7. LAND, SOILS AND GEOLOGY

7.1 Introduction

7.1.1 Background and Objectives

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

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

7.1.2 Statement of Authority

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

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

This chapter of the EIAR was prepared by Michael Gill and David Broderick.

David Broderick (BSc, H. Dip Env Eng, MSc) is a hydrogeologist with over 13 years' experience in both the public and private sectors. Having spent two years working in the Geological Survey of Ireland working mainly on groundwater and source protection studies David moved into the private sector. David has a strong background in groundwater resource assessment and geological, hydrogeological/hydrological investigations in relation to developments such as quarries and wind farms. David has completed numerous geology and water sections for input into EIARs for a range of commercial developments. David has worked on the EIS/EIARs for Derrykillew WF, Meenbog WF, and Oweninny WF, and over 60 other wind farm related projects associated grid connections across the country.

Michael Gill (BA, BAI, Dip Geol., MSc, MIEI) is an Environmental Engineer and Hydrogeologist with over 18 years' environmental consultancy experience in Ireland. Michael has completed numerous hydrological and hydrogeological impact assessments of wind farms and renewable projects in Ireland. In addition, he has substantial experience in geological characterisation, peatland morphology, and surface water drainage design and SUDs design and surface water/groundwater interactions. Michael has worked on the EIS/EIAR for Oweninny WF, Cloncreen WF, and Meenbog WF, Croagh WF and over 100 other wind farm related projects and associated grid connections across the country.

7.1.3 Relevant Legislation

The EIAR is prepared in accordance with the requirements of European Union Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment (the 'EIA

Directive') as amended by Directive 2014/52/EU. The requirements of the following legislation are complied with:

- Planning and Development Acts, 2000-2021;
- Planning and Development Regulations, 2001 (as amended);
- Directives 2011/92/EU and 2014/52/EU on the assessment of the effects of certain public and private projects on the environment, including Circular Letter PL 1/2017: Implementation of Directive 2014/52/EU on the effects of certain public and private projects on the environment (EIA Directive);
- S.I. No. 296 of 2018 European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018;
- European Communities (Environmental Impact Assessment) Regulations 1989 to 2017; and,
- S.I. No. 4 of 1995: The Heritage Act 1995, as amended.

7.1.4 Relevant Guidance

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

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

7.2 Assessment Methodology

7.2.1 Desk Study

A desk study of the Proposed Development site and receiving environment (described below) was completed in advance of undertaking the ground surveys and site investigations. This involved collecting all relevant geological data for the Proposed Development site and receiving environment. This included consultation with the following data sources:

- Environmental Protection Agency database (www.epa.ie);
- Geological Survey of Ireland - Groundwater and Geology Databases (www.gsi.ie);
- Geological Survey of Ireland – Geological Heritage site mapping (www.gsi.ie);
- Bedrock Geology 1:100,000 Scale Map Series, Sheet 21 (Geology of Kerry - Cork). Geological Survey of Ireland (GSI, 1997);
- Geological Survey of Ireland – 1:25,000 Field Mapping Sheets;
- General Soil Map of Ireland 2nd edition (www.epa.ie); and,
- Aerial Photography, 1:5000 and 6 inch base mapping.

7.2.2 Baseline Monitoring and Site Investigations

Walkover surveys, soil gouge coring and peat depth probing of the grid connection route was initially undertaken by HES on 27th and 28th February 2018 for the purpose of the Permitted Development EIAR and planning application.

An additional walkover survey and site investigations of the Proposed Development site were completed by HES on 22nd October 2021.

Geotechnical ground investigations, a peat stability assessment along with a peat management plan were also undertaken by Fehily Timoney and Company (FT). The combined geological and hydrogeological dataset collated during the iterative design collaboration by HES, MKO and FT has been used in the preparation of this EIAR Chapter.

The objectives of the intrusive site investigations included mapping the distribution and depth of blanket peat at the Proposed Development site along with assessing the mineral subsoil / bedrock conditions beneath the peat at key development locations (i.e. underground cabling routes, TDR route, substation and borrow pits). This data was used to inform the final layout design.

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

- A total of 880 no. peat probe depths/investigations points were carried out by FT, MKO and HES to determine the depth and geomorphology of the blanket peat at the Proposed Development site;
- A geotechnical and peat stability assessment report by FT July 2022);
- A total of over 24 no. gouge core sample points were undertaken by HES at proposed infrastructure locations to investigate peat and underlying mineral soil lithology;
- Trial pitting (6 no.) was carried out by FT at the proposed substation and borrow pit location;
- Logging of subsoil exposures across the site where mineral soils and peat profiles are exposed; and,
- Mineral subsoils and peat were logged according to BS: 5930 and Von Post Scale respectively.

The Geotechnical and Peat Stability Assessment Report and Spoil and Peat Management Plan prepared by FT are included as Appendix 7-1 of this EIAR.

7.2.3 Scope and Consultation

The scope for this EIAR has been informed by consultation with statutory consultees, bodies with environmental responsibility and other interested parties. This consultation process is outlined in Section 2.53 of this EIAR. The Geological Survey of Ireland was the only consultee to respond with respect to Land, Soils and Geology. However, their response was informative in nature with regard sources of online data for baseline assessment purposes.

7.2.4 Impact Assessment Methodology

Using information from the desk study and data from the site investigations, an assessment of the importance of the land, soil and geological environment within the Proposed Development site is assessed using the criteria set out in Table 7-1 (NRA, 2008).

Table 7-1 Estimation of Importance of Soil and Geology Criteria (NRA, 2008).

Importance	Criteria	Typical Example
Very High	Attribute has a high quality, significance or value on a regional or national scale. Degree or extent of soil contamination is significant on a national or regional scale.	Geological feature rare on a regional or national scale (NHA). Large existing quarry or pit. Proven economically extractable mineral resource

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

The guideline criteria (EPA, 2022) for the assessment of likely significant effects require that likely effects are described with respect to their extent, magnitude, type (i.e. negative, positive or neutral) probability, duration, frequency, reversibility, and transfrontier nature (if applicable). The descriptors used in this environmental impact assessment report are those set out in the EPA (2022) Glossary of effects as shown in Chapter 1 of this EIAR.

In order to provide an understanding of this descriptive system in terms of the geological/hydrological environment, elements of this system of description of effects are related to examples of potential likely significant effects on the geology and morphology of the existing environment, as listed in Table 7-2.

Table 7-2: Impact descriptors related to the receiving environment.

Impact Characteristics		Potential Hydrological Impacts
Quality	Significance	
Negative only	Profound	Widespread permanent impact on: › The extent or morphology of a cSAC. › Regionally important aquifers. › Extents of floodplains. Mitigation measures are unlikely to remove such impacts.
Positive or Negative	Significant	Local or widespread time-dependent impacts on: › The extent or morphology of a cSAC / ecologically important area. › A regionally important hydrogeological feature (or widespread effects to minor hydrogeological features). › Extent of floodplains. Widespread permanent impacts on the extent or morphology of an NHA/ecologically important area. Mitigation measures (to design) will reduce but not completely remove the impact – residual impacts will occur.
Positive or Negative	Moderate	Local time-dependent impacts on: › The extent or morphology of a cSAC / NHA / ecologically important area. › A minor hydrogeological feature. › Extent of floodplains. Mitigation measures can mitigate the impact OR residual impacts occur, but these are consistent with existing or emerging trends
Positive, Negative or Neutral	Slight	Local perceptible time-dependent impacts not requiring mitigation.
Neutral	Imperceptible	No impacts, or impacts which are beneath levels of perception, within normal bounds of variation, or within the bounds of measurement or forecasting error.

7.3 Existing Environment

7.3.1 Site Description and Topography

The Proposed Development site is located in the Derrynasaggart Mountains, on the Cork and Kerry border, approximately 3km to the north of Ballyvourney. The total EIAR study area/ Proposed Development site is approximately 631ha (6.31km^2) in area.

The Proposed Development site is dominated by forestry on blanket bog and is accessible via a network of farm tracks from the south, forestry roads from the northwest (proposed TDR route), and existing windfarm (Clydaghroe Windfarm) access roads to the northeast which is the proposed route of the 110kV underground electrical cable.

The elevation of the Proposed Development sites ranges between approximately 255 and 530m OD (metres above Ordnance Datum) with the site located on an east to west orientated mountain ridge/topographic divide. The ground slopes to the north and south from the central ridgeline. The Proposed Development is linear in nature along this mountain ridgeline.

The proposed 33kV underground electrical cabling commences from within the Permitted Development and connects to the proposed 110kV substation which is located approximately 4.7km to the northeast of the Permitted Development.

The 33kV cabling will consolidate all of the on-site underground cabling, from the individual turbines and solar array, into 3 cable circuits for the purposes of grid connection from the Permitted Development. The route of the 33kV cabling, which has a total length of 8.07km, is along existing farm tracks/ permitted roads in the area of the Permitted Development for ~3km and then goes off-road (within new access road) for ~5.07km until it connects to the proposed 110kV substation. The off-road section is mainly along forestry fire breaks which separate the forestry from the open blanket bog which is located upslope to the south of the route.

The initial ~3km of the 33kV underground electrical cabling route is on the south facing slopes of the Derrynasaggart Mountains where the elevation range is between 340 – 430m OD. The off-road section of the 33kV route is on the north facing slopes of the Derrynasaggart Mountains where the elevation is between 410 – 510m OD.

The 110kV underground electrical cabling route is mainly along existing forestry access roads (2km) with off-road sections through forestry (0.48km), upland peat (0.68km) and improved grassland (0.4km). The route of the 110kV underground electrical cable is mainly along the southern slopes of the Derrynasaggart Mountains where the elevation range is between 340 – 430m OD.

The proposed 110kV substation site located in an area of felled forestry on peat where the ground elevation is between 475 and 490m OD on the north facing slopes of the Derrynasaggart Mountains. There is a proposed borrow pit located immediately to the southeast of the substation which has similar terrain.

The proposed TDR between the Permitted Development and the N22, which is 5.5km in length, is along an existing forestry road with an elevation range of between 240 and 420m OD.

7.3.2 Land and Land Use

Based on Corine (2018) mapping, coniferous forestry and peat bogs are mapped in the area of the 33kV underground electrical cabling route, TDR, 110kV substation and western end of the 110kV underground electrical cabling route while agricultural areas and forest/semi-natural areas are mapped along the eastern end of the 110kV underground electrical cabling route. The TDR road for upgrade is

an existing forestry track. The temporary access road off the N22 is on grassland. The omitted 38kV substation and battery storage compound is in an area of cutaway peat.

The 110kV underground electrical cabling route is mainly adjacent to an existing forestry roads. No major land use changes have been recorded by Corine mapping (2018).

7.3.3 Peat/Soils and Subsoils

The published soil map (www.epa.ie) for the area shows that blanket peat is predominant at the Proposed Development site including along all of the 33kV underground electrical cabling route and at the 110kV substation area. Blanket peat is also mapped along the majority of the 110kV underground electrical cabling route with the exception of the section on improved grassland (0.4km) at the eastern end of the route near the Ballyvouskill substation.

Similarly, the GSI subsoil mapping shows that blanket peat is dominant at the Proposed Development site along with Devonian sandstone tills mapped along the improved grassland (0.4km) section of the 110kV underground electrical cabling route. A subsoil geology map for the Proposed Development site is shown as Figure 7-1.

Overall, peat depths recorded (880 individual locations) within the Proposed Development site ranged from 0.0 to 3.25m with an average depth of 0.85m. Approximately 92% of peat depth probes recorded peat depths of less than 2.0m and with 61% been less than 1m. A peat depth distribution plot for the Proposed Development site is shown as Figure 7-2 below.

Peat depths recorded at the proposed 110kV substation location varied from 0.6 to 1.8m with an average depth of 1.0m. With respect to the TDR road upgrade, peat depths are typically less than 2.0m (average 1.8m).

Peat depths along the 33kV underground electrical cabling route ranged from 0.2 to 1.7m and along the 110kV underground electrical cabling route ranged from 0 to 1.5m.

A summary peat depth map and trial pit locations are shown on Figure 7-3.

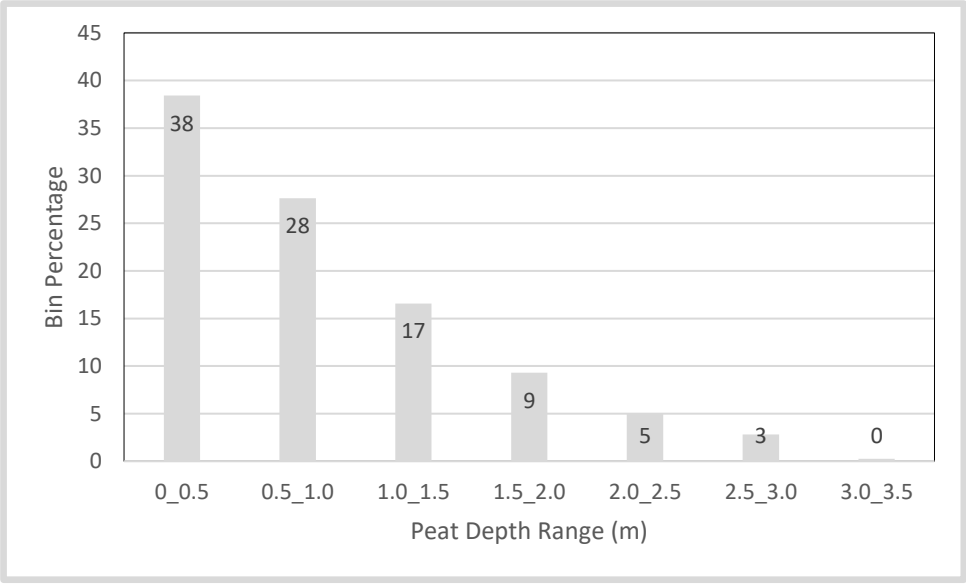
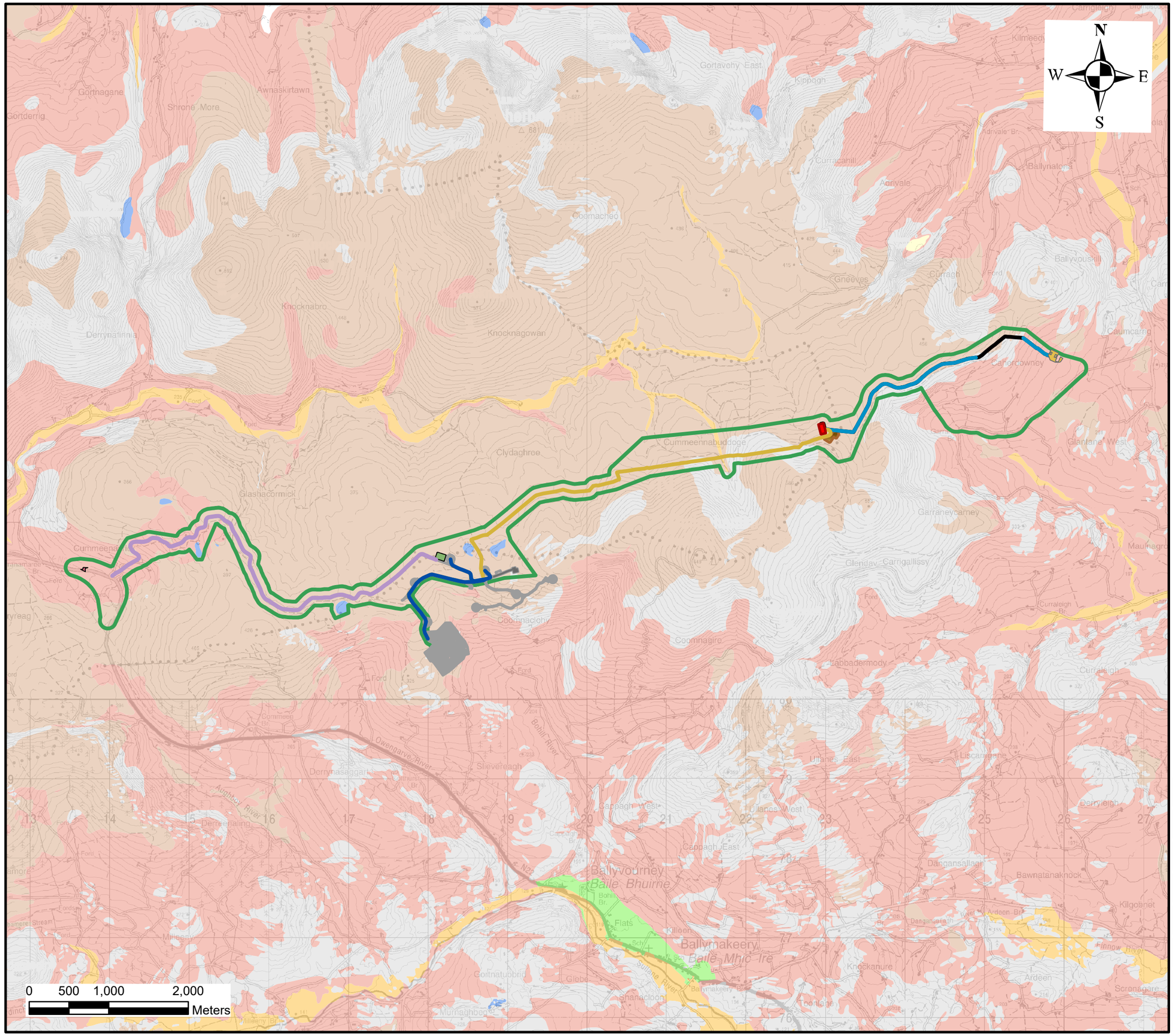


Figure 7-2 Proposed Development Site Peat Dept Distribution Plot

In order to investigate the peat and underlying mineral subsoil lithology at the 110kV substation and borrow pit location a total of 6 no. trial pits were carried out by FT on 3rd February 2022.



Legend

- EIAR Study Boundary
- Access Road (Upgrade & New)
- Temp. Road
- 33kV Underground Cabling and Access Roads
- 33kV Underground Cabling within the Permitted Development
- 110kV Underground Cabling
- 110kV Underground Cabling and Access Road
- Ballyvouskill 220kV Substation
- Proposed 110kV Substation Location
- Proposed Borrow Pit
- Permitted Borrow Pit Extension
- Omitted 38kV Electrical Substation and Battery Storage Compound
- Knocknamork Permitted Layout

Subsoils

- A, Alluvium
- BktPt, Blanket Peat
- GDSs, Gravels derived from Devonian sandstones
- L, Lacustrine sediments
- Rck, Bedrock outcrop or subcrop
- TDSs, Till derived from Devonian sandstones
- Water

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web: www.hydroenvironmental.ie

Client: Knocmnamork Ltd.

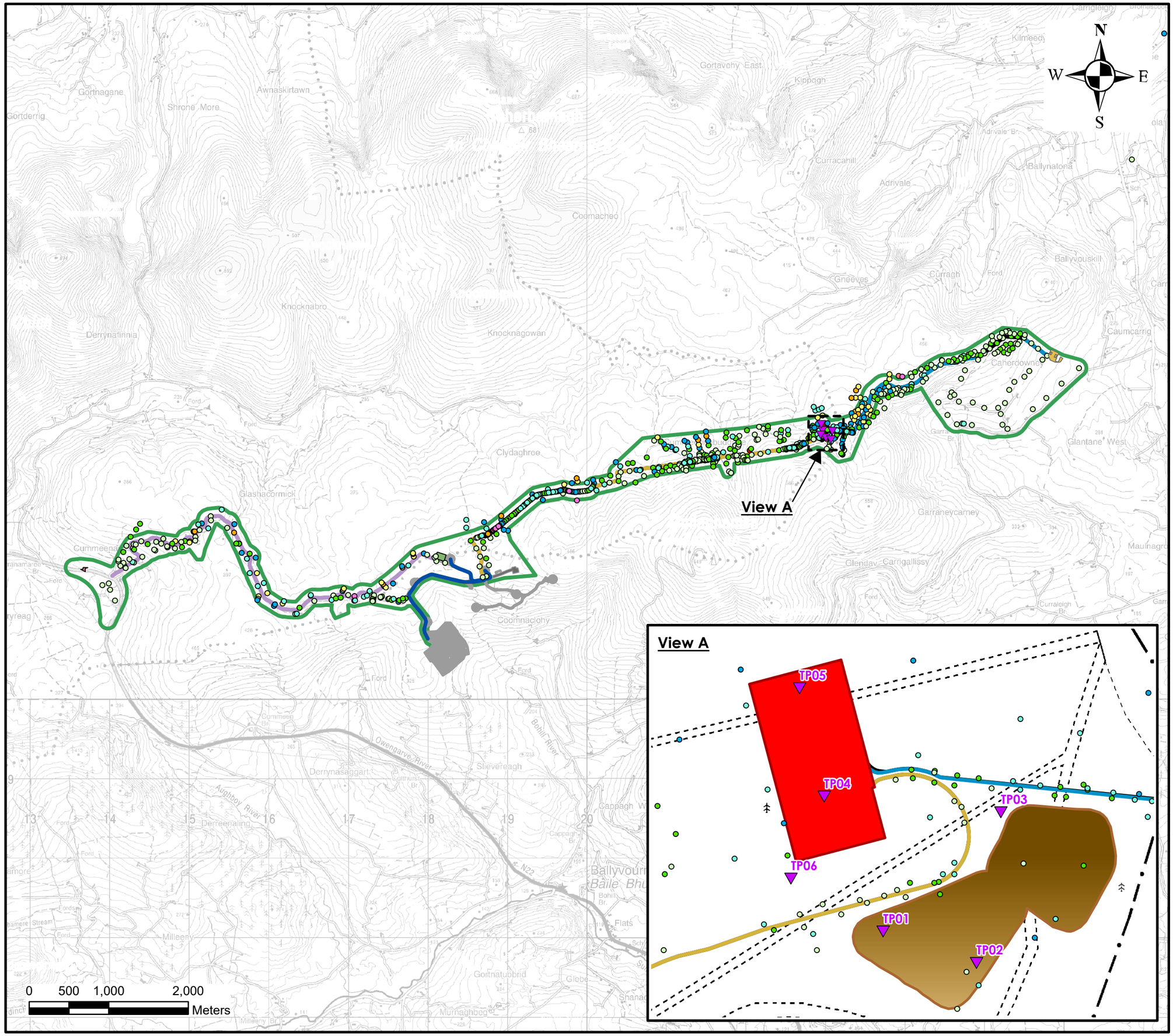
Job: Knocknamork Grid Connection, Co. Cork

Title: Local Subsoils Map

Figure No: 7-1

Drawing No: P1421-1-0722-A3-701-00A

Sheet Size: A3	Project No: P1421-1
Scale: 1:45,000	Drawn By: GD
Date: 01/07/2022	Checked By: MG



Legend

- EIAR Study Boundary
- Access Road (Upgrade & New)
- Temp. Road
- 33kV Underground Cabling and Access Roads
- 33kV Underground Cabling within the Permitted Development
- 110kV Underground Cabling
- 110kV Underground Cabling and Access Road
- Ballyvouskill 220kV Substation
- Proposed 110kV Substation Location
- Proposed Borrow Pit
- Permitted Borrow Pit Extension
- Omitted 38kV Electrical Substation and Battery Storage Compound
- Knocknamork Permitted Layout
- Trial Pit locations (FT)

Peat Depth Legend

- 0 - 0.5m
- 0.5 - 1.0m
- 1.0 - 1.5m
- 1.5 - 2.0m
- 2.0 - 2.5m
- 2.5 - 3.0m
- 3.0 - 3.5m
- 3.5 - 4.0m
- 4.0 - 5.0m

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Client: Knocknamork Ltd.

Job: Knocknamork Grid Connection, Co. Cork

Title: Summary Peat Depth and Trial Pit locations Map

Figure No: 7-3

Drawing No: P1421-1-0622-A3-703-00A

Sheet Size: A3	Project No: P1421-1
Scale: 1:45,000	Drawn By: GD
Date: 03/06/2022	Checked By: MG

Below the peat, which was up to 1.6m in thickness at the trial pit locations, sandy silty GRAVEL (with angular cobbles) were encountered down to a maximum depth of 3m below ground level (mbgl). All trial pits encountered bedrock below the mineral subsoil with subsoil thickness ranging from 0.4m to 2.5m. Refer to Appendix 7-1 for trial pit logs.

A total of 24 no. soil gouge cores were undertaken along the off-road section of the 33kV underground electrical cabling route. Gravelly till or potentially weathered bedrock was encountered below the peat along the proposed cabling route. Observations made at the Permitted Development site show that the peat is typically underlain by 0.5 to 2m of mineral subsoil (comprising gravelly subsoil with regular to abundant rock clasts) or directly on weathered or massive bedrock.

The observations were made at several bedrock exposures and road cuttings at the Permitted Development site.

The subsoil/bedrock interface observations made at the Permitted Development site are consistent with the trial pits carried out at the proposed 110kV substation location. The mineral subsoil conditions below the peat (as described above) and therefore expected to be relatively consistent across the Proposed Development site.

7.3.4 Bedrock Geology

Based on the GSI bedrock map, the bedrock unit underlying the Proposed Development site comprises Old Red Sandstone (ORS). Locally in the area of the Proposed Development, the rock formation is described by the GSI as green-grey sandstone and purple siltstone.

Based on observations made at the Permitted Development site, the weathered bedrock horizon (if present) at the peat/mineral subsoil is very thin (0.3 – 0.4m) and the underlying SANDSTONE bedrock is typical, massive and strong/competent.

This is also consistent with the 6 no. trial pits carried out at the 110kV substation location which encountered relatively competent SANDSTONE almost immediately below the mineral subsoils.

The bedrock conditions below the peat/mineral subsoil and therefore expected to be relatively consistent across the Proposed Development site.

Based on the GSI mapping, two faults are mapped to intercept the Proposed Development site, both mapped faults are northwest-southeast orientated and are located in the area of the 33kV underground electrical cabling route. These faults will have no potential to affect the Proposed Development.

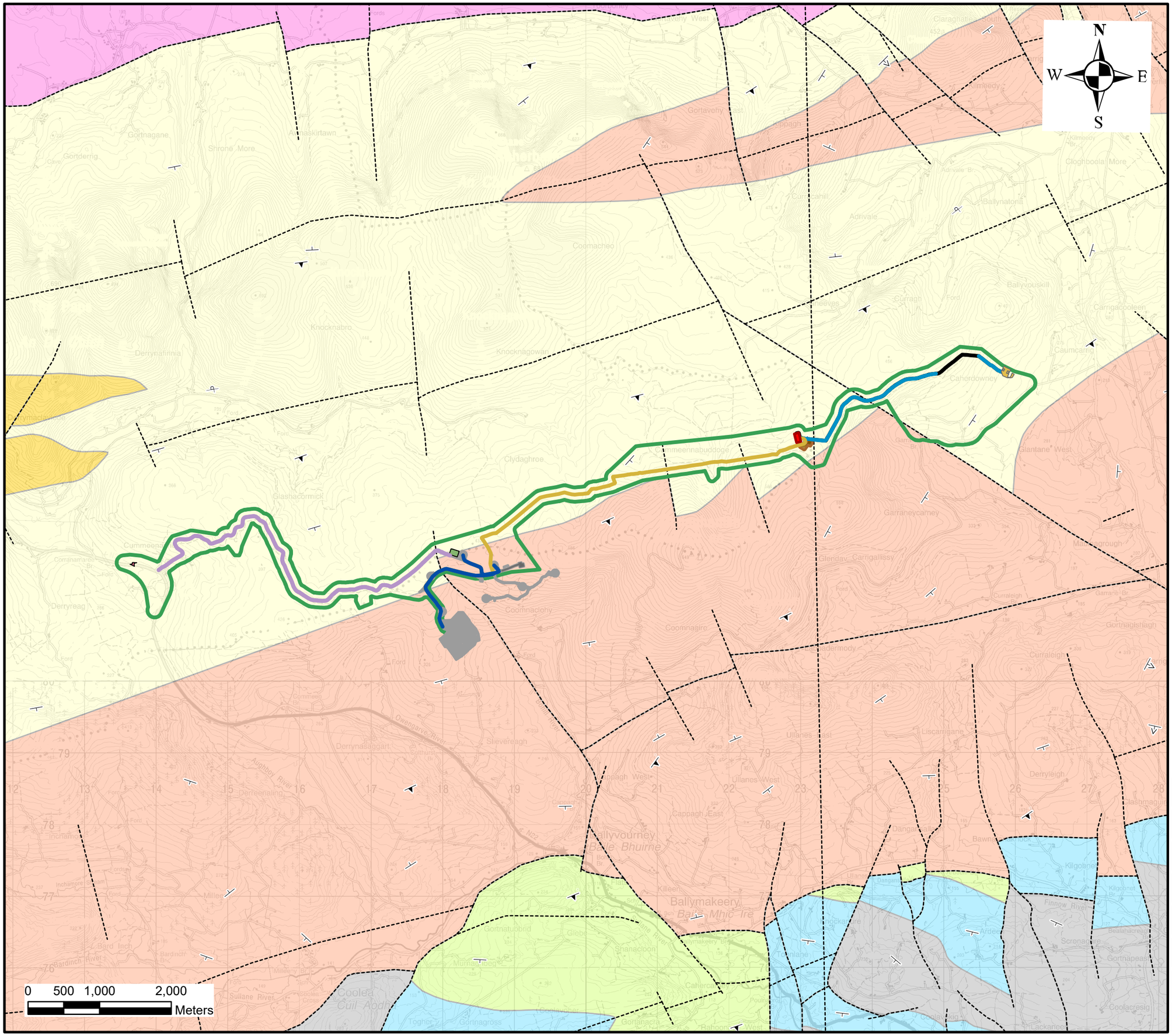
A bedrock geology map of the area is attached as Figure 7-4.

7.3.5 Geological Resource Importance

Based on NRA (2008) criteria in Table 7-1, bedrock underlying the Proposed Development site can be classified as “Medium” importance. The bedrock could be used on a “sub-economic” local scale for construction purposes.

The glacial subsoils can be classified as “Low” importance. The glacial subsoils could be used on a “sub-economic” local scale for construction purposes. There is no evidence that it was used in the past.

The overlying peat deposits at the site could be classified as “Low” importance as the peat is not designated in this area and is significantly degraded in most places due to the forestry. Refer to Table 7-1 for definition of these criteria.



Legend

- EIAR Study Boundary
- Access Road (Upgrade & New)
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- 33kV Underground Cabling within the Permitted Development
- 110kV Underground Cabling
- 110kV Underground Cabling and Access Road
- Ballyvouskill 220kV Substation
- Proposed 110kV Substation Location
- Proposed Borrow Pit
- Permitted Borrow Pit Extension
- Omitted 38kV Electrical Substation and Battery Storage Compound
- Knocknamork Permitted Layout
- Geological Linework

Structural Symbols

- Strike and dip of bedding, right way up
- Strike and dip of bedding, way up unknown
- Strike and dip of first foliation
- Strike and dip of overturned bedding

Bedrock

- Bird Hill Formation
- Caha Mountain Formation
- Glenflesk Chloritic Sandstone Forma
- Gortanimill Formation
- Gun Point Formation
- Lough Guitane rhyolites
- Namurian (undifferentiated)

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Client: Knocknamork Ltd.

Job: Knocknamork Grid Connection, Co. Cork

Title: Local Bedrock Geology Map

Figure No: 7-4

Drawing No: P1421-1-0622-A3-704-00A

Sheet Size: A3	Project No: P1421-1
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Date: 03/06/2022	Checked By: MG

7.3.6 Geological Heritage and Designated Sites

The closet designated site to the Proposed Development site is Mullaghanish to Musheramore Mountains Special Protection Area (SPA) (Code: 004162) which adjoins the south-eastern boundary of the Proposed Development site. The closet proposed infrastructure to the SPA is the 110kV underground electrical cabling route which is setback at least 250m from the SPA.

Mullaghanish Bog Special Area of Conservation (SAC) is located approximately 400m (upslope) to the south of the 33kV underground electrical cabling route. The elevation difference between the cabling route and the northern/closest edge of the bog is approximately 80m.

The closest geological heritage site is an igneous intrusion, Killeen (IGH 11), which is located approximately 4.4km north-northwest of the Proposed Development site.

Hydrologically connected Designated Sites downstream of the Proposed Development site (i.e. Killarney National Park, Macgillycuddy's Reeks And Caragh River Catchment SAC) are assessed in Chapter 9 (Hydrology/Hydrogeology).

The locations of nearby Geological Heritage sites and Designated Sites and are shown on Figure 7-5**.**

7.3.7 Soil Contamination

There are no known areas of soil contamination on the site of the Proposed Development. During the site walkovers or investigations, no areas of contamination concern were identified.

According to the EPA online mapping (http://gis.epa.ie/Envision), there are no licensed waste facilities on or within the immediate environs of the site of the Proposed Development.

There are no historic mines at or in the immediate vicinity of the site of the Proposed Development that could potentially have contaminated tailings.

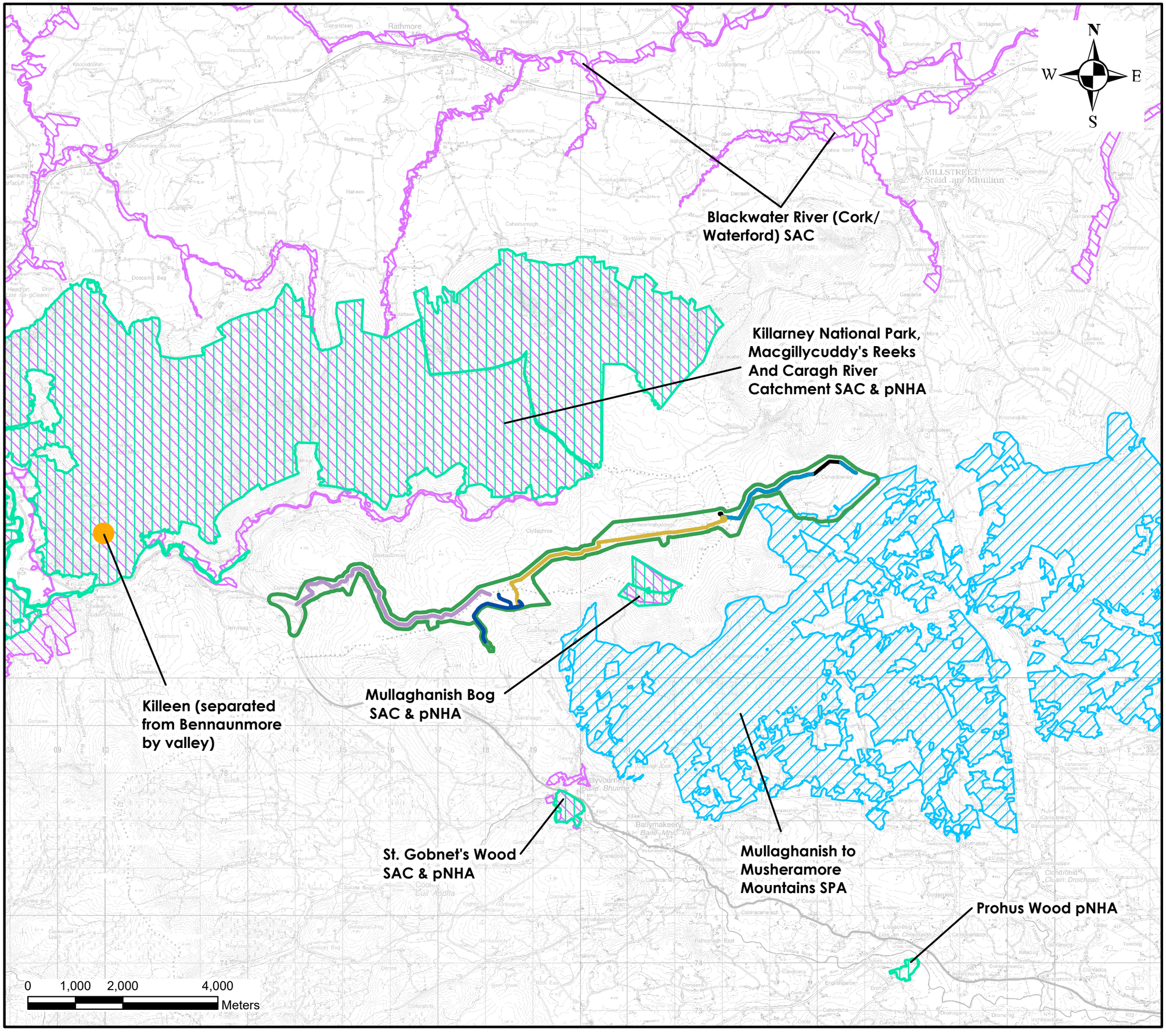
7.3.8 Peat Stability Assessment

7.3.8.1 Introduction

Fehily Timoney and Company (FT) was engaged to undertake a geotechnical and peat stability assessment of the Proposed Development site. A Geotechnical and Peat Stability Assessment Report (FT, July 2022) is attached in Appendix 7-1.

Hydrological, hydrogeological and ecological factors were also assessed in the Geotechnical and Peat Stability Assessment Report, and interaction between FT, HES and MKO were undertaken throughout the iterative design process. The assessment was undertaken following the principles outlined in Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Developments (PLHRAG, Scottish Government, 2017).

An early planning stage site suitability assessment/constraints study was initially undertaken by the Environmental (MKO), Hydrological (HES) and Ecological (MKO) members of the project design team to determine the developable area on the site, prior to the site reconnaissance by engineering geologists/geotechnical engineers from FT.



Legend

- EIAR Study Boundary
- Access Road (Upgrade & New)
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- 33kV Underground Cabling within the Permitted Development
- 110kV Underground Cabling
- 110kV Underground Cabling and Access Road
- SPA
- SAC
- pNHA

Geological Heritage Sites

- Killeen (separated from Bennaunmore by valley)_ IGH 11

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Client: Knocknamork Ltd.

Job: Knocknamork Grid Connection, Co. Cork

Title: Nearby Geological Heritage Sites and Designated Sites Map

Figure No: 7-5

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7.3.8.2 Hydrological Considerations

The hydrological factors with regard peat stability were assessed using a combination of desk study data, aerial photography (historical and contemporary), topographic lidar data, site walkovers, field drainage mapping and gouge coring. Detailed drainage maps were prepared along with hydrological constraints mapping for on-site drainage features and wet areas.

Many of the Pre-conditions (for peat failure scenarios) as described by PLHRAG are hydrological in nature and are listed in the guidance as follows:

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

Identifying the above pre-conditions at the Proposed Development site was a key part of the hydrological constraints assessment carried out in conjunction with project design team.

7.3.8.3 Peat Slides – Lessons Learned

This peat stability assessment has been undertaken taking into account peat failures that have occurred on peatland sites (such as recent failures at Shass Mountain 2020, Co. Leitrim and Meenbog 2020, Co. Donegal). The lessons learned from both peat slide events have been incorporated into the design of this project and the construction methodologies to be implemented. The Meenbog failure occurred during the construction of a section of floating road on sidelong ground in an area of weak peat. This construction technique is not proposed on the Proposed Development site. It is important that the existing site drainage is maintained during construction to avoid a similar failure to that on Shass Mountain, which occurred following heavy rainfall, and this is referenced in the Risk Assessments for the Proposed Development (FT, July 2022).

7.3.8.4 Peat Stability Investigations

A Geotechnical and Peat Stability Assessment Report (FT, July 2022) is attached in Appendix 7-1. Summary data and conclusions from that report are provided below.

An analysis of peat sliding was carried out at all the main infrastructure locations across the Proposed Development site. The purpose of the analysis was to determine the Factor of Safety (FoS) of the peat slopes. The minimum required Factor of Safety (FoS) is 1.3 based on BS6031:2009: Code of Practice for Earthworks (BSI, 2009). The assigned probability of instability associated with a given FoS value is described in Table 7-3 below.

No peat failures/landslides are recorded on the Proposed Development site which suggests that site conditions do not pre-dispose themselves to failures/landslides.

The hand vane results indicate undrained shear strengths in the range 6 to 50kPa, with an average value of about 20kPa. The strengths recorded are typical of well-drained peat as is present on the Proposed Development site.

Table 7-3: Probability Scale for Factor of Safety.

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

7.3.8.5 Peat Stability Assessment Results

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

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

To assess the factor of safety for a peat slide, an undrained[1] (short-term stability) and drained (long-term stability) analysis has been undertaken to determine the stability of the peat slopes on site.

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

An analysis of peat stability was carried out for the Proposed Development for both the undrained and drained conditions. The purpose of the analysis was to determine the Factor of Safety (FoS) of the peat slopes. 220 no. analysis points were completed.

As mentioned above, the Geotechnical and Peat Stability Assessment Report (FT, July 2022) is attached in Appendix 7-1.

7.3.8.5.1 *Undrained Analysis*

Undrained analysis results are presented in Table 7-4. As outlined above the undrained loading condition applies in the short-term during construction and until construction induced pore water pressures dissipate.

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

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

The calculated FoS for load condition 1 is in excess of 1.30 for each of the locations (approx. 220 no. locations) analysed with a range of FoS of 2.16 to 122.13, indicating a low risk of peat instability.

The calculated FoS for load condition 2 is in excess of 1.30 for each of the locations (approx. 220 no. locations) analysed with a range of FoS of 1.39 to 14.48, indicating a low risk of peat instability.

Table 7-4: Factor of Safety Results (undrained condition)

Location	Waypoint	Easting	Northing	Factor of Safety for Load Condition	
				Condition (1)	Condition (2)
TDR (Section 1)	WP20	514589	581992	14.51	3.35
	MKO181	514216	581689	34.41	3.13
	MKO170	515112	582060	3.85	2.10
TDR (Section 2)	WP31	516082	581207	2.34	1.40
	MKO157	515816	581577	2.16	1.39
	MKO161	517018	581310	5.29	4.05
	MKO163	515581	582092	2.85	1.66
TDR (Section 3)	MKO218	517455	581435	5.10	3.20
	WP40	517954	581846	4.79	3.08
Upgrade of Existing Permitted Borrow Pit	MKO158	518111	581750	86.22	7.84
33kV Cabling route	WP41	519013	582133	3.31	1.98
	Enerco226	518844	582153	3.83	2.87
	MKO223	520911	582935	3.71	2.00
	MKO243	522580	583167	5.88	3.18
Substation	WP55	522865	583428	2.42	1.55
Proposed Borrow Pit	MKO206	523128	583303	5.12	2.71
110kV Cabling route (Section 1)	WP61	523407	583500	3.84	2.47
	MKO264	523241	583451	5.40	3.32
	WP61	523407	583500	3.84	2.47
110kV Cabling route (Section 2)	MKO086	524652	584256	2.46	1.34
	MKO552	525159	584489	14.24	3.88

Location	Waypoint	Easting	Northing	Factor of Safety for Load Condition	
				Condition (1)	Condition (2)
110kV Cabling route (Section 3)	No Peat Recorded (improved grassland)				

7.3.8.5.2 *Drained Analysis*

Drained analysis results are presented in Table 7-5. As outlined above, the drained loading condition applies in the long-term. The condition examines the effect of in particular, the change in groundwater level as a result of rainfall on the existing stability of the natural peat slopes.

The calculated FoS for load condition 1 is in excess of 1.30 for each of the locations (approx. 220 no. locations) analysed with a range of FoS of 1.44 to 81.42, indicating a low risk of peat instability.

The calculated FoS for load condition 2 is in excess of 1.30 for each of the locations (approx. 220 no. locations) analysed with a range of FoS of 1.98 to in excess of 20.89, indicating a low risk of peat instability.

Table 7-5: Factor of Safety Results (drained condition)

Location	Waypoint	Easting	Northing	Factor of Safety for Load Condition	
				Condition (1)	Condition (2)
TDR (Section 1)	WP20	514589	581992	9.67	4.78
	MKO181	514216	581689	22.94	4.44
	MKO170	515112	582060	2.57	3.01
TDR (Section 2)	WP31	516082	581207	1.56	2.25
	MKO157	515816	581577	1.44	1.98
	MKO161	517018	581310	3.53	5.84
	MKO163	515581	582092	1.90	2.37
TDR (Section 3)	MKO218	517455	581435	3.40	4.61
	WP40	517954	581846	3.19	4.43
Upgrade of Existing Permitted Borrow Pit	MKO158	518111	581750	57.48	11.29
33kV Cabling route	WP41	519013	582133	2.20	2.84
	Enerco226	518844	582153	2.55	4.14
	MKO223	520911	582935	2.47	2.86

Location	Waypoint	Easting	Northing	Factor of Safety for Load Condition	
				Condition (1)	Condition (2)
	MKO243	522580	583167	3.92	4.57
Substation	WP55	522865	583428	1.61	2.22
Proposed Borrow Pit	MKO206	523128	583303	3.41	3.89
110kV Cabling route (Section 1)	WP61	523407	583500	2.56	3.55
	MKO264	523241	583451	3.60	4.78
	WP61	523407	583500	2.56	3.55
110kV Cabling route (Section 2)	MKO086	524652	584256	1.64	1.89
110kV Cabling route (Section 3)	No Peat Recorded (Improved grassland)				

The findings of the peat stability assessment shows that the Proposed Development site has an acceptable margin of safety and is suitable for the Proposed Development. The findings include recommendations and control measures (Section 12 of Appendix 7-1 of this EIAR) for construction work in peatlands to ensure that all works adhere to an acceptable standard of safety.

The peat stability risk assessment at each infrastructure location (as listed above) identified a number of mitigation/control measures to reduce the potential risk of peat failure. The post-control measure implementation risk rating is low to negligible.

In summary, the findings of the peat assessment showed that the Proposed Development has an acceptable margin of safety, is suitable for the Proposed Development and is considered to be at low risk of peat failure. The findings include recommendations and control measures for construction work in peatlands to ensure that all works adhere to an acceptable standard of safety.

7.4 Characteristics of the Proposed Development

The Proposed Development will typically involve removal of peat, subsoils and in places bedrock for electrical cable trenching, internal access road networks, hardstanding emplacement, substation platform foundations, borrow pit excavation and drainage works. Approximately 22.3ha of trees will be felled.

The construction grade granular fill and the higher quality, surfacing granular fill will be sourced from the 1 no. permitted borrow pit at the Permitted Development (proposed for extension), 1 no. proposed borrow pit near the 110kV substation and also from beneath substation platform itself.

Based on the available ground investigation information the quantity of available rock within the proposed borrow pit is 41,500m^3. 20,000m^3 of rock will be available from the excavation for the substation platform. A further 18,000m^3 will be provided from the expansion of the already permitted borrow pit that is part of the Permitted Development. The total volume available is 79,500 m^3.

The total volume of spoil (peat and non-peat superficial deposits) requiring placement/reinstatement on the Proposed Development site is estimated at 98,500m^3 (refer to Table 7-6 below).

Once excavated, spoil will be temporarily stored in localised areas adjacent to excavations for roads before being placed into the permanent spoil storage areas within the 2 no. borrow pits or reused for landscaping purposes. All temporary storage areas will be upslope of founded roads/hardstand areas and will be inspected by a suitably qualified person before material is stored in the area.

It is estimated that the permitted and proposed borrow pit will permanently store 55,000m^3 and 29,000m^3 of spoil respectively. 19,000m^3 will be used for landscaping. Total storage requirement is 103,000m^3.

Table 7-6: Estimated Peat and Mineral Soil Excavation Volumes

Development Component	**Area (m2) (approx.)**	**Peat Volume (m^3)** (approx.)	**Spoil Volume(m3) (approx.)**
Turbine Delivery Route	Widening of existing access road to 5m running surface.	17,000	2,200
Access track for 33kV cabling	Assumed 3-4m running surface with 4-5m wide development footprint.	18,000	6,000
Access track for 110kV cabling		10,500	2,500
Substation Platform	130 x 65m hardstanding area	19,000	12,000
Borrow Pit	1 no. borrow pit at substation.	3,500	4,800
Extension to already permitted borrow pit	120m x 85m footprint	1,000	2,000
Total		**69,000**	**29,500**
Total Peat & Spoil to be managed		**98,500**	

Note (1) The location of the infrastructure elements on-site are shown on Planning Drawings.
Note (2) A factor of 20% (bulking factor of 15% and contingency factor of 5%) has been applied to the excavated peat & spoil volumes to allow for expected increase in volume upon excavation and to allow for a variation in ground conditions across the site.

7.5 Likely Significant Effects and Associated Mitigation Measures

7.5.1 Do Nothing Scenario

If the Proposed Development were not to proceed, coniferous plantation and agriculture will continue to function and may be extended to occupy a larger portion of the land. Coniferous forestry will be felled as forestry compartments reach maturity. Re-planting of these areas with coniferous plantation is likely to occur. The opportunity to generate renewable energy and electrical supply to the national grid would be lost.

7.5.2 Construction Phase - Likely Significant Effects and Mitigation Measures

The likely effects of the Proposed Development and mitigation measures that will be put in place during the construction phase to eliminate or reduce them are outlined below.

7.5.2.1 Effects on Land and Land use

Due to the linear nature, and small footprint of the Proposed Development, the loss of land and landuse will not be significant. The Proposed Development also utilises existing forestry tracks.

The loss of forestry amounts to 22.3ha and the loss of agricultural land amounts only to 0.2ha. Approximately 2950m^2 of bog habitat will be affected.

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

Pathway: Landtake

Receptor: Land and Landuse (i.e. the land upon which the development will occur)

Potential Pre-mitigation Impact: Negative, slight, direct, likely, permanent impact on land and landuse.

Impact Assessment:
The loss of agricultural and forestry land resulting from the Proposed Development on a local or regional scale is minimal and therefore the effects of actual agricultural land loss is imperceptible.

Mitigation Measures:

No mitigation is proposed with regard agricultural or forestry loss of land. The ~600m section of 110Kv cabling which passes through Annex 1 bog habitat will be reinstated and no permanent access road will be placed within the bog.

The total amount to be felled (22.3ha) accounts for only approximately 5.86% of the existing forestry coverage at the site which is 380ha.

Residual Impact: Forestry is the dominant land use in the area of the Proposed Development. Only 0.4km of the underground electrical cabling route is along grassland.

Due to the small footprint of the Proposed Development on a local scale the residual effect is considered Negative, direct, slight, likely, permanent impact on land and landuse. The land and landuse along the underground electrical cabling route will not change.

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

7.5.2.2 Peat and Subsoil Excavation

Excavation of peat, subsoil and bedrock will be required for construction of the Proposed Development. Rock for construction purposes will also be sourced on-site.

This will result in a permanent removal and relocation of in-situ peat and subsoil at most excavation locations. Estimated volumes of peat, subsoils and bedrock to be excavated /relocated are summarised

above in **Section 7.4** above. There is no loss of peat, subsoil or bedrock, it will just be relocated within the site.

Pathway: Extraction/excavation.

Receptor: Peat, subsoil and bedrock.

Pre-Mitigation Potential Effect: Negative, slight/moderate, direct, likely, permanent effect on peat, subsoil and bedrock due to relocation within the Proposed Development site.

Proposed Mitigation Measures by Design:

- Placement of infrastructure in areas with shallower peat;
- The peat and subsoil which will be removed during the construction phase will be localised to the infrastructure location;
- The Proposed Development has been designed to avoid sensitive habitats within the application area as much as possible;
- A small volume of peat 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 by design (the development footprint area only accounts for 0.6% of the Proposed Development site area);
- Excavated peat and soil will not be removed from the site and will be used locally for landscaping; and,
- Construction of settlement ponds will be volume neutral, and all excess material will be used locally to form pond bunds and surrounding landscaping.

Residual Effect Assessment: The granular soil and peat at the site can be classified as of "Low" importance and the bedrock of "Medium" importance.

The overall site area is extensive while the Proposed Development footprint is approximately 0.6% of the overall site area. The negative effect is the disturbance and relocation of c 98,500m^3 of soil and subsoil and 79,500m^3 of bedrock during construction. The design measures incorporated into the project as described above in particular the avoidance of deeper peat areas combined with the 'low' importance of the deposits means that the residual effect will be - Negative, slight, direct, likely, permanent effect on peat, subsoils and bedrock due to disturbance and relocation within the site.

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

7.5.2.3 Contamination of Soil by Leakages and Spillages and Alteration of Peat/Soil Geochemistry

Accidental spillage during refuelling of construction plant with petroleum hydrocarbons is a pollution risk at the Proposed Development site. The accumulation of small spills of fuels and lubricants during routine plant use can also be a significant pollution risk. Hydrocarbon has a high toxicity to humans, and all flora and fauna, including fish, and is persistent in the environment. Large spills or leaks have the potential to result in significant effects (i.e. contamination of peat, subsoils and pollution of the underlying aquifer) on the geological and water environment.

Pathway: Peat and subsoil and underlying bedrock pore space.

Receptor: Peat and subsoil, bedrock.

Pre-Mitigation Potential Effect: Negative, slight, direct, short-term, unlikely effect on peat, subsoils and bedrock.

Proposed Mitigation Measures:

- On-site re-fuelling will be undertaken using a double skinned bowser with spill kits kept on site for accidental leakages or spillages;
- Only designated trained operatives will be authorised to refuel plant on-site;
- Taps, nozzles or valves associated with refuelling equipment will be fitted with a lock system;
- All fuel storage areas will be bunded appropriately for the duration of the construction phase. All bunded areas will be fitted with a storm drainage system and an appropriate oil interceptor. Ancillary equipment such as hoses, pipes will be contained within the bunded area;
- Fuel and oil stores including tanks and drums will be regularly inspected for leaks and signs of damage;
- The electrical substation will be bunded appropriately to the volume of oils likely to be stored and to prevent leakage of any associated chemicals to groundwater or surface water. The bunded area will be fitted with a storm drainage system and an appropriate oil interceptor;
- The plant used during construction will be regularly inspected for leaks and fitness for purpose; and,
- An emergency response plan for the construction phase to deal with accidental spillages will be contained within the Construction Environmental Management Plan (which is contained in Appendix 4.3).

Residual Effect Assessment: The use and storage of hydrocarbons and small volumes of chemicals is a standard risk associated with all construction sites. Proven and effective measures to mitigate the risk of spills and leaks have been proposed above and will break the pathway between the potential source and the receptor. The residual effect will be - Negative, imperceptible, direct, short-term, unlikely effect on peat and subsoils and bedrock.

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

7.5.2.4 Erosion of Exposed Subsoils and Peat During Construction of Infrastructure

There is a high likelihood of erosion of peat and spoil during its excavation and during landscaping works at the Proposed Development site. The main impacts associated with this aspect is to the water environment, and therefore this aspect is further assessed in detail in Chapter 9.

Pathway: Vehicle movement, surface water and wind action.

Receptor: Peat and subsoil.

Pre-Mitigation Potential Effect: Negative, slight, direct, short-term, likely effect on peat and subsoils by erosion and wind action.

Proposed Mitigation Measures:

- Peat removed from the development locations and access roads will be reinstated within the Proposed Development site;
- Where possible the upper vegetative layer (where still present) will be stored with the vegetation part of the sod facing the right way up to encourage growth of plants and vegetation at the surface of the stored peat within the peat storage areas;
- Re-seeding and spreading/planting will also be carried out in these areas; and,
- A full Peat and Spoil Management Plan for the development is shown as Appendix 7-1.

Residual Effect Assessment: Peat soils and spoil can be eroded by vehicle movements, wind action and by water movement. To prevent this all excavation works will be completed in accordance with a detailed Peat and Spoil Management Plan. Following implementation of these measures the residual effected will be - Negative, slight, direct, short-term, likely effect on peat and subsoils by erosion and wind action.

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

7.5.2.5 Peat Instability and Failure

A peat stability risk assessment was carried out for the main infrastructure elements at the Proposed Development site. This approach takes into account guidelines for geotechnical/peat stability risk assessments as given in PLHRA (2017) and MacCulloch (2005).

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

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

However, the findings of the peat assessment, which involved analysis of 220 no. locations, showed that the Proposed Development areas have an acceptable margin of safety and that the site is suitable for the Proposed Development. Notwithstanding the above, the management of peat stability and appropriate construction practices will be inherent in the construction phase of the development to ensure peat failures do not occur on site.

Pathway: Vehicle movement and excavations.

Receptor: Peat and subsoils.

Pre-Mitigation Potential Impact: Negative, significant, direct, unlikely probability permanent effect on peat and subsoils. The findings of the peat stability assessment showed that the Proposed Development site has an acceptable margin of safety, is suitable for the Proposed Development and is considered to be at low risk of peat failure. The findings include recommendations and control measures for construction work in peatlands to ensure that all works adhere to an acceptable standard of safety.

Proposed Mitigation Measures:

Firstly, the key mitigation with regard peat stability risk at the Proposed Development site was the carrying out of a robust, multidisciplinary site investigation and peat stability risk assessment carried out following the principles in (PLHRAG, Scottish Government, 2017).

Also, the lessons learned from previous known peat slide events have been incorporated into the design of this project and the construction methodologies to be implemented. These lessons show for example that it is important that the existing site drainage is maintained during construction to avoid a similar failure to that on Shass Mountain, which occurred following heavy rainfall, and this is referenced in the Risk Assessments for the Proposed Development (FT, July 2022).

The findings of the peat assessment, which involved analysis of 220 no. locations, showed that the Proposed Development areas have an acceptable margin of safety and that the site is suitable for the Proposed Development.

The peat stability risk assessment report provides a number of mitigation/control measures to reduce the potential risk of peat failure at each infrastructure location. The required mitigation/control measures are shown below:

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

- Appointment of experienced and competent contractors;
- The site will be supervised by experienced and qualified personnel;
- Allocate sufficient time for the project (be aware that decreasing the construction time has the potential to increase the risk of initiating a localised peat movement);
- Prevent undercutting of slopes and unsupported excavations;
- Maintain a managed robust drainage system;
- Prevent placement of loads/overburden on marginal ground;
- Set up, maintain and report findings from monitoring systems (as outlined in the Geotechnical and Peat Stability Assessment);
- Ensure construction method statements are developed and agreed before commencement of construction and are followed by the contractor;
- Revise and amend the Construction Risk Register as construction progresses to ensure that risks are managed and controlled for the duration of construction;
- Maintain hydrology of area as far as possible by maintaining existing drains to water pressures in the peat to avoid peat becoming “buoyant”;
- Use of experienced geotechnical staff for site investigations;
- Use of experienced contractors and trained operators to carry out the work; and,
- Detailed ground investigation to confirm peat, mineral soil and bedrock condition and properties.

Residual Effect Assessment: A detailed Geotechnical and Peat Stability Assessment has been completed for the Proposed Development. The findings of that assessment have demonstrated that there is a low risk of peat failure (at the site) as a result of the Proposed Development. Furthermore, with the implementation of the control measures outlined above the residual effect will be - Negative, imperceptible, direct, unlikely, permanent effect on peat and subsoils.

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

7.5.3 Operational Phase - Likely Significant Effects and Mitigation Measures

Very few potential direct impacts are envisaged during the operational phase of the Proposed Development. These may include:

- Some construction vehicles or plant may be necessary for maintenance at the Proposed Development site, which could result in minor accidental leaks or spills of fuel/oil;
- The transformer in the 110kV substation is oil cooled. There is potential for spills / leaks of oils from this equipment; and
- In relation to indirect impacts, a small amount of granular material may be required to maintain access tracks during operation which will place intermittent minor demand on local quarries.

None of these potential impacts will be significant, as they are of such small scale and also of an intermittent nature.

Mitigation measures for land, soils and geology during the operational phase include the use of aggregate from authorised quarries for use in road and hardstand maintenance. The substation transformer will be in a concrete bund capable of holding 110% of the stored oil volume and the runoff from the bunded area will pass through an oil interceptor. These mitigation measures are considered sufficient to eliminate potential risks to ground/peat/soils and subsoils, and groundwater and surface water quality.

Residual Effect Assessment: Residual effect during the operational phase for sediment/erosion/oil spills will be - Negative, imperceptible, direct, unlikely, permanent effect on subsoils.

Proven and effective measures to mitigate the risk of sediment, oil spillage and leaks will be in place during the operational phase and will break the pathway between the potential source and the receptor. The residual effect will be - Negative, imperceptible, direct, long-term, unlikely effect on peat, soils and subsoils and bedrock.

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

7.5.4 Decommissioning Phase - Likely Significant Effects and Mitigation Measures

The potential effects associated with decommissioning of the Proposed Development will be similar to those associated with construction but of reduced magnitude (due to smaller quantum of work that will need to be completed).

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

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

Mitigation measures applied during decommissioning activities will be similar to those applied during construction where relevant. (i.e., mitigation outlined at Sections 7.5.2.2 and 7.5.2.3).

Some of the impacts will be avoided by leaving elements of the Proposed Development in place where appropriate. The 110kV substation and cabling will become an EirGrid asset and therefore permeant permission is sought for same. The 33kV underground electrical cable ducting will remain in the ground and the cables pulled by excavating the original cable jointing pits.

Site roadways could be in use for purposes other than the operation of the development by the time the decommissioning of the Permitted Development is to be considered, and therefore it may be more appropriate to leave the site roads in situ for future use. It is envisaged that the roads will provide a useful means of extracting the commercial forestry crop which exists on the site. If it were to be confirmed that the roads were not required in the future for any other useful purpose, they could be removed where required.

Re-instatement and re-establishment of the temporary access road from the N22 to the old N22 alignment will be completed. The use of this temporary access road will be carefully managed, and the route will be blocked with traffic bollards when not in use for component removal. On completion of the component removal from the site, the temporary accommodation area will be fully re-instated.

A Decommissioning Plan has been prepared (Appendix 4-7) the detail of which will be agreed with the local authority prior to any decommissioning. The Decommissioning Plan will be updated prior to the end of the operational period in line with decommissioning methodologies that may exist at the time and will agreed with the competent authority at that time.

The excavation and movement of peat, soils and subsoils during the decommissioning works will be minimal.

Mitigation measures to avoid contamination by accidental fuel leakage and compaction of soil by on-site plant will be implemented as per the construction phase mitigation measures (i.e., mitigation outlined at Sections 7.5.2.2 and 7.5.2.3).

No significant effects on the land, soils and geological environment will occur during the decommissioning stage of the Proposed Development.

7.5.5 Cumulative Effects

Due to the localised nature of the proposed construction works which will be kept within the Proposed Development site boundary, there is no potential for any significant cumulative effects with other local developments on the land, soils and geology environment. The development is also linear in nature, spanning a distance of ~13km across several sub-catchments and therefore the works are spread out geographically. All potential cumulative projects as listed in Chapter 2 are being considered.

With regard cumulative effects with the Permitted Development, the majority of the Permitted Development is located in the River Lee catchment while the majority of the underground electrical cabling route along with the 110kV substation are located in the River Laune surface water catchment.

The only way the proposal can have cumulative effects with other off site projects and plans is via the drainage system and off site surface water drainage network, and this hydrological pathway is assessed in Chapter 9.

7.5.6 Post Construction Monitoring

None required.

7.5.7 Conclusion

The geology of the site predominately comprises blanket peat overlying glacial subsoil deposits which in turn are underlain by sandstone bedrock. Trial pits and visual inspections were undertaken to investigate the subsoil conditions below the peat. Peat depths were determined by probing.

An assessment of the construction stage, operational stage and decommissioning stage has been completed. Based on the above, and with implementation of the outlined mitigation measures, no likely significant effects on the land, soils and geology environment are predicted to occur.

This assessment confirms there will be no cumulative effects on land soil and geology environment as a result of the Proposed Development.

The peat stability assessment undertaken at the site shows that the site has an acceptable margin of safety for the Proposed Development. A number of control measures are given in the peat stability assessment to manage all risks associated with peat instability.