Moyvannan Electricity Substation

Environmental Impact Assessment Report

Chapter 6: Land & Soil

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6.1 Introduction

6.1.1 Background and Objectives

This chapter provides an assessment of the likely and significant effects of the project on the land, soil and geological environment.

This chapter provides a baseline assessment of the environmental setting of the project in terms of land, soils and geology and identifies the likely and significant effects that the construction, operation and decommissioning of the project will have. Where required, appropriate mitigation measures to avoid any identified significant effects to land, soils and geology are recommended and the residual effects of the project post-mitigation are assessed.

6.1.2 Description of the Project

In summary, the project comprises the following main components as described at Chapter 3:-

- A 110kV 'loop-in/loop-out' electricity substation;
- Approximately 270m of 110kV underground electricity line between the electricity substation and the Athlone-Lanesborough overhead transmission line and the provision of 2 no. interface masts;
- Approximately 7.5km of underground electricity line between the electricity substation and the permitted Seven Hills Wind Farm grid connection infrastructure; and,
- All associated and ancillary site development, access, excavation, construction, landscaping and reinstatement works, including provision of site drainage infrastructure.

The entirety of the project is located within the administrative area of County Roscommon; while electrical equipment suppliers, construction material suppliers and candidate quarries which may supply aggregates are located nationwide. As there is no likelihood of the works associated with the supply of such materials, including their delivery, resulting in significant effects on the geological environment, such activities have, therefore, been screened out from further assessment within this chapter.

6.1.3 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 include upland hydrology and wind farm drainage design. We routinely complete impact assessments for hydrology and hydrogeology for a large variety of project types, including wind farms and associated grid connections.

This chapter was prepared by Michael Gill, Jenny Law and Conor McGettigan.

Michael Gill (BA, BAI, Dip Geol., MSc, MIEI) is an Environmental Engineer and Hydrogeologist with over 22-years' environmental consultancy experience in Ireland. Michael has completed numerous hydrological and hydrogeological impact

assessments of wind farms and renewable projects in Ireland. He has substantial experience in surface water drainage design and SUDs design, and surface water/groundwater interactions. For example, Michael was involved in the Environmental Impact Statement/Environmental Report (EIS/EIAR) for Seven Hills Wind Farm, Oweninny Wind Farm, Cloncreen Wind Farm, and Yellow River Wind Farm, and over 100 no. other wind farm related projects.

Jenny Law (BSc, MSc) is an environmental geoscientist holding a first honours degree in applied environmental geosciences from the University College Cork in 2022. Jenny has assisted in the preparation of the land, soils and geology and hydrology chapters for various EIARs, hydrological impact assessments, Water Framework Directive Assessment reports and Flood Risk Assessment reports for a variety of projects including wind farm developments, grid connections and strategic housing developments.

Conor McGettigan (BSc, MSc) is an Environmental Scientist with over 4 years' experience in the environmental sector in Ireland. Conor holds an M.Sc. in Applied Environmental Science (2020) and a B.Sc. in Geology (2016) from University College Dublin. Conor routinely prepares the hydrology and hydrogeology chapters of EIARs for wind farm developments. Conor has also prepared several flood risk assessments and Water Framework Directive compliance assessments for various renewable energy developments in Ireland.

6.1.4 Relevant Legislation

This chapter has been 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.

Regard has also been had to the requirements of the following legislation:-

- Planning and Development Acts, 2000-2023;
- 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; and,
- The Heritage Act 1995, as amended.

6.1.5 Relevant Guidance

This chapter has been prepared having regard, where relevant, to the guidance contained in the following documents:-

- *Guidance Document on Wind Energy Developments and EU Nature Legislation* (European Commission, 2020);
- Environmental Protection Agency (2022) *Guidelines on the Information to be Contained in Environmental Impact Assessment Reports*;
- Institute of Geologists Ireland (2013) *Guidelines for Preparation of Soils, Geology & Hydrogeology Chapters in Environmental Impact Statements*;
- National Roads Authority (2008) *Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes*;
- Department of Housing, Planning & Local Government (2018) *Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment*;

- European Union (2017) Guidance *on the preparation of the EIA Report (Directive 2011/92/EU as amended by 2014/52/EU);* and
- Institute of Environmental Management (IEMA) (2022) *A New Perspective on Land and Soil in Environmental Impact Assessment.*

6.2 Methodology

6.2.1 Desk Study

A desk study of the project site (electricity substation site and underground electricity line) and the surrounding area was completed in Autumn 2023 to collect all relevant geological data. The desk study was completed in advance of, and to supplement, site walkover surveys and site investigations. The desk study information has been reviewed, and updated where necessary, in August and September 2024.

The desk study involved consultation with and a review of the following data sources:-

- Environmental Protection Agency databases (www.epa.ie);
- Geological Survey of Ireland – Groundwater and Geological Database (www.gsi.ie);
- Geological Survey of Ireland – Geological Heritage site mapping (www.gsi.ie);
- Bedrock Bedrock Geology 1:100,000 Scale Map Series, Sheet 12 (Geology of Longford-Roscommon);
- Geological Survey of Ireland – 1:25,000 Field Mapping Sheets;
- Teagasc soils map (www.gsi.ie);
- Aerial Photography, 1:5,000 and 6" base mapping.

6.2.2 Baseline Monitoring & Site Investigations

Site walkover surveys including geological mapping of the project site were undertaken by Michael Gill, Jenny Law, and Conor McGettigan of HES (refer to Section 6.1.3 above for qualifications and experience).

APEX Geophysics Limited completed geophysical surveys of the electricity substation site in April 2023. The aim of these surveys was to provide information of the presence of any potential karst features, the thickness and type of the soil material and the depth to and type of bedrock. The geophysical investigation report is provided at Annex 6.1.

The information obtained from the geophysical surveys influenced the configuration of the intrusive site investigations carried out by Ground Investigations Ireland Ltd (GII). The objectives of the intrusive site investigations was to investigate subsurface conditions at the electricity substation site and comprised borehole drilling and the excavation of trial pits. GII's ground investigation report is attached at Annex 6.2.

The combined HES, APEX and GII geological dataset has been used in the preparation of this EIAR Chapter.

The site investigations to address the land, soils and geology chapter of this EIAR included the following:

- HES completed site walkover surveys and a visual inspection of the electricity substation site on 22 February 2023, 18 January 2024 and 28 August 2024;
- HES also completed a visual assessment of exposed soils, subsoil and bedrock and topographic changes along the underground electricity line;

- APEX Geophysics Ltd completed geophysical investigations in April 2023 comprising of reconnaissance electromagnetic (EM) ground conductivity mapping with follow up Electrical Resistivity Tomography (ERT) (4 no. resistivity profiles) and seismic refraction profiling (6 no. profiles);
- GII completed the excavation of 5 no. trial pits at the electricity substation site on 14 August 2023; An additional shallow trial pit was also completed to facilitate permeability testing of the subsoils;
- GII completed the drilling of 5 no. cable percussion boreholes followed by 6 no. rotary core boreholes between 17 August and 2 October 2023;
- Geotechnical and environmental testing of recovered soil and subsoil samples; and,
- Mineral soils were logged according to BS: 5930.

6.2.3 Scoping & Consultation

The scope for this assessment has been informed by consultation with statutory consultees and other bodies with environmental responsibility.

This consultation process is outlined at Chapter 1 of this EIAR. Matters raised and recommendations highlighted by the responses in relation to land, soils and geology are summarised at Table 6.1 below. The full response from each of the below consultees are provided at Annex 1.5.

Consultee	Summary of Response	Addressed in Section
Geological Survey of Ireland (GSI)	The GSI does not envisage any impact on the integrity of County Geological Sites [discussed below in chapter] by the project as none are located nearby. Recommendation that geohazards be taken into consideration, especially when developing areas where these risks are prevalent. The GSI recommends the use of its online databases.	Identification of geological heritage sites is presented in Section 6.3.8.1. Geohazards are considered in Section 6.3.9. This assessment uses utilises the available GSI datasets.

Table 6.1: Summary of Land & Soils Scoping Responses

6.2.4 Impact Assessment Methodology

Using information gained from the desk study and data derived from the site investigations, an assessment of the importance of the land, soils and geological environment within the project site is assessed using the criteria set out at Table 6.2 (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. • Volume of peat and/or soft organic soil underlying route is significant on a	• Geological feature rare on a regional or national scale (NHA/SAC). • Large existing quarry or pit. • Proven economically extractable mineral resource.

	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 high 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.

Table 6.2: Estimation of Importance of Soil and Geology Criteria (NRA, 2008)

The assessment of effects follows the description of the baseline environment and is Stage 6 of 7 of the information which must be included in an EIAR (EPA, 2022). The guideline criteria for the assessment of effects states that the purpose of an EIAR is to identify, describe and present an assessment of the likely significant effects. The likely effects are described with respect to their quality (positive, neutral or negative), significance (imperceptible to profound), extent (i.e. size of area or number of sites effected), context (is the effect unique of being increasingly experienced), probability (likely or unlikely), duration (momentary to permanent), frequency and reversibility. The descriptors used in this environmental impact assessment report are those set out in the EPA (2022) glossary of effects as shown at Chapter 1 of this EIAR.

In order to provide an understanding of this descriptive system in terms of the geological 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 at Table 6.3.

Magnitude of Impact	Criteria	Typical Examples

Large Adverse	Results in loss of attribute	• Loss of high proportion of future quarry or pit reserves • Irreversible loss of high proportion of local high fertility soils • Removal of entirety of geological heritage feature • Requirement to excavate / remediate entire waste site • Requirement to excavate and replace high proportion of peat, • Organic soils and/or soft mineral soils beneath alignment
Moderate Adverse	Results in impact on integrity of attribute or loss of part of attribute	• Loss of moderate proportion of future quarry or pit reserves • Removal of part of geological heritage feature • Irreversible loss of moderate proportion of local high fertility soils • Requirement to excavate / remediate significant proportion of waste site • Requirement to excavate and replace moderate proportion of peat, • Organic soils and/or soft mineral soils beneath alignment
Small Adverse	Results in minor impact on integrity of attribute or loss of small part of attribute	• Loss of small proportion of future quarry or pit reserves • Removal of small part of geological heritage feature • Irreversible loss of small proportion of local high fertility soils and/or • High proportion of local low fertility soils • Requirement to excavate / remediate small proportion of waste site • Requirement to excavate and replace small proportion of peat, • Organic soils and/or soft mineral soils beneath alignment
Negligible	Results in an impact on attribute but of insufficient magnitude to affect either use or integrity	• No measurable changes in attributes

Table 6.3: Estimation of Magnitude of Impact

6.2.5 Study Area

The study area for the land, soils and geological environment is limited to within the project site boundary. There is no likelihood of the project affecting the land, soils and geological environment outside of the project site.

6.2.6 Limitations and Difficulties Encountered

No limitations or difficulties were encountered during the preparation of this chapter.

6.3 Description of the Existing Environment

6.3.1 Project Site Location and Topography

The project site is located in rural County Roscommon. The electricity substation site is located c. 8 kilometres (km) northwest of Athlone town, c. 2.5km northwest of Kiltoom and c. 8km east of the permitted Seven Hills Wind Farm. The electricity substation will be located in the townland of Moyvannan. The underground

electricity line will extend southwards from the electricity substation and will be located within private lands (in the vicinity of the substation) and along the local and regional road network as far the junction between the L7636 and the R363 in the village of Brideswell.

The electricity substation site can be accessed from the N61 national secondary road which is located c. 700m to the east. Several local roads extend to the west from this national road and facilitate access to the electricity substation site. Meanwhile, the R362 and the R363 provide access to the underground electricity line.

The project site, and surrounding topography, is typical of this region and comprise a generally flat landscape with occasional gentle undulations, with ground elevations at the electricity substation site ranging between 69 metres (m) and 80m above Ordnance Datum (mOD). Ground elevations along the underground electricity line generally range between 55m and 95mOD, with the greatest elevation location in the north. To the east of the project site, the terrain generally slopes towards the western shores of Lough Ree; while, to the north, west and south, there are a number of turloughs, including Lough Funshinagh, which highlight the presence of localised depressions in the landscape.

6.3.2 Land and Land Use

Corine land cover maps (2018) illustrate that the project site is mapped in an area of agricultural pastures. Historic Corine land cover maps (1990-2018) do not record any significant land cover changes in the local area.

Landcover at the project site has been verified during site walkover surveys completed by HES and from the inspection of recent aerial imagery. During walkover surveys, the electricity substation site was noted to comprise of agricultural pastures with field boundaries delineated by stone walls. Landuse in the wider area is also agricultural with some small pockets of forestry and areas of scrub, particularly along the shores of Lough Ree. There are also one-off rural dwellings and agricultural holdings in the local area, the nearest dwelling being c. 300m to the southeast of the electricity substation.

Meanwhile, the underground electricity line is c. 7.5km in length and is located largely within the public road network with a small section located within private lands in the immediate vicinity of the electricity substation. Dwellings are located along the majority of the public roads along which the underground electricity line is proposed.

6.3.3 Soils and Subsoils

6.3.3.1 Desk Study

The published Teagasc soils map (www.gsi.ie) for the local area shows that the electricity substation site is mapped to be overlain by mainly basic, deep, well drained mineral soils (BminDW). This is the dominant mapped soil type in the local area. Teagasc also map a pocket of mainly basic, shallow well drained mineral soils (BminSW) to the northeast of the electricity substation and within the overall landholding.

The dominant soils mapped along the northern section of the underground electricity line, as far south as the R362 in the townland of Derryglad, are deep well

drained, mainly basic mineral soils (BminDW) with occasional pockets of shallow well drained basic mineral soils (BminSW). Meanwhile, c. 580m of the underground electricity line is mapped on peat in the townlands of Derryglad and Eskerbaun. Meanwhile, some basic peaty poorly drained mineral soils (BminPDPT) are mapped in the vicinity of the Brideswell village.

The published GSI subsoils map (www.gsi.ie) shows that the area of the electricity substation is underlain predominantly by till derived from limestones (TLs) with some areas of karstified bedrock outcrop or subcrop (KaRck) mapped within the overall landholding and within the surrounding lands.

Subsoils underlying the underground electricity line are predominantly mapped as till derived from limestones in the north with some pockets of karstified bedrock outcrop or subcrop and gravels derived from limestones (GLs). Some eskers comprised of gravels of basic reaction are also mapped by the GSI in the townlands of Derryglad and Gortnasythe. Meanwhile, cut over raised peat is mapped to the north of Brideswell village.

A local subsoil geology map is shown at Figure 6.1 (Annex 6.3).

6.3.3.2 Site Investigations

The nature of the soils and subsoils at the electricity substation site have been confirmed by site investigations comprising of geophysical surveys, trial pits and boreholes.

The geophysical surveys (4 no. ERT profiles and 6 no. seismic refraction profiles) completed by APEX Geophysics Ltd in April 2023 concluded that the site is overlain by an upper layer of loose clayey sandy gravelly topsoil. The topsoil was interpreted to be underlain by intermittent layers of medium dense to dense silty sandy gravel, medium dense to very dense clayey sand/gravel to stiff sandy gravelly clay. Based on the geophysical surveys the depth total thickness of the subsoil ranges from 0.6m in the south to 22.9m in the northeast. The results of the geophysical investigations are included at Annex 6.1 and informed the intrusive site investigations which supersede the geophysical surveys.

The results of the geophysical surveys were used to guide the next phase of site investigation works completed by GII which comprised trial pit excavations (5 no.) and borehole drilling (6 no). The trial pit excavations extended to a maximum depth of 4.1mbgl and were typically terminated due to the presence of large cobbles and boulders. Meanwhile, the drilling of the boreholes revealed the full subsoil profile which ranged in thickness from 3.8m at RC02 to 12.2m at RC01 in the north.

The soils/subsoils encountered during the trial pit investigations are summarised as follows:-

- The site is overlain a TOPSOIL which was present to a maximum depth of 0.3mbgl (metres below ground level);
- Cohesive deposits were encountered beneath topsoil and were described as typically reddish brown sandy gravelly CLAY with a low cobble content. These cohesive deposits extended to depths of 0.4 to 0.8mbgl. Meanwhile, the cohesive deposits encountered in TP-02 extended to a depth of 2mbgl and were described as light brown slightly sandy gravelly CLAY with a medium cobble and boulder content; and,

- Granular deposits were encountered at the base of the cohesive clays and were typically described as brown clayey gravelly fine to coarse SAND with a medium to high cobble and boulder content.

The rotatory core boreholes illustrate that the deeper subsoils generally consist of gravelly CLAY with cobbles and boulders and occasional gravels. The full GII site investigation report is provided at Annex 6.2; while Table 6.4 below presents a summary of the trial pit logs. The locations of the site investigation points are illustrated at Figure 6.2 (Annex 6.3).

Location	Trial Pit Depth (m)	Summary of Subsoil Lithology
TP-01	4.10	0-0.2m: Topsoil 0.2-0.4m: Soft reddish brown sandy gravelly CLAY 0.4-2.0m: Light brown slightly clayey gravelly fine to coarse SAND with medium cobble and boulder content 2.0-4.1m: Light brown slightly clayey gravelly fine to coarse SAND with high cobble and boulder content
TP-02	2.6	0-0.2m: Topsoil 0.2-0.7m: Soft reddish brown slightly sandy gravelly CLAY with low cobble content 0.7-2.0m: Soft to firm light brown slightly sandy gravelly CLAY with medium cobble and boulder content, 2.0-2.6m: Light brown clayey gravelly fine to coarse SAND with medium cobble and boulder content.
TP-03	3.70	0-0.2m: Topsoil 0.2-0.7m: Soft to firm reddish brown sandy gravelly CLAY 0.7-2.5m: Light brown slightly clayey gravelly fine to coarse SAND with medium cobble and boulder content 2.5-3.7m: Light brown slightly clayey gravelly fine to coarse SAND with high cobble and boulder content.
TP-04	3	0-0.1m: Topsoil 0.1-0.8m: Soft to firm reddish brown slightly sandy gravelly CLAY 0.8-2.2m: Light brown slightly clayey gravelly fine to coarse SAND with medium cobble and boulder content 2.2-3.0m: Light brown slightly clayey gravelly fine to coarse SAND with high cobble and boulder content
TP-05	2.8	0-0.2m: Topsoil 0.2-0.4m: Soft reddish brown slightly sandy gravelly CLAY 0.4-2.1m: Light brown slightly clayey gravelly fine to coarse SAND with medium cobble and boulder content 2.1-2.8m: Light brown slightly clayey gravelly fine to coarse SAND with high cobble and boulder content

Table 6.4: Summary of Trial Pit Logs (GII, 2023)

6.3.4 Bedrock Geology

6.3.4.1 Desk Study

The GSI bedrock geology map (www.gsi.ie) of the local area shows that the electricity substation site is predominantly underlain by Visean Limestones (undifferentiated). The GSI map Mudbank Limestone in the north of the overall landholding and underlies the proposed site entrance and proposed access track.

The underground electricity line is mapped to be underlain entirely by Visean Limestones (undifferentiated).

There are no mapped faults in the local area and the GSI does not map the presence of any bedrock outcrop with the project site.

A bedrock geology map for the area is provided at Figure 6.3 (Annex 6.3).

6.3.4.2 Site Investigations

The geophysical investigations interpreted the depth to rock to range from 0.6m to 22.9mbgl with an average of c. 6mbgl across the investigation site. The depth to rock was interpreted to increase to the northeast. The investigations also identified the presence of highly weathered rock over fresh and strong limestone bedrock.

The rotary core boreholes (6 no.) undertaken by GII at the electricity substation site revealed that the depth to competent bedrock ranged from 4.05m at RC04 to 12.2m at RC01. This correlates with the geophysics report which showed increasing depth to rock in the northeast of the site. A layer of weathered bedrock was also encountered at the top of the rock profile at depths of 3.8m to 9.8m in 4 no. rotary boreholes and ranged in thickness from 1.1m to 3.35m.

Rotary core boreholes recovered strong to very strong massive light grey fine grained fossiliferous LIMESTONE interstratified with moderately weak to medium strong massive light brownish grey crystalline medium grained DOLOMITIC LIMESTONE. Occasional cavities which were infilled with clay or sand were noted in the borehole logs. The depth to competent bedrock varies from 4.05mbgl to a maximum of 12.2mbgl.

The rotary core borehole logs are provided in full at Annex 6.3.

6.3.5 Karst

6.3.5.1 Desk Study

The Visean Limestones within Roscommon are known to be karstified with ubiquitous conduits or caves throughout the county such as Pollnagran cave towards the north of the county.

The GSI does not map the presence of any karst features within the immediate vicinity of project site (www.gsi.ie). The closest mapped karst features to the electricity substation include 2 no. enclosed depressions located c. 380m to the west and c. 550m to the southwest. The GSI also map a spring, referred to as St. Patricks Well, c. 1km to the northeast of the electricity substation.

There are several other enclosed depressions mapped to the west of the underground electricity line. The closest enclosed depression is located c. 750m to the west in the townland of Curraghboy. The GSI also map 3 no. springs c. 1.1km to the southeast and downstream of the underground electricity line along the Cross (Roscommon) River. Meanwhile, Corkip Lough (Turlough) is located c. 1km to the southwest of Brideswell village.

A traced underground connection from Lough Funshinagh shows that the overall groundwater flow in this area is to the south, with the Lough linked to the Cross (Roscommon) River.

Local GSI mapped karst features are shown at Figure 6.3 (Annex 6.3).

6.3.5.2 Site Investigations

In addition to the GSI mapped karst features, turloughs have been recorded to the south of the electricity substation site during walkover surveys. Further details on these features are provided at Chapter 7.

The geophysical survey identified 2 no. zones of potential karstification within the site of the electricity substation. However, no karst features were noted during the drilling of the 6 no. boreholes. In total, 129.3m of borehole drilling has been completed in the vicinity of the electricity substation by GII (2023). Bedrock is identified at an average depth of 8.6mbgl and no significant karst conduit features have been logged throughout the 129.3m of drilling. In total, 52m of drilling was in overburden (40%) with 5 no. of the 6 no. boreholes encountering overburden thicknesses in excess of 5m.

The results of the drilling provides confidence in stating that the local limestone bedrock is overlain by thick overburden deposits and bedrock is comprised of strong, fine to medium grained limestone or dolomitic limestone with discreet weathered zones and intermittent clay fractures.

6.3.6 Soil Contamination

There are no known areas of soil contamination within the project site or in the surrounding lands. During the site walkovers and site investigations, no areas of contamination concern were identified.

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

Furthermore, there are no historic mines within or in the immediate vicinity of the project site which are likely to have contaminated tailings and could give rise to adverse environmental effects.

6.3.7 Geological Resource Importance

The GSI Online Database, accessed via the Public Data Viewer (www.gsi.ie), does not record the presence of any active quarries or sand or gravel pits within the project site or in the surrounding lands. The closest mapped active quarry is Cam Quarry mapped along the R363 c. 3.5km west of Brideswell. Data from borehole logs at Cam Quarry, provided by Roadstone, indicate an average of 8.8m of overburden above light grey limestone bedrock.

Furthermore, the GSI does not record the presence of any historic quarries or pits within the project site. The closest mapped historic quarry/pit is Harrington's sand and gravel pit which was active between 1975 and 1995. This pit is located in the townland of Knockanool, c. 1km southeast of Brideswell.

The GSI does not map the presence of any mineral localities within the project site. Harrington's sand and gravel pit is the closest mapped mineral locality to the project site.

The GSI online Aggregate Potential Mapping Database (www.gsi.ie) illustrates that the crushed rock potential of the project site ranges from 'Moderate' to 'Very High'. The electricity substation site and the northern section of the underground electricity line are mapped in areas of 'Very High' potential for a bedrock quarry. Meanwhile, the southern section of the underground electricity line, from the townland of Gortnasythe to Brideswell, has 'Moderate' potential.

The project site is generally not mapped within areas of granular aggregate potential (i.e. potential for gravel reserves) with the exception of the area mapped to be underlain by gravel deposits along the underground electricity line in the townlands of Derryglad and Gortnasythe.

6.3.8 Geological Heritage & Designated Sites

6.3.8.1 Geological Heritage Sites

There are no recorded Geological Heritage sites within or in the immediate vicinity of the project site.

The closest geological heritage sites to the electricity substation site include Carrowmurragh Mushroom Rocks County Geological Site (CGS) and Moyvannon Mushroom Rocks CGS. Both of these sites are recommended for designation as Geological Natural Heritage Areas (NHAs). These CGSs are located c. 2.5km east and c. 2.5km southeast of the electricity substation site respectively.

Another geological heritage site, Lough Funshinagh CGS is located c. 2km to the northwest of the electricity substation site and is recommended for designation as a Geological NHA.

Meanwhile, the Castlesampson Esker CGS is located c. 3km to the south/southwest of Brideswell and the southern section of the underground electricity line. The Killeglen Karst Landscape CGS is also located c. 4km to the southwest of Brideswell.

A summary of the CGS located within 5km of the project site is presented in Table 6.5. A map showing the local geological heritage sites is enclosed at Figure 6.4 (Annex 6.3).

Site Name	Site Code	IGH Theme	Description
Moyvannon Mushroom Rocks	RO023	IGH1 & IGH14	Comprises 7 no. different limestone rocks which exhibit mushroom shape
Carowmurragh Mushroom Rocks	RO007	IGH1 & IGH14	Comprises 4 no. different limestone rocks which exhibit mushroom shape
Lough Funshinagh	RO018	IGH1, IGH7 & IGH16	Turlough – Large lake which is known to occasionally disappear rapidly. It is thought that there must be one or more swallow holes which are normally 'plugged' with an impermeable layer at the base of the lake.
Castlesamplson Esker	RO010	IGH7	West-northeast to east-southeast trending esker
Killeglan Karst Landscape	RO015	IGH1 & IGH7	Extensive area of bouldery terrain

Table 6.5: Geological Heritage Site Information

6.3.8.2 Designated Sites

Designated sites include Natural Heritage Areas (NHAs), proposed Natural Heritage Areas (pNHAs), candidate Special Areas of Conservation (cSAC), Special Areas of Conservation (SAC) and Special Protection Areas (SPAs). There are no designated sites within or adjacent to the project site.

The nearest designated sites include the following:-

- Ballynamona Bog and Corkip Lough SAC (002339) located c. 0.9km west of Brideswell and south of the underground electricity line;
- Lough Ree SAC / pNHA (000440) and SPA (004064) situated c. 2km east of the electricity substation site;
- Lough Funshinagh SAC / pNHA (000611) c. 2km northwest of the electricity substation site; and,
- Castlesampson Esker SAC / pNHA (001625) c. 3.8km south of the underground electricity line.

6.3.9 Geohazards

6.3.9.1 Slope Stability

The GSI does not record the occurrence of any historic landslides within the project site or in the surrounding lands (www.gsi.ie). The closest mapped historic landslide is located at Tullywood Bog, c. 15km to the southeast of the project site.

The GSI Landslide Susceptibility Map (www.gsi.ie) classifies the probability of a landslide occurring. The landslide susceptibility for the project site was classified by the GSI as low.

The presence of dense glacial subsoil deposits, with flat to gently undulating topography means that slope stability is not an issue within the vicinity of the electricity substation site. No areas of peat or soft subsoils were encountered during the site investigations or walkover surveys in the vicinity of the electricity substation site. The SPT values (subsoil strength measurements) recorded during the rotary core borehole drilling completed in the vicinity of the electricity substation confirm this assessment.

As stated above at Section 6.3.3, c. 580m of the underground electricity line is mapped by the GSI to be underlain by peat in the townlands of Derryglad and Eskerbaun. A walkover survey and inspection of the underground electricity line in these areas identified no peat stability issues and, given the nature of the proposed works (excavation of a shallow trench within the existing road corridor), it was assessed that there was no requirement to complete a more detailed analysis of peat stability.

6.3.9.2 Karst

As described at Section 6.3.5 above, no significant areas of karst were identified during the site investigations (trial pits and boreholes). Whilst weathered limestone bedrock and clay infilled fractures were identified, these are typical across all limestone bedrock in Ireland.

6.3.10 Receptor Sensitivity and Importance

Based on the criteria set out at Table 6.2 above, the soils and subsoils at the project site can be classed as being of low importance as the overburden deposits are not designated in this area (i.e. do not form part of a designated site).

The bedrock geology underlying the project site can be classed as being of medium importance where the bedrock could be used on a sub-economic basis.

The land, soils, subsoils, and bedrock underlying the project site (electricity substation site and underground electricity line) will be included in the impact assessment due to their proximal location to the project and the direct effects that

the project may have on these receptors.

All geological heritage sites and other designated sites have been screened out of the land, soils and geological impact assessment due to their distant location from the project. There is no likelihood of effects on the geological heritage sites and other designated sites.

6.4 Description of Likely Effects

6.4.1 Characteristics of the Project

The project comprises a 110kV electricity substation; including all associated development works to accommodate its construction, operation, maintenance and the export of electricity to the national grid via the existing Athlone-Lanesborough overhead electricity transmission line; and c. 7.5km of underground electricity line.

During the construction phase, earthworks will largely arise from the excavation of topsoil, subsoil and rock (if present) at the locations of the electricity substation, access track, interface masts, site entrance and along the underground electricity line.

In order to provide a level substation compound and to ensure appropriate levels, it is proposed to implement a cut and fill approach whereby material excavated at higher elevations will be deposited at areas of lower elevation. This process will avoid excessively deep or expansive excavations and will, similarly, avoid the requirement to import significant volumes of stone aggregates to make up levels. Additionally, this process will ensure that the geological integrity of the site is maintained. Following the cut and fill process, the substation compound will be finished with compacted stone aggregates.

Due to the generally shallow nature of excavations, substantial volumes of spoil are not predicted to be generated. It is proposed that subsoil will, insofar as possible, be utilised to make up levels at the electricity substation compound; while topsoil will be used in the post-construction reinstatement of the project (e.g. at the electricity substation site, interface mast foundations, and access track).

As part of the design process, considerable attention has been given to the extent of excavations required to construct the project in order to minimise the generation of spoil and, subsequently, to the management of excavated material. Table 6.6, below, provides a breakdown of the spoil volumes predicted to be generated and proposals regarding the reuse or disposal of this material.

Where excess material is generated at the electricity substation site which cannot be utilised for reinstatement or landscaping purposes, it is proposed to develop 2 no. dedicated spoil deposition areas to the east and west, respectively, of the electricity substation where excess material will be stored permanently. It is estimated that c. 5,380m^3 of excess material will be stored within these proposed deposition areas. The location of the deposition areas was selected due to the general absence of environmental constraints, available separation distances to watercourses, generally flat or gently sloping gradient and close proximity thus avoiding traffic movements on the public road network.

Spoil will be transported to the deposition areas where is will be placed in layers in accordance with best-practice methods. Appropriate drainage management measures will be implemented to ensure that the deposited spoil does not become waterlogged. Following the completion of construction, the deposition areas will be

graded to match the profile of surrounding land, covered with topsoil and reseeded. Works at the spoil deposition areas will be monitored, on a weekly basis during the construction phase and monthly for a 6-month period thereafter, by an appropriately qualified geotechnical engineer.

During the construction phase, material will also be generated from the excavation of the underground electricity line trench and joint bays. In total, it is estimated that c. 11,240m^3 will be excavated comprising peat, subsoil and road pavement material. Due to potential for soil contamination arising from the presence of pavement material (tar & chips, etc.); all material excavated from the electricity line trench generated from the public road network will be disposed of at an approved waste facility.

Furthermore, prior to development and post consent, a detailed Spoil Management Plan will be prepared and will address the reuse, reinstatement, storage and restoration of all material excavated during the construction phase including detailed methodologies regarding the establishment and management of the spoil deposition areas.

Project Element	Volume of Material to be Excavated (m^3)	Volume of Material to be utilised for construction/ reinstatement/ landscaping (m^3)	Volume of Material to be disposed of in deposition areas (m^3)	Volume to be disposed of off-site (m^3)
Electricity Substation (incl. access track, temporary construction compound and interface masts)	14,010	9,310	4,700	0
Underground Electricity Line	11,240	0	690	10,550

Table 6.6: Spoil Generation & Management

Site investigations at the electricity substation site have revealed that rock is unlikely to be encountered during construction phase excavation. Therefore, aggregates to facilitate the construction phase will be sourced from nearby licences quarries. The estimated volumes of construction aggregates required in the construction of the project are detailed at Table 6.7.

Infrastructure ID	Rock/Stone sourced from On-Site Excavations (m^3)	Rock/Stone sourced from Local Supplier (m^3)	Concrete sourced from Local Supplier (m^3)	Road Pavement/ Tar & Chips sourced from Local Supplier (m^3)
Electricity Substation (incl. access track, temporary construction compound and interface masts)	0	7,710	160	0
Underground Electricity Line	0	4,780	4,240	2,220

Table 6.7: Estimated Construction Material Volumes

6.4.2 'Do-Nothing' Impact

In the event that the project is not progressed, existing land uses will continue and there will be no alteration to the land, soil or geological environment at the project site.

6.4.3 Construction Phase

6.4.3.1 Land

The construction of the project will result in the loss of c. 0.84ha of agricultural land which will be replaced by electricity substation compound. Agricultural land will also be replaced by the construction of the c. 630m of on-site access tracks from the L7551. The loss of this agricultural land is imperceptible in the context of the project site boundary (c. 20ha), equating to c. 5% land loss. The existing agricultural operations in the local areas can readily co-exist with the project and there will be no perceptible effect on these activities.

No effects on land will occur along the underground electricity line as all works will predominantly occur within the carriageway of the existing public road network. Some works will occur within private lands in the vicinity of the electricity substation. The works will result in the excavation of a narrow trench to accommodate the electricity line. This trench will be reinstated once the electricity line is emplaced with a comparable ground surface (i.e. tarmacadam along public roads).

There will be no effects on the lands adjoining the project site.

The pre-mitigation effect on land and land-use is summarised at Table 6.8 below.

Attribute	Description
Receptor	Land & Land Use
Pathway	Excavation and infrastructure construction
Pre-Mitigation Effect	Negative, slight, direct, likely, permanent effect on land and land use.

Table 6.8: Land

6.4.3.2 Soil, Subsoil and Bedrock Excavation

The excavation of soil and subsoils will be required for all earthworks during the construction phase including:-

- The excavation of c. 14,010m^3 of material at the electricity substation site (including the access tracks, site entrance, construction compound and interface masts); and,
- The excavation of c. 11,240m^3 of material along the underground electricity line route.

These construction phase activities will result in the permanent removal and relocation of in-situ soils and subsoils. It is estimated that the total volume of material to be excavated at the project site is 25,250m^3.

There will be no loss of peat or soil at the electricity substation site, as it will be relocated with the project site. The excavated subsoil material will be used as fill material to facilitate construction while the topsoil layers will be used in the

reinstatement of the site post construction. It is proposed to reuse c. 9,310m³ of material to facilitate construction and landscaping. Meanwhile, it is estimated that c. 4,700m³ of excess spoil material will be stored in the 2 no. proposed designated spoil deposition areas.

Site investigations indicate that significant volumes of rock are unlikely to be encountered during the excavations.

With regards to the underground electricity line, due to the potential for soil contamination arising from tar and chippings, it is estimated that c. 10,550m³ of material will be disposed of at a licenced waste disposal facility. Some material (c. 690m³) will also be stored in the designated spoil deposition areas at the electricity substation site.

The likely pre-mitigation effect (Table 6.9) is assessed to be 'slight' for the following reasons:-

- The soils, subsoils and bedrock at the project site are considered to be of 'low' to 'medium' importance;
- A minimal volume of soil, subsoil and bedrock; in comparison to the total resource present on the site; will be removed to allow for the construction of the project;
- The soil and subsoil which will be removed during the construction phase will be localised to the footprint of proposed infrastructure only;
- No infrastructure will be constructed within or near any designated sites for the protection of ecological features or geological heritage.

The excavation and relocation of material is an inevitable part of the project; however, it is assessed that the effects are not likely to be significant. The overall effect of the excavation of soil, subsoil and bedrock is summarised at Table 6.9 below.

Attribute	Description
Receptor	Soils, subsoils and bedrock
Pathway/Mechanism	Excavations
Pre-Mitigation Effect	Negative, direct, slight, likely, permanent effect on soil, subsoil and bedrock

Table 6.9: Soil, Subsoil and Bedrock Excavation

6.4.3.3 Erosion of Exposed Soil and Subsoil

The exposure of soil and subsoils at locations of excavation (at the substation site and along the underground electricity line) and spoil storage (at the substation site) will increase the likelihood of soil erosion resulting in a direct physical effect on land and soil. However, given the small footprint of the proposed excavations and spoil storage areas in the context of the overall project site and the wider area, the pre-mitigation effect is not assessed as likely to be significant.

The likely effects associated with soil and subsoil erosion relates to effects on the water environment and, therefore, this is further assessed in detail at Chapter 7.

The pre-mitigation effects of soil and subsoil erosion are summarised at Table 6.10 below.

Attribute	Description
Receptor	Soils and subsoils
Pathway/Mechanism	Vehicle movement, surface water erosion, and wind action.
Pre-Mitigation Effect	Negative, direct, slight, short-term, likely effect on soil and subsoils.

Table 6.10: Erosion of Exposed Soil and Subsoil

6.4.3.4 Contamination of Soils and Subsoils from Leakages/Spillages of Hydrocarbons

The contamination of soils and subsoils at the substation site and along the underground electricity line presents a possible direct effect on the soils and geology of the project site. Accidental spillage during refuelling of construction plant with petroleum hydrocarbons is a pollution risk. 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 are likely to result in significant effects (i.e. contamination of soils and subsoil on the geological environment.

The pre-mitigation effect is summarised at Table 6.11 below.

Attribute	Description
Receptor	Soil and subsoils
Pathway	Soil and subsoil pore space.
Pre-Mitigation Effect	Negative, direct, slight, short term, likely effect on, soils and subsoils

Table 6.11: Contamination of Soils and Subsoils from Leakages/Spillages of Hydrocarbons

6.4.3.5 Ground Instability and Failure

Ground instability or failure refers to a significant mass movement of a body of ground that would have an adverse impact on the project and the surrounding environment.

A significant amount of site investigation data has been acquired at the electricity substation site. These data provide confidence on the depth of subsoil and the subsoil type. Subsoils are logged as glacial deposits comprising of sandy gravelly CLAY underlain by fine to coarse SAND with medium to high cobble and boulder content. These subsoils would not be associated with ground instability or a risk of landslides.

The site investigation data also outline the absence of any significant karst features below the thick subsoil layers which could impact on ground instability.

Meanwhile, local geology along the underground electricity line comprises made ground (tarmacadam) over variable subsoil deposits (refer to Section 6.3.3). Peat subsoils are mapped by the GSI along the underground electricity line in the townlands of Derryglad and Eskerbaun. The underground electricity line comprises of a 1.2m deep trench below an existing roadway and, based on these characteristics, it is assessed that there is a negligible likelihood of ground instability.

The pre-mitigation effect is summarised at Table 6.12 below.

Attribute	Description
Receptor	Subsoils and weathered/karstified bedrock
Pathway	Vehicle movement and excavations
Pre-Mitigation Effect	Negative, direct, imperceptible, permanent, unlikely effect on subsoils and weathered/karstified bedrock

Table 6.12: Ground Instability and Failure

6.4.4 Operational Phase

Very few likely direct or indirect effects are envisaged during the operational phase of the project. These may include:-

- Some construction vehicles or plant may be necessary for routine maintenance. On average, the site will be visited 1-2 times a week which could result in minor accidental leaks or spills of fuel/oil;
- Emergency repair works to the underground electricity line, which are highly unlikely, could result in future excavation of soils and subsoils; and
- In relation to indirect effects, a small amount of granular material may be required to maintain access tracks during operation which will place intermittent very minor demand on local quarries.

6.4.4.1 Access Track Maintenance

In relation to indirect effects, a small amount of granular material may be required to maintain access tracks during the operational phase which will place intermittent minor demand on local quarries.

The pre-mitigation effect is summarised at Table 6.13 below.

Attribute	Description
Receptor	Soils and subsoils
Pathway	Soil and subsoil pore space
Pre-Mitigation Effect	Negative, indirect, imperceptible, short-term, unlikely effect on soils and subsoils

Table 6.13: Access Track Maintenance

6.4.4.2 Site Vehicle/Plant Use

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

The pre-mitigation effect is summarised at Table 6.14 below.

Attribute	Description
Receptor	Soils and subsoils
Pathway	Soil and subsoil pore space

Pre-Mitigation Effect	Negative, indirect, imperceptible, short-term, unlikely effect on soils and subsoils

Table 6.14: Site Vehicle/Plant Use

6.4.5 Decommissioning Phase

As set out at Chapter 3 (Sections 3.2 and 3.7), the project will form part of the national electricity network and decommissioning of the project is not proposed. Therefore, decommissioning phase effects will not occur.

6.4.6 Cumulative Effects

It is assessed that significant effects are unlikely to arise as a consequence of the project predominately due to the localised and near surface nature of the construction works and the absence of likely significant effects during the construction and operational phases.

Similarly, and given the small construction footprint and shallow earth works of the proposed electricity substation and underground electricity line; it is assessed that significant cumulative effects on land, soils and geology are unlikely to arise in-combination with any other existing, permitted or proposed projects.

Given that all likely effects relating to the project are assessed to be direct and contained within the immediate vicinity of the project; it is assessed that there is no pathway for the project to act in combination with other existing, permitted and projects including those listed at Chapter 1.

6.4.7 Health Effects

Health effects are assessed as only likely to arise through soil and ground contamination. The project is not a recognized source of pollution (e.g. it is not a waste management site, or a chemical plant), and so the likelihood of effects during the operational phase is very low.

Hydrocarbons will be used onsite during construction; however, the volumes will be small in the context of the scale of the project and will be handled and stored in accordance with best practice measures. The likely residual effects associated with soil or ground contamination and subsequent health effects are assessed to be imperceptible.

6.4.8 Risk of Major Accidents and Disasters

Due to the nature of the electricity substation site; i.e. gently sloping terrain with glacial subsoils; there is no risk of a landslide occurring.

Whilst peat is present along c. 580m of the underground electricity line in the townlands of Derryglad and Eskerbaun, walkover surveys and inspection of the underground electricity line in these areas identified no peat stability issues. The underground electricity line comprises of a 1.2m deep trench below an existing roadway, based on these characteristics there is a negligible likelihood of ground instability.

6.5 Mitigation and Monitoring

6.5.1 Construction Phase

6.5.1.1 Land

The loss of agricultural land resulting from the project on a local or regional scale is minimal and therefore the effects of actual agricultural land loss are assessed as likely to be negligible.

Given the hummocky nature of local topography resulting from the glacial deposits, any change in topography is assessed as likely to be minimal in the overall landscape.

6.5.1.2 Soil, Subsoil and Bedrock Excavation

The excavation of soil and subsoil will have a direct effect on the geological environment.

Mitigation measures at the electricity substation site include:-

- Placement of infrastructure in areas of suitable ground conditions based on detailed site investigation data;
- The soil and subsoil which will be removed during the construction phase will be localised to the proposed infrastructure location;
- The project has been designed to avoid sensitive habitats;
- A minimal volume of soil and subsoil will be excavated and removed to allow for infrastructure works to take place in comparison to the total volume of these materials present on the site;
- In order to minimise erosion during the construction phase, works will not take place during periods of intense or prolonged rainfall (to prevent increased silt laden runoff);
- At the identified spoil deposition areas, the vegetative topsoil layer will be removed to allow for spoil to be placed and upon reaching the recommended height, the vegetative topsoil layer will be reinstated;
- The spoil deposition areas will be developed in a phased approach, with the topsoil removed and temporarily stockpiled within the defined area while the spoil is being placed. The stockpiled topsoil will then be reinstated over the placed spoil, and the exercise will continue within the same spoil deposition area until the area is full;
- The placement of spoil will be restricted to a maximum height of 2m, subject to confirmation by the Geotechnical Engineer;
- Where practical, the surface of the placed spoil is shaped to allow efficient run-off of surface water. Where possible, shaping of the surface of the spoil will be carried out as placement of spoil within the area progresses. This will reduce the likelihood of debris run-off and ensure stability of the placed spoil;
- Finished/shaped side slopes of the placed spoil will be not greater than 1(v):2(h) in the deposition areas and not greater than 1(v):1(h) alongside access tracks;
- Inspections of the spoil deposition areas will be made by a Geotechnical Engineer on a weekly basis during the construction phase and monthly for a 6-month period thereafter. The appointed contractor will review work practices at the spoil deposition areas when periods of heavy rainfall are expected so as to prevent excessive dirty water runoff from being generated;

- An interceptor drain will be installed upslope of the spoil deposition areas to divert any surface water away from these areas;
- Silt fences and double silt-fences will be emplaced down-gradient of spoil deposition areas and will remain in place throughout the entire construction phase, or until reseeding has been established to a sufficient level;
- The surface of the deposited spoil will be profiled to a gradient to be agreed with the Geotechnical Engineer and vegetated or allowed to vegetate naturally;
- All the above-mentioned general guidelines and requirements will be confirmed by the Geotechnical Engineer prior to construction; and,
- Spoil deposition areas are at a minimal distance from excavation areas to avoid excessive transport of excavated materials.

Mitigation measures along the underground electricity line include:-

- Soils and subsoils excavated along the underground electricity line will be immediately removed from site to a licensed waste management facility or temporarily stored in covered stock piles along the edge of the road carriageway for removal;
- Some spoil material will be transported and stored at the designated spoil management areas at the electricity substation site;
- All material generated from the excavation of the underground electricity line trench located within the public road corridor will be disposed of in a nearby licensed waste facility to prevent a risk of soil contamination from road structure material (i.e. tarmacadam); and,
- The tarmacadam road surface will be replaced with the same design standard as the surrounding carriageway.

6.5.1.3 Erosion of Exposed Soil and Subsoil

The following mitigation measures are proposed to prevent the erosion of soil and subsoil at the electricity substation site:-

- Soils and subsoils excavated will be reinstated within the electricity substation site;
- The upper vegetative topsoil layer 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 spoil within the deposition areas;
- Re-seeding and spreading/planting will also be carried out in the spoil deposition areas;
- Temporary drainage systems will limit runoff impacts during the construction phase; and,
- A detailed Spoil Management Plan will be prepared as part of the Construction & Environmental Management Plan prior to the commencement of development.

The following mitigation measures are proposed to prevent the erosion of soil and subsoil along the underground electricity line:-

- Soil/subsoil removed from the trench will be immediately removed from site to a licensed waste management facility to prevent erosion or temporarily stored in covered stock piles along the edge of the road carriageway for removal;
- Temporary drainage systems will limit runoff impacts during the construction phase; and,

- The underground electricity line will be constructed in a stepwise manner along its length. This will minimise the time any particular section of the underground electricity line trench is open before being reinstated.

6.5.1.4 Contamination of Soils and Subsoils by Leakages/Spillages of Hydrocarbons

The following measures are proposed to specifically prevent contamination of soils and subsoils:-

- The volume of fuels or oils stored on site will be minimised;
- All fuel and oil will be stored in an appropriately bunded area of sufficient capacity within the temporary construction compound. Only an appropriate volume of fuel will be stored at any given time. The bunded area will be roofed to avoid the ingress of rainfall and will be fitted with a storm drainage system and an appropriate oil interceptor;
- All bunded areas will have 110% capacity of the volume to be stored;
- An oil interceptor will be installed within the surface water drainage system at the electricity substation site during the construction phase to intercept any accidental hydrocarbon spillages;
- From the construction compound, fuel will be transported to the works area by a 4x4, in a double skinned fuel bowser. The fuel bowser, a double-axel custom-built refuelling trailer will be re-filled at the temporary compound and will be towed around the site by a 4x4 jeep to where plant and machinery is located. The bowser/4x4 jeep will also be fully stocked with fuel absorbent material, pads and spill kits in the event of any accidental spillages. The fuel bowser will be parked on a level area in the construction compound when not in use and only designated trained and competent operatives will be authorised to refuel plant on site. Mobile measures such as drip trays and fuel absorbent mats will be used during all refuelling operations to avoid any accidental leakages;
- All plant and machinery used during construction will be regularly inspected for leaks and fitness for purpose;
- Spill kits will be available to deal with any accidental spillages within the temporary construction compound and during re-fuelling;
- All waste tar material arising from road cuttings (from trenching in public roads) will be removed off-site and disposed of at a licensed waste facility. Due to the potential for contamination of soils and subsoils, it is not proposed to utilise this material for any reinstatement works; and,
- An emergency plan for the construction phase to deal with accidental spillages is contained within the Planning-Stage Construction and Environmental Management Plan (Annex 3.4). This emergency plan will be further developed by the contractor prior to the commencement of construction.

6.5.1.5 Ground Instability and Failure

The following measures, which will be implemented during the construction phase of the project, will assist in the management of the geotechnical risks for this site:-

- Appointment of experienced and competent contractors;
- The site will be supervised by experienced and qualified engineering/geotechnical personnel;
- Prevent undercutting of slopes and unsupported excavations;
- Maintain a managed and suitable drainage system;

- Ensure construction method statements are followed or where agreed modified/ developed; and,
- Prepare, revise and amend a Geotechnical Risk Register as construction progresses.

6.5.2 Operational Phase

6.5.2.1 Access Track Maintenance

In the event that access track maintenance is required, aggregates will only be sourced from authorised quarries. No other mitigation measures are required.

6.5.2.2 Site Vehicle/Plant Use

The following mitigation measures will be implemented:-

- Vehicles used during the operational phase will be refuelled off site before entering the site;
- Fuels stored on site will be minimised and any diesel or fuel oils/hydrocarbons stored on-site will be bunded within the control building. The bund capacity will be sufficient to contain 110% of the storage tank's maximum capacity;
- Spill kits will be available in all site vehicles to deal with an accidental spillage and breakdowns; and,
- An emergency plan for the operational phase to deal with accidental spillages and breakdowns will be prepared.

6.5.3 Decommissioning Phase

As set out at Chapter 3 (Sections 3.2 and 3.7), the project will form part of the national electricity network and decommissioning of the substation is not proposed. Therefore, no decommissioning phase mitigation measures are required.

6.5.4 Monitoring Measures

There is no proposed monitoring programme for land, soils and geology. However, during and post-construction, all excavated or raised areas (i.e. cut and fill) and reinstated/landscaped ground, including the spoil deposition areas, will be inspected for signs of erosion and instability. These inspections will be undertaken by a suitably qualified Geotechnical Engineer on a weekly basis during the construction phase and monthly, for a six-month period, post construction.

6.6 Residual Effects

6.6.1 Construction Phase

6.6.1.1 Land (Land-Take)

The project will result in the loss of agricultural lands which will be replaced by the electricity substation, access tracks and associated compound. This will result in a permanent change to land at these locations. However, due to the relatively small footprint of the project infrastructure on a site scale, and even more so on a local scale, the residual effect is assessed as likely to be negative, direct, slight, permanent, likely effect on land (land-take).

For the reasons outlined above (small development footprint), no significant effects on land (land-take) are likely to occur.

6.6.1.2 Soil, Subsoil and Bedrock Excavation

The negative effect of the project is the disturbance and relocation of 25,250m^3 of spoil. on the basis of the design measures incorporated into the project combined with the 'low' importance of the soil and subsoil deposits and the 'medium' importance of the local bedrock, it is assessed that the residual effect is likely to be negative, slight, direct, likely, permanent effect on peat, subsoils and bedrock due to disturbance and relocation within the project site.

Following the excavation and construction of the underground electricity line, the area excavated will be reinstated with a comparable ground cover. The residual effect is assessed as likely to be a negative, imperceptible, direct, likely, permanent effect.

For the reasons outlined above, no significant effects on peat, subsoils and bedrock are assessed as likely to occur.

6.6.1.3 Erosion of Exposed Soil and Subsoil

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 Spoil Management Plan (to be prepared prior to the commencement of development). Material excavated for the construction of the electricity substation will remain within the project site and will be used as fill or stored within designated spoil management areas. The material excavated along the underground electricity line will either be transported to the designated spoil deposition areas or, where generated from the public road corridor, will be transported to licensed waste facility for disposal. Following implementation of the prescribed mitigation measures, the residual effects are assessed as likely to be negative, slight, direct, short-term, likely effect on soil and subsoils.

For the reasons outlined above, no significant effects on soils, subsoils or bedrock are assessed as likely to occur.

6.6.1.4 Contamination of Soils and Subsoils by Leakages/Spillages of Hydrocarbons

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 is assessed as likely to be negative, imperceptible, direct, short-term, low unlikely effect.

For the reasons outlined above, and with the implementation of the listed mitigation, no significant effects are assessed as likely to occur.

6.6.1.5 Ground Instability and Failure

The engineering design of the project is underpinned by a comprehensive site investigation dataset. The risk of ground failure during construction is very low. No residual effects are assessed as likely.

For the reasons outlined above, and with the application of the mitigation measures outlined above, no significant effects are assessed as likely to occur.

6.6.2 Operational Phase

6.6.2.1 Access Track Maintenance

The use of aggregates for access track maintenance will be minor and infrequent, and all material will be imported to the project site from local authorised quarries. The residual effect is assessed as likely to be negative, imperceptible, indirect, short-term, unlikely effect.

For the reasons outlined above, no significant effects on land, soils or geology are assessed as likely to occur.

6.6.2.2 Site Vehicle/Plant Use

The use of hydrocarbons in plant and vehicles is a standard risk associated with all operational substation 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 is assessed as likely to be negative, imperceptible, direct, short-term, unlikely effect.

For the reasons outlined above, no likely significant effects will occur.

6.6.3 Decommissioning Phase

As set out at Chapter 3 (Sections 3.2 and 3.7), the project will form part of the national electricity network and decommissioning of the substation is not proposed. Therefore, no decommissioning phase residual effects are likely to occur

6.4 Summary

Excavations will be required for site levelling and for the installation of foundations, areas of hardstanding, access tracks and the underground electricity line. This will result in a permanent removal of soil at excavation locations within the electricity substation site and along the route of the underground electricity line. Excavated material at the electricity substation site will be used for reinstatement and landscaping and, where excess material arises, this will be disposed of at the dedicated spoil deposition areas. The material excavated along the underground electricity line will be disposed of at a licenced waste facility.

Due to small scale of the works proposed at the electricity substation site, and the transient nature of the underground electricity line, there are not anticipated to result in a likely cumulative or in-combination effect. Furthermore, all other existing, permitted and proposed developments in the vicinity of the project have been assessed to determine their likelihood to act in combination with the project; however, it is concluded that there is no likelihood of significant cumulative effects.

In conclusion, this assessment has determined that the project will not result in any likely significant effects on land and soil. Where effects are likely to occur, such as soil contamination and erosion, the implementation of appropriate mitigation measures will ensure that any effects are negligible and imperceptible. Where it is not possible to implement mitigation measures, such as in respect of the direct excavation of soil and subsoil, the level of effect is considered to be slight and will not be significant.