Planning and Environmental Consultants

Environmental Impact Assessment Report

Gannow Renewable Energy Development, Co. Galway

Chapter 8 Land, Soils and Geology

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8. LAND SOILS AND GEOLOGY

8.1 Introduction

8.1.1 Background and Objectives

Hydro-Environmental Services (HES) was engaged by MKO to carry out an assessment of the potential likely and significant effects of the Proposed Project on the Land, Soils and Geology aspects of the receiving environment.

For the purposes of this EIAR, the various project components are described and assessed using the following references: 'Proposed Project', 'Proposed Wind Farm', 'proposed turbines', 'Proposed Grid Connection', 'Site' and 'Proposed Wind Farm site'. Please see Section 1.1.1 of this EIAR for further details. A detailed description of the Proposed Project is provided in Chapter 4 of this EIAR.

The Site which includes the Proposed Wind Farm and the Proposed Grid Connection is located at Gannow and adjacent townlands near Attymon in Co. Galway. The Proposed Project encompasses both the Proposed Wind Farm and the Proposed Grid Connection.

This chapter provides a baseline assessment of the environmental setting of the Proposed Project, as described in Chapter 4, in terms of Land, Soils and Geology and discusses the potential likely significant effects that the construction, operation and decommissioning of the Proposed Project will have. Where required, appropriate mitigation measures to avoid any identified significant effects to Land, Soils and Geology (i.e. natural resources) are recommended and the residual effects of the Proposed Project post-mitigation are assessed.

8.1.2 Statement of Authority

Hydro-Environmental Services (HES) are a specialist geological, hydrological, hydrogeological and environmental practice which delivers a range of water and environmental management consultancy services to the private and public sectors across Ireland and Northern Ireland. HES was established in 2005, and our office is located in Dungarvan, County Waterford.

Our core areas of expertise and experience includes soils, subsoils and geology. We routinely complete impact assessments for land, soils and geology, hydrology and hydrogeology for a large variety of project types including wind farms and renewable energy projects.

This chapter of the EIAR was prepared by Michael Gill, Conor McGettigan and Nitesh Dalal.

Michael Gill (P. Geo., B.A.I., MSc, Dip. Geol., MIEI) is an Environmental Engineer/Hydrologist with over 24 years' environmental consultancy experience in Ireland. Michael has completed numerous hydrological and hydrogeological impact assessments of wind farms in Ireland. He has also managed EIAR assessments for infrastructure projects and private residential and commercial developments. In addition, he has substantial experience in wastewater engineering and site suitability assessments, contaminated land investigation and assessment, wetland hydrology/hydrogeology, water resource assessments, surface water drainage design and SUDs design, and surface water/groundwater interactions. For example, Michael has worked on the EIS/EIARs for Slievecallan Wind Farm, Cahermurphy (Phase I & II) Wind Farm, and Carrownagowan Wind Farm, and over 100 other wind farm related projects across the country.

Conor McGettigan (BSc, MSc) is an Environmental Scientist with 4 years' experience in the environmental sector in Ireland. Conor holds an M.Sc. in Applied Environmental Science (2020) and a B.Sc. in Geology (2016) from University College Dublin. Conor routinely prepares the land, soils and

geology chapters of environmental impact assessment reports for renewable energy developments, bedrock quarries, industrial and residential developments. Conor has worked on the EIARs for over 20 no. wind farms projects across the country.

Nitesh Dalal (B.Tech, PG Dip., MSc) is an Environmental Scientist with over 7 years' experience in environmental consultancy and environmental management in India. Nitesh holds an M.Sc. in Environmental Science (2024) from University College Dublin. Nitesh also holds a PG Diploma in Health, Safety and Environment (2021) from Annamalai University, India and a B.Tech. in Environmental Engineering (2016) from Guru Gobind Singh Indraprastha University, India. Since joining HES Nitesh has assisted in the preparation of the land, soils and geology chapter of environmental impact assessments for a wide range of development types including wind farm developments.

8.1.3 Relevant Legislation

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

- Planning and Development Acts, 2000-2021;
- Planning and Development Regulations, 2001 (as amended);
- Directives 2011/92/EU and 2014/52/EU on the assessment of the effects of certain public and private projects on the environment;
- S.I. No. 296 of 2018 European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018; and,
- The Heritage Act 1995, as amended.

8.1.4 Relevant Guidance

The Land, Soils and Geology chapter of this EIAR was prepared in accordance with, where relevant, the guidance contained in the following documents:

- Environmental Protection Agency (2022): Guidelines on the Information to be contained in Environmental Impact Assessment Reports;
- Institute of Geologists Ireland (2013): Guidelines for the Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements;
- National Roads Authority (2008): Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes;
- Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment (DoHPLG, 2018); and,
- Guidance on the preparation of the EIA Report (Directive 2011/92/EU as amended by 2014/52/EU), (European Commission 2017).

8.2 Assessment Methodology

8.2.1 Desk Study

A desk study was completed in the spring of 2024 to collect all relevant geological data for the Site and the surrounding area. The desk study was completed to supplement site walkover surveys and site investigations. The desk study information has been checked and updated, where necessary, in March and April 2025.

The desk study included consultation with the following data sources:

- Environmental Protection Agency database (www.epa.ie);
- Geological Survey of Ireland - Groundwater and Geology Databases (www.gsi.ie);
- Geological Survey of Ireland – Geological Heritage site mapping (www.gsi.ie);
- Bedrock Geology 1:100,000 Scale Map Series, Sheet 14 (Geology of Galway Bay). Geological Survey of Ireland (GSI, 1997);
- Geological Survey of Ireland – 1:25,000 Field Mapping Sheets;
- Geological Survey of Ireland (2003) – Clare-Corrib Groundwater Body Initial Characterization Reports;
- General Soil Map of Ireland 2nd edition (www.epa.ie); and,
- Aerial Photography, 1:5000 and 6 inch base mapping.

8.2.2 Baseline Monitoring and Site Investigations

A walkover survey of the Site was undertaken by Michael Gill and Conor McGettigan of HES on 24th September 2024 (refer to Section 8.1.2 above for qualifications and experience). During this walkover gouge cores were completed at all proposed turbine locations and all exposed soils/subsoils were logged. Additional walkover surveys were completed by Conor McGettigan and Nitesh Dalal on 2nd April 2025 and 17th April 2025.

Geotechnical ground investigations, comprising of the excavation of 12 no. trial pits at the Proposed Wind Farm site, were completed by Irish Drilling Limited (IDL) between the 7th and 10th October 2024.

Fehily Timoney and Company (FT) completed site walkover surveys of the Proposed Wind Farm site in September 2024. During the survey and geotechnical inspections, FT completed peat probing investigation and in-situ shear vane testing.

In addition, to the above site investigations, MKO and HES completed supplementary peat probing across the Proposed Wind Farm site.

The objectives of the site investigations included mapping the subsoils lithology for all proposed turbine locations and other key infrastructure locations (i.e. access tracks). The geological data accrued from these site investigations was used to inform the final layout of the Proposed Wind Farm.

In summary, site investigations to address the Land, Soils and Geology chapter of the EIAR included the following:

- A total of 498 no. peat probes were carried out by FT, HES and MKO between October 2023 and March 2025 to determine the depth and geomorphology of the peat at the Site (463 no. probes at the Proposed Wind Farm site and 35 no. peat probes at targeted locations along the Proposed Grid Connection);
- In addition to peat probing, FT completed in-situ shear vane testing. Strength testing was carried out at selected locations (61 no.) across the Proposed Wind Farm site to provide representative coverage of indicative peat strengths;
- Gouge core sample points were undertaken by HES (September 2024) at the proposed infrastructure locations (proposed turbines and proposed onsite 38kV substation) to investigate peat and underlying mineral soil lithology;
- HES also completed a visual assessment of exposed soils, subsoil and bedrock and topographic changes at the Proposed Wind Farm site in September 2024;
- HES completed a visual assessment of exposed soils and subsoils along the Proposed Grid Connection in April 2025;
- IDL completed 12 no. trial pit excavations at the Proposed Wind Farm site from 7th to 10th October 2024. These geotechnical investigations included laboratory testing of recovered soil samples;

- FT completed site walkover inspections as part of the assessment of potential for peat failure, and a stability analysis of 202 no. locations across the Proposed Wind Farm site; and,
- All mineral subsoils and peat were logged according to BS: 5930 and Von Post Scale respectively.

The above site investigations were also used to inform the Geotechnical and Peat Stability Risk Assessment Report (GPSRA, FT, 2025) and the Peat and Spoil Management Plan (PSMP, FT, 2025) which are included as Appendix 8-1 and Appendix 4-2 of this EIAR respectively.

8.2.3 Scoping and Consultation

The scope for this chapter of the EIAR has also been informed by consultation with statutory consultees, bodies with environmental responsibility and other interested parties. This consultation process is outlined in Section 2.7 of this EIAR.

The Geological Survey of Ireland (GSI) and the Office of Public Works (OPW) were the only consultees to respond with respect to Land, Soils and Geological. The GSI provided a standard response which recommended the use of their publicly available geological data sets in the preparation of the EIAR. These data sets, available to view at www.gsi.ie, have been used in the preparation of this chapter as detailed in Section 8.2.1. The OPW's Western drainage Maintenance Division raised several hydrological issues which are addressed on Chapter 9: Water but also referenced the potential for landslides in their submission. Peat stability and geohazards are addressed in Section 8.3.10.

Matters raised by Consultees in their responses with respect to the land, soils and geological environment are summarised in Table 8-1 below.

Table 8-1 Summary of Land, Soils and Geology Related Scoping Responses

Consultee	Matters Raised - Description	Addressed in Sections
Geological Survey of Ireland (Oct, 2024)	*"Recommend using our various data sets when conducting the EIAR".*	Refer to Section 8.2.1
OPW (Oct, 2024)	*"matter referred to above principally relate to the Hydrology Section, and the Risk of Flooding on a development such as this can impact Landscape (e.g. landslides that have been reported in recent years)....."*	Refer to Section 8.3.10.

8.2.4 Impact Assessment Methodology

Using information from the desk study and data from the site investigations, an assessment of the importance of the land, soil and geological environment within the Site is assessed using the criteria set out in Table 8-2 (NRA, 2008).

Table 8-2 Estimation of Importance of Soil and Geology Criteria (NRA, 2008)

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	Geological feature rare on a regional or national scale (NHA). Large existing quarry or pit. Proven economically extractable mineral resource

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

EPA, 2022 states that there are 7 no. steps in the preparation of the EIAR. The initial steps relate to screening, scoping, the consideration of alternatives and the description of the project. Step 5 relates to the description of the baseline environment which is presented in Section 8.3 for the land, soils and geological environment. Step 6 relates to the assessment of impacts and is presented in Section 8.6. The guideline criteria for the assessment of effects states that the purpose of an EIAR is to identify, describe and present an assessment of the likely significant effects. The likely effects are described with respect to their quality (positive, neutral or negative), significance (imperceptible to profound), extent (i.e. size of area or number of sites effected), context (is the effect unique or being increasingly experienced), probability (likely or unlikely), duration (momentary to permanent), frequency and reversibility. The descriptors used in this chapter are those set out in the EPA, 2022 glossary of effects as shown in Chapter 1: Introudction of this EIAR. In addition, the two impact characteristics, proximity and probability are described for each impact and these are defined in Table 8-3.

Table 8-3: Additional Impact Characteristics.

Impact Characteristic	Degree/ Nature	Description
Proximity	Direct	An impact which occurs within the area of the proposed project, as a direct result of the proposed project.
	Indirect	An impact which is caused by the interaction of effects, or by off-site developments.
Probability	Unlikely	A low likelihood of occurrence of the impact.
	Likely	A medium likelihood of occurrence of the impact.

In order to provide an understanding of this descriptive system in terms of the geological/hydrological environment, elements of this system of description of effects are related to examples of potential likely significant effects on the geology and morphology of the existing environment, as listed in Table 8-4.

Table 8-4: Impact descriptors related to the receiving environment

Impact Characteristics		Potential Hydrological Impacts
Quality	Significance	
Negative only	Profound	Widespread permanent impact on: › The extent or morphology of a cSAC. › Regionally important aquifers. › Extents of floodplains. Mitigation measures are unlikely to remove such impacts.
Positive or Negative	Significant	Local or widespread time-dependent impacts on: › The extent or morphology of a cSAC / ecologically important area. › A regionally important hydrogeological feature (or widespread effects to minor hydrogeological features). › Extent of floodplains. Widespread permanent impacts on the extent or morphology of an NHA/ecologically important area. Mitigation measures (to design) will reduce but not completely remove the impact – residual impacts will occur.
Positive or Negative	Moderate	Local time-dependent impacts on: › The extent or morphology of a cSAC / NHA / ecologically important area. › A minor hydrogeological feature. › Extent of floodplains. Mitigation measures can mitigate the impact OR residual impacts occur, but these are consistent with existing or emerging trends

Impact Characteristics		Potential Hydrological Impacts
Quality	Significance	
Positive, Negative or Neutral	Slight	Local perceptible time-dependent impacts not requiring mitigation.
Neutral	Imperceptible	No impacts, or impacts which are beneath levels of perception, within normal bounds of variation, or within the bounds of measurement or forecasting error.

8.2.5 Limitations and Difficulties Encountered

No limitations or difficulties were encountered during the preparation of the Land, Soils and Geology Chapter of this EIAR. The site investigations and follow up monitoring carried out were thorough and exhaustive.

8.2.6 Study Area

The study area for the land, soils and geological environment is limited to within the EIAR Site Boundary (i.e. the Site). There is no potential for the Proposed Project to effect the land, soils and geological environment outside of the Site.

8.3 Existing Environment

8.3.1 Proposed Project Site Description and Topography

8.3.1.1 Proposed Wind Farm site

The Proposed Wind Farm site is located within a rural, agricultural setting in eastern Galway, approximately 9.7km east of Athenry, Co. Galway and 13km north of Loughrea, Co. Galway. The village of Attymon, Co. Galway is located approximately 1km northwest of the nearest proposed turbine (T01) and the village of New Inn is located approximately 4.6km southeast of the nearest proposed turbine (T07). The L3115 Local Road runs in north-south orientation along the western boundary of the Proposed Wind Farm site and in an east-west orientation along the northern boundary of the Site. Proposed access is via a new proposed site entrance off the L3115 local road. The Site is also served by a number of existing agricultural roads and tracks. The proposed onsite 38kV substation is located in rough agricultural land and will be accessed via the Proposed Wind Farm site access roads.

Current land-use on the Proposed Wind Farm site is predominantly comprised of peat cutting activities, commercial forestry, and pastoral agriculture land. The agricultural lands are located in the east and west of the Proposed Wind Farm site. Several natural watercourses also flow through the site including the Raford River in the east and the Killimor River in the west.

Topography at the Proposed Wind Farm site is relatively flat to gently undulating with gentle to moderate slopes. This topography is typical of a low-lying raised bog setting with local hills. Ground elevations at the Proposed Wind Farm site range from ~65mOD (metres above Ordnance Datum) to ~80mOD. The overall slope of the land is to the south/west. In places, the natural topography has been modified through previous peat extraction activities and associated drainage.

8.3.1.2 Proposed Grid Connection

The Proposed Grid Connection includes for 38kV underground cabling from the proposed onsite 38kV substation, in the townland of Attimonmore South, Co. Galway to the existing Cashla 220kV substation in the townland of Barrettspark, Co. Galway. The Proposed Grid Connection is located primarily within the public road corridor, with three sections (approximately 0.2km, 0.6km and 1.5km) being located within private land. The total length of the Proposed Grid Connection underground cabling route is ~21.8km. A full description of the Proposed Grid Connection underground cabling route is provided in Chapter 4 Section 4.3.2.

Topography along the Proposed Grid Connection is variable with the surrounding landscape comprising of undulating hills. Topography ranges from ~80mOD near Attymon to ~30mOD near the existing Cashla 220kV substation.

8.3.2 Land and Landuse

8.3.2.1 Proposed Wind Farm site

Based on Corine (2018) land cover mapping (www.epa.ie) the Proposed Wind Farm site comprises predominantly of cutover “peat bogs” with some areas of “agricultural pastures” in the west and north. Corine also map “heterogeneous agricultural areas” to the southeast of the Proposed Wind Farm site. Historic Corine land cover maps do not record any significant changes to land at the Proposed Wind Farm site.

Land cover at the Proposed Wind Farm site has been verified during site walkover surveys completed by HES, from the inspection of recent aerial imagery and from habitat mapping completed by ecologists as part of the baseline characterisation for Chapter 6: Biodiversity.

The majority of the Proposed Wind Farm infrastructure is located in areas of peat bogs. Some of these areas show evidence of turbary peat cutting whilst some areas are comprised of rough pasture. 2 no. proposed turbines (T4 and T5) are located in areas of mature coniferous forestry towards the east of the Proposed Wind Farm site. 2 no. proposed turbines (T6 and T7) in the east of the Proposed Wind Farm site are located in areas of good agricultural land.

The proposed onsite 38kV substation and associated compound are located in an area mapped by Corine as “peat bogs”. During the site walkover surveys completed by HES this area was noted to comprise of rough agricultural pasture.

8.3.2.2 Proposed Grid Connection

The Proposed Grid Connection is predominantly in the carriageway of the existing public road network with the exception of with three sections (approximately 0.2km, 0.6km and 1.5km) being located within private land. Please see Section 4.3.2.1 of Chapter 4 for details on the Proposed Grid Connection underground cabling route from the proposed onsite 38kV substation to the existing Cashla 220kV substation.

According to Corine (2018) land cover mapping (www.epa.ie), the majority of the lands surrounding the Proposed Grid Connection are comprised of agricultural lands. Land use along the Proposed Grid Connection was verified during walkover surveys completed by HES.

8.3.3 Soils and Subsoils

8.3.3.1 Proposed Wind Farm site

8.3.3.1.1 *Desk Study*

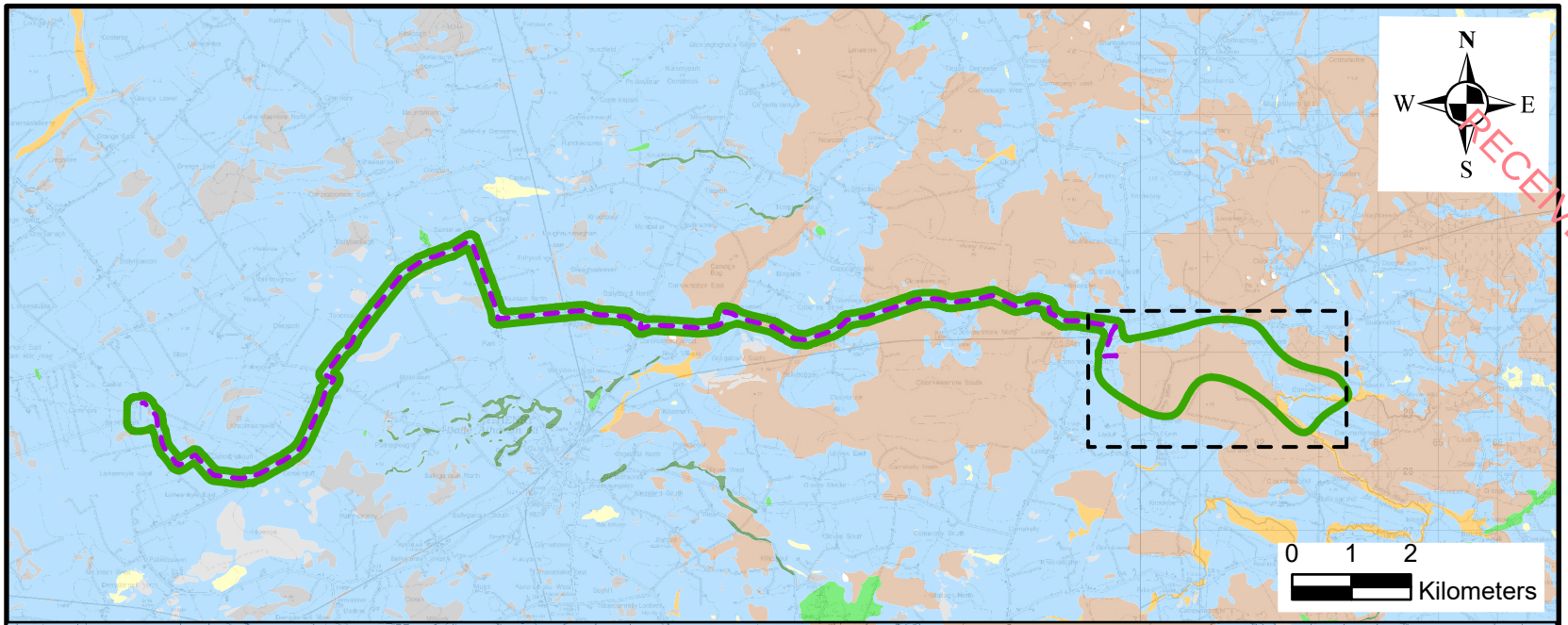
The published Teagasc soils map (www.gsi.ie) shows that the Proposed Wind Farm site is overlain by a range of soil types. Cutaway/cutover peat is mapped across much of the centre of the Proposed Wind Farm site. Some area of mainly basic poorly drained mineral soils (BminPD) and basic deep well drained mineral soils (BminDW) are mapped in the east of the proposed Wind Farm site. Further west the mapped soils also include basic, peaty, poorly drained mineral soils (BminPDPT) and basic poorly drained mineral soils (BminPD). Alluvial soils are also mapped in the southeast of the Proposed Wind Farm site along the Raford River.

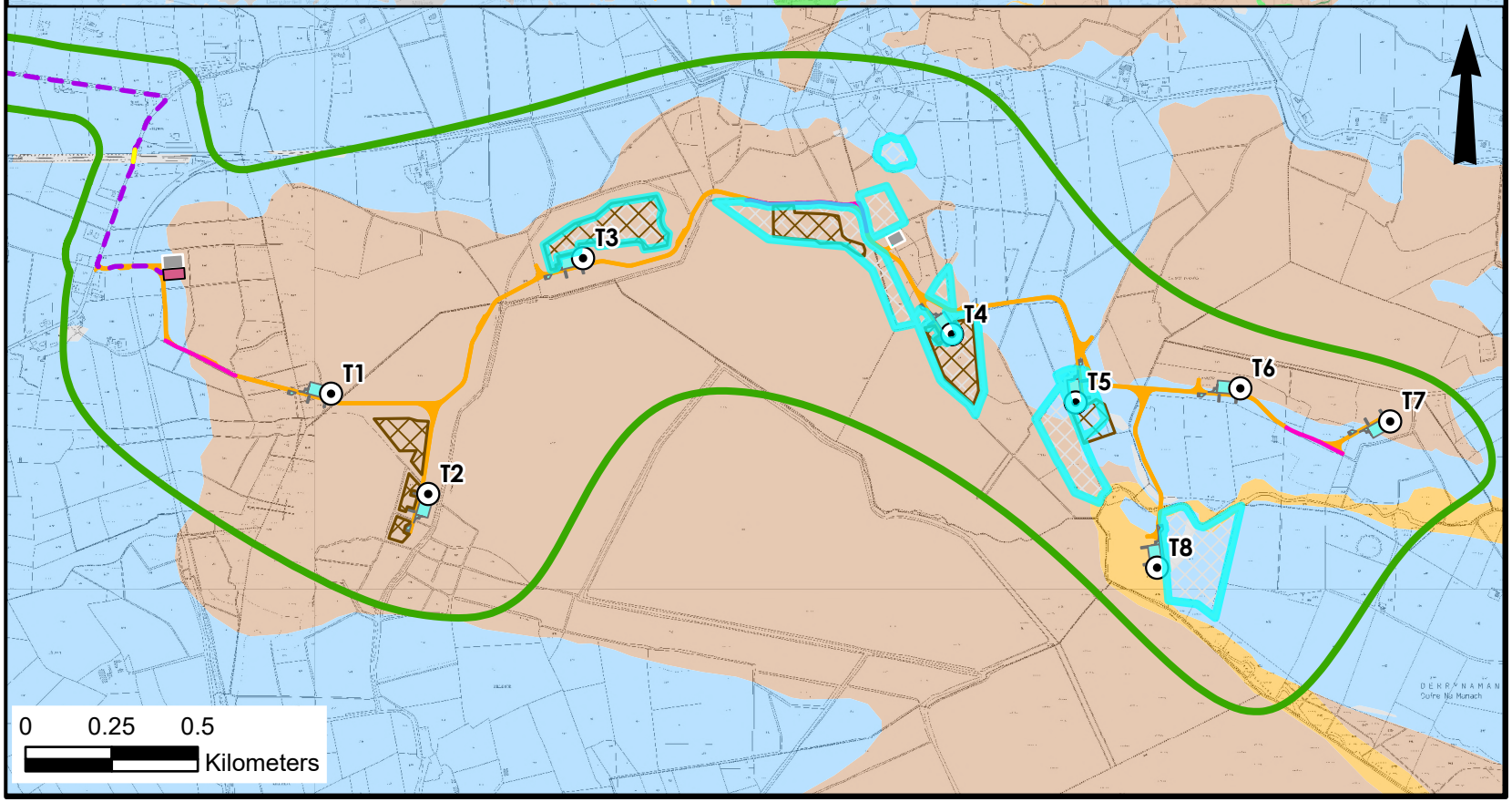
In terms of the Proposed Wind Farm infrastructure, a total of 6 no. turbines (T1, T2, T3, T4, T6 and T7), the eastern construction compound and met mast, are mapped on cutover peat soils. T5 is mapped on peaty poorly drained mineral soils and T8 is mapped in alluvial soils in the vicinity of the Raford River. Further to the west, the proposed onsite 38kV substation and the associated construction compound are mapped on basic deep well drained mineral soils.

The published GSI subsoils map (www.gsi.ie) shows that the Proposed Wind Farm site is underlain predominantly by cutover/cutaway peat. Areas in the north, east and west are mapped to be underlain by Till derived from limestones (TLs) whilst alluvium subsoils are mapped along the Raford River.

In terms of the Proposed Wind Farm infrastructure, a total of 6 no. turbines (T1, T2, T3, T4, T6 and T7), the eastern construction compound and met mast, are mapped on peat subsoils. T5 and the proposed onsite 38kV substation and the associated construction compound are mapped to be underlain by limestone derived tills. Alluvium is mapped in the area of T8.

A subsoil geology map for the Proposed Wind Farm site is included as Figure 8-1 below.





Legend

- EIAR Site Boundary
- Proposed Turbine Layout
- Proposed Hardstands
- Proposed New Roads
- Proposed Upgrades to Existing Roads
- Proposed Met Mast
- Proposed Temporary Construction Compounds
- Proposed Onsite 38kV Substation
- Proposed Grid Connection
- Proposed Grid Connection HDD Location
- Proposed Peat and Spoil Management Areas
- Proposed Enhancement and Replanting

Subsoils

- A, Alluvium
- BasEsk, Eskers comprised of gravels of basic reaction
- Cut, Cut over raised peat
- GLs, Gravels derived from Limestones
- KaRck, Kartsified bedrock outcrop or subcrop
- L, Lacustrine sediments
- Rck, Bedrock outcrop or subcrop
- TLs, Till derived from limestones

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Client: Gannow Ltd.

Job: Gannow Renewable Energy Development, Co. Galway

Title: Local Subsoils Map

Figure No: 8-1

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Date: 20/09/2025	Checked By: MG

8.3.3.1.2 Site Investigations

The soils and subsoils present at the Proposed Wind Farm site have been confirmed by site investigations comprising of peat probes, shear vane testing, gouge cores and trial pits.

A total of 498 no. peat probes have been completed at the Site by FT, HES and MKO. The combined pet probe dataset shows that peat depths across the Proposed Wind Farm site (463 no. probes) range from 0.1 to 7.2m with an average peat depth of 1.1m. 76% and 95% of the peat probes encountered peat depths less than 2m and 3m respectively. A number of localised readings recorded peat depths from 3.0 to 7.2m. The Proposed Wind Farm has been designed to avoid these areas of deep peat where possible. A peat depth distribution plot is shown as Figure 8-2 below.

FT also recorded peat strengths across the Proposed Wind Farm site using a hand shear vane with the undrained shear strengths ranging from 6 to 70kPA across the site, with an average of about 39kPA. The higher strengths recorded are typical of well drained peat as is present on the Proposed Wind Farm site. The lowest peat strength was recorded in an area of deep peat (7.2m) and is not considered to be representative of the peat strength across the entire Proposed Wind Farm site. The recorded undrained shear strength at the Proposed Wind Farm site is significantly greater than the shear strength at sites of known failures such as Derrybrien (2.5kPa).

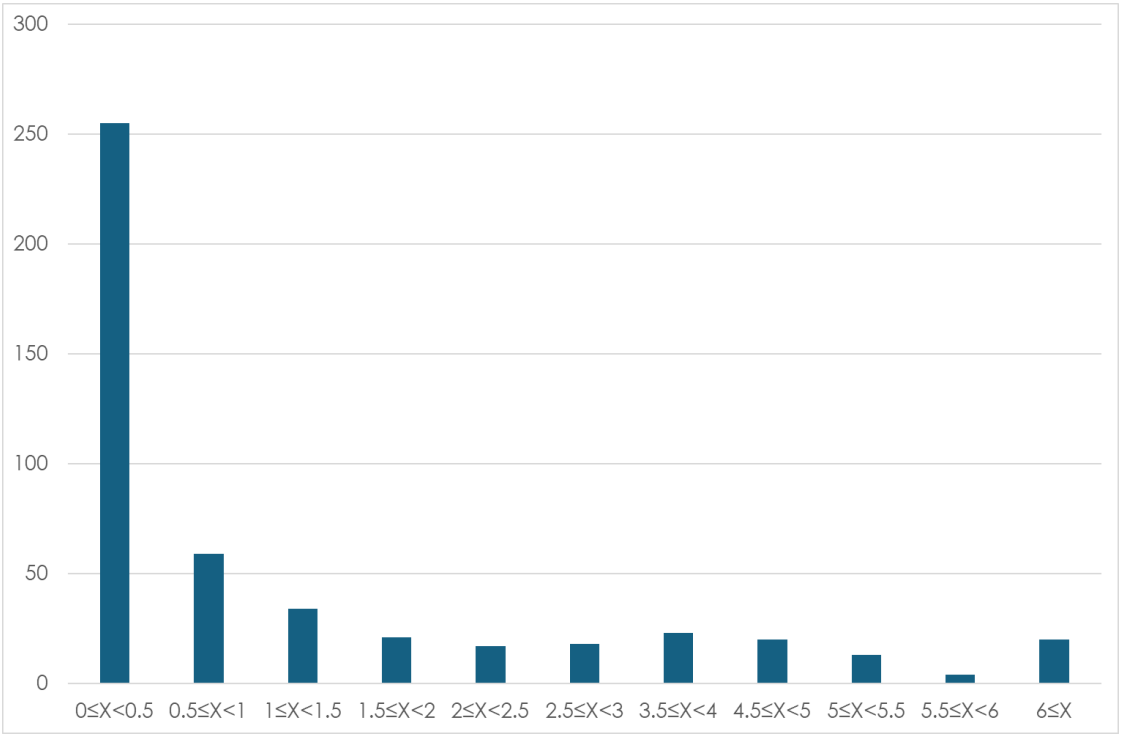


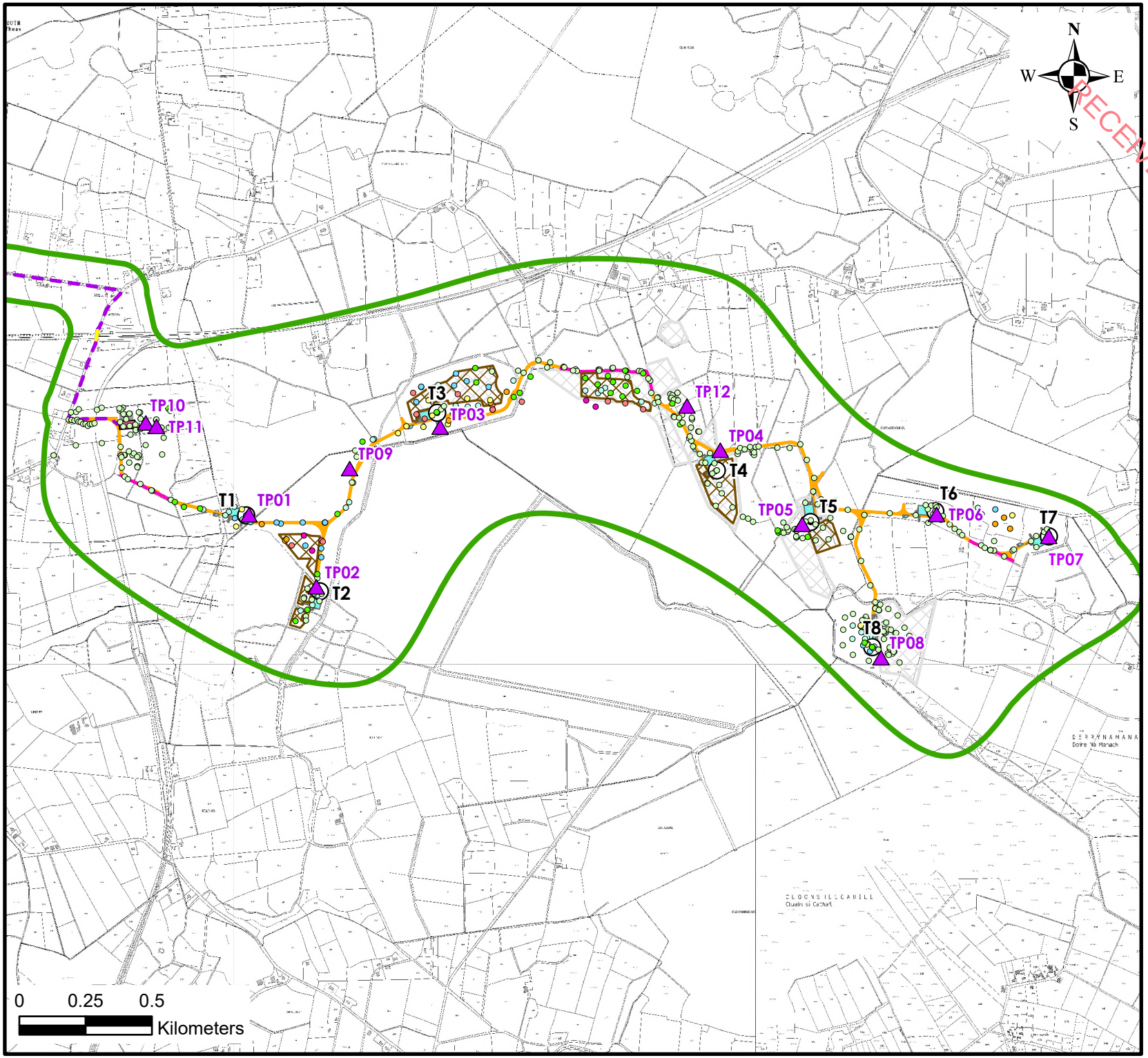
Figure 8-2: Peat Distrubution Plot (MKO, HES and FT peat probe dataset)

The data from the peat probing investigations at the Proposed Wind Farm infrastructure locations are summarised in Table 8-5. Based on the HES gouge cores, peat is present at 4 no. proposed turbine locations (T1, T2, T3, and T8). Where present, the peat was noted to range in thickness from 0.85m at T3 to 2.35m at T8. A thin layer of peaty/organic topsoil was recorded at T5 and T7. No peat was recorded at T4 or T6. The subsoils encountered beneath the peat were described as shell marl and lacustrine clay or glacial till.

Table 8-5: Site Investigation Data

Proposed Project Infrastructure Location	Peat Depth Range (m)	Average Peat Depth (m)	Soil/Subsoil Lithology
T01	2.4 – 4.0	3.4	1.25m of shell MARL over grey lacustrine CLAY
T02	2.6 – 3.5	3.0	1m shell MARL over 1.2m grey lacustrine CLAY over hard base
T03	1.4 – 6.7	1.8	Brown sandy SILT with pebbles and cobbles
T04	0.1 – 0.3	0.2	Brown SILT/CLAY mineral soil
T05	0.1 – 0.6	0.3	Brown SILT/CLAY mineral soil
T06	0	0	Brown SILT/CLAY mineral soil
T07	0.2 – 0.4	0.3	Brown SILT/CLAY mineral soil
T08	0.3 - 3.0	0.8	0.4m shell MARL over 0.05m sandy CLAY over lacustrine CLAY
Substation Compound	0.2 – 0.5	0.3	Hard base – likely cobble in GLACIAL Till deposits
Construction Compound 1	0.4 – 0.8	0.5	Grey/brown sandy SILT
Construction Compound 2	0.3 – 0.4	0.3	Brown SILT/CLAY mineral soil
Met Mast	0.3 – 0.4	0.3	Hard base – likely glacial till

IDL completed site investigations at the Proposed Wind Farm site between the 7th and 10th October 2024 under the supervision of FT, comprising of the excavation of 12 no. trial pits and the laboratory testing of the recovered soil samples. The IDL site investigation results are presented in full in Appendix D of the GPSRA which has been prepared by FT (Appendix 8-1). Trial pits were excavated at all proposed turbine locations, the trial pit at T08 was located ~20m northeast of the proposed turbine location due to access restrictions. Refer to Figure 8-3 below for trial pit locations.



Legend

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- Proposed Grid Connection HDD Location
- Proposed Enhancement and Replanting
- Proposed Peat and Spoil Management Areas
- Trial Pit Locations_IDL

Peat Depths

0.00 - 1.00m	2.01 - 3.00m	5.01 - 6.00m
1.01 - 2.00m	3.01 - 4.00m	6.01 - 7.00m
	4.01 - 5.00m	7.01 - 8.00m

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Client: Gannow Ltd.

Job: Gannow Renewable Energy Development, Co. Galway

Title: Site Investigation Map

Figure No: 8-3

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The IDL trial pits were excavated to depths ranging from 1.5mbgl (metres below ground level) to 4.2mbgl. Based on the site-specific data obtained from the trial pit investigations, the ground conditions at the Proposed Wind Farm site can be summarised as follows:

- TOPSOIL was encountered in 11 no. trial pits, typically ranging in thickness between 0.1 and 0.3m. The TOPSOIL was described as firm dark fibrous PEAT or brown peaty CLAY.
- MADE GROUND was encountered at the surface of T02 and was described as peaty SILT/CLAY.
- The topsoil was found to be underlain by PEAT in 6 no. trial pits. The peat depths range from 0.3m to 4.2m. The deepest peat was encountered at TP03.
- The subsoils underlying the peat were described in the IDL logs as peaty SILT with shell fragments (this corresponds with the shell MARL encountered in the HES site investigations). TP01 and TP02 encountered MARL.
- Where peat was not present, the subsoils are described as sandy or gravelly SILT and CLAY with cobbles of limestone.

Particle Size Distribution (PSD) analysis was completed in 5 no. samples recovered from the excavated trial pits. These analysed samples were described in the IDL logs as largely gravelly sandy SILT (TP03 and TP06). The subsoils logged at TP02 were described as soft creamy white slightly gravelly sandy organic silt with many shell fragments. This description corresponds with the sub-peat marl encountered during the peat probing investigations (refer to Table 8-5 above). The samples recovered from TP08 and TP11 were described as silty sandy GRAVEL and silty gravelly CLAY respectively. The results of the PSD analysis are shown on Figure 8-4. Based on the PSD analysis, percentage of silt in these subsoils ranges from 16% in the sample recovered from TP08 to 41% in the sample obtained from TP03. The gravel components ranged from 1% at TP03 to 49% at TP08. The percentage of SAND ranged from 26 to 51%.

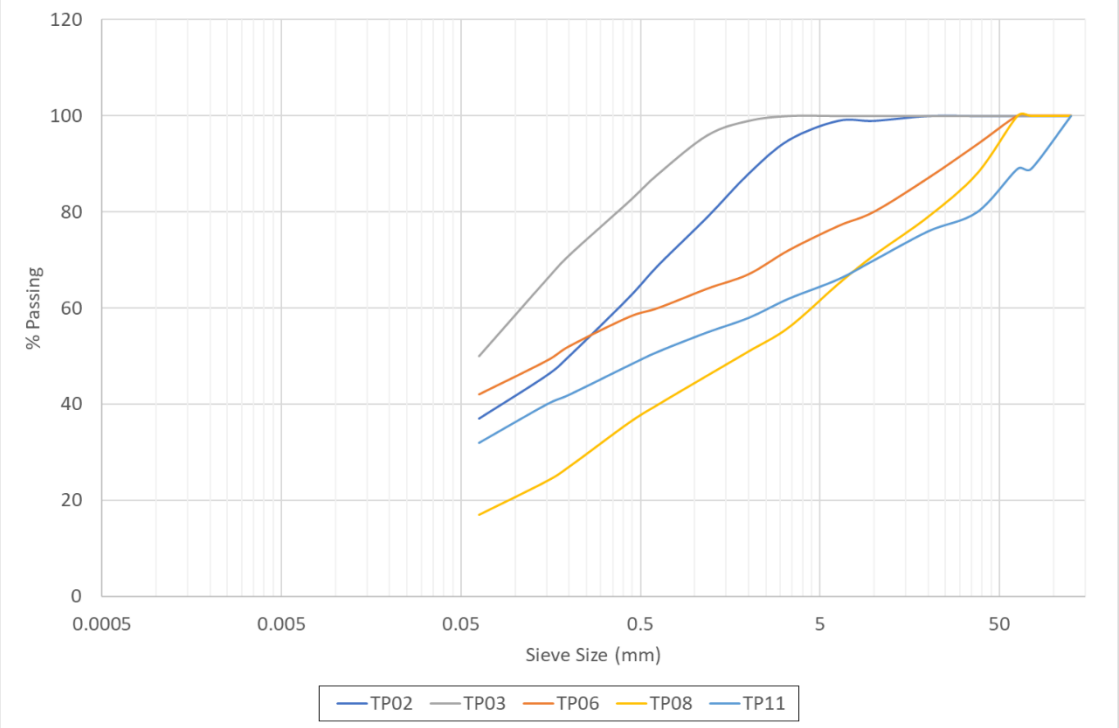


Figure 8-4: PSD Analysis of Subsoils

8.3.3.2 Proposed Grid Connection

8.3.3.2.1 *Desk study*

The vast majority of the Proposed Grid Connection (~19.3km) is mapped to be overlain by basic deep well drained mineral soils. The Teagasc soils map shows an area of peat soils and peaty poorly drained mineral soils along the Proposed Grid Connection in the townlands of Cloonkeenmore and Cloonkeenbeg to the west of Attymon.

Similarly, the GSI's published subsoils map shows that the Proposed Grid Connection is predominantly underlain by till derived from limestones (TLs). Some small pockets of karstified bedrock outcrop or subcrop are mapped in the lands surrounding the western section of the Proposed Grid Connection. Some small areas of cutover raised peat are mapped along the route in the townlands of Cloonkeenmore and Cloonkeenbeg to the west of Attymon.

Subsoils mapped along the Proposed Grid Connection are shown in Figure 8-1.

8.3.3.2.2 *Site Investigations*

The soils and subsoils along the Proposed Grid Connection were verified by HES during visual assessment of exposed soils and subsoils completed during walkover surveys of the route. The soils and subsoils encountered along the Proposed Grid Connection corresponded with the GSI mapped soils/subsoils.

FT and MKO also completed a total of 35 no. peat probes at targeted locations along the Proposed Grid Connection. These probes were completed in all areas of private accessible land and in areas of mapped by the GSI as being underlain by peat. Where present the peat was noted to be limited in extent and shallow with all probes recoding peat depths <0.3m.

8.3.4 Bedrock Geology

8.3.4.1 Proposed Wind Farm site

The entirety of the Proposed Wind Farm site is underlain by the Lucan Formation (www.gsi.ie). The Lucan Formation is noted to be comprised of dark limestone and shale.

The GSI do not map the presence of any mapped faults or structural features in the vicinity of the Proposed Wind Farm site. The closest mapped fault is a northeast to southwest orientated fault which is located ~2km to the north of the Proposed Wind Farm site. Due to the age of the faulting and the distance from the Proposed Wind Farm site, this fault is not considered to be of any significance with respect to the Proposed Wind Farm site.

The GSI map some small areas of bedrock outcrop within the Proposed Wind Farm site. The bedrock geology is poorly exposed within the Proposed Wind Farm site. No bedrock was encountered at any of the trial pit investigations. The trial pits completed extended to a maximum depth of 4.2mbgl. The extent of the site investigations, and the depth of the trial pits, are considered to be appropriate due to the geological setting of the Proposed Wind Farm and the predictability of the geological profile encountered across the Proposed Wind Farm site. Given the geological profile across much of the Proposed Wind Farm site (peat underlain by silt and/or clay) piled foundations have been proposed for 5 no. turbines (T01, T02, T03, T07 and T08). Meanwhile T04, T05 and T06 may be constructed with gravity or piled foundations depending on confirmatory site investigations. Furthermore, the assessment presented in the EIAR considers a precautionary approach by assessing both gravity and piled foundations.

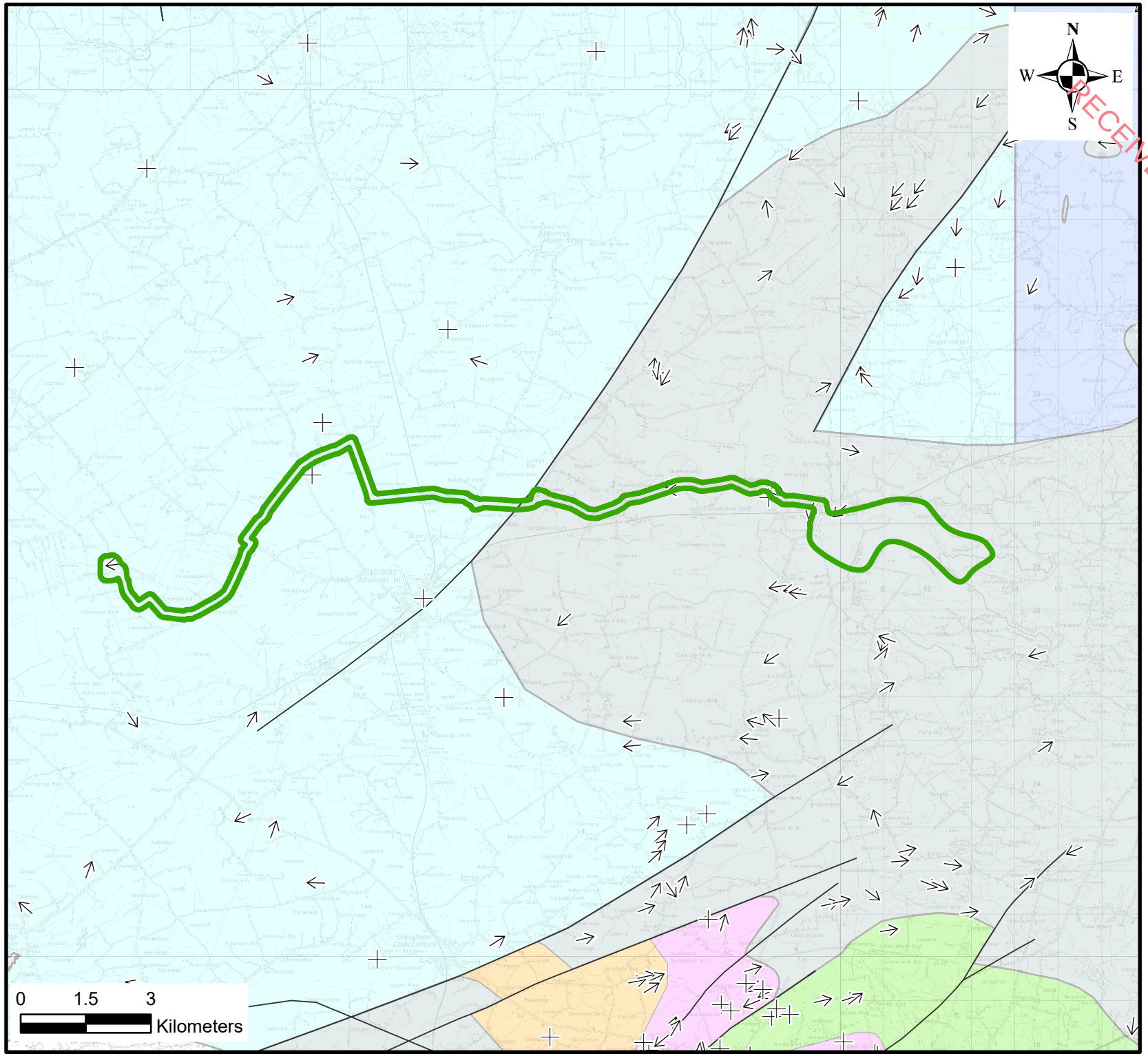
A bedrock geology map is shown as Figure 8-5 below.

8.3.4.2 Proposed Grid Connection

The eastern section of the Proposed Grid Connection is mapped to be underlain by the Lucan Formation as described above. The western section is mapped to be underlain by the Burren Formation. The Burren Formation is noted to be comprised of pale grey clean skeletal limestones.

A large northeast to southwest orientated fault, referred to as the Athenry Fault is mapped to underlie the Proposed Grid Connection. This fault juxtaposes the Burren and Lucan Formations together in this area. This is a Variscan fault, dating from ~290 to 370 million years ago and is not considered to be of any significance for the Proposed Grid Connection.

The GSI map several areas of bedrock outcrop in the lands surrounding the Proposed Grid Connection. The areas of mapped bedrock are more frequent in the western section and in the area underlain by the Burren Formation.



Legend

- EIAR Site Boundary

Bedrock Polygons

- Burren Formation
- Ballysteen Formation
- Waulsortian Limestones
- Lucan Formation
- Visean Limestones (undifferentiated
- Tubber Formation
- Geological Linework

Structural Symbols

- Dip of bedding or main foliation, old GSI data
- Horizontal Bedding
- Strike and dip of bedding, right way up

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Client: Gannow Ltd.	
Job: Gannow Renewable Energy Development, Co. Galway	
Title: Local Bedrock Geology Map	
Figure No: 8-5	
Drawing No: P1706-0-0925-A4-805-00A	
Sheet Size: A4	Project No: P1706-0
Scale: 1:120,000	Drawn By: GA
Date: 19/09/2025	Checked By: MG

8.3.5 Karst Features

8.3.5.1 Proposed Wind Farm site

According to the GSI Groundwater Resources mapping (www.gsi.ie) the bedrock underlying the Proposed Wind Farm site is a Locally Important Aquifer that is Moderately Productive in Local Zones. The bedrock is not identified as being a karst aquifer.

Furthermore, the GSI karst features database (www.gsi.ie) does not record the presence of any karst features within the Proposed Wind Farm site. The closest mapped karst features are a turlough and 2 no. swallow holes mapped ~2.5km southwest of T2.

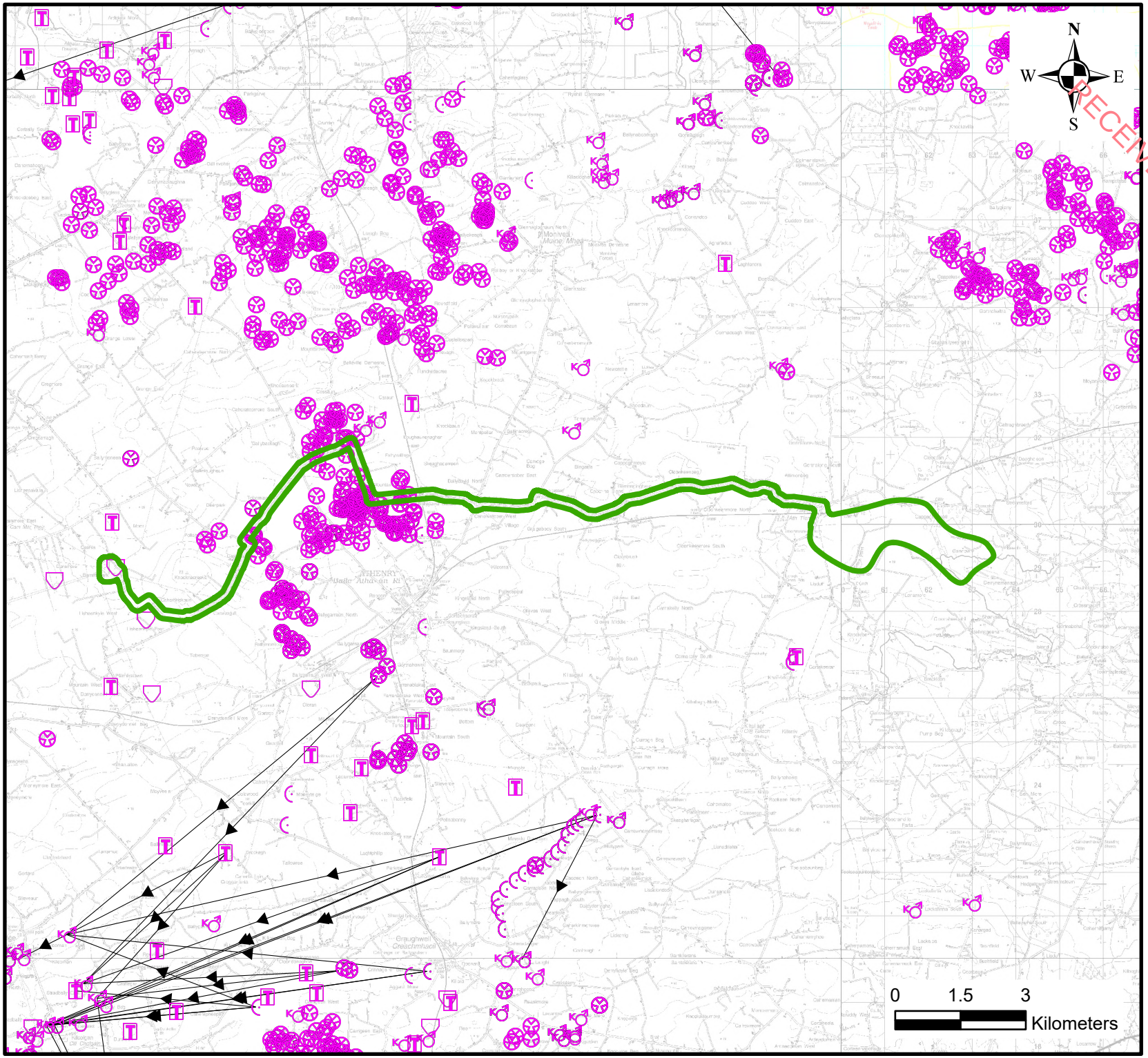
No karst features were recorded during the walkover surveys of the Proposed Wind Farm site or during the intrusive site investigations.

8.3.5.2 Proposed Grid Connection

The GSI karst features database (www.gsi.ie) does not record the presence of any karst features in the eastern section of the Proposed Grid Connection which is underlain by the Lucan Formation. Numerous karst features are mapped in the western section of the Proposed Grid Connection which is underlain by the Burren Formation. The Burren Formation is described by the GSI as a Regionally Important Karst Aquifer.

The GSI map a high density of enclosed depressions in the vicinity of the Proposed Grid Connection along the R347 and the adjacent sections of local roads to the east and west. Further, to the southwest several enclosed depressions are also mapped in the townland of Castlelambert. Also, a cave is mapped near the existing Cashla 220kV substation in the townland of Barrettspark.

A map of local karst features is shown as Figure 8-6 below.



Legend

- EIAR Site Boundary

Karst Features

- Cave
- Enclosed Depression
- Spring
- Swallow Hole
- Turlough
- Tracer Lines

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Client: Gannow Ltd.	
Job: Gannow Renewable Energy Development, Co. Galway	
Title: GSI Karst Features Map	
Figure No: 8-6	
Drawing No: P1706-0-0925-A4-806-00A	
Sheet Size: A4	Project No: P1706-0
Scale: 1:120,000	Drawn By: GA
Date: 19/09/2025	Checked By: MG

8.3.6 Geological Resource Importance

8.3.6.1 Proposed Wind Farm site

The GSI Online Database, accessed via the Public Data Viewer (www.gsi.ie) does not record the presence of any active quarries or pits within the Proposed Wind Farm site or in the surrounding lands. The closest GSI mapped bedrock quarry to the Proposed Wind Farm site is Esker Ready Mix Quarry, located ~8.5km to the southwest. The closest mapped active sand and gravel pit is located ~3.5km to the southeast at Cloonyconaun.

There are also no mapped historic quarries or sand and gravel pits within the Proposed Wind Farm site.

The GSI do not record the presence of any mineral localities in the Proposed Wind Farm site or in the surrounding lands. The closest mapped mineral locality is ~2.5km to the west where the GSI map the presence of shelly marl in Attymon Bog in the townland of Cloonkeenmore South.

The GSI online Aggregate Potential Mapping Database (www.gsi.ie) shows that the crushed rock aggregate potential of the Proposed Wind Farm site ranges from Very Low to Moderate. The vast majority of the Proposed Wind Farm site is noted to have very low potential for a bedrock quarry. The bedrock at the Proposed Wind Farm site has not been extracted to date due to the presence of the overlying peat and glacial till subsoils.

Furthermore, the majority of the Proposed Wind Farm site is not located within an area mapped for granular aggregate potential (i.e., potential for gravel reserves). Areas of Low and Moderate potential are mapped along the channel of the Raford River in the west of the Proposed Wind Farm site. The soils and subsoils at the Proposed Wind Farm site can be considered to be of "Low" importance given the fact that soils are not designated in this area and are degraded in places due to the forestry plantations and previous peat cutting activities and associated drainage.

8.3.6.2 Proposed Grid Connection

Coshla Quarry is an active quarry located to the southwest of the Cashla 220kV substation. There are no other active quarries or sand and gravel pits mapped along the Proposed Grid Connection.

The GSI online Aggregate Potential Mapping Database (www.gsi.ie) shows that the crushed rock aggregate potential along the Proposed Grid Connection ranges from Very Low to Very High. The greatest potential is found in the western section of the Proposed Grid Connection.

No area of the Proposed Grid Connection is mapped in an area for granular aggregate potential.

8.3.7 Geological Heritage Sites

8.3.7.1 Proposed Wind Farm site

There are no recorded geological heritage sites within the Proposed Wind Farm site (www.gsi.ie).

The closest geological heritage site is the Rahally M6 Road Cut (Site Code: GY117) which is located ~4.6km to the southeast. This is a County Geological Site (CGS) and is described as a 500m long road cutting along the M6 motorway with both high and low cliffs of rock. The site is of geological importance as it is a well exposed representative section of Carboniferous limestone.

A map of local geological heritage sites is included as Figure 8-7.

8.3.7.2 Proposed Grid Connection

There are no recorded geological heritage sites along or in the vicinity of the Proposed Grid Connection. The only mapped geological heritage site within 5km of the Proposed Grid Connection is

the Caherateemore M17 Road Cut (Site Code: GY024) which is located ~1.56km to the north. This CGS is described as an 800m long road cutting along the M17 motorway with both high and low cliffs of rock with a well exposed representation of Carboniferous limestone.

8.3.8 Designated Sites

8.3.8.1 Proposed Wind Farm site

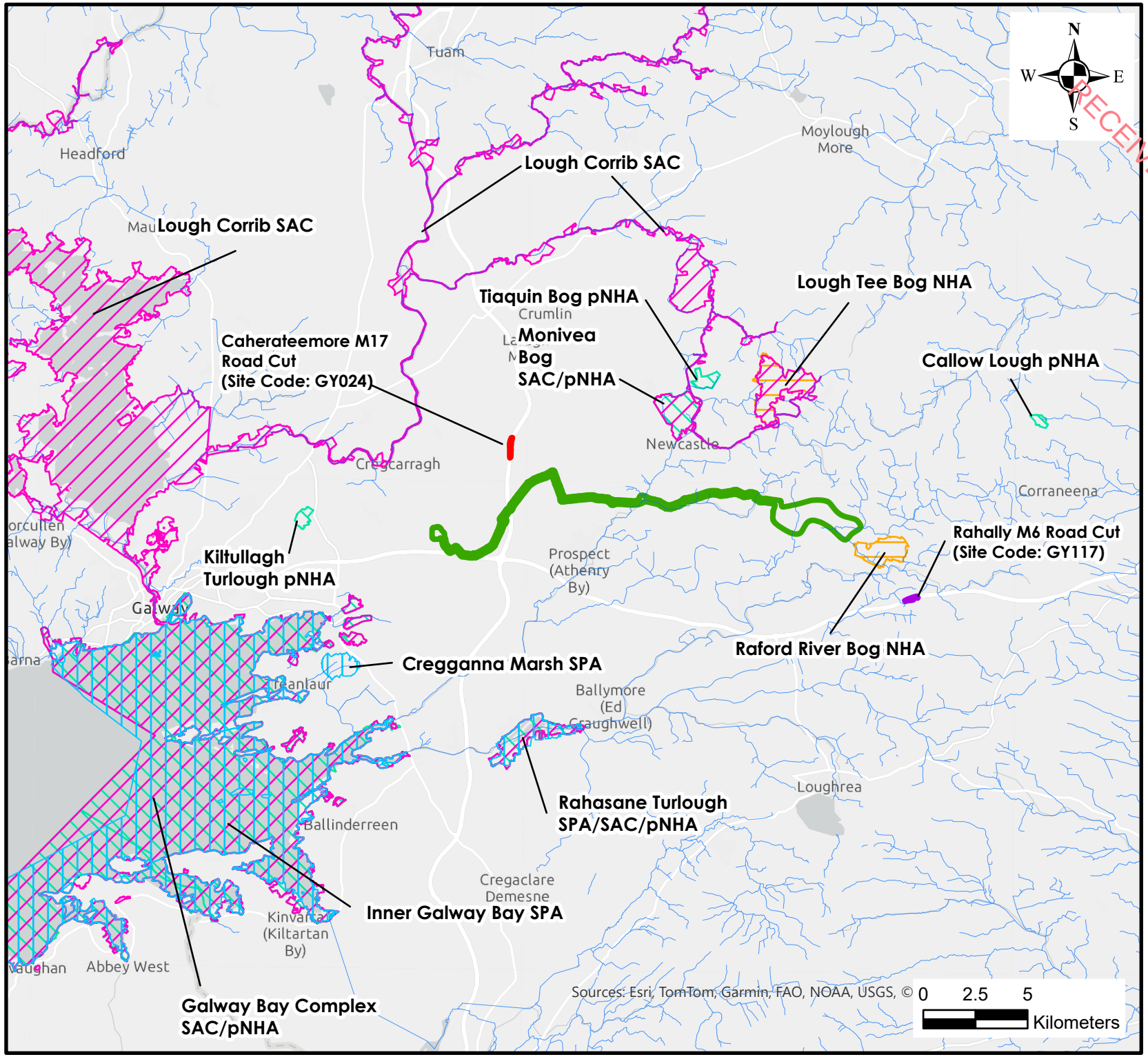
There are no designated sites mapped within or immediately adjacent to the Proposed Wind Farm site. The closest designated site is the Raford River Bog NHA (Site Code: 000321) which is located ~950m to the southeast of proposed turbine T08. This NHA is noted to comprise of a raised bog that includes both areas of high bog and cutover bog. This NHA is hydrologically connected with the Proposed Wind Farm site via the Raford River and this is assessed in Chapter 9.

Other designated sites within 10km of the Proposed Wind Farm site include:

- The Lough Corrib SAC (Site Code: 000297), located ~3.8km to the northwest;
- The Lough Tee Bog NHA (Site Code: 000307), located ~4.2km to the northwest;
- Monivea Bog pNHA (Site Code: 000311) located ~5/8km to the northwest; and,
- Tiaquin Bog pNHA, located ~6.5km to the northwest

8.3.8.2 Proposed Grid Connection

There are no designated sites along or in the immediate vicinity of the Proposed Grid Connection.



Legend

- EIAR Site Boundary
- SPA
- SAC
- pNHA
- NHA
- Watercourses

Geoheritage Heritage Sites

- Caherateemore M17 Road Cut
- Rahally M6 Road Cut

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Client: Gannow Ltd.	
Job: Gannow Renewable Energy Development, Co. Galway	
Title: Geological Heritage Sites and Designated Sites Map	
Figure No: 8-7	
Drawing No: P1706-0-0925-A4-807-00A	
Sheet Size: A4	Project No: P1706-0
Scale: 1:250,000	Drawn By: GA
Date: 19/09/2025	Checked By: MG

8.3.9 Soil Contamination

There are no known areas of soil contamination within the Proposed Wind Farm site or along the Proposed Grid Connection. During the site walkovers and site investigations, no areas of contamination concern were identified.

According to the EPA online mapping (www.epa.ie), there are no licensed waste facilities within or in the vicinity of the Proposed Wind Farm site or the Proposed Grid Connection. The closest mapped waste facility is a Greenstar Landfill Site located ~8km east of the Proposed Wind Farm site.

The GSI do not map the presence of any historic mines or quarries within the Site that could potentially have contaminated tailings.

8.3.10 Geohazards

The GSI Landslide database (www.gsi.ie) does not record any historic landslides in the vicinity of the Site or in the surrounding lands.

The GSI Landslide Susceptibility Map (www.gsi.ie) classifies the probability of a landslide occurring at a given location. The probability of a landslide occurring at the Proposed Project site is mapped as being Low. Refer to Section 8.3.11 below for the Peat Stability Risk Assessment.

8.3.11 Peat Stability Risk Assessment

8.3.11.1 Introduction

FT was engaged to undertake a geotechnical and peat stability of the Proposed Project site. A Geotechnical and Peat Stability Assessment Report (GPSRA) (FT, 2025) is attached in Appendix 8-1.

Hydrological, hydrogeological and ecological factors were also assessed in the GPSRA (FT, 2025), and interaction between FT, HES and MKO were undertaken throughout the iterative design process. The assessment was done in accordance with Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Developments (PLHRAG, Scottish Government, 2017) (hereafter referred to as PLHRAG Guidance).

The geotechnical and peat stability assessment relates to the risk of instability at the Proposed Wind Farm site. The Proposed Grid Connection and turbine delivery route are not examined in further detail as the GSI mapping and the peat probe survey indicate minimal to no presence (0.1 to 0.3m in localised areas only) of peat in these areas. As a result, the risk of peat failure along the Proposed Grid Connection is deemed to be negligible. Nevertheless, mitigation measures will be implemented for construction work in peatlands, including those along the Proposed Grid Connection, to ensure that all works adhere to an acceptable standard of safety. The subsequent sections (Section 8.3.11.2 to 8.3.11.5.2) relate solely to the Proposed Wind Farm site.

A constraints study was initially undertaken by the Environmental (MKO), Hydrological (HES) and Ecological (MKO) members of the project design team to determine the developable area at the Proposed Wind Farm site, prior to the site reconnaissance by geologists/geotechnical engineers from FT.

8.3.11.2 Hydrological Considerations

The hydrological factors with regard peat stability were assessed using a combination of desk study data, aerial photography (historical and contemporary), topographic lidar data flow path drainage

analysis, site walkovers, field drainage mapping and gouge coring. Detailed drainage maps were prepared along with hydrological constraints mapping for on-site drainage features and wet areas.

Many of the Pre-conditions as described by the PLHRAG Guidance are hydrological in nature and are listed in the guidance as follows:

- Impeded drainage caused by a peat layer overlying an impervious clay or mineral base (hydrological discontinuity, especially an iron pan at the base of the peat deposit);
- A convex slope or a slope with a break of slope at its head (concentration of subsurface flow);
- Proximity to local drainage, either from flushes, pipes or streams (supply of water); and,
- Connectivity between surface drainage and the peat/impervious interface (mechanism for generation of excess pore pressures).

Identifying the above pre-conditions at the Proposed Wind Farm site was a key part of the hydrological constraints assessment carried out in conjunction with project design team; please see Chapter 9 for further detail.

8.3.11.3 Peat Slides – Lessons Learned

The GPSRA (FT, 2025) has been undertaken taking into account peat failures that have occurred on peatland sites (such as recent failures at Shass Mountain 2020, Co. Leitrim and Meenbog 2020, Co. Donegal). The lessons learned from both peat slide events have been incorporated into the design of the Proposed Wind Farm and the construction methodologies to be implemented.

The peat present on the Proposed Wind Farm site is an area of raised bog which has been historically used for small-scale peat extraction. The site is flat in nature, and the areas where peat has been extracted have been drained to locally lower the water level within the peat. This has led to an increase in the strength of the in-situ peat when compared to undrained areas. Given the flat nature of the Proposed Wind Farm site and the higher strength of the peat, the site conditions at the Proposed Wind Farm site are not considered to be similar to Shass Mountain or Meenbog, nor is it considered likely that a similar failure could occur at Gannow.

8.3.11.4 Peat Stability – Desk Study

There are no recorded peat failures within the Proposed Wind Farm site recorded on the GSI database (www.gsi.ie). The nearest recorded peat failure is located approximately 30km south of proposed turbine T02. The failure recorded occurred within the Sonnagh Old Wind Farm, Co. Galway, on the edge of an internal site road. The slope failure in this area was a peat flow landslide, the mechanism is undefined

The GSI Landslide Susceptibility Map (www.gsi.ie) classifies the probability of a landslide occurring at the Proposed Wind Farm site as 'Low'. This is due to the sites lowland setting and relatively flat topography. Peat failures and landslides are more likely to occur in upland setting where there is sloping ground and high rainfall rates.

8.3.11.5 Geotechnical Peat Stability Risk Assessment

FT completed a peat stability analysis at all the main infrastructure locations across the Proposed Wind Farm site for both the undrained and drained conditions. The purpose of the analysis was to determine the Factor of Safety (FoS) of the peat slopes. The minimum required FoS is 1.3 based on BS6031:1981: Code of Practice for Earthworks (BSI, 2009). The assigned probability of instability associated with a given FoS value is described in Table 8-7.

Table 8-6: Probability Scale for Factor of Safety for Peat

Scale	Factor of Safety	Probability
1	1.30 or greater	Negligible/None
2	1.29 to 1.20	Unlikely
3	1.19 to 1.11	Likely
4	1.01 to 1.10	Probable
5	<1.0	Very Likely

8.3.11.5.1 Peat Stability Assessment Results

Stability of a peat slope is dependent on several factors working in combination. The main factors that influence peat stability are slope angle, shear strength of peat, depth of peat, pore water pressure and loading conditions.

An adverse combination of factors could potentially result in peat sliding. An adverse condition of one of the above-mentioned factors alone is unlikely to result in peat failure. The infinite slope model (Skempton and DeLory, 1957) is used to combine these factors to determine a factor of safety for peat sliding. This model is based on a translational slide, which is a reasonable representation of the dominant mode of movement for peat failures.

To assess the factor of safety for a peat slide, an undrained (short-term stability) and drained (long-term stability) analysis has been undertaken to determine the stability of the peat slopes on site.

- The undrained loading condition applies in the short-term during construction and until construction induced pore water pressures dissipate.
- The drained loading condition applies in the long-term. The condition examines the effect of in particular, the change in groundwater level as a result of rainfall on the existing stability of the natural peat slopes.

As mentioned above, the GPSRA (FT, 2025) is attached in **Appendix 8.1**.

Undrained Analysis

The results of the undrained analysis for the peat at the Proposed Wind Farm infrastructure locations are presented in Table 8-8. The analysis was done for 2 no. conditions: Condition 1 with no surcharge loading and Condition 2 with a surcharge of 10kPa, equivalent to 1m of stockpiled peat. As outlined above the undrained loading condition applies in the short-term during construction and until construction induced pore water pressures dissipate.

The calculated FoS for Condition 1 is in excess of 1.30 for all of the key infrastructure locations and across the 202 no. locations subject to the analysis. The calculated FoS for Condition 1 was found to range from 2.16 to 172.03 across the Proposed Wind Farm site, indicating a low risk of peat instability. The FoS at the proposed infrastructure locations (wind turbines, substation, met mast, construction compounds and peat and spoil management areas) ranged from 2.69 to 57.40.

The calculated FoS for Condition 2 is in excess of 1.30 for all key infrastructure locations and across the 202 no. locations subject to the analysis. The calculated FoS for Condition 2 was found to range from 1.72 to 28.65 across the Proposed Wind Farm site, indicating a low risk of peat instability. The FoS at the proposed infrastructure locations (wind turbines, substation, met mast, construction compounds and peat and spoil management areas) ranged from 2.05 to 13.23.

Table 8-7: Factor of Safety Results (undrained condition)

Turbine No.	Easting	Northing	Factor of Safety for Load Condition[1]	
			Condition (1)	Condition (2)
T01	560006	729599	2.69	2.05
T02	560288	729308	5.73	4.30
T03	560737	729992	11.47	6.88
T04	561808	729771	43.11	7.19
T05	562167	729573	43.11	7.19
T06	562645	729614	No peat recorded	
T07	563080	729518	21.56	6.16
T08	562403	729093	11.47	6.88
Substation	559550	729946	57.34	13.23
Construction Compound 1	559546	729981	28.70	8.20
Construction Compound 2	561644	730048	21.56	6.16
Met Mast	561635	730029	21.56	6.16
Peat and Spoil Management Area 1	560237	729492	4.30	3.44
Peat and Spoil Management Area 2	560851	730057	8.39	6.74
Peat and Spoil Management Area 3	561436	730085	7.48	5.21
Peat and Spoil Management Area 4	561832	729693	57.40	9.57
Peat and Spoil Management Area 5	562207	729542	28.70	8.20

Drained Analysis

Drained analysis results are presented in Table 8-9. Similar to the undrained analysis, the drained analysis was done for 2 no. conditions: Condition 1 with no surcharge loading and Condition 2 with a surcharge of 10kPa, equivalent to 1m of stockpiled peat. As outlined above, the drained loading

[1] *For the stability analysis two load conditions were examined, namely*

Condition (1): *no surcharge loading – natural peat slopes*
Condition (2): *surcharge of 10 kPa, equivalent to 1 m of stockpiled peat assumed as a worst case.*

condition applies in the long-term. The condition examines the effect of in particular, the change in groundwater level as a result of rainfall on the existing stability of the natural peat slopes.

The calculated FoS for Condition 1 was in excess of 1.30 at all key infrastructure locations (and at all of the 202 no. locations subject to the analysis). The FoS ranged from 1.44 to 141.33, indicating a low risk of peat instability.

The calculated FoS for Condition 2 was in excess of 1.30 at all key infrastructure locations (and at all of the 202 no. locations subject to the analysis). The FoS ranged from 2.48 to 67.12, indicating a low risk of peat instability.

Table 8-8: Factor of Safety Results (drained condition)

Turbine No.	Easting	Northing	Factor of Safety for Load Condition[2]	
			Condition (1)	Condition (2)
T01	560006	729599	1.80	2.96
T02	560288	729308	3.82	6.21
T03	560737	729992	7.65	9.93
T04	561808	729771	28.74	10.35
T05	562167	729573	28.74	10.35
T06	562645	729614	No peat recorded	
T07	563080	729518	14.37	8.87
T08	562403	729093	21.00	17.94
Substation	559550	729946	38.23	19.09
Construction Compound 1	559546	729981	19.13	11.82
Construction Compound 2	561644	730048	14.37	8.87
Met Mast	561635	730029	14.37	8.87
Peat and Spoil Management Area 1	560237	729492	2.87	4.96
Peat and Spoil Management Area 2	560851	730057	32.31	31.21
Peat and Spoil Management Area 3	561436	730085	18.34	16.83
Peat and Spoil Management Area 4	561832	729693	38.27	13.79

[2] *For the stability analysis two load conditions were examined, namely*

Condition (1): *no surcharge loading*
Condition (2): *surcharge of 10 kPa, equivalent to 1 m of stockpiled peat assumed as a worst case.*

Turbine No.	Easting	Northing	Factor of Safety for Load Condition[2]	
			Condition (1)	Condition (2)
Peat and Spoil Management Area 5	562207	729542	19.13	11.82

8.3.11.5.2 Risk Assessment

A peat stability risk assessment was carried out for the infrastructure elements at the Proposed Wind Farm site. This approach adheres to best practice guidance for geotechnical/peat stability risk assessments as given in PLHRAG Guidance and MacCulloch (2005). The risk assessment uses the results of the stability analysis (deterministic approach) in combination with qualitative factors, which cannot be reasonably included in a stability calculation but nevertheless may affect the occurrence of peat instability, to assess the risk for each infrastructure element.

For each of the main infrastructure elements, a risk rating (product of probability and impact) is calculated. Where a location is rated 'Medium' or 'High', control measures are required to reduce the risk to at least a 'Low' risk rating. Where a subsection is rated 'Low' or 'Negligible', only routine control measures are required.

The results of the peat stability risk assessment for potential peat failure at the Proposed Wind Farm site infrastructure is presented as a Geotechnical Risk Register in Appendix B of Appendix 8-1.

The risk rating for each infrastructure element of the Proposed Wind Farm is designated as Negligible or Low following some mitigation/control measures being implemented.

Details of the required infrastructure specific mitigation/control measures can be found in Appendix B of Appendix 8-1 and the general infrastructure specific control measures are summarised below:

- Detailed ground investigation to confirm peat, mineral soil and bedrock condition and properties.
- Use of experienced geotechnical staff for confirmatory site investigation.
- Maintain hydrology of area as far as possible by maintaining the flow of water in existing drains to prevent the build-up of water pressures in the peat, leading to the peat becoming "buoyant".
- Use of contractors with experience in working peat and trained operators to carry out the work.

8.3.11.5.3 Conclusions

In summary, the findings of the peat stability risk assessment showed that the Proposed Wind Farm site has an acceptable margin of safety, is suitable for the Proposed Wind Farm and is considered to be of a low risk for peat failure provided appropriate control measures, such as implementing and maintaining an appropriate drainage system, are implemented.

The Proposed Grid Connection was not assessed for peat stability risk due to the limited extent and shallow depth peat along the underground electrical cable route (<0.3).

The findings include mitigation/control measures for construction work in peat lands, all of which will be implemented in full to ensure that all works adhere to an acceptable standard of safety

8.4 Receptor Sensitivity and Importance

Based on the criteria set out in Table 8-2 above, the soils and peat at the Proposed Wind Farm site can be classed as being of low importance as the overlying peat and soil deposits are not designated in this area and are degraded in places as a result of the forestry and peat cutting operations and associated drainage. The soils and subsoils along the Proposed Grid Connection can also be considered as being of low importance as the underground electrical cable route is located predominantly along existing public roads and private access tracks, and there are no peat or soils deposits are designated along the Proposed Grid Connection. The bedrock geology underlying the Site can be classed as being of medium importance where the bedrock could be used on a sub-economic scale.

The land, peat, soils and bedrock geological formations underlying the Proposed Wind Farm site and the Proposed Grid Connection will be included in the impact assessment due to their proximal location to the Proposed Project and the potential effects that the Proposed Project may have on these receptors.

No geological heritage site or designated site will be included in the impact assessment due to their distant location from the Proposed Project. There is no potential for the Proposed Project to effect the land, soils and geological environment outside of the Proposed Project. Therefore, there is no potential for effects to occur on any geological heritage site or designated site.

8.5 Characteristics of the Proposed Project

The Proposed Project is defined in full in Chapter 4.

The Proposed Project will involve the removal of soils, subsoils and bedrock in order for access roads, internal cabling network, hardstanding emplacement, turbine foundations, substation, peat and spoil management areas, grid connection cabling, crane hardstands, construction compounds, drainage works and met mast installation. Rock for construction purposes will be sourced from local licenced quarries.

Generally, the construction methodology for constructing any structure or platform foundation, such as a turbine base, hardstand or substation, involves removing all soft material is required to a depth where a suitable bearing material is encountered. Based on the site-investigation data it is likely that piled foundations will be required at 5 no. turbine foundations, and gravity foundations may be constructed at T4, T5 and T6 subject to confirmatory ground investigations prior to construction. The impact assessment takes a precautionary approach and assesses both piled and gravity foundations at T4, T5 and T6. Roads within the Site will use both floated and excavation techniques. It is proposed to construct 1.8km of floating access road at the Proposed Wind Farm site. In addition, 4.3km of excavated road will be constructed at the Proposed Wind Farm site with 0.5km of excavated road proposed along the Proposed Grid Connection. The Proposed Wind Farm also makes use of the existing roads where possible and it is proposed to upgrade approximately 0.8km of existing roads and tracks. Existing tracks (1.6km) will also be upgraded along the Proposed Grid Connection. Crane hardstands, the substation platform, the met mast and the temporary construction compounds will all be constructed using the founded technique. The material excavated is required to be properly managed and stored and should be re-used in other elements of the Proposed Wind Farm infrastructure.

The quantities of peat and spoil requiring management at the Proposed Wind Farm site have been calculated and are presented in Table 8-9 below. The total estimated combined volume of peat and spoil to be managed following excavations during the construction phase of the Proposed Project is approximately 120,700m^3 (this includes a contingency factor of 10% to allow for increase in volume upon excavation). It is proposed to manage overburden generated through construction activities locally within the Proposed Wind Farm site, in the 5 no. designated peat and spoil management areas, for landscaping at the proposed turbine locations and along proposed accessed roads. The total capacity of the identified peat and spoil management areas, including the proposed landscaping and

sidecasting is approx. 130,500m^3 and therefore, there is more than enough capacity to manage the total volume of peat and spoil requiring management for both the Proposed Wind Farm.

The spoil generated along the Proposed Grid Connection underground cabling trench will either be managed in the identified peat and spoil management areas within the Proposed Wind Farm or sent to an appropriately licensed facility. This is dependent on the road makeup at locations along the underground electrical cabling route and the distance from the underground electrical cabling route to the Proposed Wind Farm, the main contractor will determine the appropriate location for management of arisings from the Grid Connection underground electrical cabling route.

In order to facilitate the construction of the Proposed Project, all crushed stone, hardcore materials and readymix concrete will be sourced from local suitably licenced quarries. The stone requirements for the Proposed Project are ~123,120m^3.

Table 8-9 Peat/Spoil Excavation Volumes

Development Component	Peat Volume(m^3) (approx.)	Spoil Volume(m^3) (approx.)
Proposed Wind Farm		
8 no. Turbines and Hardstanding Areas (including foundations)	82,500	26,730
Access Roads (including met mast and hardstand)	5,280	3,370
Substation	1,840	660
Met Mast	130	190
Proposed Grid Connection		
Cable Trench	-	6,750[2]
Sub-Total	**89,750**	**37,700**
Total Peat and Spoil to be managed in the Proposed Wind Farm [1]	**127,450**	

Note 1*: A contingency factor of 15% has been applied and is included in the excavated spoil volumes, and a bulking factor of 20% has been used for excavated peat volumes to allow for expected increase in volume upon excavation and to allow for a variation in ground conditions across the Site.*

Note 2: *The total spoil generation volumes for the Proposed Grid Connection underground cabling route is quantified as 16,200m3. Of this total, 2,700m3 is comprised of road make up material which will be sent to an appropriately licensed facility. The remaining spoil volume of 13,500m3 will either be managed in the identified peat and spoil management areas within the Proposed Wind Farm or sent to an appropriately licensed facility. Given the length of the Proposed Grid Connection underground cabling route, it is assumed that approximately 50% (6,750m3) of the spoil generated during the construction of the Proposed Grid Connection will be managed in the Proposed Wind Farm, which is identified in Table 4-2 above, and the remaining volume will be sent to an appropriately licensed facility. This is dependent on the road makeup at locations along the underground electrical cabling route and the distance from the underground electrical cabling route to the Proposed Wind Farm, the main contractor will determine the appropriate location for management of arisings from the Grid Connection underground electrical cabling route.*

Table 8-10: Peat/Spoil Management

Development Component	Peat and Spoil Volume(m^3) (approx.)	Comment
Peat placement within proposed peat and spoil management areas	100,500	Up to 1.5m in height at 5 no. specific designated locations
Landscaping	10,000	1,500m^3 at 5 no. turbine locations and ~800m^3 at T6, T7 and T8 including ballast backfill
Sidecasting	20,000	10m width and 1m high along sections of floating access road
Total	130,500	-

8.6 Likely Significant Effects and Associated Mitigation Measures

8.6.1 Do Nothing Scenario

An alternative land-use option to the development of a renewable energy project at the Site would be to leave the Site as it is, with no changes made to existing land-use practices. In this Do Nothing Scenario, the existing land use practices comprising of agricultural activities, turbary peat cutting and forestry would continue at the Proposed Wind Farm site. Forestry will be felled as forestry compartments reach maturity. Re-planting of these areas with coniferous plantation is likely to occur. Land drainage carried out in areas of the Site will continue to function and may be extended in some areas.

If the Proposed Project were not to proceed, the opportunity to capture part of Galway'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 opportunity to generate local employment, development contributions, rates and investment in the local area would also be lost. On the basis of the positive environmental effects arising from the Proposed Project, the do–nothing scenario was not the chosen option. The existing agricultural activities (grassland management) and forestry operations (felling and replanting) can and will continue in conjunction with the Proposed Project use of the Site.

Furthermore, the opportunity to create the proposed habitat enhancement areas would be lost. Please see Appendix 6-4 Biodiversity Management and Enhancement Plan (BMEP) for details.

8.6.2 Construction Phase - Likely Significant Effects and Mitigation Measures

The likely effects of the Proposed Project and mitigation measures that will be put in place to eliminate or reduce them are shown below. The assessment considers the Proposed Project as a whole i.e. both the Proposed Wind Farm and the Proposed Grid Connection. Where this is required to be assessed separately, this is noted in the text.

8.6.2.1 Potential Effects on Land (Land-Take)

The Proposed Project includes the construction of 8 no. turbines, associated hardstand areas, 2 no. temporary construction compound, an onsite substation, new access roads and upgrades to the existing road network. The footprint of the Proposed Wind Farm infrastructure is 7.6ha.

These works will result in a change in the land environment within these areas. For example, the proposed works will result in the loss of ~7.5ha of coniferous forestry due to the proposed infrastructure. 1.9ha of native woodland and 1.6ha of scrub will also be lost as a result of the Proposed Project. Approximately 4ha of cutover bog will also be lost, along with 0.65ha of marsh/wet grassland, 1ha of Marsh Fritillary habitat, 0.1 ha of native woodland and 1.6ha of hedgerow. Therefore, the existing baseline habitats will be replaced by turbine bases, hardstand areas, access roads and other related infrastructure.

The Proposed Wind Farm construction works will result in local topographic changes with the removal of overburden at the Proposed Wind Farm site.

There will be no effects on the lands adjoining the Proposed Wind Farm site.

The Proposed Grid Connection will result in the excavation of a narrow trench to accommodate the cabling. This trench will be reinstated once the cabling is emplaced with a comparable ground surface (tarmacadam or subsoil/topsoil). Therefore, no effects on land or landuse will occur along the majority of the Proposed Grid Connection underground cable route. However, 0.5km of new road is proposed over the Proposed Grid Connection underground cable in the agricultural lands in the townland of Lisheenkyle East. This will result in the minor loss of agricultural land in this area.

Pathways: Excavation and infrastructure construction.

Receptors: Land (i.e. land upon which the Proposed Project will occur).

Pre-Mitigation Potential Effect: Negative, slight, direct, permanent, likely effect on land (land-take) within the Proposed Wind Farm site. In the absence of mitigation measures, there will be no potential for significant effects on land at the Proposed Wind Farm site.

Negative, slight, direct, permanent, likely effect on land along the Proposed Grid Connection. In the absence of mitigation measures, there will be no potential for significant effects on land along the Proposed Grid Connection.

Mitigation Measures / Impact Assessment: The Proposed Grid Connection is located predominantly along existing public roads. There will be no change in the land environment along the existing roads, whereby the roads will be reinstated with a comparable ground surface. The use of the existing road network reduces the area which will be altered or disturbed as a result of the works associated with the Proposed Grid Connection. The only change to the land environment will occur where the new access tracks are proposed and these works will have a very small footprint.

Following the construction phase areas of the Proposed Wind Farm site will be replaced by hardstand areas with a permanent development footprint of 7.6ha. This represents a change in landcover of ~0.9%.

The loss of coniferous forestry (7.5ha), peatland (4ha), native woodland and scrub (0.1ha of native woodland and 1.6ha of scrub), marsh/wet grassland (0.65ha) and Marsh Fritillary habitat (1ha) will not have a significant effect on land at the Proposed Wind Farm site due to the small development footprint. The loss of this land is minimal on a local and regional scale and therefore, the effects of land loss is negligible. The loss will be offset by the works proposed as part of the Biodiversity Management and Enhancement Plan (refer to Appendix 6-4)

Please note, the 7.5ha of conifer plantation to be felled as part of the Proposed Wind Farm will be the subject of a Limited Felling Licence (LFL) application to the Forest Service in accordance with the Forestry Act 2014 and the Forestry Regulations 2017 (SI 191/2017) and as per the Forest Service's policy on granting felling licenses for wind farm developments. The policy requires that a copy of the planning permission for the Proposed Wind Farm be submitted with the felling licence application; therefore, the felling licence cannot be applied for until such time as planning permission is obtained for the Proposed Wind Farm.

Given the undulating nature of the local topography resulting from the quaternary deposits, any change in topography is likely to be minimal in the overall landscape.

Post-Mitigation Residual Effect: The residual effect will be a negative, direct, slight, likely, permanent effect on land and landuse.

Significance of Effects: For the reasons outlined above (small development footprint), no significant effects on land (land-take) will occur.

8.6.2.2 Potential Effects from Peat and Spoil Excavation

The peat, the cohesive soils and the granular soils and subsoils at the Site can be classified as of "Low" importance. The effect is the disturbance and relocation of 120,700m^3 of material.

Excavation of peat and mineral soil/subsoil will be required for the installation of foundations for the access roads, turbine hardstands and foundations, met mast, cable trenching, and on-site substation within the Proposed Wind Farm site. Soils and subsoil will also require excavation at the designated peat and spoil management areas. The excavation of soils will also be required along the Proposed Grid Connection underground electrical cabling route and the 0.5km of access road proposed along the Proposed Grid Connection. Estimated volumes of peat and spoil to be relocated are summarised above in Table 8-9 above. Earthworks of this type, scale and magnitude have been granted permission and successfully completed at similar sites around the country.

There will be no loss of peat or spoil from the Proposed Wind Farm site, as it will be accommodated within the proposed 5 no. designated peat and spoil management areas. Spoil will also be used for landscaping at the proposed turbine locations and in linear berms along access roads where appropriate. In addition, peat will be used in the proposed Biodiversity Management and Enhancement Plan works whereby drain blocking and peat storage will be completed to improve the hydrological condition of 5.31ha of peat bog (refer to Section 8.6.2.10).

Excavated subsoils along the Proposed Grid Connection will be removed from the underground electrical cabling trench and will be transported to a tip to be used for landscaping where the Proposed Grid Connection is located in private lands, or will be transported to the peat and spoil management area or transported to a local licenced facility as appropriate.

Pathway: Extraction/excavation.

Receptor: Soil, subsoil and bedrock within the Proposed Wind Farm site and along the Proposed Grid Connection.

Pre-Mitigation Potential Effect: Negative, slight/moderate, direct, likely, permanent effect on soils and subsoils due to relocation within the Site. In the absence of mitigation measures, there will be no potential for significant effects on soils and subsoils at the Proposed Wind Farm site or along the Proposed Grid Connection.

Proposed Mitigation Measures by Design:

All work will be in accordance with the Peat and Spoil Management Plan detailed in Section 4.3.1.9 of Chapter 4 and Appendix 4-2. The site layout design has been iteratively developed using comprehensive site-specific site investigation dataset, which includes peat probes, gouge cores and trial pits.

Proposed Wind Farm site

- Placement of turbines and associated infrastructure in areas with suitable ground conditions where appropriate (based on detailed site investigation data – the areas of deeper peat have been generally avoided by the Proposed Wind Farm infrastructure);
- The peat/soils and subsoils which will be removed during the construction of turbine hardstands will be localised to the turbine locations. The peat/soil/subsoil will be placed/spread locally alongside the excavations or stored within the 5 no. designated peat and spoil management areas;
- Excavated peat/soils/subsoils shall be excavated and stored separately to topsoil; this will prevent mixing of materials and facilitate reuse afterwards;
- At the identified peat and spoil management areas, the vegetative topsoil layer will be removed to allow for spoil to be placed and upon reaching the recommended height, the vegetative topsoil layer will be reinstated;
- The peat placed within the peat and spoil management areas will be restricted to a maximum height of 1.5m. Weak/liquified peat will be stored in the centre of
- the peat management areas with firmer/drier peat placed around the outside;
- The placement of excavated peat will be avoided without first establishing the adequacy of the ground to support the load. The placement of peat and spoil within the peat and spoil management areas will require the use of long reach excavators, low ground pressure machinery and possibly bog mats in particular for drainage works;
- It will be ensured that the surface of the placed peat will be shaped to allow efficient run-off of surface water. Shaping of the surface of the peat will be carried out as placement of peat within the peat and spoil management area progresses. This will reduce the likelihood of debris run-off and reduce the risk of instability of the placed peat;
- Finished/shaped side slopes in the placed peat will be not greater than 1 (v): 4 (h). This slope inclination will be reviewed during construction, as appropriate.
- Where available, the acrotelm will be placed on the finished surface with the vegetation part of the sod facing the right way up to encourage growth of plants and vegetation at the surface of the placed peat and spoil within the peat and spoil management areas;
- Movement monitoring instrumentation will be placed around the areas where peat has been placed. The locations where monitoring is required will be identified by the Project Geotechnical Engineer on site;
- Supervision by the Project Geotechnical Engineer will be carried out for the works; and,
- An interceptor drain will be installed upslope of the designated peat and spoil management areas to divert any surface water away from these areas. This will help ensure stability of the placed peat and reduce the likelihood of debris run-off. (interceptor drains will not be required at all areas as the existing drainage network can function as interceptor drains – silt fences will be installed upgradient of the peat and spoil management areas in these locations).

Proposed Grid Connection:

- Any overburden excavated from the cable trench will either be managed in the identified peat and spoil management areas within the Proposed Wind Farm or sent to an appropriately licensed facility;

- Some excess spoil material or pavements materials containing tar generated during the cable route construction will be transported by permitted waste contractors to a suitable permitted/licensed site for disposal/recovery.

Post Mitigation Residual Effect: With the implementation of the prescribed mitigation measures the residual effect will be negative, slight to moderate, direct, likely, permanent effect on soils and subsoils due to disturbance and relocation within the Site.

Significance of Effects: For the reasons outlined above, no significant effects on soils, subsoils or bedrock will occur.

8.6.2.3 Potential Effects from the Contamination of Soils by Leakages and Spillages of Hydrocarbons

Accidental spillage during refuelling of construction plant with petroleum hydrocarbons is a pollution risk at the Site. The accumulation of small spills of fuels and lubricants during routine plant use can also be a significant pollution risk. Hydrocarbon has a high toxicity to humans, and all flora and fauna, including fish, and is persistent in the environment. Large spills or leaks have the potential to result in significant effects (i.e. contamination of soils, subsoils and pollution of the underlying aquifer) on the geological and water environment, depending on where a spill may occur, *i.e* Proposed Wind Farm and Proposed Grid Connection. Additionally, waste tar, removed from the road hardstanding along the Proposed Grid Connection has the potential to affect soil/subsoil geochemistry.

Pathway: Subsoil and underlying bedrock pore space.

Receptor: Soils, Subsoil and bedrock.

Pre-Mitigation Potential Effect: Negative, slight, direct, short-term, unlikely effect on soils, subsoils and bedrock. In the absence of mitigation measures, there will be no potential for significant effects on soils, subsoils and bedrock at the Proposed Wind Farm site or along the Proposed Grid Connection.

Proposed Mitigation Measures:

- Minimal refuelling or maintenance of construction vehicles or plant will take place on site. Where possible, off-site refuelling will occur at a controlled fuelling station;
- On-site re-fuelling will be undertaken using a double skinned bowser or a refuelling truck with spill kits kept onboard;
- Only designated trained operatives will be authorised to refuel plant on-site;
- Taps, nozzles or valves associated with refuelling equipment will be fitted with a lock system;
- All fuel storage areas will be bunded appropriately for the duration of the construction phase. All bunded areas will be fitted with a storm drainage system and an appropriate oil interceptor. Ancillary equipment such as hoses, pipes will be contained within the bunded area;
- Fuel and oil stores including tanks and drums will be regularly inspected for leaks and signs of damage;
- The on-site substation will be bunded appropriately to the volume of oils likely to be stored and to prevent leakage of any associated chemicals to groundwater or surface water. The bunded area will be fitted with a storm drainage system and an appropriate oil interceptor;
- The plant used during construction will be regularly inspected for leaks and fitness for purpose;
- All waste tar material arising from works on hard top roads will be removed off-site and taken to licenced waste facility; and,
- An emergency response plan for the construction phase to deal with accidental spillages

is contained within the Construction and Environmental Management Plan (which is contained in Appendix 4.5).

Post Mitigation Residual Effect: With the implementation of the prescribed mitigation measures the residual effect will be a negative, imperceptible, direct, short-term, low unlikely effect on soils, subsoils and bedrock.

Significance of Effects: For the reasons outlined above, and with the implementation of the listed mitigation, no significant effects on soils, subsoils and bedrock will occur.

8.6.2.4 Potential Effects from the Erosion of Exposed Peat, Soils and Subsoils During Construction

Erosion of soil/subsoil by the pathways listed below, can have the effect of reducing the overall volume of soil/subsoil at the Site, with the potential for some eroded subsoils to reach watercourses, leading to water quality issues such as high turbidity. Erosion of soils/subsoils may occur at any works area where excavation is ongoing, i.e. turbine foundations, access roads and felling areas within the Site.

The main impacts associated with this aspect is to the water environment, and therefore this aspect is further assessed in detail in Chapter 9.

Pathway: Vehicle movement, surface water and wind action.

Receptor: Soils and subsoils.

Pre-Mitigation Potential Effect: Negative, slight, direct, short-term, likely effect on soils and subsoils by erosion and wind action. In the absence of mitigation measures, there will be no potential for significant effects on soils and subsoils at the Proposed Wind Farm site or along the Proposed Grid Connection.

Proposed Mitigation Measures:

- Soil/subsoil removed from the turbine locations and associated access roads will be used for landscaping, placed/spread locally alongside the excavation or will be stored in the designated peat and spoil management areas.
- Temporary drainage systems will be required to limit runoff impacts during the construction phase.
- In forestry areas, brash mats will be used to support vehicles on soft ground, reducing soil erosion and avoiding the formation of rutted areas, in which surface water ponding can occur. Brash mat renewal will take place when they become heavily used and worn. Provision will be made for brash mats along all off-road routes, to protect the soil from compaction and rutting.
- Soils/subsoils removed from the Proposed Grid Connection groundworks will be removed and either stored at the Proposed Wind Farm designated peat and spoil management areas or taken to an appropriately licenced facility.

Post Mitigation Residual Effect: With the implementation of the prescribed mitigation measures the residual effect will be a negative, slight, direct, short-term, likely effect on subsoils by erosion and wind action.

Significance of Effects: For the reasons outlined above, no significant effects on soils or subsoils will occur.

8.6.2.5 Erosion of Exposed Peat, Soils and Subsoils During Tree Felling

Tree felling is a component of the Proposed Wind Farm works, with ~7.5ha of felling of coniferous forestry proposed. In addition, it is proposed to fell/clear ~1.8ha of native woodland and scrub (0.1ha of native woodland and 1.7ha of scrub).

During felling operations there is a high likelihood of erosion due to the distance of soils and subsoils associated with vehicle and plant movements. This also has associated potential effects on the water environment; and therefore this aspect is assessed in further detail in Chapter 9.

Pathway: Vehicle movement, surface water and wind action.

Receptor: Soils, subsoil and weathered bedrock.

Pre-Mitigation Potential Effect: Negative, slight, direct, permanent, likely effect on soils, subsoils and weathered bedrock due to felling operations. In the absence of mitigation measures, there will be no potential for significant effects on soils, subsoils and weathered bedrock at the Proposed Wind Farm site.

Proposed Mitigation Measures:

All proposed felling works will be completed in accordance with the best practice Forest Service regulation, policies and strategic guidance documents as well as Coillte and DAFM guidance documents to ensure that felling results in minimal potential negative effects on the local soil and subsoil environment.

In addition, the following mitigation measures will be implemented during felling operations:

- Before any works are completed silt fences will be installed to limit the movement of entrained sediment in surface water runoff;
- The harvester and the forwarder are designed specifically for the forest environment and are low ground pressure machines;
- All machinery will be operated by suitably qualified personnel;
- These machines will traverse the Proposed Wind Farm site along specified off-road routes (referred to as racks);
- Brash mats will be placed on the racks to support the vehicles on soft ground, reducing mineral soil disturbance and erosion and avoiding the formation of rutted areas, in which surface water ponding can occur;
- As felling progresses, the harvester will collect brash produced by the felling and place it in front of the machine before it advances forward along the rack;
- The condition of the racks will be continually monitored and fresh brash will be applied when the brash mat becomes heavily used and worn, ensuring that the mat remains effective throughout the operational phase; and,
- The location of racks will be chosen to avoid wet and potentially sensitive areas.

Post Mitigation Residual Effect: With the implementation of the prescribed mitigation measures the residual effect will be a negative, imperceptible, direct, permanent, unlikely effect on soils, subsoils and weathered bedrock.

Significance of Effects: For the reasons outlined above, and with the implementation of the proposed mitigation measures, no significant effects on soils, subsoils or bedrock will occur.

8.6.2.6 Potential Effects on Geological Heritage Sites

The works proposed as part of the Proposed Project are remote from any geological heritage site (refer to Section 8.3.7).

There are no geological heritage sites mapped in the vicinity of the Proposed Wind Farm site or along the Proposed Grid Connection.

Potential effects on other designated sites including Special Areas of Conservation (SACs) and Special Protected Areas (SPAs) are assessed in Chapter 9.

Pathway: There is no pathway for effects between the Geological Heritage Sites and the Proposed Wind Farm site and Proposed Grid Connection.

Receptor: Geological Heritage Sites.

Pre-Mitigation Potential Effect: There is no potential for effects.

Residual Effects: There will be no residual effects on geological heritage sites as a result of the Proposed Project.

Significance of effects: No effects

8.6.2.7 Potential Effects from Peat Instability and Failure

Peat instability and failure are risks at the Proposed Wind Farm site during the construction phase and are assessed herein. Peat instability is not considered to be a risk along the Proposed Grid Connection due to the nature of the proposed works and the limited extent of peat along the route. It was deemed unnecessary to undertake a stability analysis of the Proposed Grid Connection.

A Peat Stability Risk Assessment was carried out for the main infrastructure elements at the Proposed Wind Farm site. This approach takes into account guidelines for geotechnical/peat stability risk assessments as given in PLHRAG (2017) and MacCulloch (2005).

Peat instability or failure refers to a significant mass movement of a body of peat that would have an adverse impact on the Proposed Wind Farm and the surrounding environment. The potential significant effects of peat failure at the Site may result in:

- Death or injury to site personnel;
- Damage to machinery;
- Damage or loss of infrastructure;
- Drainage disruption by blockage of drainage pathway by relocated peat and spoil;
- Site works damaged or unstable;
- Contamination of watercourses, water supplies by particulates; and,
- Degradation of the peat environment by relocation of peat and spoil.

However, the findings of the GPSRA (FT, 2025), which involved analysis of 202 no. locations, showed that all Proposed Wind Farm infrastructure elements are located in areas of negligible to low risk as discussed in Section 8.3.11 above.

Notwithstanding the above, the management of peat stability and appropriate construction practices will be inherent in the construction phase of the Proposed Wind Farm to ensure peat failures do not occur on site.

Pathway: Vehicle movement and excavations.

Receptor: Peat and subsoils.

Pre-Mitigation Potential Effect: The findings of the GPSRA (FT, 2025) showed that the Proposed Wind Farm site has an acceptable margin of safety, is suitable for the Proposed Project and is considered to be at negligible to low risk of peat failure. In the absence of mitigation measures, there will be no potential for significant effects on peat and subsoils at the Proposed Wind Farm site.

Proposed Mitigation Measures:

Firstly, the key mitigation with regard peat stability risk at the Proposed Wind Farm site was the carrying out of a robust, multidisciplinary site investigation and peat stability risk assessment. The extent and depth of ground investigation and peat stability analysis by FT have been undertaken following the principles in the Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Developments (PLHRAG, 2nd Edition, Scottish Government, 2017).

The findings of the peat assessment, which involved analysis of 202 no. locations, showed that the Proposed Wind Farm development areas have an acceptable margin of safety and that the site is suitable for the Proposed Project.

The GPSRA (FT, 2025) provides a number of mitigation/control measures to reduce the potential risk of peat failure at each infrastructure location. Sections of access roads to the nearest infrastructure element will be subject to the same mitigation/control measures that apply to the nearest infrastructure element. The required mitigation/control measures are shown below:

The following control measures incorporated into the construction phase of the Proposed Wind Farm will ensure the management of the risks for this site:

- Appointment of experienced and competent contractors;
- The Proposed Wind Farm site will be supervised by experienced and qualified personnel;
- Allocate sufficient time for the Proposed Project construction programme (be aware that decreasing the construction time has the potential to increase the risk of initiating a localised peat movement);
- Prevent undercutting of slopes and unsupported excavations;
- Maintain a managed robust drainage system;
- Prevent placement of loads/overburden on marginal ground;
- Implementation of safety buffers around deep peat areas as detailed in the GPSRA (FT, 2025), Please refer to **Appendix 8-1** for details on the safety buffers and stockpile restrictions.
- Ensure construction method statements are developed and agreed before commencement of construction and are followed by the contractor; and,
- Revise and amend the Construction Risk Register as construction progresses to ensure that risks are managed and controlled for the duration of the construction phase of the Proposed Wind Farm.

Residual Effect Assessment: With the implementation of the control measures outlined above the residual effect will be a negative, imperceptible, direct, permanent, unlikely effect on peat and subsoils.

Significance of Effects: No significant effects on peat, soils and subsoils will occur due to peat instability.

8.6.2.8 Potential Effects from Proposed Piling Works

Piling foundations may be required at several proposed turbine locations. The requirement for piling will be determined during post-consent ground investigations. Based on the site investigation data, piling works are not envisaged at proposed turbines T4, T5 or T6, however, taking a precautionary approach an assessment of piling at all proposed turbines has been included below.

Pathway: Piling works.

Receptor: Soils and subsoils.

Pre-Mitigation Potential Effect: Negative, imperceptible, direct, permanent, unlikely effect on subsoils by piling works. In the absence of mitigation measures, there will be no potential for significant effects on soils and subsoils at the Proposed Wind Farm site.

Proposed Mitigation Measures:

No mitigation measures are proposed or required for the soils and geology environment. Proposed mitigation to protect the water environment are outlined in Chapter 9.

Piles have a very small footprint and will result in the displacement of small volumes of spoil. The small spoil volumes can be easily managed at the Proposed Wind Farm site with excess spoil being removed for permanent storage within the peat and spoil management areas. Peat and spoil volumes generated by any potential piling works will only amount to a very small percentage of the overall spoil volumes for the Proposed Project.

Post Mitigation Residual Effect: The residual effect will be a negative, direct, imperceptible, permanent, unlikely effect on subsoils by piling works.

Significance of Effects For the reasons detailed above, no significant effects on subsoils will occur.

8.6.2.9 Potential Effects from Turbine Delivery Route Works

Accommodation works will be required at various locations on the national and regional road network between the port of arrival in Galway and the Proposed Wind Farm site. These areas and the proposed works are detailed in Section 4.5.3.1. No significant works are required along the turbine delivery route.

Pathway: No significant works proposed.

Receptor: Soils and subsoils.

Pre-Mitigation Potential Effect: No potential for effects.

Post Mitigation Residual Effect: There will be no residual effects on soils and subsoils as a result of works along the proposed TDR.

Significance of effects: No effects.

8.6.2.10 Potential Effects from the Proposed Biodiversity Management and Enhancement Plan (BMEP)

Drain blocking and habitat management for Marsh Fritillary enhancement is proposed over 3.5ha. In addition, ~4.5ha of commercial coniferous forestry will be felled and managed to create grassland for Marsh Fritillary. It is also proposed to replant ~1.9ha of land with native woodland. Drain blocking and peat storage will also occur in an area of 5.3ha. The proposed BMEP works represent 2.6% of the Site area.

Some of these proposals will disturb local peat, soil and subsoil deposits and increase the likelihood of erosion of peat and subsoils. However, due to the largely non-invasive nature of the works the potential for effects on the soils and geological environment are limited. The works will have a positive effect on the land environment.

Pathway: Vehicle movement, restoration works, surface water and wind action.

Receptor: Land, peat/soil and subsoil.

Pre-Mitigation Potential Effect: Negative, direct, slight, likely effect on peat and subsoils due to disturbance associated with proposed restoration works. Positive, slight, direct, permanent effect on the land at the Proposed Wind Farm site. In the absence of mitigation measures, there will be no potential for significant effects on land, peat, soils and subsoils at the Proposed Wind Farm site.

Proposed Mitigation Measures:

All proposed habitat management and enhancement works will be in accordance with the best practice Forest Service regulation, policies and strategic guidance documents as well as Coillte, DAFM and NatureScot guidance documents to ensure minimal potential negative effects on the local peat, soil and subsoil environment.

Given the nature of the restoration measures the following mitigation measures are proposed:

- Before any works are completed silt fences will be installed to limit the movement of entrained sediment in surface water runoff;
- Proposed off-road routes will be walked in advance of any machinery;
- All machinery operators will be experienced;
- The Proposed Wind Farm site will be walked before a machine goes off-road;
- Bog ats will be used where the excavator is required to travel over wet ground; and,
- A low ground pressure excavator with wide tracks (1.9m or greater) will be used to reduce compaction of the peat and subsoils.

Post-Mitigation Residual Effect: With the implementation of mitigation measures outlined above the residual effect will be a negative, direct, imperceptible, likely effect on peat, subsoils and weathered bedrock. There will be a slight, positive, permanent effect on land within the Proposed Wind Farm site.

Significance of Effects: For the reasons outlined above, and with the implementation of the listed mitigation measures, no significant effects on peat and subsoils.

8.6.3 Operational Phase - Likely Significant Effects and Mitigation Measures

There are very few potential direct impacts envisaged during the operational phase of the Proposed Project. The potential impacts may include:

- Some construction vehicles or plant may be necessary for maintenance at the Proposed Wind Farm site which could result in minor accidental leaks or spills of fuel/oil;
- The transformer in the substation and transformers in each turbine are oil cooled. There is potential for spills / leaks of oils from this equipment resulting in contamination of soils and groundwater; and,
- In relation to indirect impacts a small amount of granular material may be required to maintain access tracks during operation which will place intermittent minor demand on local quarries.

8.6.3.1 Potential Effects from Site Road Maintenance

In relation to indirect effects a small amount of granular material will be required to maintain access tracks/site roads during operation which will place intermittent minor demand on local quarries.

Pathway: Peat, subsoil and bedrock pore space.

Receptor: Peat, subsoil and bedrock.

Potential Pre-Mitigation Effect: Negative, indirect, imperceptible, short term, likely effect on peat, subsoil and bedrock. In the absence of mitigation measures, there will be no potential for significant effects on peat, soils, subsoils and bedrock at the Proposed Wind Farm site.

Proposed Mitigation Measures:

- Use of aggregate from authorised quarries for use in road and hardstand maintenance.

Post-Mitigation Residual Effect: The residual effect will be a negative, imperceptible, indirect, short-term, unlikely effect on bedrock.

Significance of Effects: For the reasons outlined above, no significant effects on land, soils or geology will occur.

8.6.3.2 Potential Effects from Site Vehicle/Plant Use

Plant and site vehicles used in site maintenance will be run on fuels and use hydraulic oils. Accidental spillage during refuelling of construction plant with petroleum hydrocarbons is a significant pollution risk to land, soils and associated ecosystems. The accumulation of small spills of fuels and lubricants during routine plant use can also be a pollution risk. Hydrocarbon has a high toxicity to humans, and all flora and fauna, and is persistent in the environment.

Pathway: Peat, subsoil and bedrock pore space.

Receptor: Peat, subsoil and bedrock.

Potential Pre-Mitigation Effect: Negative, direct, slight, short term, unlikely effect on peat, subsoil and bedrock. In the absence of mitigation measures, there will be no potential for significant effects on peat, subsoils and bedrock at the Proposed Wind Farm site.

Proposed Mitigation Measures:

- Vehicles used during the operational phase will be refuelled off site before entering the site;
- No fuels will be stored on-site during the operational phase; and
- Spill kits will be available in all site vehicles to deal with an accidental spillage and breakdowns; and,
- An emergency plan for the operational phase to deal with accidental spillages and breakdowns will be contained in the CEMP (Appendix 4-5).

Post-Mitigation Residual Effect: With the implementation of the prescribed mitigation measures the residual effect will be a negative, imperceptible, direct, short-term, unlikely effect on peat, subsoils, and bedrock.

Significance of Effects: For the reasons outlined above, no likely significant effects on land, soils, subsoils or bedrock will occur.

8.6.3.3 Potential Effects from the Use of Oil In Transformers

The transformer in the substation and transformers in each turbine are oil cooled. There is potential for spills / leaks of oils from this equipment resulting in contamination of soils and groundwater.

Hydrocarbon has a high toxicity to humans, and all flora and fauna, and is persistent in the environment.

Pathway: Peat, subsoil and bedrock pore space.

Receptor: Peat, subsoil and bedrock.

Potential Pre-Mitigation Effect: Negative, direct, slight, short term, unlikely effect on peat, subsoil and bedrock. In the absence of mitigation measures, there will be no potential for significant effects on peat, subsoils and bedrock at the Proposed Wind Farm site.

Proposed Mitigation Measures:

- All transformers and substation areas will be bunded to 110% of the volume of oil used in each transformer/substation; and,
- An emergency plan for the operational phase to deal with accidental spillages will be contained in the CEMP (Appendix 4-5).

Post-Mitigation Residual Effect: With the implementation of the prescribed mitigation measures the residual effect will be a negative, imperceptible, direct, short-term, unlikely effect on peat, subsoils, and bedrock.

Significance of Effects: For the reasons outlined above, no likely significant effects on land, soils, subsoils or bedrock will occur.

8.6.4 Decommissioning Phase - Likely Significant Effects and Mitigation Measures

The potential effects associated with decommissioning of the Proposed Project will be similar to those associated with construction but of reduced magnitude (i.e., soil/subsoil/bedrock excavation; Contamination by Leakage/Spillages).

The wind turbines proposed as part of the Proposed Wind Farm site are expected to have a lifespan of approximately 35 years. Following the end of their useful life, the equipment may be replaced with a new technology, subject to planning permission being obtained, or the Proposed Wind Farm may be decommissioned fully.

Upon decommissioning of the Proposed Wind Farm, the proposed turbines will be disassembled in reverse order to how they were erected. The proposed turbines will be disassembled with a similar model of crane that was used for their erection. The proposed turbine components will be separated and removed offsite. The proposed turbine materials will be transferred to a suitable recycling or recovery facility. Leaving the turbine foundations in-situ is considered a more environmentally prudent option, as to remove that volume of reinforced concrete from the ground could result in unnecessary environment emissions such as noise, dust and/or vibration.

The underground electrical cabling connecting the proposed turbines to the proposed onsite 38kV substation will be removed from the cable ducts. The cabling will be pulled from the cable ducts using a mechanical winch which will extract the cable and re-roll it on to a cable drum. This will be undertaken at the original cable jointing pits which will be excavated using a mechanical excavator and will be fully re-instated once the cables are removed. The cable ducting will be left in-situ as it is considered the most environmentally prudent option, avoiding unnecessary excavation and soil disturbance. The cable materials will be transferred to a suitable recycling or recovery facility.

Site roadways will be in use for purposes other than the operation of the Proposed Project by the time the decommissioning of the Proposed Wind Farm is to be considered, and therefore it may be more

appropriate to leave the Site roads in situ for future use. It is envisaged that the roads will serve as agricultural roads for local landowners.

The Proposed Grid Connection underground electrical cabling route and the proposed onsite 38kV substation will remain in place as it will be under the ownership and control of the ESB and Eirgrid.

A Decommissioning Plan has been prepared (Appendix 4-6) the detail of which will be agreed with the local authority prior to any decommissioning. The Decommissioning Plan will be updated prior to the end of the operational period in line with decommissioning methodologies that may exist at the time and will be agreed with the competent authority at that time. The potential for effects during the decommissioning phase of the Proposed Project has been fully assessed in the EIAR.

During decommissioning, it may be possible to reverse or at least reduce some of the potential effects caused during construction by rehabilitating construction areas such as turbine bases. This will be done by covering with soils/subsoils and vegetation to encourage vegetation growth and reduce run-off and sedimentation. Other effects such as possible soil compaction and contamination by fuel leaks will remain but will be of reduced magnitude. However, as noted in the Scottish Natural Heritage report (SNH) Research and Guidance on Restoration and Decommissioning of Onshore Wind Farms (SNH, 2013) reinstatement proposals for a wind farm are made approximately 30 years in advance, so within the lifespan of the wind farm, technological advances and preferred approaches to reinstatement are likely to change. According to the SNH guidance, it is therefore:

> *"best practice not to limit options too far in advance of actual decommissioning but to maintain informed flexibility until close to the end-of-life of the wind farm".*

Mitigation measures applied during decommissioning activities will be similar to those applied during construction where relevant (i.e., mitigation outlined at Sections 8.6.2). Some of the effects will be avoided by leaving elements of the Proposed Project in place where appropriate, *i.e.* the 38kV substation and underground 38kV cabling. Mitigation measures to avoid contamination by accidental fuel leakage and compaction of soil by on-site plant will be implemented as per the construction phase mitigation measures.

No significant effects on the soils and geology environment are envisaged during the decommissioning stage of the Proposed Project.

8.6.5 Assessment of Human Health Effects

Potential human health effects arise mainly through the potential for soil and ground contamination. A wind farm or grid connection is not a recognized source of pollution and so the potential for effects during the operational phase are negligible.

Hydrocarbons will be used onsite during construction and decommissioning however the volumes will be small in the context of the scale of the Proposed Project and will be handled and stored in accordance with best practice mitigation measures. The potential residual effects associated with soil or ground contamination and subsequent health effects are negligible.

Peat failure has also the potential to affect human health, but this would likely require a catastrophic failure to occur. The residual risk of significant peat slide/failure occurring is determined to be negligible to low following the implementation of the proposed control (mitigation) measures.

8.6.6 Risk of Major Accidents and Disasters

Due to the nature of the Proposed Project, *i.e.* soft peat deposits, there is a risk of peat movement occurring. However, due to the generally flat nature of the Site, the risk is low.

A comprehensive GPSRA (FT,2025) has been undertaken for all Proposed Wind Farm infrastructure locations, and it concludes that with the implementation of the proposed control (mitigation) measures the residual effect of a landslide occurring is determined to be imperceptible. Refer to Appendix 8-1 for the detailed GPSRA (FT, 2025) and Chapter 16: Major Accidents and Natural Disasters for a full assessment on risks relating to the Proposed Project.

8.6.7 Potential Cumulative Effects

Due to the localised nature of the proposed construction works which will be kept within the Site, there is no potential for significant cumulative effects in-combination with other local developments on the land, soils and geology environment as all effects are direct within the Site. Other proposed or permitted projects outside the Site do not have the potential to reduce or increase the magnitude of effects of the Proposed Project on Land, Soils and Geology.

The only way the Proposed Project can have cumulative effects with other off-site projects and plans is via the drainage and off-site surface water network, and this hydrological pathway is assessed in Chapter 9. The construction of the Proposed Grid Connection works will only require relatively localised excavation works within the Site and therefore will not contribute to any significant cumulative effects.

8.6.8 Post Construction Monitoring

No monitoring is required with respect to the land, soils and geological environment.