MWP

CHAPTER 8 LAND AND SOILS

Brittas Wind Farm

Brittas Wind Farm Ltd

November 2024

MWP

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8. Land and Soils

8.1 Introduction

This chapter describes any potential effects on land and soils due to the construction, operation and decommissioning of the proposed development. A full description of the proposed development, development lands and all associated project elements is provided in Chapter 02 Description of the Proposed Development of this EIAR. The nature and probability of any effects on the existing land and soils environment arising from the overall development has been assessed. The assessment comprises of:

- A review of the existing receiving environment;
- Prediction and characterisation of any likely effects;
- Evaluation of effects significance; and
- Consideration of mitigation measures, where appropriate and required.

8.1.1 Competency of Assessor

The assessment was written by Roman Puotkalis [BSc (Hons), MSc], an Environmental Consultant with MWP. He holds a MSc in Environmental Analytical Chemistry and BSc (Hons) Environmental Science from University College Cork. Roman has been involved in geo-environmental investigation/interpretation and hydrogeological assessment and investigations. Roman has written Land and Soils chapters for various projects such as wind farms, grid routes and power generating stations. This included assessment of environmental impact on Land, Soils, Geology, and Hydrogeology, as well as cumulative impacts with various other aspects of the environment. He has also worked on Phase 1 and 2 environmental site assessments for several projects including pharmaceutical facilities, substations, mines, and power stations.

The assessment has been reviewed by Kate Cain [BSc (Hons) Geography and Environmental Management]. Kate is an Environmental Consultant at MWP and has over 15 years of experience. Kate has authored EIA Screening reports, Environmental Impact Assessment Reports (EIAR), Detailed Site Assessments, Environmental Reports and Construction and Environmental Management Plans (CEMPs) for a wide range of projects. She has a strong background in hydrology and has undertaken water chapters and Water Framework Directive assessments for a wide range of projects.

A site investigation was undertaken by Northwest Geotech, a geotechnical engineering company, to generate a Ground Investigation Report to provide geotechnical information for the input into the design of the windfarm (dated 26th February 2024).

8.1.2 Legislation

This document is in compliance with the following European and Irish legislation:

- EU Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the Environment as amended by Directive 2014/92/EU of the European Parliament and of the Council;
- Heritage Act 2018;
- Planning and Development Act 2000 (as amended);

- Planning and Development Regulations, 2001 – 2023

8.1.3 Guidelines and Policy

The following guidelines and policies have been complied with to the extent that they are applicable for the preparation and assessment of effects from the proposed project on land and soils, including:

- Coillte (2009): Forest Operations & Water Protection Guidelines;
- Environmental Protection Agency (2022): Guidelines on the Information to be contained in Environmental Impact Assessment Reports;
- EU Environmental Impact Assessment of Projects: Guidance on Scoping. European Union;
- Environmental Protection Agency (2022): Glossary of Effects included in Guidelines on Information to be contained in Environmental Impact Assessment Reports; (EPA, 2022);
- European Union (2017): Guidance on the preparation of the EIA Report (Directive 2011/92/EU as amended by 2014/52/EU);
- Institute of Geologists Ireland (2013): Guidelines for the Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements;
- National Roads Authority (2005): Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment (DoHPLG, 2018);
- National Roads Authority (2009): Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes; and
- Scottish Executive (2017): Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Developments, 2nd Edition.
- Tipperary County Council (2022): Tipperary County Development Plan 2022-2028.

8.2 Methodology

The assessment methodology included a desk-based study, site investigation and a qualitative assessment of the potential effects. A flexibility application was granted by ABP for the proposed project - which allows for the consideration of 3 different turbines with variable designs, blade lengths, and hub height. This application was made due to the difficulties of confirming the turbine types to be used at this stage due in turn to the lengthy decision making and appeal processes for wind farm planning applications. The effects of the composite hardstand area for all three turbine types has been assessed in this chapter.

8.2.1 Study Area

The proposed Wind Farm Site is located 3km north of Thurles town. The proposed windfarm, BESS and substation are located within the townlands of Brittas, Rossestown, Clobanna, Killeenleigh, Brownstown and Kilkillahara.

The proposed grid route to Thurles 110kV substation is located within or along the boundaries of the townlands of Coolgarrane, Clobanna, Athnid More, Rossestown, Cassestown, Farranreigh, Laghtagalla, Furze, Loughlahan and Ballygammane.

The Turbine Delivery Route will begin at the port of Foynes in Limerick. The components will be delivered from the port to the proposed wind farm site along the Motorway, National, Regional and Local road network. The first section of the proposed route will be along the N69 and M7 from the Port to Junction 25 (Nenagh Centre) the second of the proposed routh is the R498, N62 and finally onto the L-8017.

8.2.2 Desktop Study

The methodology used for this study included desk-based research of published information and site visits to assemble information on the local receiving environment. The desk study included the following activities:

- Review of Ordnance Survey Mapping and aerial photography to establish existing land use and settlement patterns within the study area, refer to Section 8.3.3;
- Examination of the Geological Survey of Ireland (GSI) datasets pertaining to geological (bedrock, heritage, subsoil, etc.) and extractive industry data;
- Examination of Environmental Protection Agency (EPA) / GeoHive / Teagasc online soil and subsoil maps;
- Review of local and regional development plans and planning policy in order to identify future development and identify any planning allocations within the study area; and
- Review of Tipperary County Council's Planning Register to identify relevant development proposals currently under consideration by the Council.

Following the desktop study and field surveys, a set of geological and soils maps were generated in GIS using data acquired from GSI, the EPA and GeoHive Online maps, and are included as figures in this chapter.

8.2.3 Site Investigation

A Site Investigation (SI) was undertaken by Northwest Geotech on behalf of MWP on 16th December 2023 to provide geotechnical information for input into the design of the wind farm and provide information on the land and soils baseline conditions.

Twelve (12) trial pits were excavated using a 12t tracked excavator fitted with a 600mm wide bucket, to depths of up to 4.00m. Disturbed (small jar and bulk bag) samples were taken at standard depth intervals and at change of strata. Any water strikes encountered during excavation were recorded along with any changes in their levels as the excavation proceeded. The stability of the trial pit walls was noted on completion.

The following SI report has been prepared:

- Northwest Geotech, February 2024: Ground Investigation Report Brittas Windfarm, Thurles, Co. Tipperary (dated 26th February 2024).

The SI report is included as Appendix 8A of this EIAR.

8.2.4 Scope of Assessment

'Land and Soils' is considered a geological term in current, historical, and planned land use. The subject matter of hydrogeology is addressed in Chapter 09 Water of this EIAR.

Accordingly, the scope of this assessment is made with respect to these topic areas and considers the effects of the construction, operation, and decommissioning of the proposed development in terms of how the proposal could potentially affect the local land and soil environment, without appropriate mitigation measures being implemented if required. As part of consultation, GSI – a division of the Department of the Environment, Climate and Communications (DECC) were consulted, and a written response was received. The response provided a list of GSI's publicly available datasets. Written responses from statutory and non-statutory consultees are included as Appendix 1-E of this EIAR.

8.2.5 Assessment Criteria

The method of impact assessment and prediction follows the EPA (2022) *Guidelines on the information to be contained in Environmental Impact Assessment Reports (EIARs).* The methodology and approach for this proposed project site was informed by the guidelines outlined in the NRA 2005 guidelines assessment geology hydrology and hydrogeology for national road schemes.

8.2.5.1 Rating Sensitivity, Magnitude and Significance of Effects

A land and soils effects rating method has been developed with reference to 'Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes' (NRA, 2005). This document deals with major infrastructure developments and the assessment guidance is therefore deemed appropriate to the current project.

The receptors of this proposed project include the land, soils and geology in the project area. The land for the wind farm site and the grid connection route will include areas of the townlands of Brittas, Rossestown, Clobanna, Brownstown, Kilkillahara and Killeenleigh, for the wind farm site and for the grid route will include Killeenleigh, Coolgarrane, Clobanna, Athnid More, Rossestown, Cassestown, Laghtagalla, Farranreigh. Furze, Loughlahan and Ballygammane, all in County Tipperary. Soil receptors throughout the wind farm site and grid connection route include both well drained and poorly drained soils along with some shallow peat. The soils and subsoils within the proposed project area are discussed in Section 8.3.7. The geology receptors for the wind farm site and grid connection route include Carboniferous Limestone which is the Ballysteen Formation and Waulsortian Limestone. The grid connection route also traverses the Crosspatrick Formation. The regional geology of the proposed project site is discussed in Section 8.3.5.

The sensitivity of the receiving land, soils and geology environment was identified for the proposed project. The sensitivity of an environmental receptor is based on its ability to absorb an impact without perceptible change.

Using the NRA guidelines shown in Table 8-1, the land and soils present within the wind farm site and grid connection route have a mixture of both a high sensitivity and a low sensitivity. The well drained soils present on the windfarm site and grid connection route would indicate a high sensitivity and the poorly drained soils would indicate a low sensitivity. The small amount of peat present on the wind farm site would indicate that the sensitivity rating is low. The geology along the grid connection route would be classified as having a medium sensitivity as the bedrock may be karstified in some areas which would mean the attribute has a medium quality, significance or value on a local scale.

Then, the magnitude of the potential impact land, soils and geology impact was determined. The sensitivity rating, together with the magnitude of the potential impact, provides an overall rating of the significance of the effect prior to application of mitigation measures. The assessment of the magnitude of an effect incorporates the timing, scale, size and duration of the potential impact. The magnitude criteria for effects are defined as set out in Table 8-1 to Table 8-3.

Table 8-1: Sensitivity and importance of soil and geological attributes (Source: Box 4.1 in NRA, 2005)

Sensitivity/ Importance	Criteria	Typical Examples
Very High	Attribute has a high quality, significance or value on a regional or national scale. Degree or extent of soil contamination is significant on a national or regional scale. Volume of peat and/or soft organic soil underlying route is significant on a national or regional scale*.	Geological features are rare on a regional or national scale (NHA) large existing quarry or pit. Proven economically extractable mineral resource.
High	Attribute has a high quality, significance or value on a local scale. Degree or extent of soil contamination is significant on a local scale. Volume of peat and/or soft organic soil underlying route is significant on a local scale.	Contaminated soil on site with previous heavy industrial usage. Large recent landfill site for mixed wastes. Geological feature of high value on a local scale (county geological site). Moderate sized existing quarry or pit. Marginal economic extractable mineral resource.
Medium	Attribute has a medium quality, significance or value on a local scale. Degree or extent of soil contamination is moderate on a local scale. Volume of peat and/or soft organic soil underlying route is moderate on a local scale.	Contaminated soil on site with previous light industrial usage. Small recent landfill site for mixed wastes. Moderately drained and/or moderate fertility soils. Small existing quarry or pit. Marginal 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 route 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.

* Relative to the total volume of inert soil disposed of and/or recovered.

Table 8-2 Assessment of Magnitude of Land and Soils Impacts (Adapted from NRA, 2005)

Magnitude	Criterion	Description and Example
Major	Loss of attribute	Long term changes to the land use, geology, hydrology, water quality and hydrogeology, e.g., loss of EU-designated salmonid fishery: change in water quality status of river reach, loss of flood storage/increased flood risk, pollution of potable source of abstraction.
Moderate	Impact on integrity of attribute or loss of part of attribute	Short to medium term changes to the land use, geology, hydrology, water quality and hydrogeology: loss in productivity of a fishery, contribution of significant sediment and nutrient quantities in the receiving water, but insufficient to change its water quality status.
Minor	Minor impact on attribute	Detectable but non-material and transitory changes to the land use, geology, hydrology, water quality and hydrogeology - measurable change in attribute, but of limited size and/or proportion.
Negligible	Impact on attribute but of insufficient magnitude to affect the use/integrity	No perceptible changes to the land use, geology, hydrology, water quality and hydrogeology: discharges to watercourse but no loss in quality, fishery productivity or biodiversity, no increase in flood risk.

The potential significance of effects are assessed as being of Significant, Moderate, Slight or Not significant.

Table 8-3 Significance Rating derived from Magnitude and Sensitivity Ratings

Magnitude	Sensitivity/Importance			
	Very High	High	Medium	Low
Major	Significant	Significant	Moderate	Moderate
Moderate	Significant	Moderate	Moderate	Slight
Minor	Moderate	Slight	Slight	Not Significant
Negligible	Slight	Slight	Not significant	Not Significant

8.2.6 Statement on Limitations and Difficulties Encountered

Limitations and difficulties have not been encountered during this assessment.

8.3 Baseline Environment

8.3.1 Site Location and Description

The proposed wind farm site is located 3km north of Thurles town in the following townlands: Brittas, Rossestown, Clobanna, Brownstown, Kilkillahara and Killeenleigh in County Tipperary.

The proposed project site area is approximately 331.98 hectares and is presently a greenfield site. Refer to Figure 8-1 for the site location and wind farm layout. A full description of the site location is provided in Chapter 2 Description of the Proposed Development of this EIAR.

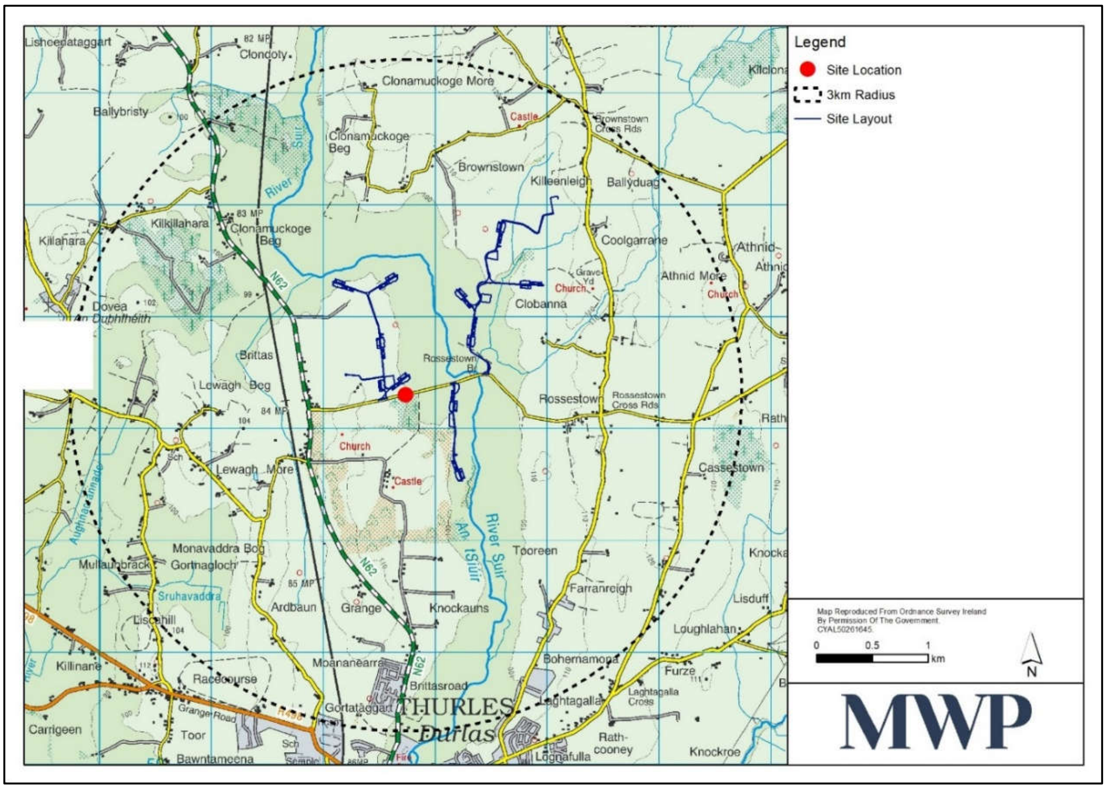

Figure 8-1: Site Location

Primary access to the proposed wind farm site will be provided from the local public Rossestown road (L-8017). There will be four site entrances. Three of these are located along the L-8017 road (**Figure 8-2**) and will provide site access during the construction, operational and decommissioning phases. The most westerly of these three site entrances provides access to turbines 1, 2, 6 and 8 as well as the Lidar and the main construction site compound to the north of the public road.

The middle entrance provides access to Turbines 9 and 10 and the borrow pit to the south of the L-8017. The third eastern entrance on the L-8017 provides access to turbines 3, 4, 5 and 7 as well as another construction compound and the proposed on-site substation. The fourth entrance (

) is to the substation only and will only be used for maintenance access during the operational phase. This entrance is located along the section of the L-4120 local road that goes northward on the eastern side of the River Suir.

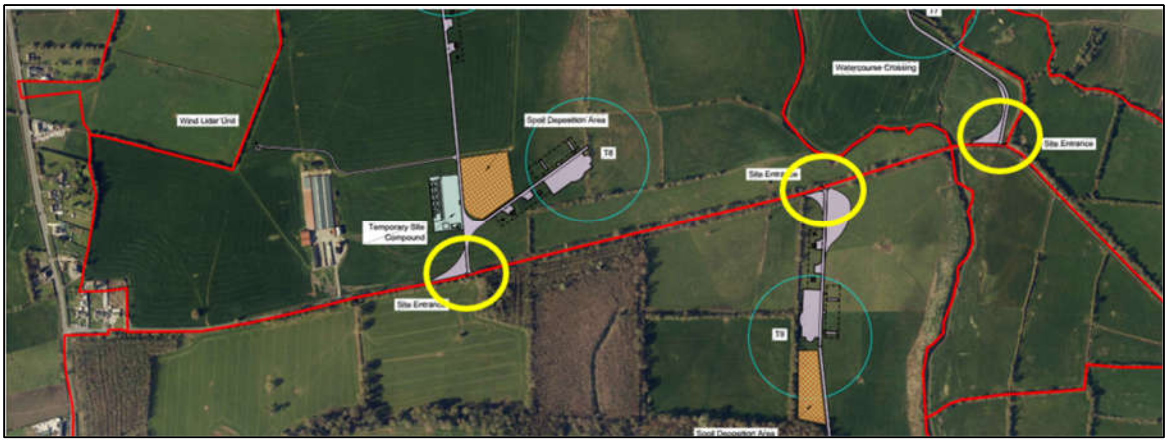

Figure 8-2: Three construction Site Access Points (circled in yellow)

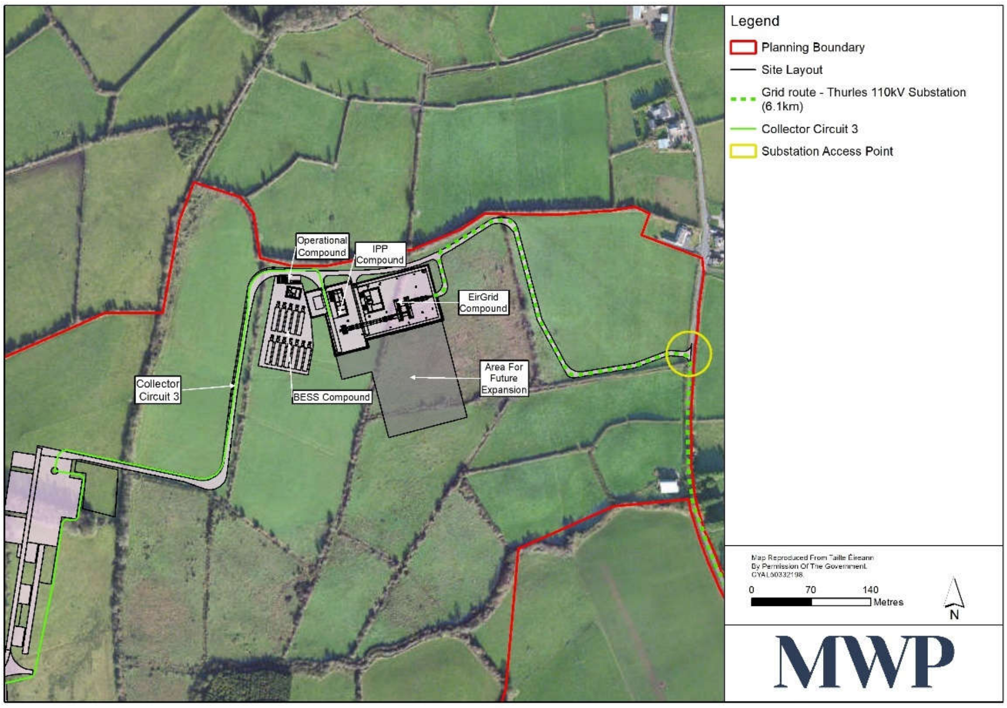

Figure 8-3: Access point for substation during the operational phase (circles in yellow)

8.3.1.1 Grid Route and Substation

The grid connection route and associated connection point for connecting the proposed Brittas Wind Farm to the National Grid as shown in Figure 8-4 has also been assessed in the EIAR. This will connect to the nearby Thurles 110kV substation located approximately 6.1km south-east of the proposed wind farm site.

The Thurles grid connection route starts from the onsite substation entrance and will follow the L-4120 road south to the L-8017 Rossestown road and turn east. At the next junction it will turn south along the L-4119 road to Thurles town. At the T-junction with the L-8015 road the route will turn east along the L-4009 and L-4119 road sections until the fork in the road and will then follow the L-8015 to Thurles substation.

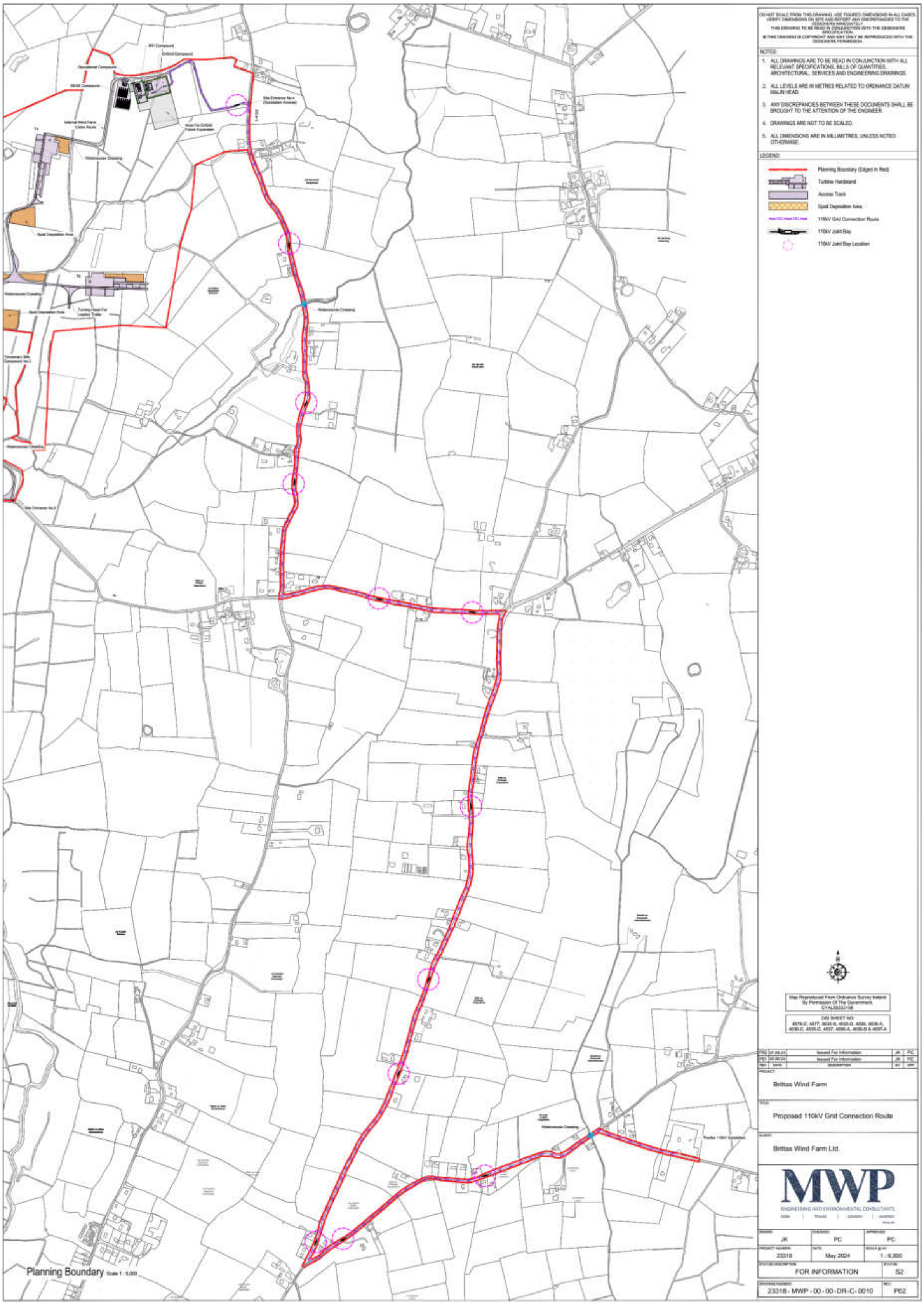

Figure 8-4: Grid Connection Route to Thurles Substation

8.3.2 Overview of the Proposed Development

The proposed project site is detailed in Chapter 02 Description of the Proposed Development of this EIAR. Refer to Figures 2-4, 2-5 and 2-20 in Chapter 02 Description of the Proposed Development of this EIAR for the infrastructure layout of the proposed development. The project includes following components:

- The proposed wind farm site, with associated turbines, hardstands, side entrances, access tracks, underground cabling, spoil deposition areas, temporary construction compounds, substation and BESS, and the rerouting of the permitted ESB 38kV overhead power line.
- The proposed grid connection route to the Thurles 110kV Substation
- The turbine delivery route

8.3.3 Land Use

The lands at the proposed project site are made up of agricultural fields bounded by hedgerows and treelines. An area of broadleaf forestry is located at the southwest of the site. The River Suir transects the site from north to south. The N62 is located west of the site, running north to south, connecting Templemore to Thurles. The L8017 local road traverses the centre of site from east to west, crossing the River Suir at a bridge point.

The land use at the proposed project site has been mapped as shown in Figure 8-5. The land cover mapping was created using information from CORINE Land Cover 2018 available on the EPA online mapping system.

The following land uses have been identified within and around the site:

- 231 - Pastures;
- 242 - Complex Cultivation Patterns;
- 311 - Broad Leaved Forest;
- 211 – Non- Irrigatable Land;
- 324 – Transitional Wood – Shrub;
- 112 – Discontinuous Urban Fabric;
- 313 – Mixed Forest; and
- 312 – Coniferous Forest.

The proposed project site is situated on land primarily composed of ‘’231- Pastures - with dense predominantly graminoid grass cover with floral composition’’, with a small section occupied by ‘’242- Complex Cultivation Patterns’’ in the central region of the site. ‘’311- Broad leaved forest’ and ‘’211- non-Irrigatable land’ are mapped in the south and southeast regions of the site.

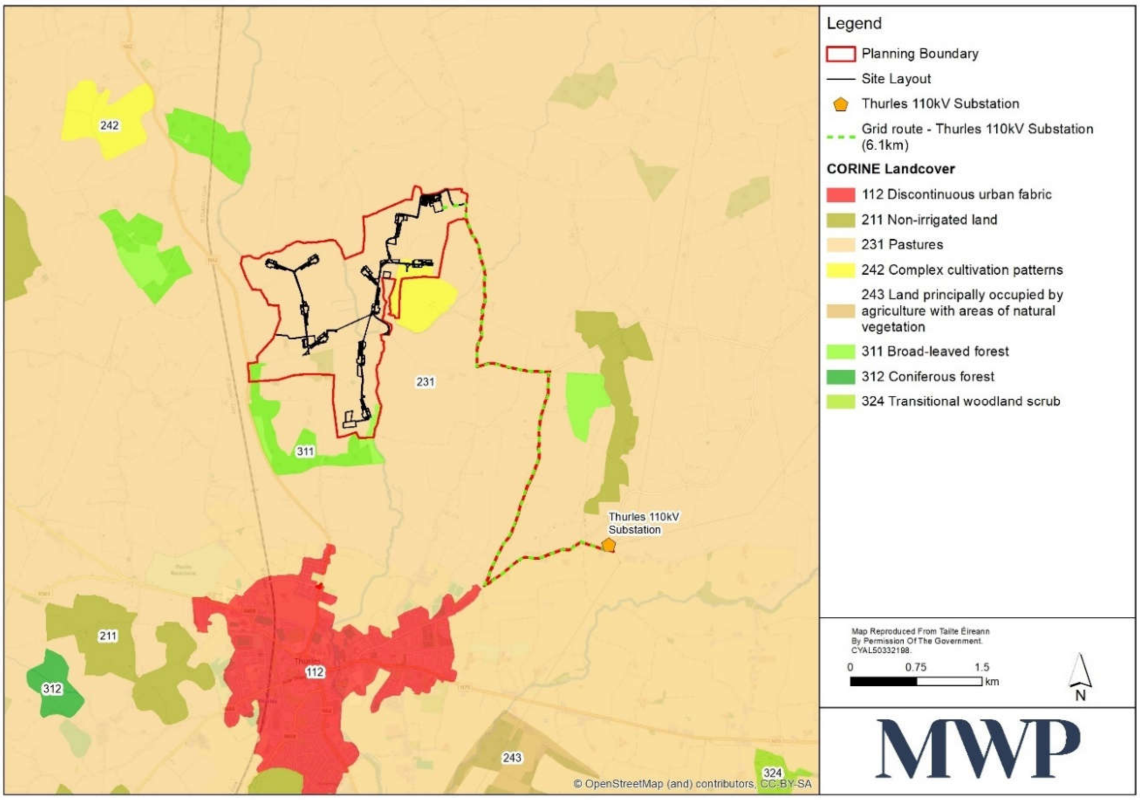

Figure 8-5: CORINE Landcover (source: EPA)

8.3.4 Topography

The proposed project sites overall topography is largely flat, with elevations ranging from 100m to 120m AoD. The centre and southern parts of the study area are low-lying regions incised by the Suir River, which flows into the site from the northwest. The ground levels drop by 5-10 m AoD along the river and slope up towards the embankment. The northern and eastern regions of site also consist of rivulets flowing into the study area from the northeast direction. See Figure 8-6.

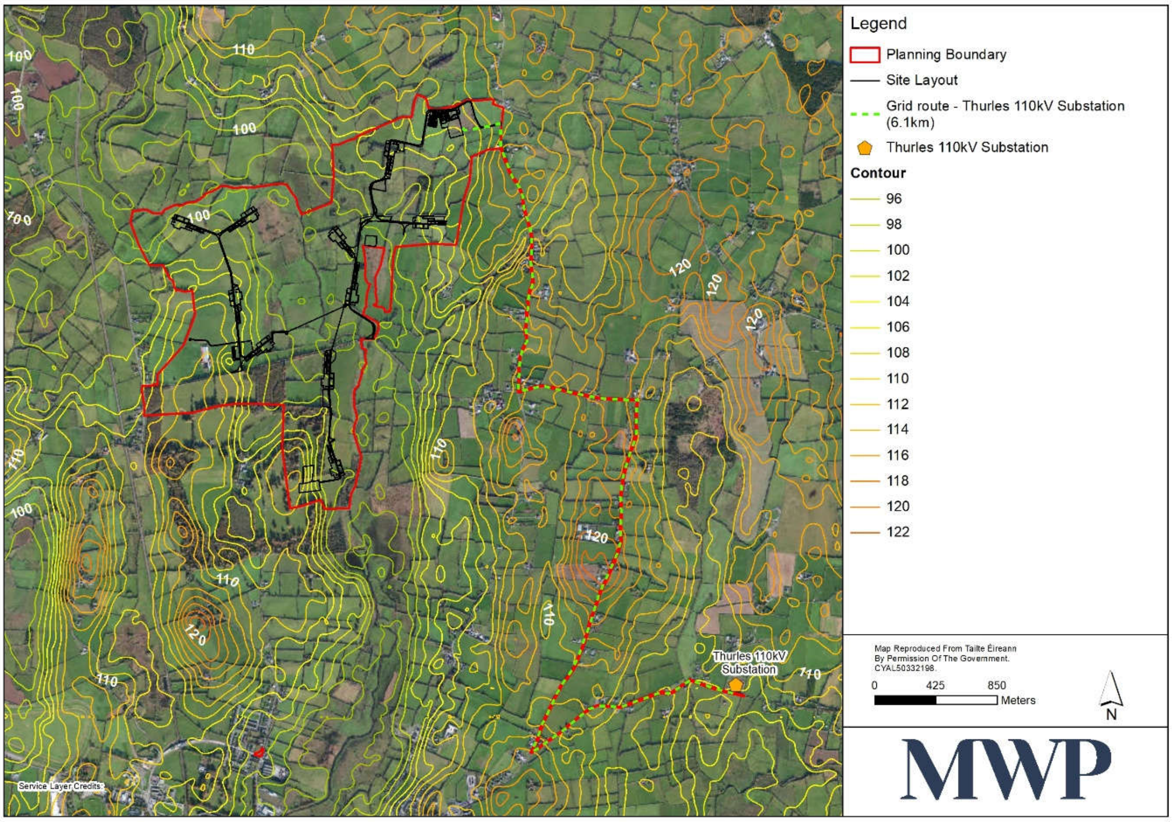

Figure 8-6: Topography (2m contour)

8.3.5 Regional Geology

The regional geology of Co. Tipperary is primarily composed of sedimentary rocks like mudstones, siltstones, sandstones belonging to the Silurian and Devonian periods, as well as limestones from the Carboniferous period. The landscape consists of mountain and plain regions.

The closing of the Iapetus Ocean during the Silurian period resulted in the deposition of oldest rocks such as grey mudstones, siltstones, and sandstones in the cores of Silvermines, Knockmealdowns, and Galtees. This was quickly followed by the deposition of sandstones and conglomerates throughout the margins of the mountains during the early Devonian period, indicating the beginning of a new cycle of depositional phase.

Later activities associated with the Caledonian mountain building event (also known as the Variscan Orogeny) in the late Devonian led to high erosional activity and earth movements, which stripped away the early deposited rocks of Silurian and Devonian age, leaving them partly preserved across the county.

This was followed by the Carboniferous period. Rising sea levels led to the inundation of the land, especially shallow environments, resulting in the deposition of first marine rocks of fossiliferous mudstones, and preserving the fossils like brachiopods, nautiloids, corals and trilobites in a high energy and high oxygenated environment.

The deposition of Carboniferous limestones across the country had a significant impact on the Irish environment. The marine mudstones were overlain by massive thick grey limestones across the low grounds. The limestones are believed to be deposited in horizontal layers and are unbedded in some places. Evidence of fossils like Trilobites and Brachiopods are preserved within the middle layers of these limestones.

The last Ice Age, which ended about 10,000 years ago, had a major influence in shaping the geomorphology of the country as we know it today. Large ice sheets hundreds of metres thick blanketed the area for tens of thousands of years, eroding the bedrock beneath. As the ice melted, the meltwaters reorganised the sediments, forming characteristic landforms such as eskers, fans and deltas of sand and gravel. Since the Ice Age, much of the exposed limestone in Tipperary has developed into karstified bedrock. The dissolution of the rock led to formation of caves, sink holes, lakes and mushroom shaped rocks. The geological processes continue to modify the landscape today, such as with seasonal flooding of the Shannon and Little Brosna River Callows. See Figure 8-7 for the bedrock geology in the region of the proposed development site.

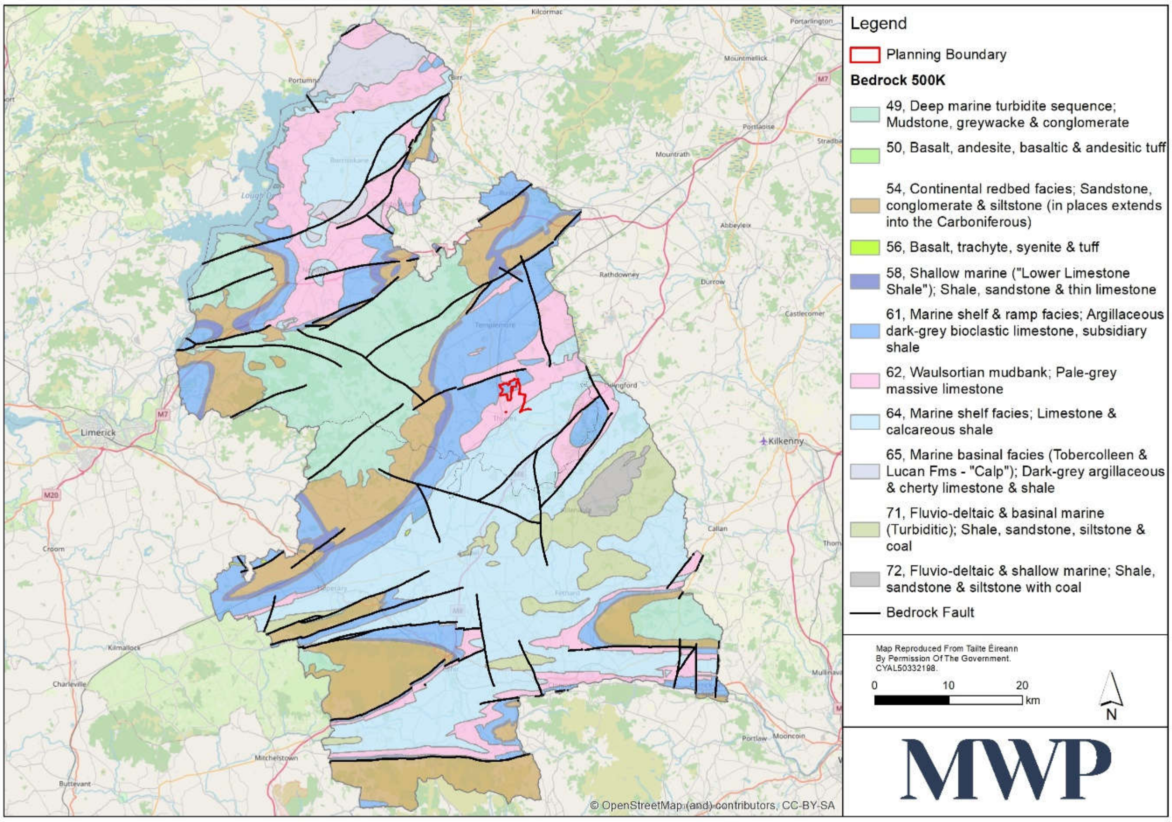

Figure 8-7: Bedrock Geology (Regional)

8.3.6 Local Geology

The proposed project site is underlain by Carboniferous Limestones, namely the *Ballysteen Formation*, *Waulsortian Limestones* and *in Waulsortian Limestones*.

These Carbonate rocks are massive, unbedded fossiliferous limestones, consisting of clastic and bio clastic components with varying composition of calcium and magnesium.

The Caledonian strike, which extends across the Irish midlands from Shannon estuary to the Irish Sea, is primarily responsible for the site's overall structural setting. The site area was subjected to severe deformation during the cycles of Caledonian orogeny, resulting in displacement of beds by substantial folding and strike-slip fault movements. These movements have also displaced the boundaries of dolomotisation resulting into sparsed presence within the underlain bedrock.

The regional bedding dips an average of 5-10^o southeast with folds trending east- west, southwest – northeast, along with fault sets trending east- west and north northeast- southwest.

According to the GSI data viewer, the southern part of the site is mapped with a synclinal fold trending southwest-northeast along with sets of cross faults passing through the site, one set strikes east- west and the second set strikes northwest-southeast. The site area also comprises of dolomitized regions which have been mapped within the synclinal fold.

Dolomitization has been seen within the Waulsortian and Ballysteen formations and the degree of dolomitized limestones in this area is yet to be seen.

The rocks found within and immediately adjacent to the site are described from literature below with the symbol for each formation given in brackets for cross-reference purposes with the GSI 1:100,000 scale bedrock geology map.

- Ballysteen Formation (CDBALL): Described as Carboniferous, fossiliferous dark grey – muddy Limestones, which are irregularly interbedded with Bioclastic limestones (Wackstones and Packstones) with fossiliferous Calcareous Shales. It is characterised with thicknesses of 100 -200m;
- Waulsortian Limestones (CDWAUL): Described as Carboniferous massive, unbedded lime- mudstones. Sometimes informally called "reef" limestones, although inaccurate. Dominantly pale grey, crudely bedded or massive limestone. Known to be moderately to intensely karstified. Typically 300 - 500 m thick; and
- In Waulsortian Limestones (CDWAULdo): Described as Carboniferous Dolomitised Limestones, with massive fine-grained limestones with distinct varieties and phases of dolomitization observed across the deposition sites. The large-scale dolomite is present in towards the Rathdowney trend area.

See Figure 8-8 for the map of the local geology sourced from the GSI database.

A summary of the ground types encountered during the SI in the exploratory holes is listed below, in approximate stratigraphic order:

- Topsoil: encountered typically in 300mm thickness across the site. Topsoil was noted as 'peaty' in several locations;
- Recent deposits (peat up to 0.5m depth): Very soft organic silt was encountered underneath the topsoil layers in some locations;
- Fluvioglacial deposits: typically medium dense sands and gravels interspersed with layers of sandy gravelly clay; and
- Glacial Till: sandy gravelly clay, frequently with low cobble content, typically firm or stiff in upper horizons, becoming very stiff with increasing depth.

See Appendix 8A for further detail including trial pit logs and photos.

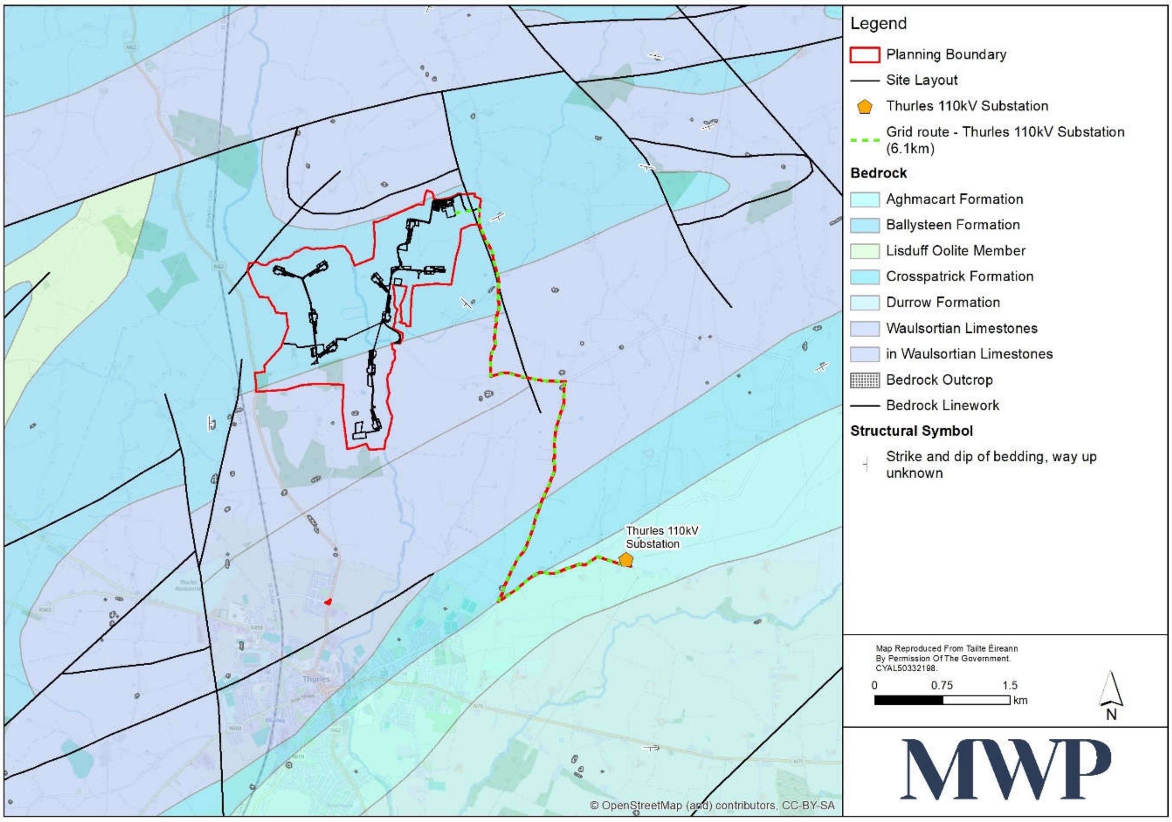

Figure 8-8: Bedrock Geology (Local)

8.3.7 Soil and Subsoil

Soil includes the topsoil (soil) and subsoil, which together provide for the following important functions:

- Facilitate the hydrological cycle in the filtration/recharge, storage and discharge of rainwater;
- Support all terrestrial ecology, including all flora and fauna (and all food crops);
- Protect and enhance biodiversity;
- Holding or preserving archaeological remains; and
- Provision of raw materials and a base on which to build.

Soil (topsoil) and subsoil may derive from parent geological material and organic matter under the influence of processes including weathering and erosion.

According to Teagsac / EPA Soil maps available on the GSI online mapping system, the predominant soil type on the proposed project site is *''BminDW- Deep well drained mineral with calcareous composition (mainly basic)''* followed by *''BminPD – Poorly drained mineral with calcareous composition (mainly basic)''* mapped in a few parts of north-east and southwest of the proposed project site. "*AlluvinMin -Alluvium*" is mapped over the banks of the River Suir and its tributaries in the southwest area. The proposed project site also comprises of few areas of ''*BminPDPT- Poorly drained peaty material calcareous in composition (mainly basic)*'' in the north and eastern side of the proposed project site. Areas of ''*Bminsw-Shallow well drained mineral (mainly basic)'' ''FenPT- Fen peat'' and ''BminSP- Shallow poorly drained mineral with calcareous composition (mainly basic)''*can also be found in central part of the proposed project site (See Figure 8-9).

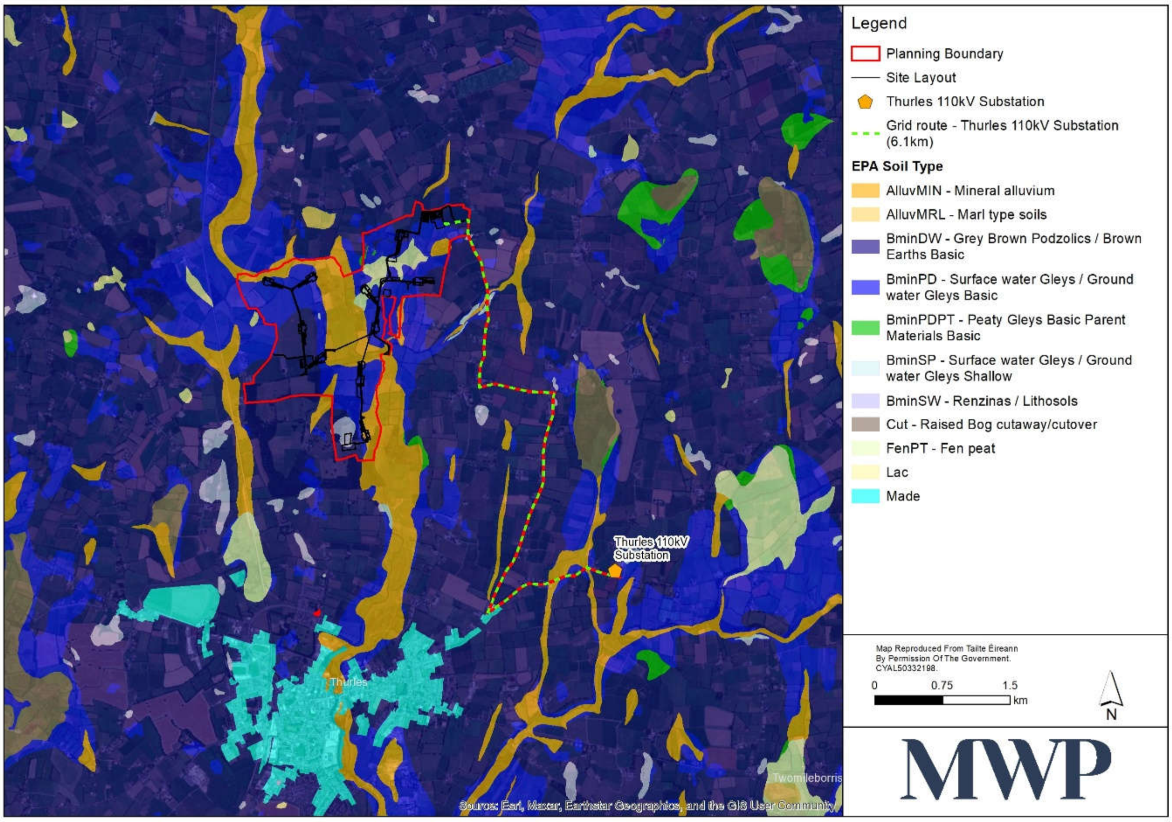

Figure 8-9: Teagasc Soils (source: GSI)

The Quaternary Sediments at the proposed project site as shown on the GSI online mapping system include ''*TLs – Tills derived from limestone*'' which dominate the proposed project site along with a few areas of ''*Alluvium*'' mapped in the central and southern part of the site.

The geomorphology of the area consists of sub -glacial bedforms like ''*Drumlins*'' - these are rounded hills formed by glacial drift formed beneath a glacier or ice sheet and aligned in the direction of ice flow. ''*Meltwater channels*'' - mainly formed when the original channel of a river is blocked by ice can also be found on the proposed project site. Meltwater builds up behind the blockage and, as the pressure is released, the energy causes the river to erode vertically, creating rapidly eroded meltwater channel. Ridges of streamlined bedrock can also be found across the study area (Figure 8-10).

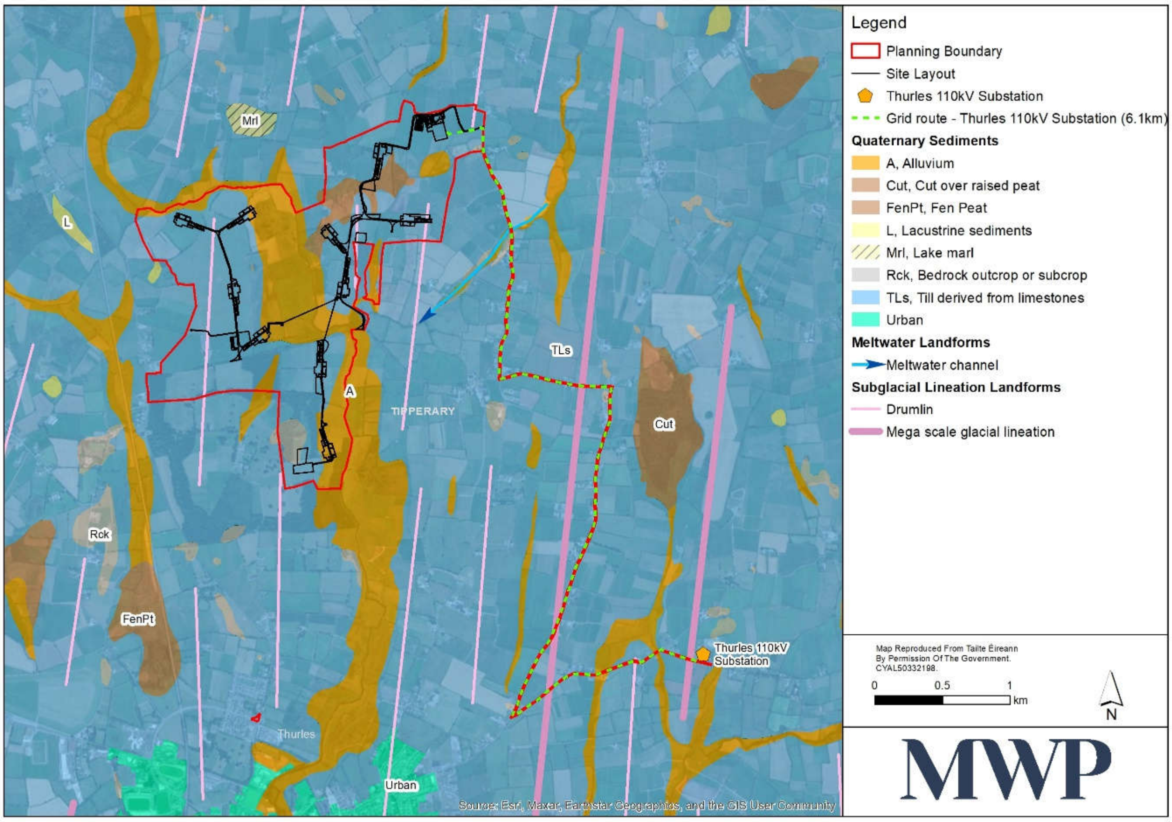

Figure 8-10: Quaternary Sediments and Geomorphology (source: GSI)

8.3.8 Geological Heritage

The GSI partnered with National Parks and Wildlife Service (NPWS) to identify, protect and promote the geologically important areas under the Irish Geological Heritage (IGH) programme. A committee of expert geologists provided an initial list of sites which then undergo a process of survey, reporting and review, to provide recommendations regarding Natural Heritage Areas (NHA) status or otherwise. These are then audited by local authorities along with The Heritage Council and fall under the protections of the Heritage Act 2018. These protected areas are differentiated based on themes varying from Karst, Palaeontology, Quaternary, Hydrogeology, and many others.

A review of the GSI Geological Heritage Database available on the GSI online mapping system indicates that there are no Geological Heritage Sites also known as County Geological Sites (CGSs) within the proposed project site boundary. The nearest mapped geological heritage sites to the proposed project site range from 3.4 to 10.6km away and are shown in Figure 8-11 and described in Table 8-4.

Table 8-4: Geological Heritage Sites in Proximity to Site (GSI online database)

Feature Name	Feature Description	Distance from Site
Thurles Cathedral (TY065)	A large Cathedral Building within the town of Thurles with brilliant exhibit of different marbles in structural and decorative use	3.4 Km South
Tobernaloo (TY068)	This one of the largest spring in Co.Tipperaray where it emerges from deep glacial till deposits at the edge of an alluvial flat.	5.4m Southwest
Lisheen Mine (TY044)	A former mine site, famous for major Irish type – Zinc- Lead deposit, now it's the location of National Bioeconomy Campus	Approx 5Km East
Littleton Bog (TY047)	An extensive area of peatland in a wide flat plain, important for the pollen present within the peat.	Approx 8Km Southeast
Carbragh Wetlands (TY018)	The site comprises of Carbragh marshes, which lie in a low-lying tributary valley of river suir. The wetlands are recognised for the geological and geomorphological diversity	Approx 7.5Km Southwest
Ballyoughter Bridge (TY010)	A stream section with exposed bedrocks comprising fossils of Michelina, Corals with honeycombed appearance	10.6Km Southwest

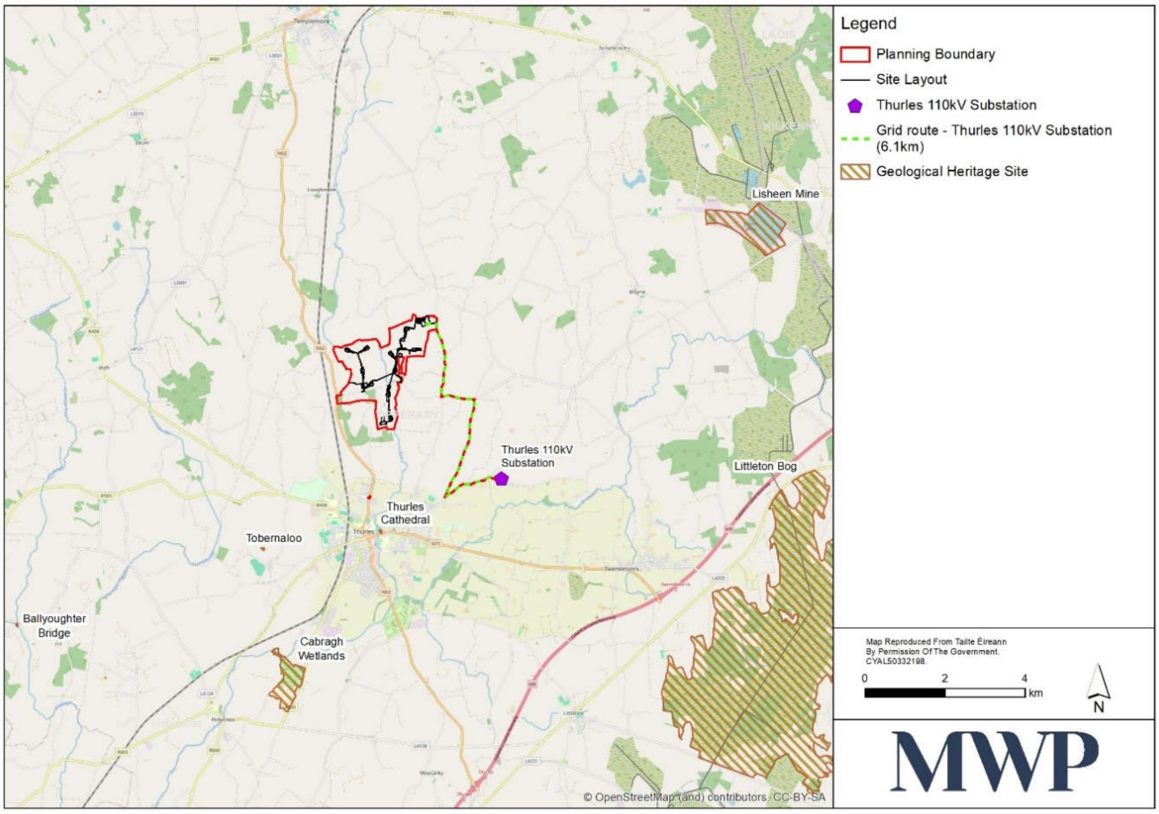

Figure 8-11: Geological Heritage Audited Sites (source: GSI)

8.3.9 Economic Geology

According to the GSI Map Viewer, there are a number of mineral locations, quarries and pits operating outside of the red line boundary of the proposed project site:

- Castletown Quarry (TY001) – Rock deposit: Blue Limestone;
- Killough Quarry (TY015) – Rock Deposit: Limestone;
- Lisduff Quarry (LS004) – Rock Deposit: Limestone;
- Curraghduff Quarry (TY003)- Rock Deposit: Greywacke;

Ballybeg Pit (TY005) – Rock Deposit: Unsorted; and Cloncannon Quarry (TY006) – Rock Deposit: Coarse sand and natural gravel products.

The economic geology sites in the area are shown in **Figure 8-12.**

The closest quarry to the site is Castletown Quarry which is located approximately 6km east of the wind farm site. Castletown Quarry is a blue limestone quarry which produces aggregates for concrete, hardcore, farm drainage and earthworks/fill.

Recorded mineral locations have the potential to be used for future mineral extraction. According to the GSI, there are a number of recorded metallic and non-metallic mineral locations in the area. The closest mineral location to the site is a stream outcrop of brecciated and stained limestone which is located approximately 0.6km from the nearest point of the proposed project site boundary in the townland of Ballyduagh.

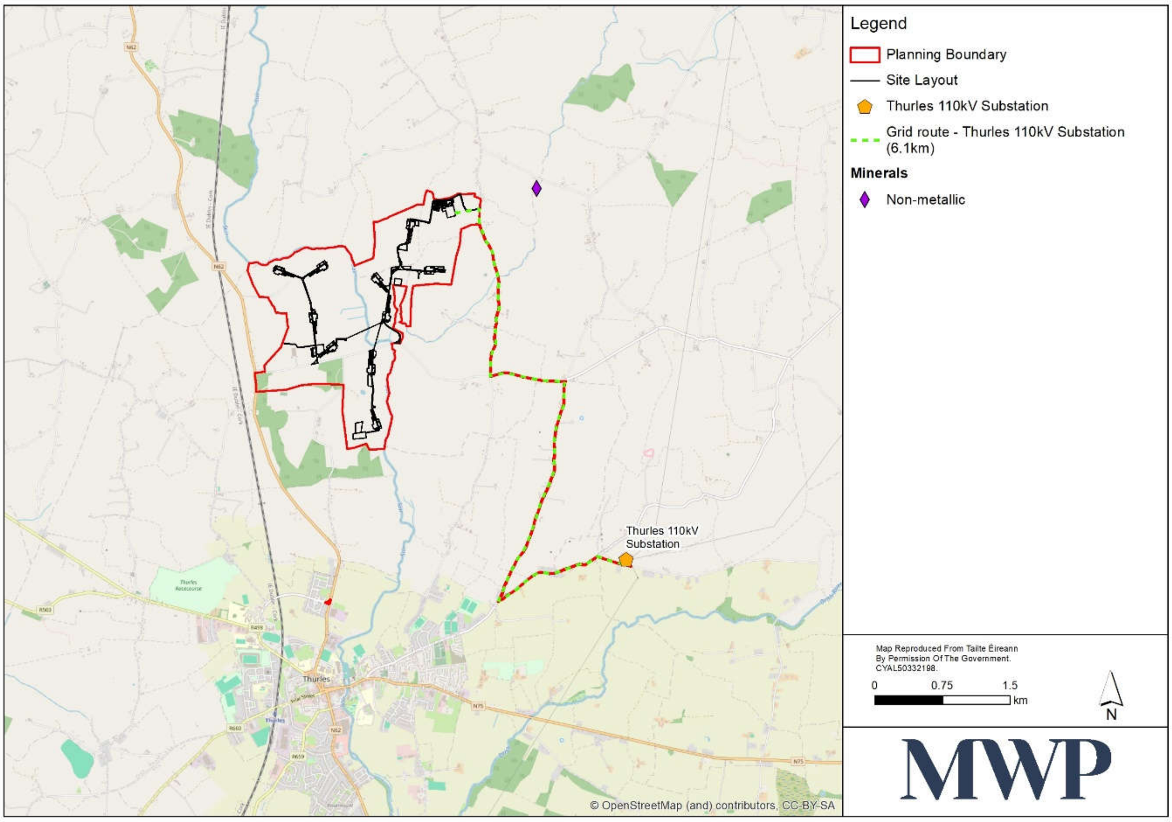

Figure 8-12: Economic geological sites (source: GSI)

8.3.10 Existing Slope Stability

From a desk-top review, the GSI's Landslide Events database has no records of any landslides recorded within the proposed project site. The entire proposed project site is situated in "low" or "low (inferred)" landslide susceptibility classified areas (Figure 8-13).

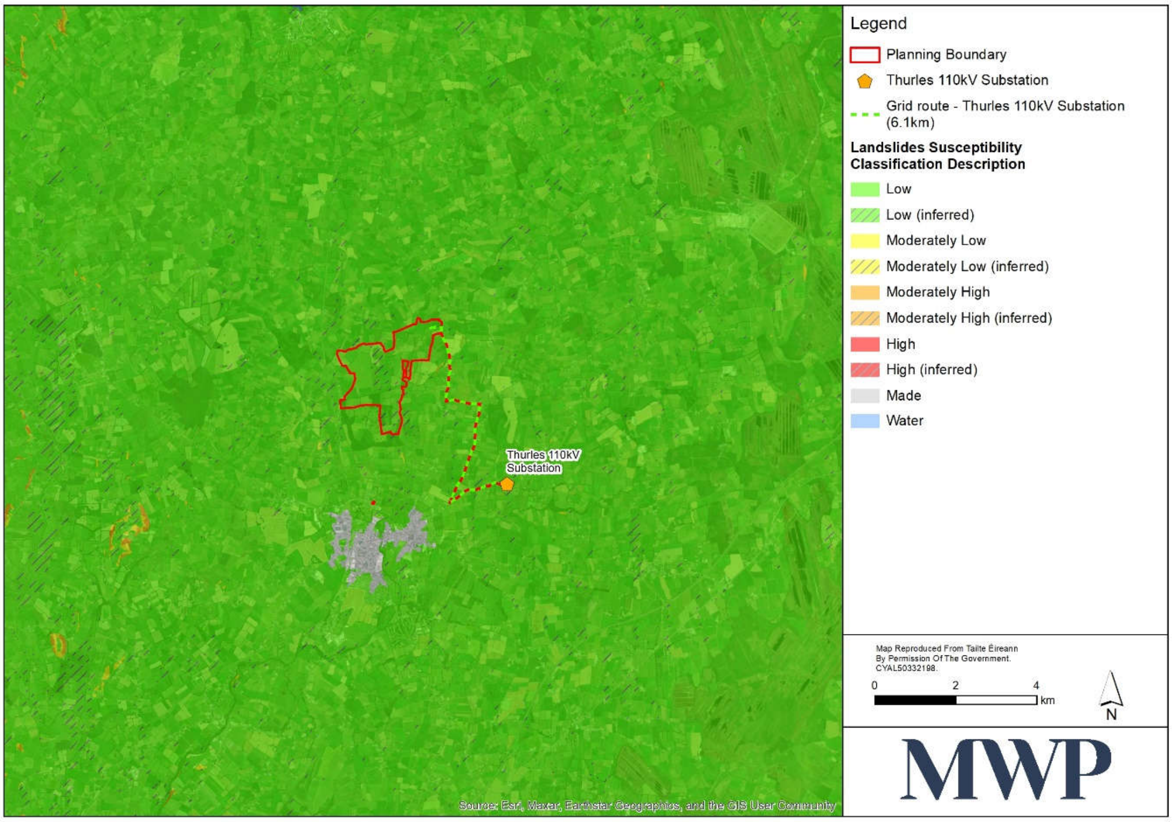

Figure 8-13: Landslide Susceptibility and Historic Landslides (Source: GSI).

From a desk-top review, the GSI's Landslide Events database has no records of any landslide events recorded within or in proximity to the site.

Previous landslides within wind farms (e.g. Meenbog, Derrybrien and Ballincollig Hill) have occurred within the peat material. No peat is mapped within the proposed project site on the GSI Quaternary Geology Maps (Figure 8-10).

A scoping exercise was carried out to determine whether a detailed Peat Landslide Hazard and Risk Assessment is required for this site. This scoping exercise reviewed whether peat was present onsite. A localised area of peat was identified near T4 and the substation site. The depth of peat in this area was identified to be a maximum of 0.5m in depth. The land in the area is improved agricultural land. The topography of the area is of a low gradient. Given the localised nature of the peat, shallow depths and low gradient, a quantitative peat stability risk assessment was not deemed necessary. Overall, there is no risk of instability of the site, access roads, turbine bases, or grid connection from peat.

8.3.11 Extraction and Deposition Areas

There are no existing extraction or deposition areas onsite.

8.4 Assessment of Effects

This section addresses the potential impacts on the land and soils environment from activities arising during construction, operation and decommissioning phases of the proposed project site and makes a determination on the likelihood of occurrence. The project has incorporated some elements of mitigation into the construction and operational design of the project. Assessments are therefore based on this being implemented.

8.4.1 Do-Nothing

If the proposed wind energy development for which this document has been prepared does not go ahead, it is assumed that the land use will remain unchanged without the construction of the wind farm. Agricultural practices will remain the same. There will be no alteration of the existing land and soils.

8.4.2 Mitigation Incorporated into the Design of the Project

This section details the proposed mitigation measures that have been developed through the design of the proposed project (mitigation by avoidance and mitigation through design). The design of the project has been outlined in detail in Chapter 02 Description of the Proposed Project and Chapter 03 Civil Engineering of this EIAR and repeated in this chapter.

Sediment such as clay or silt can cause pollution during the construction phase of a civil engineering project due to the erosion of exposed soil by surface water runoff. The wind farm site has been designed in order to control erosion and prevent sediment runoff during the construction phase. The implementation of sediment and erosion control measures is essential in preventing sediment pollution. The system was designed having regard to:

- Knowledge of the site's environmental conditions;
- Previous experience of environmental constraints and issues from construction of wind farms in similar environmental conditions;
- Technical guidance and best management practice manuals (see further details in Chapter 03 Civil Engineering)

8.4.2.1 Design Principles for Land Use

To reduce the potential effect of changing the land use associated with the footprint of the proposed project site, the footprint of the works has been minimized to avoid unnecessary splitting and encroachment into existing agricultural fields, soil sealing, disruption etc. Material extraction will be minimised as much as possible. A minimal volume of soil and subsoil will be removed to allow for infrastructural work to take place in comparison to the total volume present on the site, due to optimisation of the layout by mitigation though design. A minimal volume of material will be imported to accommodate the works. This material is required for access track construction, hardstand construction and other structures, such as the compound and storage facilities. Turbine locations, the alignment and rotation of the hardstands, and the routes of proposed new access tracks were designed to optimise the balance between access criteria and the required volumes of excavated and imported materials. The turbine foundations will be backfilled with a cohesive material, where possible using the material arising during the excavation, and landscaped using the vegetated soil set aside during the excavation.

The turbine hardstands of the proposed project site will be reinstated at the end of the operational life of the proposed project site such that it can be used again for agricultural/pastural and/or forestry purposes. The land outside the proposed project sites footprint, will not be affected by the development, and current land use practices will remain in place on these lands over the lifetime of the development. The area of land required to construct, operate, maintain and ultimately decommission the proposed project site has been kept to the minimum reasonably practicable area as part of the design process. Existing access tracks have been utilised in the design as much as possible such that the existing land use does not change in these areas of the site during the operational life of the proposed development. This approach minimises the area temporarily altered from its current land use.

These measures are designed to reduce the effect of land use change by sequestering carbon, reducing waste (soil, subsoil, and rock materials), target limitations and controls on soil sealing, and not changing the use of the original lands where practicable.

The proposed grid connection route was designed to minimise the length of cabling to connect the wind farm to the grid, with the entire route within existing roads, thereby not significantly impacting on current land use.

8.4.2.2 Site Drainage Design Principles

The site drainage system was designed integrally with the proposed wind farm infrastructure layout as a measure to ensure that the proposal will:

- Not change the existing flow regime across the site;
- Not deteriorate water quality; and
- Safeguard existing water quality status of the catchments from sediment runoff.

The design allows for site specific measures to manage water on site and it will be constructed specifically for the site to attenuate run-off, guard against soil erosion and safeguard downstream water quality. The drainage system will be implemented along all work areas including all internal site access tracks, storage areas, crane hardstand areas, substation and BESS compounds and temporary site construction compounds. Refer to Chapter 03 Civil Engineering of this EIAR for further details.

A fundamental principle of the drainage design is that clean water flowing in the upstream catchment, including overland flow and flow in existing drains, is allowed to bypass the works areas without being contaminated by silt from the works. This will be achieved by intercepting the clean water and conveying it to the downstream side of the works areas either by piping it or diverting it by means of new drains or earth mounds.

This process will cause the normally dispersed flow to be concentrated at specific discharge points downstream of the works. To disperse this flow, each clean water drain will be terminated in a discharge channel running parallel to the ground contours that will function as a weir to disperse the flow over a wider area of vegetation. An alternative method is to allow the water to discharge through perforated pipes running parallel to the ground contours. Both methods will prevent erosion of the ground surface and will attenuate the flow rate to the downstream receiving waters. The specific drainage measures to be used at each location are shown on the drainage layout Planning Drawings 23318-MWP-00-00-DR-C-5025 to 5033 included with the planning application.

The clean water interceptor drains, or earth mounds will all be positioned upslope to prevent any mixing of the clean and dirty water. The outflow from these drains is then piped under the road at suitable intervals and at low points depending on the site topography.

Separating the clean and dirty water will minimise the volume of water requiring treatment on site. The dirty water from the works areas will be collected in a separate drainage system and treated by removing the suspended solids before overland dispersal. Dirty water drains will be provided on one or both sides of the access tracks and along the periphery of the turbines, crane hardstands, substation compound, met lidar, borrow pit and the temporary site construction compounds.

The treatment system will consist of a series of settlement ponds at designated locations throughout the site (refer to Section 9.5.5.7 of Chapter 03 Civil Engineering of this EIAR for further details). The outflow from the treatment system will be dispersed over vegetation in the same manner as the clean water dispersion and will become diluted through contact with the clean water runoff in the buffer areas before eventually entering the downstream watercourses.

The clean water interceptor drains, or earth mounds are all positioned upslope to prevent any mixing of the clean and dirty water. The outflow from these drains is then piped under the road at suitable intervals and at low points depending on the site topography. In the illustration 'dirty water' drains collect all incident rainwater that falls on the infrastructure. This water then drains to settlement ponds for removal of sediment before it is discharged via overland dispersal to the downstream watercourse.

The site drainage layout and drainage details are presented in Planning Drawing 23318-MWP-00-00-DR-C-5025 to 5033. The drainage layout is overlaid on background OSI mapping in the A1 drawings that accompany the planning application.

8.4.2.3 Design to Mitigate Flood Risk

To ensure that there is no unacceptable flood risk, the following design flood levels will be implemented:

- The design flood level for the proposed substation is the 0.1%AEP MRFS 95% CI flood level plus 500mm freeboard; and
- The design flood level for the proposed 10 no. turbines is the 1%AEP MRFS flood level plus 300mm freeboard.

In the Flood Risk Assessment undertaken (attached as Appendix 9A in Volume III of the EIAR), it was concluded that, once the above flood levels are implemented, the proposed project would not have an adverse impact on flooding elsewhere.

8.4.2.4 Drainage / Stream Channel Crossings

Wind Farm Site

The selection criteria for crossing natural / artificial drains and streams within the site were:

- Avoid crossing drains or streams at acute angles where possible;
- Avoid meanders at the crossing location;
- Cross where foundations could be constructed without excess excavation; and
- Consider vertical alignment requirements.

Where crossings are cut into relatively deep channels these channels would require significant upfill to maintain vertical alignment criteria for turbine deliveries along access tracks. Clear span pre-cast concrete culverts are the preferred installation as this avoids significant instream works. Also, as spans increase the height can increase accordingly allowing significant light penetration under the culvert. The increase in height is complimentary to the vertical alignment requirements for access road design. The contractor may opt for a different method, such as a HDPE pipe, if the site conditions restrict the use of clear span pre-cast concrete culverts. The site restrictions can be, but are not limit to, boundary encroachment, existing vegetation or proximity to protected areas. Refer to Planning Drawing 233128-MWP-00-00-DR-C-5416. The design of a clear span pre-cast concrete culvert crossings will ensure that:

- The existing channel profile within the watercourse is maintained;
- Gradients within the watercourse are not altered;
- There is unrestricted passage for all size classes of fish by retaining the natural watercourse stream / riverbed;
- There are no blockages within the watercourse. The large size of a clear span culvert allows for the passage of debris in the event of flood flow conditions;
- The watercourse velocity is not changed; and
- The clear span of a culvert will ensure that the existing stream / riverbank is maintained during construction which will in turn avoid the occurrence of in-stream works.

Construction of any clear span crossings will be supervised by the Construction Manager, a suitably qualified engineer, the project manager, and the Environmental Manager in accordance with Inland Fisheries Ireland "Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters, 2016" and Office of Public Works "Construction, Replacement or Alteration of Bridges and Culverts, 2013".

The installation works for the clear span pre-cast concrete culvert are proposed to comprise the following:

I. Prior to the commencement of works the design of the culvert will be submitted for approval to the Office of Public Works (OPW) under Section 50 of the Arterial Drainage Act, 1945 and to Inland Fisheries Ireland (IFI);

II. Upon design approval the extent of the excavations required for the culvert foundations at either side of the watercourse will be marked out. The foundations are to be set to an agreed minimum distance by IFI from the existing watercourse so as not to effect on the riparian habitat. Health and safety measures such as lifebuoys on stakes will be installed and where appropriate life jackets will be provided to persons working near the watercourse;

III. Appropriate environmental control measures such as, but not limited to, silt curtains, silt traps, mats will be erected on both sides of the watercourse. These environmental control measures will reduce the potential for sedimentation of the watercourse and can be seen in Section 3.14.3 of the Civil Engineering Chapter (3) of the EIAR.;

IV. Excavators will begin to excavate the foundations to formation level where all excavations will be battered back to a safe angle of repose (minimum slope angle of 45°) and comply with the final CEMP to be produced by the appointed contractor for the proposed wind farm All excavation works will stop in the event of heavy rainfall.

V. All excavated material will be transported to the on-site deposition areas located outside of the 50m hydrology buffer zone at the proposed borrow pit. Some of the excavated material will subsequently be reused as backfill around the culvert abutments and structure upon installation. Bare ground will be minimised;

VI. Once formation is reached at suitable ground conditions; steel reinforcement and shuttering will be installed. The culvert abutments will be prepared for the pouring of concrete by dewatering standing water within the excavations, which is likely to contain suspended solids, via a pump to an adequately sized settlement pond located outside of the 50m hydrology buffer zone. The standing water will be treated through the settlement pond and clean filtration stone prior to outfall over vegetation away from the watercourse;

VII. Ready-mix concrete will be delivered to the culvert abutments by ready-mix concrete trucks and placed into each abutment by means of excavators. During the concreting works the watercourse will be temporary covered over with a tarpaulin to protect the watercourse from concrete spills. Upon completion the abutments will be covered and allowed to cure;

VIII. Following curing, the shuttering around the abutments will be struck and removed. A small temporary hardstand will be constructed so that a lifting crane, which will install the pre-cast concrete culvert components onto the abutments, can be set up;

IX. Deliveries of the pre-cast concrete culvert components will arrive to site. These components will be individually fitted and manoeuvred into position by the lifting crane onto the concrete abutments. The components will be inspected to ensure that each unit is level and secure;

X. Backfilling on either side of the culvert will commence using excavated material, in particular larger rock of a uniform size will be placed along the edge;

XI. The access track surface will be laid over the culvert structure using stone aggregate and compacted in maximum 250mm layers with the use of appropriately sized rollers. An internal cable trench will be installed within the carriageway of the culvert so that it can cross over the watercourse;

XII. Vegetated soil bunds will be installed to divert dirty water generated on the section of road over the culvert crossing into the dirty water system outside of the 50m hydrology buffer zone. This will ensure that dirty water will not enter the clean watercourse; and

XIII. Steel parapet railings and timber post and rail fencing will be installed at the sides and on the approaches to the culvert. This will prevent persons or vehicles falling into the watercourse while travelling across the culvert.

The above point describes a crossing with no works within the watercourse however If works within the watercourse are accepted with the local authority and inland fisheries, then the contractor can opt to use precast concrete or HDPE pipes for crossing existing natural or artificial drainage / stream channels.

All crossings will be designed for a minimum 1 in 200-year return rainfall event. The invert of the pipe is submerged approximately 1/4 of its diameter below the original drainage bed. Where natural gradients allow, a nominal back fall in the pipe will be incorporated to prevent scour and promote the settling of natural material along the invert of the pipe.

New turbine service tracks will be required to cross several minor drains / streams within the site. All such crossings will be in accordance with this application and/or conditions attached to a grant of planning permission and agreed with the OPW and IFI prior to construction.

Clean and dirty water separation will be put in place at drainage and watercourse crossings to ensure dirty water does not enter clean watercourses. For the proposed wind farm, the intention is to use vegetated soil bunds to divert dirty water generated on the section of road over the crossings to the dirty water system. Alternatively, silt curtains are proposed to be placed along the existing tracks within the 50m buffer zone. These silt curtains are proposed to run parallel to watercourses with a layer of stone placed along the bottom to prevent any seepage if there is a risk of silted runoff.

Grid Connection Route

The grid connection route crosses two watercourses. Both watercourse crossings are along public roads. The watercourse crossings on L4120-18 (Rossestown Road) and L8015-0 (Furze Road) are single span masonry arch span bridges. The 110kV cable will cross the bridge in a flatbed formation or alternatively a horizontal directional drill (HDD) methodology will be used. Descriptions of the methodologies proposed for crossing this bridge are given in subsequent sections of this report. No instream works will be required.

Option 1 - Flatbed Formation over Bridges

Where ducts are to be installed over an existing bridge and sufficient cover cannot be achieved by installing a standard trefoil arrangement (min 600mm cover required for Trefoil), the ducts will be laid in a much shallower trench. The ducts will be laid in a flatbed formation over the existing bridge and encased with galvanized steel plates in a concrete surround.

It may be necessary to locally raise the level of the existing road to achieve the required cover over the ducts. The increased road level will be achieved by overlaying the existing road with a new wearing course where any addition of new pavement will be tied back onto the existing road. Any works to locally raise the level of the existing road and potentially the bridge parapets are to be agreed with Tipperary County Council prior to commencement with all works and reinstatement carried out to their satisfaction. Once the ducts have crossed the bridge the ducts will resume to the standard trefoil arrangement.

Option 2 – Horizontal Directional Drilling under Bridges and Watercourses

If putting the ducts in a flatbed arrangement is not preferred by the Local Authority, directional drilling will be utilised, which will require a service trench (launch pit) for the drill in the road either side of the watercourse. The directional drill process will require that the depth of the service trench will deepen in a defined slope as it approaches the watercourse crossing on either side, as to have sufficient passing depth under the watercourse. This method crossing method is shown on Planning Drawing 23318-MWP-00-00-DR-C-5429. Horizontal Directional Drilling will be carried out as follows:

- The directional drilling machine will set up at a launch and reception pit (an enlarged portion of on-road trench, i.e., a service trench on either side of the crossing point at an appropriate distance back from the watercourse). The drill will then bore in an arc under the watercourse feature;
- The drilling head of the boring tool has a series of nozzles that feed a liquid bentonite mix along the bore direction, which provides both lubrication and seals the cut face of the bore;
- Once the bore reaches the far side, the duct is then attached to the drill head and the duct is pulled back along the route of the bore to the original drilling point;
- Any bentonite mix is deposited within the bore shaft and spillage is collected at either end of the bore with a dedicated sump; all excavated material and excess bentonite will be removed from site and brought to an authorised waste facility;
- Once the duct is in place under the watercourse, the normal process of road trenching can continue from either side of the watercourse structure; and

- The launch and reception pits will be backfilled in accordance with normal specification for backfilling excavated trenches and to the satisfaction of Tipperary County Council.

Where land drains are encountered on the proposed grid connection route there are two scenarios, as follows:

- The hardstand areas for the TDR will run off to the existing surrounding drainage network. The areas of hardstand required for the TDR are quite small in comparison to the wider drainage network;
- If there is adequate cover over the drain crossing, then the new ducts and trench will pass over the drain without interruption to the drain. No works will be required within the drain at these locations. The trench at these locations will be installed in the existing public / access road; and
- In the event where there is insufficient cover over a drain crossing point, the new grid connection route will have to be installed underneath the existing drain crossing. To do this the following approach is adopted:
- The drain is blocked upslope of the crossing, and a sump is formed using sandbagging and stable clay soil material. This sump will accumulate water flow in the drain and will facilitate the use of an adequately sized submersible pump based on expected flow rates to over pump (fluming) the drain water across the road and back into the drain on the down flow section below the road;
- Two silt fences and filters will be put in place on the downslope of the crossing point to prevent siltation/sedimentation. Once the sump and over-pumping mechanism is in place, then the service trench excavation will progress;
- A section of drain crossing (pipe or stone culvert) is temporarily removed to allow the trench and duct to continue. The duct will pass under the drain and once in place it will be surrounded with lean mix concrete and then the trench will be backfilled with suitable stone from excavations or imported; and
- The drain will then be put back in place, surrounded with stone/lean mix concrete and the track restored to its finished level. The over-pumping measure will then be removed and normal drain flow resumes. The duct/trench work can then progress over the remaining length of the public / access road.

8.4.2.5 Spoil Management

Drainage and siltation control measures have been designed and will be put in place in all spoil storage areas. This will include a dedicated drainage network, temporary silt fences and settlement ponds designed to cater for the size of each storage area. Further details of the drainage philosophy that will be applied as well as siltation control systems and attenuation systems is given in Section 8.4.2.2 and 8.4.2.3 of this report.

8.4.2.6 Construction Works Area

Runoff from the internal roadways, hardstands and other infrastructure will be isolated from the clean catchment runoff by means of a series of open drains that will be constructed within the works areas. These drains will be directed to settlement ponds that will be constructed throughout the site, downhill from the works areas and as shown on the drainage layout (Planning Drawings 23318-MWP-00-00-DR-C-5425 to 5433). Each drain will incorporate a series of check dams that will attenuate the flow and provide storage for the increased runoff from exceptional rainfall events. The ponds have been designed to a modular size to cater for a single turbine and hardstand area or a 1,200m2 area of internal access road.

Dewatering of turbine base excavations can result in significant flow rates to the drainage and settlement system if high-capacity pumps are used. To avoid the need for pumping it is proposed to provide drainage channels from the excavations to prevent a build-up of water. Where this is not feasible, temporary storage will be provided within the excavations and dewatering carried out at a flow rate that is within the capacity of the settlement ponds.

8.4.2.7 Treatment Process

Drains carrying construction site runoff will be diverted into settlement ponds that reduce flow velocities, allowing silt to settle and reducing the sediment loading. A modular approach has been adopted for the design of the settlement ponds which have been sized to cater for a catchment area of 1,200m2 works area.

The settlement ponds have been designed as a three-stage tiered system and this has been proven to work effectively on wind farm construction sites. The three-stage system also facilitates effective cleaning with minimal contamination of water exiting the pond.

The settlement ponds have been designed with regard to the following:

- flow rate for the modular catchment area;
- Met Éireann Extreme Rainfall Data (statistical rainfall intensity / duration table);
- Character of the impermeable areas (runoff coefficients); and
- Design particle size and density.

The treatment process consists of primary, secondary and tertiary treatment as follows:

- The primary treatment consists of a three-stage settlement pond with an over-topping weir at each stage. The first chamber will remove most of the sediment load, while the remaining two chambers will remove most of the remaining load;
- Before the water is released onto the existing ground surface, it passes through a secondary treatment system in the form of a graded gravel filter bed; and
- The outflow from each interceptor is dispersed across a wide area of vegetation so that the velocity is minimised and the vegetation can filter out the residual sediment. This is the final or tertiary stage of the treatment process. Existing rills and collector drains within the tertiary treatment area are blocked off to prevent concentration of the flow.

Each sediment treatment unit has been sited using the contour maps and aerial photos to avail of any locally level areas and to ensure that the outflow is spread over as much vegetation as possible before entering an aquatic buffer zone.

Settlement ponds will require inspection and cleaning when necessary . This will be carried out under low or zero flow conditions so as not to contaminate the clean effluent from the pond. The water level would first be lowered to a minimum level by pumping without disturbing the settled sediment. The sediment would then be removed by mechanical excavator and disposed of in areas designated for deposition of spoil. Settlement ponds will include perimeter fencing and signage to ensure that there are no health and safety risks.

The design of the settlement pond system for the proposed project site is detailed in the Planning Drawing 23318-MWP-00-00-DR-C-5407. The hydraulic design of the settlement ponds is outlined in Appendix 3B.

The effluent from each settlement pond will discharge to an open channel, 8 to 10 metres in length, running parallel to the ground contours. This will form a weir that will overflow on its downhill side and disperse the flow across the existing vegetation. A minimum buffer width of 20m is specified between the overflow weir and downstream watercourses. Buffer widths are designed in line with Forests and Water, UK Forestry Standard Guidelines (Forestry Commission, 2011) on protection of watercourses during forestry operations and management. This method buffers the larger volumes of run-off discharging from the drainage system during periods of high precipitation, further reducing suspended sediment load to surface watercourses. The outflow weirs will not be located on slopes steeper than 3:1. Existing drains within the dispersion zone will be blocked off where necessary to provide additional attenuation, disperse the flow across a larger area of ground and prevent the re-concentration to a single flow.

8.4.2.8 Sediment Pond Design

Generally, high-intensity rainfall events have a short duration and lower-intensity rainfall events tend to have a longer duration. The Met Éireann Extreme Rainfall Data for the area demonstrate that the chance of occurrence of a storm event of a given duration decreases (higher return period) as intensity increases.

For a given return period the total depth of rainfall increases with storm duration but the actual rainfall rate over that period of time decreases. For the operation of the settlement ponds, it is the rate of flow rather than the total rainfall that is relevant. The return period is a measure of the likelihood that a storm of a particular intensity will occur in a given year. However, it is important to note that the chances of occurrence of a storm event with a particular return period are the same in each year but should on average occur once in that time period. This is expressed as an annual exceedance probability (AEP) of 1%; that is, it has a 1% chance of being equalled or exceeded in any year.

The runoff control measures for the proposed wind farm have been designed in the context of storm events of varying duration and intensity. The settlement ponds have been designed to cater for a maximum continuous flow rate associated with a medium-intensity rainfall event. Higher intensity runoff will be attenuated by the open drain collection system which provides temporary storage and limits the rate at which it enters the settlement ponds. This is achieved by the use of check dams within the open drains as described in Section 9.4.2.13. Longer duration storms of 24 hours or more generally have very low intensity and are not critical in terms of the runoff rates that they generate.

The modular settlement ponds are designed to operate effectively for the runoff rate associated with a continuous high rainfall rate of 20 mm/hour. This is approximately equal to a 60-minute duration storm event with a 10-year return period (M10 60). These rates are taken from the Met Éireann Point Rainfall Frequency table for the site location.

Theoretically, the pond depth is not relevant but in practice, a minimum depth is required to ensure laminar flow and to allow temporary storage of settled silt. The modular settlement pond has been designed with a surface area of 24m2 (12m x 2m) and a depth of 1.25m. This is divided into three chambers of equal length and in practice, it has been found that most of the settlement occurs in the first chamber with very low turbidity levels being achieved in the final effluent. The design is conservative and therefore has sufficient redundancy to cater for occasional higher runoff rates or sediment loads.

8.4.2.9 Attenuation Design

For rainfall intensities above the design value of 20mm/hour, the excess runoff needs to be temporarily stored. The storage is provided in the drainage channels by installing check dams at intervals along the channel as described below.

The storage volumes required for 10-year storm events of various durations are detailed in Section 3.14.4.14 of Chapter 03 Civil Engineering of this EIAR. The volumes are based on a catchment area of 1,200m2 and a runoff coefficient of 0.70. The maximum storage volume required is 6.61m3 for 15 minutes storm duration. This is equivalent to 24 minutes of flow through the settlement pond at the design-through flow rate of 5.10

litres/second. The stored water will drain off gradually as runoff from the works area subsides. The storage volume represents an average depth of 0.055m in a 200m long, 0.60m wide open drain and can therefore be easily accommodated in the drainage system.

8.4.2.10 Access Track Construction

On-site experience in wind farm construction and forestry development across the country has shown that the single most effective method of reducing the volume of sediment created by construction is the finishing of all service tracks with high quality, hard wearing crushed aggregate such as basalt, granite or limestone laid to a transverse grade. When surface water drains transverse across a road constructed from hard wearing aggregate, as opposed to low class aggregate, the level of suspended solids is reduced significantly. The internal tracks will be finished with a hard-wearing aggregate. This can have the added benefit of contributing a balancing pH to help protect water quality from acidic runoff. The proposed project is serviced by a local quarries (detailed in Chapter 02 Description of the Proposed Project of the EAIR) which can be used as a source of hard-wearing aggregate for road construction.

8.4.2.11 Check Dams

Check dams will be placed at regular intervals, based on gradient, along all drains to provide flow attenuation, slow down runoff to promote settlement and to reduce scour and ditch erosion. Check dams are relatively small and constructed with gravel, straw bales, or other suitable material. They will be placed at appropriate intervals and heights, depending on the drain gradient, to allow small pools to develop behind them.

8.4.2.12 Silt Fences

Silt fences placed along drains are an alternative method of reducing the volume of suspended sediment. They will be placed at the end of any locally steep section of drain. They have the double benefit of effectively producing a localised swale to reduce scour effects and attenuating and filtering the discharge

8.4.3 Receptor Sensitivity

According to the EIA Guidelines 2022, the sensitivity refers to the potential of a receptor to be significantly affected. The sensitivity of the receptors was rated in Section 8.2.5.1. This was done by rating the sensitivity low, medium, high and very high using the criteria in the NRA 2005 Guidelines. Using these criteria (see Table 8-1), the sensitivity of the land, soils and geology at the wind farm site is considered low as there are no economically extractable mineral resources, no valuable geological features, and the soil is poorly drained and of low to moderate fertility. Similarly, the sensitivity of the soils and geology under the roads along the Grid Route and the Turbine Delivery Route are considered low as they are of low value and are compacted and covered by the road surface.

8.4.4 Construction Phase

8.4.4.1 Effect 1: Soil and Bedrock Excavations

The predicted effects on land and soils for the proposed project are discussed in the following sections. As the bulk of the earthworks and excavations will be at the proposed windfarm site, where the wind farm will be constructed, this is the main focus of the assessment. The grid route and turbine delivery route are also assessed.

The activities that can cause damage to the existing geological environment may indirectly affect the aquatic environment without appropriate mitigation measures where required, as discussed in Chapter 09 Water.

8.4.4.1.1 Wind Farm Site

The proposed wind farm site will involve removal of soil, subsoil, and bedrock for facilitating the construction of elements of the proposed project such as access tracks and hardstand emplacements.

There will be a requirement to excavate some existing ground around the substation. The area of the substation compound will be marked out using ranging rods or wooden posts and the soil stripped and removed to a temporary storage area (in development footprint) for later use in landscaping. All remaining excavated material will be taken to the on-site borrow pit / storage areas for final deposition. The area will be surveyed, and all existing services will be identified. All soils on the substation site will be removed and replaced with site won compacted crushed rock or granular fill.

Formation of the substation compound will be achieved with compacted layers of suitable hardcore. It is proposed to topsoil and revegetate the cut and fill slopes required for the substation platform. The land use around the substation area consists of agricultural grasslands.

The BESS will be constructed along with the adjacent substation. Cabling trenches and access infrastructure will be completed first. The foundations necessary for elevating the battery containers will then be completed and the empty metal containers brought on to the site and accurately placed in their final position by a mobile crane. Following the placing of the containers, they are then filled with battery racks brought to the site by lorry and connected together via wiring. Upon completion of the wiring of the containerized solution, all the ancillary infrastructure (inverter units, step up transformers and cooling units) will then be installed and connected.

Without appropriate mitigation measures, soil and bedrock excavations have the potential to have an effect which can cause changes in the land and soils environment affecting its sensitivities. The magnitude of these potential impacts, prior to mitigation, is considered to be minor.

8.4.4.1.2 Borrow Pit

There is one proposed on-site borrow pit location which has been identified to provide 20% of the required fill material for internal roads, passing bays, hardstands, foundations, and temporary compound. The location of this proposed borrow pit is shown in Figure 8-14.

It is estimated that approximately 22,319 m³ of aggregate will be won from this borrow pit. The extraction of rock from the borrow pit may potentially be undertaken by a combination of rock breaking, ripping, and blasting. The effect rating for rock breaking, ripping and blasting is referred to in Table 8-5. Aggregates (rock, stone, gravel, sand) used during construction of the access tracks, hardstands, substation and BESS will be extracted from the proposed on-site borrow pit as discussed above. Large amounts of aggregates, concrete, and steel will be used during construction. Concrete and additional aggregate materials will be sourced from authorised facilities. The following quarries are in close proximity to the proposed site:

- Castletown Quarry (TY001) – Rock deposit: Blue Limestone;
- Killough Quarry (TY015) – Rock Deposit: Limestone;
- Lisduff Quarry (LS004) – Rock Deposit: Limestone;
- Curraghduff Quarry (TY003)- Rock Deposit: Greywacke; and
- Ballybeg Pit (TY005) – Rock Deposit: Unsorted.

These are the most likely sources to be used.

It has been calculated that there will be approximately 163,752 m³ of material excavated during the construction of the proposed project site. Approximately 78% of all soils and subsoils generated from excavation works (128,350 m^3) will be retained on site and reused in bunding, landscaping and localised earthworks. Excess spoil material will be stored on site in designated deposition areas and used to infill the borrow pit. Approximately 22% (35,402m^3) of excavated material will need to be classified and removed from site. The excavated areas will be revegetated with grass to return the area to agricultural land uses.

This will result in a permanent removal of subsoil and bedrock at these locations. Refer to Chapter 2 Project Description for full details.

Any potential waste soil will be notified under Article 27 (European Communities (Waste Directive) Regulations 2011) or treated to comply with Article 28 (European Communities (Waste Directive) Regulations 2011). Any materials containing invasive species will be appropriately managed and sent to authorised facilities.

Figure 8-14: Green hatched area showing Borrow Pit/Material Storage Location west of Turbine 10 which will also act as a deposition area.

8.4.4.1.3 Grid Connection Route

The majority of subsoil excavated along the grid cable connection route along the public roads will be reinstated to existing ground/road level following these works. The active construction area for the grid connection will be small, ranging from 100 to 200 meters in length at any one time, and it will be transient in nature as it moves along the route.

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The land use along the grid connection route comprises mainly of agricultural land and facilities and residential dwellings. In terms of effects to neighbouring lands and land uses, it is considered that the grid connection will not pose a risk to either existing or future land uses. Horizontal Directional Drilling (HDD) within the public road corridor will be used for two water crossings over streams along the grid route.

8.4.4.1.4 Turbine Delivery Route

Excavation of soils and subsoils will be required along the turbine delivery route at 2 no. locations where hardstanding areas are required, and the lowering of some road side banks in other locations. These works will result in temporary and transient disturbance of road surfaces and soil/subsoils. The soil/subsoil excavated along the turbine delivery route will be used locally for landscaping at the 2 no. locations where works and reinstatement are required.

The evaluation of the likely effects are described below. The lands within the windfarm site, grid connection route and turbine delivery route were assessed and rated. Due to the small scale of the facilities to be developed, the duration and design mitigation measures incorporated into the design the magnitude of these potential effects, prior to mitigation, is considered to be minor. As the magnitude is considered to be minor in the wind farm site and grid connection route and the sensitivity of the land and soils in the wind farm site and grid connection route is low this leads to the significance of the soil and bedrock excavation in the wind farm site and grid connection to be determined as not significant. The turbine delivery route has a **negligible magnitude** and **low sensitivity** leading to a **not significant** rating.

Refer to **Table 8-5** for the effect rating associated with excavation of natural material if not mitigated. Mitigation measures are outlined in **Section 8.5**.

The impact from soil and bedrock excavation in the windfarm site during the construction phase is assessed as **negative, localised, short-term, direct, likely, minor, low, not significant effect.**

The impact from blasting in the wind farm site during the construction phase is assessed as **negative, localised, brief and occasional, direct, likely, minor, low, not significant effect.**

The impact from ripping and crushing in the wind farm site during the construction phase is assessed as **negative, localised, temporary, direct, likely, minor, low, not significant effect.**

The impact from soil and bedrock excavation throughout the grid connection route during the construction phase is assessed as **negative, localised, temporary, direct, likely, minor, low, not significant effect.**

The impact from soil and bedrock excavation throughout the turbine delivery route during the construction phase is assessed as **negative, localised, temporary, direct, likely, negligible, low, not significant effect.**

Table 8-5: Construction Phase Effect 1 Rating

Effect 1: Excavation of Soil and Bedrock								
Impact	Quality of Effect	Spatial Extent	Duration	Other Relevant Criteria	Likelihood	Magnitude	Sensitivity	Significance
Wind Farm Site								
Soil and Bedrock Excavations	Negative	Localised	Short-term	Direct	Likely	Minor	Low	Not Significant
Borrow Pit - blasting	Negative	Localised	Brief & occasional	Direct	Likely	Minor	Low	Not Significant
Borrow Pit – ripping and crushing	Negative	Localised	Temporary	Direct	Likely	Minor	Low	Not Significant
Grid Connection Route								
Soil and Bedrock Excavations	Negative	Localised	Temporary	Direct	Likely	Minor	Low	Not Significant
Turbine Delivery Route								
Soil and Bedrock Excavations	Negative	Localised	Temporary	Direct	Likely	Negligible	Low	Not Significant

8.4.4.2 Effect 2: Change of Land Use

Land use is the term to describe the human activities which take place within a given area of space.

All new development proposals have the potential to affect the character of a local area and human environment by introducing a new and potentially incompatible land use activity which could result in physical disruption, severance or exclusion of the user's ability to continue existing activities, or the sterilisation of lands thus preventing any additional further land use potential.

The surrounding land use, outside the proposed project site, is a mixture of rural farmland, forestry and low-density residential settlement. The majority of the proposed project site consists of pastures with hedgerows and treelines forming boundaries between the pastures. An area of broadleaf forestry is located at the southwest of the site. Felling of some hedgerows and portions of existing woodland is required within and around wind farm infrastructure to accommodate the construction of the turbine foundations and associated hardstands, access tracks, and turbine assembly and turbine delivery routes. Overall felling of approximately 1.4 ha of forestry and removal of 4086m of hedgerow will be undertaken in line with best practice. See Chapter 02 Description of Proposed Development for further detail on tree and hedge felling.

The proposed works require the construction of turbine bases, hardstands, permanent meteorological lidar, substation, BESS, internal access tracks, cable trenches, grid connection and turbine delivery route works.

The construction works areas on the wind farm site will be minimized, fenced off and not available for existing agricultural land uses. Existing agricultural land uses will continue in the areas immediately surrounding the construction areas. Consequently, this will result in a partial loss of agricultural land uses on the wind farm site during the construction phase.

The construction works for the grid route and turbine delivery route will be in the public roads and immediately adjacent areas. This will have a temporary effect on existing road transport land uses. While the roads are not likely to be closed, there will be a need for temporary traffic accommodation and management measures.

With the removal of soil and subsoil from the construction areas, there will be slight alteration to site topography. However, these changes in the land and landscape due to the proposed project will be minor. All excavations will be reinstated to ground level/existing level where possible.

The temporary alteration of land use does not have the potential to alter the character of the land and soils (including geological) or the existing baseline trends.

Due to the small scale of the facilities to be developed, the short-term duration and design mitigation measures incorporated into the design the magnitude of these potential impacts, prior to mitigation, is considered to be moderate. As the magnitude is considered to be moderate for the wind farm site, grid connection route and turbine delivery route and the sensitivity of the land and soils in the proposed project site is low this leads to the significance of the change in land use to be rated as slight without the implementation of the proposed mitigation measures. Refer to Table 8-6 for the effect rating if not mitigated. Mitigation measures are outlined in Section 8.5

The impact from the changes of land use throughout the wind farm site, grid connection route and turbine delivery route during the construction phase is assessed as **negative, localised, short term, direct, likely, moderate, low, slight effect.**

Table 8-6: Construction Phase Effect 2 Rating

Effect 2: Change of Land Use								
Impact	Quality of Effect	Spatial Extent	Duration	Other Relevant Criteria	Likelihood	Magnitude	Sensitivity	Significance
				Wind Farm Site				
Change in Land Use – Land and Soils	Negative	Localised	Short-term	Direct	Likely	Moderate	Low	Slight
				Grid Connection Route				
Change in Land Use – Land and Soils	Negative	Localised	Short-term	Direct	Likely	Moderate	Low	Slight
				Turbine Delivery Route				
Change in Land Use – Land and Soils	Negative	Localised	Short-term	Direct	Likely	Moderate	Low	Slight

8.4.4.3 Effect 3: Soil Erosion, Soil Compaction and Soil Stability

Soil Erosion

Soil erosion is the process whereby agents, such as wind and water, gradually detach, remove, and transport soil particles, causing a breakdown in the soil resource. Soil erosion from wind, water and ice can occur when:

- Topsoil is removed, exposing the soil and subsoil;
- Soil levels from cut and fill practices are altered due to excavation and compaction;
- Open excavations are left exposed for a period of time;
- Stockpiles and exposed soil is not maintained or stored incorrectly;
- Activities from earthworks leave soils exposed;
- Mismanagement of material transport, material alterations and waste disposal occurs;
- Other construction activities such as vehicular movement and heavy machinery with large tyre threads remove topsoil and soils from excavations; and
- Heavy rainfall causes soil to mobilise.

During the construction phase, volumes of soil, subsoil and bedrock will be excavated, moved, altered and/or removed from certain areas of the site. Topsoil and subsoil will be reused for landscaping where possible. Excavated soil, subsoil and bedrock will be required for site levelling, construction of the wind farm site infrastructure, i.e., gravity foundations for turbine bases, crane hardstands, meteorological mast, substation, grid connection, access tracks and drainage accommodation works. This will result in permanent removal of material at excavation locations. Stone (outside of that sourced from the on-site borrow pit) required for the construction of new access tracks, construction compound and drainage will be imported from local quarries, where required.

The accommodation works associated with the TDR route will include the localised excavation of existing overburden deposits. The potential impact will be from the exposure of the overburden and underlying bedrock to erosion via surface water ingress during the works.

The total volume of excavated material for the proposed project site is approximately 163,752m^3. All material volume estimates can be found in Table 3-3 in Chapter 03 Civil Engineering of this EIAR.

Excavation, material management, and vehicular movement activities will be managed during construction as detailed in the Construction Environmental Management Plan (CEMP) (Appendix 2B).

Soil Compaction

Soil compaction describes the reduction of pore space within the soil structure. This also causes the soil to have less total pore volume, an increase in bulk density, reduced rate of water infiltration and drainage, expulsion of air within the soil, and change in soil strength.

Soil compaction may occur due to movement of overland traffic, such as construction and maintenance vehicles. Regular movement of heavy vehicles and plant on off-alignment sections, and greenfield areas would result in an increased risk to soil and subsoil integrity during the construction phase of the proposed wind farm site, without implementation of mitigation measures discussed in further sections. Without mitigation, other effects such as a temporary increase in surface water runoff, and subsequently an increase in erosion may result.

Slope Stability

A slope failure involves a mass movement of earth material under shear stress along one or several surfaces. The movement may be rotational or planar (Landslides in Ireland, (GSI, 2006)). A slip is defined as a small movement of soil, debris, earth, or rock down a slope. It can take the form of a minor landslide, a land slip, a soil slip, or soil creep. These can affect the land and soils environment during the construction phase of this proposed project , particularly during excavations, material movement, earthworks, and storage of material on the proposed project site. Without appropriate mitigation measures put into place on the windfarm site, grid connection route and turbine delivery route, as outlined in further sections, this can result in several direct effects including erosion, contamination, sedimentation, instability of the land, and waste generation, as well as indirectly affecting other environments including water, biodiversity, material assets and landscape and visual.

Slippage can occur in the proposed project sites as a result of an increase in overburden load on slopes, earthworks that affect slope angles and embankments, unstable embankments, unstable excavations, cut-and-fill techniques from excavations, uncovered stockpiled materials, or unforeseen ground conditions not identified during geotechnical investigations. These can be exacerbated by adverse weather conditions from heavy rain, wind, and ice. Slips are more likely to occur on slopes >25° but have been known to occur on much gentler slopes. The slopes on the wind farm site have been identified as <3°. Refer to Table 3-1 in Chapter 03 Civil.

There is potential for overburden collapse at the proposed HDD locations during the advancement of the HDD bore. The magnitude of these potential impacts, prior to mitigation, is considered to be negligible..

To reduce the risk of erosion there may be a need to manage slopes on excavated embankments and stockpiles on the proposed project site. If required, the slopes will be designed and constructed in compliance with best practice and industry standards. The slopes will be landscaped with topsoil and vegetation to support their stability. Stockpiled material is at risk of slipping if no mitigation measures are implemented.

The lands within the windfarm site, grid connection route and turbine delivery route were assessed and rated. Due to the small scale of the facilities to be developed, the short-term duration and design mitigation measures incorporated into the design, the magnitude of these potential impacts on land and soils, prior to mitigation, on the wind farm site is moderate and the sensitivity of the land and soils in the wind farm site is low leading to a slight significance rating. The magnitude of the impact on the underlying bedrock and of HDD under watercourses on the wind farm site is negligible and the sensitivity is low leading to a not significant significance rating. The magnitude of the land and soils in the grid connection route is minor and the sensitivity rating is low leading to a not significant rating. The magnitude of the effect on land and soils in the turbine delivery route is negligible and the sensitivity rating is low leading to a not significant rating.

The impact on land and soils from soil erosion, soil compaction and slope stability throughout the wind farm site, during the construction phase is assessed as **negative, localised, short term, direct, likely, moderate, low, and a slight effect.**

The impact on underlying bedrock from soil erosion, soil compaction and slope stability throughout the wind farm site during the construction phase is assessed as **negative, localised, short term, direct, likely, negligible, low, and not significant effect.**

The impact on HDD under watercourses from soil erosion, soil compaction and slope stability throughout the wind farm site during the construction phase is assessed as **negative, localised, short term, direct, likely, negligible, low, and not significant effect.**

The impact on land and soils from soil erosion, soil compaction and slope stability throughout the grid connection route, during the construction phase is assessed as **negative, localised, short term, direct, likely, minor, low, and not significant effect.**

The impact on land and soils from soil erosion, soil compaction and slope stability throughout the turbine delivery route, during the construction phase is assessed as **negative, localised, short term, direct, likely, negligible, low, not significant effect.**

Refer to Table 8-7 for the effect ratings if not mitigated. Appropriate mitigation measures can be found in Section 8.5.1.2.

Table 8-7: Construction Phase Effect 3 Rating

Effect 3: Soil Erosion, Soil Compaction, Soil Stability								
Impact	Quality of Effect	Spatial Extent	Duration	Other Relevant Criteria	Likelihood	Magnitude	Sensitivity	Significance
Wind Farm Site								
Effect on Land and Soil	Negative	Localised	Short-term	Direct	Likely	Moderate	Low	Slight
Effect on Underlying Bedrock Geology	Negative	Localised	Short-term	Direct	Likely	Negligible	Low	Not Significant
Effect on Underlying Geology – HDD under watercourses	Negative	Localised	Short-term	Direct	Likely	Negligible	Low	Not Significant
Grid Connection Route								
Effect on Land and Soils	Negative	Localised	Short-term	Direct	Likely	Minor	Low	Not Significant
Turbine Delivery Route								
Effect on Land and Soils	Negative	Localised	Short-term	Direct	Likely	Negligible	Low	Not Significant

8.4.4.4 Effect 4: Piled Foundations

If poor ground conditions are encountered during excavation for the proposed project site and a significant depth to sub-formation is required, a piled foundation may be considered. A piled foundation requires the use of a piling machine equipped with an auger drill to rotary bore a number of holes around the area of the turbine base to the sub-formation depth determined at construction stage. Once all the holes have been bored, reinforcement steel is inserted into each hole with concrete poured afterwards. The potential effects associated with using and not using piled foundations for the turbines are detailed below in Table 8.8. Piling, if required on this proposed project site, will be limited and will not produce significant volumes of spoil. Any spoil arising from piling will be removed for recovery to the on-site deposition areas.

The lands within the windfarm site, grid connection route and turbine delivery route were assessed and rated. Due to the small scale of the facilities to be developed, the short-term duration and design mitigation measures incorporated into the design the magnitude of these potential impacts, prior to mitigation, is considered to be moderate if piling is used and minor if piling is not used.

If piling is used, a slight effect on the land and soils and geology will occur within the wind farm site, grid connection route and turbine delivery route during construction works without the implementation of the proposed mitigation measures. If piling is not used, a not significant effect will occur.

The impact on land and soils and geology from using piled foundations throughout the wind farm site, during the construction phase is assessed as **negative, localised, temporary, direct, likely, moderate, low, slight effect.**

The impact on land and soils and geology without using piled foundations throughout the wind farm site, during the construction phase is assessed as **negative, localised, temporary, direct, likely, minor, low, and not significant effect.**

Table 8-8: Construction Phase Effect 4 Rating

Effect 4: Piling Foundation								
Impact	Quality of Effect	Spatial Extent	Duration	Other Relevant Criteria	Likelihood	Magnitude	Sensitivity	Significance
				Piling				
Effect on Land and Soils	Negative	Localised	temporary	Direct	Likely	Moderate	Low	Slight
Effects Geology	Negative	Localised	temporary	Direct	Likely	Moderate	Low	Slight
				Without Piling				
Effect on Land and Soils	Negative	Localised	temporary	Direct	Likely	Minor	Low	Not Significant
Effects Geology	Negative	Localised	temporary	Direct	Likely	Minor	Low	Not Significant

8.4.4.5 Effect 5: Hydrocarbon Spill

Use of machinery during construction has the potential to result in spillage of fuels, oils, lubricants, or other hydrocarbons to land and soils, with potentially adverse effects on the land and soils in the proposed project site. Contamination can lead to the degradation and the physio-chemical alteration of the land and soils environment as well as cause indirect effects to the biodiversity, human health and material asset environments. During the construction phase, there is a risk of accidental pollution incidences from the following sources:

- Spillage or leakage of fuels (and oils) stored on site;
- Spillage or leakage of fuels (and oils) from construction machinery or site vehicles; and
- Spillage of oil or fuel from refuelling machinery on site.

Hydrocarbon has a high toxicity to humans, and all flora and fauna, including fish, and is persistent when exposed to the environment. While the sensitivity of the soils and geology is low, the sensitivity of the aquatic ecology that may be indirectly effected by water quality is high.

The effect of hydrocarbon spills on lands within the windfarm site, grid connection route and turbine delivery route were assessed and rated. Due to the small scale of the facilities to be developed, the duration and design mitigation measures incorporated into the design the magnitude of these potential impacts, prior to mitigation, is considered to be moderate. As the magnitude is considered to be moderate and the sensitivity of the land and soils in the proposed project site is low, this results in a slight significance rating for hydrocarbon spills, without the implementation of the proposed mitigation measures.

The impact on land and soils and geology from hydrocarbon spills throughout the proposed project site, during the construction phase is assessed as negative, localised, temporary, indirect, likely, moderate, high and moderate effect.

Refer to Table 8.9 for the effect rating if no mitigation measures are implemented.

Table 8-9: Construction Phase Effect 5 Rating

Effect 5: Hydrocarbon Spills								
Impact	Quality of Effect	Spatial Extent	Duration	Other Relevant Criteria	Likelihood	Magnitude	Sensitivity	Significance
Wind Farm Site								
Effect on Land and Soil	Negative	Localised	temporary	Indirect	Likely	Moderate	High	Moderate
Effect on Geology	Negative	Localised	temporary	Indirect	Likely	Moderate	High	Moderate

8.4.4.6 Effect 6: Cement Spill

Concrete and other cement-based products are highly alkaline and corrosive and can have significant negative effects on land, soils and water quality. They generate very fine, highly alkaline (pH 11.5) sediments that can physically damage fish by burning their skin and blocking their gills.

Entry of cement-based products into the proposed project site drainage system, into surface water runoff, and hence to surface watercourses or directly into watercourses, represents a risk to the aquatic environment. Batching of wet concrete will not occur onsite, therefore concrete truck chute washing, wheel washing, and the placement of machinery are the activities most likely to generate a risk of cement-based pollution which can pose a threat to the land and soils environment (soil matrix) and may indirectly impact on the hydrological environment and groundwater environment, as pH would likely be altered. While the sensitivity of the soils and geology is low, the sensitivity of the aquatic ecology that may be indirectly effected by water quality is high.

The lands within the windfarm site, grid connection route and turbine delivery route were assessed and rated. Due to the small scale of the facilities to be developed, the duration and design mitigation measures incorporated into the design the magnitude of these potential impacts, prior to mitigation, is considered to be moderate. As the magnitude is considered to be moderate and the sensitivity of the water and ecology is high this leads to the significance of the cement contamination to be determined as moderate, without the implementation of the proposed mitigation measures.

The impact on land and soils and geology from cement spills throughout the proposed project site, during the construction phase is assessed as negative, localised, temporary, indirect, likely, moderate, high, and moderate

effect. Water management procedures are detailed in **Chapter 03 Civil Engineering** and **Chapter 09 Water** of this EIAR.

Refer to **Table 8-10** for the effect rating if not mitigated. Mitigation measures to limit this can be found in **Section 8.5.1.2**.

Table 8-10: Construction Phase Effect 6 Rating

Effect 6: Accidental spills & contamination/pollution - Cement Spill								
Impact	Quality of Effect	Spatial Extent	Duration	Other Relevant Criteria	Likelihood	Magnitude	Sensitivity	Significance
Effect on Land and Soil	Negative	Localised	temporary	Indirect	Likely	Moderate	High	Moderate
Effect on Geology	Negative	Localised	temporary	Indirect	Likely	Medium	High	Moderate

8.4.4.7 Effect 7: Effects from Rock Blasting

Blasting at turbine locations to enable excavation of the rock if encountered at less than 3m depth is unlikely to be necessary given the soils and geology of the area. Blasting at the borrow pit may be necessary to enable excavation of the rock in the borrow pit and increase production rates to match the construction programme.

If uncontrolled and not properly mitigated, this could result in soil liquefaction in the vicinity of the blast hole and could contribute to slope instability. The intensity of vibration will depend on a number of factors including rock type and structure, weight/timing of explosive and distance from the blast site. The seismic wave parameters used for correlation with structural damage is the peak particle velocity (ppv). It has been found that the safe limit for ppv below which structural damage is unlikely to occur is 50mm/s. British Standard BS 7385 Part 2: 1993, which provides guidance on vibration measurement, states that loose/waterlogged/cohesionless soils start to become vulnerable to liquefaction at ppv values of about 10 mm/s. The publication “Rock Engineering Guides to Good Practice Road Rock Slope Engineering” (Transport Research Laboratory 2000) refers to the range of ppv experienced for a wide variety of civil engineering projects and shows that a ppv of > 10 mm/s is generally only experienced within 20 m of the blast holes if not properly mitigated. Rock blasting also has the potential to result in excessive dust within the vicinity of the turbine bases or borrow pit which may affect the soils or nearby aquatic environment, without appropriate planning and mitigation. The effects rating has been detailed for the proposed project site in **Table 8-11.**

The lands within the windfarm site, grid connection route and turbine delivery route were assessed and rated. Due to the small scale of the facilities to be developed, the duration and design mitigation measures incorporated into the design the magnitude of these potential impacts, prior to mitigation, is considered to be low for the wind farm site on land, soils and geology. For the wind farm site as the magnitude is considered to be low and the sensitivity of the land and soils in the proposed project site is low leading to the significance of blasting to be determined as slight without the implementation of the proposed mitigation measures.

The impact on land and soils and geology from rock blasting throughout the wind farm site, during the construction phase is assessed as **negative, localised, brief and occasional, direct, likely, minor, low, and not significant effect.**

Refer to Table 8-11 for the effect rating if not mitigated. Blasting, and mitigation measures associated with the process, are discussed in further detail in Section 8.5.1.4 and the Chapters 06 Biodiversity and Chapter 12 Noise and Vibration of this EIAR.

Table 8-11: Construction Phase Effect 7 Rating

Effect 7: Effects Rock Blasting								
Impact	Quality of Effect	Spatial Extent	Duration	Other Relevant Criteria	Likelihood	Magnitude	Sensitivity	Significance
Wind Farm Site								
Effect on Land and Soils	Negative	Localised	Brief and occasional	Direct	Likely	Minor	Low	Not Significant
Effect on Geology	Negative	Localised	Brief and occasional	Direct	Likely	Minor	Low	Not significant

8.4.4.8 Effect 8: Effects from Tree and Hedge Felling

Felling of approximately 1.4.ha of forestry and the removal of 4086m of hedgerows is required within and around wind farm infrastructure to accommodate the construction of the turbine foundations and associated hardstands, access tracks, and turbine assembly and turbine delivery routes. Trees in a radius of 105m around each turbine will be felled as part of the project. Three sections of forestry that will be felled for this purpose are indicated in Figure 2-17. One additional section of forestry felling will be needed on the south side of the junction between Rossestown road L8017 and the N67 for the delivery of the turbines. Additional tree line and hedge removal will be needed in some areas for the new access roads and construction areas. The forestry felling will be undertaken in accordance with a tree felling licence, using good working practices as outlined by the Department of Agriculture, Food, and the Marine (DAFM) Standards for Felling and Reforestation (2019) and will follow the specifications set out in Forest Service's 'Forestry and Water Quality Guidelines' (2000) and 'Forest Harvesting and Environmental Guidelines' (2000). Refer to mitigation measures in Section 8.5.1.5.

These standards deal with sensitive areas, buffer zone guidelines for aquatic zones, ground preparation and drainage, chemicals, fuel, and machine oils. All conditions associated with the felling licence will be complied with. Section 8.5.1.4 provides mitigation measures for these activities.

The main effects arising from tree felling involve effects to soil (see Section 8.4.4.3). Landscaping, soil excavation, and root and stump harvesting can cause extensive soil disturbance and expose underlying overburden which may influence soil stability and contribute to soil sedimentation, soil erosion and surface water runoff. A large volume of soil can remain attached to roots when stumps are extracted from the ground. The use of heavy machinery can induce soil loading and compression of soft deposits which may influence surface water runoff and soil erosion rates.

The lands within the windfarm site, grid connection route and turbine delivery route were assessed and rated. Due to the small scale of the facilities to be developed, the duration and design mitigation measures incorporated into the design the magnitude of these potential impacts, prior to mitigation, is considered to be minor for the wind farm site on land, soils and geology. As the wind farm site as the magnitude is considered to be low and the sensitivity of the land and soils in the proposed project site is low, this results in the significance of the effects of blasting to be determined as slight

without the implementation of the proposed mitigation measures.

The impact on land and soils and geology from rock blasting throughout the wind farm site, during the construction phase is assessed as **negative, localised, temporary, direct, likely, negligible, low, not significant effect.**

Refer to Table 8-12 for the effect rating if not mitigated. Mitigation measures to limit this can be found in Section 8.5.1.4.

Table 8-12: Construction Phase Effect 8 Rating

Effect 8: Tree and Hedge Felling								
Impact	Quality of Effect	Spatial Extent	Duration	Other Relevant Criteria	Likelihood	Magnitude	Sensitivity	Significance
Effects on Land and Soils	Negative	Localised	Temporary	Direct	Likely	Negligible	Low	Not Significant
Effects on Geology	Negative	Localised	Temporary	Direct	Likely	Negligible	Low	Not Significant

8.4.5 Operational Phase

8.4.5.1 Effect 1: Change of Land Use

Additional temporary displacement effects on some agricultural land use adjacent to the turbines may occur during the operational phase if any wind turbine blades require replacement. Once the wind farm is operational, the unused construction areas will be returned to agricultural land uses.. Conventional agricultural and forestry activities will resume and continue to take place at the site independent of the wind farm development. Only a relatively small area of forestry, approximately 1.8ha of the proposed development site, will be permanently displaced in the footprint of the wind farm infrastructure. This loss of land use will not be significant.

While unlikely, it may be necessary to reinstate the two temporary hardstand areas along the TDR in the event turbine blades need replacing during the operational phase.

The lands within the windfarm site, grid connection route and turbine delivery route were assessed and rated. Due to the small scale of the facilities to be developed, the short duration and design mitigation measures incorporated into the design, the magnitude of these potential impacts on land use, prior to mitigation, is considered to be negligible for the wind farm site and turbine delivery route without the implementation of the proposed mitigation measures.. As the magnitude is considered to be negligible and the sensitivity of the land and soils in the wind farm site and turbine delivery route is low this leads to the significance of change of land use during the operational phase to be determined as not significant.

The impact on land and soils and geology from change of land use throughout the wind farm site, during the operational phase is assessed as **negative, localised, temporary, direct, likely, negligible, low, and not significant effect.**

The impact on land and soils and geology from change of land use if the reinstatement of TDR hardstands throughout the wind farm site, during the operational phase is assessed as **negative, localised, temporary, direct, likely, negligible, low, not significant effect.**

Refer to Table 8-13 for the effect rating.

Mitigation measures have been applied to the design to minimise the land use footprint and land use change associated with the proposed project site. No mitigations are considered necessary for the effects on land use during the operational phase of the proposed development.

Table 8-13: Operational Phase Effect 1 Rating

Effect 1: Change of Land Use								
Impact	Quality of Effect	Spatial Extent	Duration	Other Relevant Criteria	Likelihood	Magnitude	Sensitivity	Significance
Wind farm site	Negative	Localised	temporary	Direct	Likely	Negligible	Low	Not Significant
Grid Connection Route	Negative	Localised	temporary	Direct	Likely	Negligible	Low	Not Significant
TDR -	Negative	Localised	Temporary	Direct	Likely	Negligible	Low	Not Significant

8.4.5.2 Effect 2: Effects on Soil and Geology

The potential effect on the land and soils on the wind farm site due to excavations during the operational phase will be minimal as no further excavations are envisaged once the facility is constructed. The only potential of soil erosion would be related to erosion of soil on spoil deposition areas and other areas where soil has been exposed and vegetation has not yet stabilised the soils. As vegetation becomes established and equilibrium is achieved in these areas, erosion rates will reduce to pre-construction levels. All vehicular movement during operation and maintenance will be restricted to the areas of hardstanding and existing/newly constructed access tracks to prevent soil erosion relating to run off The effect on the hydrogeology will remain, although to a far lesser extent, due to the risks associated with sedimentation and contamination of the aquifers as a result of erosion and runoff (see Chapter 09 Water), however as areas are reinstated and revegetated and construction traffic is stopped, these effects will also be reduced to minimal levels.

Traffic levels will be very low during the operational phase in comparison to the construction phase. Maintenance works on turbines will be carried out from the existing access tracks and hardstands. All vehicular movement during operation and maintenance will be restricted to the areas of hardstanding and existing/newly constructed access tracks.

Minor excavations of replaced soils, subsoils, trench backfill material could be required along the grid connection route if a fault occurred during the operational phase, which is highly unlikely. Similarly with the turbine delivery route if additional blades need to be delivered. These works would be temporary and short in duration. Any material excavated during such works would however be reinstated back into the trench/road infrastructure.

The lands within the windfarm site, grid connection route and turbine delivery route were assessed and rated. Due to the small scale of the facilities to be developed, the duration and design mitigation measures incorporated into the design the magnitude of these potential impacts, prior to mitigation, is considered to be minor for the wind farm site, grid connection route and turbine delivery route on land, soils and geology, without the implementation of the proposed mitigation measures. As the sensitivity of the land and soils in the proposed project site is low, this leads to the significance of change of land use during the operational phase to be determined as not significant.

The impact on land and soils and geology within the wind farm site, during the operational phase is assessed as negative, localised, temporary, direct, likely, minor, low, and not significant effect.

Refer to **Table 8-14** for the effect rating if not mitigated. Mitigation measures to limit this can be found in **Section 8.5.2.2.**

Table 8-14: Operational Phase Effect 2 Rating

Effect 2: Effects on Soil and Geology								
Impact	Quality of Effect	Spatial Extent	Duration	Other Relevant Criteria	Likelihood	Magnitude	Sensitivity	Significance
Effects on Soils and Geology	Negative	Localised	temporary	Direct	Likely	Minor	Low	Not Significant

8.4.5.3 Effect 3: Accidental Spills and Contamination/Pollution

There is the potential for accidental spillages from plant and machinery operating at the proposed project site to occur, with the effect depending on the nature of the emission. Some construction vehicles or plant may be necessary for the maintenance of turbines 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.

The lands within the windfarm site, grid connection route and turbine delivery route were assessed and rated. Due to the small scale of the facilities to be developed, the duration and design mitigation measures incorporated into the design the magnitude of these potential impacts, prior to mitigation, is considered to be medium for the proposed project site, without the implementation of the proposed mitigation measures. As the magnitude is considered to be moderate and the sensitivity of the land and soils in the proposed project site is low this would lead to the significance of accidental spills and contamination/pollution during the operational phase to be determined as slight.

The impact on land and soils and geology from change of land use throughout the wind farm site, during the operational phase is assessed as **negative, localised, temporary, direct, likely, moderate, high, and moderate effect.**

Refer to **Table 8-15** for the effect rating if not mitigated. Mitigation measures to limit this can be found in **Section 8.5.2.3**.

Table 8-15: Operational Phase Effect 3 Rating

Effect 3: Accidental Spills & Contamination/Pollution								
Impact	Quality of Effect	Spatial Extent	Duration	Other Relevant Criteria	Likelihood	Magnitude	Sensitivity	Significance
Effects on Land, soils and geology	Negative	Localised	temporary	Direct	Likely	Moderate	High	Moderate

8.4.6 Decommissioning Phase

At the end of the 35-year lifespan of the proposed project, the Developer will make the decision whether to repower or decommission the turbines. Any further proposals for development at the site during or after this time will be subject to a new planning permission application. If planning permission is not sought after the end of life of the turbines, the site will be decommissioned and reinstated with all 10 No. wind turbines and towers removed. Removal of infrastructure will be undertaken in line with landowner and regulatory requirements and subject to approval of the local authority. The information below outlines the likely decommissioning tasks based on current requirements and best practice.

Prior to the decommissioning work, the following will be provided to Tipperary County Council for approval:

- A plan outlining measures to ensure safety of the public workforce; and
- A comprehensive reinstatement proposal, including the implementation of a program that details the removal of all structures and landscaping.

If the site is to be decommissioned, cranes of similar size to those used for construction will disassemble each turbine. The towers, blades and all components will then be removed.

Wastes generated during the decommissioning phase will be taken off site and disposed of at an authorised waste facility. Any materials suitable for recycling will be disposed of in an appropriate manner.

At present it is anticipated that underground cables connecting the turbines to the selected substation will be cut back and left underground. The cables will not be removed if an environmental assessment of the decommissioning operation demonstrates that this would do more harm than leaving them in situ. The assessment will be carried out closer to the time to take into account environmental changes over the project life.

Hardstand and turbine foundation areas will be left in situ and covered with soil to match the existing landscape. Access roads will be left for agricultural use.

The grid cable will remain a permanent part of the national grid and therefore decommissioning is not foreseen. In the event of decommissioning, it will involve removing the cable from the ducting but leaving the ducting and associated supporting structure in place. It is also likely the substation will remain in place and will previously have been taken in charge by the system operator, after the wind farm is connected to the national electricity grid.

Effects resulting from decommissioning activities (increased traffic onsite and removal of wind farm infrastructure) on the land and soils include:

- Minimal Earthworks to cover foundations and hardstands
- Revegetation Impacts

The magnitude of the effect of these minor earth works during the decommissioning phase I negligible. It is envisaged that access tracks will remain in place. Hardstanding and foundation areas will be reinstated to match the surrounding landscape which will require minor earthworks. The turbine bases will be rehabilitated by covering with local topsoil in order to regenerate vegetation which will reduce run off and sedimentation effects. Therefore, no significant effect will occur.

Hydrocarbon spills could arise from vehicles and machinery used to remove turbine components. This will however be temporary in nature and no significant effect will result.

A return to the original land use practices will recommence. The lands within the windfarm site, grid connection route and turbine delivery route were assessed and rated. A slight significant effect will occur on the proposed project site during the decommissioning phase without the implementation of the proposed mitigation measures. Due to the small scale of the facilities to be developed, the duration and design mitigation measures incorporated into the design the magnitude of these potential impacts, prior to mitigation, is considered to be negligible for the proposed project site. As the magnitude is considered to be negligible this would indicate the sensitivity of the land and soils in the proposed project site is low leading to the significance during the decommissioning phase to be determined as slight.

The impact on land and soils and geology from change of land use throughout the wind farm site, during the operational phase is assessed as positive, localised, long term, direct, likely, negligible, low and not significant effect.

Refer to Table 8-16 for the effect rating if not mitigated.

Table 8-16: Decommissioning Phase Effect 1 Rating

Effect 1: Land Use								
Impact	Quality of Effect	Spatial Extent	Duration	Other Relevant Criteria	Likelihood	Magnitude	Sensitivity	Significance
Land use	Positive	Localised	Long-term	Direct	Likely	Negligible	low	Not Significant

8.5 Mitigation and Monitoring Measures

Appropriate mitigation measures to avoid, or significantly reduce any potential effects during the construction, operational and decommissioning phases of the proposed development are outlined in this section.

The primary mitigation measure employed has been the design of the proposed development in terms of locating the turbines, access tracks, and other proposed infrastructure in order to reduce the effects on land and soils.

8.5.1 Construction Phase

8.5.1.1 Mitigation Measures for Soil Erosion, Soil Compaction and Slope Stability

Soil Erosion

A site surface water management system will be constructed on the site to attenuate run-off, guard against soil erosion and safeguard downstream water quality. The drainage system will be implemented along all work areas including all internal site access roads, storage areas, crane hardstand areas and temporary site construction compound. Details of the proposed site drainage system are described in Chapter 03 Civil Engineering of this EIAR.

The following gives an outline of drainage management arrangements along internal services roads:

- The surface water run-off drainage system will be implemented along all internal access routes, to separate and collect 'dirty water' run-off from the roadway and to intercept clean over land surface water flows from crossing internal roadways;
- To achieve separation, clean water drains will be positioned on the upslope and dirty water drains positioned on the downslope of roadsides, with road surfaces sloped towards dirty drains; and
- Clean water will be piped under both the access roads and downslope collection drains to avoid contamination. Piping the clean water under the service road allows the clean water to follow the course it would have taken before construction thus mimicking the existing surface water over land flow pattern of the site and thus not altering the natural existing hydrological regime on site.

Temporary stockpiles of excavated spoil, stored in the footprint of the excavation areas, will be directed for use in backfilling and restoration or placed in the deposition areas on site. Reusable excavated sub-soils and aggregate will be stored in temporary stockpiles at suitably sheltered areas to prevent erosion or weathering and shall be shaped to ensure rainfall does not degrade the stored material. Stockpiles will be stored away from any open surface water drains, managing height and slope of all stockpiles and minimising soil movement. Estimated volumes of material can be found in Chapter 03 Civil Engineering of this EIAR.

Whenever possible, existing access tracks have been utilised to access turbine locations. This reduces the volume of excavated material and imported crushed rock for track construction. Excavations and material removal that will take place during the construction phase will be localised to the turbine locations and access tracks.

Excavated material from the grid connection route will be used to reinstate the area around the cable trench following backfilling of the trench with approved materials. Any excess material from the grid connection route will be removed and disposed of to the onsite deposition areas or to an appropriate facility licensed to accept such waste.

In terms of the turbine delivery route, the following mitigation measure will be implemented:

- Use of the existing road network to reduce soil/subsoil excavation volumes;
- The soil/subsoil which will be excavated during the construction phase will be localised to the proposed 2 no. locations along the turbine delivery route;
- A minimal volume of soil/subsoil will be excavated/landscaped and the areas of ground where works will occur is small;
- Excess excavated material will be used for local landscaping; and
- Temporary hardstand area will be reinstated to original condition on completion of the works.

The implementation of erosion and sediment controls will be made prior to the commencement of site clearance works. Silt traps, such as geotextile membrane, will be placed in the existing drainage network prior to construction work. These will be inspected weekly by the Environmental Manager and cleaned regularly as required as directed by the Environmental Manager.

Soil Compaction

The CEMP (Appendix 2B) includes minimum site management controls to reduce and mitigate for compaction.

A Traffic Management Plan (TMP) (Appendix 16A) has been developed to manage and control vehicular movement onsite. Measures will include the scheduling of HGVs during the construction phase to reduce the number of vehicle movements in, through and off site. This in turn will reduce the impact of soil compaction and erosion. Unscheduled vehicles will not have access to the site. Machinery will not operate directly on excavated/stockpiled soils. Heavy vehicles will only follow designated and newly constructed access tracks and avoid loading areas which are not contained within the footprint of the main works to minimise disturbance of the original soil and subsoil formations and to retain soil structure.

The compound, vehicles, stockpiled materials and heavy machinery will be in place for the duration of the construction phase and will be removed once commissioning is complete.

Within and around excavations, pore water pressure will be kept low by avoiding loading the soil/subsoil and giving careful attention to the existing drainage, as compaction would alter the surface drainage regime (see Chapter 09 Water).

Slope Stability

All temporary cuts/excavations will be carried out such that they are stable or adequately supported. Temporary works will be such that they do not adversely interfere with existing drainage channels/regimes.

All site excavations and construction will be supervised by a suitably competent and experienced engineer. The Contractor's method statements for each element of work will be reviewed and approved by the engineer prior to site operations. Prior to excavation, drains will be established to effectively intercept overland flow prior to earthworks. From examination of factual evidence to date, the majority of landslides occur after an intense period of rainfall. An emergency response system will be developed for the construction phase of the project, particularly during the early excavation phase. This, as a minimum, will involve 24 hour advance meteorological forecasting (Met Éireann download) linked to a trigger-response system. When a pre-determined rainfall trigger level is exceeded (e.g. 1 in 100 year storm event or very heavy rainfall at >25mm/hr), planned responses will be undertaken. These responses will include cessation of construction until the storm event including storm runoff has passed over.

From a desk-top review, the GSI's Landslide Events database has no records of any landslide events recorded within or in proximity to the site.

A competent project geotechnical engineer or engineering geologist will be employed during the construction phase of the works. As part of the detailed design and assessment, identification of potential planes of weakness will be made in the overburden such as discrepancies in the material type and foliation direction in the bedrock. Earthworks will be constructed to safe stable angles in accordance with the detailed design and best practice.

HDD will be carried out by an experienced HDD specialist.

Plant and materials will be stored in approved locations only (such as the proposed temporary site compound) and will not be positioned or trafficked in a manner that would surcharge existing or newly-formed slopes.

8.5.1.2 Mitigation Measures for Accidental Spills and Contamination/Pollution

The CEMP (Appendix 2B) includes site management controls to mitigate for contamination/pollution.

The permanent access track works will require a drainage network to be in place for the construction and operation phases of the wind farm. Fundamental to any construction phase is the need to keep clean water (i.e. runoff from adjacent ground upslope of the permitted development footprint) clean and manage all other runoff and water from construction in an appropriate manner. Wheel wash facilities will be available onsite for the duration of the construction phase. These, and other measures are outlined in the CEMP (Appendix 2B). The proposed surface water drainage is summarised in Chapter 03 Civil Engineering and Chapter 09 Water.

A bunded containment area will be provided within the compound for the storage of fuels, lubricants, oils etc.

Good site practice will be applied to ensure no fuels, oils or any other substance are stored in a manner on site in which they may spill and enter the ground, particularly when the initial top layer of made ground is excavated. Dedicated, bunded storage areas will be used for all fuels or hazardous substances. Spill kits will be maintained on site. The CEMP includes a management plan and can be seen in Appendix 2B.

The potential for hydrocarbons getting into the existing drains, local watercourses, and the land and soils environment will be mitigated by only refuelling construction machinery and vehicles in designated refuelling areas using a prescribed re-fuelling procedure. A fuel management plan will be implemented incorporating the following elements:

- Refuelling of Construction Plant On-Site - Refuelling will be carried out using 110% capacity double bunded mobile bowsers. The refuelling bowser will be operated by trained personnel. The bowser will have spill containment equipment which the operators will be fully trained in using. Plant nappies or absorbent mats will be placed under refuelling points during all refuelling to absorb drips. Mobile bowsers, tanks and drums will be stored in secure, impermeable storage areas, over 50m away from drains and open water. To reduce the potential for oil leaks, only vehicles and machinery will be allowed onto the site that are mechanically sound. An up to date service record will be required from the main contractor. Should there be an oil leak or spill, the leak or spill will be contained immediately using oil spill kits, all oil and any contaminated material will be removed and properly disposed of in a licensed facility. Immediate action will be facilitated by easy access to oil spill kits. An oil spill kit that includes absorbing pads and socks will be kept at the site compound and also in site vehicles and machinery. Correct action in the event of a leak or spill will be facilitated by training all vehicle/machinery operators in the use of the spill kits and the correct containment and cleaning up of oil spills or leaks. This training will be provided by the Environmental Manager at site induction. In the event of a major oil spill, a company who provide a rapid response emergency service for major fuel spills will be immediately called for assistance, their contact details will be kept in the site office and in the spill kits kept in site vehicles and machinery; and
- Materials Handling, Fuels and Oil Storage - Leakages of fuel/ oil from stores will be prevented by storing these materials in bunded tanks which have a capacity of 110% of the total volume of the stored oil. Ancillary equipment such as hoses and pipes will be contained within the bunded storage container. Taps, nozzles or valves will be fitted with a lock system. On-site washing of concrete truck barrels will not be allowed. A designated chute wash down area, which will retain the washout water, will be located within the construction compound and there will be no other chute wash down activity on any other part of the site.

The drainage and treatment system will be managed and monitored and particularly after extreme rainfall events during the construction phase. Controls will be regularly inspected and maintained. A programme of inspection and maintenance will be designed and dedicated construction personnel assigned to manage this programme. A checklist of the inspection and maintenance control measures will be developed and records kept of inspections and maintenance works. The purpose of this management control is to ensure that the measures in place are operating effectively, prevent accidental leakages, and identify potential breaches in the protective retention and attenuation network during earthworks operations.

Stockpiles of stripped topsoil will be in locations with minimum trafficking to prevent damage and dusting.

The access track surface can become contaminated with clay or other silty material during construction. Access track cleaning will, therefore, be undertaken regularly during wet weather to reduce the volume of sediment runoff to the treatment system. This is normally achieved by scraping the track surface with the front bucket of an excavator and disposing of the material at designated locations within the site.

8.5.1.3 Mitigation Measures for Rock Blasting

In order to further mitigate against possible slope instability close to the borrow pit, blasting will not occur after periods of heavy rainfall. In particular, no blasting will take place for at least 24 hours following a period of rainfall which exceeds 25mm within the previous 24 hours. Rock blasting will only take place within the borrow pit if extraction using rippers or hydraulic breakers is deemed impractical. Circumstances include where the rock strength is such that other means of extraction are not possible and production rates need to be increased to keep up with the construction programme. If rock blasting proves to be necessary, a detailed blasting design will be undertaken by a suitably qualified and experienced specialist for each location to ensure that a peak particle velocity (PPV) of 10 mm/s is not exceeded at a distance of greater than 20m from the blast holes as per BS 7385 Part 2: 1993. If this cannot be achieved, blasting will not be permitted at this location. To mitigate against the risk of slope failure occurring, blasting will not be permitted at turbine locations unless robust mitigation measures are put in place. Blasting for the access track cuttings and hardstands will be subject to the same rigorous controls as that proposed at borrow pit and turbine foundation locations. To mitigate against the risk of excessive dust within the vicinity of the borrow pit, the blast areas will be lightly sprayed with water prior to blasting. A Blast Management Plan will ensure compliance with the Explosive Act 1923 (amended by Part 6 of the Criminal Justice Act 2006) and related legislation, and BS 7385 will be complied with during any blasting. Tipperary County Council, An Garda Síochána, and adjoining landowners will be notified in advance of any blasting activities on the site. The Blast Management Plan will be prepared by the appointed contractor prior to the construction phase and in consultation with Tipperary County Council, An Garda Síochána and adjoining landowners. Additionally, the NPWS and any other required consultees will be consulted as part of the general consultation and blasting permitting process, in order to keep them informed of any blasting proposals for the site.

8.5.1.4 Mitigation Measures for Tree and Hedge Felling

Topsoil removed from felled areas for the construction of the proposed development will be used in landscaping works or placed in the deposition areas. Where possible, the vegetative layer will be stored with the vegetation and soil facing the right way up to encourage regrowth. The felling areas will then be monitored and maintained following construction and into the operational phase of the development.

Any runoff from the clear-felled areas will be treated using the same design philosophy as that for the access tracks and hardstands. This includes the separation of clean and dirty water by the installation of berms, channelling dirty water to silt traps and settlement ponds and ensuring that the discharge rate of the drainage system is no higher than the existing condition by using engineered settlement ponds.

Where practicable, 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 off-track routes where practicable, to protect the soil from compaction and rutting.

All works will be completed to standard forestry guidelines (Department of Agriculture, Food and the Marine [Teagasc], 2019, Standards for Felling and Reforestation), and in accordance with licence conditions issued by the Forest Service.

8.5.1.5 Mitigation Measures for Borrow Pit

The borrow pit proposed within the site will be used to obtain site won stone aggregate for use in the construction of the proposed wind farm. This borrow pit will be located within the southern area of the site where it will be used as a source of hardcore for the construction of access tracks, crane hardstands and construction compound. The proposed location of the borrow pit is shown on Planning Drawings 22156-MWP-00-00-DR-C-5415.

Prior to commencement of excavation works, an interceptor drain will first be excavated upslope to intercept existing overland flows and divert them around the borrow pit prior to discharge via a buffer zone on the downslope side. Any subsoil material overlying the rock will be excavated and stockpiled. The stockpile will be sealed, and a perimeter drain installed to intercept any run-off so that it can be discharged through an appropriately designed silt trap.

Standing water, any surface water runoff or water pumped from within the borrow pit is likely to contain an increased concentration of suspended solids. Runoff or pumped water from the borrow pit will be isolated from the clean catchment runoff by means of a series of open drains that will be constructed within the area. These drains will be of check dams that will attenuate the flow and provide storage for the increased runoff from exceptional rainfall events. The settlement ponds have been designed to a modular size where if larger areas of runoff must be catered for at a single discharge point the size of the settlement pond will be increased pro rata.

Inspections of the borrow pit will be made by a geotechnical engineer through regular monitoring of the opening works. The appointed contractor will review work practices at the borrow pit where periods of heavy rainfall are expected where work will be stopped to prevent excessive runoff from being generated. Excavators will extract the stone using buckets and a ripper attachment or rock-breaker attachments may be utilised in the borrow pit location. It is expected that excavators will be utilised in tandem in the extraction of rock from the borrow pit.

Once all the obtainable rock has been removed from the borrow pit, it will be backfilled by spoil from the onsite excavation works, covered with topsoil, revegetated and reinstated as pasture land. This will reinstate the existing land use.

8.5.2 Operational Phase

8.5.2.1 Mitigation Measures for Land Use

No additional mitigation measures are required in relation to land use for the soil and geological environment during the operation of the proposed development.

8.5.2.2 Mitigation Measures for Soil and Geology

All vehicular movement during operation and maintenance will be restricted to the areas of hardstanding and existing/newly constructed access tracks.

No excavation works are expected during the operational phase unless there is some contaminated soil that needs to be removed, repairs to roads and foundations needed, or some turbine blades need to be repaired and the two temporary hard stands needed to facilitate turbine deliver need to be reinstated. In this case the same mitigation measures for the construction phase will apply (see mitigation measures in Sections 8.4.1.1 and 8.4.1.2).

8.5.2.3 Mitigation Measures for Accidental Spills and Contamination/Pollution

Mitigation measures for oils and fuels remain the same as the construction phase, however, will be significantly reduced during the operation stage as maintenance of the turbines, substation and maintenance vehicles is all that is required. Turbine transformers will be located within the turbines, so any leak of oil would be contained within or adjacent to the turbine. Minimal refuelling or maintenance of operational vehicles or plant will take place on site. Off-site refuelling will occur at a controlled fuelling station. Any on site re-fuelling will be undertaken using a double skinned bowser with spill kits at the ready for accidental leakages or spillages. A minimal amount of fuels will be stored on site. Storage areas where required will be bunded appropriately for the fuel storage volume during the operational phase and will be fitted with a storm drainage system and an appropriate oil interceptor. The plant used will be regularly inspected for leaks and fitness for purpose. These measures will be sufficient to reduce the risk of contamination to soils and subsoils, and groundwater and surface water quality. An emergency plan for the operational phase to deal with accidental spillages will be prepared and will be communicated to plant operatives. Spill kits will be available to deal with any accidental spillage in and outside the re-fuelling area.

The substation transformer oil storage tanks will be in a concrete bund capable of holding 110% of the oil in the transformer and storage tanks.

8.5.2.4 Mitigation Measures for the Grid Connection, Substation and BESS Compound

No excavation activities are expected during the operational phase. The only possible excavation works that may be required would be related to contamination or repair works. In this case, the mitigation will include:

- Use of temporary excavations over the shortest distances possible; and
- All excavated material will be stored and reused during reinstatement.

8.5.3 Mitigation Measures for Cumulative Effects

Based on the finding that the potential for significant cumulative effects on land and soils arising from the proposed development is considered to be not significant, no specific measures to mitigate against cumulative effects are considered necessary.

8.5.4 Decommissioning Phase

Where appropriate, mitigation measures used during decommissioning activities shall be comparable to those used during construction. By keeping some development components in place, when necessary, some of the effects will be avoided. In order to recover vegetation and lessen the effects of runoff and sedimentation, the turbine bases will be rehabilitated by being covered with local topsoil. Access tracks that are not needed for farming or forestry will also be allowed to naturally revert to vegetation. The wind farm's materials and equipment will all be removed from the site and disposed of or repurposed in a way that is environmentally responsible. The same relevant mitigation measures proposed for the construction phase will be applied during the decommissioning phase to prevent potential pollution from fuel leaks and soil compaction caused by nearby plants.

8.6 Risk of Major Accidents and Disasters

Incidents such as landslides or technological disasters can result in liabilities such as contaminated soil, loss of infrastructure and loss of life. Proactive risk management reduces the potential for an incident to occur, and therefore the CEMP (Appendix 2B) for the proposed development sets out the Emergency Response Procedure to be adopted in the event of an emergency including contamination, health and safety and environmental protection.

The proposed development has been designed and will be built in accordance with the best practice measures set out in this EIAR and, as such, mitigation against the risk of major accidents and/or disasters is embedded through the design.

8.6.1 Peat Stability

From a desk-top review, the GSI's Landslide Events database has no records of any landslide events recorded within or in proximity to the site.

A scoping exercise was carried out to determine whether a detailed Peat Landslide Hazard and Risk Assessment is required for this site. This scoping exercise reviewed whether peat was present onsite. A localised area of peat was identified near T4 and the substation site. The depth of peat in this area was identified to be a maximum of 0.5m in depth. The land in the area is improved agricultural land. The topography of the area is of a low gradient. Given the localised nature of the peat, shallow depths and low gradient, a quantitative peat stability risk assessment was not deemed necessary. Overall, there is no risk of instability of the site, access roads, turbine bases, or grid connection from peat.

8.7 Residual Effects

No significant residual effects on land, soil and geology are likely.

Table 8-17: Residual Effects

EFFECT (PRE-MITIGATION)	RECEPTOR	IMPACT/ ACTIVITY	EFFECT (PRE-MITIGATION)	MITIGATION MEASURES	RESIDUAL EFFECT (POST-MITIGATION)							
					QUALITY OF EFFECT	SPATIAL EXTENT	DURATION	OTHER RELEVANT CRITERIA	LIKELIHOOD	MAGNITUDE	SENSI-TIVITY	SIGNIFICANCE
CONSTRUCTION												
Soil and Bedrock Excavation	Soils and Geology	Wind Farm site & facilities	Negative,Localised, short-term, direct, likely, minor, low and not significant effect	Section 8.5.1.1.	Negative	Localised	Short-term	Direct	Likely	Negligible	Low	Not Significant
		Grid Connection	Negative, localised, temporary, direct, likely, minor, low and not significant effect	Section 8.5.1.4	Negative	Localised	Temporary	Direct	Likely	Negligible	Low	Not Significant
		TDR	Negative, localised, temporary, direct, likely, negligible, low and not significant effect	Section 8.5.1.1.	Negative	Localised	Temporary m	Direct	Likely	Negligible	Low	Not Significant
		Borrow Pit - blasting	Negative, localised, brief and occasional, direct, likely, minor, low and not significant effect	Section 8.5.1.5	Negative	localised	Brief and Occasional	direct	likely	Negligible	Low	Not significant
		Borrow Pit – ripping and crushing	Negative,Localised, temporary, direct, likely, minor, low	Section 8.5.1.5.	Negative	Localised	Temporary	Direct	Likely	Negligible	Low	Not Significant

EFFECT (PRE-MITIGATION)	RECEPTOR	IMPACT/ ACTIVITY	EFFECT (PRE-MITIGATION)	MITIGATION MEASURES	RESIDUAL EFFECT (POST-MITIGATION)							
					QUALITY OF EFFECT	SPATIAL EXTENT	DURATION	OTHER RELEVANT CRITERIA	LIKELIHOOD	MAGNITUDE	SENSI-TIVITY	SIGNIFICANCE
			and not significant effect									
		Piled Turbine Foundations	Negative, localised, temporary, direct, likely, moderate, low and slight effect	Section 8.5.1.1.	Negative	Localised	Temporary	Direct	Likely	Minor	Low	Not Significant
		Unpiled Turbine Foundations	Negative, localised, temporary, direct, likely, minor, low and not significant effect	Section 8.5.1.1.	Negative	Localised	Temporary	Direct	Likely	Negligible	Low	Not Significant
Change of Land Use	Land, Soils	Wind Farm site & facilities	Negative, localised, short-term, direct, likely, moderate, low and slight effect	Section 8.5.1.1.	Negative	Localised	Short-term	Direct	Likely	Minor	Low	Not Significant
		Grid Connection	Negative, localised, short-term, direct, likely, moderate, low and slight effect	Section 8.5.1.1.	Negative	Localised	Short-term	Direct	Likely	Minor	Low	Not Significant
		TDR	Negative, localised, short-term, direct, likely, moderate, low and slight effect	Section 8.5.1.1.	Negative	Localised	Short-term	Direct	Likely	Minor	Low	Not Significant
Soil erosion, compaction and slope stability	Underlying bedrock and Geology	Wind Farm site & facilities	Negative, localised, short-term, direct, likely, moderate, low and slight effect	Section 8.5.1.1	Negative	Localised	Short-term	Direct	Likely	Minor	Low	Not Significant
		Grid Connection	Negative, localised, short-		Negative	Localised	Short-term	Direct	Likely	Negligible	Low	Not Significant

EFFECT (PRE-MITIGATION)	RECEPTOR	IMPACT/ ACTIVITY	EFFECT (PRE-MITIGATION)	MITIGATION MEASURES	RESIDUAL EFFECT (POST-MITIGATION)							
					QUALITY OF EFFECT	SPATIAL EXTENT	DURATION	OTHER RELEVANT CRITERIA	LIKELIHOOD	MAGNITUDE	SENSI-TIVITY	SIGNIFICANCE
			term, direct, likely, negligible, low and slight effect									
		TDR	Negative, localised, short-term, direct, likely, negligible, low and slight effect		Negative	Localised	Short-term	Direct	Likely	Negligible	Low	Not Significant
Soil erosion, compaction and slope stability – HDD under watercourses	Geology	Wind farm site	Negative, localised, short-term, direct, likely, negligible, low and not significant effect	Section 8.5.1.1.	Negative	Localised	Short-term	Direct	Unlikely	Negligible	Low	Not Significant
		Grid Route	Negative, localised, short-term, direct, likely, minor, low and not significant effect	Section 8.5.1.1.	Negative	Localised	Short-term	Direct	Likely	Negligible	Low	Not Significant
Accidental spills & contamination/ pollution – hydrocarbons & cement	Land and Soils	Wind Farm Site	Negative, localised, short-term, indirect, likely, moderate, high and moderate effect	Section 8.5.1.2	Negative	Localised	Short-term	Direct	Unlikely	Minor	High	Slight
	Geology	Wind Farm Site	Negative, localised, short-term, indirect, likely, moderate, high and moderate effect		Negative	Localised	Short-term	Indirect	Unlikely	Minor	High	Slight
Rock Blasting	Soils and Geology	Wind Farm Site	Negative, localised, brief and occasional, direct, likely, minor, low and not significant effect	Section 8.5.1.3	Negative	Localised	Brief and Occasional	Direct	Likely	Negligible	Low	Not Significant

EFFECT (PRE-MITIGATION)	RECEPTOR	IMPACT/ ACTIVITY	EFFECT (PRE-MITIGATION)	MITIGATION MEASURES	RESIDUAL EFFECT (POST-MITIGATION)							
					QUALITY OF EFFECT	SPATIAL EXTENT	DURATION	OTHER RELEVANT CRITERIA	LIKELIHOOD	MAGNITUDE	SENSI-TIVITY	SIGNIFICANCE
Tree and Hedge Felling	Land and Soils, and Geology	Wind Farm site	Negative, localised, temporary, direct, likely, negligible, low and not significant effect	Section 8.5.1.4	Negative	Localised	Temporary	Direct	Likely	Negligible	Low	Not Significant
OPERATIONAL												
Change of Land Use	Land & soils & Geology	Wind Farm Site	Negative localised, temporary, direct, likely, negligible, low and not significant effect	No mitigation required.	Positive	Localised	Long-term	Direct	Likely	Negligible	Low	Not Significant
		Grid Route	Negative localised, temporary, direct, likely, negligible, low and not significant effect	No mitigation required.	Negative	Localised	Temporary	Direct	Likely	Negligible	Low	Not Significant
		TDR	Negative, localised, temporary, direct, likely, negligible, low and not significant effect	No mitigation required.		Localised	Temporary	Direct	Likely	Negligible	Low	Not Significant
Effects on Soil and Geology	Soils and Geology	WF, GR & TDR	Negative, localised, temporary, direct, likely, minor, low and not significant effect	Section 8.5.2.2	Negative	Localised	Temporary	Direct	Likely	Negligible	Low	Not Significant
Accidental spills & contamination/ pollution	Land, Soils and Geology	WF, GR & TDR	Negative, localised, temporary, direct, likely, moderate, high and moderate effect	Section 8.5.2.3	Negative	Localised	Long-term	Direct	Unlikely	Minor	High	Slight

EFFECT (PRE-MITIGATION)	RECEPTOR	IMPACT/ ACTIVITY	EFFECT (PRE-MITIGATION)	MITIGATION MEASURES	RESIDUAL EFFECT (POST-MITIGATION)							
					QUALITY OF EFFECT	SPATIAL EXTENT	DURATION	OTHER RELEVANT CRITERIA	LIKELIHOOD	MAGNITUDE	SENSI-TIVITY	SIGNIFICANCE
DECOMMISSIONING												
Land use	Land and Soils	Wind farm	Positive, localised, long-term, direct, likely, negligible, low and not significant effect	Section 8.5.2.4	Positive	Localised	Long-term	Direct	Likely	Negligible	Low	Not Significant

8.8 Cumulative Effects

The potential cumulative effects of the proposed development along with other existing, approved and proposed developments have been assessed. Cumulative effects relate to the addition of many minor or insignificant effects, including effects of other projects, to create larger, more significant effects. A list of proposed and approved/permitted developments assessed in the EIAR for cumulative impact assessment with the proposed project is provided in Chapter 01 Introduction.

There are several planning applications within 5km of the proposed project site. These include:

- Six multiple housing developments (five in Thurles and 1 in Roscrea):
    - One multi-housing development (86 units) in Thurles was permitted in Feb 2024, another in Feb 2023 (26 units) and a third in Sept 2022 (63 dwellings). One multi-housing planning application in Thurles is still under consideration. These are all located at least 3km south and downstream of the proposed wind farm site.
- One incomplete powerline (Borrisoleigh to Thurles):
    - The powerline will transect the proposed project site. It is likely that the construction of this powerline will be complete prior to the construction of the wind farm and any rerouting required will be submitted as a separate planning application, in consultation with ESB;
- One solar farm and substation (Rahelty 5km south east);
- A community health care centre and pharmacy (Thurles);
- One staff welfare compound (Birchgrove – 23km south west); and
- A multifunctional spectator stand for a sports facility with three pitches in Thurles.

These large projects will be put through a rigorous design process for obtaining planning permission. Where relevant, these projects/plans have incorporated Construction Environmental Management Plans (CEMPs) and Appropriate Assessments to ensure that there will be no adverse effects on land, soils and geology. The only potential development where direct cumulative effects that could reasonably be foreseen is the incomplete powerline which transects the proposed Brittas WF development site (see Figure 2-25 in Chapter 02 Project Description). This c.6.94 km of incomplete powerline requires either new poles to be erected or that existing poles be strung. The structures to be erected comprise either twin or predominately single timber pole structures strung or to be strung with a twin line. This development was permitted in mid-2023 and is likely to be constructed prior to construction phase of the proposed project. The wind farm developer will submit a separate planning application for the rerouting of this line through the wind farm site to Tipperary County Council, in consultation with ESB. The possible options for this re-routing are outlined in Chapter 04 Alternatives of the EIAR.

The construction of this powerline will be completed prior to construction of the Brittas windfarm project and will therefore not have any additional cumulative effects in combination with the proposed wind farm. This EIAR has assessed the potential effects of rerouting this powerline during the construction of the wind farm – as part of the project. Therefore, an assessment of cumulative effects is not relevant.

There are 29 smaller planning projects within close proximity to the proposed project. These include agricultural sheds and shed extensions, livestock facilities, dwelling houses, and extensions to dwelling houses, attic conversions, domestic wastewater treatment systems, property entrances and roads, sports facilities, garages, demolitions, and retention permission applications etc. These projects are not located within the proposed project site and will not introduce complex or significant issues in terms of environmental effects. Cumulative effects would therefore be insignificant with the proposed project in terms of land and soils.

There are several other wind farm developments within 20km of the proposed project. The closest of these is the Lisheen Wind Farm which is located approximately 9.8km to the north east. The nearest Solar farm to the proposed project is the ENGIE Solar Farm which is proposed to be located approximately 5km south-west of the proposed project site. In terms of cumulative land and soil effects arising from elements of the proposed project, the potential for effects on land and soils is low as they are all contained within the proposed project site.

Therefore, the construction phase cumulative effect of the proposed project in combination with the related projects mentioned on land and soils aspects is considered to be negative, imperceptible and temporary (the construction phase of the proposed project will be no more than 18 months).No significant cumulative effects will occur during the operational phase of the proposed development or the decommissioning phase.

8.9 Conclusions

In conclusion, no significant effects on the land, soil and geology of proposed development site or along the grid connection route will occur during construction, operation, or during decommissioning due to correct procedures and outlined mitigations being implemented.

The assessment also confirms that there will be no significant cumulative effects on the land, soil and geology environment as a result of the proposed development and other proposed projects.

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8.10 References

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