9 SOILS AND GEOLOGY

9.1 INTRODUCTION

This section assesses the potential impacts on soils and geology arising from the proposed Laois-Kilkenny Reinforcement Project. This evaluation follows a Stage 1 and Stage 2 Lead Consultant's Report, which included the production of a study area constraints report and a consideration of substation and route corridor options in terms of soils and geology. This section has been prepared by Dominica Baird BSc (Hons) MSc CGeol EurGeol MIAH, Senior Hydrogeologist with AWN Consulting, Teri Hayes BSc (Hons) MSc PGeo EurGeol, Principal Consultant with AWN Consulting and Brian Tiernan BSc (Hons) MSc MCIWM MCIWEM, Principal Environmental Consultant with AWN Consulting.

The project includes a number of components which are broken down into units for ease of description (Units 1 - 8). A description of each unit is presented in Section 2 of this EIS.

9.2 METHODOLOGY

The assessment of the potential impact of the Reinforcement Project on the soil and geological environment was carried out according to the methodology specified by the Environmental Protection Agency (EPA) and the Institute of Geologists of Ireland (IGI).

The collection of baseline data to assess the receiving environment was undertaken by focusing upon a review of the following sources:

- Guidelines on the Information to be Contained in Environmental Impact Statements (EPA)[1]
- Advice Notes on Current Practice (in the Preparation of Environmental Impact Statements) (EPA)[2]
- Guidelines for the Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements[3]
- Towards Setting Environmental Quality Objectives for Soil - Developing a Soil Protection Strategy for Ireland (EPA)[4]
- Phase 1 Lead Consultants Report (ESBI)[5]
- Stage 2 Lead Consultants Report Constraints Report (ESBI)[6]
- Geology of Kildare-Wicklow, Sheet 16, GSI[7]
- Geology of Carlow - Wexford, Sheet 19, GSI[8]
- Geology of Tipperary, Sheet 18, GSI[9]
- Geology of Laois and Offaly, Feehan.J[10]
- Laois - Kilkenny Reinforcement Project - Coolnabacky 400kV Substation and Ballyragget 110kV Substation - Factual Report on Ground Investigation (Appendix 9.1)[11]
- Site Investigation and Hydrogeological Assessment, Proposed Coolnabacky 400/110kV GIS Substation, AWN Consulting[12]
- Karst Database (GSI)[13]
- Groundwater Well Database (GSI)[14]
- EPA ENVision Database – Soils and Subsoils[15]
- EPA Extractive Industries Register Database[16]
- Sites of Geological Interest (GSI)[17]
- Landslides in Ireland (GSI)[18]
- Guidelines and Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes (National Roads Authority (NRA))[19]
- Construction Industry Research and Information Association (CIRIA) Environmental Good Practice on Site (C650), 2005[20]
- CIRIA Control of water pollution from linear construction projects. Technical guidance (C648), 2006[21]

An extensive walkover and windscreen surveys of the substation sites, structure locations (proposed wooden pole set locations, proposed angle mast locations, guarding points) and proposed construction access tracks were carried out in October 2011, June 2012 and June 2013 by environmental consultants from AWN Consulting Ltd, in order to assess the baseline soils and geological environment in the study area and confirm the findings of the desk study.

The quality, magnitude and duration of potential impacts is defined in accordance with the assessment criteria provided in the EPA publication *"Guidelines on the Information to be contained in Environmental Impact Statements" (2002)*[1], outlined in Tables 9.1, 9.2 and 9.3.

Quality of Impacts	Description
Positive Impact	A change which improves the quality of the environment (for example, by increasing species diversity; or the improving reproductive capacity of an ecosystem, or removing nuisances or improving amenities).
Neutral Impact	A change which does not affect the quality of the environment.
Negative Impact	A change which reduces the quality of the environment (for example, lessening species diversity or diminishing the reproductive capacity of an ecosystem; or damaging health or property or by causing nuisance).

Table 9.1 Impact Assessment Criteria (Quality)

Magnitude of Impact	Description
Imperceptible	An impact capable of measurement but without noticeable consequences
Slight	An impact that alters the character of the environment without affecting its sensitivities
Moderate	An impact that alters the character of the environment in a manner that is consistent with existing or emerging trends
Significant	An impact, which by its character, magnitude, duration or intensity alters a sensitive aspect of the environment.
Profound	An impact which obliterates all previous sensitive characteristics

Table 9.2 Impact Assessment Criteria (Magnitude)

Duration of Impact	Description
Short-term Impact	Impact lasting one to seven years.
Medium-term Impact	Impact lasting seven to fifteen years.
Long-term Impact	Impact lasting fifteen to sixty years.
Permanent Impact	Impact lasting over sixty years.
Temporary Impact	Impact lasting for one year or less.

Table 9.3 Impact Assessment Criteria (Duration)

With respect to the construction of an overhead transmission line the impact on the soils and geology is considered slight with respect to other environmental criteria. The EPA Advice Notes on Current Practice in the preparation of Environmental Impact Statements (2003)[2] categorises 'Construction of overhead power lines' as 'Project Type 20'. The advice notes list typical significant impacts likely to affect the environment in terms of a Project Type 20. The advice notes do not list any impacts specific to the soils and geology environment in terms of Project Type 20.

9.3 RECEIVING ENVIRONMENT

9.3.1 UNIT 1 - NEW 400/110KV GIS SUBSTATION AT COOLNABACKY TOWNLAND, CO. LAOIS

9.3.1.1 Topography and Geomorphology

The proposed Coolnabacky substation is situated approximately 2.5km north of Timahoe, Co. Laois. The site consists of a large roughly rectangular field where the proposed substation is planned and another field through which the proposed site access route is to be located. The site area is at 100m AOD, is level and is presently being used as agricultural land. The access route rises towards the South West over its length by circa 15m. At the time of the site visit in June 2013 the ground was dry with no marshy/wet areas encountered.

9.3.1.2 Soils

The EPA ENVison database was reviewed in relation to soils[15]. Figure 9.1 shows the range of different soil types underlying the proposed substation. The principal soil group underlying the site was Alluvium. This is loose, weathered and/or eroded rock material that has formed in particles. Commonly of sands and gravels, transported and deposited by a river. The proposed substation site is surrounded by soils classified as BminSP - Shallow poorly drained mineral, derived from mainly calcareous parent materials. Surface water Gleys (shallow) and Ground water Gleys (shallow) included within this group. Gleys are soils in which the effects of drainage impedance dominate and which have developed under the influence of permanent or intermittent water logging. The impedance may be due to a high water table, to a 'perched' water table caused by the impervious nature of the soil itself, or to seepage of runoff from slopes.

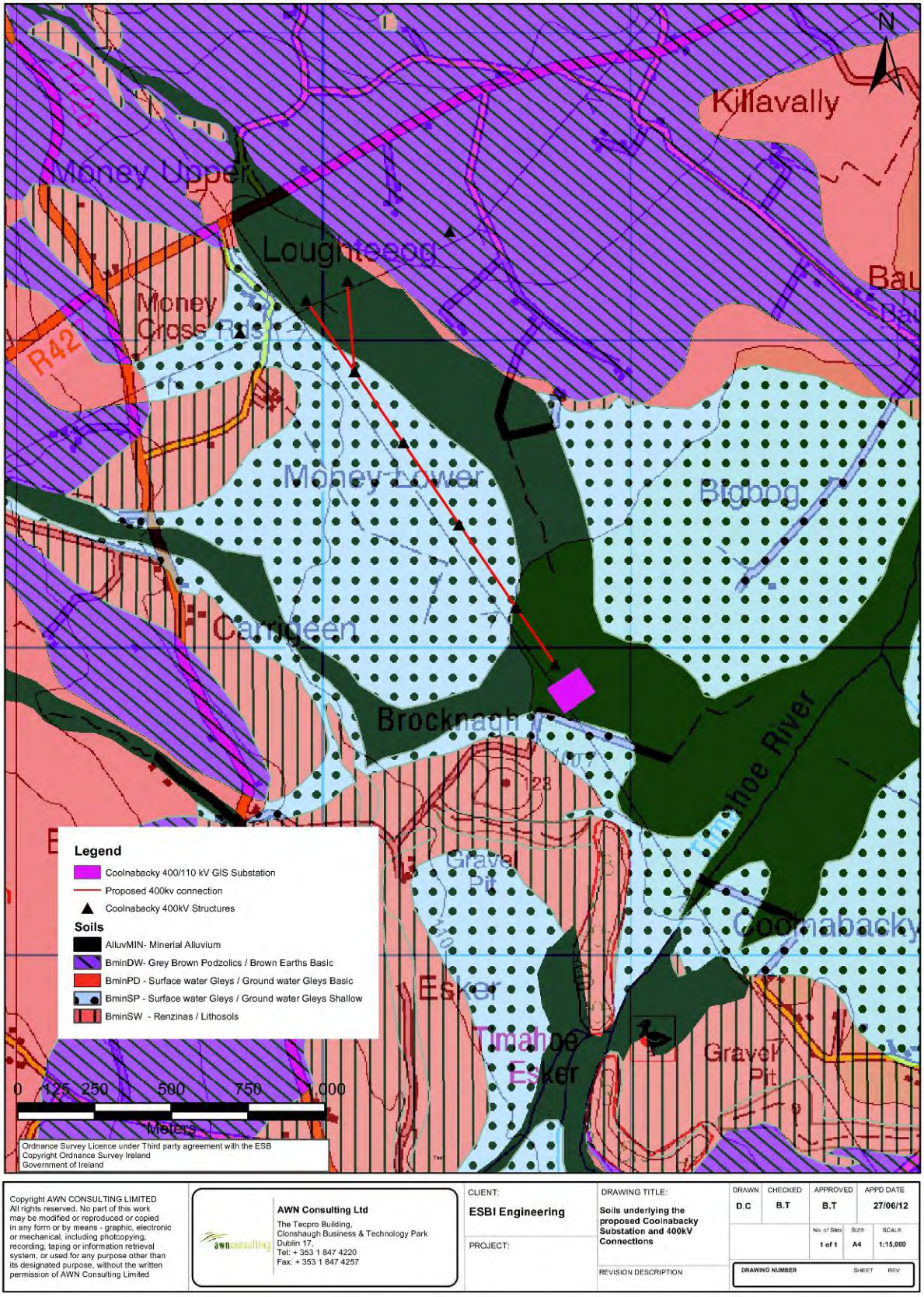


Figure 9.1 Soils Underlying the proposed Coolnabacky Substation and 400kV Connections

9.3.1.3 Quaternary Geology

Figure 9.2 highlights the different subsoil types underlying the proposed substation. The EPA ENVison database was reviewed in relation to subsoils[15]. The site comprises primarily of alluvium with glaciofluvial sand and gravels found at different locations in the vicinity of the site.

Alluvial subsoils consist of gravel, sand, silt or clay in a variety of mixes and usually consist of a fairly high percentage of organic carbon (10%-30%). The alluvial deposits are usually bedded, consisting of many complex strata of waterlain material left both by the flooding of rivers over their floodplains and the meandering of rivers across their valleys.

Glacial till is a term which is applied to glacially derived and/or transported soils. It comprises a wide range of soil particle sizes in varying proportions. Glacial till is either laid down at the base of an ice sheet (lodgement till) or as water borne sediment by glacial meltwaters (fluvioglacial deposits) or in a sea environment (glacio-marine deposits). Tills are often over consolidated, or tightly packed, unsorted, unbedded, possessing many different particle and clast (stone) sizes, and commonly have sharp, angular clasts. Tills are often termed 'boulder clays'. Grain size of the matrix, or the texture of the till, is important, as this determines permeability, which is important for soil development processes. Thus, tills may be described as gravelly till, sandy till, silty till or clayey till. Depending on the till type, a wide variety of permeabilities are possible, and therefore a wide variety of soil types.

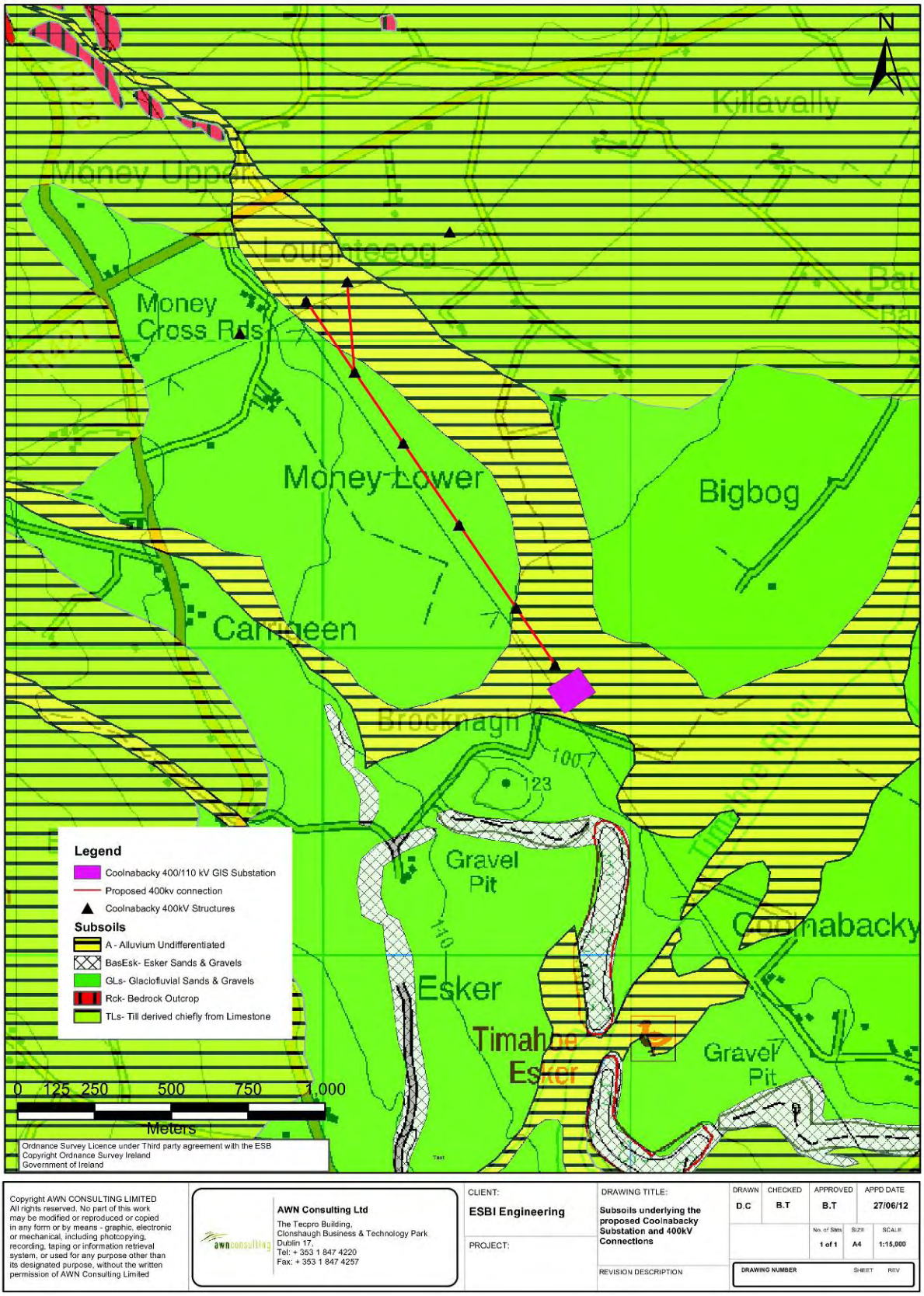


Figure 9.2 Subsoils Underlying the proposed Coolnabacky Substation and 400kV Connections

During the intrusive site investigation[11], Sand and Gravel deposits were encountered beneath the topsoil to between 0.9m to 1.9m below ground level (bgl). The sand and gravel deposits are typically described as brown to orange brown with sub rounded cobbles of limestone. Sand and Gravel deposits were encountered at all locations.

Clay deposits were encountered from 0.9m bgl and proved to a maximum depth of 8.5m bgl (BH2). Between 2.7m to 6.8m of clay was proved in the boreholes. The clay consisted of grey to brown grey firm to stiff clay with sub rounded gravel and cobbles of limestone. The clay became very stiff in some locations with depth. Clay deposits were encountered at all locations[11].

The GSI Well Card Index[14] is a record of wells drilled in Ireland. While much useful information can be obtained from this Index, it is important to note that it is by no means exhaustive, as it requires individual drillers to submit details of wells in each area. Well card data for the wells in the vicinity of the site were reviewed. Two wells were located in the townlands of Killavalley and Bauteogue (1km North East of the proposed substation location). See Figure 9.3. No information on depth to bedrock (DTB) and hence the depth of the soil/subsoil was available for both wells.

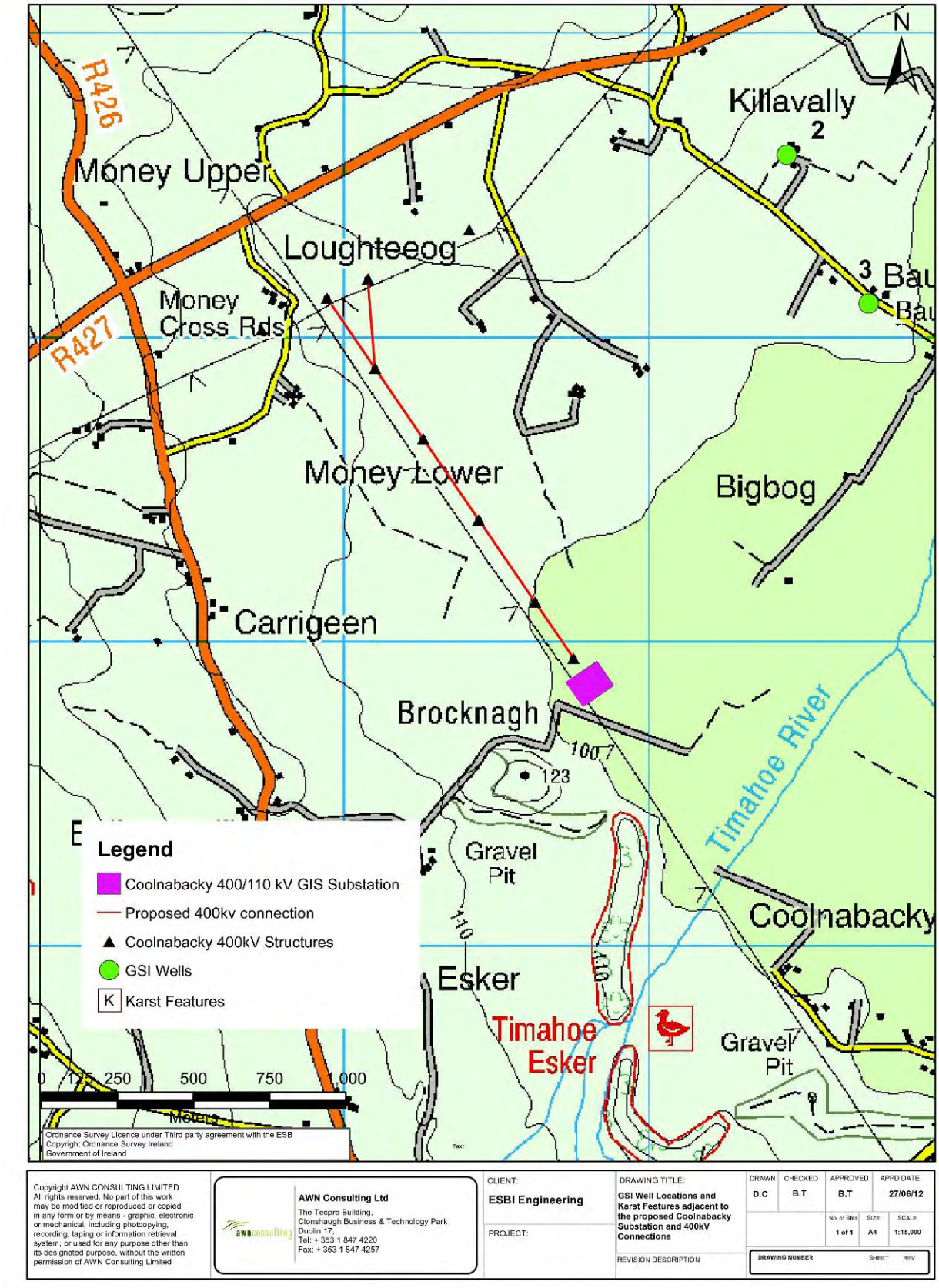


Figure 9.3 GSI Well Locations adjacent to the proposed Coolnabacky Substation and 400kV Connections

9.3.1.4 Bedrock Geology

An inspection of the GSI[7,8,9] records shows the proposed substation to be underlain by limestones of the Lower Carboniferous - The Ballyadams Formation. This Formation consists of pale-grey thick-bedded pure fossiliferous limestone. It comprises water-bearing units of pure limestone and dolomitised limestone and Calp. The dolomitisation is not complete and therefore there may be areas of undolomitised limestone that act as aquitards. See Figure 9.4 for bedrock geology.

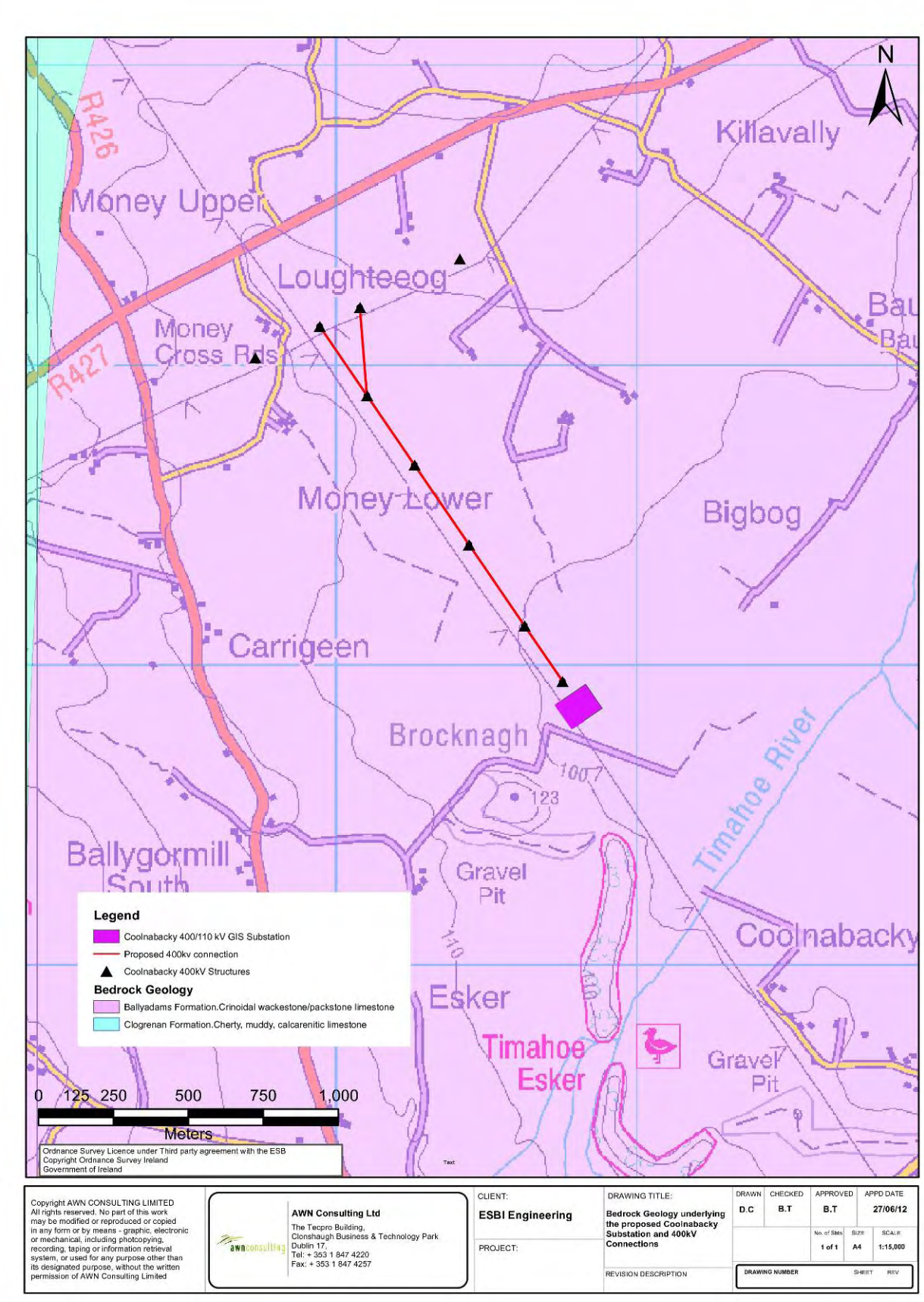


Figure 9.4 Bedrock Geology underlying the proposed Coolnabacky Substation and 400kV Connections

Bedrock was not encountered at the site during the site walkover and intrusive site investigations[11].

9.3.1.5 Karst Features

The Karst database held by the GSI was consulted[13]. This database holds records of locations and types of reported Karst features. The GSI database shows no record of any karst features at or in the vicinity of the proposed substation.

9.3.1.6 Economic Geology

The EPA Extractive Industries Register[16] was reviewed. There is a sand and gravel quarry located 160m. South West of the proposed substation site. This quarry is registered under the National Register of Extractive Industries. This register is required under the *Waste Management (Management of Waste from the Extractive Industries) Regulations 2009 (S.I. No. 566 of 2009).* The Quarry Register Number is QS-00496. The site location is 253589.36E, 192513.53N.

9.3.1.7 Landfills and Licenced Sites

The EPA has a database of waste and Integrated Pollution Prevention Control (IPPC) licenced activities in Ireland. The database shows there is no waste or IPPC licenced activities at or in the vicinity of the proposed substation site.

9.3.1.8 Areas of Geological Heritage Importance

The GSI was consulted in relation to any areas of geological heritage or interest located in the study area[17]. The GSI is in partnership with the National Parks and Wildlife Service (NPWS) to identify and select any important geological and geomorphological sites throughout the country for designation as NHAs. This is addressed under 16 different geological themes in the Irish Geological Heritage (IGH) Programme. A large number of sites are currently being examined in order to identify the most significant scientifically. Sites that do not qualify as a proposed NHA, may qualify under the second tier of County Geological Sites (CGS), which would be included in County Development Plans and receive a measure of protection through inclusion in the planning system.

According to the GSI, there is 1 no. site of geological interest that lies within the vicinity of the proposed substation (located 250m. south). This is described as follows:

- Timahoe Eskers, Co. Laois - Esker ridges. This site is proposed for a CGS under IGH 7 - Quaternary Theme. The GSI has classified it as one of the best examples of esker ridges in the country showing branching and other characteristic features. A nice anatomising ridge, associated with moraine and fan features in a nice topographic setting. The deposits consist of clean, well-sorted sands and gravels showing layering, channel features and imbrication.

The Timahoe Esker is a prominent feature, traversing from east to west but much of the esker has been removed by quarrying activities. Because of this some of the site features were removed impairing the esker's integrity, hence its recommendation for CGS only. Eskers of CGS importance, which would have been partly obliterated by past quarrying, have a lesser value in terms of geological heritage but are still important at local level[17].

9.3.1.9 Geotechnical and Slope Stability

In areas with sloping ground, the composition and extent of the superficial geology affects the stability of the slopes and therefore the potential for slippage. The site is level and is at 100m AOD and therefore due to lack of gradient there is little risk of slippage.

In terms of the geotechnical properties of the subsurface the consolidation of deposits varies considerably based on a wide range of factors at the local level. The proposed substation site is underlain by Alluvium followed by sand and gravel and clay deposits. The Coolnabacky 400kV Substation - Factual Report on Ground Investigation (Appendix 9.1)[11] highlights the geotechnical properties of the underlying subsurface.

9.3.2 UNIT 2 - NEW CONNECTION TO COOLNABACKY FROM THE EXISTING MONEYPOINT-DUNSTOWN 400KV LINE

9.3.2.1 Topography and Geomorphology

The proposed connection to Coolnabacky (Unit 1) from the existing Moneypoint-Dunstown 400kV line passes through areas that are largely agricultural and 100-120m AOD. The route lies in the townlands of Coolnabacky, Brocknagh, Money Lower and Loughteeog (at Money Cross Roads) where it connects with the existing Moneypoint-Dunstown 400kV line.

9.3.2.2 Soils

The EPA ENVison database was reviewed in relation to soils[15]. Figure 9.1 shows the range of soil types underlying the proposed connection. The soils comprise of alluvium at the connection to the Coolnabacky substation and Surface water Gleys (shallow) and Ground water Gleys (shallow) are present in Money Lower, this soil type is classified as BminSP - Shallow poorly drained mineral, derived from mainly calcareous parent materials. As the proposed line route connects to the existing Moneypoint-Dunstown 400kV line alluvium is present. Overall 4 no. angle masts are underlain by Alluvium and 3 no. angle masts are underlain by Gleys. The soil types are described in Section 9.3.1.2.

9.3.2.3 Quaternary Geology

Figure 9.2 highlights the subsoil types underlying the proposed 400kV line route. With reference to the EPA ENVison database[15], the subsoils comprise of alluvium at the connection to the Coolnabacky substation and glaciofluvial sand and gravels are present in Money Lower. As the proposed route connects to the existing Moneypoint-Dunstown 400kV line alluvium is present. Section 9.3.1.3 details a description of each subsoil type.

The GSI Well Card Index[14] was reviewed. Two wells were located in the townlands of Killavalley and Bauteogue (1km North East of the proposed substation location). See Figure 9.3. No information on depth to bedrock and hence the depth of the soil/subsoil was available for both wells.

9.3.2.4 Bedrock Geology

An inspection of the GSI [7,8,9] records shows the proposed line route to be underlain by the Ballyadams Formation. The Ballyadams Formation consists of pale-grey thick-bedded pure fossiliferous limestone. It comprises water-bearing units of pure limestone and dolomitised limestone and Calp. The dolomitisation is not complete and therefore there may be areas of dolomitized limestone that act as aquitards. See Figure 9.4 for bedrock geology.

9.3.2.5 Karst Features

The Karst database held by the GSI was consulted. This database holds records of locations and types of reported Karst features. The GSI database shows no record of any karst features along the proposed line route [13].

9.3.2.6 Economic Geology

The EPA Extractive Industries Register[16] was reviewed. There is a sand and gravel quarry located 160m. South West of the proposed substation site and the beginning of the proposed line route. This quarry is registered under the National Register of Extractive Industries. This register is required under the *Waste Management (Management of Waste from the Extractive Industries) Regulations 2009 (S.I. No. 566 of 2009).* The Quarry Register Number is QS-00496. The site location is 253589.36E, 192513.53N.

9.3.2.7 Landfills and Licenced Sites

The EPA has a database of waste and Integrated Pollution Prevention Control (IPPC) licenced activities in Ireland. The database shows there is no waste or IPPC licenced activities along the proposed line route.

9.3.2.8 Areas of Geological Heritage Importance

The GSI was consulted in relation to any areas of geological heritage or interest located in the study area[17]. According to the GSI, there is 1 no. site of geological interest that lies within the vicinity of the proposed line route - Timahoe Esker. See Section 9.3.1.8 for description.

9.3.2.9 Geotechnical and Slope Stability

In areas with sloping ground, the composition and extent of the superficial geology affects the stability of the slopes and therefore the potential for slippage. There is little risk of slippage along the proposed line route due to its gradient. The proposed line route passes through agricultural land, gently undulating at 100-120m AOD.

In terms of the geotechnical properties of the subsurface the consolidation of deposits varies considerably based on a wide range of factors at the local level. The proposed connection is underlain by alluvium followed by sand and gravel and clay deposits. The Coolnabacky 400kV Substation - Factual Report on Ground Investigation (Appendix 9.1)[11] highlights the geotechnical properties of the underlying subsurface.

9.3.3 UNIT 3 NEW CONNECTION TO COOLNABACKY FROM THE EXISTING ATHY-PORTLAOISE 110KV LINE

9.3.3.1 Topography and Geomorphology

The proposed cable connection is situated within and adjacent to the proposed substation at Coolnabacky approximately 2.5km north of Timahoe, Co. Laois. The location is at 100m AOD, is level and is presently being used as agricultural land. The typical width of the trench for the proposed cable connection is from 0.6m to 1.1m with a depth of excavation of 1.25m bgl.

9.3.3.2 Soils

The EPA ENVison database was reviewed in relation to soils[15]. Figure 9.1 shows the range of different soil types underlying the proposed connection. The principal soil group is Alluvium. This is loose, weathered and/or eroded rock material that has formed in particles. Commonly of sands and gravels, transported and deposited by a river. The site is surrounded by soils classified as BminSP - Shallow poorly drained mineral, derived from mainly calcareous parent materials. Surface water Gleys (shallow) and Ground water Gleys (shallow) included within this group. These are described in Section 9.3.1.2.

9.3.3.3 Quaternary Geology

Figure 9.2 highlights the different subsoil types underlying the proposed substation. With reference to the EPA ENVison database[15], the subsoils comprise primarily of alluvium.

Alluvial subsoils consist of gravel, sand, silt or clay in a variety of mixes and usually consist of a fairly high percentage of organic carbon (10%-30%). Alluvium is mapped only on modern day river floodplains. The alluvial deposits are usually bedded, consisting of many complex strata of waterlain material left both by the flooding of rivers over their floodplains and the meandering of rivers across their valleys.

The GSI Well Card Index[14] was reviewed. Two wells were located in the townlands of Killavalley and Bauteogue (1km North East of the proposed substation location). See Figure 9.3. No information on depth to bedrock and hence the depth of the soil/subsoil was available for both wells.

9.3.3.4 Bedrock Geology

An inspection of the GSI [7,8,9] records shows the proposed line route to be underlain by the Ballyadams Formation. The Ballyadams Formation consists of pale-grey thick-bedded pure fossiliferous limestone. It comprises water-bearing units of pure limestone and dolomitised limestone and Calp. The dolomitisation is not complete and therefore there may be areas of dolomitized limestone that act as aquitards. See Figure 9.4 for bedrock geology.

9.3.3.5 Karst Features

The Karst database held by the GSI was consulted. This database holds records of locations and types of reported Karst features. The GSI database shows no record of any karst features along the proposed line connection [13].

9.3.3.6 Economic Geology

The EPA Extractive Industries Register[16] was reviewed. There is a sand and gravel quarry located 160m. South West of the proposed cable connection. This quarry is registered under the National Register of Extractive Industries. This register is required under the *Waste Management (Management of Waste from the Extractive Industries) Regulations 2009 (S.I. No. 566 of 2009).* The Quarry Register Number is QS-00496. The site location is 253589.36E, 192513.53N.

9.3.3.7 Landfills and Licenced Sites

The EPA has a database of waste and Integrated Pollution Prevention Control (IPPC) licenced activities in Ireland. The database shows there is no waste or IPPC licenced activities along the proposed line route.

9.3.3.8 Areas of Geological Heritage Importance

The GSI was consulted in relation to any areas of geological heritage or interest located in the study area[17]. According to the GSI, there is 1 no. site of geological interest that lies within the vicinity of the proposed line route - Timahoe Esker. See Section 9.3.1.8 for description.

9.3.3.9 Geotechnical and Slope Stability

In areas with sloping ground, the composition and extent of the superficial geology affects the stability of the slopes and therefore the potential for slippage. The proposed connection passes through agricultural land at 100m AOD. There is little risk of slippage due to the lack of gradient.

In terms of the geotechnical properties of the subsurface the consolidation of deposits varies considerably based on a wide range of factors at the local level. The proposed substation site is underlain by alluvium followed by sand and gravel and clay deposits. The Coolnabacky 400kV Substation - Factual Report on Ground Investigation (Appendix 9.1)[11] highlights the geotechnical properties of the underlying subsurface.

9.3.4 UNIT 4 - A NEW 110KV / 38KV / MV SUBSTATION IN BALLYRAGGET, CO. KILKENNY

9.3.4.1 Topography and Geomorphology

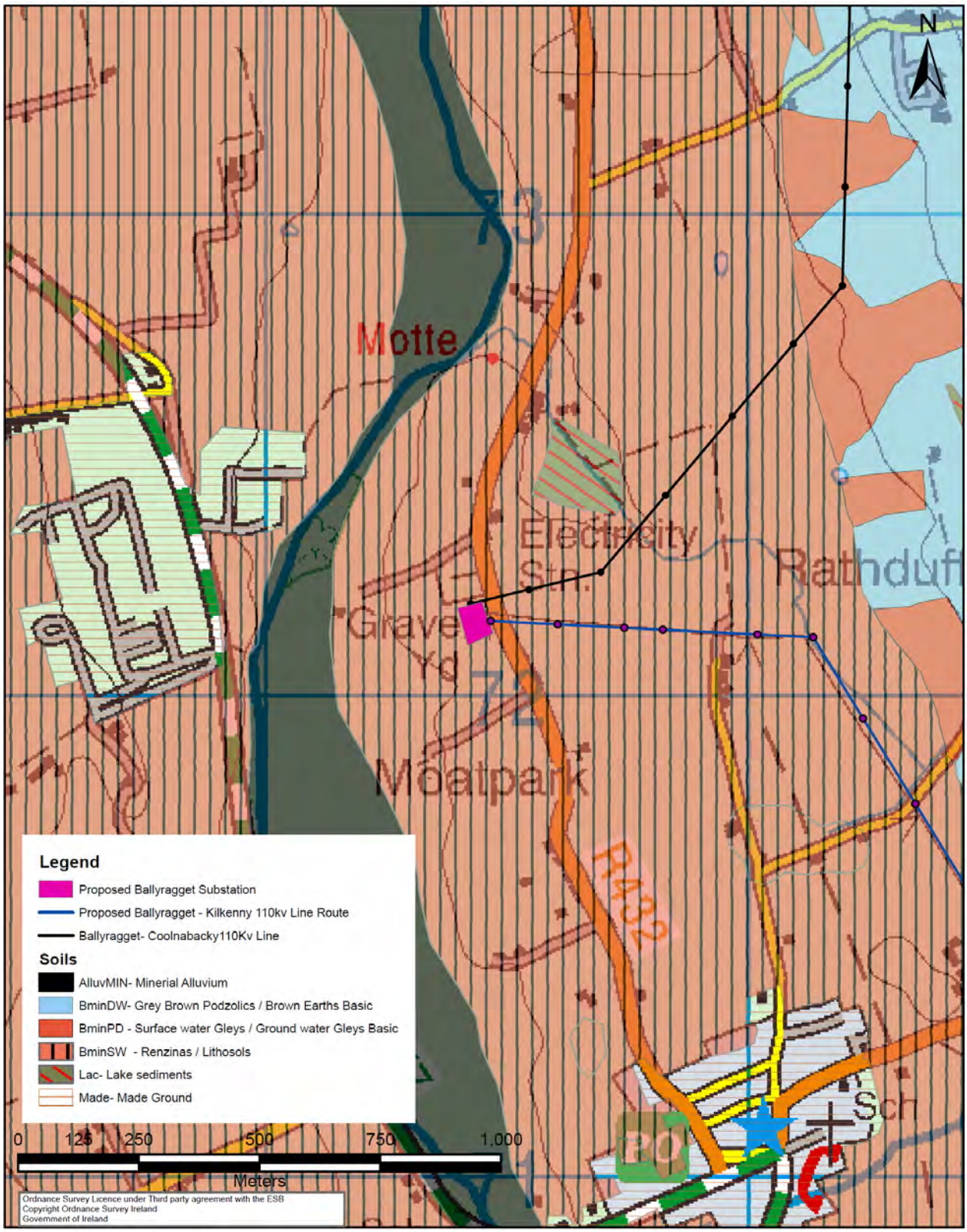
The proposed 110kV/38kV/MV substation is located in a Greenfield site adjacent to the existing 38kV substation in Ballyragget, Co. Kilkenny. The site consists of a large roughly rectangular field where the proposed substation is planned to be constructed and an adjacent field through which the proposed access route is planned. The site area is at 100m AOD, is level and is presently being used as agricultural land. The existing 38kV Substation bounds the site to the east with the northern boundary being located adjacent to an existing graveyard. To the west and south of the proposed station is currently agricultural land.

9.3.4.2 Soils

The EPA ENVison database was reviewed in relation to soils[15]. Figure 9.5 shows the range of different soil types underlying the proposed substation and the surrounding area. The principal soil groups are Lithosols and Renzinas (BminSW); these are shallow well drained mineral soil, derived from mainly basic parent materials. A description of each is as follows:

Lithosols - These are skeletal stony soils, usually overlying solid or shattered bedrock. They are often associated with podzols at higher elevations. Generally such soil areas have bare rock outcropping at frequent intervals and many also have steep slopes.

Renzinas - Shallow soils, derived from patent material containing over 40% carbonates. The surface horizon is very dark in colour, with a strong structure and with a neutral or alkaline reaction. Their shallow depth often limits the use range of Rendzinas. They are suited mostly to extensive grazing but where sufficient deep they can also be excellent tillage soils.



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CLIENT: ESBI Engineering

PROJECT:

DRAWING TITLE: Soils underlying the proposed Ballyragget Substation

REVISION DESCRIPTION

DRAWN	CHECKED	APPROVED	APPD DATE
D.C	B.T	B.T	24/09/12

No. of Shts	SIZE	SCALE
1 of 1	A4	1:10,000

DRAWING NUMBER SHEET REV

Figure 9.5 Soils underlying the proposed Ballyragget Substation

During the Intrusive Site Investigation[11], topsoil was encountered from ground level to a maximum depth of 0.6m bgl. Topsoil was encountered at all trial pit and borehole locations.

9.3.4.3 Quaternary Geology

Figure 9.2 highlights the different subsoil types underlying the proposed substation. With reference to the EPA ENVison database [15]. Glaciofluvial sands and gravels (glacial till derived mainly from limestone) are the predominant subsoil type underneath the proposed substation. Glacial till is either laid down at the base of an ice sheet (lodgement till) or as water borne sediment by glacial meltwaters (fluvioglacial deposits) or in a sea environment (glacio-marine deposits). Tills are often over consolidated, or tightly packed, unsorted, unbedded, possessing many different particle and clast (stone) sizes, and commonly have sharp, angular clasts. Tills are often termed 'boulder clays'. Grain size of the matrix, or the texture of the till, is important, as this determines permeability, which is important for soil development processes.

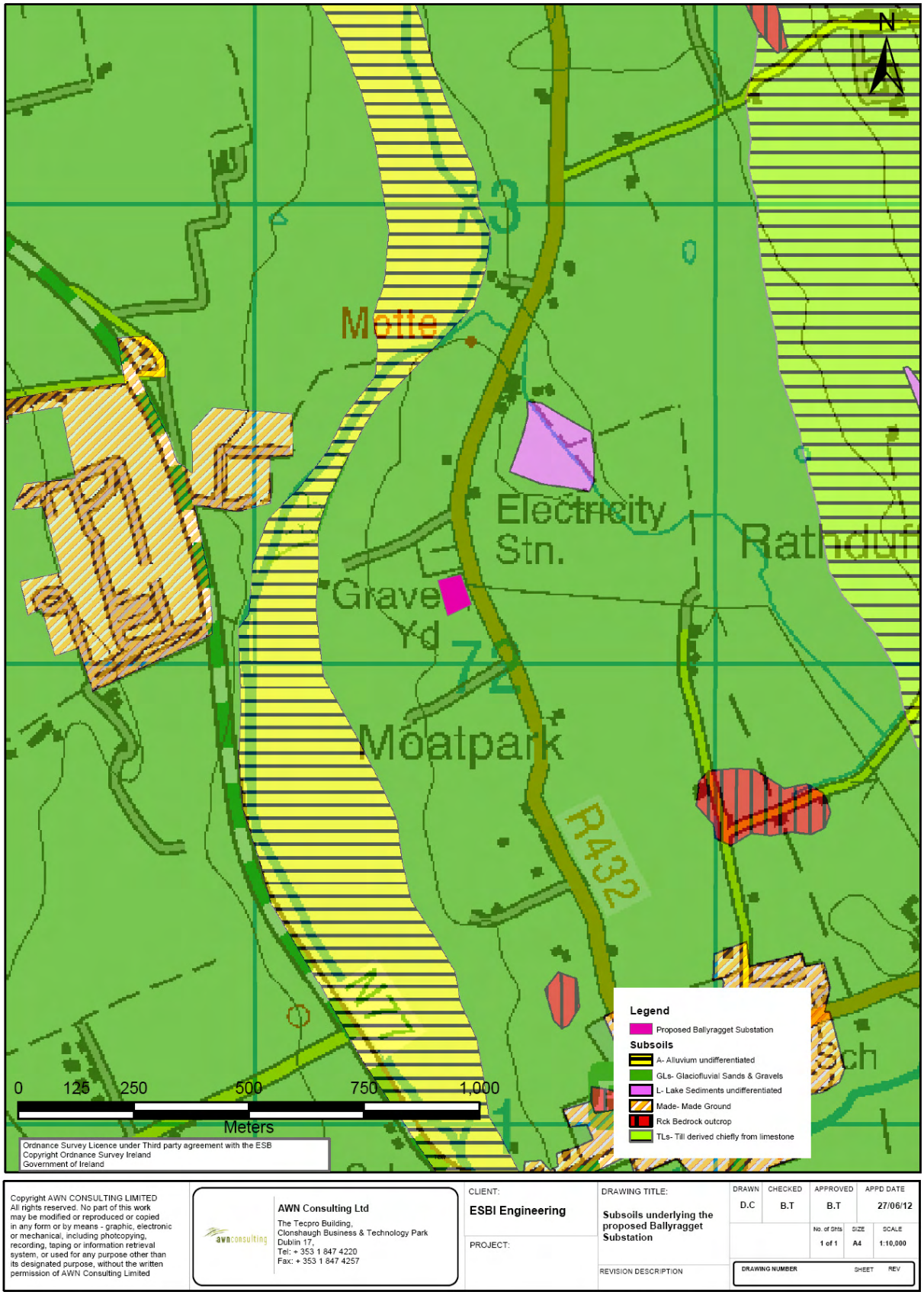


Figure 9.6 Subsoils underlying the proposed Ballyragget Substation

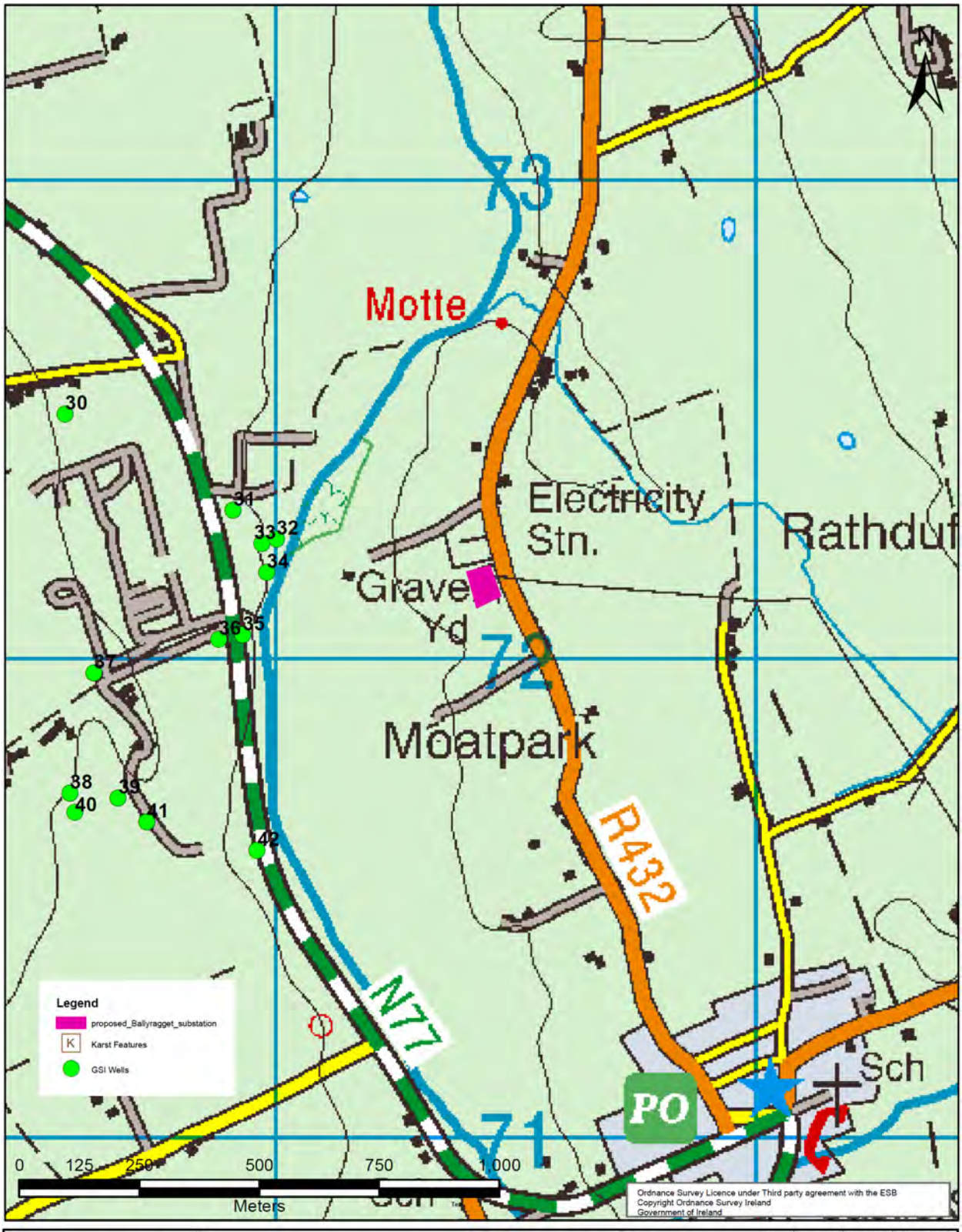
During the Intrusive Site Investigation[11], Sand and Gravel deposits were encountered beneath the topsoil. The sand and gravel deposits are typically described as grey brown slightly gravelly to very gravelly sand and a sandy gravel with medium cobble content of sub rounded to rounded limestone. Sand texture was described as fine to coarse. Gravel texture was described as sub rounded to rounded with high cobble content in the deeper deposits. Sand and Gravel deposits were encountered at all trial pit and borehole locations.

Clay deposits were predominantly encountered from 0.7m bgl and were present to a maximum depth of 8.1m bgl (BH5). The clay consisted of very stiff grey brown slightly sandy and slightly gravelly. Clay deposits were encountered at the majority of locations[11]. No clay was found at BH3 and 4 and TP1, 4, 7, 8 and 9.

The GSI Well Card Index[14] shows a number of wells in the vicinity of the proposed substation. Well card data for the wells in the vicinity of the site were reviewed. Table 9.4 details the information in relation to each well. The majority of wells were found at the Glanbia site, located west of the proposed substation site across the River Nore. It shows that the DTB and hence the depth of overburden varies from 3.0m bgl to 25.9m. The nearest wells located to the proposed station are 32, 33 & 34. The DTB are 9.8m, 68.6m & 45.7m respectively. This group of wells are located approx. 300m to the west of the proposed substation. See Figure 9.7 for well locations.

Number	GSI Code	Easting	Northing	Townland	DTB
1	2317SWW421	243580	171680	BALLYCONRA	25.9
2	2317SWW443	243420	171760	BALLYCONRA	9.4
3	2317SWW444	243360	171900	BALLYCONRA	13.1
4	2317SWW445	243620	171970	BALLYCONRA	14.8
5	2317SWW446	243280	172240	BALLYCONRA	19.5
6	2317SWW447	243910	172310	BALLYCONRA	12.2
7	2317SWW448	243560	172510	BALLYCONRA	-
8	2317SWW449	244000	172250	BALLYCONRA	5.0
9	2317SWW450	243970	172240	BALLYCONRA	5.0
10	2317SWW451	243980	172180	BALLYCONRA	6.7
11	2317SWW452	243930	172050	BALLYCONRA	3.0
12	2317SWW453	243570	171720	BALLYCONRA	11.9
13	2317SWW454	243670	171710	BALLYCONRA	-
14	2317SWW455	243960	171600	BALLYCONRA	21.5
15	2317SWW456	243730	171660	BALLYCONRA	10.0
16	2317SWW417	243280	173100	BALLYCONRA	8.1
17	2317SWW439	243650	171140	PARKSGROVE	-

Table 9.4 GSI Well Data for Study Area showing DTB



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PROJECT:

DRAWING TITLE: GSI Well Locations and Karst Features adjacent to the proposed Ballyragget Substation

DRAWN	CHECKED	APPROVED	APPD DATE
D.C	B.T	B.T	27/06/12

No. of Sht	SIZE	SCALE
1 of 1	A4	1:10,000

REVISION DESCRIPTION

DRAWING NUMBER SHEET REV

Figure 9.7 GSI Well Locations adjacent to the proposed Ballyragget Substation

9.3.4.4 Bedrock Geology

An inspection of the GSI [7,8,9] records shows the proposed substation to be underlain by the Ballyadams Formation of grey thick bedded crinoidal calcarenitic wackstone and packstone limestone with clay wayboards towards the top. It comprises water-bearing units of pure limestone and dolomitised limestone and Calp. The dolomitisation is not complete and therefore there may be areas of dolomitized limestone that act as aquitards. See Figure 9.8 for bedrock geology. The Durrow Formation is located adjacent to the proposed substation site. The Durrow Formation comprises fossiliferous limestones, shales and oolites, with a few micrites.

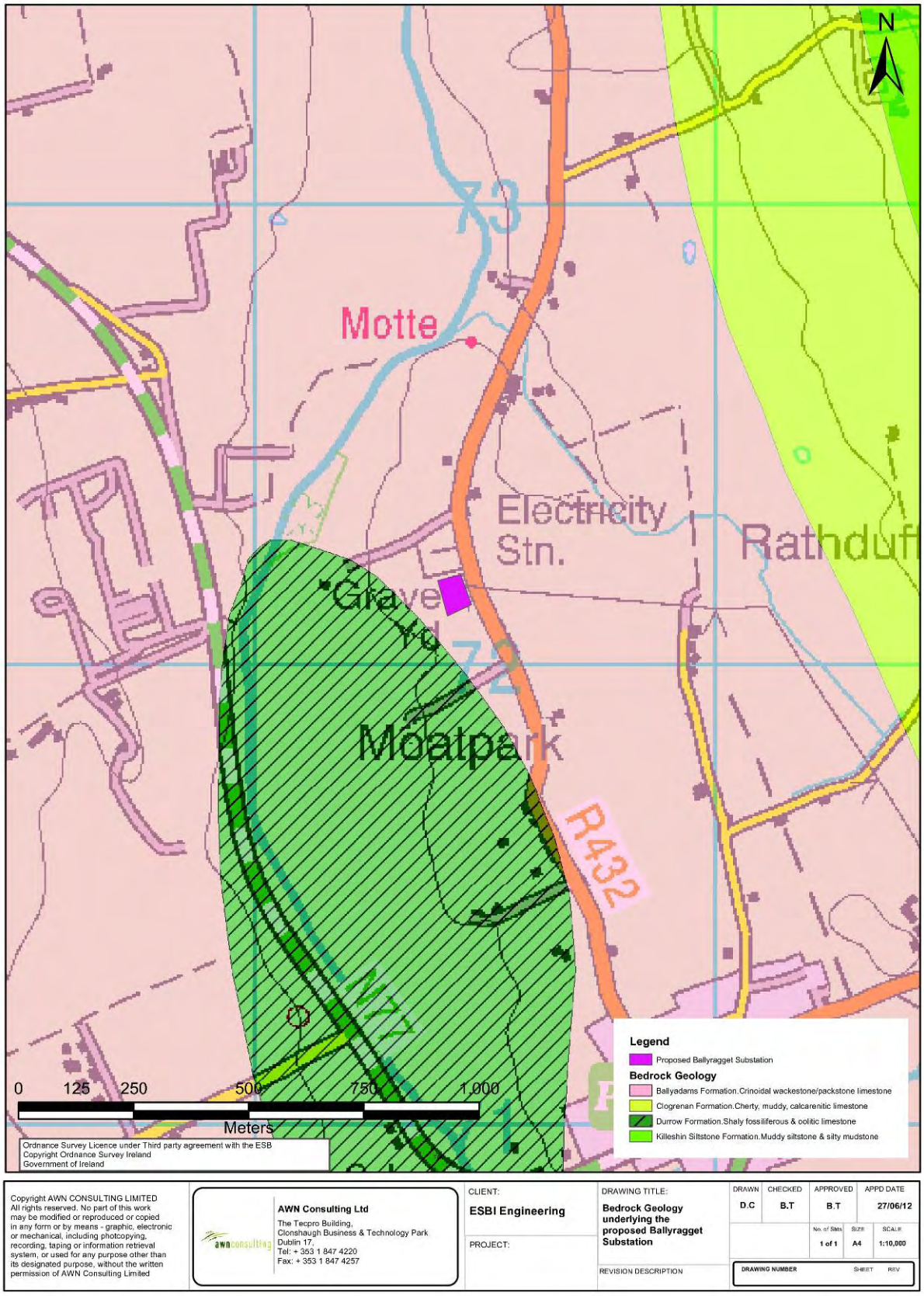


Figure 9.8 Bedrock Geology underlying the proposed Ballyragget Substation

Bedrock was not encountered at the site during the site walkover and intrusive site investigations[11].

9.3.4.5 Karst Features

The Karst database held by the GSI was consulted. This database holds records of locations and types of reported Karst features. The GSI database shows no record of any karst features along the proposed substation [13].

9.3.4.6 Economic Geology

The EPA Extractive Industries Register[16] was reviewed. This register is required under the *Waste Management (Management of Waste from the Extractive Industries) Regulations 2009 (S.I. No. 566 of 2009).* No quarries are located in the vicinity of the proposed substation site.

9.3.4.7 Landfills and Licenced Sites

The EPA has a database of waste and Integrated Pollution Prevention Control (IPPC) licenced activities in Ireland. The database shows there is no waste or IPPC licenced activities adjacent the proposed substation site. Glanbia Ingredients (Ballyragget) Limited (IPPC Licence No. P0359-02) is located approximately 0.5km to the west of the proposed substation site.

9.3.4.8 Areas of Geological Heritage Importance

The GSI was consulted in relation to any areas of geological heritage or interest located in the study area. No area of geological heritage importance is located at the proposed substation location[17].

9.3.4.9 Geotechnical and Slope Stability

In areas with sloping ground, the composition and extent of the superficial geology affects the stability of the slopes and therefore the potential for slippage. The proposed substation is located at 100m AOD. There is little risk of slippage due to lack of gradient.

In terms of the geotechnical properties of the subsurface the consolidation of deposits varies considerably based on a wide range of factors at the local level. The proposed substation site is underlain by shallow mineral clayey soil followed by sand and gravel. The Ballyragget 110kV Substation - Factual Report on Ground Investigation[11] (Appendix 9.1) highlights the geotechnical properties of the underlying subsurface.

9.3.5 UNIT 5 - A NEW 110KV OVERHEAD LINE BETWEEN BALLYRAGGET AND COOLNABACKY

9.3.5.1 Topography and Geomorphology

The northern section of the proposed line route is located in the North-East area of Timahoe and surrounding townlands. The Cullenagh Mountain and Fossy Mountain dominate the southern section; here the area is made up of agricultural land and undulating hills to the East is dominated by the Nore River and includes Ballyragget. The central section is comprised of undulating topography located near the village of Ballinakill. The proposed line route varies in topography. The topography of the proposed line route varies approximately from:

- 100m AOD at Brocknagh to 185m AOD at Ballyoskill in the northern section;
- 155m AOD at Boleybeg to 240m AOD at Knockardagur in the central area; and
- 75m AOD at Moatpark to 190m AOD at Ballyinaclogh Upper in the southern section.

9.3.5.2 Soils

The EPA ENVison database was reviewed in relation to soils[15]. Figure 9.9 and Figure 9.10 shows the range of different soil types underlying the proposed line route. Table 9.5 shows the soil types along the proposed line route from North to South. This Table also shows the associated townlands where the predominant soil type is present. The principal soil groups are as follows:

- *AminPD* – Poorly drained soil under the influence of permanent or intermittent waterlogging. Most gleys have poor physical conditions, derived from mainly from acidic parent materials. Surface water/Groundwater gleys, acidic are included in this category. AminPD are deep poorly drained soils. (% occurrence along proposed line route – 40.5%)
- *BminSP* – Shallow Poorly drained Surface water Gleys/Groundwater Gleys under the influence of permanent or intermittent waterlogging. Most gleys have poor physical conditions, derived from mainly from Basic parent materials. (% occurrence along proposed line route - 16.6%)

The following soil groups also occur along the line route but are less widespread and found in minor formations:

- *AlluvMIN* – Alluvial undifferentiated
- *AminDW* – Acid Brown Earths/Brown Podzolics;
- *AminSW*- Lithosols, Regosols, Acidic;
- *BminPD*- Surface water Gleys/ Groundwater Gleys, Basic;
- *BminDW*- Grey Brown Podzolics/Brown Earth, Basic;
- *BminSW*- Renzinas/ Lithosols, Basic;
- *BminDW*- Surface water/Groundwater gleys, Basic.

A description of these is as follows:

Gleys - see definition under Section 9.3.1.2.

Alluvial undifferentiated - These soil types are deposited by fluvial processes such as rivers and lakes. Therefore they are primarily found along existing river channels and floodplains. As such there is a mixture of soil types.

Acid Brown Earths - These soils are well-drained, mineral soils. Most Brown Earths occur on lime-deficient parent materials. These soils, in general, possess medium textures (sandy loam, loam, sandy clay loam).

Brown Podzolics - These soils are generally poor soils, depleted of nutrients by heavy rainfall leaching through an organic layer (the podzolisation process). The surface layer contains organic matter that is intimately mixed with mineral matter.

Podzols - These soils are generally poor soils, depleted of nutrients by heavy rainfall leaching through an organic layer (the podzolisation process). They have high lime and fertiliser requirements and are usually found in hill and mountain areas where mechanical means of reclamation and cultivation are not feasible.

Lithosols - see definition under Section 9.3.4.2.

Regosols - These are soils which show no distinct horizon (layer) development. The texture of these soils varies between sands and clays, depending on the material from which they are derived. Regosols have a wide use range but they are mostly used for grazing.

Soil Type	Townland
AlluvMin, BminSW	Brocknagh
AlluvMin, BminSW, BminDW	Carrigeen
AlluvMIN, BminPD	Ballygormill South
BminPD, BminDW	Cromorgan
AlluvMIN,BminDW, BminSW	Baunree
BminPD, BminDW, BminSP	Raheenduff Big
AminSP, BminPD	Ballinaclogh Upper
AlluvMIN, AminPD, AminDW	Garryglass
AlluvMIN, AminPD	Clarbaccacum
AlluvMIN, AminPD	Boleybeg
AminPD, AminSP, AminSRPT, AminDW	Keelagh
AminSP, AminPD, AminSW	Knockardagur
AminSP, AminPD, BminDW	Boleybawn
AlluvMIN, AminPD, BminSW	Kilcronan
AminSW, AminPD, AminDW, AminSRPT, BminDW	Loughill
AminSW, AminDW,	Ballyoskill
AminSW, AminDW, AminPD	Ballynalacken
AminSW, BminSW, BminDW, BminPD	Tinnalintan
BminPD, BminDW	Sraleegh
BminSW, BminDW, BminPD	Rathduff

Table 9.5 Soil Types along proposed line route (North to South)

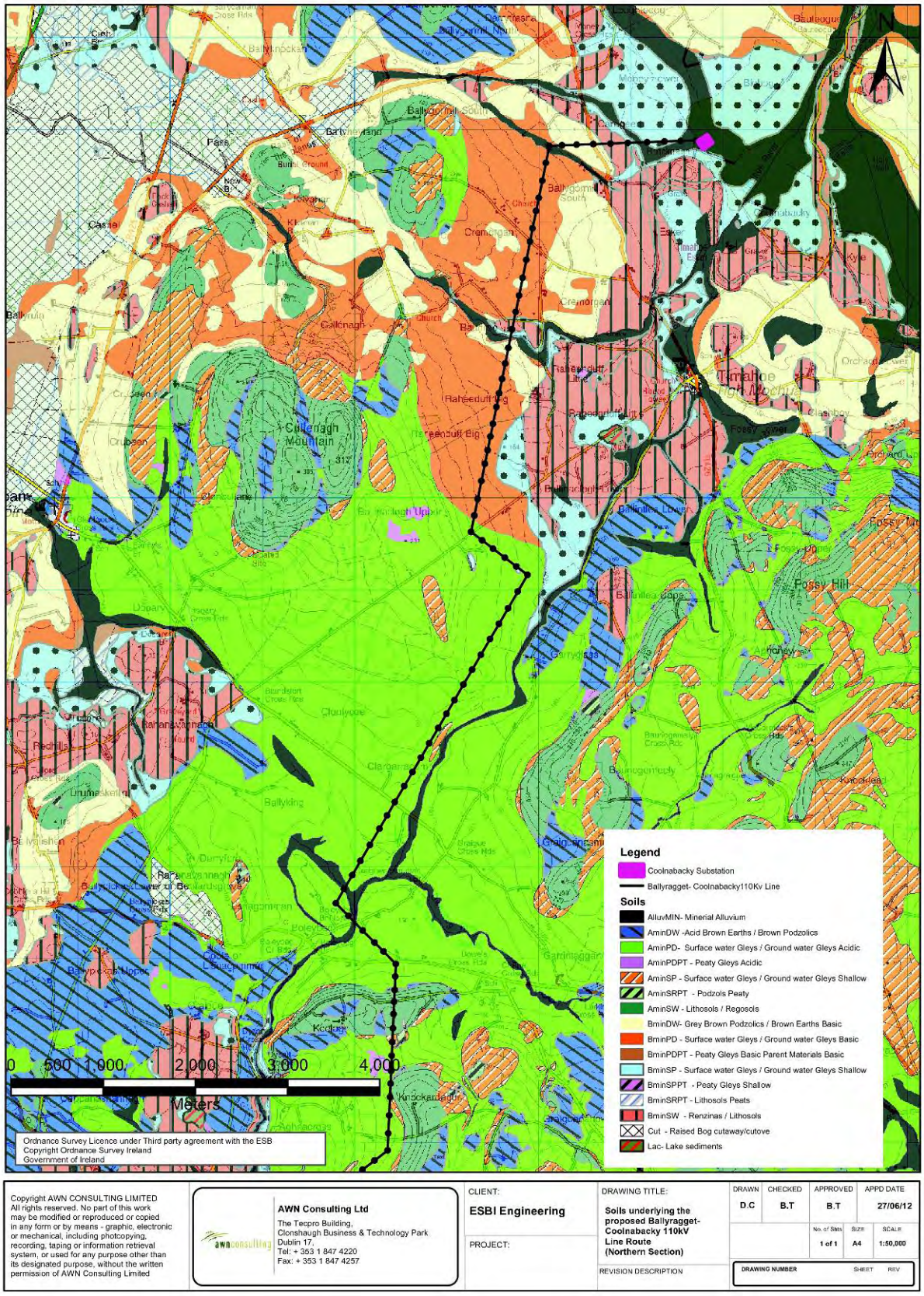


Figure 9.9 Soils underlying the proposed Ballyragget – Coolnabacky 110kV Line Route (Northern Section)

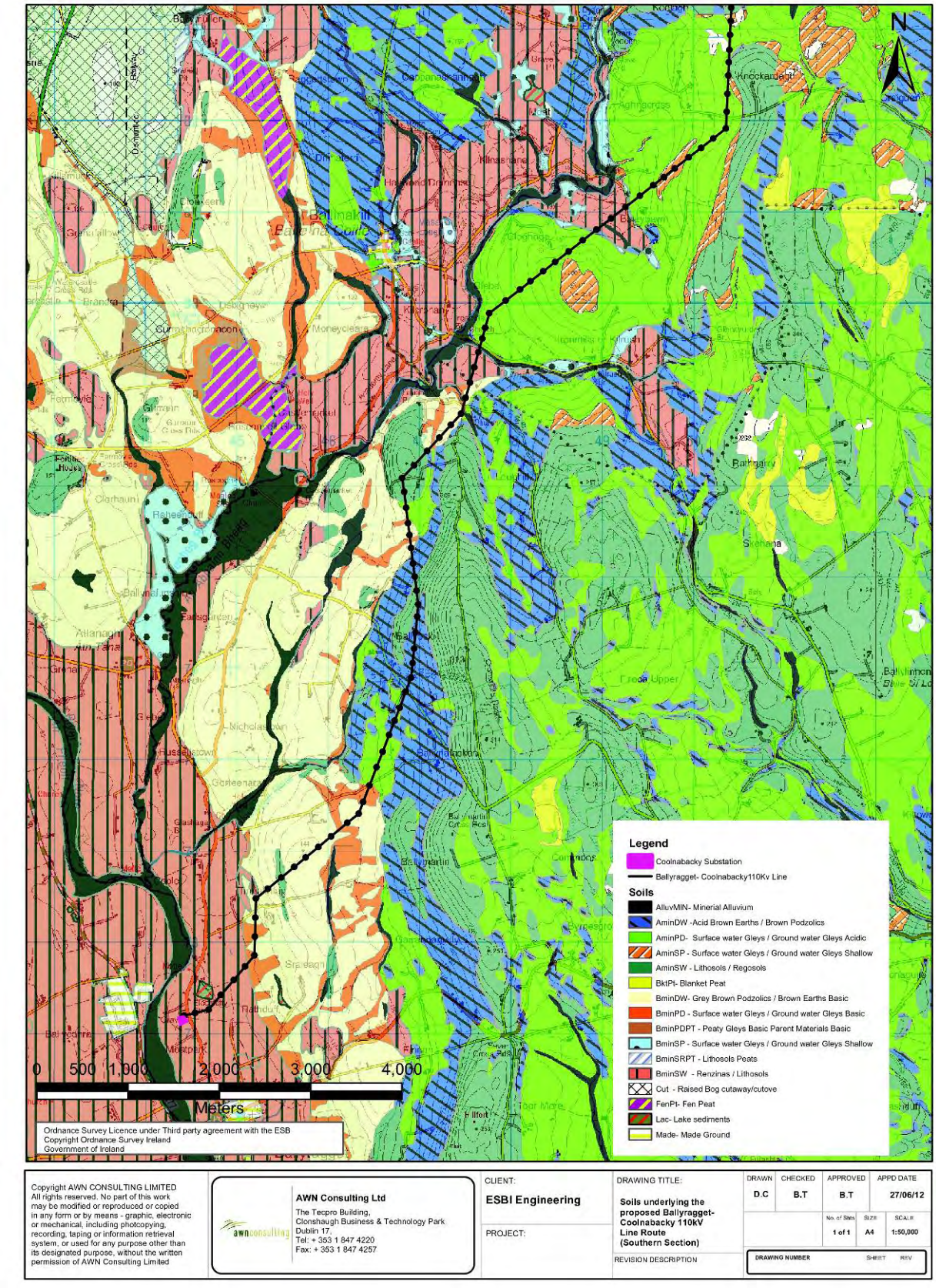


Figure 9.10 Soils underlying the proposed Ballyragget – Coolnabacky 110kV Line Route (Southern Section)

9.3.5.3 Quaternary Geology

There is evidence of two main glaciations in the Midlands area; however there is no indication that any deposits took place during the first glacial period in Laois and Kilkenny. During the second glaciation, approx. 18,000 years ago, the area was covered by a massive ice sheet with coalescentdomes. The general flow direction was in a North-South direction but with some South-Easterly and South-Westerly splays. Towards the end of this glaciations period the ice began to shrink and deposited debris into ridges of moraine. These are evident at Portlaoise on the East side of Slieve Bloom.

Post glacial deposits take the form of river alluvium along the valleys of the main rivers. The quaternary deposits of the proposed line route have provided the parent material for almost all the agricultural soils.

See Figure 9.11 and Figure 9.12 for the different subsoil types underlying the proposed line route. With reference to the EPA ENVison database[15], the subsoils comprise primarily limestone till from the Carboniferous (TLs) and shales and sandstone from the Namurian (TNSSs). The following subsoil groups also occur along the line route, but are less dominant:

- A – Alluvium undifferentiated
- GLs – Limestone sands and gravels Carboniferous
- KaRck – Karstified limestone bedrock at surface
- Rck – Bedrock at surface
- TDsS – Sandstone Till Devonian/Carboniferous

A general description of subsoils within the proposed line route is provided in the following paragraphs. These descriptions can be read in conjunction with Figure 9.11 and Figure 9.12.

Alluvium - Although post-glacial, alluvial (river deposited) subsoils are to be expected along or adjacent to surface watercourses and the available EPA ENVison database[15] indicate that significant alluvial deposits occur around Timahoe and its townlands such as Coolnabacky, Brocknagh and along the river courses of the Timahoe and Timogue Rivers. Other significant deposits occur along the river courses of the Owenbeg and Nore Rivers and their tributaries in the central and southern sections. Alluvial subsoils consist of gravel, sand, silt or clay in a variety of mixes and usually consists of a fairly high percentage of organic carbon (10%-30%).

The alluvial deposits are usually bedded, consisting of many complex strata of waterlain material left both by the flooding of rivers over their floodplains and the meandering of rivers across their valleys.

Glacial till - This is a term which is applied to glacially derived and/or transported soils (see also description under Section 9.3.1.3). Depending on the till type, there are a wide variety of permeabilities are possible, and therefore a wide variety of soil types. For example:

- If the tills are deep but are waterlogged close to the land surface owing to fine matrix or to high water table within the deposits, the soils are generally poorly drained Gleys, regardless of dominant rock type and matrix chemical reaction
- If the tills are deep and well drained and dominated by acidic rock and matrix, the soils may be Acid Brown Earths, Brown Podzolics or Podzols, depending on the degree of leaching that has occurred within the unsaturated solum.
- If the tills are deep and well drained, and dominated by basic rock and matrix, the soils are generally Grey Brown Podzolics.

The predominant till along the proposed line route comprise primarily of Limestone Till from the Carboniferous and Shales & Sandstone till from the Namurian. The locations are shown in Figure 9.11 and Figure 9.12.

Basic Esker sands and gravels - Quaternary deposits consisting of sands and gravels. Deposited when retreating ice sheets deposited the sands and gravels to form this subsoil group. The Timahoe Esker is a

prominent feature of this type in the study area, it traverses a sinuous course from east to west, but much of the esker has been removed by gravel working. The deposits consist of clean, well-sorted sands and gravels showing layering, channel features and imbrication

Limestone Sands and Gavels (Carboniferous) - Predominantly found in the southern and northern sections. It is formed form carboniferous bedrock material which in this case are mainly the Ballyadams formation and the Clogrenan formation.

Shales and Sandstone, Sands and Gravels (Namurian) - Only found in a small section in the southern section near Ballyoskill.

Bedrock at Surface- This exposed bedrock usually on high ground. This is a predominant feature located on the eastern side of the proposed line routes and is found in the townlands of Ballyinlee Upper, Keelagh and Knockardagur, Boleybawn, Loughill, Ballyoskill, Tinnalintan.

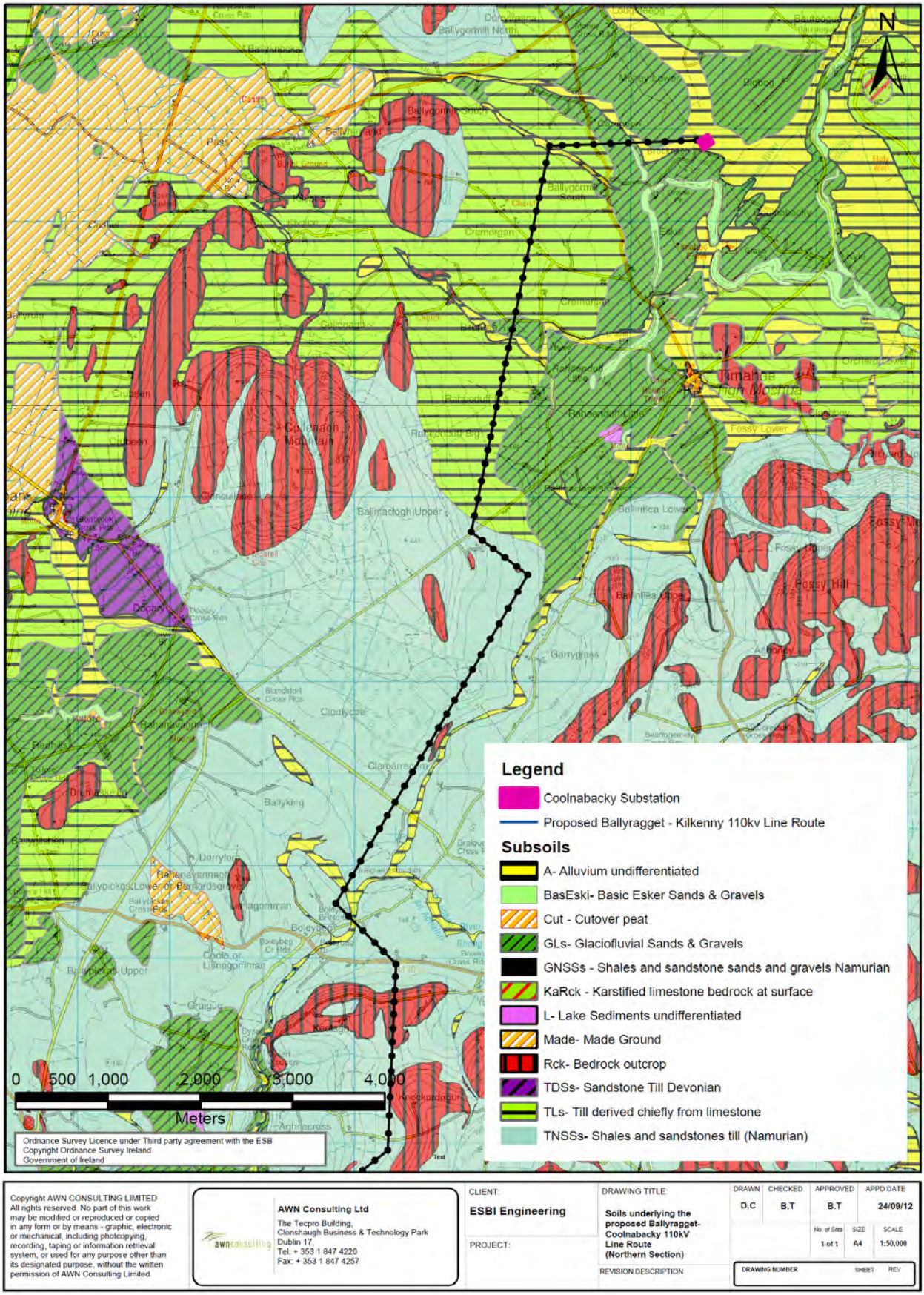


Figure 9.11 Subsoils underlying the proposed Ballyragget – Coolnabacky 110kV Line Route (Northern Section)

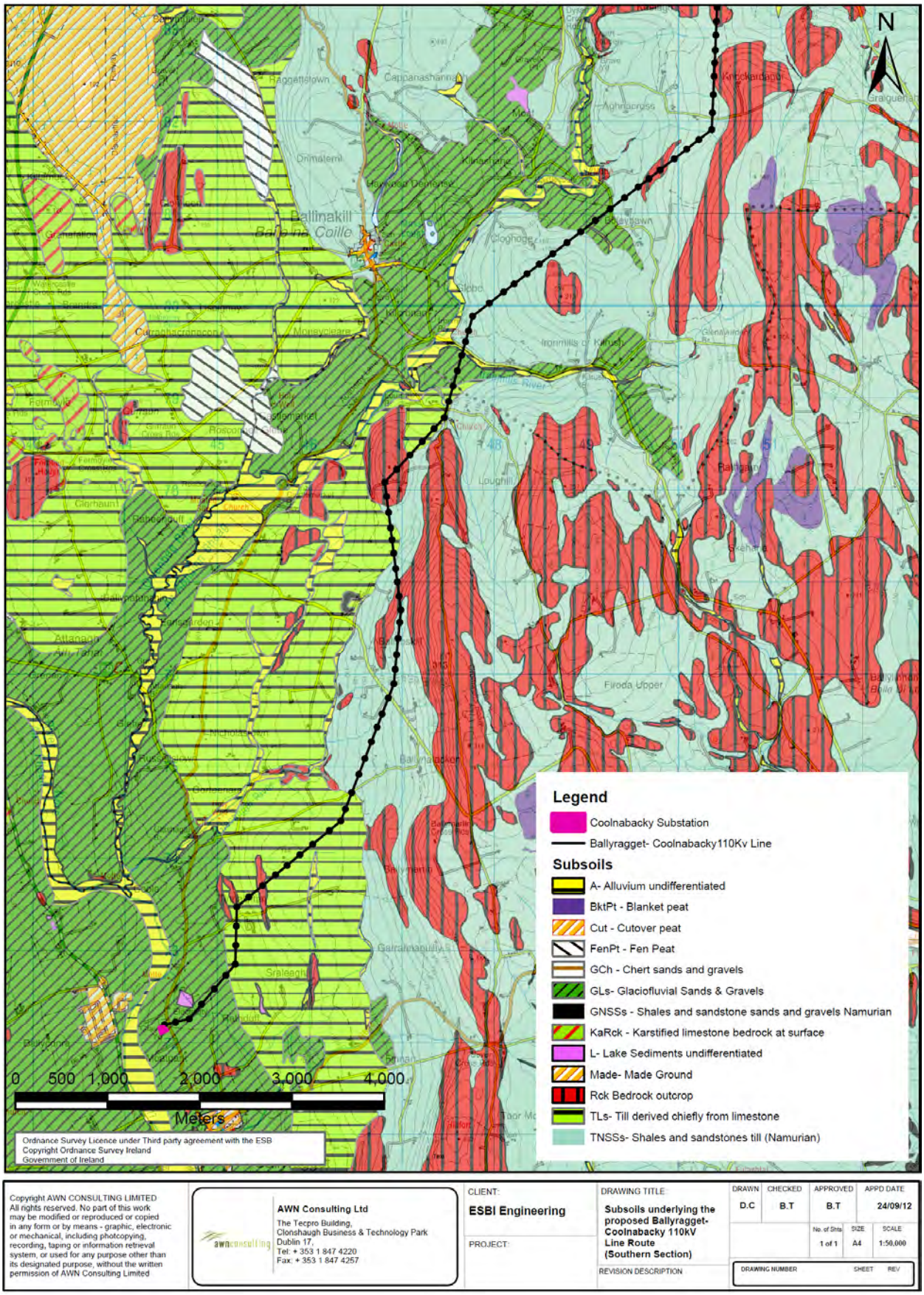


Figure 9.12 Subsoils underlying the proposed Ballyragget – Coolnabacky 110kV Line Route (Southern Section)

The GSI Well Card Index[14] for the wells in the vicinity of the proposed line route is shown in Table 9.6. The DTB and hence the depth of the soil/subsoil varies throughout the proposed line route; this is dependent on the underlying subsoil and the topography for the area.

Number	GSI Code	Easting	Northing	Townland	DTB
1	2317SEW101	247850	178540	LOUGHILL	11.0
2	2317SEW104	245880	178530	CASTLEMARKET	6.0
3	2317SEW107	246300	178560	CASTLEMARKET	14.0
4	2317SEW113	251360	179180	MOYHORA	1.0
5	2317SEW114	252050	179320	CRUTT	2.0
6	2317SEW117	253250	178830	CRUTT	3.0
7	2317SEW118	253000	178140	CRUTT	2.0
8	2317SEW137	246150	176290	BALLYOSKILL	7.5
9	2317SEW151	247640	172250	FINNAN	3.8
10	2317SEW152	246840	172220	FINNAN	6.0
11	2317SWW415	242620	174820	BALLYNASLEE	4.3
12	2317SWW416	242640	174750	BALLYNASLEE	3.7
13	2317SWW417	243280	173100	BALLYCONRA	8.1
14	2317SWW418	243630	172820	BALLYCONRA	27.4
15	2317SWW420	243500	171730	BALLYCONRA	9.4
16	2317SWW421	243580	171680	BALLYCONRA	25.9
17	2317SWW423	243880	172040	BALLYCONRA	4.6
18	2317SWW424	244870	176550	EARLSGARDEN	3.7
19	2317SWW425	244920	176200	BALLYOSKILL	4.7
20	2317SWW426	244340	175480	RUSELLSTOWN	3.9
21	2317SWW444	243360	171900	BALLYCONRA	13.1
22	2317SWW445	243620	171970	BALLYCONRA	14.8
23	2317SWW446	243280	172240	BALLYCONRA	19.5
24	2317SWW447	243910	172310	BALLYCONRA	12.2
25	2317SWW449	244000	172250	BALLYCONRA	5.0
26	2317SWW450	243970	172240	BALLYCONRA	5.0
27	2317SWW451	243980	172180	BALLYCONRA	6.7
28	2317SWW452	243930	172050	BALLYCONRA	3.0
29	2317SWW453	243570	171720	BALLYCONRA	11.9
30	2317SWW455	243960	171600	BALLYCONRA	21.5
31	2317SWW456	243730	171660	BALLYCONRA	10.0
32	2317SWW468	244800	176210	EARLSGARDEN	4.9
33	2319SEW117	255970	193950	TIMOGUE	3.7
34	2319SEW118	256350	194590	TIMOGUE	17.1

Table 9.6 GSI Well Data for Study Area showing Depth to Bedrock (DTB)

Table 9.6 shows that the wells recorded show the depth of overburden to range from 1.0m BGL (below ground level) in Moyhora to 27.4m bgl in Ballyconra. In the Southern section the nearest wells are 12, 13 & 14. The DTB for these wells are 15.7, 21.5 & 11.8 respectively. Well locations are shown in Figure 9.13 and Figure 9.14.

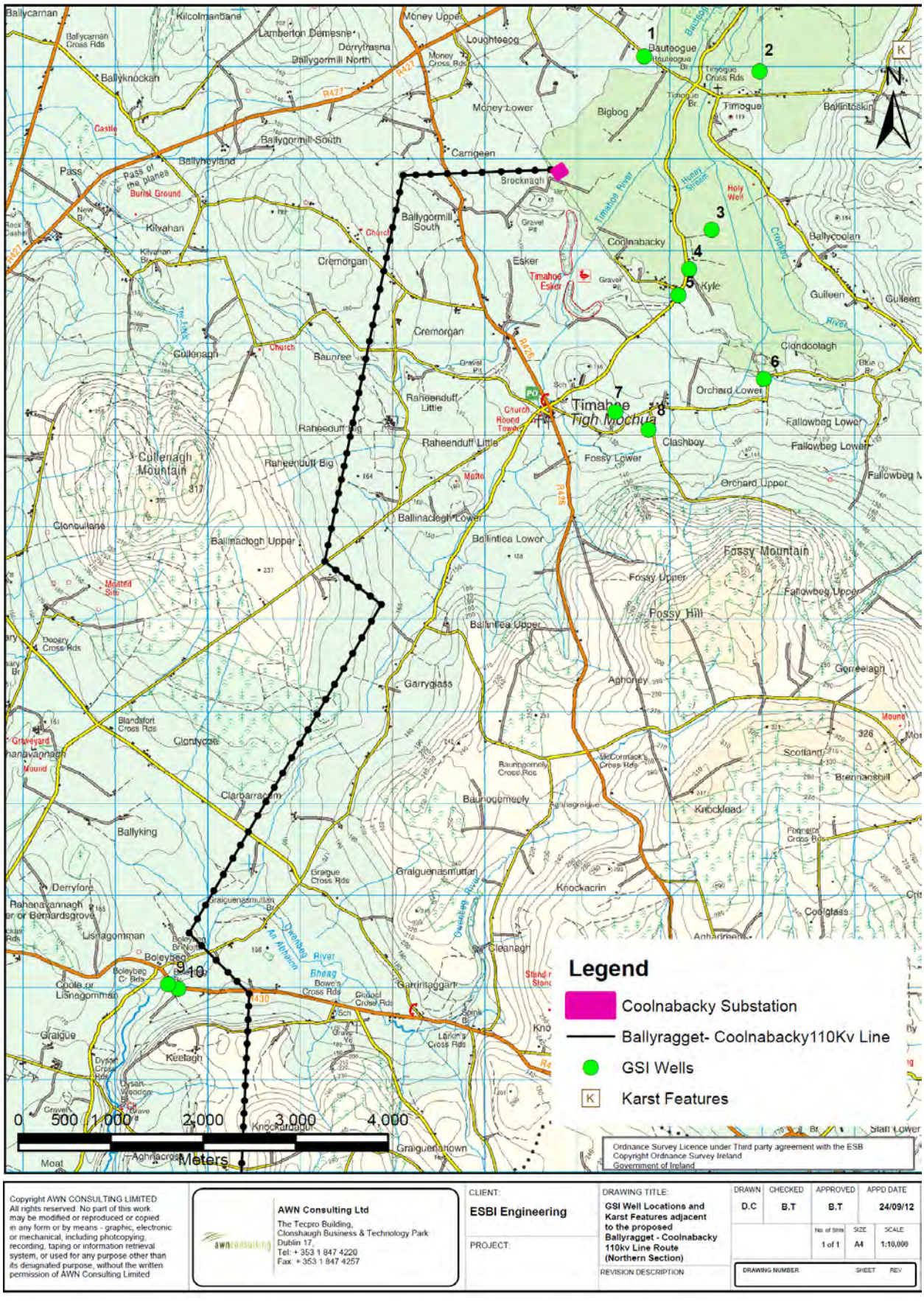


Figure 9.13 GSI Well Locations adjacent to the proposed Ballyragget – Coolnabacky 110kV Line Route (Northern Section)

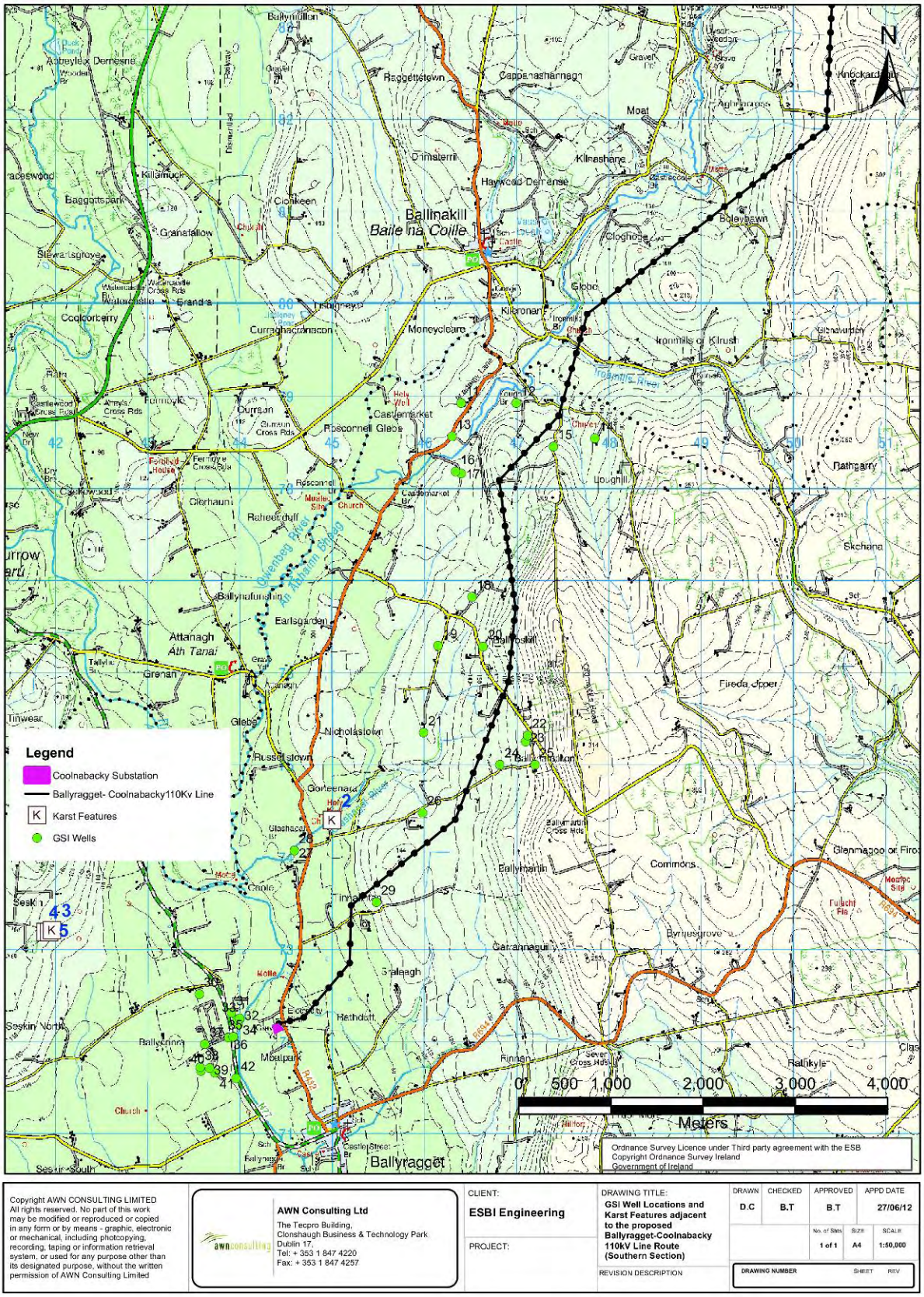


Figure 9.14 GSI Well Locations adjacent to the proposed Ballyragget – Coolnabacky 110kV Line Route (Southern Section)

9.3.5.4 Bedrock Geology

An inspection of the GSI [7,8,9] records shows the proposed line route to be underlain by limestone, shales and sandstones of the Dinantian, Namurian and Westphalian Periods of the Lower Carboniferous. The proposed line route is underlain by a mixture of Dinantian pure bedded limestones, Namurian Shales, Namurian sandstones. The sediments were originally deposited in quiet and possible deep waters.

The Namurian is present in the eastern half of the central section is divided in to following formations the Bregaun Flagstone Formation, Killeshin Siltstone Formation and the Luggacurren Shale Formation. The Dinantian formations dominated the northern section and the western half of the southern section. They are comprised of Clogrenan Formation and the Ballyadams Formation.

The different geological formations are described in Table 9.7, the associated townland locations from North to South are also included. See Figure 9.15 and Figure 9.16 for the bedrock geology underlying the proposed line route.

Formation	Period	Lithology	Townlands
Ballyadams Formation	Lower Carboniferous	Consists mainly of pale grey shelf limestones of Holkerian to Asbian age. The thickness can range between 400-700m. The upper part tends to be cyclic, dark argillaceous thin-bedded limestones passing up into massive pale-grey limestones.	Bauteogue, Loughteeog, Brocknagh, Cremorgan, Rath, Ballynafunshin, Coole, Ballyconra, Ballyragget.
Bregaun Flagstone Formation	Upper Carboniferous	Consists of thick grey flaggy-bedded sandstones and siltstones with subordinate amounts of silty, grey and often micaceus shales	Cullinagh Mountain, Knockload, Scotland, Cleanagh, Knockardogur, Boleybawn, Rathgarry, Fireda Upper, Toor Moire
Clogrenan Formation	Lower Carboniferous	Consists of shelf limestone with abundant chert in bands. Corals and brachiopods occur widely	Barrytransa, Cremorgan, Raheen duff bid, Timahoe, Clondoolagh, Ballinlough, Ballinakill, Rosconnel Glebe, Durrow, Nicholastown, Ballynaslee
Killeshin Siltstone Formation	Upper Carboniferous	Consists of grey argillaceous siltstones or silty mudstones with lesser amounts of sandstone and shale.	Ballyknockan, Kilrahan, Clontycore, Fossy Mountain, Drumaskellig, Ballyking, Ballypickas upper, Cloghoge, Ballyaskill, Finnan
Luggacurren Shale Formation	Upper Carboniferous	Consists of black to grey shales and mudstones. Thin argillaceous cherts and limestones are found on the lower and middle sections	Mopshall, Ballygormill South, Raheenduff, Ballislee upper, Fallowbeg upper

Table 9.7 Geological Formations along proposed line route (North to South)

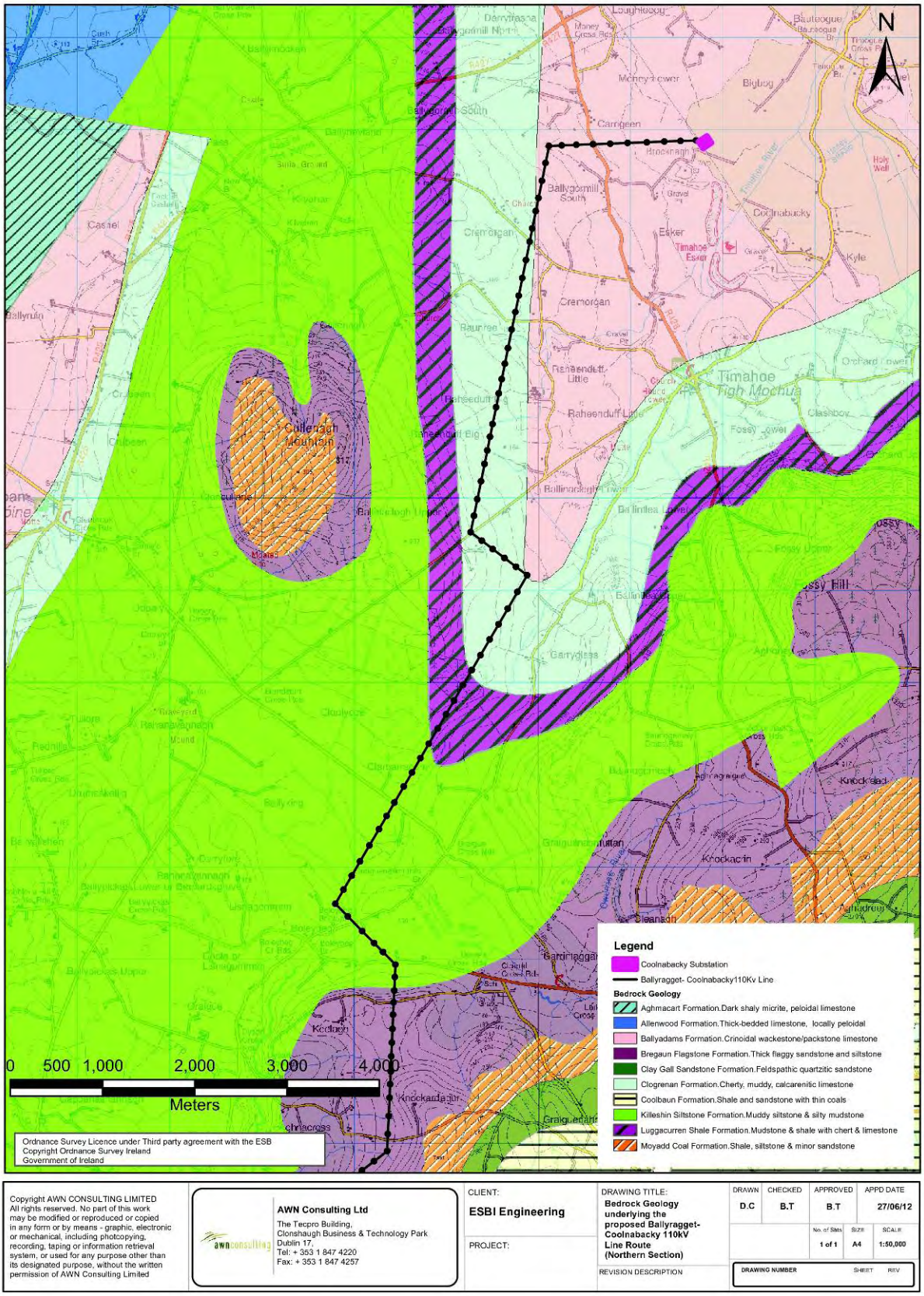


Figure 9.15 Bedrock Geology underlying the proposed Ballyragget – Coolnabacky 110kV Line Route (Northern Section)

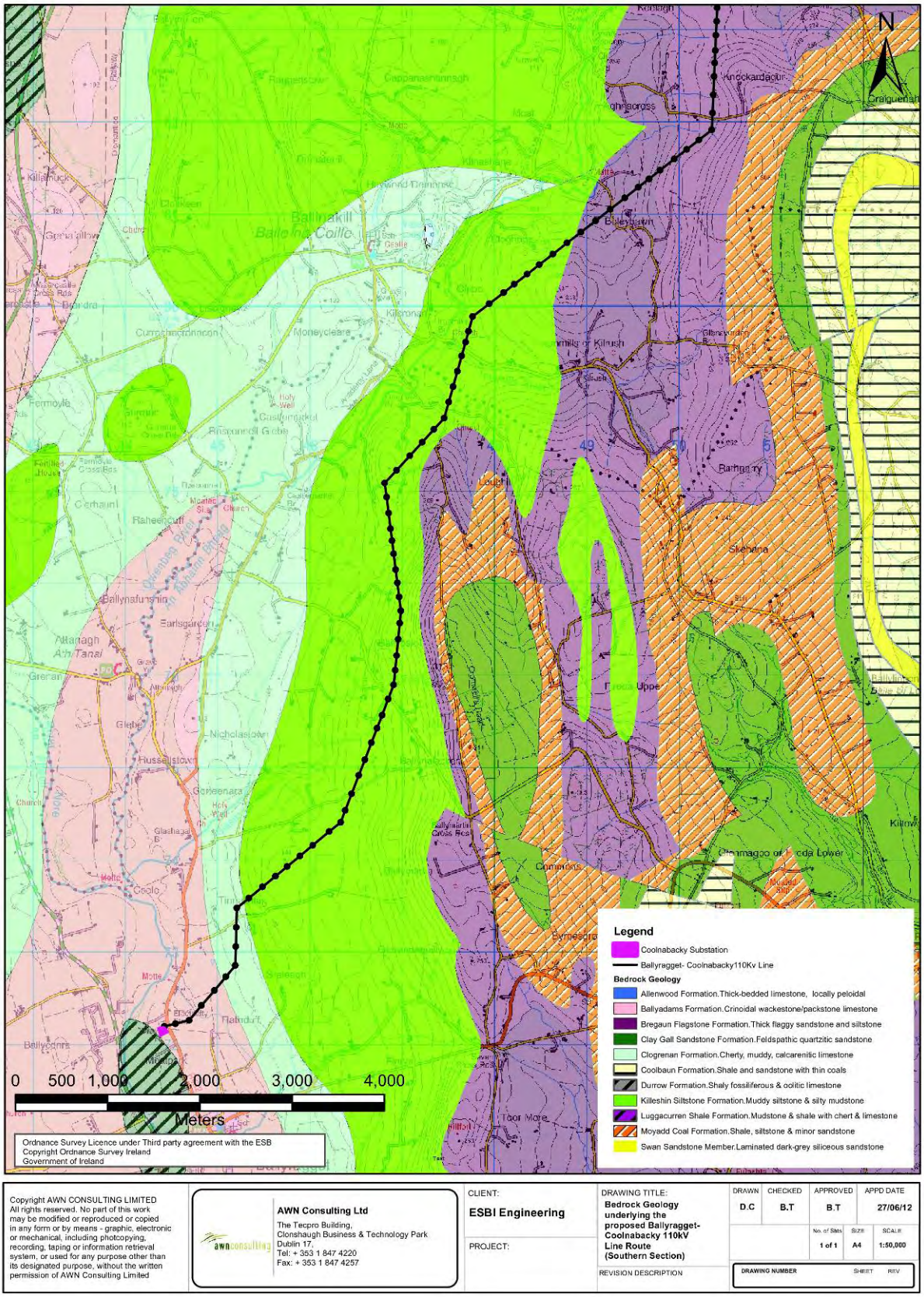


Figure 9.16 Bedrock Geology underlying the proposed Ballyragget – Coolnabacky 110kV Line Route (Southern Section)

9.3.5.5 Karst Features

The Karst database held by the GSI was consulted[13]. This database holds records of locations and types of reported Karst features. One karst feature was found in the vicinity of the proposed line route (1.3km West of the line route), this is a spring feature called St. Finians Well, located in the townland of Gorteenara (Grid Reference 245000 174400). See Figure 9.14 for location.

9.3.5.6 Economic Geology

The EPA Extractive Industries Register[16] was reviewed. This register is required under the *Waste Management (Management of Waste from the Extractive Industries) Regulations 2009 (S.I. No. 566 of 2009).* There are several quarries in the vicinity of the proposed line route. These are located as follows:

- Ballinaclough Lower, Rath, Timahoe, Co. Laois - Quarry Register Number QS-00470. The site location is 252683.79E, 189288.61N. Located 1km east of the proposed line route.
- Rahanavannagh, Ballyroan, Co. Laois- Quarry Register Number QS-00562. The site location is 248104.85E, 186319.64N. Located 2.1km to the North-east of the proposed line route.
- Coolnabacky, Timahoe, Co. Laois - The Quarry Register Number is QS-00496. The site location is 253589.36E, 192513.53N. Located 200m to the South of the proposed line route.
- Knockbaun, Spink, Abbeyleix, Co. Laois - The Quarry Register Number is QS-00571. The site location is 253345.49E, 183135.03N. Located 2.5km to the East of the proposed line route.
- Moat, Ballinakill, Co. Laois. The Quarry Register Number is QS-00543. The site location is 248444.13E, 182830.93N. Located 1.7km to the West of the proposed line route.
- Kilnashane, Ballinakill, Co. Laois. The Quarry Register Number is QS-00492. The site location is 247581.46E, 180910.6N. Located 800m to the North-West of the proposed line route.
- Lower Grennan, Attanagh, Co. Laois. The Quarry Register Number is QS-00515. The site location is 243781.69E, 173800.23N. Located 1.4km west of the proposed line route.

9.3.5.7 Landfills and Licenced Sites

From the information provided by the Laois and Kilkenny County Councils the following is a list of historic landfills within the study area:

- Ballinakill, Co. Laois E246720 N180180. Located 1.1km to the North-West of the proposed line route.
- Donaghmore, Ballyragget, Co. Kilkenny E245863 N169526. Located 35m to the West of the proposed line route.
- Ballyragget, Co. Kilkenny E246144 N171845. Located 720m to the North-East of the proposed line route.

9.3.5.8 Areas of Geological Heritage Importance

The GSI was consulted in relation to any areas of geological heritage or interest located in the study area[7]. According to the GSI, there is 1 no. site of geological interest that lies within the vicinity of the proposed line route - Timahoe Esker. See Section 9.3.1.8 for description.

9.3.5.9 Geotechnical and Slope Stability

The line route passes through an undulating topography ranging from 50m – 330m AOD. In areas with sloping ground, the composition and extent of the superficial geology affects the stability of the slopes and therefore the potential for slippage.

There are two key types of deposits along the line route that can be characterised by generic degrees of consolidation. These are the Glacial Till and Alluvium deposits described below. The actual consolidation of deposits varies considerably based on a wide range of factors at the local level.

Glacial Till: The majority of the line route crosses an area covered by glacial till deposits commonly comprising sandstone and shale till. These deposits are generally consolidated although this varies between deposits.

Alluvium: Sections of the line route cross areas of fluvio-glacial deposits comprising Alluvium. These occur around Timahoe and its townlands such as Coolnabacky, Brocknagh and along the river courses of the Timahoe and Timogue Rivers. Other significant deposits occur along the river courses of the Owenbeg and Nore Rivers and their tributaries in the central and southern sections. Alluvial subsoils consist of gravel, sand, silt or clay in a variety of mixes and usually consists of a fairly high percentage of organic carbon (10%-30%).

9.3.6 UNIT 6 - AN UPRATE OF THE EXISTING BALLYRAGGET-KILKENNY 110KV OVERHEAD LINE

9.3.6.1 Topography and Geomorphology

The northern section of the proposed line route is located in the area South-East of Ballyragget and surrounding townlands. Rolling hills dominate the North-East of this section while the South and East are dominated by the Dinin River and the River Nore respectively. The surface gradient is relatively flat in these areas. The southern section is based in the areas around Kilkenny City and mainly to the North-East of the city. The area is comprised of undulating hills while to the North there are low lying hills. The topography of the proposed line route is as follows:

- 55m AOD at Dunmore West to 290m AOD at Commons, located to the North-East of Ballyragget in the northern section;
- 50m AOD at Maddockstown, just South of Kilkenny city to 334m AOD at Mount Nugent Upper in the southern section.

9.3.6.2 Soils

The EPA ENVison database was reviewed in relation to soils[15]. Figure 9.17 and Figure 9.18 shows the range of different soil types underlying the proposed line route. Table 9.8shows the soil types along the proposed line route from North to South and the associated townlands where the predominant soil type is present. The principal soil groups are as follows. See Section 9.3.5.2 for a description of each type:

The following soil groups also occur along the line route:

- *AminPD* – Surface water Gleys/Ground water Gleys. (% occurrence along proposed line route – 14%)
- *BminSW*- Renzinas/Lithosols. (% occurrence along proposed line route – 31.5%)
- *AlluvMIN* – Alluvial undifferentiated (% occurrence along proposed line route – 2.5 %);
- *AminDW* – Acid Brown Earths/Brown Podzolics (% occurrence along proposed line route – 15%);
- *AminSW*- Lithosols, Regosols, Acidic (% occurrence along proposed line route – 10%);
- *BminDW*- Grey Brown podzolics, Brown earth, basic (% occurrence along proposed line route – 21%)
- *BminPD*- Surface water/Groundwater gleys, Basic (% occurrence along proposed line route – 6%).

Soil Type	Townland
BminDW, BminPD, BminSW	Rathduff
BminDW, BminPD, BminSW	Ballyragget
BminDW, BminSW	Donaghmore
BminPW, BminPD, AminPD	Connahy
BminPW, BminPD, AminPD	Foulksrath
BminDW, BminPD, AminPD	Swiftsheath
AlluvMIN, BminSW, AminPD	Inchakill Glebe
BminSW, AminPD, AminSW	Ballyrafton
AminPD, AminSW	Kilmademoge
AminPD, AminSW	Radestown North
AminPD, AminSW, AminDW	Kyleroe
AminPD, AminDW	Brownstown
AminDW,	Kingsland
AminDW, BminSW	Archersrath
AminDW, BminDW, BminSW	Templemartin
BminPW, BminDW	Ballynamona
AlluvMin	Archesrath, Brownstown and Eagleshill

Table 9.8 Soil Types along proposed line route (North to South)

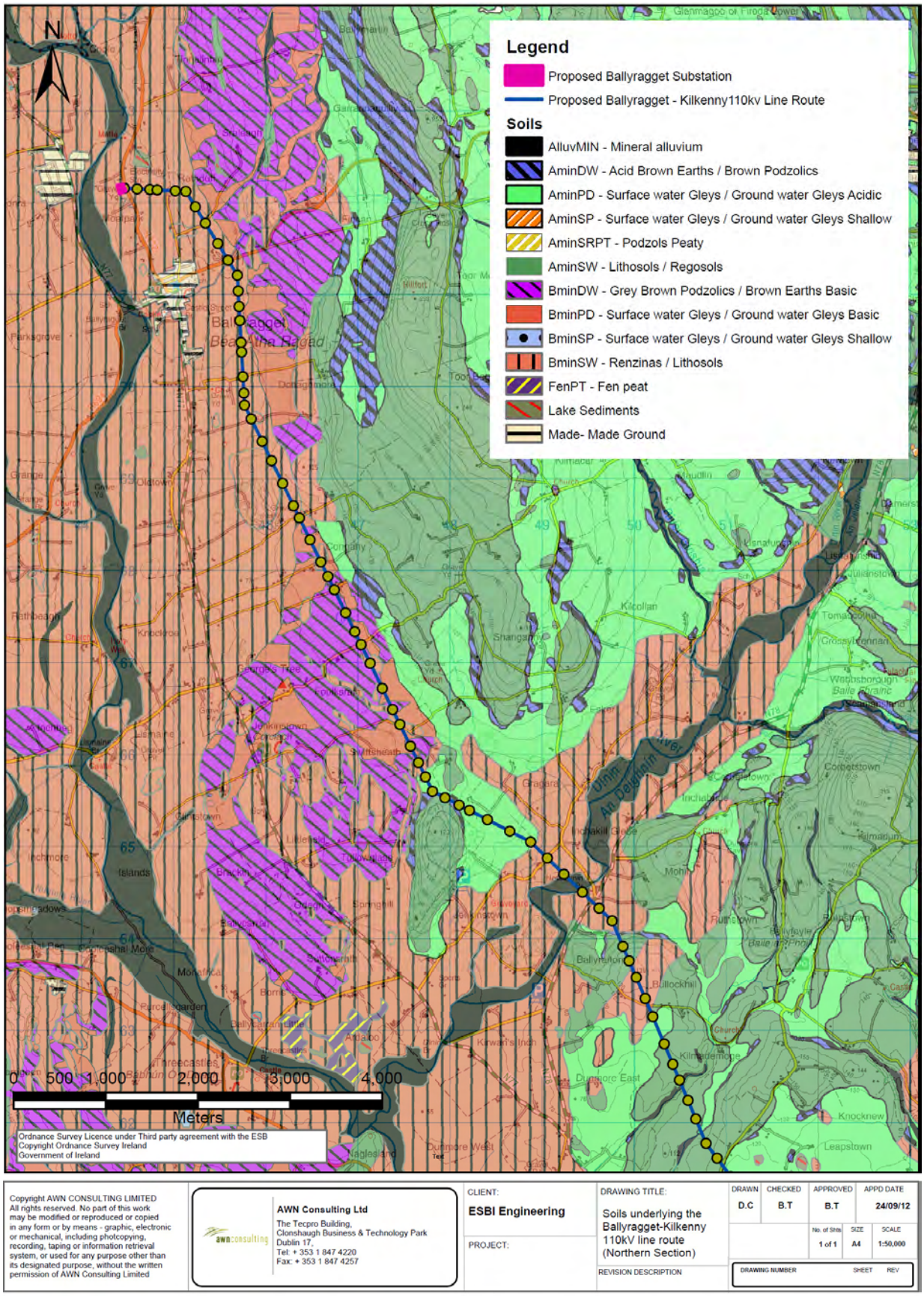


Figure 9.17 Soils underlying the Ballyragget – Kilkenny 110kV Line Route (Northern Section)

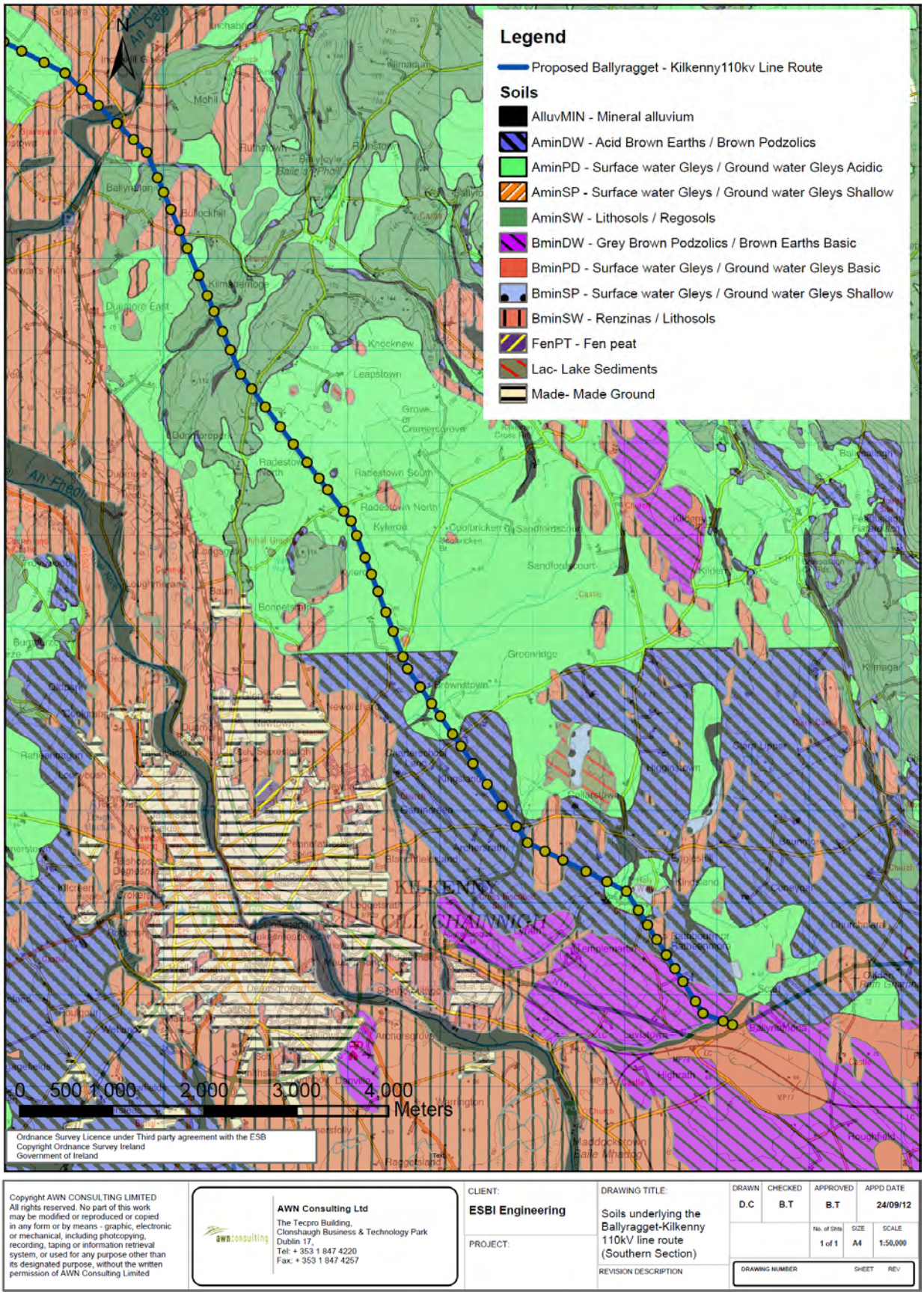
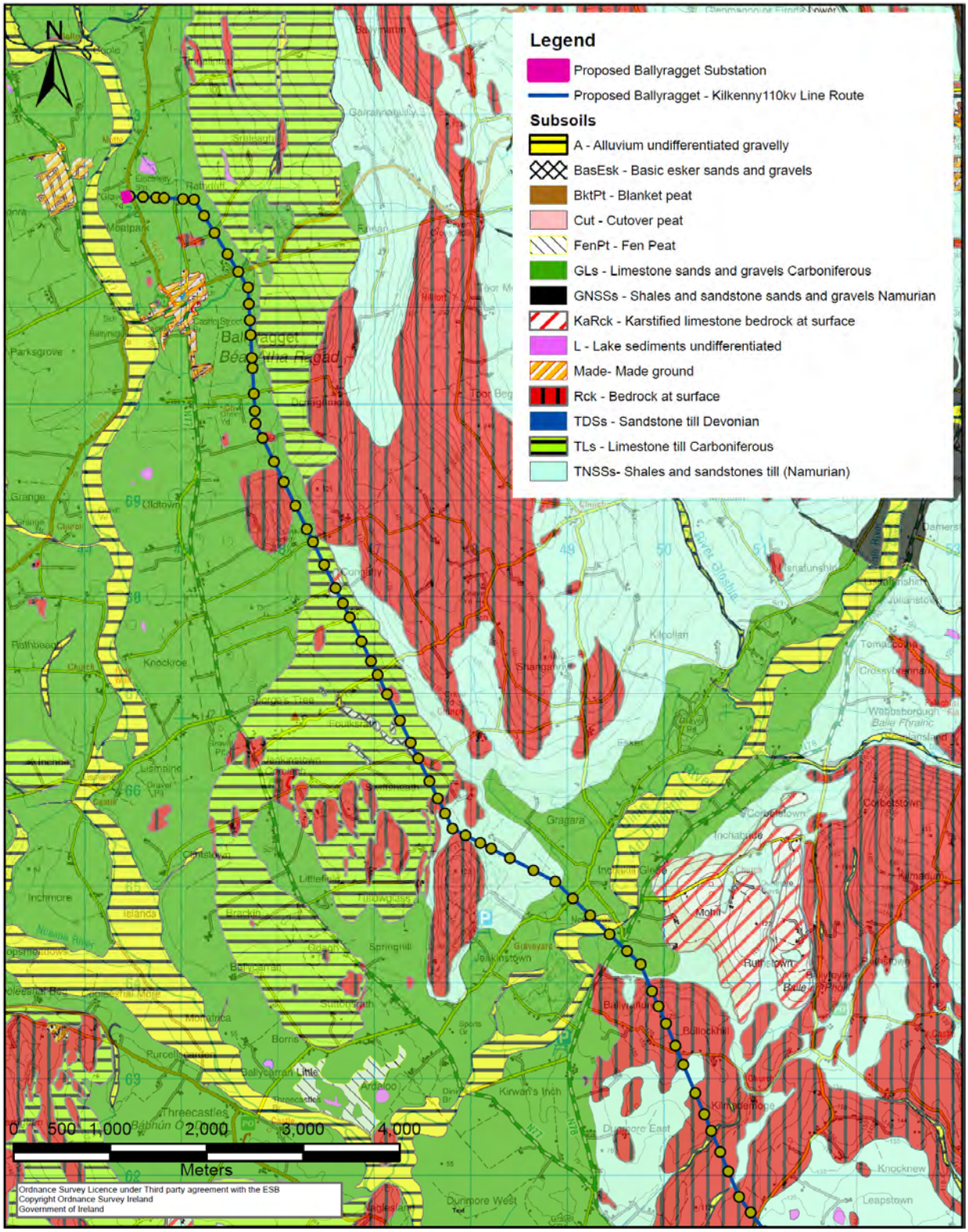


Figure 9.18 Soils underlying the Ballyragget – Kilkenny 110kV Line Route (Southern Section)

9.3.6.3 Quaternary Geology

See Figure 9.19and Figure 9.20for the different subsoil types underlying the proposed line route. With reference to the EPA ENVison database[15], the subsoils comprise primarily limestone sands & gravels till from the Carboniferous (GLs) and shales and sandstone from the Namurian (TNSSs). The following subsoil groups also occur in the study area, but are less dominant. See Section 9.3.5.3 for a description of each:

- A – Alluvium undifferentiated
- KaRck – Karstified limestone bedrock at surface
- Rck – Bedrock at surface
- TLs- Limestone Till Carboniferous



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DRAWING TITLE: Subsoils underlying the Ballyragget-Kilkenny 110kV line route (Northern Section)

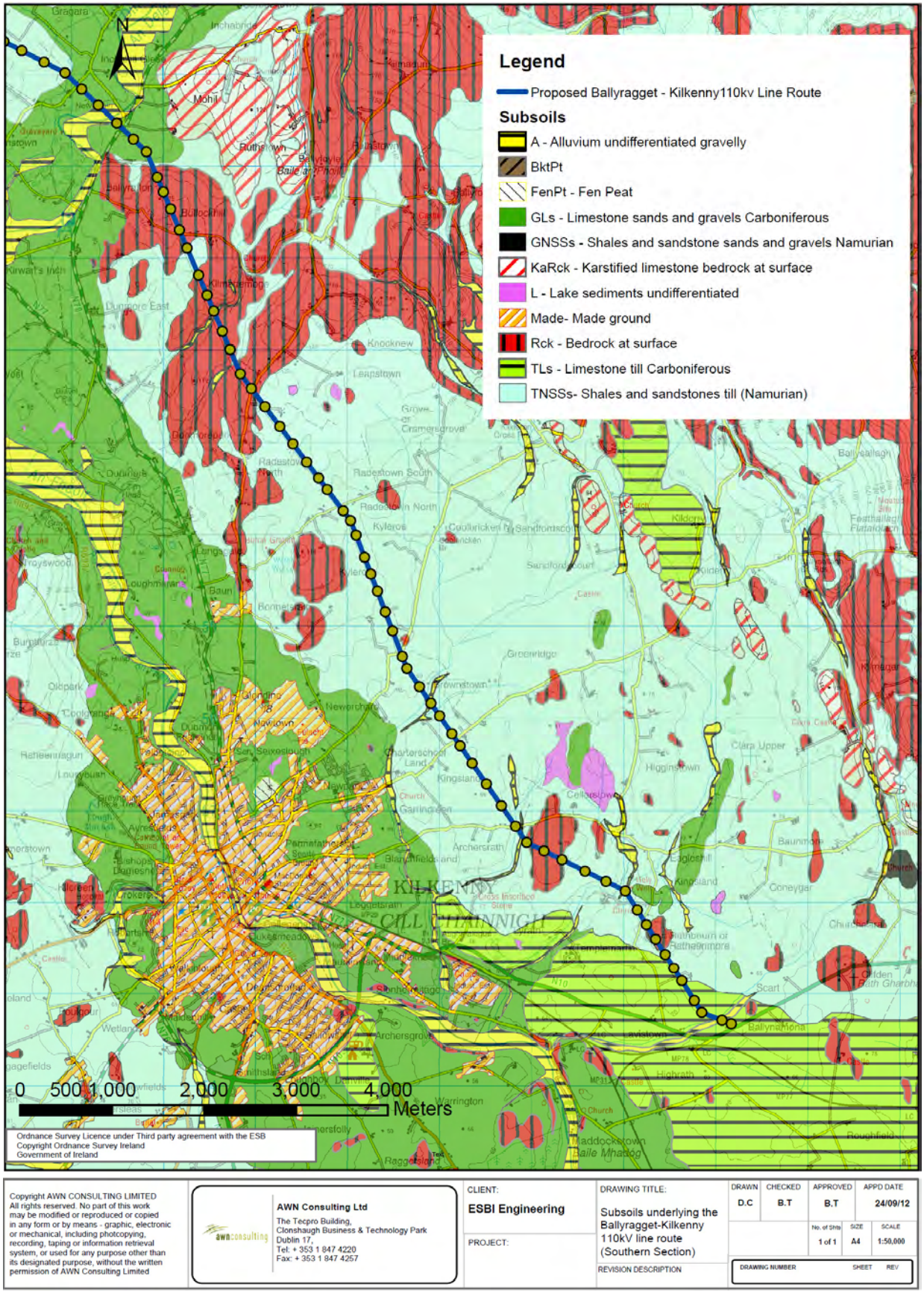
DRAWN	CHECKED	APPROVED	APPD DATE
D.C	B.T	B.T	24/09/12

No. of Shts	SIZE	SCALE
1 of 1	A4	1:50,000

REVISION DESCRIPTION

DRAWING NUMBER SHEET REV

Figure 9.19 Subsoils underlying the Ballyragget – Kilkenny 110kV Line Route (Northern Section)



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PROJECT:

DRAWING TITLE: Subsoils underlying the Ballyragget-Kilkenny 110kV line route (Southern Section)

REVISION DESCRIPTION

DRAWN	CHECKED	APPROVED	APPD DATE
D.C	B.T	B.T	24/09/12

No. of Shts	SIZE	SCALE
1 of 1	A4	1:50,000

DRAWING NUMBER SHEET REV

Figure 9.20 Subsoils underlying the Ballyragget – Kilkenny 110kV Line Route (Southern Section)

The GSI Well Card Index[14] shows a number of wells in the vicinity of the proposed line route see Table 9.9. The DTB and hence the depth of the soil/subsoil varies throughout the proposed line route; this is dependent on the underlying subsoil and the topography for the area.

Number	GSI Code	Easting	Northing	Townland	DTB
13	2317SEW254	246630	170170	DONAGHMORE	7.6
14	2315NEW209	246630	169720	DONAGHMORE	1.3
15	2315NEW102	246700	168940	CONNAHY	36.6
16	2315NEW103	246690	168890	CONNAHY	48.6
17	2315NEW210	246980	168430	CONNAHY	4.1
18	2315NEW100	247850	167700	CONNAHY	23.3
19	2315NWW111	246300	167470	CLONTUBBRID	23
20	2315NEW104	246300	166750	FOULKSRATH	6.7
21	2315NEW212	246210	166710	FOULKSRATH	6.6
22	2315NEW213	246580	166670	FOULKSRATH	2.4
23	2315NEW094	249440	165670	GRAGARA	17.7
24	2315NEW095	249480	165640	GRAGARA	12.2
25	2315NEW093	249450	165600	GRAGARA	13.8
26	2315NEW092	249410	165510	GRAGARA	6.1
27	2315NEW136	246980	165060	TULLOWGLASS	34.2
28	2315NEW144	250100	164700	MOHIL	6.8
29	2315NEW133	248460	164610	JENKINSTOWN	15
30	2315NEW145	249600	164500	MOHIL	36.5
31	2315NEW256	248460	164420	JENKINSTOWN	22.9
32	2315NEW139	249300	164150	BALLYRAFTON	NA
33	2315NEW246	249440	164050	BALLYRAFTON	54.9
34	2315NEW141	249850	163460	BALLYRAFTON	36.5
35	2315NEW140	249510	163440	BALLYRAFTON	NA
36	2315NEW142	250490	163260	BULLOCKHILL	3.8
37	2315NEW143	250990	162760	KILMADEMOGE	13.1
38	2315NEW023	251250	161270	RADESTOWN NORTH	5.8
39	2315NEW065	250170	161000	DUNMOREPARK	1.5
40	2315NEW017	250860	160700	DUNMOREPARK	3.2
41	2315NEW022	250750	160690	DUNMOREPARK	12.5
42	2315NEW016	250874	160494	RADESTOWN NORTH	30.5
43	2315NEW006	250768	160505	DUNMOREPARK	31
44	2315NEW251	252040	160320	RADESTOWN SOUTH	21.3
45	2315NEW003	250860	160320	RADESTOWN NORTH	24.4
46	2315NEW250	251540	160240	RADESTOWN SOUTH	2
47	2315NEW252	251848	160155	RADESTOWN SOUTH	51.8
48	2315SEW029	252400	159860	RADESTOWN SOUTH	36.6
49	2315SEW033	252620	159840	BROWNSTOWN	4.4
50	2315SEW026	251840	159200	BONNETSRATH	39.6
51	2315SEW028	252240	159140	KYLEROE	44.2
52	2315SEW027	252200	159020	KYLEROE	15.9

53	2315SEW032	252610	158991	BROWNSTOWN	76.2
54	2315SEW031	252540	158990	BROWNSTOWN	41.1
55	2315SEW030	252540	158920	BROWNSTOWN	28.9
56	2315SEW111	252504	158377	BROWNSTOWN	21.3
57	2315SEW126	254017	158240	CELLARSTOWN WEST	36.6
58	2315SEW125	253600	158190	BROWNSTOWN	3.1
59	2315SEW127	253950	158160	CELLARSTOWN WEST	4.6
60	2315SEW110	252380	158010	NEWORCHARD	9.4
61	2315SEW104	251827	157965	NEWORCHARD	38.4
62	2315SEW121	253600	157930	ARCHERSRATH	2.3
63	2315SEW120	253594	157965	ARCHERSRATH	55.8
64	2315SEW105	252000	157860	NEWORCHARD	31
65	2315SEW118	253245	157774	KINGSLAND	36.6
66	2315SEW117	252990	157450	KINGSLAND	8.8
67	2315SEW116	252938	157435	KINGSLAND	30.5
68	2315SEW113	252610	157430	CHARTERSCHOOLLAND	30.6
69	2315SEW112	252500	157380	CHARTERSCHOOLLAND	36
70	2315SEW221	254462	156991	CELLARSTOWN UPPER	23.8
71	2315SEW122	253500	156870	ARCHERSRATH	30.4
72	2315SEW123	253540	156840	ARCHERSRATH	NA
73	2315SEW128	253920	156800	CELLARSTOWN LOWER	6.4
74	2315SEW119	253340	156747	ARCHERSRATH	48.8
75	2315SEW115	252885	156726	ARCHERSRATH	6.1
76	2315SEW124	253550	156650	LEGGETSRATH EAST	36
77	2315SEW223	254680	156500	HIGGINSTOWN	12.2
78	2315SEW224	254748	156472	HIGGINSTOWN	25.9
79	2315SEW226	255080	156160	TEMPLEMARTIN	NA
80	2315SEW225	254820	156080	TEMPLEMARTIN	8.3
81	2315SEW254	255170	155440	TEMPLEMARTIN	16.5
82	2315SEW246	254450	155400	LYRATH	30.5
83	2315SEW255	255030	154830	LAVISTOWN	22.9
84	2315SEW253	254820	154800	LAVISTOWN	NA
85	2315SEW256	255720	154360	HIGHRATH	7.8
86	2315SEW351	256010	154010	MADDOCKSTOWN	NA
87	2315SEW258	256314	153795	MADDOCKSTOWN	21.3

Table 9.9 GSI Well Data for Study Area showing Depth to Bedrock (DTB)

Table 9.9shows that the wells recorded show the depth of overburden to range from 1.3m bgl in Donaghmore to 152m bgl in Ballyconra. In the Northern section wells 60, 64 and 68 are located within 100m of the line. The DTB for these wells are 36.5m, 36.5m and 5.8m respectively. In the Southern section wells 83, 84, 103 and 108 are located within 100m of the line. The DTB for these wells are 76.2m, 41.1m, 6.4m, and 25.9m. Well locations are shown in Figure 9.21 and Figure 9.22.

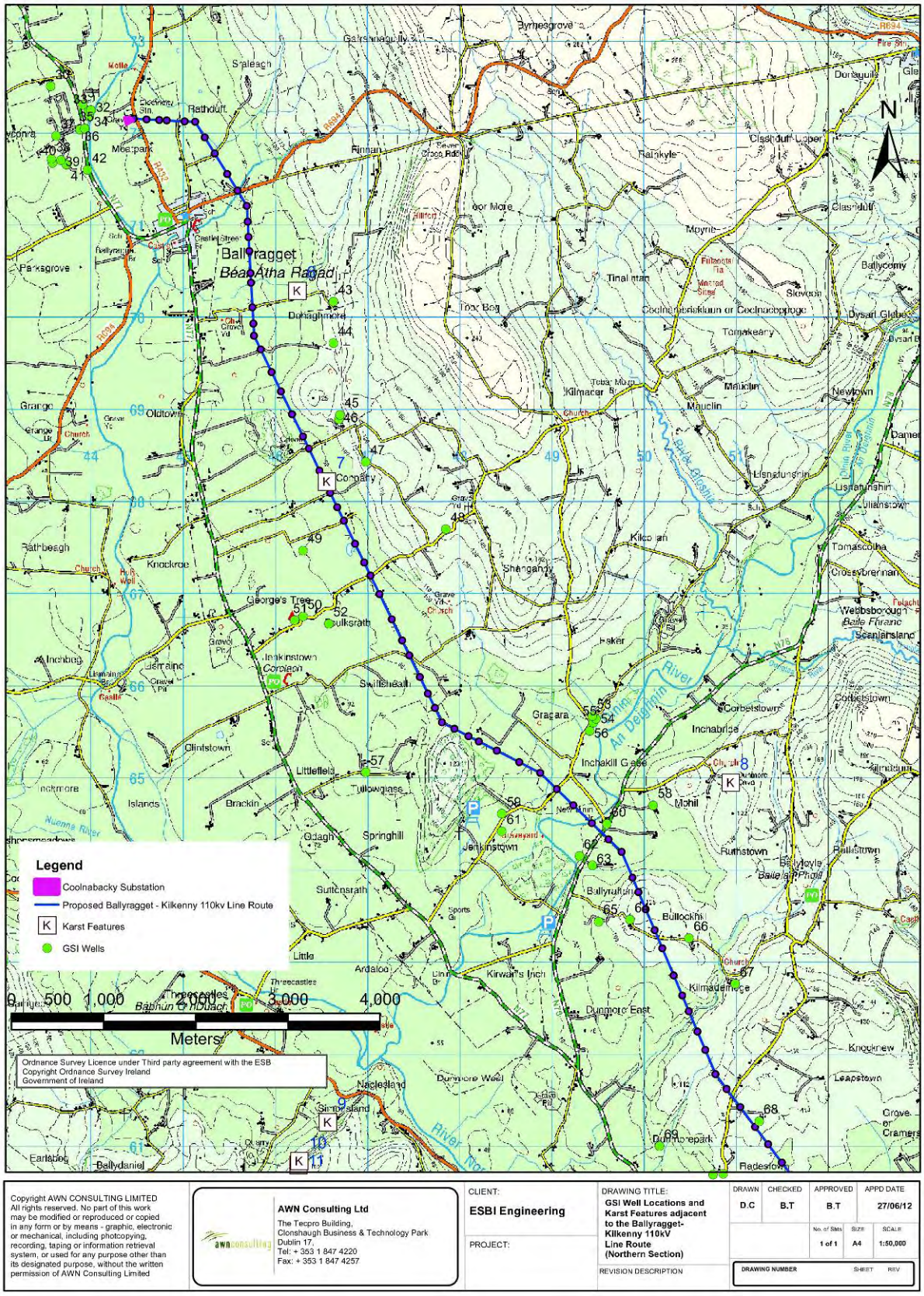


Figure 9.21 GSI Well Locations adjacent to the Ballyragget – Kilkenny 110kV Line Route (Northern Section)

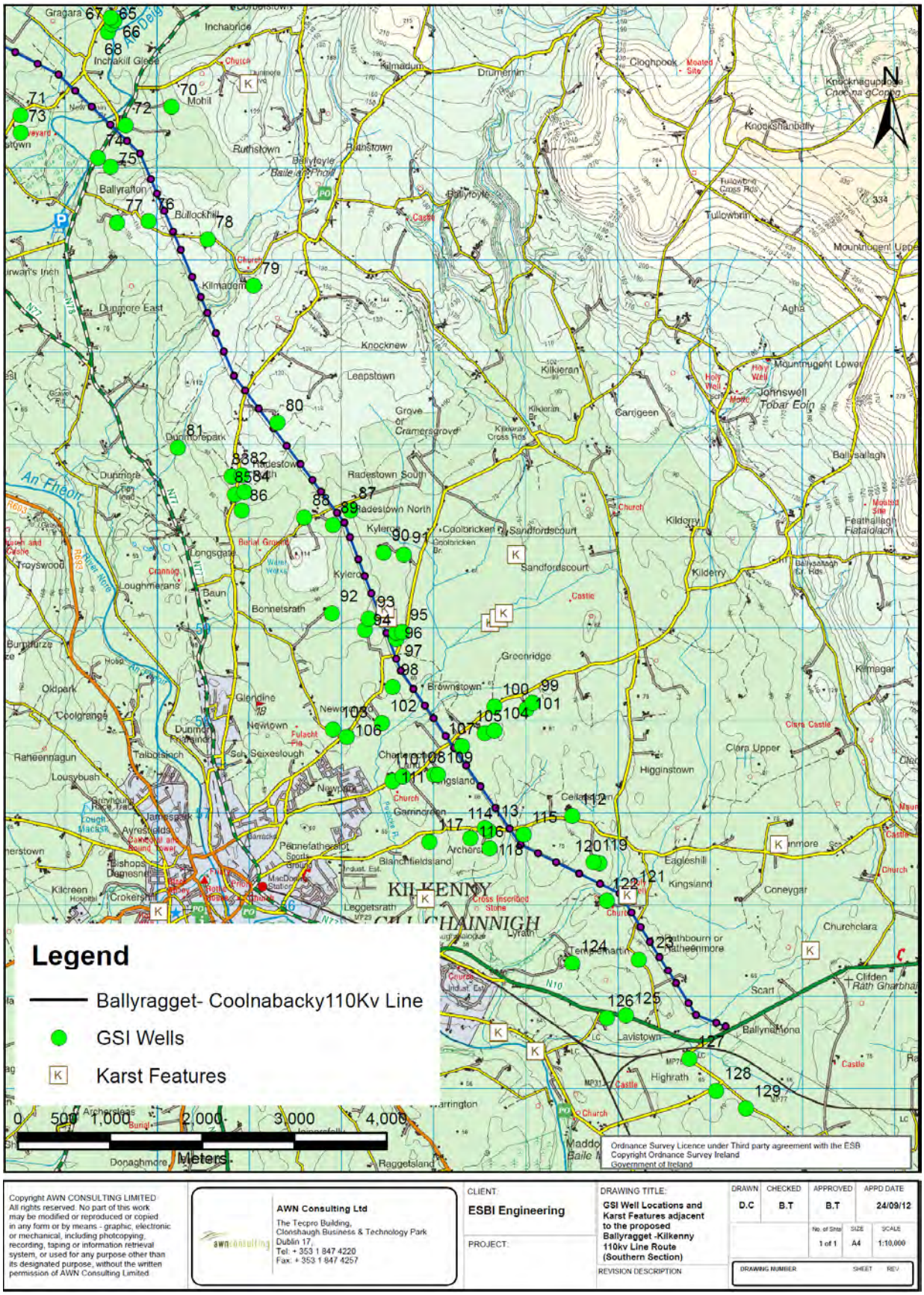


Figure 9.22 GSI Well Locations adjacent to the Ballyragget – Kilkenny 110kV Line Route (Southern Section)

9.3.6.4 Bedrock Geology

An inspection of the Geological Survey of Ireland (GSI) [7, 8, 9] records shows the proposed line route to be underlain by limestone, shales and sandstones of the Dinantian, Namurian and Westphalian Periods. The proposed line route is underlain by a mixture of Dinantian limestones, Namurian Shales, Namurian sandstones, Westphalian shales and Westphalian sandstones. The sediments were originally deposited in quiet and possible deep waters

The Namurian is present in the eastern half of the northern section and the northern half of the southern section. It is divided into the following formations, the Bregaun Flagstone Formation, Killeshin Siltstone Formation and the Luggacurren Shale Formation. The Dinantian formations dominated the western half of the northern section and the southern half of the southern section. They are comprised of Allenwood formation, Clogrenan Formation, Bultersgrove formation, Ballyadams Formation and the Durrow formation.

The different geological formations that make up the proposed line route are shown in Table 9.10 with associated townland locations from North to South. See Figure 9.23 and Figure 9.24 for the bedrock geology underlying the proposed line route.

Formation	Period	Lithology	Townlands
Ballyadams Formation	Lower Carboniferous	Consists mainly of pale grey shelf limestones of Holkerian to Asbian age. The thickness can range between 400-700m. The upper part tends to be cyclic, dark argillaceous thin-bedded limestones passing up into massive pale-grey limestones.	Ballyconra, Ballyragget, Lismaine, Clintstown, Coole, Knockroe, Littlefield, Grange, Inchbeg, Monafrica, Brackin, Brownstown, Greenridge
Bultersgrove Formation	Lower Carboniferous	Consists of dark grey, well-bedded muddy bioclastic limestones interbedded with thin calcareous shales	Archsrath, Cellerstown, Eagleshill, Coneygar, Rathbourn, Roughfield, Ballynamona.
Clogrenan Formation	Lower Carboniferous	Consists of shelf limestone with abundant chert in bands. Corals and brachiopods occur widely	Rathduff, Donaghmore, Swiftsheath, Tullowglass, Springhill, Ardaloo, Ballydaniel, Ruthstown, Dunmore East, Kilkieran, Kilderry, Leapstown, Kyleroe, Oldpark,
Killeshin Siltstone Formation	Upper Carboniferous	Consists of grey argillaceous siltstones or silty mudstones with lesser amounts of sandstone and shale.	Garrannaguilly, Finnan, Kilcollan, Eskerm Corbetstown, Tomascotha, Gragara, Rathstown, Kilmademoge, Ballyfoyle, Dunmore West, Dunmore, Radestown North, Burntfurze
Luggacurren Shale Formation	Upper Carboniferous	Consists of black to grey shales and mudstones. Thin argillaceous cherts and limestones are found on the lower and middle sections	Bullockhill, Inchabride, Knocknew, Carrigeen, Bonnetsrath, Friarsinch

Table 9.10 Geological Formations along proposed line route (North to South)

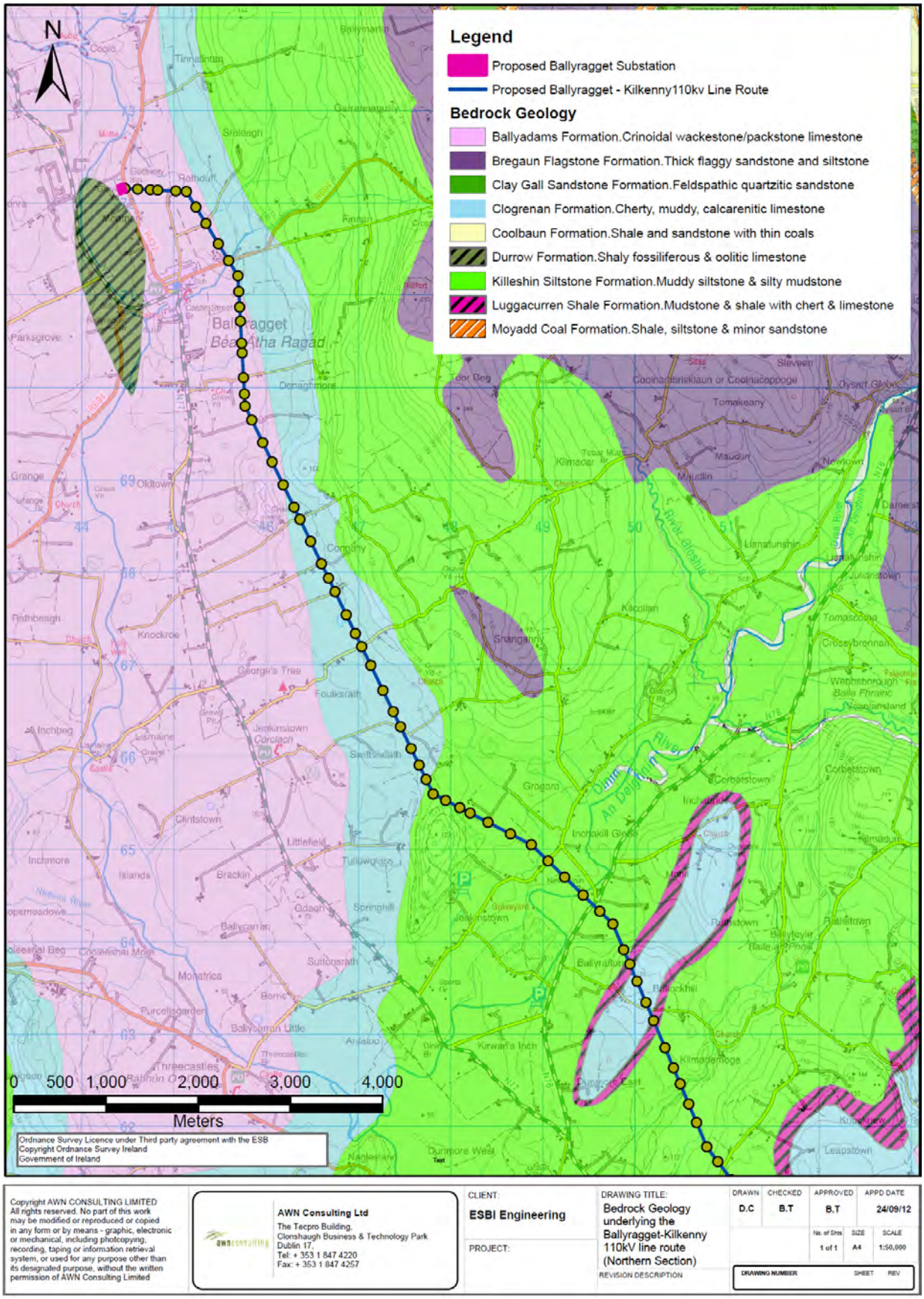


Figure 9.23 Bedrock Geology underlying the Ballyragget – Kilkenny 110kV Line Route (Northern Section)

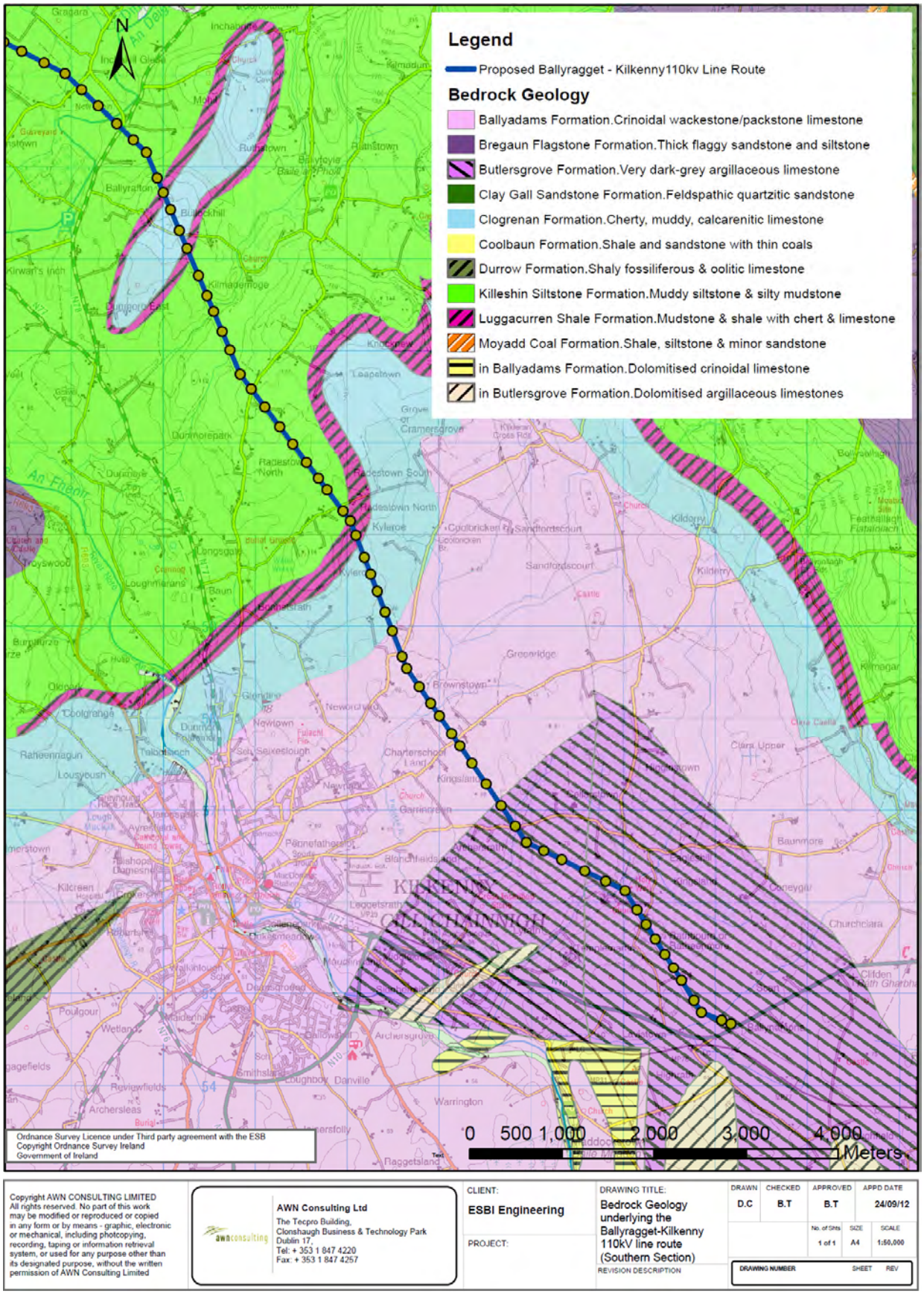


Figure 9.24 Bedrock Geology underlying the Ballyragget – Kilkenny 110kV Line Route (Southern Section)

9.3.6.5 Karst Features

The Karst database held by the GSI was consulted[13]. This database holds records of locations and types of reported Karst features. The GSI database highlighted karst features in the southern section as shown in Table 9.11.

The closest feature to the proposed 110kV line is No.2, in the townland of Connahy which is approximately 22m from the line. This feature consists of a swallow hole in a muddy limestone lithology. In addition No 11, in the townland of Templemartin is located 60m from the line and No's 8 & 5, in the townland of Kylemore are approximately 80m from the line. All the other karst features are greater than 500m from the line.

Number	GSI Code	Easting	Northing	Type	Lithology	Townland
1	2317SEK002	246240	170290	Spring	Limestone, muddy	DONAGHMORE
2	2315NEK001	246560	168220	Swallow Hole	Limestone, muddy	CONNAHY
3	2315NEK006	250940	164950	Cave	Limestone, cherty	MOHILL
4	2315SEK028	253840	159840	Spring	Limestone, clean	SANDFORDSCOURT
5	2315SEK027	252420	159250	Swallow Hole	Limestone, clean	KYLEMORE
6	2315SEK031	253710	159200	Spring	Limestone, clean	SANDFORDSCOURT
7	2315SEK030	253650	159150	Spring	Limestone, clean	SANDFORDSCOURT
8	2315SEK026	252450	159150	Spring	Limestone, clean	KYLEMORE
9	2315SEK029	253560	159100	Spring	Limestone, clean	SANDFORDSCOURT
10	2615SWK005	256690	156690	Spring	Limestone, clean	MONEFELIM
11	2315SEK023	255050	156140	Spring	Limestone, muddy	TEMPLEMARTIN
12	2315SEK008	252860	156100	Spring	Limestone, clean	LEGGETSRATH EAST
13	2315SEK009	249960	155960	Spring	Limestone, clean	CROKERSHILL
14	2315SEK024	257030	155540	Spring	Limestone, clean	CONEYGAR
15	2315SEK007	251570	155350	Spring	Limestone, clean	DUKESMEADOWS
16	2315SEK002	252590	154880	Spring	Limestone, clean	PURCELLSINCH
17	2315SEK001	250450	154840	Spring	Limestone, clean	PURCELLSINCH
18	2315SEK006	251840	154790	Spring	Limestone, clean	GALLOWSHILL
19	2315SEK003	253650	154640	Spring	Limestone, clean	LAVISTOWN
20	2315SEK004	254050	154440	Spring	Limestone, clean	LAVISTOWN

Table 9.11 Karst features in the study area

9.3.6.6 Economic Geology

The EPA Extractive Industries Register[16] was reviewed. This register is required under the *Waste Management (Management of Waste from the Extractive Industries) Regulations 2009 (S.I. No. 566 of 2009).* There are several quarries in the vicinity of the proposed line route. These are located as follows:

- Firoda Upper, Co. Kilkenny - Quarry Register Number QS-01039. The site location is 249017.38E, 176802.94N. Located 1.9km to the east from the proposed line route.
- Ballyragget Quarry, Ballyragget, Co. Kilkenny - Quarry Register Number QS-00470. The site location is 252683.79E, 189288.61N. Located 1.4 km to the North-East from the proposed line route.

9.3.6.7 Landfills and Licenced Sites

The EPA has a database of waste and Integrated Pollution Prevention Control (IPPC) licenced activities in Ireland. The database shows there is the following waste or IPPC licenced activities along the proposed line route.

- Tex Tech Industries (Ireland) Ltd, Purcellsinch Industrial Park, Kilkenny. The facility involves the dyeing, treatment/finishing of fibres and textiles. Located 1.7km to the South-West of the proposed line route.
- NN Euroball Ireland Ltd, Unit 4, IDA Industrial estate, Purcells Inch, Kilkenny. The facility involves the processing of Iron and steel in forges, drawing plants and rolling mills. Located 1.7km to the South-West of the proposed line route.
- E. Smithwick & Sons, Parliament Street, Kilkenny. The facility involves the commercial brewing and distilling. Located 2.8km to the South-West of the proposed line route.
- Roadstone Provinces Ltd, Maddoxtown, Co. Kilkenny. The facility involves the extraction and processing of minerals. Located 1.8km to the South-West of the proposed line route.
- Sunglen Ltd, Threecastle, Co. Kilkenny. The facility involves the intensive rearing of pigs in units. Located 3.8km to the South-West of the proposed line route.
- Glanbia Ingredients, Ballyragget, Co. Kilkenny. The facility manufactures dairy products such as milk and cheese etc. Located 700m to the West and South-West of the proposed line.

From the information provided by the Kilkenny County Council, the following is a list of historic landfills within the study area;

- Dunmore, Co. Kilkenny E249687 N160651. Located 1.55km to the South-West of the proposed line route.
- Troyswood, Co. Kilkenny E247512 N161202. Located 3.3km to the South-West of the proposed line route.
- Kiltown, Castlecomer, Co. Kilkenny E252221 N173495. Located 5.8km to the South-East of the proposed line route.
- Donaghmore, Ballyragget, Co. Kilkenny E245863 N169526. Located 35m to the West of the proposed line route.
- Ballyragget, Co. Kilkenny E246144 N171845. Located 720m to the West of the proposed line route.

9.3.6.8 Areas of Geological Heritage Importance

The GSI was consulted in relation to any areas of geological heritage or interest located in the study area[17]. According to the GSI, there are three sites of geological interest in the vicinity of the proposed line route. These are as follows:

- Ballyragget Quarry (Grid Reference 245800 168700). Located 100m to the West of the proposed line route. This is a working aggregate quarry and according to the GSI exposes good sections of Ballyadams Formation limestone (upper Lower Carboniferous). This is a geologically interesting location for viewing young Dinantian rocks of the Lower Carboniferous.
- Dunmore Cave (Grid Reference 250900 165000). Located 1.4km to the South-West of the proposed line route. This is a large show cave and is a rare Irish example of a cave that has been formed directly by glacial meltwaters, rather than solution caused by the presence of groundwater.
- Ballyfoyle Channels (Grid Reference 252600 164300). Located 2.8km to the South-West of the proposed line route. This extensive site represents a series of five north-south trending subglacial deeply incised channels, known as Nye channels, which deeply cut into the surrounding bedrock. Their formation is dictated by the permeability and erosional strength of the underlying bedrock.

9.3.6.9 Geotechnical and Slope Stability

The line route passes through an undulating topography ranging from 50m – 334m AOD. In areas with sloping ground, the composition and extent of the superficial geology affects the stability of the slopes and therefore the potential for slippage.

There are two key types of deposits along the line route that can be characterised by generic degrees of consolidation. These are the Glacial Till and Alluvium deposits described below. The actual consolidation of deposits varies considerably based on a wide range of factors at the local level.

Glacial Till: The majority of the line route crosses an area covered by glacial till deposits commonly comprising sandstone and shale till. See Section 9.3.6.3. These deposits are generally consolidated although this varies between deposits.

Alluvium: Sections of the line route cross areas of fluvio-glacial deposits comprising Alluvium. These occur in the townlands such as Archesrath, Brownstown and Eagleshill. Other significant deposits occur along the river courses of the River Nore and the Dinin River and their tributaries. Alluvial subsoils consist of gravel, sand, silt or clay in a variety of mixes and usually consists of a fairly high percentage of organic carbon (10%-30%).

9.3.7 UNIT 7 - A NEW 110KV BAY IN THE EXISTING KILKENNY 110KV STATION

9.3.7.1 Topography and Geomorphology

The existing Kilkenny 110kV Substation is situated approximately 3km South East of Kilkenny City. It is on the Southern end of the Ballyragget-Kilkenny 110kV overhead line. The site is located adjacent to the R712 secondary road. The site is low-lying at 50-60m AOD.

9.3.7.2 Soils

The EPA ENVison database was reviewed in relation to soils[15]. Figure 9.18 shows the range of different soil types underlying the area where the existing Kilkenny substation is located, shown at the southern end of the proposed Ballyragget-Kilkenny 110kV overhead line. The principal soil group underlying the site is BminPD - Surface Water Gleys derived from calcareous parent.

9.3.7.3 Quaternary Geology

Figure 9.20 highlights the subsoil type underlying the proposed substation. With reference to the EPA ENVison database[15], the subsoils are comprised of Limestone Till (TLs).

The GSI Well Card Index[14] for the wells in the vicinity of the proposed line route is shown in Table 9.12. The DTB and hence the depth of the soil/subsoil varies from 1.5m bgl to 25.9m bgl, this is dependent on the underlying subsoil and the topography for the area. The nearest well to the substation is Well No. 116 which is located approx. 500m to the South. The DTB for this well is 8.2m.

Number	GSI Code	Easting	Northing	Townland	DTB
108	2315SEW223	254680	156500	HIGGINSTOWN	12.2
109	2315SEW224	254740	156490	HIGGINSTOWN	25.9
110	2315SEW225	254820	156080	TEMPLEMARTIN	-
111	2315SEW226	255080	156160	TEMPLEMARTIN	-
112	2315SEW246	254450	155400	LYRATH	1.5
113	2315SEW254	255170	155440	TEMPLEMARTIN	12.8
114	2315SEW255	255030	154830	LAVISTOWN	6.4
115	2315SEW256	255720	154360	HIGHRATH	-
116	2315SEW258	256330	153820	MADDOCKSTOWN	8.2
117	2315SEW351	256010	154010	MADDOCKSTOWN	-

Table 9.12 GSI Well Data for Study Area showing DTB

9.3.7.4 Bedrock Geology

An inspection of the GSI [7,8,9] records shows the proposed substation to be underlain by the Butlersgrove Formation; this is described as a very dark-grey argillaceous limestone. See Figure 9.24 for bedrock geology.

9.3.7.5 Karst Features

The Karst database held by the GSI was consulted. This database holds records of locations and types of reported Karst features. The GSI database shows no record of any karst features adjacent to the substation[13].

9.3.7.6 Economic Geology

The EPA Extractive Industries Register[16] was reviewed. This register is required under the *Waste Management (Management of Waste from the Extractive Industries) Regulations 2009 (S.I. No. 566 of 2009).* No quarries are located in the vicinity of the proposed substation site.

9.3.7.7 Landfills and Licenced Sites

The EPA has a database of waste and Integrated Pollution Prevention Control (IPPC) licenced activities in Ireland. The database shows there is no waste or IPPC licenced activities at substation site. Two IPPC facilities – NN Euroball Ireland Limited (Register No. P0313-01) and Tex Tech Industries (Register No. P0258-01) are located 1.7km to the South West of the substation site in Kilkenny City.

9.3.7.8 Areas of Geological Heritage Importance

The GSI was consulted in relation to any areas of geological heritage or interest located in the study area[17]. According to the GSI, there is one site of geological interest in the vicinity of the substation site. This is as follows:

- Archersgrove Quarry (Grid Reference 251900 154800). Located 4km to the West of the substation site. This quarry shows the remaining faces of a disused quarry showing Lower Carboniferous limestone. The exposed faces display widely spaced horizontal bedding and vertical jointing, which made the limestone ideal for dimension stone quarrying in the past. Some fossils can be observed on the visible rock faces, mainly solitary corals and occasional brachiopods. This disused quarry is thought to be the first location where the Kilkenny Black Marble was quarried in Ireland.

9.3.7.9 Geotechnical and Slope Stability

In areas with sloping ground, the composition and extent of the superficial geology affects the stability of the slopes and therefore the potential for slippage. The substation is located in a low lying area therefore there is no risk of slippage.

The actual consolidation of deposits varies considerably based on a wide range of factors at the local level. Glacial Till is present in the area. Glacial Till deposits are generally consolidated although this varies between deposits.

9.3.8 UNIT 8 - MODIFICATIONS TO EXISTING ATHY-PORTLAOISE 110KV LINE

9.3.8.1 Topography and Geomorphology

The proposed route passes through areas that are largely agricultural and are 100-120m AOD. The route lies in the townlands of Orchard Lower, Coolnabacky, Brocknagh, Money Lower, Loughteeog (at Money Cross Roads) and Powelstown.

9.3.8.2 Soils

The EPA ENVison database was reviewed in relation to soils[15]. The soils distribution across the proposed line route varied. The distribution is provided in Figure 9.25. The principal soil groups are as follows:

- AlluvMIN - Mineral alluvium
- BminSP - Shallow poorly drained mineral, derived from mainly calcareous parent materials. Surface water Gleys (shallow) and Ground water Gleys (shallow) included within this group.
- BminDW- Grey Brown Podzolics / Brown Earths Basic
- BminSW - Renzinas / Lithosols

A description of these soil types are found in Section 9.3.5.2.

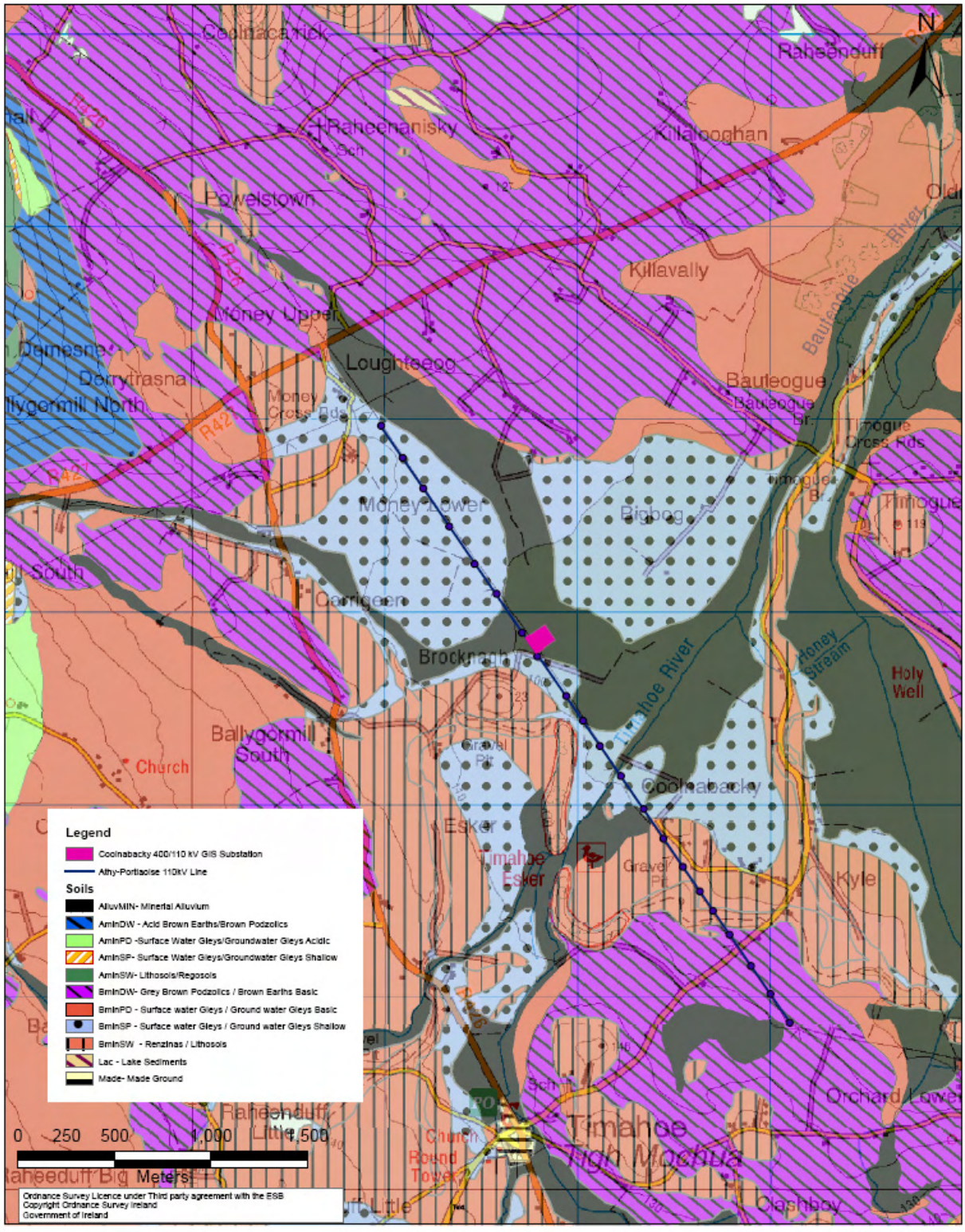
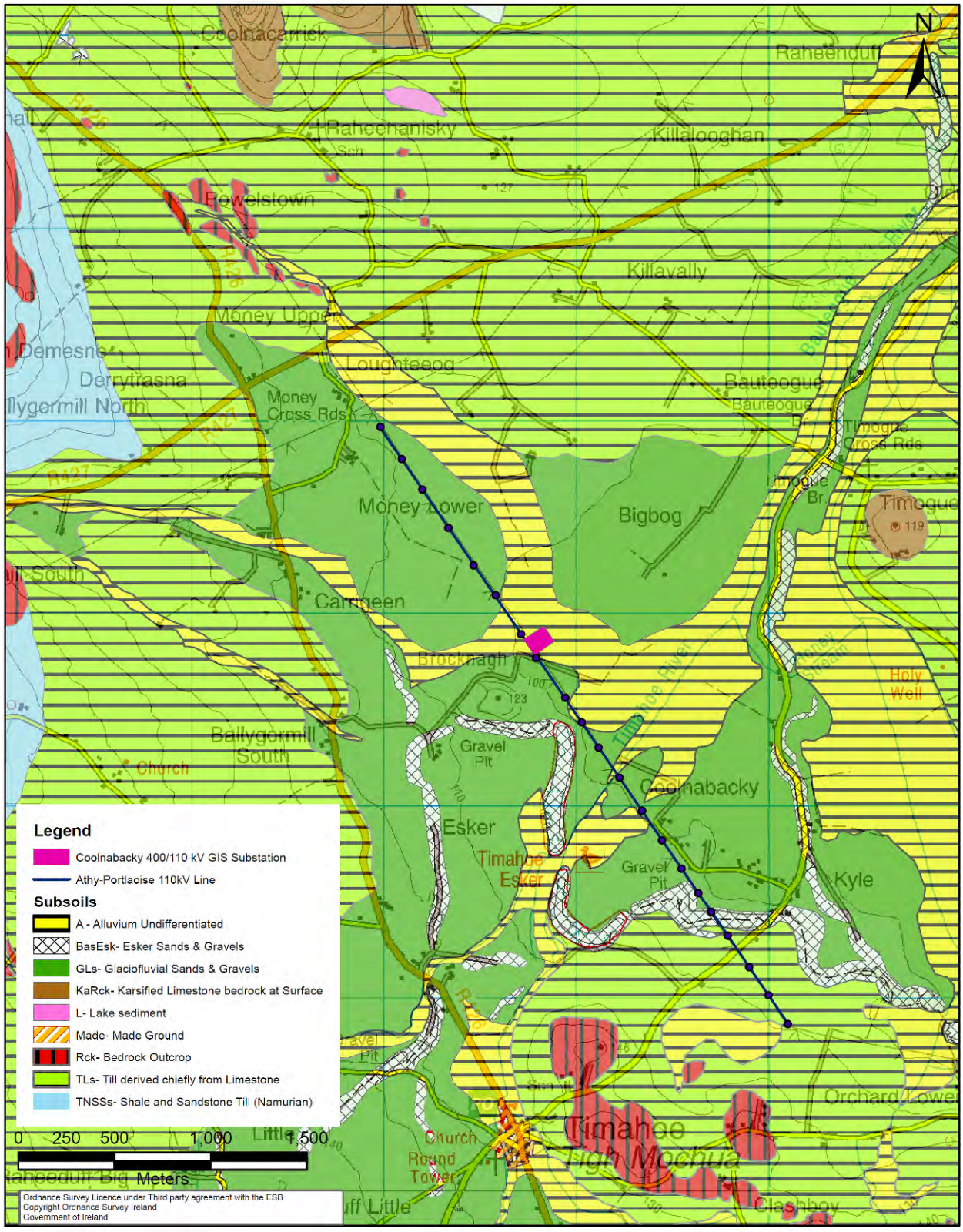


Figure 9.25 Soils underlying the Athy-Portlaoise 110kV line

9.3.8.3 Quaternary Geology

Figure 9.26 highlights the different subsoil types underlying the proposed line route. With reference to the EPA ENVison database [15], the subsoils comprise primarily of glacial till derived chiefly from Limestone, glaciofluvial sand and gravels and alluvium. See Section 9.3.5.3 for a description of each subsoil type.



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CLIENT: ESBI Engineering

PROJECT:

DRAWING TITLE: Subsoils underlying the Athy-Portlaoise 110kV line

REVISION DESCRIPTION

DRAWN	CHECKED	APPROVED	APPD DATE
D.C	B.T	B.T	24/09/12

No. of Shts	SIZE	SCALE
1 of 1	A4	1:25,000

DRAWING NUMBER SHEET REV

Figure 9.26 Subsoils underlying the Athy-Portlaoise 110kV line

The GSI Well Card Index[14] for the wells in the vicinity of the site was reviewed. 8 no. wells were located in the townlands of Killalooghan, Killavally, Loughteeog, Kyle, Timahoe and Clashboy. See Figure 9.21. No information is available on DTB and hence none available for the depth of the soil/subsoil.

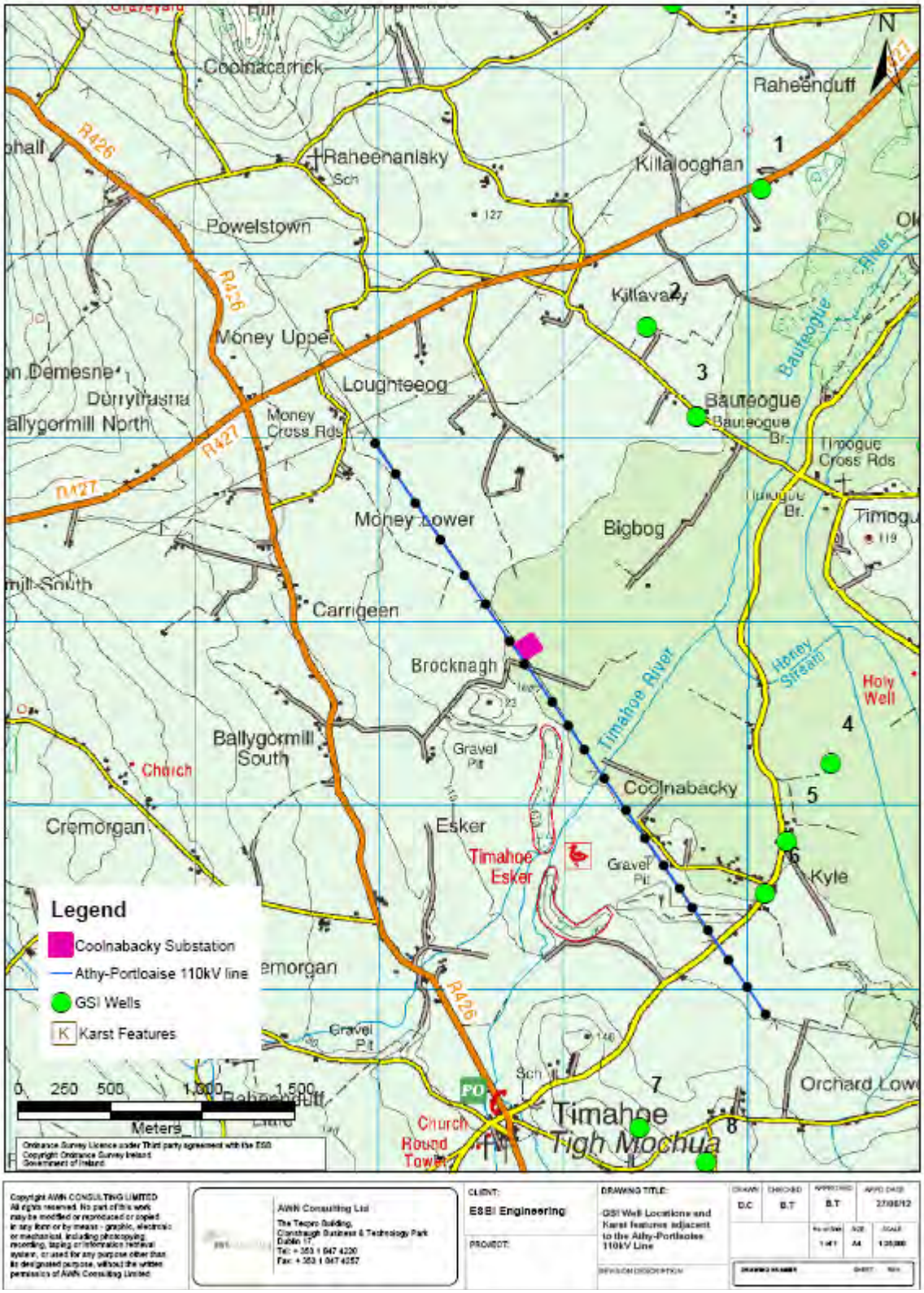

Figure 9.27 GSI Well Locations adjacent to the Athy-Portlaoise 110kV line

9.3.8.4 Bedrock Geology

An inspection of the GSI [7,8,9] records shows the proposed line route to be mainly underlain by the Ballyadams Formation, with the Clogrenan Formation noted to the North and South, as shown in Figure 9.28.

The Ballyadams Formation consists of a grey thick bedded crinoidal calcarenitic wackstone and packstone limestone with clay wayboards towards the top. It comprises water-bearing units of pure limestone and dolomitised limestone and Calp. The dolomitisation is not complete and therefore there may be areas of dolomitized limestone that act as aquitards.

The Clogrenan Formation consists of shelf limestones with abundant chert in bands and nodules in varying concentrations vertically. Fossils occur, concentrated in horizons where they are locally abundant. The Clogrenan Formation is also karstified and occupies the central part of the catchment i.e. South of the Ballyadams Formation and North of the Upper Carboniferous strata.

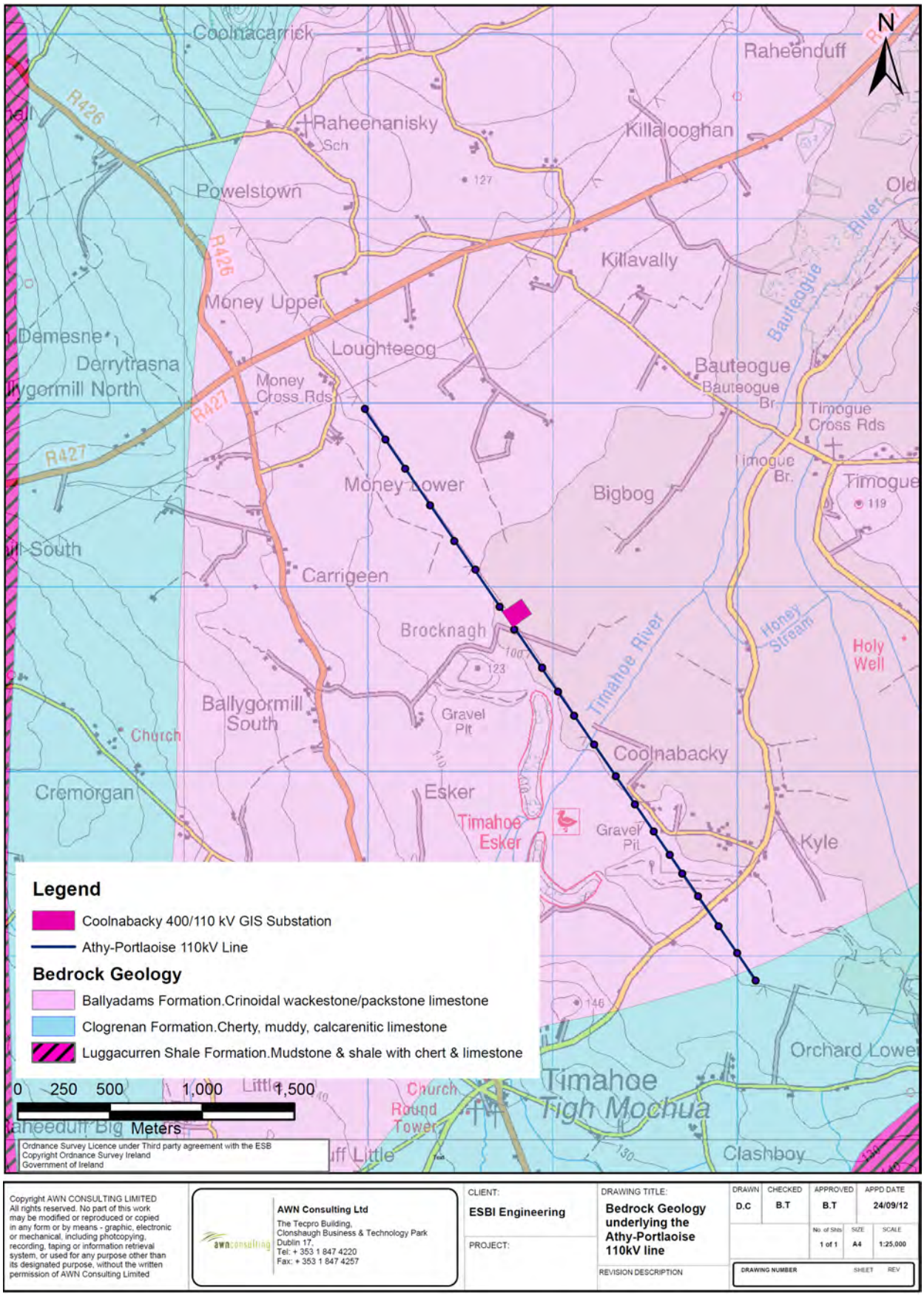

Figure 9.28 Bedrock Geology underlying the Athy-Portlaoise 110kV line

9.3.8.5 Karst Features

The Karst database held by the GSI was consulted. This database holds records of locations and types of reported Karst features. The GSI database shows no record of any karst features at or in the vicinity of the proposed line route.

9.3.8.6 Economic Geology

The EPA Extractive Industries Register[16] was reviewed. There is a sand and gravel quarry located 160m. South West of the proposed Coolnabacky substation site and proposed Athy-Portlaoise 110kV line route. This quarry is registered under the National Register of Extractive Industries. This register is required under the *Waste Management (Management of Waste from the Extractive Industries) Regulations 2009 (S.I. No. 566 of 2009).* The Quarry Register Number is QS-00496. The site location is 253589.36E, 192513.53N.

9.3.8.7 Landfills and Licenced Sites

The EPA has a database of waste and Integrated Pollution Prevention Control (IPPC) licenced activities in Ireland. The database shows there is no waste or IPPC licenced activities along the line route.

9.3.8.8 Areas of Geological Heritage Importance

The GSI was consulted in relation to any areas of geological heritage or interest located in the study area[17]. According to the GSI, there are 2 no. sites of geological interest that lie within the vicinity of the proposed line route - Timahoe Esker and the Kyle Spring. See Section 9.3.1.8 for description of the Timahoe Esker.

The Kyle Spring is located 1.5km East of the proposed line route (Grid Ref. 255450 192230). The spring lies in an extensive alluvial flat, which is drained by two main canalised streams: the Crooked River drains the eastern side of the flat, and the Timahoe/Bauteogue River drains the western side (west of the Timahoe-Stradbally road). The spring itself discharges into an unnamed stream which runs parallel to the Crooked River and then joins it about 1km North of the spring. North of Timogue Bridge, Crooked River becomes the Timogue River. Just South of Stradbally, the Bauteogue and Timogue join to become the Stradbally River.

9.3.8.9 Geotechnical and Slope Stability

In areas with sloping ground, the composition and extent of the superficial geology affects the stability of the slopes and therefore the potential for slippage. The proposed line route passes through agricultural land, gently undulating at 100-120m AOD. There is no risk of slippage due to lack of gradient along the proposed line route.

The actual consolidation of deposits varies considerably based on a wide range of factors at the local level. Glacial Till deposits are generally consolidated although this varies between deposits. Alluvium deposits are generally more loosely consolidated than glacial till deposits however as with other deposits. These are described in Section 9.3.6.9.

9.4 POTENTIAL IMPACT

9.4.1 DO NOTHING IMPACT

If the proposed development does not proceed, agricultural activities are likely to continue at the proposed substation sites and line routes. The type of agricultural activity would dictate the potential impact on the underlying soils. The underlying geology will be expected to remain the same.

9.4.2 POTENTIAL IMPACT FROM PROJECT

The potential impacts of the construction and operational phases of the proposed Reinforcement Project on the soil and geological environment are outlined in the following sections.

Due to the inter-relationship between soils and geology and water (hydrology and hydrogeology) the following impacts discussed will be considered applicable to both. Waste Management is also considered an interaction in some sections.

9.4.3 UNIT 1 - NEW 400/110KV GIS SUBSTATION AT COOLNABACKY TOWNLAND, CO. LAOIS

9.4.3.1 Construction Phase

The soil and geology impacts likely to arise during the construction phase of the proposed Coolnabacky 400/110kV substation are associated with the excavation, handling, storage, transport and re-use of soil, subsoil and are local in nature. The depth of excavation works will be limited to 2.5m bgl therefore, based on the results of the site investigations, [11,12] bedrock will not be encountered.

The potential impacts have been assessed under the following headings:

- Degradation of soils and/or subsoils
- Excavation of soils and/or subsoils
- Contamination of soils and/or subsoils
- Management of excavated materials
- Waste Management
- Proximity to Site of Geological Interest

Degradation of soils and/or subsoils

During the construction phase, there will be a large volume of machinery on site, which may include diesel powered trucks, excavators, cranes and graders. Movement of the machinery during site works can give rise to physical or chemical damage to soil and underlying subsoil in the confined area. Increased compaction by machinery destroys soil structure and reduces subsoil drainage, which in turn leads to water logging and increased runoff. Placement of excavated soil in oversized temporary stockpiles may also result in damage to existing soil structure.

It is expected that vehicles used on the site will be refuelled at a nearby service station. In addition, vehicle maintenance and repairs are expected to take place off-site. When necessary, a mobile fuel bowser may be brought onto the site for refuelling operations. Storage of minor quantities of fuel and oils is anticipated on the site.

In relation to the degradation of soils and/or subsoils the potential impact is considered to be ***Long term - Slight.***

Excavation of soils and/or subsoils

Construction of the proposed substation requires local excavation and disturbance of undisturbed soil and subsoil and replacing excavated materials with a similar volume of concrete and/or hardcore backfill.

The construction of the proposed 400/110kV substation will leave a volume of approximately 11,600m^3 of material to be stored in berms. This figure includes the spoil material to be transported from the proposed Ballyragget substation site (Unit 4).

Where existing soil and/or subsoil are disturbed, excavated and/or stored for re-use during construction, they are prone to erosion by surface water runoff. In the absence of any active management of surface water runoff during the construction phase of the proposed substation, there is potential for sediment laden surface water runoff to discharge to existing watercourses.

The magnitude of the overall impact associated with erosion of soil and subsoil prior to mitigation will typically be low during the construction phase as the scale and depth of construction excavations will generally be limited to 2.5m bgl.

In relation to the excavation of soils and/or subsoils the potential impact is considered to be ***Permanent - Slight.***

Contamination of soils and/or subsoils

Local removal of the upper soil layers will occur during the construction of the proposed substation. It is understood that the risk of land contamination is considered to be low based on the existing land use (agricultural) and the findings of the intrusive site investigations[11,12]. However, if contaminated soil or subsoil is encountered, the associated excavation, handling and transport of this material could result in mobilisation of contaminants, increasing the extent or degree of contamination in surrounding areas.

Concrete operations carried out at during construction activities could lead to a discharge of wastewaters to the ground. Concrete (specifically, the cement component) is highly alkaline and any spillage has a potential impact on the underlying soil/subsoil.

The storage and handling of fuels and lubricants for plant and machinery and non-hazardous or hazardous liquid and solid wastes during the construction phase of the proposed line route will increase the risk of an accident, spill or leak. This increases the risk of contamination for soil and/or subsoil.

In relation to the contamination of soils and/or subsoils the potential impact is considered to be ***Long term – Moderate.***

Management of excavated materials

If the excavated materials cannot be re-used immediately for construction, it will be necessary to dispose of, re-use the material off-site and/or temporarily store these materials during the construction phase.

Although much of the subsoil remaining in situ will generally provide a competent foundation, localised pockets of water softened mineral subsoil will require excavation and replacement, where encountered.

It may be necessary to temporarily stockpile materials excavated in the course of utility works, earthworks or track foundation construction at off-site locations, pending recovery or re-use within the proposed substation. The temporary storage and recovery of excavated subsoil at an off-site location is classified as a waste activity under the *Waste Management Act 1996 (as amended)* and associated regulations.

Excavated soil and/or subsoil, if loosely placed and left unmanaged, will be prone to erosion by rainfall and/or surface water runoff. If runoff with high levels of suspended solids is discharged to adjoining local watercourses, it may also have impacts on water quality. These impacts, were they to arise, would most likely be of temporary to short/medium-term duration.

In relation to the management of excavated materials the potential impact is considered to be ***Short term – Slight.***

Waste Management

During the construction phase of the proposed substation, various activities will result in the generation of waste material and the management of this waste will impact on both the study area and outside the study area at the disposal location(s). Due to the nature of the development the overall waste volumes will be low. It is expected that the majority of waste will arise from the removal of existing overburden.

Due to the agricultural nature of the land use, the likelihood of hazardous waste being encountered during the construction phase is low; however, if encountered, it has the potential to lead to soil or groundwater contamination if not properly planned for, stored, transported and disposed of.

In relation to waste management the potential impact is considered to be ***Short term – Slight.***

Proximity to Site of Geological Interest

The Timahoe Esker lies within the vicinity of the proposed substation (located 250m. south). Due to quarrying activities, some of the site features were removed impairing the integrity of the esker, hence its recommendation for CGS only. Eskers of CGS importance, which would have been partly obliterated by past quarrying, have a lesser value in terms of geological heritage but are still important at local level. There is a potential impact on the Timahoe Esker if parts of the sites geological features have to be dug up and therefore altered or removed.

In relation to the proximity of construction to the Site of Geological Interest the potential impact is considered to be ***Short term – Imperceptible.***

9.4.3.2 Operational Phase

There is potential for leakage from the transformers on site, which could cause localised contamination if it enters the soils environment.

Due to the nature of the development, there will be machinery periodically on the site at a given time. This may lead to occasional accidental emissions, in the form of oil, petrol or diesel leaks, which could cause contamination if they enter the underlying soils or landscaped areas within the substation compound.

In relation to the operational phase, the potential impact on the soils and geology is ***Long term - Moderate.***

9.4.4 UNIT 2 - NEW CONNECTION TO COOLNABACKY FROM THE EXISTING MONEYPOINT-DUNSTOWN 400KV LINE

9.4.4.1 Construction Phase

The soil and geology impacts likely to arise during the construction phase of the proposed line route are associated with the excavation, handling, storage, transport and re-use of soil, subsoil and bedrock (if present) and are local in nature. The depth of excavation works will be limited to between 1.5-3.1m bgl for the masts.

The potential impacts have been assessed under the following headings:

- Degradation of soils and/or subsoils
- Excavation of soils and/or subsoils
- Contamination of soils and/or subsoils
- Management of excavated materials
- Waste Management
- Proximity to Site of Geological Interest

Degradation of soils and/or subsoils

See text under Section 9.4.3 *Degradation of soils and/or subsoils*.

Excavation of soils and/or subsoils

Construction of the proposed masts requires local excavation and disturbance of undisturbed soil and subsoil and replacing excavated materials with a similar volume of excavated material, concrete and/or hardcore backfill.

The construction of the proposed Masts will require the excavation and removal of 930.56m^3 of soil/subsoil which will be filled with concrete foundations for the masts.

Where existing soil and/or subsoil are disturbed, excavated and/or stored for re-use during construction, they are prone to erosion by surface water runoff. In the absence of any active management of surface water runoff during the construction phase of the proposed line route, there is potential for sediment laden surface water runoff to discharge to existing watercourses.

The magnitude of the overall impact associated with erosion of soil and subsoil prior to mitigation will typically be low during the construction phase as the scale and depth of construction excavations will generally be limited to 3.1m bgl.

In relation to the excavation of soils and/or subsoils the potential impact is considered to be ***Permanent - Slight.***

Contamination of soils and/or subsoils

Local removal of the upper soil layers will occur during the construction of the proposed line route. It is understood that the risk of land contamination is considered to be low based on the existing land use (agricultural). However, if contaminated soil or subsoil is encountered, the associated excavation, handling and transport of this material could result in mobilisation of contaminants, increasing the extent or degree of contamination in surrounding areas.

Concrete operations carried out at during construction activities could lead to a discharge of wastewaters to the ground. Concrete (specifically, the cement component) is highly alkaline and any spillage has a potential impact on the underlying soil/subsoil.

The storage and handling of fuels and lubricants for plant and machinery and non-hazardous or hazardous liquid and solid wastes during the construction phase of the proposed line route will increase the risk of an accident, spill or leak. This increases the risk of contamination for soil and/or subsoil.

In relation to the contamination of soils and/or subsoils the potential impact is considered to be ***Long term – Moderate.***

Management of excavated materials

If the excavated materials cannot be re-used immediately for construction, it will be necessary to dispose of, re-use the material off-site and/or temporarily store these materials during the construction phase.

Although much of the bedrock/subsoil remaining in situ will generally provide a competent foundation, localised pockets of water softened mineral subsoil will require excavation and replacement, where encountered. These excavated materials may also have to be disposed of, re-used off-site or temporarily stored during the construction phase.

It may be necessary to temporarily stockpile materials excavated in the course of utility works, earthworks or track foundation construction at off-site locations, pending recovery or re-use within the proposed line route. The temporary storage and recovery of excavated subsoil at an off-site location is classified as a waste activity under the *Waste Management Act 1996 (as amended)* and associated regulations.

Excavated soil and/or subsoil, if loosely placed and left unmanaged, will be prone to erosion by rainfall and/or surface water runoff. If runoff with high levels of suspended solids is discharged to adjoining local watercourses, it may also have impacts on water quality. These impacts, were they to arise, would most likely be of temporary to short/medium-term duration.

In relation to the management of excavated materials the potential impact is considered to be ***Short term – Slight.***

Waste Management

During the construction phase, various activities will result in the generation of waste material and the management of this waste will impact on both the study area and outside the study area at the disposal location(s). Due to the nature of the development the overall waste volumes will be low. It is expected that the majority of waste will arise from the removal of existing overburden.

Due to the agricultural nature of the land use, the likelihood of hazardous waste being encountered during the construction phase is low; however, if encountered, it has the potential to lead to soil or groundwater contamination if not properly planned for, stored, transported and disposed of.

In relation to waste management the potential impact is considered to be ***Short term – Slight.***

Proximity of construction to Site of Geological Interest

The Timahoe Esker lies within the vicinity of the proposed line route (located 250m. South of the proposed Coolnabacky substation). Due to quarrying activities, some of the site features were removed impairing the integrity of the esker, hence its recommendation for CGS only. Eskers of CGS importance, which would have been partly obliterated by past quarrying, have a lesser value in terms of geological heritage but are still important at local level. There is a potential impact on the Timahoe Esker if parts of the sites geological features have to be dug up and therefore altered or removed.

In relation to the proximity of construction to Site of Geological Interest the potential impact is considered to be ***Short term – Imperceptible.***

9.4.4.2 Operational Phase

There will be no direct discharges to the soils and geology environment during the operational phase.

Due to the nature of the development, there will be machinery periodically on the site at a given time. This may lead to occasional accidental emissions, in the form of oil, petrol or diesel leaks, which could cause contamination if they enter the underlying soils.

In relation to the operational phase the potential impact on the soils and geology is considered to be ***Long term – Moderate.***

9.4.5 UNIT 3 NEW CONNECTION TO COOLNABACKY FROM THE EXISTING ATHY-PORTLAOISE 110KV LINE

9.4.5.1 Construction Phase

The soil and geology impacts likely to arise during the construction phase of the proposed cable route are associated with the excavation, handling, storage, transport and re-use of soil and subsoil and are local in nature. There are a number of different trench cross sections that may be installed along the proposed route depending on the type of circuit being installed. The typical width of the trench is from 0.6m to 1.1m. The maximum depth of excavation is 1.25m bgl therefore, based on the results of the site investigations, [11,12] bedrock will not be encountered.

The potential impacts have been assessed under the following headings:

- Degradation of soils and/or subsoils
- Excavation of soils and/or subsoils
- Contamination of soils and/or subsoils
- Management of excavated materials
- Waste Management
- Proximity to Site of Geological Interest

Degradation of soils and/or subsoils

See text under Section 9.4.3 *Degradation of soils and/or subsoils*.
Excavation of soils and/or subsoils

Construction of the proposed cable connection route requires local excavation and disturbance of undisturbed soil and subsoil and replacing excavated materials with a similar volume of concrete and/or hardcore backfill and/or excavated material.

The construction of the proposed cable connection will require the excavation of 158.4m³ of soil/subsoil.

Where existing soil and/or subsoil are disturbed, excavated and/or stored for re-use during construction, they are prone to erosion by surface water runoff. In the absence of any active management of surface water runoff during the construction phase of the proposed cable route, there is potential for sediment laden surface water runoff to discharge to existing watercourses.

The magnitude of the overall impact associated with erosion of soil and subsoil prior to mitigation will typically be low during the construction phase as the scale and depth of construction excavations will generally be limited to 1.25m bgl.

In relation to the excavation of soils and/or subsoils the potential impact is considered to be ***Permanent - Slight.***

Contamination of soils and/or subsoils

Local removal of the upper soil layers will occur during the construction of the proposed cable route. It is understood that the risk of land contamination is considered to be low based on the existing land use (agricultural). However, if contaminated soil or subsoil is encountered, the associated excavation, handling and transport of this material could result in mobilisation of contaminants, increasing the extent or degree of contamination in surrounding areas.

The storage and handling of fuels and lubricants for plant and machinery and non-hazardous or hazardous liquid and solid wastes during the construction phase will increase the risk of an accident, spill or leak. This increases the risk of contamination for soil and/or subsoil.

In relation to the contamination of soils and/or subsoils the potential impact is considered to be ***Long term – Moderate.***

Management of excavated materials

If the excavated materials cannot be re-used immediately for construction, it will be necessary to dispose of, re-use the material off-site and/or temporarily store these materials during the construction phase.

Although much of the subsoil remaining in situ will generally provide a competent foundation, localised pockets of water softened mineral subsoil will require excavation and replacement, where encountered. These excavated materials may also have to be disposed of, re-used off-site or temporarily stored during the construction phase.

It may be necessary to temporarily stockpile materials excavated in the course of utility works, earthworks or track foundation construction at off-site locations, pending recovery or re-use within the proposed connection route. The temporary storage and recovery of excavated subsoil at an off-site location is classified as a waste activity under the *Waste Management Act 1996 (as amended)* and associated regulations.

Excavated soil and/or subsoil, if loosely placed and left unmanaged, will be prone to erosion by rainfall and/or surface water runoff. If runoff with high levels of suspended solids is discharged to adjoining local

watercourses, it may also have impacts on water quality. These impacts, were they to arise, would most likely be of temporary to short/medium-term duration.

In relation to the management of excavated materials the potential impact is considered to be ***Short term – Slight.***

Waste Management

During the construction phase, various activities will result in the generation of waste material and the management of this waste will impact on both the study area and outside the study area at the disposal location(s). Due to the nature of the development the overall waste volumes will be low. It is expected that the majority of waste will arise from the removal of existing overburden.

Due to the agricultural nature of the land use, the likelihood of hazardous waste being encountered during the construction phase is low; however, if encountered, it has the potential to lead to soil or groundwater contamination if not properly planned for, stored, transported and disposed of.

In relation to waste management the potential impact is considered to be ***Short term – Slight.***

Proximity of construction to Site of Geological Interest

The Timahoe Esker lies within the vicinity of the proposed cable route (located 250m. south). Due to quarrying activities, some of the site features were removed impairing the integrity of the esker, hence its recommendation for CGS only. Eskers of CGS importance, which would have been partly obliterated by past quarrying, have a lesser value in terms of geological heritage but are still important at local level. There is a potential impact on the Timahoe Esker if parts of the sites geological features have to be dug up and therefore altered or removed.

In relation to the proximity of construction to Site of Geological Interest the potential impact is considered to be ***Short term – Imperceptible.***

9.4.5.2 Operational Phase

There will be no direct discharges to the soils and geology environment during the operational phase.

Due to the nature of the development, there will be machinery periodically on the site at a given time. This may lead to occasional accidental emissions, in the form of oil, petrol or diesel leaks, which could cause contamination if they enter the underlying soils.

In relation to the operational phase the potential impact on the soils and geology is considered to be ***Long term – Moderate.***

9.4.6 UNIT 4 - A NEW 110KV / 38KV / MV SUBSTATION IN BALLYRAGGET, CO. KILKENNY

9.4.6.1 Construction Phase

The soil and geology impacts likely to arise during the construction phase of the proposed Ballyragget 110kV substation are associated with the excavation, handling, storage, transport and re-use of soil, subsoil and are local in nature. The depth of excavation works will be limited to 2.5m bgl therefore, based on the results of the site investigation, [11] bedrock will not be encountered.

The potential impacts have been assessed under the following headings:

- Degradation of soils and/or subsoils
- Excavation of soils and/or subsoils
- Contamination of soils and/or subsoils
- Management of excavated materials

- Waste Management

Degradation of soils and/or subsoils

See text under Section 9.4.3 *Degradation of soils and/or subsoils*.

Excavation of soils and/or subsoils

Construction of the proposed substation requires local excavation and disturbance of undisturbed soil and subsoil and replacing excavated materials with a similar volume of concrete and/or hardcore backfill. The construction of the proposed 110kV substation will require the excavation of approximately 3600m^3.

Excess spoil will be transported to the proposed Coolnabacky substation site for reuse. Transport will be carried out by a licenced waste contractor.

Where existing soil and/or subsoil are disturbed, excavated and/or stored for re-use during construction, they are prone to erosion by surface water runoff. In the absence of any active management of surface water runoff during the construction phase of the proposed substation, there is potential for sediment laden surface water runoff to discharge to existing watercourses.

The magnitude of the overall impact associated with erosion of soil and subsoil prior to mitigation will typically be low during the construction phase as the scale and depth of construction excavations will generally be limited to 1.5m.

In relation to the excavation of soils and/or subsoils the potential impact is considered to be ***Permanent - Slight.***

Contamination of soils and/or subsoils

Local removal of the upper soil layers will occur during the construction of the proposed substation. It is understood that the risk of land contamination is considered to be low based on the existing land use (agricultural) and the lab analysis results carried out as part of the intrusive site investigation[11]. However, if contaminated soil or subsoil is encountered, the associated excavation, handling and transport of this material could result in mobilisation of contaminants, increasing the extent or degree of contamination in surrounding areas.

Concrete operations carried out at during construction activities could lead to a discharge of wastewaters to the ground. Concrete (specifically, the cement component) is highly alkaline and any spillage has a potential impact on the underlying soil/subsoil.

The storage and handling of fuels and lubricants for plant and machinery and non-hazardous or hazardous liquid and solid wastes during the construction phase of the proposed line route will increase the risk of an accident, spill or leak. This increases the risk of contamination for soil and/or subsoil.

In relation to the contamination of soils and/or subsoils the potential impact is considered to be ***Long term – Moderate.***

Management of excavated materials

If the excavated materials cannot be re-used immediately for construction, it will be necessary to dispose of, re-use the material off-site and/or temporarily store these materials during the construction phase.

Although much of the subsoil remaining in situ will generally provide a competent foundation, localised pockets of water softened mineral subsoil will require excavation and replacement, where encountered. These excavated materials may also have to be disposed of, re-used off-site or temporarily stored during the construction phase.

It may be necessary to temporarily stockpile materials excavated in the course of utility works, earthworks or track foundation construction at off-site locations, pending recovery or re-use within the proposed substation. The temporary storage and recovery of excavated subsoil at an off-site location is classified as a waste activity under the *Waste Management Act 1996 (as amended)* and associated regulations.

Excavated soil and/or subsoil, if loosely placed and left unmanaged, will be prone to erosion by rainfall and/or surface water runoff. If runoff with high levels of suspended solids is discharged to adjoining local watercourses, it may also have impacts on water quality. These impacts, were they to arise, would most likely be of temporary to short/medium-term duration.

In relation to the management of excavated materials the potential impact is considered to be ***Short term – Slight.***

Waste Management

During the construction phase of the proposed substation, various activities will result in the generation of waste material and the management of this waste will impact on both the study area and outside the study area at the disposal location(s). Due to the nature of the development the overall waste volumes will be low. It is expected that the majority of waste will arise from the removal of existing overburden.

Due to the agricultural nature of the land use, the likelihood of hazardous waste being encountered during the construction phase is low; however, if encountered, it has the potential to lead to soil or groundwater contamination if not properly planned for, stored, transported and disposed of.

In relation to waste management the potential impact is considered to be ***Short term – Slight.***

9.4.6.2 Operational Phase

There is potential for leakage from the transformers on site, which could cause localised contamination if it enters the soils environment.

Due to the nature of the development, there will be machinery periodically on the site at a given time. This may lead to occasional accidental emissions, in the form of oil, petrol or diesel leaks, which could cause contamination if they enter the underlying soils or landscaped areas within the substation compound.

In relation to the operational phase, the potential impact on the soils and geology is ***Long term - Moderate.***

9.4.7 UNIT 5 - A NEW 110KV OVERHEAD LINE BETWEEN BALLYRAGGET AND COOLNABACKY

9.4.7.1 Construction Phase

The soil and geology impacts likely to arise during the construction phase of the proposed line route are associated with the excavation, handling, storage, transport along the proposed access tracks and re-use of soil, subsoil and bedrock (if present) and are local in nature. The depth of excavation works will be limited to between 1.5–2.3m bgl for polesets and 1.5-3.1m bgl for typical angle masts.

The potential impacts have been assessed under the following headings:

- Degradation of soils and/or subsoils
- Excavation of soils and/or subsoils
- Contamination of soils and/or subsoils
- Management of excavated materials
- Waste Management

Degradation of soils and/or subsoils

Movement of the machinery during site and access works can give rise to physical or chemical damage to soil and underlying subsoil in the confined area. Increased compaction by machinery destroys soil structure and reduces subsoil drainage, which in turn leads to water logging and increased runoff. Placement of excavated soil in oversized temporary stockpiles may also result in damage to existing soil structure.

It is expected that vehicles used at each location along the proposed line route will be refuelled at a nearby service station. In addition, vehicle maintenance and repairs are expected to take place off-site. When necessary, a mobile fuel bowser may be brought onto the site for refuelling operations. Storage of minor quantities of fuel and oils is anticipated on the site.

In relation to the degradation of soils and/or subsoils the potential impact is considered to be ***Long term - Slight.***

Excavation of soils and/or subsoils

Construction of the proposed line route requires local excavation and disturbance of undisturbed soil and subsoil and replacing excavated materials with a similar volume of concrete and/or hardcore backfill.

The construction of the proposed line route will require the excavation and removal of 1135.68m^3 of soil/subsoil. Where existing soil and/or subsoil are disturbed, excavated and/or stored for re-use during construction, they are prone to erosion by surface water runoff (Interaction with Section 10 Water). In the absence of any active management of surface water runoff during the construction phase of the proposed line route, there is potential for sediment laden surface water runoff to discharge to existing watercourses.

The magnitude of the overall impact associated with erosion of soil and subsoil prior to mitigation will typically be low during the construction phase as the scale and depth of construction excavations will generally be limited to a maximum 3.1m bgl.

In relation to the excavation of soils and/or subsoils the potential impact is considered to be ***Permanent - Slight.***

Contamination of soils and/or subsoils

Local removal of the upper soil layers will occur during the construction of the proposed line route. It is understood that the risk of land contamination is considered to be low based on the existing land use (agricultural). However, if contaminated soil or subsoil is encountered, the associated excavation, handling and transport of this material could result in mobilisation of contaminants, increasing the extent or degree of contamination in surrounding areas.

The proposed line route will utilise wooden poles at many locations and these are currently treated with creosote, which acts as a preservative. There is unlikely to be any significant impact in locations where individual poles or polesets are installed. However, there is a potential for impact to soil where large numbers of poles are stored prior to placement at the works site.

Concrete operations carried out at during construction activities could lead to a discharge of wastewaters to the ground. Concrete (specifically, the cement component) is highly alkaline and any spillage has a potential impact on the underlying soil/subsoil.

The storage and handling of fuels and lubricants for plant and machinery and non-hazardous or hazardous liquid and solid wastes during the construction phase of the proposed line route will increase the risk of an accident, spill or leak. This increases the risk of contamination for soil and/or subsoil.

In relation to the contamination of soils and/or subsoils the potential impact is considered to be ***Long term – Moderate.***

Management of excavated materials

If the excavated materials cannot be re-used immediately for construction, it will be necessary to dispose of, re-use the material off-site and/or temporarily store these materials during the construction phase.

Although much of the bedrock/subsoil remaining in situ will generally provide a competent foundation, localised pockets of water softened mineral subsoil will require excavation and replacement, where encountered. These excavated materials may also have to be disposed of, re-used off-site or temporarily stored during the construction phase.

It may be necessary to temporarily stockpile materials excavated in the course of utility works, earthworks or track foundation construction at off-site locations, pending recovery or re-use within the proposed line route. The temporary storage and recovery of excavated subsoil at an off-site location is classified as a waste activity under the *Waste Management Act 1996 (as amended)* and associated regulations.

Excavated soil and/or subsoil, if loosely placed and left unmanaged, will be prone to erosion by rainfall and/or surface water runoff. If runoff with high levels of suspended solids is discharged to adjoining local watercourses, it may also have impacts on water quality. These impacts, were they to arise, would most likely be of temporary to short/medium-term duration.

In relation to the management of excavated materials the potential impact is considered to be ***Short term – Slight.***

Waste Management

During the construction phase, various activities will result in the generation of waste material and the management of this waste will impact on both the study area and outside the study area at the disposal location(s). Due to the nature of the development the overall waste volumes will be low. It is expected that the majority of waste will arise from the removal of existing overburden.

Due to the agricultural nature of the land use, the likelihood of hazardous waste being encountered during the construction phase is low; however, if encountered, it has the potential to lead to soil or groundwater contamination if not properly planned for, stored, transported and disposed of.

In relation to waste management the potential impact is considered to be ***Short term – Slight.***

9.4.7.2 Operational Phase

There will be no direct discharges to the soils and geology environment during the operational phase.

Due to the nature of the development, there will be machinery periodically on the site at a given time. This may lead to occasional accidental emissions, in the form of paints, oil, petrol or diesel leaks, which could cause contamination if they enter the underlying soils.

The polesets and angle masts use products that have a potential impact on the underlying soils. The timber used in the Polesets is treated with creosote as a preservative. Typical angle masts use concrete for foundations.

In relation to the operational phase the potential impact on the soils and geology is considered to be ***Long term – Moderate.***

9.4.8 UNIT 6 - AN UPRATE OF THE EXISTING BALLYRAGGET-KILKENNY 110KV OVERHEAD LINE

9.4.8.1 Construction Phase

The soil and geology impacts likely to arise during the construction phase of the proposed line route are associated with the excavation, handling, storage, transport along the proposed access tracks and re-use of soil, subsoil and bedrock (if present) and are local in nature. The depth of excavation works will be limited to between 1.5–2.3m bgl for polesets and 1.5-3.1m bgl for typical angle masts.

The potential impacts have been assessed under the following headings:

- Degradation of soils and/or subsoils
- Excavation of soils and/or subsoils
- Contamination of soils and/or subsoils
- Management of excavated materials
- Waste Management
- Proximity to Site of Geological Interest

Degradation of soils and/or subsoils

Movement of the machinery during site works can give rise to physical or chemical damage to soil and underlying subsoil in the confined area. Increased compaction by machinery destroys soil structure and reduces subsoil drainage, which in turn leads to water logging and increased runoff. Placement of excavated soil in oversized temporary stockpiles may also result in damage to existing soil structure.

It is expected that vehicles used at each location on the proposed line route will be refuelled at a nearby service station. In addition, vehicle maintenance and repairs are expected to take place off-site. When necessary, a mobile fuel bowser may be brought onto the site for refuelling operations. Storage of minor quantities of fuel and oils is anticipated on the site.

In relation to the degradation of soils and/or subsoils the potential impact is considered to be ***Long term - Slight.***

Excavation of soils and/or subsoils

Construction of the proposed line route requires local excavation and disturbance of undisturbed soil and subsoil and replacing excavated materials with a similar volume of concrete and/or hardcore backfill.

The construction of the proposed line route will require the excavation and removal of 754.36m^3 of soil/subsoil. Where existing soil and/or subsoil are disturbed, excavated and/or stored for re-use during construction, they are prone to erosion by surface water runoff (Interaction with Section 10 Water). In the absence of any active management of surface water runoff during the construction phase of the proposed line route, there is potential for sediment laden surface water runoff to discharge to existing watercourses.

The magnitude of the overall impact associated with erosion of soil and subsoil prior to mitigation will typically be low during the construction phase as the scale and depth of construction excavations will generally be limited to a maximum 3.1m bgl.

In relation to the excavation of soils and/or subsoils the potential impact is considered to be ***Permanent - Slight.***

Contamination of soils and/or subsoils

Local removal of the upper soil layers will occur during the construction of the proposed line route. It is understood that the risk of land contamination is considered to be low based on the existing land use

(agricultural). However, if contaminated soil or subsoil is encountered, the associated excavation, handling and transport of this material could result in mobilisation of contaminants, increasing the extent or degree of contamination in surrounding areas.

The proposed line route will utilise wooden poles at many locations and these are currently treated with creosote, which acts as a preservative. There is unlikely to be any significant impact in locations where individual poles or polesets are installed. However, there is a potential for impact to soil where large numbers of poles are stored prior to placement at the works site.

Concrete operations carried out at during construction activities could lead to a discharge of wastewaters to the ground. Concrete (specifically, the cement component) is highly alkaline and any spillage has a potential impact on the underlying soil/subsoil.

The storage and handling of fuels and lubricants for plant and machinery and non-hazardous or hazardous liquid and solid wastes during the construction phase of the proposed line route will increase the risk of an accident, spill or leak. This increases the risk of contamination for soil and/or subsoil.

In relation to the contamination of soils and/or subsoils the potential impact is considered to be ***Long term – Moderate.***

Management of excavated materials

If the excavated materials cannot be re-used immediately for construction, it will be necessary to dispose of, re-use the material off-site and/or temporarily store these materials during the construction phase.

Although much of the bedrock/subsoil remaining in situ will generally provide a competent foundation, localised pockets of water softened mineral subsoil will require excavation and replacement, where encountered. These excavated materials may also have to be disposed of, re-used off-site or temporarily stored during the construction phase.

It may be necessary to temporarily stockpile materials excavated in the course of utility works, earthworks or track foundation construction at off-site locations, pending recovery or re-use within the proposed line route. The temporary storage and recovery of excavated subsoil at an off-site location is classified as a waste activity under the *Waste Management Act 1996 (as amended)* and associated regulations.

Excavated soil and/or subsoil, if loosely placed and left unmanaged, will be prone to erosion by rainfall and/or surface water runoff. If runoff with high levels of suspended solids is discharged to adjoining local watercourses, it may also have impacts on water quality. These impacts, were they to arise, would most likely be of temporary to short/medium-term duration.

In relation to the management of excavated materials the potential impact is considered to be ***Short term – Slight.***

Waste Management

During the construction phase, various activities will result in the generation of waste material and the management of this waste will impact on both the study area and outside the study area at the disposal location(s). Due to the nature of the development the overall waste volumes will be low. It is expected that the majority of waste will arise from the removal of existing overburden.

Due to the agricultural nature of the land use, the likelihood of hazardous waste being encountered during the construction phase is low; however, if encountered, it has the potential to lead to soil or groundwater contamination if not properly planned for, stored, transported and disposed of.

In relation to waste management the potential impact is considered to be ***Short term – Slight.***

Proximity to Site of Geological Interest

The GSI was consulted in relation to any areas of geological heritage or interest located in the study area[17]. According to the GSI, there are three sites of geological interest in the vicinity of the proposed line route. These are Ballyragget Quarry, located 100m to the West of the proposed line route Dunmore Cave, located 1.4km to the South-West of the proposed line route and Ballyfoyle Channels, located 2.8km to the South-West of the proposed line route.

In relation to the proximity of construction to Site of Geological Interest the potential impact is considered to be ***Short term – Imperceptible.***

9.4.8.2 Operational Phase

There will be no direct discharges to the soils and geology environment during the operational phase.

Due to the nature of the development, there will be machinery periodically on the site at a given time. This may lead to occasional accidental emissions, in the form of oil, petrol or diesel leaks, which could cause contamination if they enter the underlying soils.

The polesets and angle masts use products that have a potential impact on the underlying soils. Polesets use Creosote as a preservative. Typical angle masts use concrete for foundations.

In relation to the operational phase the potential impact on the soils and geology is considered to be ***Long term – Moderate***

9.4.9 UNIT 7 - A NEW 110KV BAY IN THE EXISTING KILKENNY 110KV STATION

9.4.9.1 Construction Phase

The soil and geology impacts likely to arise during the construction phase of the proposed works at Kilkenny 110kV substation are associated with the excavation, handling, storage, transport and re-use of soil, subsoil and possibly bedrock are local in nature.

The potential impacts have been assessed under the following headings:

- Degradation of soils and/or subsoils
- Excavation of soils and/or subsoils
- Contamination of soils and/or subsoils
- Management of excavated materials
- Waste Management

Degradation of soils and/or subsoils

See text under Section 9.4.3 *Degradation of soils and/or subsoils*.

Excavation of soils and/or subsoils

Construction of the proposed bay at the Kilkenny 110kV substation requires local excavation and disturbance of undisturbed soil and subsoil and replacing excavated materials with a similar volume of concrete and/or hardcore backfill.

The construction works will require the excavation of approximately 20m^3 of soil/subsoil.

Where existing soil and/or subsoil are disturbed, excavated and/or stored for re-use during construction, they are prone to erosion by surface water runoff. In the absence of any active management of surface water runoff during the construction phase of the substation, there is potential for sediment laden surface water runoff to discharge to existing watercourses.

The magnitude of the overall impact associated with erosion of soil and subsoil prior to mitigation will typically be low during the construction phase as the scale and depth of construction excavations will generally be limited to 2m.

In relation to the excavation of soils and/or subsoils the potential impact is considered to be ***Permanent - Slight.***

Contamination of soils and/or subsoils

Local removal of the upper soil layers will occur during the construction works at the substation. It is understood that the risk of land contamination is considered to be low based on the existing land use (agricultural). However, if contaminated soil or subsoil is encountered, the associated excavation, handling and transport of this material could result in mobilisation of contaminants, increasing the extent or degree of contamination in surrounding areas.

Concrete operations carried out at during construction activities could lead to a discharge of wastewaters to the ground. Concrete (specifically, the cement component) is highly alkaline and any spillage has a potential impact on the underlying soil/subsoil.
The storage and handling of fuels and lubricants for plant and machinery and non-hazardous or hazardous liquid and solid wastes during the construction phase will increase the risk of an accident, spill or leak. This increases the risk of contamination for soil and/or subsoil.

In relation to the contamination of soils and/or subsoils the potential impact is considered to be ***Long term – Slight.***

Management of excavated materials

If the excavated materials cannot be re-used immediately for construction, it will be necessary to dispose of, re-use the material off-site and/or temporarily store these materials during the construction phase.

Although much of the bedrock/subsoil remaining in situ will generally provide a competent foundation, localised pockets of water softened mineral subsoil will require excavation and replacement, where encountered. These excavated materials may also have to be disposed of, re-used off-site or temporarily stored during the construction phase.

It may be necessary to temporarily stockpile materials excavated in the course of utility works, earthworks or track foundation construction at off-site locations, pending recovery or re-use within the substation. The temporary storage and recovery of excavated subsoil at an off-site location is classified as a waste activity under the *Waste Management Act 1996 (as amended)* and associated regulations.

Excavated soil and/or subsoil, if loosely placed and left unmanaged, will be prone to erosion by rainfall and/or surface water runoff. If runoff with high levels of suspended solids is discharged to adjoining local watercourses, it may also have impacts on water quality. These impacts, were they to arise, would most likely be of temporary to short/medium-term duration.

In relation to the management of excavated materials the potential impact is considered to be ***Short term – Slight.***

Waste Management

During the construction works at the Kilkenny substation, various activities will result in the generation of waste material and the management of this waste will impact on both the study area and outside the study area at the disposal location(s). Due to the nature of the development the overall waste volumes will be low. It is expected that the majority of waste will arise from the removal of existing overburden.

Due to the agricultural nature of the land use, the likelihood of hazardous waste being encountered during the construction phase is low; however, if encountered, it has the potential to lead to soil or groundwater contamination if not properly planned for, stored, transported and disposed of.

In relation to waste management the potential impact is considered to be ***Short term – Slight.***

9.4.9.2 Operational Phase

Due to the nature of the development, there will be machinery periodically on the site at a given time. This may lead to occasional accidental emissions, in the form of oil, petrol or diesel leaks, which could cause contamination if they enter the underlying soils or landscaped areas within the substation compound.

In relation to the operational phase the potential impact on the soils and geology is considered to be ***Long term – Slight.***

9.4.10 UNIT 8 - MODIFICATIONS TO EXISTING ATHY-PORTLAOISE 110KV LINE

9.4.10.1 Construction Phase

The soil and geology impacts likely to arise during the construction phase of the proposed line route are associated with the excavation, handling, storage, transport and re-use of soil, subsoil and bedrock (if present) and are local in nature. The depth of excavation works will be limited to between 1.5–2.3m bgl for polesets and 1.5-3.1m bgl for typical angle masts.

The potential impacts have been assessed under the following headings:

- Degradation of soils and/or subsoils
- Excavation of soils and/or subsoils
- Contamination of soils and/or subsoils
- Management of excavated materials
- Waste Management
- Proximity to Site of Geological Interest

Degradation of soils and/or subsoils

Movement of the machinery during site works can give rise to physical or chemical damage to soil and underlying subsoil in the confined area. Increased compaction by machinery destroys soil structure and reduces subsoil drainage, which in turn leads to water logging and increased runoff. Placement of excavated soil in oversized temporary stockpiles may also result in damage to existing soil structure.

It is expected that vehicles used on the site will be refuelled at a nearby service station. In addition, vehicle maintenance and repairs are expected to take place off-site. When necessary, a mobile fuel bowser may be brought onto the site for refuelling operations. Storage of minor quantities of fuel and oils is anticipated on the site.

In relation to the degradation of soils and/or subsoils the potential impact is considered to be ***Long term - Slight.***

Excavation of soils and/or subsoils

Construction of the proposed line route requires local excavation and disturbance of undisturbed soil and subsoil and replacing excavated materials with a similar volume of concrete and/or hardcore backfill.

The construction of the proposed line route will require the excavation and removal of 325.1m^3 of soil/subsoil. Where existing soil and/or subsoil are disturbed, excavated and/or stored for re-use during construction, they are prone to erosion by surface water runoff (Interaction with Section 10 Water). In the absence of any active management of surface water runoff during the construction phase of the

proposed line route, there is potential for sediment laden surface water runoff to discharge to existing watercourses.

The magnitude of the overall impact associated with erosion of soil and subsoil prior to mitigation will typically be low during the construction phase as the scale and depth of construction excavations will generally be limited to a maximum 3.1m bgl.

In relation to the excavation of soils and/or subsoils the potential impact is considered to be ***Permanent - Slight.***

Contamination of soils and/or subsoils

Local removal of the upper soil layers will occur during the construction of the proposed line route. It is understood that the risk of land contamination is considered to be low based on the existing land use (agricultural). However, if contaminated soil or subsoil is encountered, the associated excavation, handling and transport of this material could result in mobilisation of contaminants, increasing the extent or degree of contamination in surrounding areas.

The proposed line route will utilise wooden poles at many locations and these are currently treated with creosote, which acts as a preservative. There is unlikely to be any significant impact in locations where individual poles or polesets are installed. However, there is a potential for impact to soil where large numbers of poles are stored prior to placement at the works site.

Concrete operations carried out at during construction activities could lead to a discharge of wastewaters to the ground. Concrete (specifically, the cement component) is highly alkaline and any spillage has a potential impact on the underlying soil/subsoil.

The storage and handling of fuels and lubricants for plant and machinery and non-hazardous or hazardous liquid and solid wastes during the construction phase of the proposed line route will increase the risk of an accident, spill or leak. This increases the risk of contamination for soil and/or subsoil.

In relation to the contamination of soils and/or subsoils the potential impact is considered to be ***Long term – Moderate.***

Management of excavated materials

If the excavated materials cannot be re-used immediately for construction, it will be necessary to dispose of, re-use the material off-site and/or temporarily store these materials during the construction phase.

Although much of the bedrock/subsoil remaining in situ will generally provide a competent foundation, localised pockets of water softened mineral subsoil will require excavation and replacement, where encountered. These excavated materials may also have to be disposed of, re-used off-site or temporarily stored during the construction phase.

It may be necessary to temporarily stockpile materials excavated in the course of utility works, earthworks or track foundation construction at off-site locations, pending recovery or re-use within the proposed line route. The temporary storage and recovery of excavated subsoil at an off-site location is classified as a waste activity under the *Waste Management Act 1996 (as amended)* and associated regulations.

Excavated soil and/or subsoil, if loosely placed and left unmanaged, will be prone to erosion by rainfall and/or surface water runoff. If runoff with high levels of suspended solids is discharged to adjoining local watercourses, it may also have impacts on water quality. These impacts, were they to arise, would most likely be of temporary to short/medium-term duration.

In relation to the management of excavated materials the potential impact is considered to be ***Short term – Slight.***

Waste Management

During the construction phase, various activities will result in the generation of waste material and the management of this waste will impact on both the study area and outside the study area at the disposal location(s). Due to the nature of the development the overall waste volumes will be low. It is expected that the majority of waste will arise from the removal of existing overburden.

Due to the agricultural nature of the land use, the likelihood of hazardous waste being encountered during the construction phase is low; however, if encountered, it has the potential to lead to soil or groundwater contamination if not properly planned for, stored, transported and disposed of.

In relation to waste management the potential impact is considered to be ***Short term – Slight.***

Proximity of construction to Site of Geological Interest

The Timahoe Esker lies within the vicinity of the proposed line route. Due to quarrying activities, some of the site features were removed impairing the integrity of the esker, hence its recommendation for CGS only. Eskers of CGS importance, which would have been partly obliterated by past quarrying, have a lesser value in terms of geological heritage but are still important at local level. There is a potential impact on the Timahoe Esker if parts of the sites geological features have to be dug up and therefore altered or removed.

In relation to the proximity of construction to Site of Geological Interest the potential impact is considered to be ***Short term – Slight.***

9.4.10.2Operational Phase

There will be no direct discharges to the soils and geology environment during the operational phase.

Due to the nature of the development, there will be machinery periodically on the site at a given time. This may lead to occasional accidental emissions, in the form of oil, petrol or diesel leaks, which could cause contamination if they enter the underlying soils.

The polesets and angle masts use products that have a potential impact on the underlying soils. Polesets use Creosote as a preservative. Typical angle masts use concrete for foundations.

In relation to the operational phase the potential impact on the soils and geology is considered to be ***Long term – Moderate.***

9.4.11POTENTIAL DECOMMISSIONING IMPACTS

The expected lifespan of the development is in the region of 50 to 60 years. In the event that part of, or, the entire proposed infrastructure is to be decommissioned, all structures, equipment and material to be decommissioned will be removed and the land reinstated. This applies to all structures, equipment and material that was brought into the development site or sites and will be by way of procedures to be agreed with Laois County Council and Kilkenny County Council in the event of decommissioning.

The potential impacts during decommissioning will be similar to those described for the construction phase.

9.4.12CUMULATIVE IMPACTS

The project consists of 8 units therefore the potential cumulative impacts of the project and the associated mitigation measures have already been assessed. Due to the scale of the study area it is possible that several other projects are likely to take place within the study area during the construction phase.

There are currently no other known permitted developments in the vicinity of the proposed development that could contribute to cumulative impacts.

The potential cumulative impacts of these units on soils and geology is imperceptible as the impacts identified for the proposed project (Units 1-8) are very much 'site-specific' and relevant to the immediate area. Some individual elements of the project have the potential to result in localised impacts on the soils and geology. Any cumulative impacts would not be synergistic, i.e. the combination of these impacts will not result in a more significant impact on soils and geology.

9.5 MITIGATION

The design of the proposed substations and line routes has taken account of the potential impacts of the developments on the soils and geology environment local to the area where construction is taking place. Measures have been incorporated in the design to mitigate the potential effects on the surrounding soils and geology environment. These measures seek to avoid or minimise potential effects in the main through the implementation of best practice construction methods and adherence to all relevant legislation.

A project-specific Construction and Environmental Management Plan (CEMP) will be established and maintained by the contractors during the construction and operational phases. The CMEP will cover all potentially polluting activities and include an emergency response procedure. All personnel working on the site will be trained in the implementation of the procedures. In consideration of soils and geology the Plan will, as a minimum, consider the following sources:

- Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes (NRA)[19]
- Construction Industry Research and Information Association (CIRIA) Environmental Good Practice on Site (C650), 2005[20]
- CIRIA Control of water pollution from linear construction projects. Technical guidance (C648), 2006[21]

The mitigation measures for end of lifetime decommissioning phase would be the same as the measures highlighted for the construction phase. The pole sets will be removed. It is not expected that the foundations of the towers will be fully removed, as they will already be partially vegetated, however part of the neck of the foundation will be cut away. The lower impact option is to cover the exposed area with stored topsoil and allow it to revegetate. The underground cables will be removed and the ducting will be abandoned. No fluids or toxic materials are contained within the cables.

The following mitigation measures are designed to address the impacts associated with the construction and operational phase of the reinforcement project. Due to the inter-relationship between soils and geology and water (hydrology and hydrogeology) the following mitigation measures discussed will be considered applicable to both. Waste Management is also considered an interaction in some sections.

9.5.1 UNIT 1 - NEW 400/110KV GIS SUBSTATION AT COOLNABACKY TOWNLAND, CO. LAOIS

9.5.1.1 Construction Phase

During the construction phase the mitigation measures on soil and geology are associated with the following:

- Degradation of soils and/or subsoils
- Excavation of soils and/or subsoils
- Contamination of soils and/or subsoils
- Management of excavated materials at off-site locations
- Waste Management
- Proximity to Site of Geological Interest

Degradation of soils and/or subsoils

Planned construction works will be carried out in such a manner as to ensure the least feasible disturbance of soils. It is envisaged that all topsoil will be retained on site where possible and reused as fill material (if suitable). An additional 3,500m^3 of soil will be imported from the Ballyragget substation site (Unit 4) to supplement the berms.

Contractors will be required to submit and adhere to a method statement indicating the extent of areas likely to be affected and demonstrating that this is the minimum disturbance necessary to achieve the required works. Where soil stripping occurs the resulting excavated soil fractions will be separated into topsoil/fill and subsoil stockpiles.

Compaction of areas will be avoided where possible. Where compaction has occurred due to truck movements and other construction activities, restoration will be undertaken with areas reinstated to their original condition, where possible.

Temporary storage of spoil will be carefully managed in such a way as to prevent any potential negative impact on the receiving environment and the material will be stored away from any ditches or surface water drains.

In order to minimise potential degradation of in situ soil as a result of construction activities, the following measures will be implemented during the construction phase of the proposed line route:

- In so far as practicable, compaction of any soil or subsoil which remains in situ along the proposed line route will be avoided
- Stockpiles of soil/subsoil will be restricted to less than 3m in height
- Repeated handling of soil will be avoided and ideally all soil stockpiles will remain undisturbed pending later re-use and re-establishment along the proposed line route
- Construction traffic within the site will be required to follow dedicated routes

Excavation of soils and/or subsoils

In order to reduce potential erosion of in situ and excavated soils/subsoil and minimise sediment discharge during the construction phase, the following measures will be implemented:

- Leaving soil and/or subsoil undisturbed in situ for as long as possible prior to excavation
- Minimising excavation and stockpiling activities during wet weather periods
- Shaping stockpiles of excavated soil and/or subsoil so as to shed water
- Construction of silt traps at an early stage in the construction programme
- Interception and channelling of surface water runoff over exposed soil/subsoil surfaces to sumps, silt traps or settlement ponds where practicable, prior to discharge to existing drains or outfalls
- Interception and diversion of surface water runoff away from open excavations where practicable

Contamination of soils and/or subsoils

To minimise any impact on the underlying subsurface strata from material spillages, all oils, solvents and paints used during construction will be stored within specially constructed dedicated temporary bunded areas. Oil and fuel storage tanks will be stored within designated areas with an impervious base. These areas will be bunded to a volume of 110% of the capacity of the largest tank/container within the bunded area(s) (plus an allowance of 30 mm for rainwater ingress). Filling and draw-off points will be located entirely within the bunded area(s). Drainage from the bunded area(s) will be diverted for collection and safe disposal.

In order to reduce the risk of contamination arising as a result of spills or leakages mitigation measures will include, but will not be limited to, the following:

- Storing fuels, chemicals, liquid and solid waste on impermeable surfaces

- Undertaking refuelling of plant, equipment and vehicles on impermeable surfaces
- Ensuring all tanks and drums are bunded in accordance with established best practice guidelines
- Provision of spill kits and hydrocarbon absorbent packs in all construction vehicles.

No concrete batching facility will be required at the site. All ready-mixed concrete will be brought to site by truck. A suitable risk assessment for wet concreting will be completed prior to works being carried out which will include the following measures to prevent discharge of alkaline wastewaters or contaminated storm water to the underlying subsoil.

- The contractor will be required to make provision for removal of any concrete wash waters, most likely by means of tankering off-site.
- Only the chute of the concrete delivery truck will be cleaned on site, using the smallest volume of water necessary.
- Concrete trucks will be directed back to their batching plant for washout.
- The arrangements for concrete deliveries to the site will be discussed with suppliers before commencement of work, agreeing routes, prohibiting onsite washout and discussing emergency procedures.
- Clearly visible signs will be placed in prominent locations close to concrete pour areas, stating that washout of concrete Lorries are not permitted on the site.
- Wash down water from exposed aggregate surfaces and cast-in-place concrete, and from washing of delivery truck chutes will be trapped on site to allow sediment to settle out and reach neutral pH before clarified water is released to a stream or drain system or allowed to percolate into the ground.

Re-fuelling of construction equipment and the addition of hydraulic oil or lubricants to vehicles/ equipment will take place in designated bunded areas, where possible, and not on-site. If it is not possible to bring machinery to the refuelling point, fuel will be delivered in a double-skinned mobile fuel bowser. Any refuelling on site will take place at a designated distance away from watercourses (>10m) in accordance with the buffer zone guidelines highlighted in Section 10 Water (Interaction). A drip tray will be used beneath the fill point during refuelling operations in order to contain any spillages that may occur. Spill-kits and hydrocarbon absorbent packs will be stored in the cabin of each vehicle and operators will be fully trained in the use of this equipment.

All associated hazardous waste residuals will also be appropriately stored within temporary bunded storage areas prior to removal by a licensed waste management contractor for off-site treatment/recycling/disposal.

Management of excavated materials at off-site locations

If it is not feasible to immediately incorporate excess soil/subsoil into the permanent works, the appointed contractor will be required to dispose of, re-use the material off-site or store any excess earthworks materials at an appropriately permitted or licensed waste management facility, in accordance with the requirements of the *Waste Management Act of 1996 (as amended)* and associated Regulations. This restriction will ensure that potential indirect impacts on soil and geology at off-site locations will be subject to adequate environmental control and monitoring.

Where practicable, excess earthworks materials will be temporarily stored at appropriately permitted or licensed waste management facilities, pending processing or re-use on future public works and/or private development projects.

Implementation of these mitigation measures during the construction phase will ensure that excavated materials generated by site construction activities will be directed, where necessary, to waste recovery or disposal facilities, where the existing baseline rating of soil and/or subsoil is typically low or very low and the level of protection provided to the environment is appropriate to the risks involved.

Waste Management

In the event of soils being taken off site they will be removed and disposed of by contractors licensed under the *Waste Management Act of 1996 (as amended),* the *Waste Management (Facility Permit & Registration) Regulations of 2007 (as amended)* and the *Waste Management (Collection Permit) Regulations of 2007 (as amended)*. The issuing of such a permit to contractors allows them to use such material for landscaping and land reclamation, subject to conditions defined in the permit if the material has been classified as suitable for this use. Otherwise, the material will be classified for disposal at a suitably licensed landfill and removed off-site by a licensed waste contractor. In terms of surplus soil, any residuals will be stored within appropriate storage areas of sufficient capacity prior to removal by a suitably licensed waste management contractor for off-site treatment/recycling/disposal.

A construction and demolition waste management plan will be developed by the appointed contractor in accordance with the *Best Practice Guidelines on the Preparation of Waste Management Plans for Construction and Demolition Projects (DoEHLG, 2006)* to ensure that all construction waste is stored, managed, moved, reused or disposed of in an appropriate manner by appropriate contractors in accordance with all relevant waste legislation. See Section 11.3 Waste (Interaction) for more detailed information.

Proximity to Site of Geological Interest

The GSI have stated that the only direct impact on any CGS would be from locating substations, structures or similar, at those locations[17.] The construction activities associated with the substation will not take place within the outline of the Timahoe Esker extents as issued by the GSI.[17]

The GSI requested notification of any ground excavations, etc. undertaken that might provide good geological exposures for their examination. Ground excavations will be in shallow subsoils only. Consultation will take place with the GSI before and during the construction phase to ensure that the substation construction is at a suitable distance from the Timahoe Esker. The GSI have stated that there are no set distance requirements for proposed developments in the vicinity of a CGS. Distance is decided on a project by project basis.

9.5.1.2 Operational Phase

In order to prevent potential contamination of soil/groundwater media with surface water runoff that may be contaminated with oil/solids from transformers and on-site activities, an interceptor will be installed through which surface water run-off will be channelled, prior to discharge to the on-site surface water system.

At the proposed substation in order to minimise any impact on the underlying subsurface strata from material spillages, oil and fuel storage tanks will be stored in designated areas with an impervious base. These areas will be bunded to a volume of 110% of the capacity of the largest tank/container within the bunded area(s) (plus an allowance of 30 mm for rainwater ingress). Filling and draw-off points will be located entirely within the bunded area(s). Drainage from the bunded area(s) will be diverted for collection and safe disposal.

Re-fuelling of equipment and the addition of hydraulic oil or lubricants to vehicles/ equipment will take place off site, where possible. If it is not possible to bring machinery off-site to a refuelling point, fuel will be delivered in a double-skinned mobile fuel bowser. A drip tray will be used beneath the fill point during refuelling operations in order to contain any spillages that may occur. Spill-kits and hydrocarbon absorbent packs will be stored in the cabin of each vehicle and operators will be fully trained in the use of this equipment.

All associated hazardous waste residuals will also be appropriately stored prior to removal by a licensed waste management contractor for off-site treatment/recycling/disposal.

Any vehicles utilised during the operational phase will be regularly maintained and checked regularly to ensure any damages or leakages are corrected.

In the event of an environmental incident at the proposed substation the ESB Networks Emergency Response Procedure will be activated. The Environmental Incident Reporting System is a key component of this procedure. Environmental significance is classified into major, minor and general. All environmental incidents will be reported to the ESB Networks Environmental Systems Manager immediately. All environmental incidents/non-conformances will be logged in the Environmental Incident Reporting System within 2 working days. Details of the appropriate corrective action taken by the relevant supervisor in charge will be entered into the environmental incident reporting system, for review by the environmental management team within ESB Networks.

The implementation of these mitigation measures will minimise the potential for the migration of potential contaminants from the surface into the underlying groundmass.

9.5.2 UNIT 2 - NEW CONNECTION TO COOLNABACKY FROM THE EXISTING MONEYPOINT-DUNSTOWN 400KV LINE

9.5.2.1 Construction Phase

During the construction phase the mitigation measures on soil and geology are associated with the following:

- Degradation of soils and/or subsoils
- Excavation of soils and/or subsoils
- Contamination of soils and/or subsoils
- Management of excavated materials at off-site locations
- Waste Management
- Proximity to Site of Geological Interest

Degradation of soils and/or subsoils

Planned construction works will be carried out in such a manner as to ensure the least feasible disturbance of soils. It is envisaged that all topsoil will be retained on site where possible and reused as fill material (if suitable). Some of the subsoil and bedrock excavated (if encountered) will be, where possible, retained for use on site.

Some locations for angle masts will require access over unprotected soil. To minimise impacts to the integrity of soil strata and reduce risks of soil destabilisation and sediment release, all traffic will take place using preselected routes and where necessary soil protection, such as geotextile, bog mats and bridging will be utilised where possible.

See also relevant text under *Degradation of soils and/or subsoils* Section 9.5.1.1.

Excavation of soils and/or subsoils

See text under *Excavation of soils and/or subsoils* Section 9.5.1.1.

Contamination of soils and/or subsoils

Due to the agricultural nature of the land use the likelihood of hazardous waste being encountered during the construction phase is low however, if encountered; all excavated materials will be assessed for signs of possible contamination such as staining (visual assessment) or strong odours. Should any unusual staining or odour be noticed, samples of this soil will be analysed for the presence of possible contaminants in order to ensure that historical pollution of the soil has not occurred. Should it be determined that any of the soil excavated is contaminated, this will be dealt with appropriately as per the *Waste Management Act of 1996* (as amended) and associated regulations.

Also see text under *Contamination of soils and/or subsoils* Section 9.5.1.1.

Management of excavated materials at off-site locations

See text under *Management of excavated materials at off-site locations* Section 9.5.1.1.

Waste Management

See text under *Waste Management* Section 9.5.1.1.

Proximity of construction to Site of Geological Interest

The GSI have stated that the only direct impact on any CGS would be from locating substations, structures or similar, at those locations[17.] The construction activities associated with the proposed line route will not take place within the outline of the Timahoe Esker extents as issued by the GSI.[17]

The GSI requested notification of any ground excavations, etc. undertaken that might provide good geological exposures for their examination. Ground excavations will be in shallow subsoils only. Consultation will take place with the GSI before and during the construction phase to ensure that the construction of the proposed line route is at a suitable distance from the Timahoe Esker. The GSI have stated that there are no set distance requirements for proposed developments in the vicinity of a CGS. Distance is decided on a project by project basis.

9.5.2.2 Operational Phase

Apart from the general maintenance of the polesets and angle masts there will be few on-site activities during the operational phase.

The construction of the angle mast foundations would be from concrete that is sulphate resistant and appropriate for the site conditions. This would ensure that there will be little corrosion of the angle mast bases during the operational phase.

ESB will not be carrying out creosote treatment of wooden poles at storage facilities or at work sites, all poles will be provided pre-treated. For the Laois – Kilkenny project material to be used for the construction of the overhead lines will come from the ESB storage yard at Kilteel by way of just-in-time deliveries.

Also see paragraphs regarding re-fuelling, hazardous waste residuals and maintenance of vehicles under Section 9.5.1.2.

9.5.3 UNIT 3 NEW CONNECTION TO COOLNABACKY FROM THE EXISTING ATHY-PORTLAOISE 110KV LINE

9.5.3.1 Construction Phase

During the construction phase the mitigation measures on soil and geology are associated with the following:

- Degradation of soils and/or subsoils
- Excavation of soils and/or subsoils
- Contamination of soils and/or subsoils
- Management of excavated materials at off-site locations
- Waste Management
- Proximity to Site of Geological Interest

Degradation of soils and/or subsoils

Planned construction works will be carried out in such a manner as to ensure the least feasible disturbance of soils. It is envisaged that all topsoil will be retained on site where possible and reused as fill material (if suitable). Some of the subsoil excavated will be, where possible, retained for use on site.

Some locations for angle masts will require access over unprotected soil. To minimise impacts to the integrity of soil strata and reduce risks of soil destabilisation and sediment release, all traffic will take place using preselected routes and where necessary soil protection, such as geotextile, bog mats and bridging will be utilised where possible.

See also relevant text under *Degradation of soils and/or subsoils* Section 9.5.1.1.

Excavation of soils and/or subsoils

See text under *Excavation of soils and/or subsoils* Section 9.5.1.1.

Contamination of soils and/or subsoils

Due to the agricultural nature of the land use the likelihood of hazardous waste being encountered during the construction phase is low however, if encountered; all excavated materials will be assessed for signs of possible contamination such as staining (visual assessment) or strong odours. Should any unusual staining or odour be noticed, samples of this soil will be analysed for the presence of possible contaminants in order to ensure that historical pollution of the soil has not occurred. Should it be determined that any of the soil excavated is contaminated, this will be dealt with appropriately as per the *Waste Management Act of 1996* (as amended) and associated regulations.

Also see text under *Contamination of soils and/or subsoils* Section 9.5.1.1.

Management of excavated materials at off-site locations

See text under *Management of excavated materials at off-site locations* Section 9.5.1.1.

Waste Management

See text under *Waste Management* Section 9.5.1.1.

Proximity of construction to Site of Geological Interest

The GSI have stated that the only direct impact on any CGS would be from locating substations, structures or similar, at those locations[17]. The construction activities associated with the cable connection will not take place within the outline of the Timahoe Esker extents as issued by the GSI.[17]

The GSI requested notification of any ground excavations, etc. undertaken that might provide good geological exposures for their examination. Ground excavations will be in shallow subsoils only. Consultation will take place with the GSI before and during the construction phase to ensure that the construction cable connection is at a suitable distance from the Timahoe Esker. The GSI have stated that there are no set distance requirements for proposed developments in the vicinity of a CGS. Distance is decided on a project by project basis.

9.5.3.2 Operational Phase

It is anticipated that the need to access the cables for maintenance will be infrequent. However when access and works are required these will be carried out in accordance with the same measures highlighted in the Construction and Environmental Management Plan.

Also see paragraphs regarding re-fuelling, hazardous waste residuals and maintenance of vehicles under Section 9.5.1.2.

9.5.4 UNIT 4 - A NEW 110KV / 38KV / MV SUBSTATION IN BALLYRAGGET, CO. KILKENNY

9.5.4.1 Construction Phase

During the construction phase the mitigation measures on soil and geology are associated with the following:

- Degradation of soils and/or subsoils
- Excavation of soils and/or subsoils
- Contamination of soils and/or subsoils
- Management of excavated materials at off-site locations
- Waste Management

Degradation of soils and/or subsoils

Planned construction works will be carried out in such a manner as to ensure the least feasible disturbance of soils. It is envisaged that all topsoil will be retained on site where possible and reused as fill material (if suitable). Some of the subsoil excavated will be transported to the proposed Coolnabacky substation site (Unit 1).

See also relevant text under *Degradation of soils and/or subsoils* Section 9.5.1.1.

Excavation of soils and/or subsoils

See text under *Excavation of soils and/or subsoils* Section 9.5.1.1.

Contamination of soils and/or subsoils

Due to the agricultural nature of the land use and the findings of the site investigations [11,12] the likelihood of hazardous waste being encountered during the construction phase is low however, if encountered; all excavated materials will be assessed for signs of possible contamination such as staining (visual assessment) or strong odours. Should any unusual staining or odour be noticed, samples of this soil will be analysed for the presence of possible contaminants in order to ensure that historical pollution of the soil has not occurred. Should it be determined that *any of the soil excavated is contaminated, this will be dealt with appropriately as per the Waste Management Act of 1996 (as amended)* and associated regulations.

Also see text under *Contamination of soils and/or subsoils* Section 9.5.1.1.

Management of excavated materials at off-site locations

See text under *Management of excavated materials at off-site locations* Section 9.5.1.1.

Waste Management

See text under *Waste Management* Section 9.5.1.1.

9.5.4.2 Operational Phase

In order to prevent potential contamination of soil/groundwater media with surface water runoff that may be contaminated with oil/solids from transformers and on-site activities, an interceptor will be installed through which surface water run-off will be channelled, prior to discharge to the on-site surface water system.

At the proposed substation in order to minimise any impact on the underlying subsurface strata from material spillages, oil and fuel storage tanks will be stored in designated areas with an impervious base. These areas will be bunded to a volume of 110% of the capacity of the largest tank/container within the

bunded area(s) (plus an allowance of 30 mm for rainwater ingress). Filling and draw-off points will be located entirely within the bunded area(s). Drainage from the bunded area(s) will be diverted for collection and safe disposal.

In the event of an environmental incident at the proposed substation the ESB Networks Emergency Response Procedure will be activated. The Environmental Incident Reporting System is a key component of this procedure. Environmental significance is classified into major, minor and general. All environmental incidents will be reported to the ESB Networks Environmental Systems Manager immediately. All environmental incidents/non-conformances will be logged in the Environmental Incident Reporting System within 2 working days. Details of the appropriate corrective action taken by the relevant supervisor in charge will be entered into the environmental incident reporting system, for review by the environmental management team within ESB Networks.

The implementation of these mitigation measures will minimise the potential for the migration of potential contaminants from the surface into the underlying groundmass.

Also see paragraphs regarding re-fuelling, hazardous waste residuals and maintenance of vehicles under Section 9.5.1.2.

9.5.5 UNIT 5 - A NEW 110KV OVERHEAD LINE BETWEEN BALLYRAGGET AND COOLNABACKY

9.5.5.1 Construction Phase

During the construction phase the mitigation measures on soil and geology are associated with the following:

- Degradation of soils and/or subsoils
- Excavation of soils and/or subsoils
- Contamination of soils and/or subsoils
- Management of excavated materials at off-site locations
- Waste Management

Degradation of soils and/or subsoils

Planned construction works will be carried out in such a manner as to ensure the least feasible disturbance of soils. It is envisaged that all topsoil will be retained on site where possible and reused as fill material (if suitable). Some of the subsoil and bedrock excavated (if encountered) will be, where possible, retained for use on site.

Some locations for angle masts will require access over unprotected soil. To minimise impacts to the integrity of soil strata and reduce risks of soil destabilisation and sediment release, all traffic will take place using preselected routes and where necessary soil protection, such as geotextile, bog mats and bridging will be utilised where possible.
See also relevant text under *Degradation of soils and/or subsoils* Section 9.5.1.1.

Excavation of soils and/or subsoils

See text under *Excavation of soils and/or subsoils* Section 9.5.1.1.

Contamination of soils and/or subsoils

Due to the agricultural nature of the land use the likelihood of hazardous waste being encountered during the construction phase is low however, if encountered; all excavated materials will be assessed for signs of possible contamination such as staining (visually assessed) or strong odours. Should any unusual staining or odour be noticed, samples of this soil will be analysed for the presence of possible contaminants in order to ensure that historical pollution of the soil has not occurred. Should it be

determined that any of the soil excavated is contaminated, this will be dealt with appropriately as per the *Waste Management Act of 1996 (as amended)* and associated regulations.

In relation to the storage of creosote treated wood poles during the construction phase, these will be stored in designated bunded areas. When required, the poles will be transported directly to the work location.

ESB will not be carrying out creosote treatment of wooden poles at storage facilities or at work sites, all poles will be provided pre-treated and transferred to the works site separately. Material to be used for the construction of the overhead lines will come from the ESB storage yard at Kilteel by way of just-in-time deliveries.

Also see text under *Contamination of soils and/or subsoils* Section 9.5.1.1.

Management of excavated materials at off-site locations

See text under *Management of excavated materials at off-site locations* Section 9.5.1.1.

Waste Management

See text under *Waste Management* Section 9.5.1.1.

9.5.5.2 Operational Phase

Apart from the general maintenance of the polesets and angle masts there will be few on-site activities during the operational phase.

The construction of the angle mast foundations would be from concrete that is sulphate resistant and appropriate for the site conditions. This would ensure that there will be little corrosion of the angle mast bases during the operational phase.

ESB will not be carrying out creosote treatment of wooden poles at storage facilities or at work sites, all poles will be provided pre-treated. When required, the poles will be transported directly to the work location.

Also see paragraphs regarding re-fuelling, hazardous waste residuals and maintenance of vehicles under Section 9.5.1.2.

9.5.6 UNIT 6 - AN UPRATE OF THE EXISTING BALLYRAGGET-KILKENNY 110KV OVERHEAD LINE

9.5.6.1 Construction Phase

During the construction phase the mitigation measures on soil and geology are associated with the following:

- Degradation of soils and/or subsoils
- Excavation of soils and/or subsoils
- Contamination of soils and/or subsoils
- Management of excavated materials at off-site locations
- Waste Management
- Proximity to Site of Geological Interest

Degradation of soils and/or subsoils

Planned construction works will be carried out in such a manner as to ensure the least feasible disturbance of soils. It is envisaged that all topsoil will be retained on site where possible and reused as

fill material (if suitable). Some of the subsoil and bedrock excavated (if encountered) will be, where possible, retained for use on site.

Some locations for angle masts will require access over unprotected soil. To minimise impacts to the integrity of soil strata and reduce risks of soil destabilisation and sediment release, all traffic will take place using preselected routes and where necessary soil protection, such as geotextile, bog mats and bridging will be utilised where possible.
See also relevant text under *Degradation of soils and/or subsoils* Section 9.5.1.1.

Excavation of soils and/or subsoils

See text under *Excavation of soils and/or subsoils* Section 9.5.1.1.

Contamination of soils and/or subsoils

Due to the agricultural nature of the land use the likelihood of hazardous waste being encountered during the construction phase is low however, if encountered; all excavated materials will be assessed for signs of possible contamination such as staining (visual assessment) or strong odours. Should any unusual staining or odour be noticed, samples of this soil will be analysed for the presence of possible contaminants in order to ensure that historical pollution of the soil has not occurred. Should it be determined that any of the soil excavated is contaminated, this will be dealt with appropriately as per the *Waste Management Act of 1996 (as amended)* and associated regulations.

ESB will not be carrying out creosote treatment of wooden poles at storage facilities or at work sites, all poles will be provided pre-treated and transferred to the works site separately. Material to be used for the construction of the overhead lines will come from the ESB storage yard at Kilteel by way of just-in-time deliveries.

Also see text under *Contamination of soils and/or subsoils* Section 9.5.1.1.

Management of excavated materials at off-site locations

See text under *Management of excavated materials at off-site locations* Section 9.5.1.1.

Waste Management

See text under *Waste Management* Section 9.5.1.1.

Proximity to Site of Geological Interest

The GSI have stated that the only direct impact on any CGS would be from locating substations, structures or similar, at those locations[17.] The construction activities associated with the proposed line route will not take place within or adjacent to Ballyragget Quarry, Dunmore Cave and Ballyfoyle Channels.

The GSI requested notification of any ground excavations, etc. undertaken that might provide good geological exposures for their examination. Ground excavations will be in shallow subsoils only. Consultation will take place with the GSI before and during the construction phase to ensure that the construction of each poleset/angle mast is at a suitable distance from each site of geological interest. The GSI have stated that there are no set distance requirements for proposed developments in the vicinity of a CGS. Distance is decided on a project by project basis.

9.5.6.2 Operational Phase

Apart from the general maintenance of the polesets and angle masts there will be few on-site activities during the operational phase.

The construction of the angle mast foundations would be from concrete that is sulphate resistant and appropriate for the site conditions. This would ensure that there will be little corrosion of the angle mast bases during the operational phase.

ESB will not be carrying out creosote treatment of wooden poles at storage facilities or at work sites, all poles will be provided pre-treated. Material to be used for the construction of the overhead lines will come from the ESB storage yard at Kilteel by way of just-in-time deliveries.

Also see paragraphs regarding re-fuelling, hazardous waste residuals and maintenance of vehicles under Section 9.5.1.2.

9.5.7 UNIT 7 - A NEW 110KV BAY IN THE EXISTING KILKENNY 110KV STATION

9.5.7.1 Construction Phase

During the construction phase the mitigation measures on soil and geology are associated with the following:

- Degradation of soils and/or subsoils
- Excavation of soils and/or subsoils
- Contamination of soils and/or subsoils
- Management of excavated materials at off-site locations
- Waste Management

Degradation of soils and/or subsoils

Planned construction works will be carried out in such a manner as to ensure the least feasible disturbance of soils. It is envisaged that all topsoil will be retained on site where possible and reused as fill material (if suitable). Some of the subsoil and bedrock excavated (if encountered) will be, where possible, retained for use on site.

See also relevant text under *Degradation of soils and/or subsoils* Section 9.5.1.1.

Excavation of soils and/or subsoils

See text under *Excavation of soils and/or subsoils* Section 9.5.1.1.

Contamination of soils and/or subsoils

Due to the agricultural nature of the land use the likelihood of hazardous waste being encountered during the construction phase is low however, if encountered; all excavated materials will be assessed for signs of possible contamination such as staining (visual assessment) or strong odours. Should any unusual staining or odour be noticed, samples of this soil will be analysed for the presence of possible contaminants in order to ensure that historical pollution of the soil has not occurred. Should it be determined that any of the soil excavated is contaminated, this will be dealt with appropriately as per the *Waste Management Act of 1996 (as amended)* and associated regulations.

See text under *Contamination of soils and/or subsoils* Section 9.5.1.1.

Management of excavated materials at off-site locations

See text under *Management of excavated materials at off-site locations* Section 9.5.1.1.

Waste Management

See text under *Waste Management* Section 9.5.1.1.

9.5.7.2 Operational Phase

In order to prevent potential contamination of soil/groundwater media with surface water runoff that may be contaminated with oil/solids from on-site activities, an interceptor will be installed through which surface water run-off will be channelled, prior to discharge to the on-site surface water system.

In order to minimise any impact on the underlying subsurface strata from material spillages, oil and fuel storage tanks will be stored in designated areas with an impervious base. These areas will be bunded to a volume of 110% of the capacity of the largest tank/container within the bunded area(s) (plus an allowance of 30 mm for rainwater ingress). Filling and draw-off points will be located entirely within the bunded area(s). Drainage from the bunded area(s) will be diverted for collection and safe disposal.

In the event of an environmental incident at the proposed substation the ESB Networks Emergency Response Procedure will be activated. The Environmental Incident Reporting System is a key component of this procedure. Environmental significance is classified into major, minor and general. All environmental incidents will be reported to the ESB Networks Environmental Systems Manager immediately. All environmental incidents/non-conformances will be logged in the Environmental Incident Reporting System within 2 working days. Details of the appropriate corrective action taken by the relevant supervisor in charge will be entered into the environmental incident reporting system, for review by the environmental management team within ESB Networks.

The implementation of these mitigation measures will minimise the potential for the migration of potential contaminants from the surface into the underlying groundmass.

Also see paragraphs regarding re-fuelling, hazardous waste residuals and maintenance of vehicles under Section 9.5.1.2.

9.5.8 UNIT 8 - MODIFICATIONS TO EXISTING ATHY-PORTLAOISE 110KV LINE

9.5.8.1 Construction Phase

During the construction phase the mitigation measures on soil and geology are associated with the following:

- Degradation of soils and/or subsoils
- Excavation of soils and/or subsoils
- Contamination of soils and/or subsoils
- Management of excavated materials at off-site locations
- Waste Management
- Proximity to Site of Geological Interest

Degradation of soils and/or subsoils

Planned construction works will be carried out in such a manner as to ensure the least feasible disturbance of soils. It is envisaged that all topsoil will be retained on site where possible and reused as fill material (if suitable). Some of the subsoil and bedrock excavated (if encountered) will be, where possible, retained for use on site.

Some locations for angle masts will require access over unprotected soil. To minimise impacts to the integrity of soil strata and reduce risks of soil destabilisation and sediment release, all traffic will take place using preselected routes and where necessary soil protection, such as geotextile, bog mats and bridging will be utilised where possible.
See also relevant text under *Degradation of soils and/or subsoils* Section 9.5.1.1.

Excavation of soils and/or subsoils

See text under *Excavation of soils and/or subsoils* Section 9.5.1.1.

Contamination of soils and/or subsoils

The likelihood of hazardous waste being encountered during the construction phase is low however, if encountered; all excavated materials will be assessed for signs of possible contamination such as staining (visual assessment) or strong odours. Should any unusual staining or odour be noticed, samples of this soil will be analysed for the presence of possible contaminants in order to ensure that historical pollution of the soil has not occurred. Should it be determined that any of the soil excavated is contaminated, this will be dealt with appropriately as per the *Waste Management Act of 1996 (as amended)* and associated regulations.

ESB will not be carrying out creosote treatment of wooden poles at storage facilities or at work sites, all poles will be provided pre-treated and transferred to the works site separately. Material to be used for the construction of the overhead lines will come from the ESB storage yard at Kilteel by way of just-in-time deliveries.

Also see text under *Contamination of soils and/or subsoils* Section 9.5.1.1.

Management of excavated materials at off-site locations

See text under *Management of excavated materials at off-site locations* Section 9.5.1.1.

Waste Management

See text under *Waste Management* Section 9.5.1.1.

Proximity of construction to Site of Geological Interest

The GSI have stated that the only direct impact on any CGS would be from locating substations, structures or similar, at those locations[17]. The construction activities associated with the proposed line route will take place within the outline of the Timahoe Esker extents as issued by the GSI.[17]

The GSI requested notification of any ground excavations, etc. undertaken that might provide good geological exposures for their examination. Ground excavations will be in shallow subsoils only. Consultation will take place with the GSI before and during the construction phase as a poleset (AM89) is located within the Timahoe Esker extents. The GSI have stated that there are no set distance requirements for proposed developments in the vicinity of a CGS. Distance is decided on a project by project basis.

9.5.8.2 Operational Phase

Apart from the general maintenance of the polesets and angle masts there will be few on-site activities during the operational phase.

The construction of the angle mast foundations would be from concrete that is sulphate resistant and appropriate for the site conditions. This would ensure that there will be little corrosion of the angle mast bases during the operational phase.

ESB will not be carrying out creosote treatment of wooden poles at storage facilities or at work sites, all poles will be provided pre-treated. Material to be used for the construction of the overhead lines will come from the ESB storage yard at Kilteel by way of just-in-time deliveries.

Also see paragraphs regarding re-fuelling, hazardous waste residuals and maintenance of vehicles under Section 9.5.1.2.

9.6 RESIDUAL IMPACT

This section describes the predicted impact of the Reinforcement Project on the soils and geology following the implementation of the mitigation measures.

9.6.1 CONSTRUCTION PHASE

The implementation of the construction phase remedial and mitigation measures highlighted in Section 9.5 will ensure that the soils and geology environment is not adversely impacted during normal and/or emergency conditions in the construction phase and that the impact will be ***Short Term - Imperceptible.***

9.6.2 OPERATIONAL PHASE

The implementation of the operational phase remedial and mitigation measures highlighted in Section 9.5 and ESB Network's Contract Management Procedures Manuals will ensure that the soil and geology environment is not adversely impacted during normal and/or emergency conditions in the operational phase and that the impact will be ***Long Term - Imperceptible.***

9.6.3 MONITORING

Monitoring during the Construction Phase will consist of the following:-

- Normal quality control inspection of the works
- Adherence to the CEMP
- All excavations will be assessed for signs of possible contamination such as staining (visual assessment) or strong odours.
- All silt traps and sediment ponds will be inspected regularly and in particular after heavy rainfall events to ensure that they are not blocked or overflowing and to carry out regular maintenance.
- A record of daily checks that the works are being undertaken in accordance with the CEMP will be made available for inspection by Laois County Council/Kilkenny County Council.
- Monitoring reports shall be submitted to Laois County Council/Kilkenny County Council and other relevant statutory bodies in accordance with the requirements of the planning conditions.

9.6.4 REINSTATEMENT

In relation to the substations, the temporary construction compounds will be completely removed from the site following the end of the construction phase. The area will be regraded to a suitable topography in line with the proposed landscaping plan for the sites. It will be allowed to re-vegetate by natural processes of seeding and propagation. The landscaping plans will be implemented towards the end of the construction phase.

Reinstatement at completion of the works will involve restoring areas to their original condition, where practical, leaving the area in a neat and clean condition, removing all deleterious materials that may have been deposited during construction works. Generally this work is carried in accordance with the relevant Inland Fisheries Ireland (IFI) and Irish Farming Association (IFA) agreements and in consultation with the individual landowner.

9.7 INTERRELATIONSHIPS BETWEEN ENVIRONMENTAL FACTORS

This section should be read in conjunction with Section 10 *Water (Hydrology and Hydrogeology)* and Section 11 *Material Assets* (with regard to waste management) for a full understanding of the main interactions between these environmental topics.

Potential interactions between *Cultural Heritage* and *Soils and Geology* (Section 9), *Water* (Section 10) and *Ecology* (Section 8) were identified in the recommended mitigation of archaeological testing at the

proposed 400kV tower locations and the proposed substation sites (Unit 1 Coolnabacky and Unit 4 Ballyragget). Such testing has the potential to impact on watercourses, soils and flora and fauna. Similarly, potential impacts on soils can be mitigated by those measures outlined in this soils and geology section regarding reinstatement and waste management.