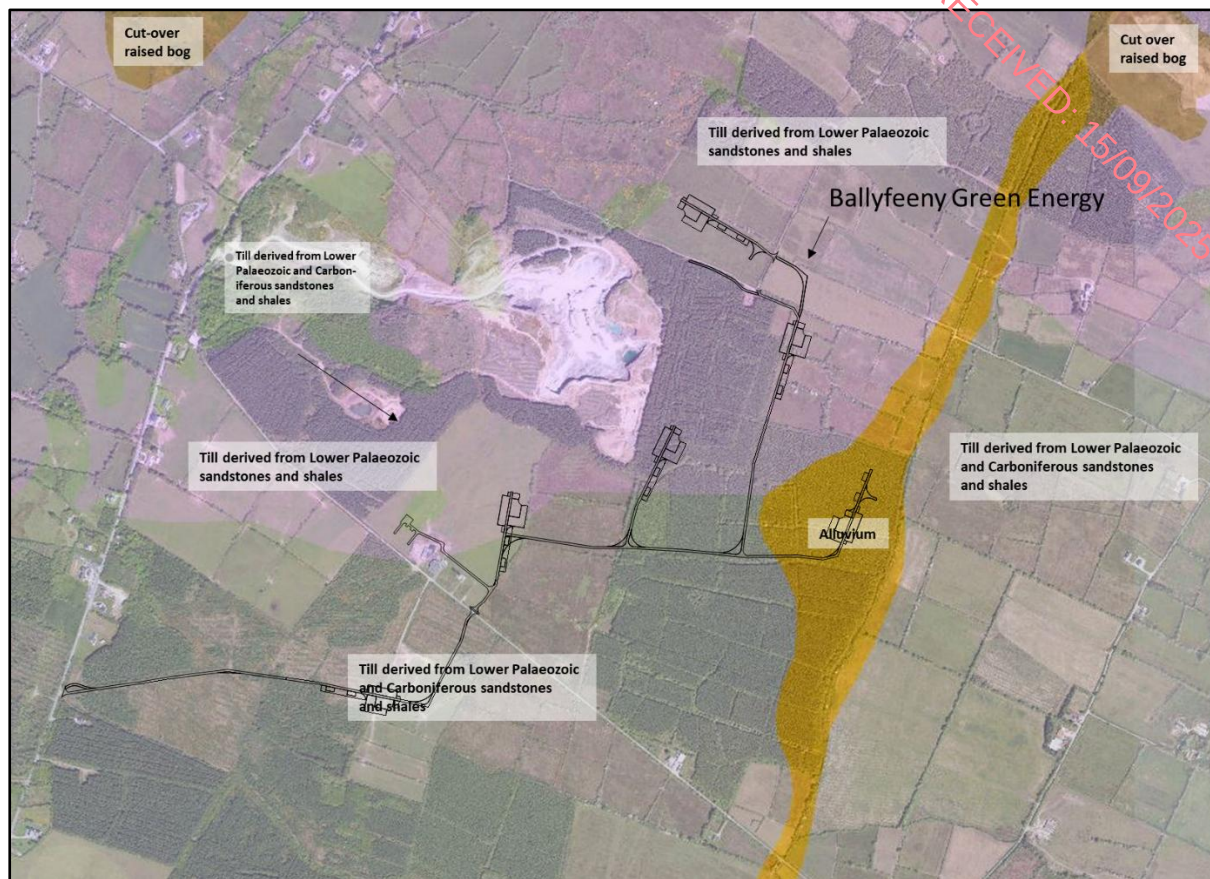


Figure 7-6: Superficial Soils (Ref: EIAR Figure 7-6 (Volume 4))

Soils and Subsoils

A study was made of available geological information. This study indicated that the following natural drift geology is present across the Site (**Figure 7-6**).

- Topsoil;
- Boulder Clay (Glacial Till / Mineral Soils; the predominate soil within the northern part of the Site);
- Alluvium. (Alluvium is present at the eastern edge of the site where it is associated with a minor watercourse);
- No soils (Outcropping rock; recorded on GSI mapping within the southern part of the Site) Corine Land Classifications within the RLB: 231 Agricultural Areas – Pastures; 243 Agricultural Areas – Heterogeneous agricultural areas; 312 Forest and semi-natural areas – Coniferous forests; 314 Forest and semi-natural areas – Mixed forests;
- SIS National Soils Classification and Soil Fertility within RLB: 700b Kilrush - Surface-water Gley: poorly drained mineral soil; 05RIV River – River Alluvium, poorly drained;

- Soil Erosion Potential: Soil erosion occurs where the action of water, wind or tillage on sloping ground causes soils to be displaced downhill. Given the low slope gradients, lack of significant wind effects at ground level, limited tillage and lack of surface water flow, soil erosion within the RLB is low;
- Soil Contamination; and
- Section 4 Discharge License WP-06-05A, approximately 1.2km southwest of the proposed wind farm Site and 900m west of GCR on Scramoge River.

Sites of Geological Significance

The GSI also maintains a database for known Geological Heritage Sites in Ireland. This database was accessed on 30th April 2025 and review of its published contents has determined that the following audited Geological Heritage Sites are present in the 10km Study Area (**Figure 7-7**) (**Table 7-5A – Table 7-5E**).

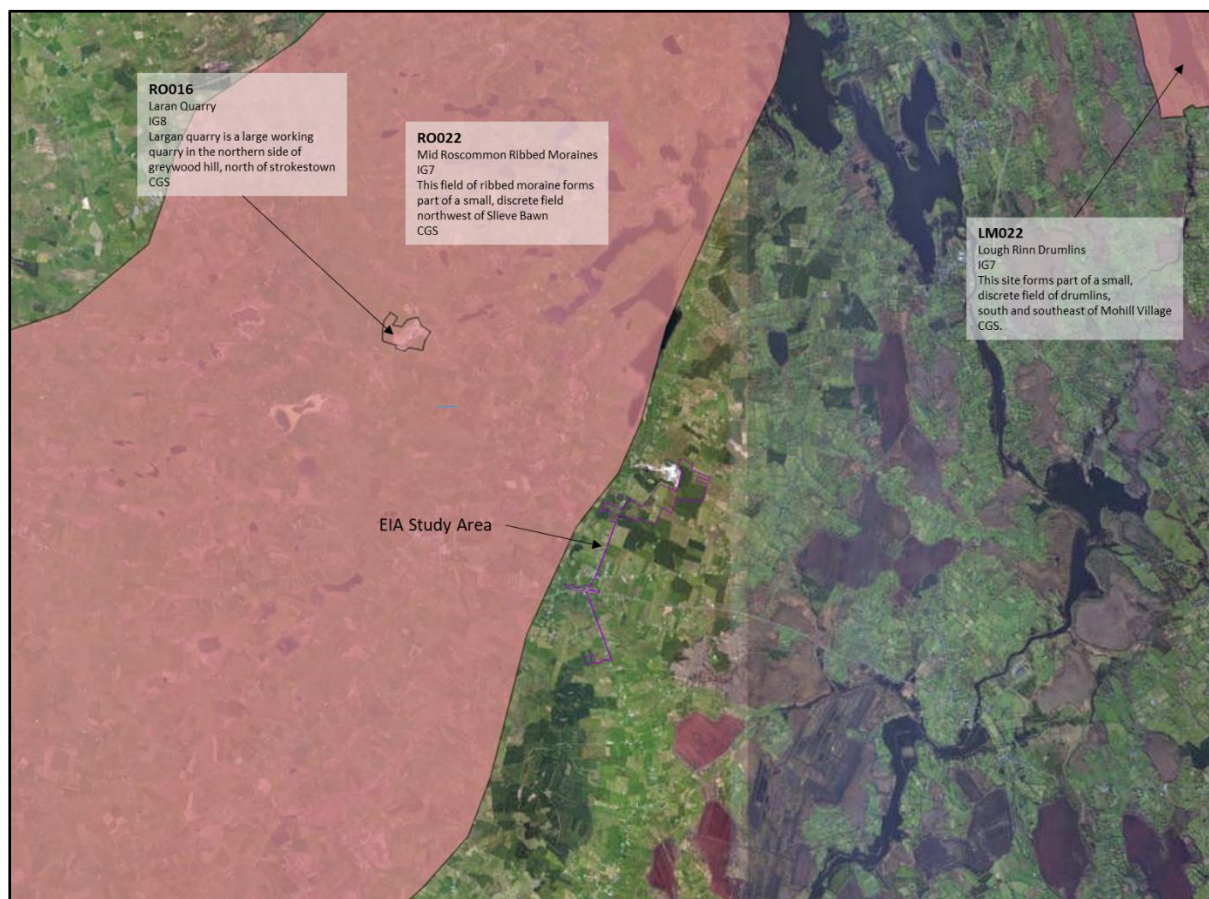


Figure 7-7: Protected Geological areas within the study area (Ref: EIAR Figure 7-7 (Volume 4))

Table 7-5A: Audited Geological Site – Mid Roscommon Ribbed Moraines

Site Code	RO022 (within the study area)
Site Name	Mid Roscommon Ribbed Moraines (c.0.6 km West)
IGH Theme 1	IGH7
County	Roscommon
Description	This field of ribbed moraine forms part of a small, discrete field northwest of Sliabh Bawn
Designation	CGS
Geological	This field of ribbed moraines form the perfect 'ribbed' topography
Report	https://gsi.geodata.gov.ie/downloads/Geoheritage/Reports/RO022_Mid_Roscommon_Ribbed_Moraines.pdf
Coordinates (IG)	188269, 281685
Coordinates (ITM)	588222.859, 781701.684

Table 7-5B: Audited Geological Site at Largan Quarry

Site Code	RO016
Site Name	Largan Quarry (c.5.9km North West)
IGH Theme 1	IGH8
County	Roscommon
Description	Largan quarry is a large working quarry in the northern side of Greywood Hill, north of Strokestown
Designation	CGS
Geological	The GSI maps the limestone as undifferentiated; the rocks may be of Ballymore Limestone Formation
Report	https://gsi.geodata.gov.ie/downloads/Geoheritage/Reports/RO016_Largan_Quarry.pdf
Coordinates (IG)	192462, 285407

Site Code	RO016
Coordinates (ITM)	592414.967, 785422.552

Table 7.5C: Audited Geological Site at Creeve Quarry

Site Code	LD007
Site Name	Creeve Quarry (c.19.7km East)
IGH Theme 1	IGH8
County	Longford
Description	A long disused quarry with adjacent wooded knoll of exposed rock
Designation	CGS
Geological	A good representative exposure of the Lower Carboniferous rocks in Longford
Report	https://gsi.geodata.gov.ie/downloads/Geoheritage/Reports/LD007_Creeve_Quarry.pdf
Coordinates (IG)	218353, 276290
Coordinates (ITM)	618300.245, 776307.746

Table 7-5D: Audited Geological Site at Brierfield Turlough

Site Code	RO006
Site Name	Brierfield Turlough (c.16km Southwest)
IGH Theme 1	IGH1
IGH Theme 2	IGH7
IGH Theme 3	IGH16
County	Roscommon
Description	Brierfield turlough is in a noticeable basin, bordered by a rock outcrop and sloping fields underlain by till around the rest of the feature
Designation	CGS, may be recommended for Geological NHA

Site Code	RO006
Geological	The turlough has been formed by solution of the karstified Lower Carboniferous limestone
Report	https://gsi.geodata.gov.ie/downloads/Geoheritage/Reports/RO006_Brierfield_Turlough.pdf
Coordinates (IG)	181107, 277446
Coordinates (ITM)	581061.903, 777463.532

Table 7-5E: Audited Geological Site at Mulligollan Turlough

Site Code	RO024
Site Name	Mulligollan Turlough (c.17.1km Southwest)
IGH Theme 1	IGH1
IGH Theme 2	IGH7
IGH Theme 3	IGH16
County	Roscommon
Description	Mulligollan turlough is in a noticeable basin, bordered by a rock outcrop and sloping fields underlain by till
Designation	CGS
Geological	The turlough has been formed by solution of the karstified Lower Carboniferous limestone
Report	https://gsi.geodata.gov.ie/downloads/Geoheritage/Reports/RO024_Mulligollan_Turlough.pdf
Coordinates (IG)	179835, 279446
Coordinates (ITM)	579790.710, 779463.191

Regional Hydrogeology

For further details on the hydrogeological environment, refer to **Chapter 8 – Water, Hydrology (Flood Risk Assessment) and Hydrogeology**

Aquifer Classification

A review of the Site was undertaken with respect to the GSI Online database's Bedrock Aquifer, Potential Superficial Aquifer and Groundwater Vulnerability Mapping.

Surface water can be expected to enter the subsurface where the surface is permeable and to continue vertically downwards until it comes in contact with either an impermeable stratum or the water table. At this point the surface water will migrate in the same direction as the groundwater or according to the gradient of the impermeable stratum.

GSI database mapping indicates that the wind farm Site is underlain by **Poor Aquifers** - Bedrock which is **Generally Unproductive except for Local Zones**, whilst portions of the GCR across cross regions of **Locally Important Aquifers** – Bedrock which is **Generally Moderately Productive**. Potential superficial aquifers are not recorded within the site boundary.

Groundwater Vulnerability

The groundwater vulnerability varies within the wind farm Site and GCR between moderate and extreme vulnerability, particularly where rock outcrops close to the surface.

This is because thin soils overly weak to moderately permeable sedimentary bedrock and therefore any contaminated surface water could rapidly impact the underlying bedrock aquifer (**Figure 7-8**).

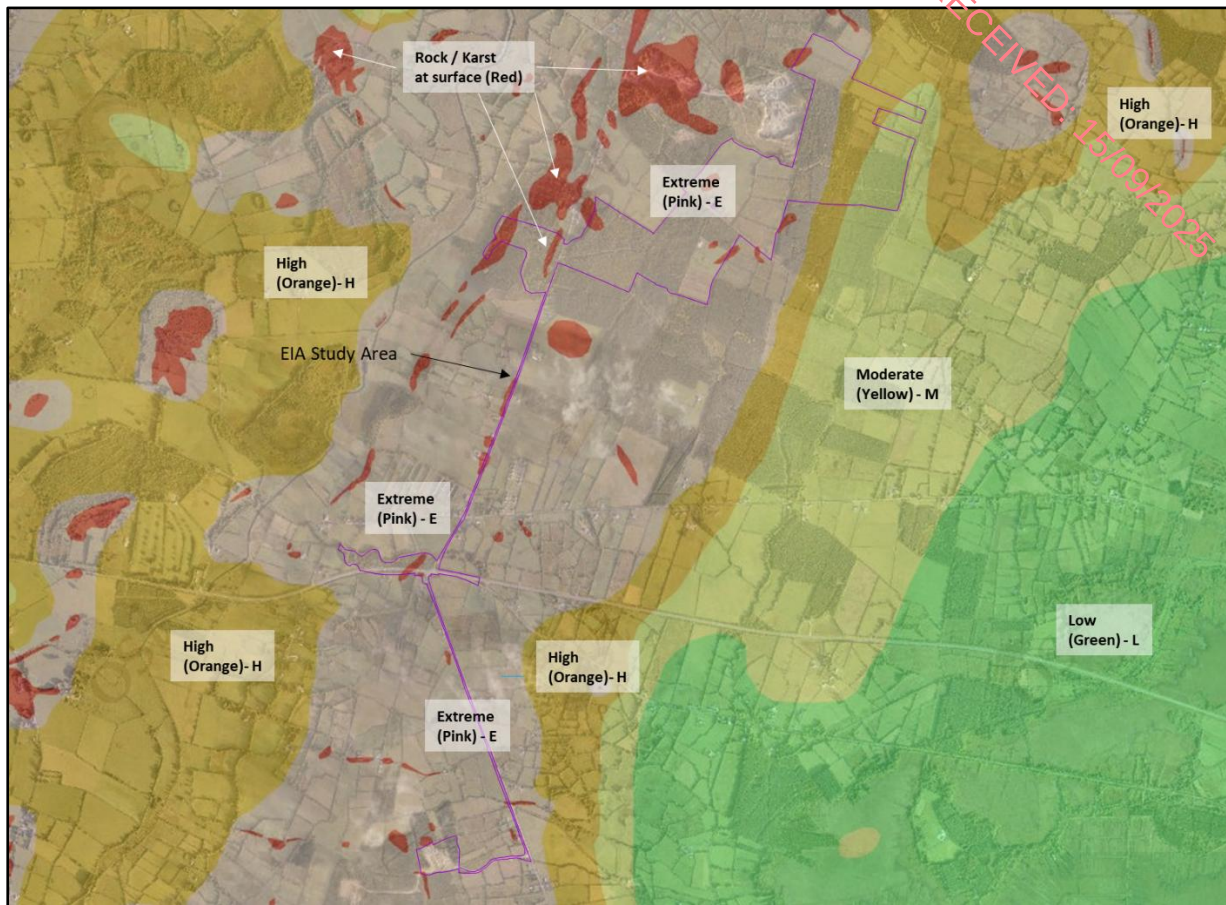


Figure 7-8: Groundwater Vulnerability (Ref: EIAR Figure 7-8 (Volume 4)).

Well Database

The GSI Geoindex database¹ contains records of groundwater wells within the vicinity of the proposed Project.

Although no such wells are recorded within the Site, three “dug” wells are recorded to the northwest of Ballyfeeny Rock Quarry (<1km to the west), one borehole c.1.5km to the east of the proposed wind farm and another c.0.75km north of the N5, to the eastern side of the GCR.

Public consultation highlighted concerns regarding private wells supplying drinking water to nearby homes and farms. While not all wells are mapped in the GSI database, a precautionary approach has been adopted in this assessment by assuming the presence of private wells at residential properties surrounding the site.

¹ <https://www.gsi.ie/en-ie/data-and-maps/Pages/default.aspx>

No “springs” and “rises” nor “karst” features are indicated on GSI mapping within and immediately external to the site boundary. These features have been identified within the 10km Study Area but given that the rock formations underlying the Project are non-soluble and sedimentary, any adverse risk from “karst” is imperceptible. (Figure 7-9).



Figure 7-9: Groundwater Features, Karst Features, Springs and Abstraction Points (Ref: EIAR Figure 7-9 (Volume 4)).

Local Hydrology

Site Drainage

Across the Site occasional drainage channels are evident within the extensive areas of forestry. Most are approximately 0.5m in width and up to 1.0m in depth.

Local Watercourses

For the purpose of defining water courses as key soils and geology receptors these are defined using the following criteria:

1. Consistently contain flowing water / not ephemeral.

2. Be a natural watercourse with either a designated name or be a smaller tributary of a designated watercourse. i.e. Not man made in origin.

The proposed Project is located within the Upper Shannon Catchment, with the wind farm Site, GCR and TDR situated across three of the catchment's sub-catchments; the Scramoge_SC_010 to the west, the Shannon [Upper]_SC_070 to the east and the Shannon [Upper]_SC_040 sub-catchment to the north.

The local hydrology includes the Culliagh Stream (first order stream) which runs adjacent to the Site's eastern boundary and approximately 153m from turbine T03. The Culliagh Stream flows south and turns east to join the Feorish River (second order river) (and also referred to as the Tammonbary) before joining the Shannon Upper River (third order river).

The Ballymartin Stream (first order stream) is also located directly adjacent to the wind farm Site's western boundary and approximately 60m from the proposed Onsite Substation and Communications Relay Tower. The Ballymartin Stream flows west before turning north to flow into Kilglass Lough. There are no EPA mapped watercourse crossings within the proposed wind farm Site boundary.

The Gortustia Stream (first order stream), rises west of the GCR, which flows into the Scramoge 26 River (second order river). The Scramoge River then continues into the Mountain West River (third order river) and ultimately reaches Kilglass Lough.

The GCR also transects the Bellmount or Cloggernagh Stream (first order stream) further south, just before it turns west to join the existing Sliabh Bawn 110kV Substation. This route will cross one watercourse (Bellmount (or Cloggernagh) Stream and passes the Gortlusia Stream as it rises adjacent to the R371. The crossing method proposed is cable trenching within the existing road carriageway (see **Planning Drawings 23604-307 and 564**). The GCR water crossing is detailed in full in **Chapter 2 – Project Description** and also **Chapter 8 – Water, Hydrology (Flood Risk Assessment) and Hydrogeology** in Section 8.8, 8.9 and 8.10.

It is proposed to utilise HDD at one location along the GCR – the N5/R371 road junction; to cross the N5 without open excavation of the road, see **Planning Drawing 23604-304 and 562 (Part-1)**. The HDD at this location will be approximately 50 m in length.

Palaeo-Karst Features

Karst topography is defined as “*An assemblage of topographic forms resulting from dissolution of the bedrock and consisting primarily of closely spaced sinkholes.*” Karst topography can form in regions of exceptionally soluble rocks, including Limestone.

Soluble rocks generally mean the presence of limestone, chalk or evaporite deposits such as gypsum that contain carbonates which are particularly susceptible to dissolution under the action of rainfall.

The presence of such features has, in some cases, can result in structural instability.

The rock formations underlying the Site are not soluble and although limestone rock formations and karst features are recorded by GSI within the 10km Study Area, these are considered remote and do not affect the Site and the GCR, which is devoid of such soluble features. The TDR does cross areas of soluble limestone formations within which karst features are common, however given the limited scale of the TDR construction works (both in terms of extent and depth) any stability risk in this respect is negligible. As a result, paleo-karst hazard has been screened out.

Landslide Susceptibility

Analysis of GSI Geoindex online and other records do not record any Landslide events within 5km of the Site boundary. Two landslide events; 1) GSI_LS13-0002, Tomisky 2009, Longford and 2) GSI_LS03-0007 Newtownforbes 1883, Longford are recorded within a 10km radius. Both events record a low level of impact (**Figure 7-10**).

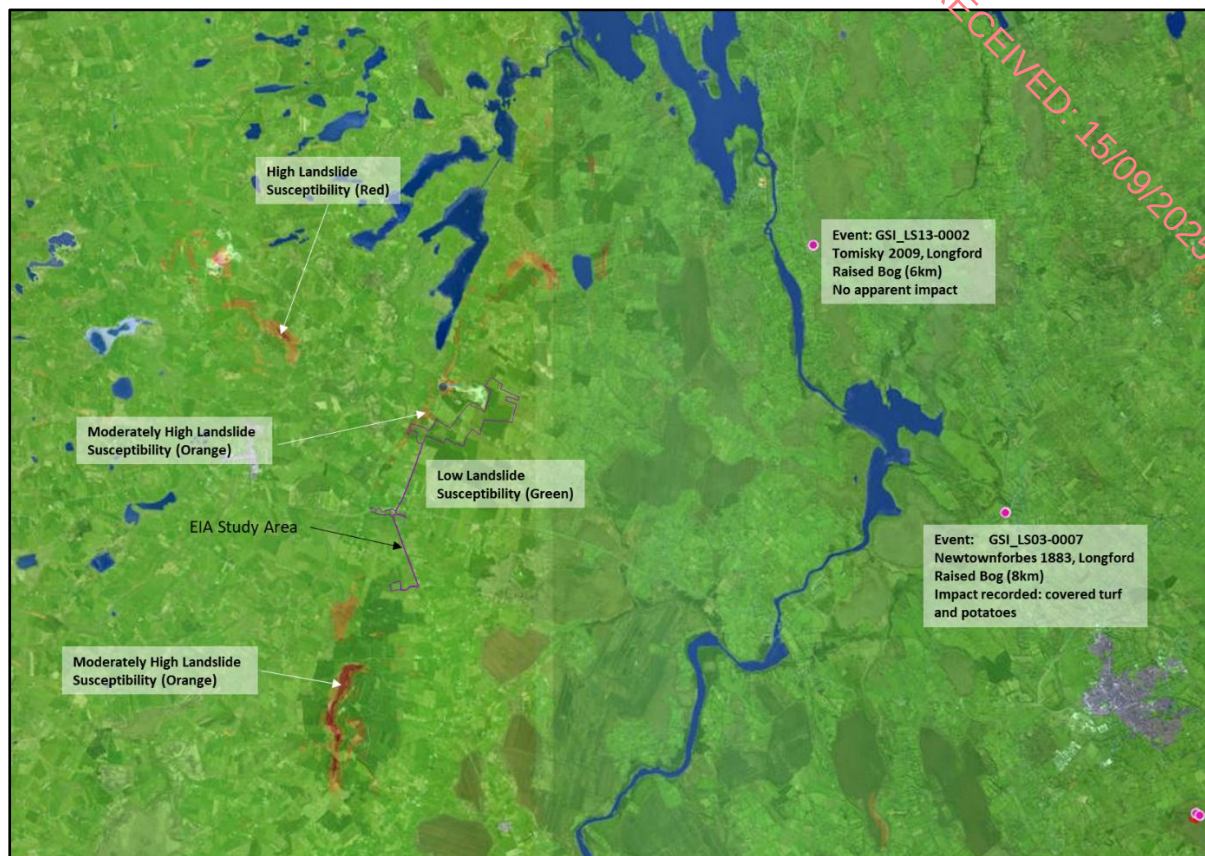


Figure 7-10: Landslide Susceptibility and Recorded Events (Ref: EIAR Figure 7-10 (Volume 4)).

Quarrying and Mining Activity / Geological Resources

Review of the GSI online mapping data indicates that crushed rock aggregate potential within the Site is predominantly high to very high.

There is one active quarry / pit immediately to the west of the Site boundary and a further 2 no. within 15km of the Site, as follows:

1. Ballyfeeny Rock Quarry: less than 150m west of Turbines T04 and T06, crushed greywacke rock aggregate.

This quarry currently employs blasting to remove bedrock and given its proximity to the proposed Project, potential effects in relation to ground vibrations and high air overpressures on the turbine infrastructure at T02, T04 and T06 is assessed in **Chapter 10 – Noise and Vibration**. The investigation demonstrated that vibration tremor levels were detected however, the turbine manufacturer confirmed that the energy is of such duration and frequency as not to pose any risk to the structural integrity of the turbine tower. The effects associated with the quarry operations on the operation of the proposed Project are therefore considered

as **Not Significant** in EIA terms. The **Blasting Technical Report** detailing the findings of the investigation is provided in **Appendix 10.8 – Blasting Technical Note**

2. Laragan's Quarry (Hanly's): c. 6km northwest; crushed limestone rock aggregate
3. Castlemines Quarry, c. 14km southwest.

Although, Laragan's Quarry is located less than 10km from the Site, there is no hydrological linkage that might propagate an indirect soil or geology related effect. In terms of direct effects Laragan's Quarry is too distant to be effected.

Although mineral workings are recorded within 10km of the Site, no records of shafts or adits or other mineral workings are recorded within the Site, shown in **Figure 7-11**. The potential risk in this respect is not significant.

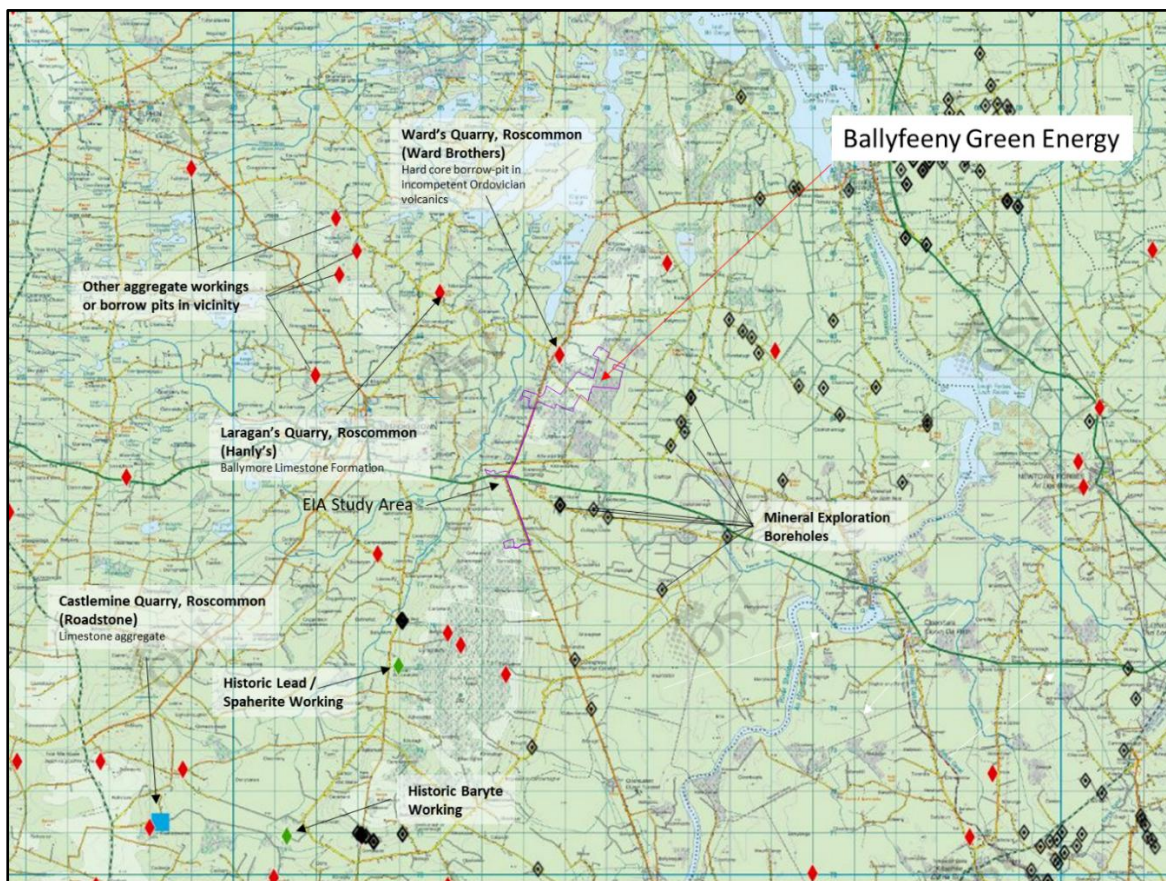


Figure 7-11 Minerals and Active Quarrying (Ref: EIAR Figure 7-11 (Volume 4)).

7.3.3 Fieldwork

Following completion of the desk study, follow-up investigations were undertaken at the proposed wind farm site in May and June 2024.

These investigations consisted of two parts, a walkover survey carried out in May 2024 and a follow-up ground investigation campaign carried out in May and June 2024. The purpose of the walkover survey was to visit the site of the main infrastructure (T01, T02, T03, T04, T05, T06 and the Onsite Substation) and gather the following site-specific information:

- Peat thickness and characteristics, in order to screen for Peat Landslide Hazard;
- Identify and classify shallow soils;
- Check for landforms that might indicate past soil movement, current instability, hydrological features, previously unidentified watercourses, drainage and other features of note;
- Record maximum ground slopes;
- Estimate distance to designated watercourses;
- Check for evidence of overhead or underground services / utilities; and
- Record any other features of note.

The purpose of the ground investigation campaign was to collect additional information for the purpose of refining the initial wind farm layout plan. This ground investigation allowed for a more detailed assessment of soils and geology, as follows:

- Detailed characterisation of the Site's topographical, geological, hydrological and geomorphological regime from the data acquired;
- Detailed consideration of ground stability issues as a result of the proposed Project, its specific design, proximity to the existing quarry and method of construction;
- Assessment of the collected baseline data acquired to update the preliminary assessment of impacts on the soils, geology and hydrological aspects of the environment;
- Laboratory analysis of soils samples to determine specific stability characteristics for the native soils and rock formations;
- Where adverse impacts are identified, consider measures that would mitigate or reduce the identified impact; and
- Consider that the Site will be most at risk of soil movement during the construction phase. Whether a failure occurs during the operational life of the wind farm or not, the likelihood of it occurring will be demonstrated from the factors applied.

Walkover Survey Observations

The following tables **7-6A** to **7-6E**, provide an appraisal of ground conditions at each of the locations where Turbine Hardstands and other infrastructure are being considered. This section contains data, which was originally collected using a previous layout design, but which has subsequently been updated to represent the final site layout plans for the proposed wind farm Site.

This site walkover was undertaken between 8 to 10 May 2024 by Whiteford Geoservices Ltd and primarily focused on;

- a) classification of soils at the main infrastructure (SI Fieldwork: Stage 1 Walkover); and
- b) screening for Peat Landslide Hazard.

The Peat Landslide Hazard screening exercise found peat soils to be absent at the location of the main wind farm infrastructure.

Table 7-6A: Point 1 - Turbine 1 (T01)

Nature of Assessment	Observations
Position (TM)	598030, 781311
Peat Depth	Peat 0m / Topsoil 0.30m
Superficial Soils	Firm, orangish brown, sandy, gravelly CLAY/SILT overlying firm becoming stiff, grey, sandy, gravelly CLAY/SILT with a low cobble and boulder content
Solid Geology	1.90m below ground level (b.g.l) . - Grey, fine grained GREYWACKE
Presence of peat landforms, evidence of past ground movement, hydrological features, other watercourses or other features of note	None identified
Topography	Up to 1.4 degrees to horizontal.
Soils and Geology Receptors	> 500m from designated watercourse
Utilities: Underground or overhead	None evident in vicinity
Any other observations	None observed

Table 7-6B: Point 2 - Turbine 2 (T02)

Nature of Assessment	Observations
Position (ITM)	598323 781869
Peat Depth	Peat 0m / Topsoil 0.60m
Superficial Soils	Firm becoming stiff, grey, sandy, gravelly CLAY/SILT with a low cobble and boulder content
Solid Geology	1.70m b.g.l. - Grey, fine grained GREYWACKE
Presence of peat landforms, evidence of past ground movement, hydrological features, other watercourses or other features of note	None identified
Topography	Up to 2.1 degrees to horizontal.
Soils and Geology Receptors	Approx. 60m from communications tower; 115m from reservoir, 270m from Ballymartin 26 stream.
Utilities: Underground or overhead	Approx. 200m from utilities associated with the reservoir and communications mast.
Any other observations	None

Table 7-6C: Point 3 - Turbine 3 (T03)

Nature of Assessment	Observations
Position (ITM)	599075 781813
Peat / Topsoil Depth	Peat 0m / Topsoil 0.25m
Superficial Soils	Firm, grey mottled orange, sandy, gravelly CLAY/SILT overlying Firm becoming stiff, grey, sandy, gravelly CLAY/SILT with a low cobble and boulder content
Solid Geology	Not identified at Structure. Soil > 4.00m thick. Underlying rock formation anticipated to be grey, fine-grained GREYWACKE
Presence of peat landforms, evidence of past ground movement, hydrological features, other watercourses or other features of note	None identified
Topography	Up to 3.3 degrees to horizontal.
Soils and Geology Receptors	153m west of Cuillagh Stream.
Utilities: Underground or overhead	None evident in vicinity
Any other observations	Within area of forestry. Concentrated drainage network.

Table 7-6D: Point 4 - Turbine 4 (T04)

Nature of Assessment	Observations
Position (ITM)	598719 782011
Peat Depth	Peat 0m / Topsoil 0.30m
Superficial Soils	Firm, orangish brown, sandy, gravelly CLAY/SILT with a low cobble content overlying, stiff, grey, sandy, gravelly CLAY/SILT with a low cobble and boulder content and hard, grey, sandy, gravelly CLAY/SILT with a low cobble and boulder content
Solid Geology	Not identified at Structure. Soil > 3.50m thick. Underlying rock formation anticipated to be grey, fine-grained GREYWACKE
Presence of peat landforms, evidence of past ground movement, hydrological features, other watercourses or other features of note	No peat. Surface was saturated
Topography	Up to 2.7 degrees to horizontal
Soils and Geology Receptors	> 500m from designated watercourse
Utilities: Underground or overhead	None evident in vicinity
Any other observations	Within forestry. Concentrated drainage network. Infrastructure is approx. 85m from existing quarry face.

Table 7-6B: Point 5 - Turbine 5 (T05)

Nature of Assessment	Observations
Position (ITM)	599018 782289
Peat Depth	Peat 0m / Topsoil 0.30m
Superficial Soils	Firm, orangish brown, sandy, gravelly CLAY/SILT overlying Firm becoming stiff, grey, sandy, gravelly CLAY/SILT with a low cobble and boulder content
Solid Geology	Not identified at Structure. Soil > 3.70m thick. Underlying rock formation anticipated to be grey, fine grained GREYWACKE
Presence of peat landforms, evidence of past ground movement, hydrological features, other watercourses or other features of note	No peat. Surface was saturated
Topography	Up to 5.5 degrees to horizontal

Nature of Assessment	Observations
Soils and Geology Receptors	c.330m west of Cuillagh Stream.
Utilities: Underground or overhead	None evident in vicinity
Any other observations	Adjacent to existing forestry. Concentrated drainage network. Infrastructure is approx. 280m from existing quarry face.

Table 7-6E: Point 6 - Turbine 6 (T06)

Nature of Assessment	Observations
Position (ITM)	598713 782537
Peat Depth	Peat 0m / Topsoil 0.30m
Superficial Soils	Firm becoming stiff, grey, sandy, gravelly CLAY/ SILT
Solid Geology	1.20m b.g.l. - Grey, fine grained GREYWACKE
Presence of peat landforms, evidence of past ground movement, hydrological features, other watercourses or other features of note	No peat. Surface was saturated
Topography	Up to 3.9 degrees to horizontal
Soils and Geology Receptors	>500m from designated watercourse.
Utilities: Underground or overhead	None evident in vicinity
Any other observations	Infrastructure is approx. 130m from existing quarry face.

Table 7-6F: Point 7 – Onsite Substation

Nature of Assessment	Observations
Position (ITM)	598059 781764
Peat Depth	Peat 0m / Topsoil 0.80m
Superficial Soils	sandy, slightly gravelly SILT / CLAY
Solid Geology	Some outcropping of rock or boulders in the vicinity.
Presence of peat landforms, evidence of past ground movement, hydrological features, other watercourses or other features of note	Surface was saturated
Topography	Up to 2.1 degrees to horizontal

Nature of Assessment	Observations
Soils and Geology Receptors	Adjacent to reservoir and existing farmyard; approx. 140m from communications mast; approx. 60m from Ballymartin 26 watercourse;
Utilities: Underground or overhead	Underground and overhead utilities associated with Ballyfeeny Reservoir, farmyard and communications tower infrastructure immediately adjacent to Site.
Any other observations	Adjacent to minor public road L6018.

Existing Services / Utilities

The walkover survey did not yield any further information, regarding the position of additional underground utilities within the Site, other than the utility records consulted for the desk study. Please refer to **Chapter 14 – Material Assets** for further information on existing services and utilities.

Potential Receptors

Analysis of desk study resources and follow up walkover surveys have identified the following receptors with the potential to be effected by activity related to the proposed Project construction and / or operation.

Table 7-7: Analysis of Receptors Applicable to the Site

Receptor	Minimum distance to Development	Exposure Assigned (Using Factor Based Probabilistic Analysis)	Remarks
Peatlands / Bog	750m	1	-
Agricultural Lands	0m (within site)	1	-
Minor Utilities	0m (within site)	2	Utilities near Onsite Substation and T02
Designated Minor Watercourses / Water Bodies	0m (within site)	2	Ballymartin 26 and Cuillagh Stream
Designated Major Watercourses / Water Bodies	c. 1.8km	3	Kilglass Lough

Receptor	Minimum distance to Development	Exposure Assigned (Using Factor Based Probabilistic Analysis)	Remarks
Undesignated Watercourses / Drainage	0m (within site)	1	e.g. ditches and man-made land drains, ephemeral run-off channels. Associated with forestry
Minor Public Roads	0m (at Site Entrances)	3	R371, L6018 and L60498
Sites of Geological Importance	<1km to the west	3	RO022 Mid Roscommon Ribbed Moraines
Moderately to highly trafficked Public Road	0m	4	R371
Dwellings	c.30m	4	Various
Commercial Property	0m (within site boundary)	3	Various. Farmyard, communications mast and reservoir adjacent to Onsite Substation and T01. Existing quarry adjacent to T02, T04 and T06.
Significant Utilities (Overhead) / Underground	>1km	3	Large watermain and overhead utilities within the vicinity.
Population centre / Urban area	c.4.5km southwest	5	Strokestown, population 824 (2016)

Potential Geohazards identified within the Study Area

Analysis of desk study resources and follow up walkover survey have identified the following static or inherited factors that could potentially act as preconditions to slope instability affecting soils.

Table 7-8: Potential Geohazards Applicable to the Site

Precondition	Minimum distance to Development (m)	Remarks
Concentrated drainage network / presence of standing water / area of flush / springs, or rises	0m (within forestry)	
Significant slopes	<100m	Existing slopes associated with active quarry adjacent to turbine T02, T04 and T06
Significant peat thickness	Not applicable – no peat at infrastructure	No peat encountered at Site
Very highly decomposed Peat	Not applicable – no peat at infrastructure	No peat encountered at Site
Very weak Peat or underlying mineral soils	Not applicable – no peat at infrastructure	Potentially present, although current data suggests that where weak soils are present these are at the surface and thin.
Karst Instability	>500m to closest, potentially karstic rock formation (Oakport Limestone Formation). 3.2km to closest Karst feature (Enclosed Depression)	
Potential sonic vibration or ground accelerations	The existing quarry face is subject to blasting for rock recovery. At its current position these quarry faces are located less than 300m from T02, T04 and T06, and less than 500m from T01, T03, T05 and the Onsite Substation.	Vibrationally induced energy from blasting can generate the undesirable effects: - Refer to Chapter 10 – Noise and Vibration for full assessment of potential effects in this respect.

Existing Slopes

An analysis of both desk study topographic and walkover survey data was undertaken to identify the variation in gradient applicable to the existing slopes within the vicinity of the proposed wind farm Site.

Slope gradient has a direct relationship to ground stability and this relationship has been used to predict risk of soil and rock movement at the main structures. Ground stability can be divided into two main types – Soil and Rock stability; with the former being further sub-divided into peat and mineral Soils. Since peat is absent this assessment relates to mineral soils and rock only.

Soil Stability

For the purpose of this assessment the term mineral soils relates to all other cohesive and granular natural soils. These soils are significantly more stable than peat / organic soils, with specific properties dependant on a combination of their relative density, particle distribution and shear strength properties.

Landslides within mineral soils are generally by rotational failure and greatly influenced by weather conditions, in particular how this affects the groundwater table and how the resulting surface water erodes the soil substrate.

In light of the reasons given above, this report advocates a banded factor-based approach to apportioning risk for mineral soil failure. The following bands are used for this purpose.

Table 7-9: Risk Factor Assignment – Existing Slope Gradient²

Existing Slope Angle (Measured at Surface of Peat, Angle to Horizontal)	Relative Risk	Remarks
0 - ≤3	Negligible influence	Peat & organic soils only
3 - 5	Low	Peat & organic soils only
5 - ≤ 10	Medium (Peat) / Low (Mineral Soil)	Peat & organic soils only
10 - ≤ 22.5	High (Peat) / Medium (Mineral Soil)	Potential for Unsupported granular soil failure
> 22.5	Very High (Peat) / High (Mineral Soil)	Unsupported granular soil failure. Potential failure in poor quality rock formations

Rock Stability

Rock formations are generally significantly more stable than soil formations, where these repose at shallow angles (<45 degrees). Where rock faces are present in the vicinity of wind

² Professional Judgement Rule of Thumb approach based on the angle of internal friction for drained cohesive soils

farm infrastructure, particularly slope gradients in excess of 45 degrees to the horizontal, the risk of rock instability needs to be considered.

In the case of the proposed wind farm Site, the three closest turbines are located less than 150m from the existing quarry.

Turbines T02, T04 and T06 are in close proximity to the sub vertical face of an active rock aggregate quarry. Given the proximity to wind farm infrastructure a computer-based analyses of slope stability, in respect to both soils and rock has been undertaken for the worst-case, drained, condition.

Ground Investigation Campaign

Refer to **Appendix 7.2 – Preliminary Ground Investigation** report pertaining to this phase of the assessment.

The site investigation (SI) campaign consisted of the following works:

- 7 no. Peat probes;
- A total of 7 No. Trial Holes at each of the turbines and at the Onsite Substation;
- Laboratory testing of recovered soil samples;
- One Soakaway Test at the Onsite Substation;
- Geophysical Profiles using ERT at Turbines T02, T04 and T06 (closest to the existing quarry face); and
- Slope Stability Analysis.

Refer to **Figure 7-11**, overleaf, for SI Layout Arrangements.

The following sections provide a summary of the findings of the SI campaign, a summary of existing site topography, as well as a summary of the main elements of the proposed Project.

These SIs were undertaken in two phases, as detailed overleaf:

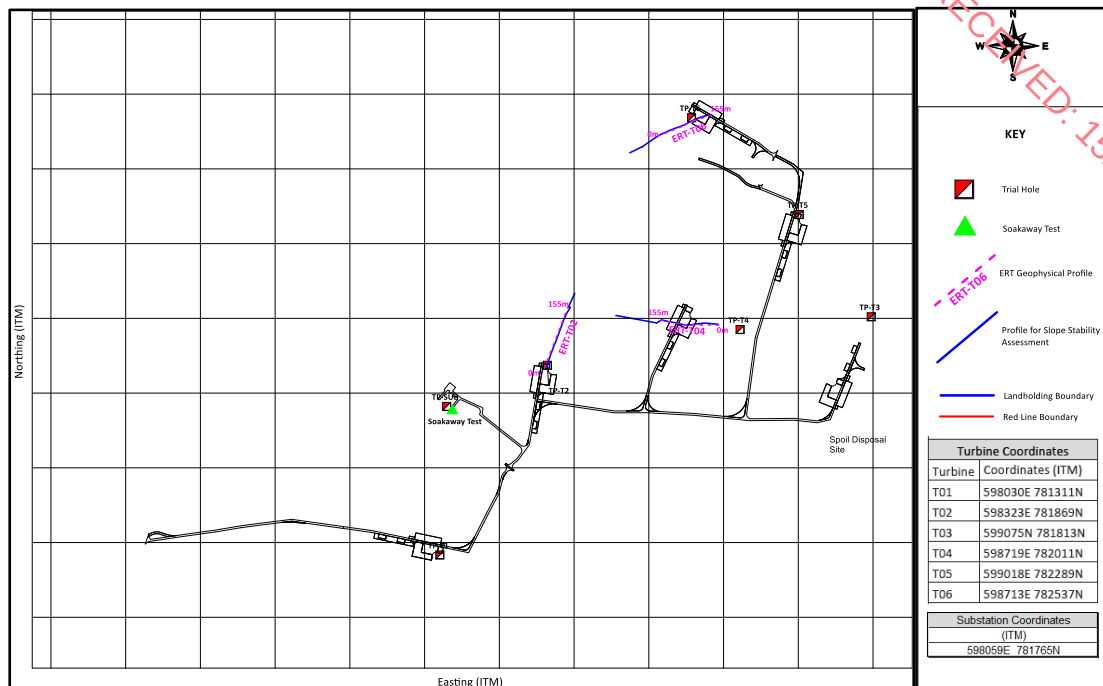


Figure 7-11: Site Investigation Layout Plan (Ref: Appendix 7.2 - Drawings)

- Whiteford Geoservices Ltd – 8 to 10 May 2024 (SI Fieldwork – Stage 1 Walkover)

Peat Landslide Hazard screening: soil shear strength was recorded at the turbine centres (according to the proposed layout at that time), with peat found to be absent at the location of the main wind farm infrastructure; and

- Whiteford Geoservices Ltd – 29 to 30 May 2024 (SI Fieldwork – Stage 2 Intrusive Works).

Solid Geology

The SI was undertaken between 29 and 30 May 2024. Trial holes undertaken recorded the presence of only greywacke rock. Consequently, karst landforms and their potential for instability have been screened out as a potential hazard at the Site.

Intact bedrock (Greywacke pertaining to the Finnalaghta Formation) was encountered during the intrusive investigations at turbines T01, T02, T06 and the Onsite Substation, at depths of between 1.20m and 1.90m below existing ground level. Rock was absent or >3.50m (in the case of turbines T03 and T04) and >4.00m deep (at turbine T05) at the excavations undertaken to inform foundation design.

Peat Soils

The following table summarises the findings of the peat probing works and illustrates the general absence of peat soils at the main infrastructure.

Table 7-10: Peat Depth Distribution

Peat Depth Range (m)	Peat Depth Distribution from analysed data (%)
0.00 – 0.50	0
0.50 – 1.00	0
1.00 – 2.00	0
2.00 – 3.00	0
3.00 – 4.00	0
> 4.00	0

This assessment is believed to be representative for the Site as a whole. Peat is absent at all structures and thus peat landslide hazard assessment is not required.

Soils and Subsoils

- **Table 7-11** summarises the ground conditions encountered at the location of the main infrastructure. Refer to **Appendix 7.2 – Preliminary Ground Investigation** for further details.

The superficial soils are confirmed to consist of boulder clays mantled by topsoil, which are in turn underlain by greywacke rock pertaining to the Finnalaghta and Fernaght rock formations.

Topsoil thickness recorded in the trial holes was found to vary from 0.25m to 0.60m.

Table 7-11: Summary of Ground Conditions and Foundation Recommendations

Turbine / Infrastructure	Stratum Encountered	Depth to Stratum (m)	Remarks	Turbine Foundation Recommendation
T01	TOPSOIL	0.00		Gravity Base foundation in weak rock formation at 3.50m depth
	Firm sandy gravelly CLAY/SILT	0.30		
	Stiff sandy gravelly CLAY/SILT with low cobble and boulder content	1.00		
	Extremely weak GREYWACKE rock	1.90	Refusal at 2.10m	
T02	TOPSOIL	0.00		Gravity Base foundation in weak rock formation at 3.50m depth
	Firm to stiff sandy gravelly CLAY/SILT with low cobble and boulder content	0.60		
	Extremely weak GREYWACKE rock	1.70	Refusal at 2.00m	
T03	TOPSOIL	0.00		Gravity Base foundation in weak rock formation if encountered at or before 5.50m depth, or Piled / rock anchored foundation, where suitable rock formation is >5.50m b.g.l.
	Firm sandy gravelly CLAY/SILT	0.25		
	Firm to stiff sandy gravelly CLAY/SILT with low cobble and boulder content	1.75	No rock encountered. Limit of excavation at 4.00m.	
T04	TOPSOIL	0.00		Gravity Base foundation in weak rock formation at 5.50m depth, or Piled / rock anchored foundation, where suitable rock formation is >5.50m b.g.l.
	Firm sandy gravelly CLAY/SILT with low cobble and boulder content	0.30		
	Stiff sandy gravelly CLAY/SILT with low cobble and boulder content	1.60		
	As above but very stiff	2.70	No rock encountered. Limit of excavation at 3.50m.	

Turbine / Infrastructure	Stratum Encountered	Depth to Stratum (m)	Remarks	Turbine Foundation Recommendation
T05	TOPSOIL	0.00		Gravity Base foundation in weak rock formation if encountered at or before 5.50m depth, or Piled / rock anchored foundation, where suitable rock formation is >5.50m b.g.l.
	Firm sandy gravelly CLAY/SILT	0.30		
	Firm to stiff sandy gravelly CLAY/SILT with low cobble and boulder content	0.50		
	As above but stiff to very stiff.	2.60	No rock encountered.	
T06	TOPSOIL	0.00	-	Gravity Base foundation in weak rock formation at 3.50m depth
	Firm sandy gravelly CLAY/SILT	0.30		
	Extremely weak GREYWACKE rock	1.20		
	Weak GREYWACKE rock	1.60	Refusal at 1.70m	
Onsite Substation	TOPSOIL	0.00		Strip, pad or raft foundations within weak GREYWACKE rock at 1.80m depth.
	Firm sandy gravelly CLAY/SILT	0.80	-	
	Extremely weak GREYWACKE rock	1.50	Refusal at 1.80m	

Groundwater was generally not encountered within exploratory trial hole excavations during the relatively transient fieldwork period.

Estimates of excavation volumes, based on the above exploratory hole information, are presented in the **Table 7-12**. Taken from **Chapter 2 – Project Description; Table 2-10**.

Table 7-12: Details of Estimated Soil Excavation for the proposed Project

Spoil Volumes		
Item	Unit	Quantity
Total Excavation Volumes	m ³	62,731
Excavated Material Stored and Reused On-site	m ³	56,458
Excavated Material Removed from Site	m ³	6,273

Refer to **Appendix 7.1 – Drawing 2273-24-D1** for screening plot depicting discrete peat depth in the vicinity of each of the main infrastructure. **Appendix 7.1 – 2273-24-D2** and **2273-24-**

D3 display the variation in ground surface as contoured plots of surface elevation and ground slope gradient respectively, for the purpose of stability analysis. All plots are provided as overlays on top of the proposed wind farm layout.

7.3.4 Analytical Analysis of Slope Stability

The following analysis uses an analytical approach to determine factors of safety to quantify the risks of soil and rock movement and local rotational failure or engulfment of excavations occurring.

The assessment is detailed in full in **Appendix 7.1 – Appendix 2**.

Soil Slopes

The application of Infinite Slope Stability Analysis be employed to gauge the stability of mineral soils on slopes and for the determination of the relevant Factor of Safety (FoS). As an additional observation, the stability of excavations within mineral soils at the site of approved turbine excavations has also been considered (**Table 7-13**).

Table 7-13: Analytical Assessment of Infinite Slope Stability of Soils³

LOCATION	Max Slope (°)	z (m)	Undrained Condition		Dry Condition	
			Cu ⁴ (kPa)	Factor of Safety Sliding	Cu (kPa)	Factor of Safety Sliding ⁵
T01	1.4	3.5	40	26.0	15	9.75
T02	2.1	3.5	40 - 75	17.3	15	6.49
T03	3.3	5.5	40	7.03	15	2.64
T04	2.7	5.5	40	8.59	15	3.22
T05	5.5	5.5	40 – 75	4.24	15	1.59
T06	3.9	3.5	40 - 75	9.36	15	3.51
Onsite Substation	2.1	1.8	40	33.71	15	12.64

All positions assessed safety factors in excess of 1.1 (as defined in Eurocode 7) and are considered to be acceptable in respect to failure by Sliding.

³ Tables 7-13, 7-14 and 7-15 assume that appropriate drainage will be employed to keep excavations clear of groundwater and surface water

⁴ Minimum in-situ test values used

Table 7-14: Analytical assessment of Rotation Slope Stability of Soils

LOCATION	Cu (kPa)	Maximum Face Height Considered (m)	Factor of Safety Rotational Failure
T01	40	3.5	>1.10
T02	40 - 75	3.5	
T03	40	5.5	
T04	40	5.5	
T05	40 – 75	5.5	
T06	40 - 75	3.5	
Onsite Substation	40	1.8	

All positions assessed safety factors in excess of 1.1 (as defined in Eurocode 7) and are considered to be acceptable in respect to rotational failure.

Rock Slopes

The application of Rotation Slope Stability Analysis (Bishop 1955) has been employed to gauge the stability of rock slopes in the vicinity of turbines T02, T04 and T06 (as they exist now) and for the determination of the relevant Factor of Safety (FoS).

As an additional observation, the Rotation Slope Stability of Rock Slopes Analysis is detailed in full under - “Analytical Analysis” in **Appendix 7.1 – Soil & Geology Technical Assessment**.

Table 7-15: Analytical assessment of Rotation Stability of Rock Slopes

LOCATION	Cu (kPa)	Maximum Face Height Considered (m)	Factor of Safety Rotational Failure
T02	500	3.50	> 1.1
T04	500	3.50	> 1.1
T06	500	3.50	> 1.1

All positions assessed safety factors in excess of 1.1 (as defined in Eurocode 7) and are considered to be acceptable in respect to rotational failure or rock faces.

Slope Stability Risk at Main Structures

The following table details the calculation of hazard in relation to soil and soil slope stability at both the turbines and the Onsite Substation.

Slope Stability is considered to be of NEGLIGIBLE / IMPERCEPTIBLE hazard for turbines T01, T03, T05. The hazard at turbines T02, T04 and T06 is considered to be LOW.

Table 7.16 – Preliminary Hazard Ranking for each Turbine Location prior to Implementation of Mitigation Measures

Turbine Location	Slope Stability (Soil / Rock) Pre-Mitigation		
	Likelihood (L)	Impact (I)	HAZARD RANKING (HR) HR = L x I
T01	1	4	4
T02	2	4	8
T03	1	4	4
T04	2	4	8
T05	1	4	4
T06	2	4	8
Onsite Substation	1	4	4

Likelihood Rating	Likelihood
1	Highly Unlikely
2	Unlikely
3	Likely
4	Very likely
5	Frequent

Impact Rating	Impact of Risk
1	Low
2	Minor
3	Serious
4	Major
5	Catastrophic

Hazard Ranking	Category
1 to 4	Negligible / Imperceptible
5 to 10	Low
11 to 18	Medium
19 to 25	High

7.4 Embedded Mitigation

Through the development of the proposed Project, measures have been adopted as part of the evolution of the design to avoid or reduce adverse impacts on the environment. These measures are referred to as 'embedded mitigation' and are effectively built into the impact assessment. Embedded mitigation relevant to land, soils and geology is set out below. Where additional mitigation measures are proposed, these are detailed after the impact assessment (**Section 7.6**).

The embedded mitigation measure employed has been the design of the proposed wind farm in terms of locating the turbines, Site Access Tracks and other site infrastructure on agricultural lands and minor 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 land, soils and geology, 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 preliminary design stage to apply risk avoidance by design which has included the following:

- Extensive 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 turbines, Turbine Hardstands, Site Access Tracks and other infrastructure based on the site assessments and geotechnical assessments in order to reduce ground risk associated with the proposed Project; and
- The works have been designed and checked by geotechnical engineers, who are suitably qualified and experienced in excavation and earthworks design and construction methodologies.

Preliminary site investigation has also allowed for selection of the most appropriate type of foundation for structures, Site Access Tracks, Onsite Substation, Relay Tower 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.

For further details on the site selection process and the consideration of alternatives, refer to **Chapter 3 – Consideration of Reasonable Alternatives**.

7.5 Assessment of Effects

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

7.5.1 Do Nothing Scenario

The “Do Nothing Scenario” is the change to the baseline environment should the proposed Project not proceed. In this case, it is envisaged that the current land use would remain as it is now, with continued medium intensity grazing for cattle, private forestry and use of public roads. Given the nature of the land, being generally pastureland, it is unlikely that any substantial changes in this use will occur in the near future, there will still be potential for moderate adverse effects on the groundwater aquifer from contamination of soils by agricultural activities.

If the proposed Project were not to proceed, the opportunity to capture part of Roscommon’s valuable renewable energy resource would be lost, as would the opportunity to contribute to meeting Government and EU targets for the production and consumption of electricity from renewable resources and the reduction of greenhouse gas emissions”. The RCDP 2022-2028, supports the concept of generating renewable energy at ‘local’ level and the significant contribution that wind energy can make as a clean sustainable solution to energy requirements.

7.5.2 Construction Phase

The proposed Project is characterised by the construction of infrastructure as described in **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:

- Turbine construction including the Turbine Foundations and Turbine Hardstands;
- Construction of the Onsite Substation;
- Provision of 2 no. Temporary Construction Compounds;
- Installation of Wind Farm Internal Cabling;
- Installation of GCR;
- Installation of Relay Tower;
- Construction of the Site Access Tracks; and

- Temporary accommodating works for the TDR.

The effects on land, land use, natural resources and geological protected sites, as a consequence of the construction phase of the proposed Project are detailed in the following sections.

Land and Land Use

58,670m³ of topsoil, subsoil and bedrock removal will occur during construction excavations and is an unavoidable consequence of the proposed Project. This will result in an adverse effect to land capability for agriculture, causing a loss of moderately productive agricultural 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 of the agricultural capability is possible after decommissioning.

Land and Land Use Assessment of Effects

Land Take – Wind Farm

Construction of the proposed wind farm Site will be a long-term alteration to the current agricultural and forestry land use. Although, the wind farm will have a 35-year lifespan and the land use returned to agriculture following decommissioning, there will initially be a long-term loss of farmland and forestry, which will have a commercial impact on the land holdings. This land loss will be greatest during the construction phase (c. 49.774ha) but will be reduced following construction and during the operational phase, when lands within the construction zone, but peripheral to the infrastructure will be returned to agricultural usage.

Considering the above the magnitude of impact is small adverse and the effect caused to soils and geology, by land take for the wind farm Site, is considered to be **Long-term, Adverse** and **Slight**. In EIA terms, the effect is considered as **Not Significant**.

Land Take - Turbine Delivery Route (TDR)

Land take within public roads will be limited to local widening to accommodate abnormal load wheel over run. Within private lands, land take will consist of widening at the 4 no. permanent site entrances (SE2, 3, 4 and 5) and at 2 no. temporary site entrance SE1 and SE6. The magnitude of impact is small adverse and the effect of this land take, when consolidated, is considered to be **Long-term, Adverse** and **Imperceptible**. In EIA terms, the effect is considered as **Not Significant**.

Land Take - Grid Connection Route (GCR)

Removal of the pavement and soils to install cables within a public road, as well as to construct temporary entrance and exit compounds for the HDD works at the N5 junction, are considered to be temporary effects 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 GCR is considered to be **Temporary, Adverse** and **Slight**. In EIA terms, the effect is considered as **Not Significant**.

Table 7-17: Effect Summary – Land Use

Effect Description	Type	Quality	Significance	Extent	Context	Probability	Duration / Frequency
Land Take – Wind Farm	Direct	Adverse	Slight (Not Significant in EIA terms)	Site	Contrast to baseline	Likely	Long term
Land Take – TDR	Direct	Adverse	Imperceptible (Not Significant in EIA terms)	Site	Contrast to baseline	Likely	Long term
Land Take - GCR	Direct	Adverse	Slight (Not Significant in EIA terms)	Site	Conforms to baseline	Likely	Temporary

Soil Compaction and Sealing

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. These effects are not applicable to the GCR and TDR. Refer to EIAR **Chapter 8 – Water, Hydrology (Flood Risk Assessment) and Hydrogeology**.

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; and
- Increasing the risk of surface water runoff and erosion. This reduction in permeability is known as “soil sealing”.

Soil Compaction and Sealing Assessment of Effects

The superficial soils underlying the Site are generally of low permeability and coupled with the fact that the Site has flat or gently sloping topography, compaction will not result in a significant increase in runoff. Given that the soil resource is also currently considered to be well drained and fertile, the magnitude of impact is considered small adverse and the effects that result from soil compaction and sealing are **Short-term, Adverse** and of **Moderate** significance. In EIA terms, the effect is considered as **Not Significant**.

Whilst there are no significant effects, measures for compaction will be implemented during the construction phase, as this is considered construction best practise. These measures will reduce the occurrence of compaction, although it should be noted that the majority of the construction work and vehicles will take place on the Site Access Tracks and Turbine Hardstanding and thus of a smaller footprint.

Table 7-18: Effect Summary – Soil Compaction and Sealing

Effect Description	Type	Quality	Significance	Extent	Context	Probability	Duration / Frequency
Compaction, Erosion and Degradation of Soil	Direct	Adverse	Moderate (Not Significant in EIA terms)	Site	Contrast to baseline	Likely	Short Term

Subsoil and Bedrock Removal

Subsoil and bedrock (to a much lesser degree) removal will occur during construction excavations and is an unavoidable consequence of the proposed 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; and
- Alteration of topography so as to reduce slope stability

Invasive species can also be spread during the removal of soils. The field surveys undertaken for the proposed Project identified no evidence of Invasive Alien Plant Species listed under the third schedule of S.I. 477 or the first schedule of S.I. 347 EU Regulations, this is addressed further in **Chapter 6 – Biodiversity**.

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

Subsoil and Bedrock Removal Assessment of Effects

Excavations

The operation of removing soils and bedrock, by excavation, also increases the potential for contaminating soil movements to occur. Processes such as soil instability, poor spoil handling, compaction and subsidence brought about by such 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 proposed Project including for turbines, Turbine Hardstand, Site Access Tracks, areas of widening on the TDR, Temporary Construction Compounds, Wind Farm Internal Cabling, Onsite Substation, GCR other ancillary infrastructure and drainage. Estimates of excavation volumes are presented in **Table 2.8, Chapter 2 – Project Description**.

Considering the above the magnitude of impact is medium adverse and the effect caused to soils and geology, by excavations, is considered to be **Long-term, Adverse** and **Significant**.

This is because of the scale of the earthworks (both in terms of depth and volume) required for the main infrastructure, the volume of material removed and the handled as spoil. Refer to Table 5-5, CEMP which details the excavation works required. In EIA terms, the effect is considered as **Significant**.

Site Access Tracks

Site Access Tracks will be needed to accommodate the construction works and to provide access to the turbine locations for the whole life cycle of the wind farm. The Site Access Tracks will be constructed using unbound crushed aggregates and incorporate drainage to maintain the performance of the pavement during wet weather.

These tracks will be constructed within the mineral soils, but where sensitive soils such as organic or very soft clays are present, “floated” road construction methods may be employed to satisfy a particular need.

The effect associated with excavations for soil and bedrock removal for the Site Access Tracks (*loss of agricultural resource, degradation of soil structure, changes to drainage, as well as*

increased potential for erosion) is **Long-term, Adverse** and **Significant**. In EIA terms, the effect is considered as **Significant**.

Turbines and Turbine Hardstands

The soil encountered at each turbine and infrastructure location, during construction, is a combination of topsoil, and both granular and cohesive mineral soils. The underlying greywacke rock formation will be exposed in the excavation of Turbine Foundations, where it is the preferred formation for construction of gravity base foundations for turbines T01, T02, T03, T04, T05 and T06. The Onsite Substation building will be constructed using strip, pad or raft foundations placed within the weak rock formation. For construction of all other infrastructure, the overlying topsoils will be removed until mineral till soils of sufficient competence are encountered and construction commenced. Refer to **Table 7-11** for proposed Turbine Foundation arrangements.

Bedrock Excavations at Turbines

Significant bedrock excavations will be required for the construction of Turbine Foundations, which will be at depths of up to 5.5m below existing ground level. The majority of these excavations will encounter rock.

Rock excavated during the construction phase will be removed using a combination of mechanical excavation and the use of heavy hydraulic breaks. This recovered rock will be selectively reused and processed as construction fill/aggregate for the proposed Project, where possible.

Table 7-19: Indicative Depth to Bedrock at Main Structures

Turbine No. / Unit	Depth to Competent Formation (mBGL)	Depth to Competent Rock (mBGL)
T01	2.10	3.50
T02	3.00	3.50
T03	4.00	>5.50
T04	3.50	>5.50
T05	3.70	>5.50
T06	1.70	3.50
Onsite Substation	1.50	1.80

The effects associated with excavations for soil and bedrock removal at Turbine and Turbine Hardstand areas (*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**.

Wind Farm Internal Cabling Trenches

Cable trenches throughout the proposed wind farm Site will be excavated to a depth of approximately 1.1m and width of 0.5m to accommodate the 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 management 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 wind farm 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**.

Turbine Delivery Route (TDR)

With the exception of the Site Entrances, which have been assessed along with the wind farm Site, the TDR will generally utilise the existing public roads and require, localised temporary widening and stoning of public road verges and roundabout. Details are presented in **Chapter 12 – Traffic and Transport**.

Generally, the impacts associated with this will be as per the Site Access Track 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**.

Grid Connection (GCR)

Grid connection cable trenches will be excavated along the GCR, between the Onsite Substation and the Sliabh Bawn 110kV Substation. On leaving the proposed wind farm Site, the trenches will be within public roads and verges, to a proposed depth of 1.235m, depending on confirmatory investigations. Excavation of topsoil and mineral soils will be required.

It is proposed to utilise HDD at one location along the GCR – the N5/R371 road junction; to cross the N5 without open excavation of the road, (see **Planning Drawing 23604-304 and 562**).

HDD is a method of drilling under obstacles such as roadways, bridges, railways, water courses, utility services etc. in order to install cable ducts under the obstacle. This method is employed where installing the ducts using standard installation methods is not possible or impractical, in the case of the proposed Project.

The HDD at this location will be approximately 50 m in length and is in consideration of the Transport Infrastructure Ireland (TII) scoping response **Chapter 12 – Traffic and Transport and Appendix 1.3 – Scoping Consultation**). HDD works are not considered likely to interact directly with groundwater due to the relatively shallow depths (estimated at 2m at the deepest point) needed in order to drill under the N5 road.

These trenches will be backfilled using imported granular material with the excavated material stored on-site at one of the soil repositories or recycled for use elsewhere.

The effects associated with excavations for cable trenches and HDD (*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**.

Temporary Construction Compounds

Two temporary compounds will be established and used for the proposed Project. The temporary compounds will be used as support, welfare and storage areas, for the duration of the construction phase. Refer to **Chapter 2 – Project Description** for details.

The potential effects for the Temporary Construction Compound are **Short-Term, Adverse and Slight**. In EIA terms, the effect is considered as **Not Significant**.

Total Volumes of Material to be Excavated

Approximately 62,731m³ of topsoil, mineral soils and rock will be excavated to construct the proposed Project.

Approximately 56,458m³ of the topsoil, mineral soil and rock will be re-used during construction. An allowance of 10% or 6,273m³ of the remaining spoil has been made for disposal off-site.

A general summary of all the pre-mitigation effects associated with subsoil and bedrock removal is presented in **Table 7-20**.

Table 7-20: Effect Summary – Soil and Bedrock Removal

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

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Storage and Stockpile Management

Overview

It is expected that the majority of spoil generated on Site will be either topsoil, small amounts of organic soils, mineral soils or rock.

In line with the requirements of the Circular Economy Act, soil and excavated materials will be treated as an Article 27 by-product (a non- waste) where possible and if that is not possible, they will be recycled. Any potential waste will be treated to comply with Article 28 if practicable. In the event of any materials containing invasive species, these will be appropriately managed and sent to authorised facilities.

Spoil will be utilised in the construction of permanent track side bunds / low earthen mounds along the edge of the Access Tracks, to control and divert surface water, prevent erosion (**Chapter 8 – Water, Hydrology (Flood Risk Assessment) and Hydrogeology and Planning Drawings 23604-400 to 405**) and to provide a barrier to keep vehicles from leaving the Site Access Tracks. Spoil will be utilised to create low earthen mounds to support the enhancement / new planting of hedgerow and treelines.

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 proposed Project (mainly, Turbine Foundations, Site Access Tracks, Turbine Hardstands, Onsite Substation, Wind Farm Internal Cabling, GCR, TDR nodes etc.).

Storage and Stockpile Management Assessment of Effects

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.

Excavated material generated during construction will be retained on Site and, where appropriate, incorporated into the works. However, an allowance of 10% of total excavated spoil material has been made for removal off site. This material will be transported off site by an appropriately authorised waste collector and disposed of at an appropriately licenced waste facility or recycled.

It is envisaged that all excavated material generated during construction will be retained on site and, where appropriate, incorporated into the works. However, an allowance of 10% of total excavated spoil material has been made for removal off site.

An example of materials to be removed from site are excavated material from the public road which have bitumen mixed through. Depending on the constituents of the bituminous road make-up, this material may be inert or non-inert waste. This material will be transported off site by an appropriately authorised waste collector and disposed of at an appropriately licenced waste facility or recycled. Further detail on waste material removed from site is set out in the **Waste Management Plan (WMP) (Appendix 2.1.2)**.

Initially excavated material will be stored in Temporary Spoil Storage Areas, and later, selected spoil will be incorporated into the works as they are completed. Temporary Spoil Storage Areas are identified on **Planning Drawings 23604-201 to 208**.

Spoil will be utilised in the construction of permanent track side bunds / low earthen mounds along the edge of the Access Tracks, to control and divert surface water, prevent erosion (**Chapter 8 – Water, Hydrology (Flood Risk Assessment) and Hydrogeology and Planning Drawings 23604-400 to 405**) and to provide a barrier to keep vehicles from leaving the Site Access Tracks. Spoil will be utilised to create low earthen mounds to support the enhancement / new planting of hedgerow and treelines.

Upon completion of the construction works, all remaining excavated material will be integrated into the final landscaping, blending seamlessly with the existing terrain to avoid leaving any mounds of spoil around the Site. See **Planning Drawing 23604-551** for Spoil Management details.

Temporary construction areas such as the Temporary Construction Compounds, Turbine Hardstand assembly areas, blade fingers etc. will be reinstated utilising stored material from the Temporary Spoil Storage Areas (See **Planning Drawings 23604-200 to 208**). Spoil Management is detailed on **Planning Drawings 23604-251 to 258**.

Spoil Management is discussed in further detail **Appendix 2.1- CEMP**.

This process of spoil management will have a **Long Term, Adverse** and **Moderate** effect on the geology and soils associated with the proposed project. In EIA terms, the effect is considered as **Not Significant**.

A general summary of all the pre-mitigation effects associated with spoil management removal is presented in **Table 7-21**.

Table 7-21: 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 (Not Significant in EIA terms)	Site	Contrast to baseline	Likely	Long Term

Vehicular Movement

Overview

Vehicle movement will occur primarily during the construction phase at the proposed wind farm Site. Construction vehicles will include cranes, excavators, dumper trucks, concrete trucks, private cars (construction personnel). Please refer to the **Chapter 12 – Traffic and Transport**, for details. 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.

Vehicular Movement Assessment of Effects

TDR and Site Access Tracks

Along the TDR there will be localised temporary widening and stoning of public road verges and roundabouts to facilitate abnormal load vehicle overrun. There will also be minor changes to the lands at the site entrances where local widening will also be required. This will result in compaction and sealing of the underlying soils. In the case of site entrances SE2, SE3, SE4 and SE5 this will be permanent, although in the case of the public roads and SE1 and SE6,

will be temporary and will only be used during the construction phase. The overall effect is **Permanent, Adverse** and **Slight**.

The effects of associated with additional heavy vehicle movements along the TDR are considered to be **Short-term, Adverse** and **Moderate**.

The resulting effects associated with vehicle movements on the geology and soils along the Site Access Tracks are 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 7-22**.

Table 7-22: 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 (Not Significant in EIA terms)	Localised	Conforms to baseline	Likely	Short term
Vehicle Movement – Compaction, subsidence and settlement of newly established and upgraded Internal Site Access Tracks	Direct	Adverse	Moderate (Not Significant in EIA terms)	Localised	Contrast to baseline.	Likely	Permanent

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.

Peat Landslide Hazard, Ground Stability and Failure Assessment of Effects

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 has been screened out as a potential impact on soils and geology as peat was not recorded within the footprint of the proposed wind farm Site.

A significant amount of ground investigation data has been acquired across the proposed 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 Silty / Clayey SANDS and GRAVELS or Sandy / Gravelly SILTS and CLAYS.

These assessments of soil and rock slope stability detailed in **Table 7.16** indicate the hazard to be acceptable, for the purpose of design, at the main structures.

These subsoils and rock formation are generally not associated with ground instability or a risk of landslides, with overall landslide susceptibility assessed to be low to moderately low within the footprint of the proposed wind farm Site.

SI's did not record the presence of typical karst features, within the rock below the proposed wind farm subsoils, which could affect ground stability. Neither would these be anticipated within the mainly sedimentary rocks underlying the Site. Consequently, the hazard of karst instability is negligible / imperceptible.

GCR will be installed in an excavated trench approximately 1.235m deep, predominately within the existing public road carriageway and private tracks, which consist of road surfacing materials overlying a combination of glacial till deposits of varying consistency, cut-over raised peat and alluvium. Lesser portions of the GCR will be laid in verges and mantled by topsoil.

It is proposed to utilise HDD at one location along the GCR – the N5/R371 road junction; to cross the N5 without open excavation of the road, (see **Planning Drawing 23604-304 and 562**). The HDD at this location will be approximately 50 m in length.

Only limited rock excavation is expected to be needed to install the circuits at the scheduled depth. Grid connection construction works are of low impact with respect to the underlying rock formation and consequently, the significance of karst instability is considered to be negligible / imperceptible.

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

The potential effects associated with soil landslide are considered to be **Permanent, Adverse** and **Moderate**, In EIA terms, the effect is considered as **Not Significant**.

Table 7-23: 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 failures occurring in the face of excavations undertaken during construction. (Localised displacement and settlement)	Direct or Indirect / Secondary	Adverse	Significant (Significant in EIA terms)	Localised / Potentially Regional	Contrast to baseline	Likely	Short term
Ground Stability and Failure - Potential for soil landslide to occur as a result of construction activities.	Indirect / Secondary	Adverse	Moderate (Not Significant in EIA terms)	Localised / Potentially Regional	Contrast to baseline	Unlikely	Permanent

Soil Contamination

Overview

No extant contaminated soils were recorded during the ground investigation campaign. Accidental spillage of fuels, release of chemicals or importation of contaminated materials during construction works poses a pollution risk, where receptors such as the native soils, underlying groundwater aquifers, adjacent quarry and local watercourses could be adversely affected.

No third schedule invasive plant species were recorded within the Project (see **Chapter 6 – Biodiversity**). Therefore, the spread of invasive plant species is unlikely to occur. As such, standard invasive species and biosecurity protocols will be followed per standard practice to

ensure no vehicle to introduce invasive plant species to the ecological baseline occurs during the life cycle of the proposed Project. As no such event is likely, effects as a result of invasive plant species during the construction of the Project are considered **Not Significant**. In EIA terms, this is considered to be **Not Significant**.

Soil Contamination Assessment of Effects

The most sensitive receptors in this respect are the Scramoge, Feorish and Shannon Rivers, and their tributaries and indirectly the Roscommon Ribbed Moraines Site of Geological Significance less than 0.5km to the east.

The overlying soils are considered weakly permeable and are generally thick enough to offer a moderate degree of protection to the low potential greywacke aquifer below. The large separation between the construction works to the Rivers Scramoge and Feorish means that they are at limited risk from any soils and geology effects caused by the proposed Project.

The Roscommon Ribbed Moraines Site is hydrologically linked to the proposed Site and this directs the assessment of soils and geology related effects for contamination. Due to its Geological Significance the sensitivity of the Roscommon Ribbed Moraines Site is considered to be High.

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

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 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 is considered to be a **Short-term, Adverse and Significant** effect on the soils and geological environment associated with the proposed Project. In EIA terms, the effect is considered as **Significant**.

Wastewater and Sanitation

During the construction phase, wastewater / sewerage effluent will arise from the on-site welfare facilities and has the potential cause contamination of the soils depending on the method of treatment employed. For sanitary provisions, self-contained toilets and wash areas with integrated waste holding tanks will be provided. A temporary water storage tank will be used as the site's source of water.

The effects associated with wastewater and sewerage are considered to be **Short-term, Adverse** and **Slight**. In EIA terms, the effect is considered as **Not Significant**.

Construction or Cementitious Materials

A number of potentially contaminating materials will be stored and used onsite throughout the construction phase of the proposed Project, such as concrete and bentonite. Should these materials be spilt onto the soil environment, they have potential to have an adverse impact on soils and water quality.

Spillages of concrete may occur during the laying of foundations required for the Project structures. 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 proposed Site.

Imported aggregates will be employed as part of the construction process. Importation of materials from sources outside the 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 **Short term, Adverse** and **Moderate**. In EIA terms, the effect is considered as **Not Significant**.

General Waste

General Waste Assessment of Effects

Construction Spoil

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**.

General Waste

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

In summary, the proposed Project has the potential to give rise to the following pre-mitigation soil contamination effects, shown in **Table 7.24**.

Table 7-24: 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 (Not Significant in EIA terms)	Localised / Potentially Regional	Contrast to baseline	Unlikely	Short term
Soil and Groundwater Contamination - Hydrocarbons	Direct or Indirect / Secondary	Adverse	Significant (Significant in EIA terms)	Localised / Potentially Regional	Contrast to baseline	Unlikely	Short term
Soil and Groundwater Contamination – Wastewater and Sanitation	Direct or Indirect / Secondary	Adverse	Slight (Not Significant in EIA terms)	Localised / Potentially Regional	Contrasts to baseline	Unlikely	Short term
Soil and Groundwater Contamination – Construction and Cementitious materials	Direct or Indirect / Secondary	Adverse	Moderate (Not Significant in EIA terms)	Localised / Potentially Regional	Contrast to baseline	Unlikely	Short term
Waste Materials – Construction Spoil	Direct	Adverse	Moderate (Not Significant in EIA terms)	Localised	Contrast to baseline	Unlikely	Long term

Effect Description	Type	Quality	Significance	Extent	Context	Probability	Duration / Frequency
Waste Materials – General Waste	Direct	Adverse	Slight (Not Significant in EIA terms)	Localised	Contrast to baseline	Unlikely	Short term

Quarry Blasting Activity

This activity can have the potential to affect both the integrity of the works and the safety of the site users / workers. With regard to soils the potential effects are as follows.

- Adverse seismic energy, in the form of vibration and air over pressure, causing soil movement; and
- Adverse seismic energy, in the form of vibration experienced at structures, affecting structural integrity.

Quarry Blasting Activity Assessment of Effects

To quantify the vibration levels associated with the blasting activity, a vibration survey was conducted by Enfonic on January 9, 2025 during a schedule blasting event. Blasting Activity at the adjacent Ballyfeeney Rock Quarry has been assessed in **Chapter 10 – Noise and Vibration**. A Blasting Technical Report has been prepared for the proposed Project detailing the findings of the survey is provided in **Appendix 10.8**.

In respect to Ground Vibration and Air Overpressure Blast, the assessment indicates that the max. vibration level predicted to occur at structures will be below the threshold at which we would reasonably anticipate minor structural damage to occur to the foundations (BS 5228 1.2009+A1.2014). Air overburden pressure is within the operational range for the wind farm infrastructure and will have imperceptible effect on soil stability. **Table 7-25** summarises these likely significant effects.

The potential effect of vibration from Quarry Blasting is considered to be **Short-term, Adverse** and **Imperceptible**. In EIA terms, the effect is considered as **Not Significant**.

Table 7-25: Effect Summary – Quarry Blasting Activity

Effect Description	Type	Quality	Significance	Extent	Context	Probability	Duration / Frequency
Quarry Blasting – Structural Integrity	Direct	Adverse	Imperceptible (Not Significant in EIA terms)	Localised	Conforms to baseline	Likely	Short term

Features of Geological Heritage

Features of Geological Heritage Assessment of Effects

The Roscommon Ribbed Moraines Site (RO022) of geological heritage is located approximately 0.5km to the east of the proposed wind farm Site and has been assessed for potential effects from the proposed Project.

The RO022 site is considered to be unusual and relatively unique and consequently recognised as a County Geological Site. The features themselves are typically large-scale landforms over a very large region, where these landforms register “coarsely” within the landscape. It is recognised that contamination entering local land drainage and tributaries have the potential to cause a visible impact on the Geological Site, where such an effect will have an impact on a small part of the protected landscape.

The Project and the RO022 site are hydrologically linked by the tributaries of the Scramoge River and therefore, there is the potential for a **Short-term, Adverse** and **Significant** effect as a result of contamination by hydrocarbons, chemicals or siltation contamination entering the watercourse. In EIA terms this effect is considered **Significant**.

Table 7-26: Effect Summary – Features of Geological Heritage

Effect Description	Type	Quality	Significance	Extent	Context	Probability	Duration / Frequency
Degradation of Quality of Sites of Geological Significance caused by emissions / pollution from the proposed Project	Indirect/ Secondary	Adverse	Significant (Significant in EIA terms)	Regional	Contrast to baseline	Unlikely	Short term

7.5.3 Operational Phase

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

Land Take Wind Farm

Land Take Wind Farm Assessment of Effects

No further effect on land use is envisaged during the operational phase of the proposed Project. Land take is addressed under **Section 7.4.2**. Portions of the land will be reinstated following the construction phase and this will have a minor beneficial effect on soils and geology.

Overall, the effects are considered to be **Long Term, Positive** and **Slight**. In EIA terms, the effect is considered as **Not Significant**.

Soil Compaction, Erosion and Degradation

Soil Compaction, Erosion and Degradation Assessment of Effects

No new excavations will be undertaken during the operational phase of the proposed Project, so no new compaction of soils will occur. Ongoing settlement of structures, Site Access Tracks and other infrastructure will continue to occur during the operational phase, but this is low in significance and monitored regularly in the short-term.

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

Soil Contamination

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

Soil Contamination Assessment of Effects

Hydrocarbons and Chemicals

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

General Waste

General Waste Assessment of Effects

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**.

Quarry Blasting Activity

Quarry Blasting Activity Assessment of Effects

The effects associated with Blasting Activity on the operational phase of the proposed Project are considered to be **Short-term, Adverse** and **Imperceptible**. In EIA terms, the effect is considered as **Not Significant**.

Sites of Geological Heritage

Sites of Geological Heritage Assessment of Effects

The magnitude of the adverse effect on Geological Heritage during the operational phase of the proposed Project is considered to be **Short-term, Adverse** and **Imperceptible**. In EIA terms, the effect is considered as **Not Significant**.

In summary, the proposed Project has the potential to give rise to the following pre-mitigation operational effects, shown in **Table 7-27**.

Table 7-27: Effect Summary – Operational Phase

Effect Description	Type	Quality	Significance	Extent	Context	Probability	Duration / Frequency
Land Take	Direct	Beneficial	Slight (Not Significant in EIA terms)	Localised	Conforms to baseline	Likely	Long-term
Soil Compaction and Subsidence	Direct	Adverse	Slight (Not Significant in EIA terms)	Localised	Contrast to baseline	Likely	Long-term
Soil Contamination – Hydrocarbons and Chemicals	Direct	Adverse	Slight (Not Significant in EIA terms)	Localised	Contrast to baseline	Unlikely	Long term

Effect Description	Type	Quality	Significance	Extent	Context	Probability	Duration / Frequency
Soil contamination - Operational Wastes	Direct	Adverse	Slight (Not Significant in EIA terms)	Localised	Contrast to baseline	Unlikely	Long term
Blasting Activity	Direct	Adverse	Imperceptible (Not Significant in EIA terms)	Localised	Conforms to baseline	Likely	Short term
Sites of Geological Heritage	Direct / Indirect	Adverse	Imperceptible (Not Significant in EIA terms)	Localised / Regional	Contrast to baseline	Unlikely	Long term

7.5.4 Decommissioning

The Applicant is seeking consent for a period of 35 years for the operation of the proposed Project from the date of commissioning. Following the end of the operational phase the Applicant may wish to replace the turbines with a new set of turbines, subject to fulfilling the planning requirements at the time or the proposed Project may be decommissioned. The Onsite Substation and grid connection will remain in place as it will be in the ownership of ESB Networks and will form part of the National Grid. The Relay Tower will remain in place as it will form part of the telecommunication network in the area.

A description of the decommissioning is as follows:

- Removal of the turbines including the blades, hub, nacelle and wind turbine towers;
- Removal of the above ground section of the Turbine Foundation called the 'plinth';
- Removal of all Wind Farm Internal Cabling. The cable ducting will remain in-situ to minimise the associated ground disturbance; and
- Reinstatement of the Turbine Hardstands and Turbine Foundations, by covering with earth and reseeded/replanted as appropriate.

The Turbine Foundations will remain in place underground except for the foundation plinth that will be removed below ground level. The Site Access Tracks and associated drainage will serve the ongoing forestry and farming practices in the area. All other hard surfaced areas

such as the Turbine Hardstands will be covered by earth and reseeded/replanted as agreed at the time with the landowners and the Local Authority.

Decommissioning Phase Assessment of Effects

In general, the potential effects associated with decommissioning will be similar to those associated with construction phase, but of reduced magnitude because extensive excavation and wet concrete handling will not be required. In EIA terms, the likely effect is considered as **Not Significant**.

A summary of these potential effects is provided in **Table 7-28**.

Table 7-28: Effect Summary – Decommissioning Phase

Effect Description	Type	Quality	Significance	Extent	Context	Probability	Duration / Frequency
Land and Land Uses	Direct	Positive	Slight (Not Significant in EIA terms)	Localised	Contrast to baseline	Likely	Long-term
Compaction, Erosion and Degradation of Soils	Direct	Adverse	Slight (Not Significant in EIA terms)	Localised	Contrast to baseline	Likely	Short term
Earthworks – Excavations	Direct	Adverse	Slight (Not Significant in EIA terms)	Localised	Contrast to baseline	Likely	Short 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	Contrast to baseline	Likely	Short term
Ground Stability and Failure - Stability issues and slope failure arising from construction activities. (Localised displacement and settlement)	Direct	Adverse	Slight (Not Significant in EIA terms)	Localised	Contrast to baseline	Likely	Short term
Ground Stability and Failure - Stability issues and slope failure arising from construction	Direct	Adverse	Slight (Not Significant in EIA terms)	Localised	Contrast to baseline	Unlikely	Short term

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Effect Description	Type	Quality	Significance	Extent	Context	Probability	Duration / Frequency
activities (Landslide)							
Soil and Groundwater Contamination	Direct	Adverse	Moderate (Not Significant in EIA terms)	Localised	Contrast to baseline	Unlikely	Long term
Decommissioning Spoil	Direct	Adverse	Slight (Not Significant in EIA terms)	Localised	Contrast to baseline	Likely	Short term
Waste Materials – General Waste	Direct	Adverse	Slight (Not Significant in EIA terms)	Localised	Contrast to baseline	Unlikely	Short term
Blasting Activity	Direct	Adverse	Imperceptible (Not Significant in EIA terms)	Localised	Conforms to baseline	Unlikely	Short-term

7.6 Mitigation Measures

7.6.1 Construction Phase

The following sections outline the mitigation measures that will be carried out to avoid or reduce the potential effects of the proposed Project during the construction phase.

Design

The following will be implemented for wind farm Site, GCR and TDR construction:

- Any excavation or 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 effects will be recorded and relayed to appropriate parties;
- A detailed method statement for each element of the works will be prepared by the Appointed Contractor prior to any element of the work being carried out;
- Given that the works comprise a sizeable proportion of excavation and earthworks, suitably qualified and experienced geotechnical personnel will be required on site to supervise the works;
- Appointment of an Environmental Manager;
- Appointment of an Environmental Clerk of Works (ECoW) to oversee and ensuring the project adheres to the application of all environmental mitigation measures and undertaking of monitoring to minimise adverse impacts on the surrounding natural environment;
- The ECoW will also be responsible for ensuring that all waste soils taken off-site are classified to the appropriated EU Waste Code, tested and certified to the correct Waste Acceptance Criteria; and
- The Appointed Contractor will programme works such that earthworks are not scheduled during severe weather conditions or at times of prolonged high rainfall.

Construction Environmental Management Plan

A **CEMP (Appendix 2.1)** and **SWMP (Appendix 2.1.1)** have been prepared for the proposed Project and will be implemented by the Appointed Contractor for the construction phase.

The CEMP sets out a framework associated, to ensure that appropriate controls are in place, to manage environmental effects associated with the construction phase.

The CEMP is a live document will be updated prior to the construction phase commencing, by the Appointed Contractor, to address the requirements of any relevant planning conditions, including any additional mitigation measures that are conditioned.

A copy of the CEMP shall be submitted to the Local Authority prior to the commencement of the construction phase.

All mitigation measures outlined hereunder have been incorporated into **Appendix 2.1 – CEMP** and **Appendix 2.1.1 SWMP**.

Pollution Prevention

Prior to commencement of construction works at structures in the proximity of sensitive waterbodies and Site Access Track crossing watercourses, pollution prevention arrangements will be put in place to prevent contaminated surface water run-off from construction activities entering these watercourses, other water bodies.

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 construction compound;
- Refuelling and maintenance of vehicles and plant will take place in designated areas of hardstanding;
- 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.

Refer to **Chapter 8 – Water, Hydrology (Flood Risk Assessment) & Hydrogeology** for further details.

In the event of a pollution event, the Emergency Response Plan, as detailed in the **Appendix 2.1 – CEMP**, will put into action immediately in order to both contain and remove any contaminated soils.

Soil Compaction and Sealing

The proposed Project will be constructed in a phased manner in order to reduce, minimise and eradicate where possible the potential effects on land, 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 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 carried out from Site Access Tracks 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. Further mitigation with respect to stockpiles is contained in **Chapter 9 – Air Quality and Climate**.

Subsoil and Bedrock Removal

Implementation of the proposed Project will result in the removal of soils in parts of the Site to facilitate excavation for the construction of Site Access Tracks and Turbine Hardstands for the turbines within a competent stratum suitable for the emplacement of Turbine Foundations.

Ground conditions vary across the Site with mineral soils of varying depths and competence present. At the turbine bases the excavation depth required is anticipated to be a maximum of 5.50m to a suitable bearing stratum. For Site Access Tracks and Turbine Hardstands this is expected to be average 0.60m and consequently less significant.

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 proposed Project, all excavated overburden will either be re-used or retained on-site for reinstatement purposes. In the event where residual quantities of spoil cannot be re-used on site, it will be sent for further offsite processing at an appropriately licensed facility.

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 Tracks, Turbine Hardstands and in reinstatement around Turbine Foundations.
- Residual surplus overburden will also be stored at Temporary Spoil Storage Areas. Temporary construction areas will be reinstated utilising stored material from the Temporary Spoil Storage Areas. Refer to the Spoil Management Plan in **Appendix 2.1 – CEMP** for details.

Surplus overburden deposits excavated during the course of the works will be stored, for the duration of the proposed Project, in designated spoil deposition areas until they can be employed for proposed 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 and landscaping. These stockpiles will be shaped and sealed to prevent the ingress of water from rainfall.

Any surplus/waste soil or rock will be removed from the proposed Site and disposed of according to **Appendix 2.1 – CEMP**.

Mitigation by Good Practices

In order to reduce the potential for adverse impact to the soil resource the following mitigation will be employed:

- The construction zone will be physically demarcated by means of fencing prior to commencement construction activities; and
- Temporary stockpiles will be covered by appropriate weather-proof sheeting to guard against degradation from wind and rainfall.

Excavated material generated during construction will be retained on Site and, where appropriate, incorporated into the works. However, an allowance of 10% of total excavated spoil material has been made for removal off site. This material will be transported off site by

an appropriately authorised waste collector and disposed of at an appropriately licenced waste facility or recycled.

An example of materials to be removed from site are excavated material from the public road which have bitumen mixed through. Depending on the constituents of the bituminous road make-up, this material may be inert or non-inert waste. This material will be transported off site by an appropriately authorised waste collector and disposed of at an appropriately licenced waste facility or recycled or reused as byproducts.

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:

- Mineral soils will be deposited directly on top of other mineral soils. This will require the removal of topsoil or peat, where present, to facilitate the process;
- Topsoils / Organic Soils will be stored separately according to their classification, 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 proposed Project;
- Mineral soil spoil deposition will take place at various locations within the Redline Boundary where low surface gradients combine with minimal peat depth and sufficient distance from sensitive receptors. These proposed spoil deposition arrangements are detailed in **Appendix 2-1 - CEMP** and **Planning Drawings 23604-201 to 208 (Part 1)**;
- 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;
- Preparation of the spoil deposition 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;
- Spoil will be deposited, in layers of 0.50m and will not exceed a total thickness of 2.00m, unless contained by suitably designed berms;
- Spoil will only be deposited on slopes of <5 degrees to the horizontal and greater than 10m from the top of a cutting;
- Spoil deposition sites used 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; and

- Once spoil deposition is complete the deposition sites will be re-vegetated with the upper vegetated layer removed at the commencement of management 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.
- Spoil management measures have been included to reduce prey availability and limit foraging activity for Kestrel, Buzzard and other raptors, around the turbines during the operational phase. This will include the spreading and compaction of spoil to create a flat surface around the turbines, to prevent rapid colonisation of new vegetation. These areas will be planted with ryegrass to create uniform short vegetation heights. Further detail is provided in **Chapter 6 – Biodiversity** and **Volume III Appendix 6.10 – Species Habitats and Management Plan**.

Vehicular Movements

Vehicle movements are assessed in full in EIAR **Chapter 12 –Traffic and Transport**.

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

Vehicular traffic to the proposed Site will be minimised through the re-use of excavated material 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 Irish Wind Energy Association (IWEA) (2012) “Best Practice Guidelines for the Irish Wind Energy Industry” and NatureScot (July 2024) “Good practice during wind farm construction”, 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 CEMP, which will be updated by the Appointed Contractor and issued to the Local Authority, prior to any site works commencing.

Ground Stability

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

An Emergency Response Plan (as part of **Appendix 2.1 – CEMP**) has been prepared and will be enacted should soil movement occur.

Earthworks & Ground Stability – Prevention of Landslide

Application of the following procedures will have the effect of reducing the hazard with respect to Soil Instability:

- 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;
- Excessive quantities of spoil loaded onto sensitive topsoil, organic soils or other sensitive soil covered sloping ground will greatly increase the risk of soil movement. (The gradient of the slope should be no more than 5 degrees to the horizontal). Topsoils and organic soils shall be removed prior to depositing spoil and retained for re-use as landscaping a material;
- The angle of repose of the cut face of excavations must be adjusted to minimise to potential for slope failure. Battering back the sides of an excavation to approx. 60 degrees in clay soils and 30 degrees in granular or organic soils will help to reduce the potential for slippage, significantly reducing the potential for soil movement;
- The Turbine Hardstanding areas 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;
- Ground movements can often occur during or following severe rainstorm events, particularly when following a prolonged dry spell. Extra vigilance will be maintained during/or following such events;
- All slopes will be regularly checked for development of tension cracks, which are indicative of ground movement;
- Method statements will be followed at all times. Where modification is required this will first be agreed by the supervising engineer;

- 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;
- Surface water flows will compromise most granular or cohesive soils at any slope angle and care shall be taken to stop the development of such flows during construction;
- 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;
- The potential for ground movement will be monitored regularly during the construction works, by means of regular site visits and assessments, by the ECoW; and
- 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. Low ground bearing pressure machinery will be considered for transport of construction materials in sensitive areas.

Soil Contamination

Hydrocarbons and Cementitious Materials

The probability of contamination resulting via hydrocarbons and cementitious materials will be minimised through the application of good practice and adherence to the CEMP, which contain an Environmental Management Plan in respect to fuel, Oil and Chemical Management. Mitigation measures to be adopted include:

To prevent contamination from fuel, oil, chemical and cementitious materials, the following measures will be adopted:

During concrete pours:

- Concrete pours shall not occur during forecasted heavy rainfall, and the pour area must be drained of any water. In case of spills, temporarily block dirty water drains in the immediate area, monitor and adjust the pH levels of water in settlement ponds using CO₂ entrainment if necessary, and clear any spillage immediately, depositing it in the chute wash down area; and

- Delivery trucks, tools, and equipment will be cleaned at designated areas within a controlled site area, with the concrete truck chute cleaning area lined with impermeable material to protect groundwater from pollution (refer to **Planning Drawing 23604 - 405) – Part 1**;

For fuel, oils and chemicals

- Ensure all fuels, oils, and chemicals are stored in bunded areas at least 50 meters from watercourses or drainage areas, with a capacity of 110% of the total volume.
- Construct bunded areas in accordance with AS 1940:2004 standards;
- The refuelling of construction machinery and vehicles will be carried out in designated refuelling areas using a prescribed re-fuelling procedure;
- Refuelling and maintenance activities will be prohibited near watercourses or drainage areas to minimise contamination risks;
- Refuelling and maintenance activities will be undertaken on impervious surfaces or bunded trays to prevent spills from seeping into the ground;
- Appropriate spill kits will be readily available and stocked. Spill kits will be maintained on the mobile fuel truck and at numerous locations on the Site; and
- Only mechanically sound vehicles, equipment and machinery on Site will be used on site.

Importation of materials such as aggregates and other forms of construction materials will be monitored, documented, certified, sampled and tested as per the requirements of the CEMP.

Importation of materials from off-site, such as aggregates and other construction materials, will be closely monitored to ensure that no contamination or invasive species, is brought onto the Site from external sources. Importation of materials such as aggregates and other forms of construction materials will be monitored, documented, certified, sampled and tested as per the requirements of the **Appendix 2.1.2 – Waste Management Plan**.

Likewise, spoil materials removed from site will be closely monitored to ensure that no contamination or invasive species, are recorded

Similarly, but to a lesser degree, there is potential for adverse effect from wastewater percolation. The only source of wastewater production will be the welfare facilities at the Temporary Construction Compounds

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, 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.

General Waste

All materials used on the proposed Site and wastes generated will be reduced by good Site practice and attention to **Appendix 2.1.2 – Waste Management Plan**. 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.

Emergency Response

An Emergency Response Plan (ERP) will be in place for the construction phase and includes a spill response and control procedure that will be followed in the event of a spill/leakage occurring during construction.

All site operatives will be trained in the requirements of the ERP and all site vehicles will also contain emergency spill kits.

The ERP will be updated prior to the construction phase commencing, by the Appointed Contractor. The ERP is detailed in **Appendix 2.1 – CEMP**. In the event of a spill/leak, the following steps will be followed:

- Stop the source of the spill and raise the alarm to alert people working in the vicinity of any potential dangers.
- If applicable, eliminate any sources of ignition in the immediate vicinity of the incident.
- Contain the spill using the spill control materials, track mats or other material as required.
- Do not spread or flush away the spill. If possible, cover or bund off any vulnerable areas where appropriate such as drains, watercourses or sensitive habitats.
- If possible, clean up as much as possible using the spill control materials.

- Contain any used spill control material and dispose of used materials appropriately using a fully licensed waste contractor with the appropriate permits so that further contamination is limited.
- Notify the ECoW immediately giving information on the location, type and extent of the spill so that they can take appropriate action.
- The ECoW will inspect the site and ensure the necessary measures are in place to contain and clean up the spill and prevent further spillage from occurring.
- The ECoW will notify the appropriate regulatory body such as Roscommon County Council and the Environmental Protection Agency (EPA), if deemed necessary.

A record of all environmental incidents will be kept on file by the ECoW and the Main Contractor.

Quarry Blasting Activity

A **Blasting Coordination and Cooperation Plan (Appendix 2.1.5)** has been prepared for the proposed Project. The plan outlines the procedures which will be taken during a blasting event at the Ballyfeeny Rock Quarry. The Blasting Coordination and Cooperation Plan is a live document and will be updated prior to the construction phase of the Project to include any changes to the blasting schedule of the quarry and any potential conditions of planning on the proposed Project. The plan will ensure health and safety controls are in place during each phase of the proposed Project to protect staff, onsite vehicles and equipment.

7.6.2 Operational Phase

It is not envisaged that the operation of the proposed Project will result in significant effects on the soils and geology regime within the study area, as there will be no further disturbance of overburden post construction.

The main potential impact during the operational phase would be the risk to groundwater from contamination from spills. A permanent fuel bowser will be used to store fuel within the compound at the Onsite Substation, for the refuelling of emergency generating equipment. Other maintenance oils and hydraulic fluids will be stored within the storeroom and will be suitable bunded (see **Planning Drawing 23604 – 520**). All fuel tanks and bowzers will be self-contained and of double-walled construction with refuelling only undertaken at designated

refuelling areas. Specific mitigation measures relating to the management of all 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 by a licensed contractor;
- 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; and
- All wastes from the Onsite Substation, turbines and ancillary facilities will be removed by the licensed contractor. The operational team will carry out maintenance works (to Site Access Tracks, Onsite Substation, 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 wind farm. 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.

These potential effects are limited by the size of the fuel tanks employed and volume of oils and lubricant used for maintenance during the operational phase.

In addition, the design of the Onsite Substation transformers and batteries incorporates bunding to protect soils against accidental leakages of oils and battery fluids.

Welfare facilities during the operational phase will be located at the Onsite Substation and will be a “closed” system where no irrigation field is required (see **Planning Drawing 23604 – 529**). The facilities will be serviced regularly and waste removed on a regular basis for disposal at the appropriate off-site licensed facility.

Quarry Blasting Activity

The **Blasting Coordination and Cooperation Plan (Appendix 2.1.5)** referenced in **Section 7.6.1** will be implemented during the operational phase.

7.6.3 Decommissioning Phase

Decommissioning of Infrastructure

During the decommissioning phase, silt protection controls similar to those used during the construction phase will be implemented. The drainage system will remain operational to treat any sediment-laden surface water runoff caused by soil disturbance.

Turbine Foundations, Turbine Hardstands and other below ground works and will be left in place. Leaving below ground structures in place is seen as a more ecologically responsible choice since removing may cause environmental disturbances including noise, dust, and vibration. These will be reinstated with stored topsoil and re-vegetated, see **Chapter 6 – Biodiversity** and **Appendix 2.1.4 – Decommissioning Management Plan (DMP)** for details on re-vegetation and planting.

As decommissioning will not occur for at least 35 years, in accordance with the Scottish National Heritage Decommissioning and Restoration Plan for wind farms (SNH, 2016), a review of the DMP will be conducted to appropriately identify any additional measures required based on any changes in the future baseline, any updates to legislation, guidance or best practice techniques or conditions of planning.

The revegetation process following the backfilling of Turbine Hardstanding areas will be monitored, and if necessary, erosion control matting will be used to aid in the re-establishment of vegetation.

7.7 Residual Effects

7.7.1 Construction Phase

The residual effects after implementation of all mitigation measures for the construction phase of the proposed Project are presented in **Table 7-29**. In EIA terms, the effect is considered as **Not Significant**.

Table 7-29: Construction Phase Residual Effects Summary

Effect Description	Type	Quality	Significance	Extent	Context	Probability	Duration / Frequency
Land Take – Wind Farm	Direct	Adverse	Slight (Not Significant in EIA terms)	Site	Contrast to baseline	Likely	Long term
Land Take – TDR	Direct	Adverse	Imperceptible (Not Significant in EIA terms)	Site	Contrast to baseline	Likely	Long term
Land Take - GCR	Direct	Adverse	Slight (Not Significant in EIA terms)	Site	Conforms to baseline	Likely	Temporary
Soil Compaction and Sealing	Direct	Adverse	Slight (Not Significant in EIA terms)	Site	Contrast to baseline	Likely	Short term
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	Direct	Adverse	Not significant	Site	Contrast to baseline	Likely	Short term

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Effect Description	Type	Quality	Significance	Extent	Context	Probability	Duration / Frequency
Construction Compounds							
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	Short term
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	Contrast to baseline	Likely	Short term
Ground Stability and Failure - Stability issues and slope failure arising from construction activities (Landslide)	Indirect / Secondary	Adverse	Slight (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 –	Direct or Indirect / Secondary	Adverse	Slight (Not Significant in EIA terms)	Localised / Potentially Regional	Conforms to baseline	Unlikely	Short term

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Effect Description	Type	Quality	Significance	Extent	Context	Probability	Duration / Frequency
Wastewater and Sanitation							
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	Unlikely	Short term
Waste Materials – Construction Spoil	Direct	Adverse	Slight (Not Significant in EIA terms)	Localised	Contrast to baseline	Unlikely	Long term
Waste Materials – General Wastes	Direct	Adverse	Not significant	Localised	Contrast to baseline	Unlikely	Short term
Quarry Blasting – Structural Integrity	Direct	Adverse	Imperceptible (Not Significant in EIA terms)	Localised	Contrast to baseline	Likely	Short term
Degradation of Quality of Sites of Sites of Designated Importance caused by emissions / pollution from the Development	Direct / Indirect	Adverse	Slight (Not Significant in EIA terms)	Regional	Contrast to baseline	Unlikely	Short term

7.7.2 Operational Phase

The residual effects after implementation of all mitigation measures for the operational phase of the proposed Project are presented in **Table 7-30**. In EIA terms, the effect is considered as **Not Significant**.

Table 7-30: Operational Phase Residual Effect Summary

Effect Description	Type	Quality	Significance	Extent	Context	Probability	Duration / Frequency
Soil Compaction and Sealing	Direct	Adverse	Not Significant (Not Significant in EIA terms)	Localised	Contrast to baseline	Likely	Long-term
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 (Not Significant in EIA terms)	Localised	Contrast to baseline	Unlikely	Long term
Quarry Blasting – Structural Integrity	Direct	Adverse	Imperceptible (Not Significant in EIA terms)	Localised	Conforms to baseline	Likely	Short term

7.7.3 Decommissioning

The residual effects after implementation of all mitigation measures for the decommissioning phase of the proposed Project are presented in **Table 7-31**. In EIA terms, the effect is considered as **Not Significant**.

Table 7-31: Decommissioning Phase Residual Effects Summary

Effect Description	Type	Quality	Significance	Extent	Context	Probability	Duration / Frequency
Land and Land Uses	Direct	Positive	Not Significant (Not Significant in EIA terms)	Localised	Contrast to baseline	Likely	Long-term
Soil Compaction and Sealing	Direct	Adverse	Not Significant (Not Significant in EIA terms)	Localised	Contrast to baseline	Likely	Short term
Earthworks – Excavations	Direct	Adverse	Not Significant (Not Significant in EIA terms)	Localised	Contrast to baseline	Likely	Short term
Vehicle Movement - Compaction, erosion and degradation of soils arising from vehicular movement along existing public and private roads	Direct	Adverse	Not Significant (Not Significant in EIA terms)	Localised	Contrast to baseline	Likely	Short term
Ground Stability and Failure - Stability issues and slope failure arising from construction activities. (Localised displacement and settlement)	Direct	Adverse	Not Significant (Not Significant in EIA terms)	Localised	Contrast to baseline	Likely	Short term
Ground Stability and Failure - Stability issues and slope failure arising from construction activities (Landslide)	Direct	Adverse	Not Significant (Not Significant in EIA terms)	Localised	Contrast to baseline	Unlikely	Short term
Soil and Groundwater Contamination	Direct	Adverse	Not Significant (Not Significant in EIA terms)	Localised	Contrast to baseline	Unlikely	Long term
Decommissioning Spoil	Direct	Adverse	Not Significant (Not Significant in EIA terms)	Localised	Contrast to baseline	Likely	Short term

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Effect Description	Type	Quality	Significance	Extent	Context	Probability	Duration / Frequency
Waste Materials – General Waste	Direct	Adverse	Not Significant (Not Significant in EIA terms)	Localised	Contrast to baseline	Unlikely	Short term
Blasting Activity	Direct	Adverse	Not Significant (Not Significant in EIA terms)	Localised	Conforms to baseline	Likely	Short-term
Degradation of Quality of Sites of Sites of Designated Importance caused by emissions / pollution from the Development	Direct / Indirect	Adverse	Not Significant (Not Significant in EIA terms)	Regional	Contrast to baseline	Unlikely	Short term

7.8 Risk of Major Accidents and/or Disasters

This section considers the vulnerability of the proposed Project to major accidents and/or disasters, the risk of those major accidents and/or disasters occurring and the potential for any significant adverse effects on soils and geology.

According to EPA Guidelines, these unplanned events can include 'spill from traffic accidents, floods or landslides affecting the site, fire, collapse or equipment failure on site'. Additionally, the EIA Directive requires "major accidents, and/or natural disasters (such as flooding, sea level rise or earthquakes)" be addressed.

The *Environmental Impact Assessment of Projects: Guidance on the preparation of the Environmental Impact Assessment Report* (European Commission, 2017) requires the consideration of major hazards in the context of the SEVESO III Directive. It is noted that the proposed Project will not come under the Control of Major Accident Hazards (COMAH) Regulations. Additionally, the wind farm Site and GCR are not located in proximity to a COMAH establishment with the closest establishment located c. 37km west. Works for the TDR will be localised and temporary in nature and no interactions with COMAH sites are anticipated

In absence of mitigation measures, the proposed Project could potentially result in leakage of wastewater or chemicals associated with wastewater sanitation onto soils in the event of a major accident or natural disaster. **Section 7.6** stipulates numerous mitigation measures to reduce and avoid any adverse effects to soils and geology as a result of the proposed Project.

Furthermore, a **CEMP (Appendix 2.1)** and **SWMP (Appendix 2.1.1)** have been prepared for the proposed Project and will be implemented by the Appointed Contractor for the construction phase. These documents set out a framework to ensure that appropriate controls will be implemented on site, including the implementation of an ERP. With this mitigation in place, it is considered that the risk associated with soil contamination events is low and there are no associated significant adverse effects on soils and geology. This is considered **Not Significant** in EIA terms.

7.9 Cumulative Effects Assessment

This section represents the findings for the cumulative effects assessment (CEA) and considers the residual effects for land, soils and geology presented in **Section 7.7** against the potential effects of other proposed projects during the construction, operational and decommissioning phases. In summary, the CEA has been approached in a staged process. The stages included the following:

- Stage 1: Establishing the list of other projects;
- Stage 2: Applying topic specific criteria to the list of other projects, to confirm a short list for each topic chapter;
- Stage 3: Collating information on each of the other projects to inform the CEAs; and
- Stage 4: Undertaking the assessment to an appropriate level of detail. This is based on the information available on each of the other projects.

Full details on the approach to the assessment of cumulative effects are provided in **Chapter 16 – Cumulative Effects**. A list of other projects relative to the proposed Project was compiled by the project team and is provided in **Appendix 16.1 – Long list of other projects for the cumulative effects assessment**

The initial list of other projects for the proposed wind farm Site and GCR (Stage 1) was produced based on a 20km radius from the outermost turbines. The 20km radius aligned with the study area (the zone of theoretical visibility) applied in **Chapter 11 – Landscape and Visual** and which is defined in the Draft WEDG 2019.

In confirming the topic specific screening range for land, soils and geology (Stage 2), it was determined that the area of 20km would be considered as this allowed the assessment to account for potential indirect cumulative effects on land, soils and geology receptors

The use of local quarries and concrete suppliers, of which there are 3 no. within 20km of the proposed wind farm Site, have been assessed to be a potential cumulative effect to the proposed Project and these potential effects; Vehicle Movement, Grid Connection Route, Turbine Delivery Route / Construction Delivery Route are discussed in this section.

During the construction of the proposed Project there will be a requirement for the importation of engineered fill from source quarries. There is a total of 5 no. energy related projects that have been granted planning permission within a 20km radius of the proposed Site. Should construction work of the proposed Project coincide with the construction of these energy developments and the N5 Ballaghadreen to Scramoge Project, currently under construction,

the demand for imported aggregate for these projects have the potential to have a cumulative impact on local quarries.

However, given that there is a total of 3 no. quarry and concrete suppliers within 20km, the impact on local quarries is expected to be manageable, as supply is considered to exceed demand.

As such, it is considered there will be a **Short-term, Adverse and Imperceptible**, cumulative effect on soils and geology, caused by the project. In EIA terms, the effect is considered as **Not Significant**.

During the operational phase this effect will be a **Long-term, Adverse and Imperceptible** cumulative effect. In EIA terms, the effect is considered as **Not Significant**.

7.10 Inter-Related Effects

Chapter 17 – Inter-Related Effects describes any interactions between Soil and Geology effects on different environmental aspects.

7.11 Monitoring

Construction phase monitoring is captured within Section 7.6.1. No further monitoring is proposed for the operational phase.

7.12 Summary of Effects

This chapter has assessed the potential effects on land, soils and geology during the construction, operational and decommissioning phases of the proposed Project. **Table 7-32** overleaf displays the impact assessment for all phases of the Project and confirms the residual effects following the application of mitigation measures. The assessment has identified that there will be **No Significant** effects on land, soils and geology as a result of the proposed Project.

Table 7-32: Summary of Effects

Receptor	Potential Effect	Significance of effect	Mitigation Measures	Residual significance of effect
Construction Phase				
Soils, Agricultural / Forestry capability	Land Take – Wind Farm	Slight (Not Significant in EIA terms)		Slight (Not Significant in EIA terms)
Soils	Land Take – TDR	Imperceptible (Not Significant in EIA terms)		Imperceptible (Not Significant in EIA terms)
Soils	Land Take - GCR	Slight (Not Significant in EIA terms)		Slight (Not Significant in EIA terms)
Soils	Soil Compaction and Sealing	Moderate (Not Significant in EIA terms)	1. 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. 2. Excavations will be carried out from Site Access Tracks as they are constructed in order to reduce the compaction of soft or otherwise sensitive ground 3. Amount of exposed ground and stockpiles will be minimised. 4. Any stockpiles in place for an extended period of time will be allowed to revegetate naturally.	Slight (Not Significant in EIA terms)
Soils, Geomorphology, Economical Resource	Soil and Bedrock Removal –Excavations	Significant (Significant in EIA terms)	1. Best practice as described in the Irish Wind Energy Association (IWEA) (2012) “Best Practice Guidelines for the Irish Wind Energy Industry” and NatureScot (July 2024) “Good practice during wind farm construction”, will be applied during construction which will minimise double handling, again reducing the site traffic. 2. Where possible site won material will be re-used as general fill during construction. 3. Surplus overburden will be stored at Temporary Spoil Storage Areas,	Slight (Not Significant in EIA terms)
Soils, Geomorphology, Economical Resource	Soil and Bedrock Removal - Access Tracks	Significant (Significant in EIA terms)		Slight (Not Significant in EIA terms)
Soils, Geomorphology, Economical Resource	Soil and Bedrock Removal – Turbine and Hardstand Areas	Significant (Significant in EIA terms)		Slight (Not Significant in EIA terms)

Receptor	Potential Effect	Significance of effect	Mitigation Measures	Residual significance of effect
Soils, Geomorphology, Economical Resource	Soil and Bedrock Removal – Wind Farm Internal Cabling Trenches	Not significant (Not Significant in EIA terms)	4. Surplus soils will be stored separately depending on their classification. i.e. mineral soils will be stored separately from topsoil or organic soils.	Not significant (Not Significant in EIA terms)
Soils, Geomorphology, Economical Resource	Soil and Bedrock Removal – Turbine Delivery Route / Haul Route	Not significant (Not Significant in EIA terms)	5. Stockpiles will not exceed 2m in height (unless constrained by suitable berms), deposited in layers of 0.5m thick at a time, and will be suitably protected in order to guard against degradation.	Not significant (Not Significant in EIA terms)
Soils, Geomorphology, Economical Resource	Earthworks Activities – Grid Connection Cable	Not significant (Not Significant in EIA terms)	6. Spoil movements will be minimised by disposing of the spoil within or immediately adjacent to the structures whence it was excavated.	Not significant (Not Significant in EIA terms)
Soils, Geomorphology, Economical Resource	Earthworks Activities – Temporary Construction Compounds	Slight (Not Significant in EIA terms)	7. Spoil deposition sites will have a regular weekly assessed carried out by a suitably qualified individual, to ensure the stability and good condition is maintained.	Not significant (Not Significant in EIA terms)
Soils, Waterbodies (indirect)	Earthworks Activities – Storage and Stockpiles / Spoil Management	Moderate (Not Significant in EIA terms)	8. Once spoil deposition operations are complete the sites will be revegetated with the upper vegetate material removed at commencement of management operations.	Slight (Not Significant in EIA terms)
Soils, Agricultura / Forestry capability	Vehicle Movement - Compaction, erosion and degradation of soils arising from vehicular movement along existing public and private roads	Moderate (Not Significant in EIA terms)	9. All topsoil will either be reused for landscaping purposes or stored on-site for reuse during decommissioning.	Slight (Not Significant in EIA terms)
Soils, Agricultura / Forestry capability	Vehicle Movement – Compaction, subsidence and settlement of newly established and upgraded Access Tracks	Moderate (Not Significant in EIA terms)	1. Vehicular movements will be restricted to the footprint of the proposed Project, particularly with respect to the newly constructed Site Access Tracks. This ensures that machinery must be kept on Site Access Tracks and will not move onto areas that are not permitted. 2. Vehicular traffic on the proposed Site will be minimised through the re-use of excavated material on-site which will reduce the need to source material from external quarries.	Slight (Not Significant in EIA terms)

Receptor	Potential Effect	Significance of effect	Mitigation Measures	Residual significance of effect
Soils, Waterbodies (indirect)	Ground Stability and Failure - Stability issues and slope failure arising from construction activities. (Localised displacement and settlement)	Significant (Significant in EIA terms)	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.	Slight (Not Significant in EIA terms)
Soils, Waterbodies (indirect)	Ground Stability and Failure - Stability issues and slope failure arising from construction activities (Landslide)	Moderate (Not Significant in EIA terms)	2. Excessive quantities of spoil loaded onto sensitive topsoil, organic soils or other sensitive soil covered sloping ground will greatly increase the risk of soil movement. (The gradient of the slope should be no more than 5 degrees to the horizontal). Topsoils and organic soils shall be removed prior to depositing spoil and retained for re-use as landscaping a material. 3. The angle of repose of the cut face of excavations must be adjusted to minimise to potential for slope failure. Battering back the sides of an excavation to approx. 60 degrees in clay soils and 30 degrees in granular or organic soils will help to reduce the potential for slippage, significantly reducing the potential for soil movement. 4. The Turbine Hardstanding areas 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. 5. Ground movements can often occur during or following severe rainstorm events, particularly when following a prolonged dry spell. Extra vigilance will be maintained during/or following such events. 6. All slopes will be regularly checked for development of tension cracks, which are indicative of ground movement.	Slight (Not Significant in EIA terms)

Receptor	Potential Effect	Significance of effect	Mitigation Measures	Residual significance of effect
			7. Method statements will be followed at all times. Where modification is required, this will first be agreed by the supervising engineer. 8. 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. 9. Surface water flows will compromise most granular or cohesive soils at any slope angle and care shall be taken to stop the development of such flows during construction. 10. 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. 11. The potential for ground movement will be monitored regularly during the construction works, by means of regular site visits and assessments, by the ECoW. 12. 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. Low ground bearing pressure machinery will be considered for transport of construction materials in sensitive areas.	
Soils, Aquifers	Soil and Groundwater – Pollution of Groundwater Aquifer	Significant (Not Significant in EIA terms)	1. The probability of contamination resulting via hydrocarbons and cementitious materials will be minimised through the application of good practice and adherence to the CEMP, which contain an Environmental Management Plan in respect to fuel, Oil and Chemical Management.	Slight (Not Significant in EIA terms)
Soils, Waterbodies (indirect), Geological Heritage (indirect)	Soil and Groundwater Contamination - Hydrocarbons	Significant (Significant in EIA terms)		Slight (Not Significant in EIA terms)

Receptor	Potential Effect	Significance of effect	Mitigation Measures	Residual significance of effect
Soils, Waterbodies (indirect)	Soil and Groundwater Contamination – Wastewater and Sanitation	Slight Significant in EIA terms) (Not Significant in EIA terms)	2. Importation of materials such as aggregates and other forms of construction materials will be monitored, documented, certified, sampled and tested as per the requirements of the CEMP.	Slight (Not Significant in EIA terms)
Soils, Waterbodies (indirect)	Soil and Groundwater Contamination – Construction and Cementitious materials	Moderate Significant in EIA terms) (Not Significant in EIA terms)	3. Importation of materials from off-site, such as aggregates and other construction materials, will be closely monitored to ensure that no contamination or invasive species, is brought onto the Site from external sources.	Slight (Not Significant in EIA terms)
Soils, Waterbodies (indirect)	Waste Materials – Construction Spoil	Moderate Significant in EIA terms) (Not Significant in EIA terms)	Importation of materials such as aggregates and other forms of construction materials will be monitored, documented, certified, sampled and tested as per the requirements of the Appendix 2.1 – CEMP , Waste Management Plan.	Slight (Not Significant in EIA terms)
Soils, Waterbodies (indirect)	Waste Materials – General Wastes	Slight Significant in EIA terms) (Not Significant in EIA terms)	4. Spoil materials removed from site will be closely monitored to ensure that no contamination or invasive species, is brought onto the Site from external sources. 5. The only source of wastewater production will be the welfare facilities at the Temporary Construction Compounds. 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, drained on a regular basis and disposed of off-site at a suitable licensed facility. 6. All materials used on the proposed Site and wastes generated will be reduced by good Site practice and attention to Appendix 2.1 – CEMP , Waste Management Plan. A policy of reduce, re-use and recycle will apply. 7. 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.	Not significant (Not Significant in EIA terms)

Receptor	Potential Effect	Significance of effect	Mitigation Measures	Residual significance of effect
			8. Whenever possible, excavated spoil materials will be re-used close to the area of excavation. 9. An Emergency Response Plan will be prepared by the Project Supervisor for the Construction Phase (PSCS) and will accompany the CEMP, in order to deal with any emergency accidents or spills.	
Structures, Site Users	Quarry Blasting – Structural Integrity	Imperceptible (Not Significant in EIA terms)	1. A Blasting Coordination and Cooperation Plan (Appendix 2.1.5) has been prepared for the proposed Project	Imperceptible (Not Significant in EIA terms)
Geological Heritage	Degradation of Quality of Sites of Sites of Designated Importance caused by emissions / pollution from the Development	Significant (Significant in EIA terms)	1. The potential unlikely adverse effect to Geological Heritage is mitigated by application of the Surface Water Management Plan and pollution prevention protocols outlined for Contamination, above.	Slight (Not Significant in EIA terms)
Operational Phase				
Soils, Agricultural / Forestry capability	Land Take	Slight (Not Significant in EIA terms)		Not Significant (Not Significant in EIA terms)
Soils	Soil Compaction and Subsidence	Slight (Not Significant in EIA terms)		Not Significant (Not Significant in EIA terms)
Soils, Waterbodies (indirect)	Soil Contamination – Hydrocarbons and Chemicals	Slight (Not Significant in EIA terms)	1. Maintenance oils and hydraulic fluids will be stored within service vehicles.	Not Significant (Not Significant in EIA terms)
Soils, Waterbodies (indirect)	Soil contamination - Operational Wastes	Slight (Not Significant in EIA terms)	2. All fuel tanks and bowsters will be self-contained and of double-walled construction with refuelling only undertaken at designated refuelling areas. 3. Fuels, lubricants and hydraulic fluids for equipment used on the Site will be carefully handled to avoid spillage.	Slight (Not Significant in EIA terms)

Receptor	Potential Effect	Significance of effect	Mitigation Measures	Residual significance of effect
			4. Any spillage of fuels, lubricants or hydraulic oils will be immediately contained, and the contaminated soil removed from the Site and properly disposed of. 5. Waste oils and hydraulic fluids will be collected in leak-proof containers and removed from the site for recycling by a licensed contractor. 6. 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. 7. All wastes from the Onsite Substation, turbines and ancillary facilities will be removed by the licensed contractor. 8. The operational team will carry out maintenance works (to Site Access Tracks, Onsite Substation, 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 wind farm. 9. 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. 10. These potential effects are limited by the size of the fuel tanks employed and volume of oils and lubricant used for maintenance during the operational phase. 11. The design of the Onsite Substation transformers and batteries incorporates bunding to protect soils against accidental leakages of oils and battery fluids. 12. Welfare facilities during the operational phase will be located at the Onsite Substation and will be a “closed” system where no irrigation field is required. The facilities will be serviced regularly and waste removed on a regular	

Receptor	Potential Effect	Significance of effect	Mitigation Measures	Residual significance of effect
			basis for disposal at the appropriate off-site licensed facility.	
Structures, Site Users	Blasting Activity	Imperceptible (Not Significant in EIA terms)	Blasting Coordination and Cooperation Plan (See Appendix 2.1.5) has been prepared for the proposed Project	Not Significant (Not Significant in EIA terms)
Geological Heritage	Sites of Geological Heritage	Imperceptible (Not Significant in EIA terms)	The potential unlikely adverse effect to Geological Heritage is mitigated by application of the Standard Operating Procedure and pollution prevention protocols outlined for Contamination, above.	Imperceptible (Not Significant in EIA terms)
Decommissioning phase				
Soils, Agricultural / Forestry capability	Land and Land Uses	Slight Significant (Not Significant in EIA terms)		Not Significant (Not Significant in EIA terms)
Soils	Compaction, Erosion and Degradation of Soils	Slight Significant (Not Significant in EIA terms)	As for Construction Phase.	Not Significant (Not Significant in EIA terms)
Soils	Earthworks Excavations	Slight Significant (Not Significant in EIA terms)	As for Construction Phase.	Not Significant (Not Significant in EIA terms)
Soils, Agriculture / Forestry capability	Vehicle Movement - Compaction, erosion and degradation of soils arising from vehicular movement along existing public and private roads	Slight Significant (Not Significant in EIA terms)	As for Construction Phase.	Not Significant (Not Significant in EIA terms)

Receptor	Potential Effect	Significance of effect	Mitigation Measures	Residual significance of effect
Soils, Waterbodies (indirect)	Ground Stability and Failure - Stability issues and slope failure arising from construction activities. (Localised displacement and settlement)	Slight Significant (Not in EIA terms)	As for Construction Phase.	Not Significant (Not Significant in EIA terms)
Soils, Waterbodies (indirect)	Ground Stability and Failure - Stability issues and slope failure arising from construction activities (Landslide)	Slight Significant (Not in EIA terms)	As for Construction Phase.	Not Significant (Not Significant in EIA terms)
Soils, Aquifers, Waterbodies (indirect),	Soil and Groundwater Contamination	Moderate Significant (Not in EIA terms)	As for Construction Phase.	Not Significant (Not Significant in EIA terms)
Soils, Waterbodies (indirect)	Decommissioning Spoil	Slight Significant (Not in EIA terms)	As for Construction Phase.	Not Significant (Not Significant in EIA terms)
Soils, Waterbodies (indirect)	Waste Materials – General Waste	Slight Significant (Not in EIA terms)	As for Construction Phase.	Not Significant (Not Significant in EIA terms)
Structures, Site Users	Blasting Activity	Imperceptible (Not Significant in EIA terms)	As for Construction Phase.	Not Significant (Not Significant in EIA terms)

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