5 LAND AND SOIL

5.1 INTRODUCTION

This chapter assesses the impact to the land and soils environment and considers any indirect effects arising from the proposed works for the Kilcumber Bridge 110kV substation, as detailed in **Chapter 2**. The baseline conditions at the site are presented and the impacts anticipated from the proposed substation and the associated infrastructure are discussed. Mitigation measures are suggested where appropriate and any residual impacts are assessed.

5.1.1 Scope of Assessment

The chapter includes data and descriptions of the soil and subsoil at the site (comprising of the substation building infrastructure, 2ha substation compound area, 400m 110kV overhead line (OHL) grid connection and site entrance on the R401 regional road) as well as any prominent features. Data includes information from site visits as well as desk top research. The geology is briefly described at the local and regional level. All activities associated with the project are considered for the construction and operation phase impacts. The assessment was completed having regard to the new EIA Directive, the revised EPA guidelines and the inclusion of land in describing and assessing the site geology.

5.1.2 Methodology

A desk study was undertaken to collate and review available information, datasets and documentation sources pertaining to the sites natural environment. The desk study involved the following:

- Examination of maps and aerial photography;
- Examination of the Geological Survey of Ireland (GSI) datasets pertaining to geological (bedrock, heritage, subsoil, aquifer) and extractive industry data;
- Examination of EPA / Teagasc online soil and subsoil maps;
- Preparation of site maps.

Following the desk top study and field surveys, a soil map and a map of the bedrock were generated in GIS and are included as figures in this chapter. Site photographs are also included in the chapter where relevant.

Field surveys for land and soils were undertaken for the Cushaling Wind Farm EIAR, which included the area of the proposed Kilcumber Bridge 110kV substation, during 2019 and comprised the following:

- A walkover survey of the site to identify geological and soil features, geomorphological features, relict failures, rock exposures, wet ground, general soil and rock types and drainage patterns.
- The walkover included the measurement of slope inclination and mapping of prominent features.
- Identify, if present, any prominent water features on site and existing drainage patterns

5.1.3 Assessment Criteria

The assessment is based on the EPA Glossary of Impacts, included in the draft revised Guidelines on Information to be contained in Environmental Impact Assessment Reports (2017). The assessment of the Likely Significant Impacts in the Institute of Geologists of Ireland Guide to Geology in Environmental Impact Statements (2002) was also consulted.

5.1.4 Statement on Limitations and Difficulties Encountered

The information used for this assessment is suitable for environmental assessment and planning design purposes only. Further ground investigation consisting of trial pits, boreholes and laboratory testing will be required for detailed civil and structural design of the scheme.

The area is flat and will not require any significant earthworks. No site investigation has been carried out in this area to date as it was not deemed necessary due to the minor nature of the earthworks required here.

5.1.5 Competency of Assessor

The Assessor, Jasmin Spoerri, is a Graduate Engineering Geologist with 1 years' experience in engineering geology in the area of Geotechnical Engineering. Jasmin graduated from University College Cork, Ireland in 2019 with a B.Sc. (Hons) in International Field Geoscience and completed a M.SC. in Applied Environmental Geoscience from University College Cork, Ireland in 2020. Jasmin has experience in geological investigation/interpretation, geotechnical investigation/interpretation, hydrogeological assessment and investigation, and environmental assessment. She has worked on several stages of wind farm and substation projects, most notably with ground investigation and feasibility. Her project experience includes geotechnical interpretation and environmental impact assessment for wind farms namely Moanvane Wind Farm, Co. Offaly and Coole Wind Farm, Co. Westmeath. This included geotechnical assessment of the Land, Soils, Geology, Hydrogeology.

The Assessor, Paddy Curran, is a Senior Engineer with 10 years' experience in civil engineering, particularly in the area of Geotechnical Engineering. Paddy graduated from University College Cork, Ireland in 2008 with a B.E. (Hons) in Civil Engineering and completed a Master's of Science in Soil Mechanics (MSc DIC) at Imperial College London, United Kingdom in 2012. Paddy's professional registrations include being a Chartered Engineer and Registered Ground Engineering Professional with the Institution of Civil Engineers. He has worked on all stages of the project life cycle from feasibility through to commissioning on a large number of wind farm and roads projects. His experience includes environmental assessment, geotechnical investigation/interpretation, design and construction support. His project experience at the planning and environmental impact assessment stage includes Mount Lucas Wind Farm, Derryadd Wind Farm, M25 Regional Investment Scheme, Galway Wind Park and Kilathmoy Wind Farm and Grid Connection. This included assessment of environmental impact on Land, Soils, Geology, Hydrogeology as well as cumulative impacts with various other aspects of the environment. These assessments included areas of peat similar to those encountered in Cushaling.

5.2 EXISTING RECEIVING ENVIRONMENT

5.2.1 Location of the Proposed Site

The proposed development site is in the townlands of Ballykilleen, Cloncreen and Ballinowlart North, Co. Offaly. The proposed development is opposite the Edenderry power station and approximately 6km south of Edenderry on the R401. The Site can be accessed from the R401 which is adjacent to the site, running north-south between Edenderry and Clonbullogе.

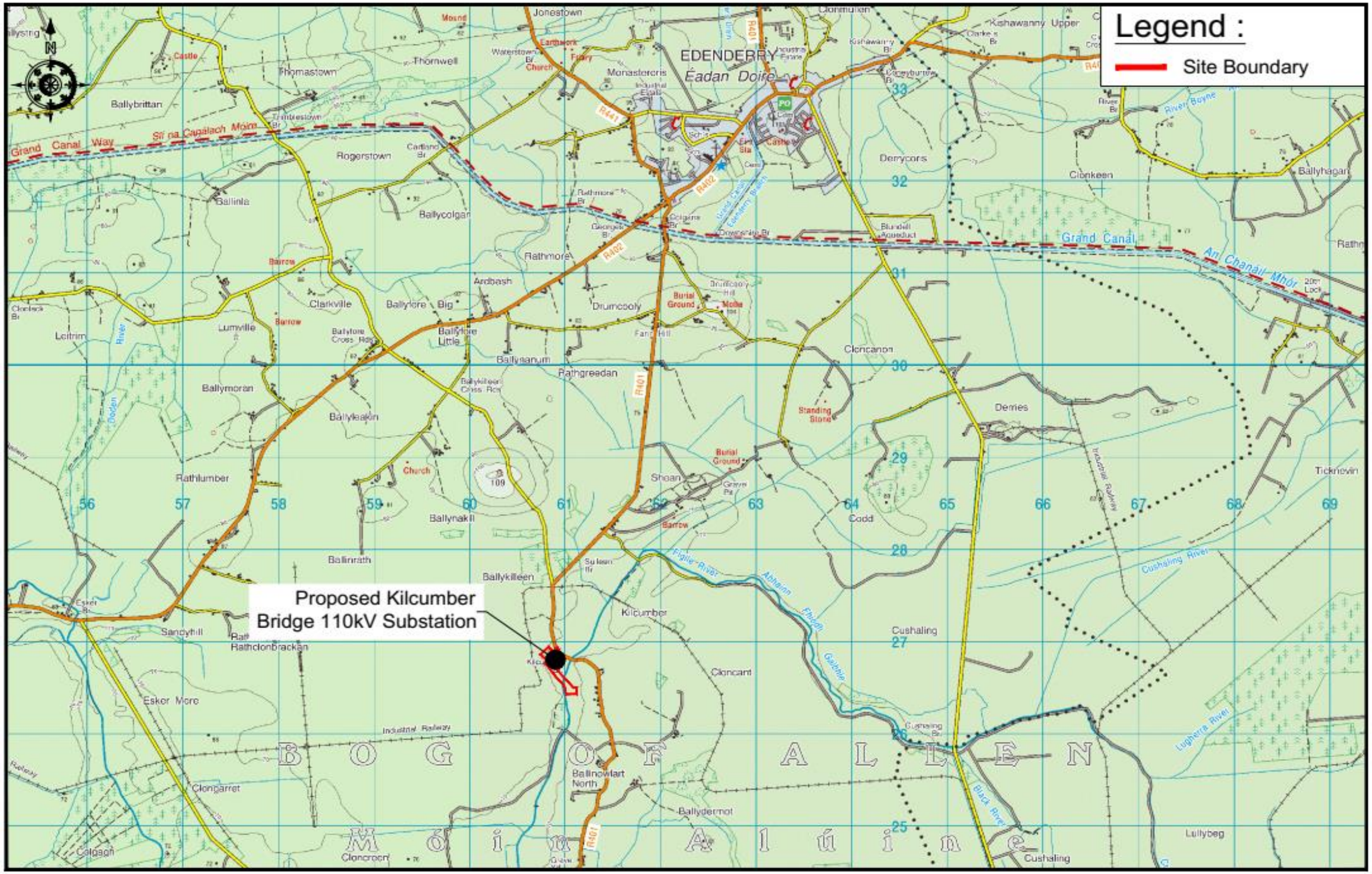

Figure 5-1 Site Location

5.2.2 Topography

The site is situated in a low-lying area and is generally very flat with a slight slope dipping east towards the River Figile. This is evident in the 10m contours shown on the OSI Mapping (Figure 5-1) where contours are between approximately 65 and 70 metres Above Ordnance Datum (mAOD) and widely spaced. Topographical surveys undertaken also illustrated the flat nature of the site with recorded levels ranging from approximately 65mAOD to 70mAOD.

5.2.3 Land Use

The land use at the site has been mapped as shown in Figure 5-2. The land cover mapping was created using information from CORINE Land Cover 2018 available on the EPA online mapping system.

The following land uses have been identified at the site:

- 131 – Mineral Extraction Sites
- 231 – Pastures
- 412 – Peat Bogs

The proposed substation is located adjacent to the existing Edenderry substation on land which is mapped as *Pastures*. The proposed grid connection route and internal roads go through land mapped as *Pastures* and *Mineral Extraction Sites*. *Peat Bogs* are seen to be in close proximity to the site boundary in the west.

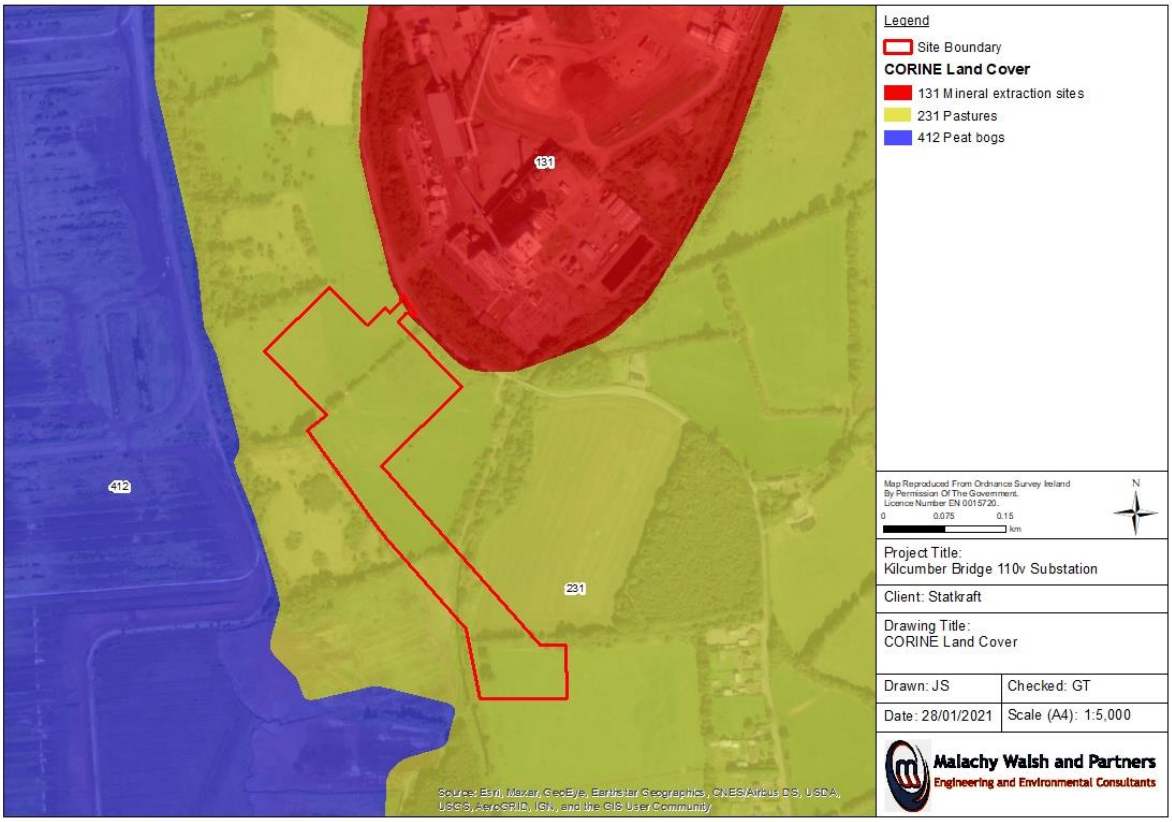

Figure 5-2 Land Cover (CORINE map from EPA online Mapping)

5.2.4 Regional Geology

The landscape of the eastern area of Co. Offaly and western area of Co. Kildare is mostly low-lying. The underlying bedrock in the area consists of Limestone. The first of these marine rocks to be deposited were dark grey fossiliferous mudstones, but above these is a series of thick grey limestones which underlie much of the low ground across the area. Further information on bedrock in the area is given in Section 5.2.7.

The most significant force to shape the form of the county as we see it today was the Ice Age which ended about 10,000 years ago. Large ice sheets several hundred metres in thickness covered the county for thousands of years and eroded the rocks beneath. As the ice eventually melted away, the meltwaters reorganised the sediments into iconic landforms like eskers, adjacent to large fans and deltas of sand and gravel. Eskers were formed by sub-glacial rivers, that is, they flowed in tunnels at the base of the ice sheets. Some eskers are small and local within Offaly and Kildare, but the majority that traverse the counties form extended networks and cross several counties.

Raised bogs are a distinctive and characteristic feature of the landscape of the midlands of Ireland in which they are concentrated. Raised bogs are discreet, raised, dome-shaped masses of peat occupying former lakes or shallow depressions in the landscape. They occur throughout the midlands of Ireland. Their principal supply of water and nutrients is from rainfall and the substrate is acid peat soil, which can be up to 12 m deep. Raised bogs are characterised by low-growing, open vegetation dominated by mosses, sedges and heathers, all of which are adapted to waterlogged, acidic and exposed conditions (From Irish Peat Conservation Council Website). The majority of the peat in the proximity of Kilcumber Bridge has been cut away as part of the peat harvesting process or has since been redeveloped for agriculture.

5.2.5 Local Geology

The local geology at this site reflects the regional geological features discussed in Section 5.2.4. The site is relatively flat and is surrounded by cutaway peatlands. The River Figile crosses the site on its most eastern border, slowing south. At a local level, this feature is likely to have an influence on the geology of the site through both erosion and depositional process. Soil and subsoil geology is discussed further in Section 5.2.6.

5.2.6 Soil and Subsoil

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

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

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

The predominant soil type at the majority of the site is “Cut – Raised Bog cutaway/cutover” according to the Teagasc/EPA Soil Maps available on the Geological Survey of Ireland online mapping system (See Figure 5-3 and Figure 5-4). The characteristics of the above soil type based on data from Teagasc are a high level of organic matter and very high moisture content. The eastern bank of the River Figile is in an area mapped as having "BminPD - Mineral poorly drained (Mainly basic)" and "BminPDPT - Peaty poorly drained mineral (Mainly basic)".

The Quaternary Sediments at the site shown on the Geological Survey of Ireland online mapping system include "Cut–over peat" and "Limestone till carboniferous" (See Figure 5-3).

Land use practice has much altered the natural soil environment at the site through improvement for agricultural purposes.

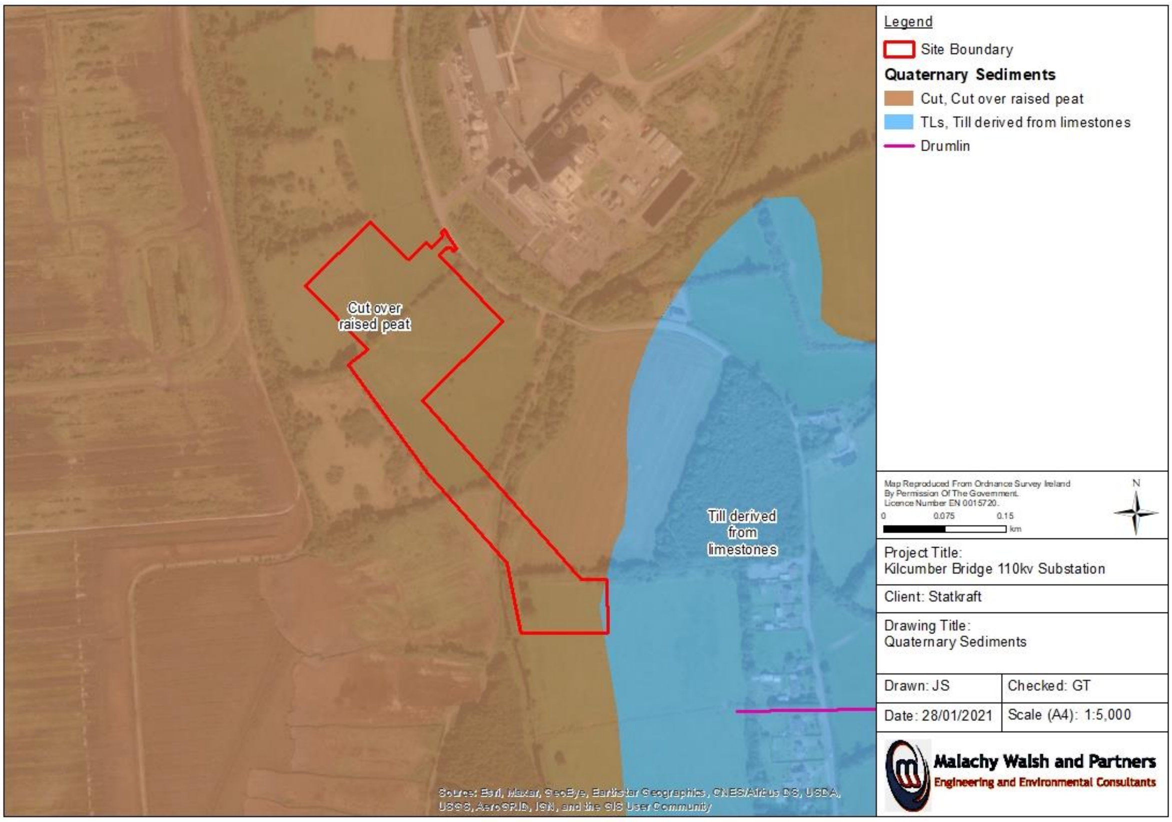

Figure 5-3 Subsoils (From GSI Online Mapping)

Figure 5-4 Soils (From GSI Online Mapping)

5.2.7 Bedrock Geology

The bedrock geology maps available on the Geological Society of Ireland (GSI) online mapping system were reviewed (Figure 5-5 and Figure 5-6). The Lucan Formation (Dark limestone and Shale Calp) is mapped under the substation. The Edenderry Oolite Member (Oolite Limestone) are mapped to the West and East of the site, respectively.

The site is primarily underlain by two formations. The Lucan Formation, described as a Dark Limestone and Shale, is mapped underlaying the main substation compound. The Edenderry Oolite Member, described as an Oolitic Limestone, is mapped underlaying the area west of the site boundary. It has been noted from GSI cross-section that a portion of Edenderry Oolite Member is potentially cross bedded with Waulsortian Limestone which is prone to karstification. The main structural features of the region are two fault sets which intersect one another. The first trends northeast to southwest while the second trends northwest to southeast. An unconformity is the main contact between the two formations.

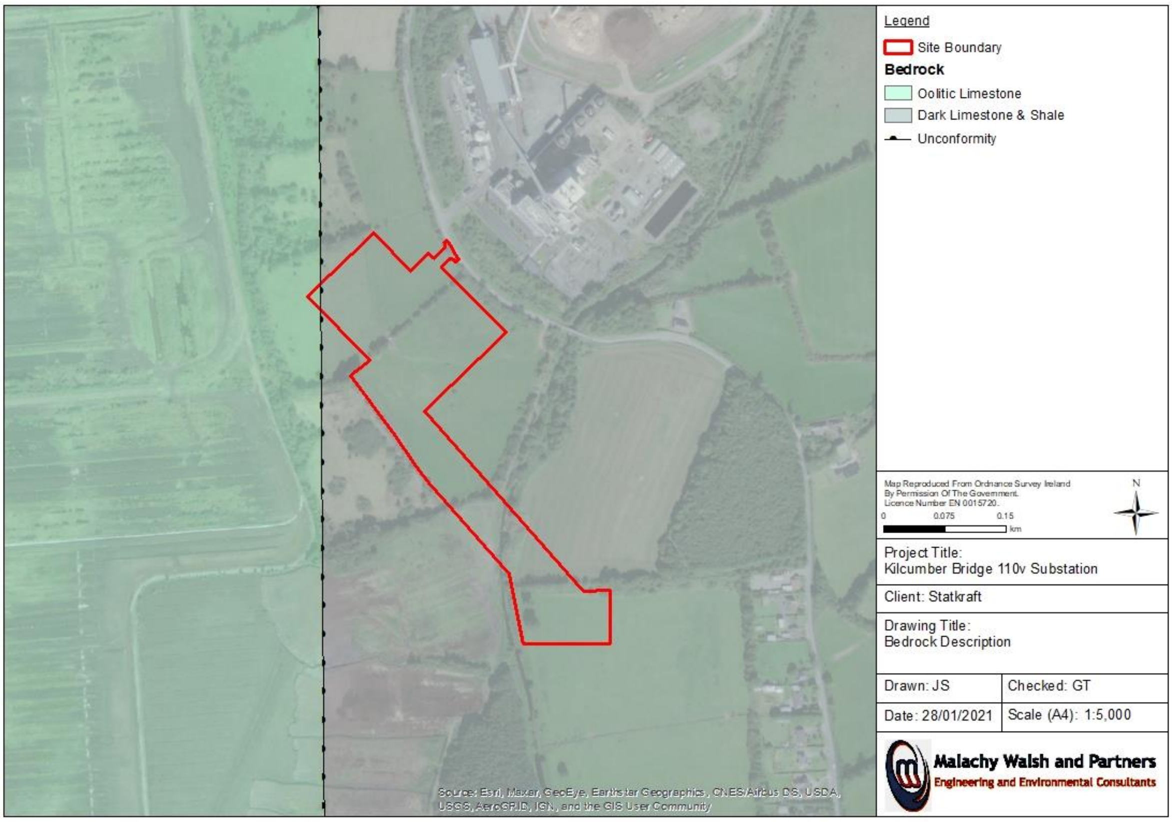

Figure 5-5 Bedrock Descriptions (From GSI Online Mapping)

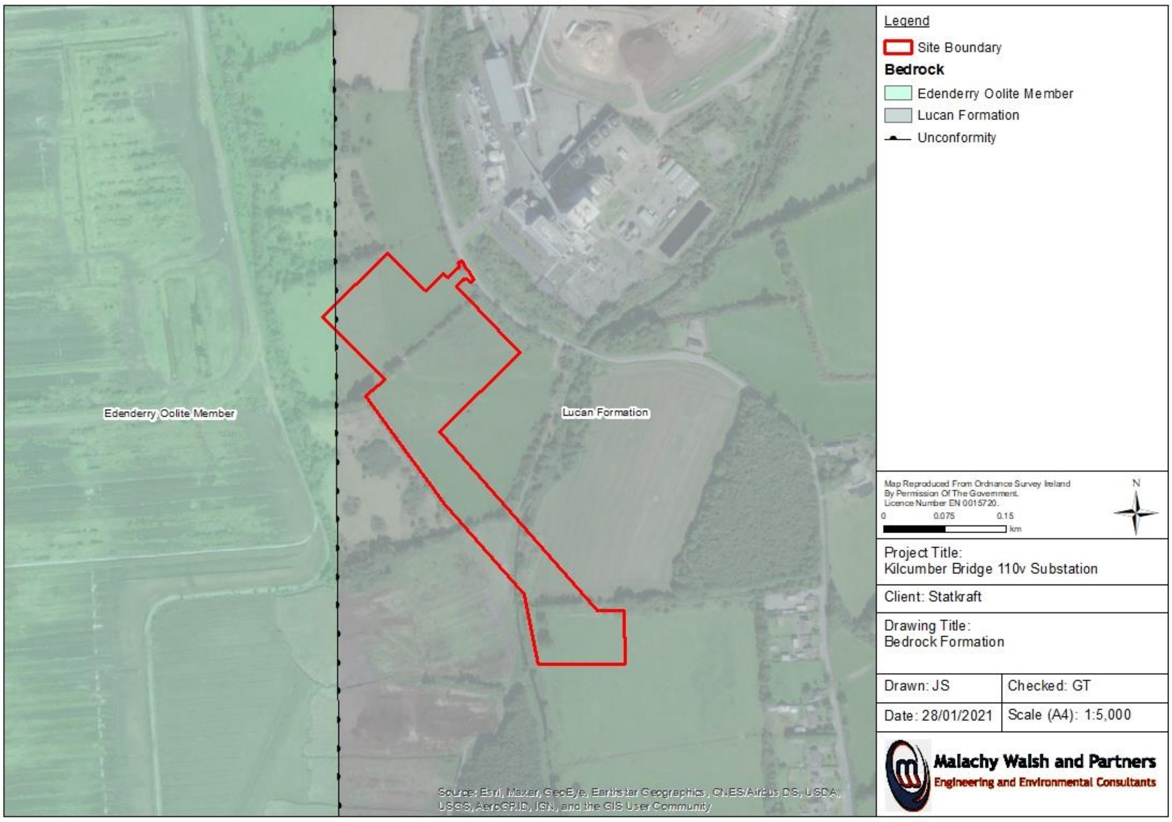

Figure 5-6 Bedrock Formations (From GSI Online Mapping)

5.2.8 Geological Heritage

The Irish Geological Heritage (IGH) Programme identifies and selects a complete range of sites that represent Ireland's geological heritage under a variety of themes ranging from Karst features to Hydrogeology. The IGH Programme is a partnership between the GSI and the National Parks and Wildlife Service (NPWS) and sites identified as important for conservation are conserved as Natural Heritage Areas (NHA). Review of the GSI Geological Heritage Database available on the GSI online mapping system indicates that there are no Geological Heritage Sites within the site. The nearest mapped Geological Heritage Sites are listed below in Table 5-1.

Table 5-1 Geological Heritage Sites in Vicinity of Site

Reference Number	Site Name	Description	Approximate Distance from Site (km)
OY006	Clonbullogue Spring	A significant spring rising situated 2m from the eastern bank of the Figile River. The temperature of the groundwater issuing from the 'WARM' spring is almost 15ºC	3.15
OY007	Clonkeen Mushroom Rock	A Mushroom Rock – isolated upstanding rock in a grass field	3.8
KE011	Carbury Castle	A disused quarry at the north end of carbury hill below the ruined castle. The quarry exposes good sections of Calp limestones; individual beds of limestone around 10-40cm thick in general with thin interbedded black shales.	11
KE003	Hill of Allen	Large working quarry. The Hill of Allen has been heavily excavated on its northwest face. This excavation has exposed part of the Allen Andesite Formation, a massive andesitic lava, which in places within the quarry is porphyritic	15

The Geological Heritage of Co. Offaly and Co. Kildare are also detailed in the below listed publications. Maps from these publications confirm that there are no Geological Heritage Sites within the site (See Figure 5-7 and Figure 5-8).

- The Geological Heritage of County Offaly: An audit of County Geological Sites in County Offaly, by Ronan Hennessy, Robert Meehan, Matthew Parkes, Vincent Gallagher and Sarah Gatley, 2016.
- The Geological Heritage of Kildare: An audit of County Geological Sites in Kildare by Matthew Parkes and Aaron Sheehan-Clarke September 2005.

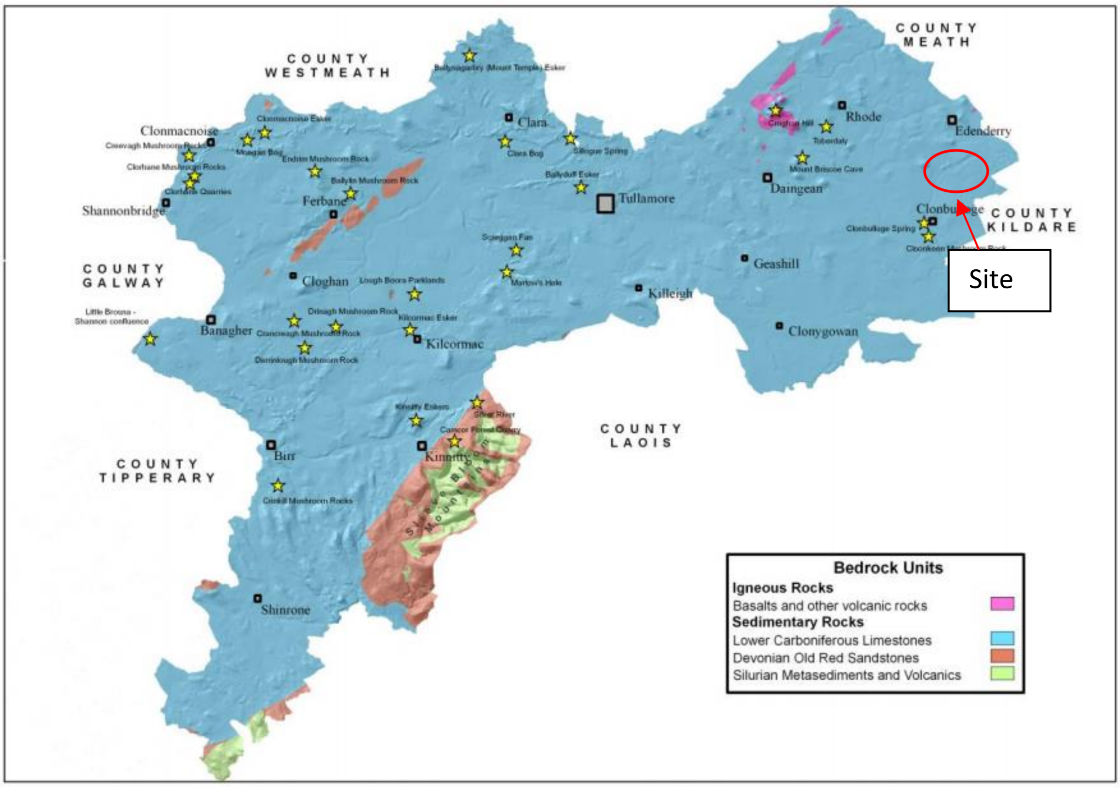

Figure 5-7 Geological Heritage Map of Co. Offaly (REF 1)

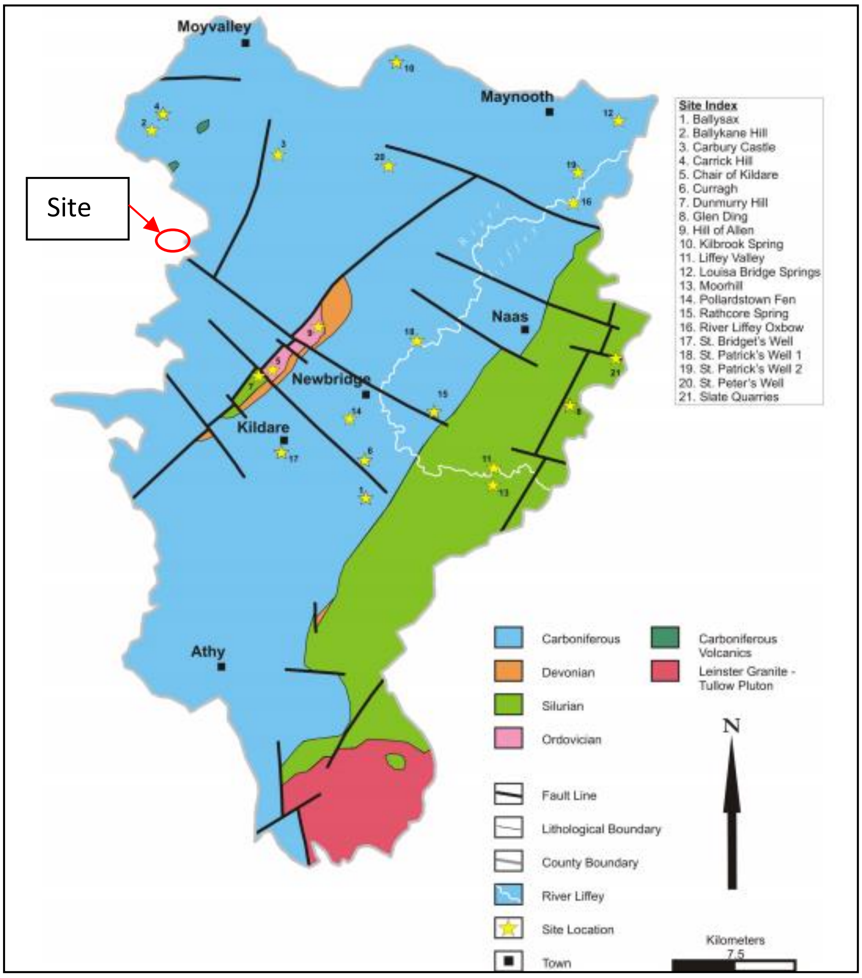

Figure 5-8 Geological Heritage Map of Co. Kildare (REF 2)

5.2.9 Economic Geology

There are a number of quarries operating in proximity to the proposed site in Co. Offaly, Co. Kildare, Co. Meath and Co. Weatmeath including:

- Clonard Quarry, Kilsaran Build, Enfield, Co. Kildare (GSI Quarry Number: KE001)
- Kilrathmurray Pit, Kilsarn Build, Kilrathmurry, Enfield Co. Kildare (GSI Quarry Number: KE005)
- Allen Quarry operated by Roadstone Limited, Kilmeague, Naas, Co. Kildare (GSI Quarry Number: KE006)
- Clongall Pit, George Dunne, Clongall, Castlejordan, Co. Meath (GSI Quarry Number: MH010)
- Derrtarkin Pit, Conor Kilmurray, Derryarkin, Rhode, Co. Offaly (GSI Quarry Number: OY010)
- Drumman, Roadstone Limited, Rochfortbridge, Co. Westmeath (GSI Quarry Number: WH005)
- Derrygreenagh Quarry, Roadstone Limited, Derrygreenagh, Co. Offaly (GSI Quarry Number: OY012)
- Jude Shean Sand and Gravel (noted to the north of the site during the site reconnaissance)

The location of the quarries in the area is shown on Figure 5-9. The closest quarry to the site is the Jude Shean Sand and Gravel Quarry which is located approximately 2.5 km from the nearest point of the site (See Figure 5-10).

Peat harvesting is also prominent in the area. Large areas of cutaway peat are shown on the geological maps (See Figure 5-4) and are evident on aerial photography. The Edenderry Power Plant is located northeast of the site. This power plant is fired by a combination of peat and biomass. The peat for the plant is harvested from bogs in the surrounding area, including those located north and south of the proposed development site.

Recorded mineral locations have the potential to be used for future mineral extraction. According to the GSI, there are a number of recorded metallic mineral locations in the area (See Figure 5-11). None of these locations are within the site. The closest is approximately 5.3 km from the site therefore the development of this site will not impact on any potential future mineral extraction location.

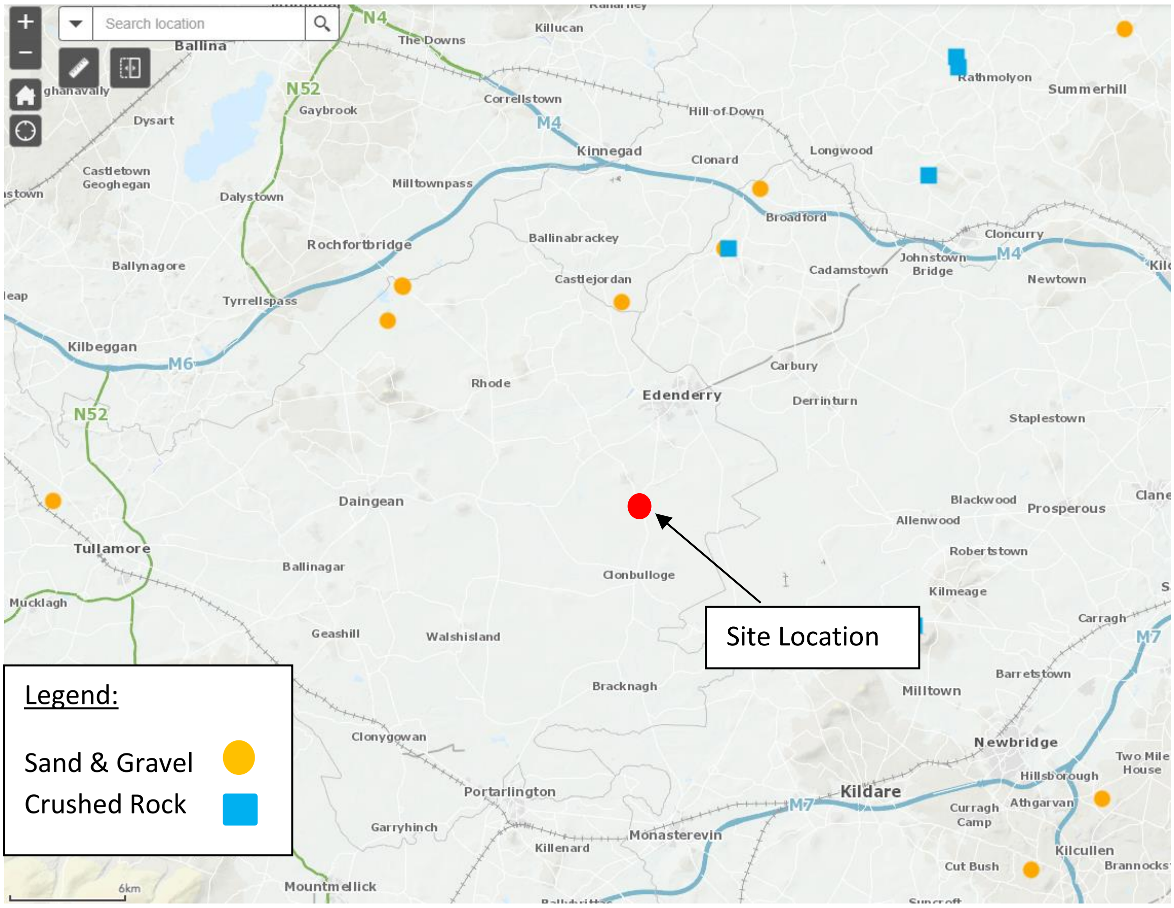

Figure 5-9 Quarries in Areas (From GSI Online Mapping Tool)

Figure 5-10 Location of Jude Shean Sand and Gravel Quarry (From GSI online orthophotography)

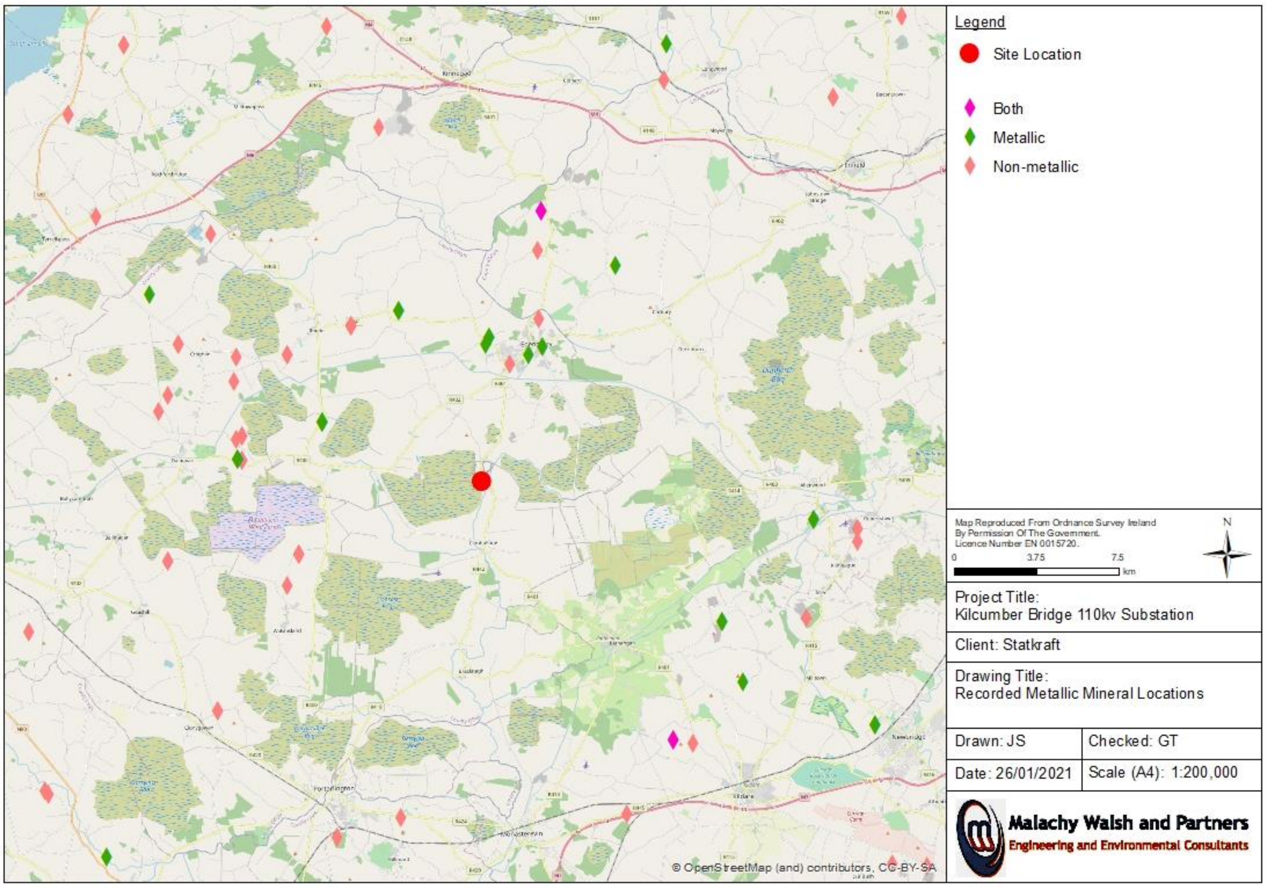

Figure 5-11 Recorded Metallic Mineral Locations

5.2.10 Do-Nothing Scenario

If no development took place on this site, the land and soils environment would remain unchanged, with the exception of future agricultural change.

5.3 LIKELY SIGNIFICANT EFFECTS

The proposed works require the construction of the proposed substation building, substation compound, overhead line grid connection, and the site entrance off the R401 road.

The existing environment is highly modified due to agricultural practices. These existing activities have disturbed the subsoils throughout large portions of the site. Existing drainage characteristics vary, but generally consist of surface water runoff intercepted by manmade drainage channels. The potential additional impacts of the development on the soils and land of the site are assessed below.

The following on-site activities have been identified as the sources of potential risks to the soils and land on the site:

- Excavations and drilling
- Storage and management of excavated materials
- Dewatering

The potential impacts of the project on the land and soil environment discussed in the following sections are considered to be the worst case for all possible impacts if unmitigated.

5.3.1 Construction Phase

The predicted impacts on soils and land for the proposed development are discussed in the following sections. The activities that can cause damage to the existing geological environment may indirectly impact on the aquatic environment.

- Roads and drainage;
- Excavation Works;
- Storage of Materials, Soil Erosion; and
- Waste Generation.

5.3.1.1 Land Use

The land area covered by the footprint of the proposed infrastructure associated with the development of the substation will be sterilised from their existing land use for the duration of the substation's operational life. This includes the substation compound and new access road.

The proposed substation is located adjacent to the existing Edenderry substation on land which is mapped as *pastures.* The change of use of this land to a substation compound represents a ***slight negative medium term irreversible impact***.

Mitigation measures for land use are discussed in 5.4.1.2.

5.3.1.2 Roads and Drainage

A new drainage network will be installed on impermeable areas within the site. This network and design approach is outlined in the in Chapter 2 of this EIAR.

The construction of the road and drainage network will involve both excavation and importation of soil and crushed rock respectively. The impacts of the construction of roads and drainage are the same as for excavations discussed in 5.3.1.3. Given the highly modified nature of the land and soils environment at this site, the construction of roads and drainage represent as ***slight negative permanent impact.***

Mitigation measures for roads, amenity trail and drainage construction are discussed in 5.4.1.3 and 5.4.1.4

5.3.1.3 Excavation Activities

The construction of the proposed development will result in the removal of soil and subsoil in parts of the site in order to facilitate the construction of the substation and grid connection. This removal of soil is a ***slight negative, permanent, direct impact*** on the land and soil environment. However, it is not envisaged that the impact will have a significant effect. The volume of material to be excavated will be managed, reused and stored locally on site. Material will be used landscaping from topsoil and subsoil will be reused.

The total volume of excavated material for the proposed development is approximately 1,816m^3 (See Table 5-2).

In order to minimise the movement of excavated material within a site, a balance must be achieved in terms of how excavated material is managed and deposited on site.

Stone required for the construction of new roads, compound, drainage and will be imported from local limestone quarries.

The volumes involved are typical of a construction project of this nature and size and do not represent a significant environmental impact.

Mitigation measures for excavations for this scheme are discussed in 5.4.1.3 and 5.4.1.4

Table 5-2. Quantities of excavation and construction materials

Item	Unit	Quantity
Length of new entrance roads	m	60
Excavation of topsoil for substation	m3	1,800
Excavation of subsoils for pylon foundation	m3	16
Volume of subsoil to be excavated	m3	16
Volume of topsoil to be excavated	m3	1,800
Total volume of excavated material	m3	1,816
Volume of subsoil/topsoil from excavations to be re-used	m3	1,816
Imported stone for entrance road	m3	320
Imported stone for substation compound	m3	28,160
Total volume of imported stone required	m3	28,480
Concrete for substation foundation	m3	25
Concrete for overhead grid connection Pylon bases	m3	16

5.3.1.4 Stockpiles of Excavated Materials

The handling and re-use of excavated materials are of importance during the construction phase of the project. Excavated material should be managed on site, stored temporarily and re-used in landscaping.

Seeding of the work affected areas with indigenous species should proceed, only where natural re-vegetation is unsuccessful. The re-vegetation of these areas promotes stability, reduces desiccation, run-off erosion and susceptibility to freeze/thaw action.

There is potential for a ***moderate negative impact*** on water as a result of the erosion of soil and the inappropriate storage of excavated materials. However, any risk from the stockpiling of excavated materials can be managed through good site practice. **Chapter 6** outlines the impacts and mitigation measures relevant to Water.

Mitigation measures for storage and stockpiling of material for this scheme are discussed in 5.4.1.4. No excavated material will be removed from the site.

5.3.1.5 Vehicular movement

The main vehicular movements relate to the following phases of development;

- Site mobilisation and temporary compound set up;

- Installation of the drainage network on new internal site service road and integration with the existing network;
- Delivery of construction materials;
- Vehicular traffic for employees;
- Excavation and formation of the roads network;
- Construction of the substation

Given the highly modified nature of the land and soils environment at this site, it is not envisaged that vehicular activity will have any detrimental effect on the existing soil regime on site.

5.3.1.6 Hydrocarbon Release

Wherever there are vehicles and plant in use, there is the potential for hydro-carbon release which may contaminate the soil and subsoil. A spill has the potential to indirectly pollute water, if the soil and subsoil act as a pathway from any source of pollution. Any spill of fuel or oil would potentially present a ***moderate, negative permanent impact*** on the soil and geological environment.

Good site practice and mitigation measures for hydrocarbon release are discussed in 5.4.1.6 and 5.4.1.8.

5.3.2 Materials and Waste

5.3.2.1 Construction Materials

Excavated materials will be re-used on the site. Additional materials will be imported and this includes crushed stone and hardcore, quarry run, ready-mix concrete, capping material for the roads, services ducts, pipe work and steel. The handling, storage and management of excavated spoil will be carried out in line with an approved Construction Environmental Management Plan (CEMP).

5.3.2.2 Waste Generation and Management

During the construction phase, waste will be generated from the following activities:

- Construction waste from building materials such as cabling, ducts, concrete and any materials from the construction of the substation;
- Mixed organic waste from the temporary canteen and staff facilities;
- Mixed dry recyclables from the staff facilities;
- Toilet waste from the temporary welfare facilities; and
- Unused oil, diesel and building materials.

All waste will be managed, collected, stored and segregated in separate areas and removed off site by a licensed/permitted waste management contractor at regular intervals during the works.

The level of waste generated on site will be minimal. It is considered a ***minor, negative impact*** during the temporary construction phase of the works.

Mitigation measures for materials and waste are discussed in 5.4.1.6 and 5.4.1.8.

5.3.3 Operational Phase

The potential impact on the land and soils of the site due to excavations will be lower during operation and maintenance, as the majority of excavations will have been reinstated. Some erosion of soil will continue into the operation phase, however as vegetation becomes established and equilibrium is achieved, erosion rates will reduce to pre-construction levels.

The impact on the hydrogeology will remain due to the risks associated with sedimentation and contamination of the aquifers due to erosion and runoff, however as areas are reinstated and revegetated and construction traffic is stopped, these impacts will also be reduced to minimal levels. The impact due to lowering of the groundwater level will also be reduced as groundwater levels will tend to revert back to former levels.

The impact due to operation and maintenance of the substation represent ***slight medium term negative impacts*** on the land and soil environment.

The mitigation measures appropriate to the operation and maintenance of the substation are presented in Section 5.4.2**.**

5.3.4 Risk of Major Accidents and Disasters

There were no risks associated with major accidents or disasters identified for land and soils.

5.3.5 Cumulative Effects

The cumulative impacts due to the interaction with other nearby developments and activities have been considered. Due to the relatively static nature of soils, geology and land use it has little potential to cause cumulative impacts except where influenced by gravity (on slopes); however this may be exacerbated by external factors. These factors may be man-made as discussed previously or natural (wind, water etc).

Evaluation of the cumulative impacts must also assess the potential linkage pathways with nearby permitted/operational developments relative to their shared receptors. In this way, cumulative impacts on the hydrogeology of the area must also be considered here.

Changes to the groundwater table of the site will be generally localised and restricted to development areas. As erosion, sedimentation and contamination of the groundwater has the potential to enter watercourses and aquifers within the site, the cumulative effect with the adjacent developments must also be considered.

The aquifers under the site are classified by GSI as a *Locally Important Aquifer – Bedrock which is Moderately Productive Only in Local Zones* (Cushina) and *Locally Important Aquifer – Bedrock which is General Moderately Productive* (Rhode). The vulnerability of the groundwater is described by the GSI as Low in the western boundary of the side and Moderate in the western, centre and eastern portions of the site, and High in the eastern boundary of the site. Given the moderate vulnerability of the aquifer, highly disturbed nature of the existing site and drainage/sedimentation control measures proposed at the site, the cumulative effect of this development with the adjacent developments is a ***slight negative impact***.

The land and soils environment within the site and surrounding area has been highly modified over a long period of time for agricultural purposes. Given the highly modified nature of the site and surrounding area, the potential for significant cumulative impacts on land and soils arising from the proposed development and developments on adjacent sites is considered to have a ***slight medium term negative impact.***

Mitigation measures for the cumulative effects are discussed in 5.4.3.

5.4 MITIGATION

Appropriate mitigation measures to avoid or reduce the potential impacts of the proposed development are outlined in this section.

The primary mitigation measure employed has been the design of the substation in terms of locating the substation building, substation compound, access roads, and other proposed infrastructure in order to reduce the impacts on land and soils.

Specific mitigation measures in respect of subsoil and bedrock excavation and removal are addressed below in terms of:

- Design
- Excavations
- Storage and reuse of excavated materials
- Groundwater

5.4.1 Construction Phase

5.4.1.1 Mitigation by Design

The proposed substation, substation compound, access road and grid connection were designed to optimise the balance between access criteria and the required volumes of excavated and imported materials. The proposed substation is located as close as possible to the national grid in order to minimise the length of cabling to connect to the grid.

5.4.1.2 Mitigation Measures for Land Use

The proposed development will be a permanent part of the national electricity grid. The area of land required to construct, operate, and maintain the substation has been kept to the minimum reasonably practicable area as part of the design process.

5.4.1.3 Mitigation Measures for Excavation

The soil excavated from the construction of the proposed development will be reused for localised landscaping. Excavation will be carried out from access roads or hardstanding areas to reduce the compaction of soil.

Excavation and construction of the substation and entrance road will be carried out by excavation of the topsoil followed by replacement with compacted crushed rock. Machinery will not operate directly on excavated/stockpiled soils.

Drainage will be constructed in parallel with substation and road construction. This approach will be used in combination with the installation of other drainage protection measures in advance of construction, such as the installation of silt fencing or other waterway protection measures. Further details on the drainage are given in **Chapter 2** and **Chapter 6**.

Within excavations and around excavations, pore water pressure will be kept low by avoiding loading the soil/subsoil and giving careful attention to the existing drainage and how structures could affect it.

All temporary cuts/excavations will be carried out such that they are stable or adequately supported. Where appropriate and necessary, cuts and excavations will be protected against ingress of water or erosion by the use of cut off drains around the excavation works. Temporary works will be such that they do not adversely interfere with existing drainage channels/regimes.

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

5.4.1.4 Mitigation Measures for the Storage and Management of Excavated Material

The handling, storage and management of excavated spoil will be carried out in line with an approved Construction Environmental Management Plan (CEMP). Site management should include the checking of equipment, materials storage and transfer areas, drainage structures and their attenuation ability on a regular basis during the construction phase of the project. The purpose of this management control is to ensure that the measures in place are operating effectively, prevent accidental leakages, and identify potential breaches in the protective retention and attenuation network during earthworks operations.

5.4.1.5 Waste Management

A construction phase waste management plan should be developed to control all site generated construction waste and the storage and disposal of same.

Any introduced semi-natural (road building materials) or artificial (PVC piping, cement materials, electrical wiring) materials must be taken off site at the end of the construction phase. Any accidental spillage of solid state introduced materials must be removed from the site by the appropriate means.

5.4.1.6 General Site Management

The CEMP should include the checking of equipment, materials storage and transfer areas, drainage structures and their attenuation ability on a regular basis during the construction phase of the project. The purpose of this management control is to ensure that the measures in place are operating effectively, prevent accidental leakages, and identify potential breaches in the protective retention and attenuation network during earthworks operations.

It is also recommended to implement a fuel management plan which should incorporate the following elements:

- Mobile bowsers, tanks and drums should be stored in secure, impermeable storage area, away from drains and open water;
- Fuel containers must be stored within a secondary containment system e.g. bund for static tanks or a drip tray for mobile stores;
- Ancillary equipment such as hoses, pipes must be contained within the bund;
- Taps, nozzles or valves must be fitted with a lock system;
- Fuel and oil stores including tanks and drums should be regularly inspected for leaks and signs of damage;

- Only designated trained operators should be authorised to refuel plant on site;
- Procedures and contingency plans need to be set up to deal with an emergency accidents or spills;
- An emergency spill kit with oil boom and absorbers should be kept on site in the event of an accidental spill. All site operatives shall be trained in its use.

5.4.1.7 Drainage

The permanent road works will require a drainage network to be in place for the construction and operation phases of the substation. Fundamental to any construction phase is the need to keep clean water (i.e. runoff from adjacent ground upslope of the permitted development footprint) clean and manage all other run off and water from construction in an appropriate manner. Refer to **Chapter 6** Water for details on the mitigation measures.

5.4.1.8 Surface Water

To ensure that there is no adverse impact on surface water flow, a regular programme of environmental audit and site maintenance of the constructed drainage and attenuation structures and drainage crossings is required to ensure attenuation performance to regulatory standards at the site. Mitigation measures for water are fully described in **Chapter 2** and **Chapter 6**.

5.4.2 Operational Phase

The potential impact on the land and soils of the site due to excavations will be lower during operation and maintenance, as the majority of excavations will have been reinstated. Some erosion of soil may continue into the operation phase, however as vegetation becomes established and equilibrium is achieved, erosion rates will reduce to normal levels.

The risks associated with sedimentation and contamination of the aquifers due to erosion and runoff will be reduced to minimal levels as areas are re-vegetated and construction traffic is stopped.

The impact due to lowering of the groundwater level will also be reduced as groundwater levels will tend to revert back to former levels except locally where they have been reduced by drainage networks.

5.4.3 Mitigation Measures for Cumulative Impacts

Based on the finding that the potential for significant cumulative impacts on land and soils arising from the proposed development is considered to be negligible, no specific measures to mitigate against cumulative impacts are considered necessary.

5.5 RESIDUAL IMPACTS

Given the low risk and highly modified nature of the site and in light of the works and the mitigation measures outlined above, it is considered that there will be ***no significant residual impact*** to land and soils environment due to the development and operation of this project.

5.6 CONCLUSION

The proposed development does not constitute a significant effect on the land and soils environment, either alone or in combination with other plans or projects.

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