

Proposed Gathabawn Windfarm

Environmental Impact Assessment Report

Chapter 7: Soils



September 2026

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CHAPTER 7 SOILS

EIAR 7.1 INTRODUCTION

EIAR 7.1.1 Competent Expert

This EIAR section relating to Soils was prepared by:

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Jack Crawley (BSc, MSc (Hydrogeology and Water Management)) is an associate hydrogeologist within SLR, and has worked in environmental consultancy for 10 years, specialising in the conceptualisation of hydrogeological setting and groundwater risk. Jack has worked on several national infrastructure projects, and has significant experience in the development of Environmental Impact Assessment chapters for wind and solar farms, as well as grid connections and cabling routes. In addition to this, Jack has strong experience in undertaking groundwater risk assessments and hydrogeological impact appraisals to support planning and environmental permitting requirements.

Stephen Muggeridge (BSc, MSc (Hydrogeology)) is a Technical Director (Hydrogeology) with SLR with over seventeen years' experience in environmental consulting, specialising in hydrogeology. Stephen's expertise include development of Environmental Impact Assessment chapters for a range of developments including quarries, landfills, renewables (wind farms and solar farms) and in the development of supporting technical assessments including groundwater risk assessment, flood risk assessments and hydrogeological impact assessments for dewatering of construction sites.

EIAR 7.1.2 Sources of Information

Consultation, desktop studies and fieldwork were carried out in order to gather information on the baseline environment.

Table 7-1: Sources of Baseline Information for Soils

Desktop Sources
• Environmental Protection Agency website (www.epa.ie); • Irish Soils Information Systems (www.teagasc.ie); • Teagasc soil and subsoil mapping for Irish Forestry Soils Project (www.epa.ie); • Irish Geological Heritage Programme (www.gsi.ie); • Tailte Éireann (www.tailte.ie); • Geological Survey Ireland website (www.gsi.ie); • National Geospatial Data Hub (www.geohive.ie); • Met Éireann Irish Meteorological Services (www.met.ie); • National Parks and Wildlife Service (NPWS) Designations Viewer (www.npws.ie); • Groundwater Protection Schemes (www.gsi.ie); and • Water Maps and Water Framework Directive online mapping (www.catchments.ie)

Review of the other EIA Report Chapters:

- Chapter 5: Description of the Development
- Chapter 6: Land
- Chapter 8: Water

Fieldwork

- Borehole survey at the Ballylehaun Section in 2021
- Trial pit investigations in August 2021, March 2023 and August 2026 across the site – 30 no. trial pits were completed in total.
- Geotechnical assessment of the windfarm site in September 2026, including slope stability assessment by Fehily Timoney and Company.

EIAR 7.1.3 Methodology Used

The evaluations for Soils herein have been carried out in accordance with the following guidelines:

- Institute of Geologists Ireland (2013) Guidelines for Preparation of Soils, Geology & Hydrogeology Chapters in Environmental Impact Statements;
- The National Roads Authority (2008) Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes;
- The Environmental Protection Agency (2022) Guidelines on the Information to be Contained in Environmental Impact Assessment Reports; and
- The Department of Heritage and Local Government and the Office of Public Works (2009) The Planning System and Flood Risk Management Guidelines for Planning Authorities.

This methodology has been used to determine the importance of receptors, and the magnitude and significance of potential impacts. The methodology can be found in full in [Appendix 7.1: Methodology for the evaluation of Soils](#). The author's extensive experience with EIA preparation and soil management also informs this report.

A list of guidelines and legislation which were taken into account during the evaluation of this chapter is also included in [Appendix 7.1](#).

EIAR 7.1.4 Statement on Certainty and Sufficiency of Information Provided

A clear documentary trail is provided throughout this chapter and chapter appendices to the competency of data and methods used and the rationale for selection of same. The information used to compile this chapter is collated from site-specific investigations, data and documents generated by public bodies and statutory agencies and from site-specific investigations.

The criteria used for Soils appraisals are derived from the Institute of Geologists Ireland (2013) guidance document. All documentation used is referenced at the end of the chapter.

In respect of Soils, no material limitations or difficulties were encountered during the course of the studies carried out to inform the assessment of impacts of the Proposed Gathabawn Windfarm Project on Soils.

EIAR 7.2 SENSITIVE ASPECTS

EIAR 7.2.1 Zone of Influence/Study Areas

The area or zone of influence around the proposed Gathabawn Windfarm Project within which the sensitive aspects of the environment could be affected by the Project is called the Study Area herein. The Study Areas for the Sensitive Aspects of the Soils environment are set out in the table below.

A description of the development is provided in **Chapter 5: Description of the Development** but can be summarised as follows:

The proposed Gathabawn Windfarm is located entirely within County Kilkenny, with the wind turbines located on two areas of high ground – at Ballylehaun (7 turbines) and at Ballyring (5 turbines). The nearest village is Gathabawn village which is 1km southeast from the nearest Ballylehaun turbine and 3km west from the nearest Ballyring turbine. In addition to the turbines and their hardstanding areas, the windfarm development also includes site access roads, 2 Control Buildings; 1 met mast, underground cabling, temporary works to facilitate turbine deliveries, and other associated and ancillary works.

The majority of the Facilitating Works (FW) for the Turbine Delivery Route (TDR) are within the Ballylehaun and Ballyring turbine clusters except for FW8, located c. 1.5km southwest of T11 and FW9, located c. 0.9km west of T8. Hence, FW8 and FW9 will be assigned a separate 2km study area.

While the Underground Cabling (UGC) between the Ballylehaun Area and the Ballyring Area and the Candidate Gathabawn Grid Connection (CGGC) from the Ballyring Area to the EirGrid Ballyragget substation will be subject to a separate planning application at a future date, it is still considered as part of this EIAR in order to facilitate the cumulative evaluation of the Whole Gathabawn Windfarm Project. Hence, the CGGC will be referred to throughout this chapter but a zone of influence will not be applied to it.

Table 7-2: Study Area of the Project in relation to sensitive aspects of the Soils environment

Sensitive Aspect	Zone of Influence/Study Area	Justification for the Study Area extent
Local Soils, Subsoils & Bedrock	Within 5km of the Ballylehaun Area Red Line Boundary. Within 2km of the Ballyring Area and all other aspects of the Proposed Development. The route of the candidate Gathabawn Grid Connection (CGGC)	As per the Institute of Geologists of Ireland (2013) guidelines, the minimum distance of 2 km from the site boundary has been applied to the Ballyring Area.
Soils, Subsoils & Bedrock in Designated & Protected Sites:	Within 5km of the Ballylehaun Area Red Line Boundary. Within 2km of the Ballyring Area and all other aspects of the Proposed Development The route of the candidate Gathabawn Grid Connection (CGGC)	Per guidelines and industry standards, an increased minimum distance of 5 km has been applied to the Ballylehaun Area due to the presence of karst systems.
Soils, Subsoils & Bedrock in Geological Heritage Sites:	Within 5km of the Ballylehaun Area Red Line Boundary.	

	Within 2km of the Ballyring Area and all other aspects of the Proposed Development The route of the candidate Gathabawn Grid Connection (CGGC)	

EIAR 7.2.2 Overview of Soils in the Local Environment

Soil is a biologically active, complex mixture of weathered minerals, organic matter, organisms, air and water. This mixture supports a range of critical functions such as supporting terrestrial ecosystems and biological diversity, agricultural food production, flood alleviation, water filtration and storage, and carbon capture.

This Soils chapter relates to the land coverage/use, topsoil and subsoil (collectively referred to as overburden) along with the underlying bedrock, associated geological heritage and supported ecological habitats.

The proposed Gathabawn Windfarm is located entirely in northwest County Kilkenny.

It is located on the Cullahill Mountain area of the Castlecomer Plateau. The landscape comprises a predominantly lowland landscape dominated by agricultural grassland and occasional forestry. Land use cover mapping is presented on [Figure 7-2a](#) and [Figure 7-2b](#) and confirms that the Gathabawn Windfarm is located entirely on agricultural land comprising either pastures, 'land principally occupied by agriculture with significant areas of natural vegetation or complex cultivation patterns.

Soils (i.e. superficial geology including subsoils) in the study area comprise mainly mineral or organic topsoil over shallow glacial tills or bedrock. The permeability of study area soils ranges from low to moderate but is largely unmapped. The underlying bedrock in the study area comprises a mixture of siltstone, sandstone, and limestone. No peat deposits occur at the site.

The soils are not sited in designated areas (i.e. NHA, SAC etc), there is one County Geological Heritage Sites within the study area, this is Lisdowney Quarry. The predominant soil group, according to Teagasc mapping, on the proposed development area is the Crosstown Association Group, however part of the Ballylehaun Area and the Candidate Gathabawn Grid Connection are also in the Elton Association Group. The subsoils are predominately encountered as 'bedrock at surface' in the turbine locations themselves. Bedrock is partly recorded as non-calcareous lithology, the western section of the study area comprising turbines T1 – T5 is calcareous. Geoheritage and designated site mapping is presented on [Figure 7-1a](#) and [Figure 7-1b](#).

EIAR 7.3 BASELINE ENVIRONMENT

The context and characteristics of the baseline environment, and the trends and evolution thereof, in relation to *Local Soils, Subsoils & Bedrock* and Soils, Subsoils and Bedrock in Designated Sites and Geological Heritage Sites are described in the subsections below.

The result of fieldwork and desktop surveys are summarised in the sections below, illustrated on the mapping listed below, with the detailed data included in the Appendices listed:

EIAR Figures (included at the end of this Chapter):

Figure 7-1a Proposed Gathabawn Windfarm: Geological Heritage & Designated Sites

Figure 7-1b Candidate Gathabawn Grid Connection: Geological Heritage & Designated Sites

Figure 7-2a Proposed Gathabawn Windfarm: Land Use Cover

Figure 7-2b Candidate Gathabawn Grid Connection: Land Use Cover

Figure 7-3a Proposed Gathabawn Windfarm: ISIS Soils Association

Figure 7-3b Candidate Gathabawn Grid Connection: ISIS Soils Association

Figure 7-4a Proposed Gathabawn Windfarm: Subsoils

Figure 7-4b Candidate Gathabawn Grid Connection: Subsoils

Figure 7-5a Proposed Gathabawn Windfarm: Bedrock Geology 100k

Figure 7-5b Candidate Gathabawn Grid Connection: Bedrock Geology 100k

Figure 7.6 Other Projects Scoped-In for the Soils Cumulative Evaluations

EIAR Appendices (included at the end of this Chapter):

Appendix 7.2: Trial Pit Investigation Results

Appendix 7.3: Geotechnical Assessment Report

EIAR 7.3.1 Context and Characteristics

EIAR 7.3.1.1 Local Soils, Subsoils & Bedrock

EIAR 7.3.1.1.1 Soils and Subsoils

Proposed Gathabawn Windfarm: The Irish Soil Information Systems (ISIS) soil mapping project has identified a number of Soil Associations across Ireland, each of which comprise a range of similar soil types, or ‘Series’. The majority of the proposed Gathabawn Windfarm development site, including turbines T5, T6 and T7 at the Ballylehaun Section and all of the turbines at the Ballyring Section, is covered by the Crosstown Association Group (1030a). However, the Ballylehaun Area turbines (T1 – T4) and FW8 and FW9 are covered by the Elton Association Group (1000x/a), see [Figure 7-3a](#).

Within 5km of the Ballylehaun Area lies the Ballinamore (760e) Association Group and the Ballylanders Association Group (1100e). These lie c.1km east of the Ballylehaun Area. Across the study area of the Proposed Gathabawn Windfarm Development, there is minor coverage of the River Association Group (5RIV), these mark the site of palaeochannels and current channels, namely, the River Nore and Lisdowney Stream to the east, and the River Goul to the west. The 5km study area west of the Ballylehaun Section is largely covered by the Elton Association Group (1000a) with some areas of peat c. 3km southwest of T2 and c. 3.8km north of T1 and an area of the Mylerstown Association Group (0650a) c. 0.4km west of the Ballylehaun red line boundary. The Clonroche Association Group (1100a) is located c. 3km south of T6.

- The Elton Association Group is classified as ‘Fine loamy drift with limestones.’
- The Crosstown Association Group is classified as ‘Fine loamy drift with siliceous stones.’

- The River Association Group (SRIV) is classified as 'Silty River Alluvium'.
- The Ballylanders Association Group is classified as 'Fine Loamy over shale or slate bedrock.'
- The Ballinamore Association Group is classified as 'Fine loamy drift with limestones'.
- The Mylerstown Association Group is classified as 'Loamy drift with limestones'.
- The Clonroche Association Group is classified as 'Fine loamy drift with siliceous stones.'

The Quaternary (subsoil) deposits were deposited during the last 2 million years and essentially comprise the unconsolidated materials overlying the bedrock. The two main types of quaternary subsoils in Ireland are glacial till, deposited at the base of ice sheets, and sand and gravel deposits associated with the melting of the ice sheets which are generally termed glaciofluvial outwash sands and gravels. Other extensive quaternary subsoils in Ireland include peat, river alluvium and coastal process deposits. Most Quaternary subsoils in Ireland were deposited since the maximum of the last glaciation, the Midlandian, which occurred approximately 17,000 years ago.

To the west, the areas immediately surrounding Ballylehaun Hill, are comprised of geology identified by the GSI as 'karstic limestone bedrock at surface'. This includes 5 of the 7 no. turbines at the Ballylehaun Section, see [Figure 7-5a](#). Further details on the bedrock geology is presented in Section EIAR 7.3.1.1.2 below.

The remaining 2 no. turbines and much of the study area to the west of the site (in the surrounding 5km) is covered by Carboniferous limestone till. Its coverage is irregular with sporadic areas of Carboniferous limestone sands and gravels, alluvium, peat and exposed bedrock, see [Figure 7-4a](#) and [Figure 7-5a](#).

The area around the Ballyring Section is largely comprised of Carboniferous shales and sandstones till. However, it's coverage is intermittent with sporadic areas of exposed bedrock, particularly in the area of the Ballyring turbines. Within the wider (2km) study area surrounding the Ballyring Section, coverage remains similar, however, subsoil coverage transitions to limestone till 1.6km southeast of the site boundary.

Findings from the site investigations (see sections EIAR 7.3.1.1.4 and EIAR 7.3.1.1.5) confirms the coverage of Carboniferous limestone till, outlined by EPA mapping, around the Ballylehaun Section. The site investigations indicate significant coverage of slightly sandy gravelly clay with limestone cobbles. Furthermore, the site investigations also indicate that many of the turbines in this section are underlain by rock at or near surface, as confirmed by EPA mapping.

Around the Ballyring Area, findings from the site investigation indicate significant coverage of firm to stiff silt, occasionally with cobbles. This aligns with EPA mapping of sandstone and shale tills in the area. However, EPA mapping also suggests there are areas of bedrock at surface at this turbine cluster. Findings from the site investigation suggest bedrock is reached at shallow depths (0.7m – 0.9m) but not at surface.

Candidate Gathabawn Grid Connection:

Within the proposed development site, the cable connecting the two windfarms (Ballylehaun-Ballyring UGC) is underlain by a small area of the Ballylanders Association Group and Ballinamore Association Group, but primarily by the Crosstown Association Group, see [Figure 7-3b](#).

The Ballyring-Parksgrove UGC runs from the Control Building at Ballyring, where it is underlain by the Crosstown Association Group, it runs northeast, underlain by the Elton Association Group and, briefly, the River Association Group in the vicinity of the Lisdowney Stream and River Nore. The Parksgrove Substation and the existing EirGrid Ballyraggett Substation are also underlain by the Elton Association Group.

Subsoils underlying the underground cable comprise, from west to east, shales and sandstone till, bedrock at surface, limestone till, limestone sands and gravel, and river alluvium. The Parksgrove Substation and the existing Ballyraggett Substation are also underlain by limestone sands and gravel, see [Figure 7-4b](#).

The Urban Association Group is within 2km of the candidate grid connection, but does not underlay any part of the underground cabling or Parksgrove Substation.

EIAR 7.3.1.1.2	Bedrock Geology
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Proposed Gathabawn Windfarm: The Ballylehaun Section is partly underlain by the Ballyadams Formation (4 of the 7 no. turbines, T1 to T4), and Clogrenan Formation (1 of the 7 no. turbines, T5). The Ballyadams formation is lithologically described as '*Crinoidal wackestone/packestone limestone*' while the Clogrenan Formation is lithologically described as a '*Cherty, muddy, calcarenitic limestone*', see Figure 7-5a. This agrees with the findings from the borehole drilling (see Section EIAR 7.3.1.1.5), confirming the bedrock in this area is limestone. Four investigatory boreholes were sunk in the area of the 5 turbines to confirm the bedrock geology;

- BH1 sunk to a total depth of 39.80m BGL, identified weathered limestone from 1.2m depth, and competent "very strong grey limestone with rare fractures" from 4m depth;
- BH2 sunk to a total depth of 39.50m BGL, identified weathered limestone at surface, becoming competent "strong to very strong, grey limestone with occasional fractures" from 0.8m depth;
- BH3 sunk to a total depth of 21m BGL, identified weathered limestone from 0.6m depth, becoming competent "medium-strong to strong, grey limestone with occasional fractures from 1.6m depth. Between 17 and 21m depth the borehole encountered "firm dark-brown, clay void infill", possibly indicative of an infilled karst feature; and
- BH4 sunk to a total depth of 40.00m BGL, identified weathered limestone from 0.3m depth, and competent "strong grey limestone with occasional fractures" from 1.6m depth.

The boreholes confirmed the limestone to be present at, or very near to, surface with the initial 1-2 metres showing weathering and degradation. The competent limestone was described as fractured in all boreholes with BH3 showing evidence of a karstic feature at a depth of 17m.

The eastern part of the Ballylehaun Section (2 of the 7 no. turbines, T6 and T7) is underlain by the Killeslin Siltstone Formation. The Killeslin Siltstone Formation is described as '*Muddy siltstone and silty mudstone*'. No boreholes were drilled in this part of the site, however, trial pits in this area were terminated at shale thus likely confirming the presence of this formation in the area.

The Ballyring Section is predominantly underlain by the Bregaun Flagstone Formation (4 of the 5 no. turbines, T8 to T11) and Killeslin Siltstone Formation (1 of the 5 no. turbines, T12). The Bregaun Flagstone Formation is lithologically described as '*Thick flaggy sandstone and siltstone*'. No boreholes were drilled in this area. Trial pits were terminated at siltstone at TP-SubS, TP-T2, and TP-T3 thus confirming the presence of the Bregaun Flagstone Formation beneath turbines T10 and T12. Shale or mudstone was recorded at TP-T13, TP-T14, and TP09, indicating the presence of the Killeslin Siltstone Formation and suggesting the boundary may vary to that suggested by the GSI. This confirms turbine T12 is underlain by the Killeslin Siltstone Formation. The bedrock geology underlying turbines T9 and T11 is ambiguous given the GSI mapping is incongruous with the trial pit logs in these areas. Facilitating Works FW8 and FW9 are both underlain by the Killeslin Siltstone Formation.

Other formations within the study area, but not underlain by the Proposed Gathabawn Windfarm, include the Moyadd Coal Formation, lithologically described as '*Shale, siltstone and minor sandstone*'. There are several more limestone lithologies, extending westwards into the wider 5km study area. From east to west, these include the Durrow Formation, described as '*Shaly fossiliferous & oolitic limestone*', the Aghmacart Formation, described as '*Dark shaly micrite, peloidal limestone*', the Crosspatrick Formation, described as '*Pale-grey cherty crinoidal limestone*', the Waulsortian Limestones, described as '*Massive unbedded lime-mudstone*', and the Ballysteen Formation, '*Dark muddy limestone, shale*'.

Several bedrock faults exist in the centre of the study area, around Gathabawn Village itself, at approximately three different orientations. This faulting continues westwards at a lesser density. In the western section of the study area, west and north of the Ballylehaun Section, there is a high density of smaller faults across two orientations, North - South and East – West.

Candidate Gathabawn Grid Connection:

The Ballylehaun-Ballyring UGC is underlain by the Clogrenan Formation, Killeslin Siltstone Formation and Bregaun Flagstone Formation. The Ballyring-Parksgrove UGC route runs from the Substation at Ballyring, where it is underlain by the Bregaun Flagstone Formation, it runs northeast, underlain by the Killeslin Siltstone Formation, Clogrenan Formation and Ballyadams Formation. It terminates at the Parksgrove Substation where it is underlain by the Durrow Formation. Underground cabling then continues to the existing Ballyraggett Substation, underlain by the Ballyadams Formation, see [Figure 7-5b](#).

EIAR 7.3.1.1.3	Karst
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Proposed Gathabawn Wind Farm:

Based on a review of the GSI Karst database there are no identified karst geological features at the Proposed Gathabawn Wind Farm Site, see [Figure 8-5a](#) in [Chapter 8: Water](#).

Karst geology at the Site is discussed in detail in [Chapter 8: Water](#) relating to Groundwater Bodies and Aquifers, and also Groundwater Interaction with Designated Sites.

The Site area underlain by the Ballyadams Formation, which is classed as a Karstified (diffuse) Bedrock Aquifer (Rkd), has the potential for Karst Geology. However, the karst aquifer is classified as being of diffuse nature where karstified groundwater flows mainly occur in the near surface hence groundwater flow predominantly occurs in this upper zone. Studies show a continuous water table does not exist, indicating that flow in the aquifer may be through a diffuse network of conduits, in this aquifer.

The closest karst feature to the Gathabawn Wind Farm Project is an enclosed depression located approximately 2.4 km to the southeast of T4. There is a linear row of four springs c. 2.7 km south of T6., as shown on [Figure 8-5a](#) in [Chapter 8: Water](#). There is a cluster of swallow holes c. 3 km south of T6 and up to 23 enclosed depressions in the same area south of Ballylehaun Area near Clomantagh Hill.

There are no karst features within 2km of the Ballyring Area.

As outlined by the borehole drilling, discussed in Section 7.3.1.1.2 above, there is no evidence of karst features at surface with the logs indicating a typically very thin weathered horizon (1-2m) overlying competent strong limestones with no evidence of near surface karst features. The nearest potential karst feature being a “firm dark-brown, clay void infill” located between 17 and 21m below ground level within BH3.

Candidate Gathabawn Grid Connection:

There is a cluster of karst features located southwest of Ballyraggett town. One of these karst features, an enclosed depression is located c. 2 km from the Ballyring – Parksgrove UGC at its closest point. The other karst features are more than 2 km away from any aspects of the grid connection.

EIAR 7.3.1.1.4	Trial Pit Investigations
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Three rounds of trial pitting have taken place across the site, the first in 2021, the second in 2023, and a final round in 2026. The 2021 trial pitting, consisting of 14 no. trial pits, occurred predominantly across the area of the proposed Ballylehaun turbines with a number of trial pits also located in the area of the proposed Ballyring turbines. The 2023 trial pitting, consisting of 8 no. trial pits, occurred predominantly across the area of the proposed Ballyring turbines, with several trial pits also located in the area of the proposed Ballylehaun

turbines. The 2026 trial pitting, consisting of nine trial pits, occurred predominantly across the area of the Ballylehaun turbines, with one other trial pit located adjacent to proposed turbine T9 at the Ballyring site. The trial pit logs are included in [Appendix 7.2](#).

Ballylehaun: in the three trial pits to the northwest of Ballylehaun, quaternary strata typically comprise some variation of: firm sandy gravelly silt/clay with numerous subrounded cobbles. In the trial pits (2023 trial pits, TP01-TP10, and 2026 trial pits, TP03 – TP05) located in the area of the proposed Ballylehaun turbines, weathered limestone is typically encountered between 0.10mBGL and 0.90mBGL.

Ballyring: predominantly; firm to stiff silt overlying weathered siltstone in all trial pits in the vicinity. However, there is some variability. Mudstone is encountered in northerly trial pit TP09 (2026) and shale encountered in southerly trial pits TP-T13 and TP-T14.

The findings of the trial pit investigations are outlined in the table below. The locations of the trial pits are identified on [Figure 7-4a](#) and [Figure 7-4b](#).

Table 7-3: Summary of Trial Pits at Development Locations

Location	Relevant Trial Pit	Depth to Bedrock/ Trial Pit Depth (m)	Subsoil Summary Description	Bedrock Description	GSI Mapped Bedrock Formation
Ballylehaun	TP-T1 (W1)	2.50	Firm SILT/CLAY	Not encountered	Ballyadams Formation
Ballylehaun	TP-T2 (W2)	2.70	Firm SILT/CLAY	Not encountered	Ballyadams Formation
Ballylehaun	TP-T3 (W3)	1.00	Firm SILT/CLAY	LIMESTONE	Ballyadams Formation
Ballylehaun	TP-T8 (W8)	2.10	Firm SILT/CLAY Soft SHALE	SHALE	Killeshin Siltstone Formation
Ballylehaun	TP-T9 (W9)	2.40	Firm SILT/CLAY	Weathered SHALE	Killeshin Siltstone Formation
Ballyring	TP-T12 (W12)	2.10	Stiff CLAY	Boulders – Possibly bedrock	Bregaun Flagstone Formation
Ballyring	TP-T13 (W13)	2.15	Firm SILT/CLAY	Weathered SHALE	Bregaun Flagstone Formation
Ballyring	TP-T14 (W14)	2.00	Firm SILT	SHALE	Killeshin Siltstone Formation
Ballylehaun	TP01	0.40	Firm SILT/CLAY	Weathered LIMESTONE	Ballyadams Formation
Ballylehaun	TP02	0.45	Firm SILT/CLAY	Weathered LIMESTONE	Ballyadams Formation
Ballylehaun	TP03	0.20	Not encountered	Weathered LIMESTONE	Ballyadams Formation
Ballylehaun	TP04	0.25	Firm SILT/CLAY	Competent LIMESTONE	Ballyadams Formation
Ballylehaun	TP05	0.25	Firm SILT/CLAY	Competent LIMESTONE	Ballyadams Formation
Ballylehaun	TP06	0.15	Not encountered	Weathered LIMESTONE	Ballyadams Formation
Ballylehaun	TP07	0.25	Firm SILT/CLAY	Weathered LIMESTONE	Ballyadams Formation
Ballylehaun	TP08	0.15	Not encountered	Weathered LIMESTONE	Ballyadams Formation
Ballylehaun	TP09	0.25	Firm SILT/CLAY	Competent LIMESTONE	Ballyadams Formation

Ballylehaun	TP10	0.15	Not encountered	Weathered LIMESTONE	Ballyadams Formation
Ballyring	TP-T2	0.85	Very firm SILT	Not encountered	Bregaun Flagstone Formation
Ballyring	TP-T3	0.75	Very firm SILT	LIMESTONE	Bregaun Flagstone Formation
Ballyring	TP-T4	1.60	Very firm SILT	Weathered SILTSTONE	Killeshin Siltstone Formation
Ballyring	TP_Sub S	0.90	Not encountered	Weathered SILTSTONE	Bregaun Flagstone Formation
Ballylehaun	TP02 (2026)	1.50	Soft CLAY Loose SAND	Not encountered	Ballyadams Formation
Ballylehaun	TP03 (2026)	0.90	Soft CLAY Loose SAND	Not encountered	Ballyadams Formation
Ballylehaun	TP04 (2026)	0.10	Not encountered	Weathered LIMESTONE/SANDSTONE	Ballyadams Formation
Ballylehaun	TP05 (2026)	0.30	Not encountered	Competent LIMESTONE	Clogrenan Formation
Ballylehaun	TP06 (2026)	3.00	Firm CLAY Medium dense SAND	Not encountered	Killeshin Siltstone Formation
Ballylehaun	TP07 (2026)	0.40	Soft CLAY	Weathered LIMESTONE	Killeshin Siltstone Formation
Ballylehaun	TP07a (2026)	1.50	Not encountered	Weathered MUDSTONE	Killeshin Siltstone Formation
Ballyring	TP09 (2026)	1.80	Soft CLAY	Weathered MUDSTONE	Bregaun Flagstone Formation

EIAR 7.3.1.1.5 Borehole Investigations

In 2021, a site investigation took place comprising four boreholes in the area of the proposed Ballylehaun turbines T3, T4 and T5. Three of these were installed with standpipes to facilitate groundwater monitoring, these were drilled to 39.50mbgl - 40.00mbgl. No standpipe was installed in BH3 which reached a depth of 21.00mbgl. Borehole locations are presented on [Figure 7-5a](#).

Table 7-4: Summary of Boreholes

Borehole ID	Relative Position	GL Elevation (mAOD)	Borehole depth (mbgl)
BH1	270m NE of T3	215.3	39.8
BH2	200m SW of T3	217.4	39.5
BH3	240m SW of T4	253.1	21
BH4	60m SE of T5	234.6	40

A summary of the geological findings from the boreholes are set out below:

Quaternary geology: Typically comprise some variation of a thin bed of firm, brown, sandy topsoil overlying firm brown sandy silty clay. In the northerly boreholes, BH1 and BH2, limestone boulders are frequent within the clay.

Bedrock geology: Predominantly a weathered medium strong limestone overlying a strong to very strong limestone. Typically occurs at a depth range of 0.30mbgl – 1.60mbgl.

EIAR 7.3.1.1.6 Peat Investigations

No peat deposits were encountered in the site during the site visits or in the course of the ground investigations. This is consistent with regional mapping which does not indicate the presence of any peat in the area. A geotechnical assessment of the windfarm site was undertaken in September 2026 by Fehily Timoney and Company who identified no areas of peat during site investigations ([Appendix 7.3](#)).

EIAR 7.3.1.2 Soils, Subsoils and Bedrock in Designated & Protected Sites**Proposed Gathabawn Windfarm:**

The Proposed Gathabawn Windfarm site is located adjacent to the Cullahill Mountain SAC, Cullahill Mountain pNHA and Gales Hill Nature Reserve. The Spahill and Clomantagh Hill SAC and Spahill and Clomantagh Hill pNHA are located c.860m from the site boundary at the Ballylehaun Section. These are of interest for their semi-natural dry grasslands and scrubland facies on calcareous substrates.

Candidate Gathabawn Grid Connection:

The Ballylehaun-Ballyring UGC is located adjacent to the boundary of Cullahill Mountain SAC and pNHA and Gales Hill Nature Reserve at the Ballylehaun Area.

Designated Sites within 2km of the Candidate Gathabawn Grid Connection construction works area include the River Barrow and River Nore SAC, River Nore SPA and River Nore/Abbeyleix Woods Complex pNHA, and Spahill and Clomantagh Hill SAC and pNHA. This area has a considerable number of qualifying interests concerning flora and geomorphological phenomena.

A section of the Parksgrove-Moatpark UGC is routed to cross these Designated Sites c.1.2km north of the N77 bridge in Ballyragget.

EIAR 7.3.1.3 Soils, Subsoils and Bedrock in Geological Heritage Sites**Proposed Gathabawn Windfarm:**

A review of the GSI digital map indicates that one County Geological Heritage Site lies within the study area at the very eastern edge, this is Lisdowney Quarry. This is of interesting for its high diversity of Lower Carboniferous crinoid fauna, particularly, a number of blastoid species. This is a very small quarry that only partly lies within the study area. M8 Road cut – Addergoole is located within 5km of the Ballylehaun Area.

Candidate Gathabawn Grid Connection: A review of the GSI digital map indicates that there are no County Geological Heritage Site along the Candidate Gathabawn Grid Connection route, however Lisdowney Quarry is located c.0.25km south of the Ballyring-Parksgrove UGC.

EIAR 7.3.2 Existing Sources of Impacts

The occurrence of existing pollution or environmental damage in the areas on or around the location of the Gathabawn Windfarm have been considered. No existing pollution or damage to Soils, Subsoils & Bedrock is taking place at the windfarm site: during the site investigations, no areas of contamination concern were identified during site investigations at the windfarm site and there are no licensed waste facilities within or in the immediate environs of the windfarm site.

EIAR 7.3.3 Importance, Sensitivity and Vulnerability to Change**EIAR 7.3.3.1 Importance**

The importance of soils and geology receptors has been determined with reference to their quality, function, rarity, condition and geographical extent. Consideration has been given to factors including soil characteristics and classification, peat depth and extent, carbon storage potential, geological features, mineral resources, and the rarity or uniqueness of the resource at a local, regional or national scale. The assigned importance is subsequently used to inform the sensitivity of receptors within the assessment of effects.

The soils at the site are predominantly loamy drift soils. The loamy drift soils are considered to be of **Low** importance due to their widespread nature in the region around the site, and are not considered to be unique in any way. It is further noted that the soils are considered to have been previously altered as a result of current and historic landuse such as forestry and agriculture.

The bedrock geology is considered to be of **Low to Medium** importance given the lack of designated geological receptors in the vicinity of the site but there is the potential for presence of Karst features.

Soils, subsoils and bedrock in Designated Sites are considered to be of **Very High** importance, while soils, subsoils and bedrock in Geological Heritage sites are of **High** importance. It is noted that the Gathabawn Windfarm does not directly overlap the boundary of any Designated or Geological Heritage site. However, within 2km of the site boundary, there is one geological heritage site and several designated sites.

EIAR 7.3.3.2 Sensitivity

Soils and geology can be sensitive to processes such as erosion, compaction, loss of biodiversity and drainage. The rate of these processes can be increased by certain landuse practices or landuse changes such as deforestation. Soil is also biologically active, and it supports complex ecosystems which are sensitive to chemical and biological changes. The soils and subsoils within the proposed Gathabawn Windfarm are predominantly loamy drift soils. The loamy drift soils are considered to be of **Low** sensitivity due to their widespread nature in the region around the site.

The bedrock geology is considered to be of **medium** sensitivity due to the karstic nature of the limestone underlying Ballylehaun site, and with consideration for the lack of designated geological receptors in the immediate vicinity of the site which may be impacted by site activity.

EIAR 7.3.4 Evolution of the Baseline Environment (the 'Do-Nothing' scenario)

The soils and subsoils at the project site have all been altered to some extent by agricultural landuse and occasional forestry landuse around the windfarm site. Both of these landuses are associated with land improvement works, which are expected to continue, as agricultural land and forestry regularly needs continued management to improve soil and subsoil structure. Forestry tracks and farm tracks are also regularly maintained, and forestry is felled and replanted in a growing and harvesting cycle.

EIAR 7.3.5 Climate Change effects to Soils

Climate change is not likely to significantly alter Soils compared to the site baseline over the lifetime of the Gathabawn Windfarm. Agriculture and forestry activities are the main potential drivers of change.

EIAR 7.4 IMPACT OF THE PROPOSED DEVELOPMENT

This Section comprises an evaluation of the impacts of the proposal on the receiving Soils environment.

EIAR 7.4.1 Criteria and Methodology

The criteria used for impact evaluation in this report is based on the Institute of Geologists Ireland 2013 *Guidelines for Preparation of Soils, Geology & Hydrogeology Chapters in Environmental Impact Statements*, and the National Roads Authority 2009 *Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes*. The methodology for determining the significance of impacts to Soils is based on the importance of the attribute (sensitive aspect) and the magnitude of the impact, as outlined in [Appendix 7.1](#).

EIAR 7.4.2 Source-Pathway-Receptor

The following sources of impacts and pathways for these impacts to the identified receptors (sensitive aspects) of Soils are listed below.

EIAR 7.4.2.1 Sources of Impact

Activities or events that might impact quaternary sediment quality during construction and operation phase (e.g. soil contamination by a fuel or oil spill or leakage or soil compaction) Such as:

- Excavation of soil, subsoil and bedrock, including extraction from borrow pits;
- Relocation and storage of soil, subsoil and bedrock;
- Weight/movement/vibration of plant, machinery and construction traffic causing geotechnical instability;
- Weight of overburden and temporary infrastructure causing geotechnical instability;
- Use of machinery and equipment run on hydrocarbons;
- Use of cement-based compounds; and
- Groundworks.

EIAR 7.4.2.2 Pathways

The following potential pathways for impacts on receptors can occur:

- Physical disturbance;
- Physical movement;
- Physical compression;
- Wind and rain erosion; and
- Soil, subsoil and bedrock pore space (pathway for contaminants)

EIAR 7.4.2.3 Receptors

Based on the review of the baseline setting the following potential receptors have been identified:

- Local Soils, Subsoils & Bedrock
- Soils, Subsoils and Bedrock in Designated & Protected Sites:
 - Cullahill Mountain SAC
 - River Barrow and River Nore SAC
 - Spahill and Clomantagh Hill SAC
 - River Nore SPA

- Cullahill Mountain pNHA
- River Nore/Abbeyleix Woods Complex pNHA
- Spahill and Clomantagh Hill pNHA
- Gales Hill Nature Reserve
- Soils, Subsoils and Bedrock in Geological Heritage Sites
 - Lisdowney Quarry

EIAR 7.4.3 Overview of the Proposed Development

The proposed Gathabawn Windfarm Project comprises 12 wind turbines with an overall blade tip height of 150m for T6, T7 and T9, and 170m for all other turbines, and all associated foundations and hard-standing areas in respect of each turbine, cabling, access roads, windfarm substation, lattice tower meteorological mast 30m in height and all ancillary associated and facilitating works and activities.

EIAR 7.4.4 Evaluation of effects on Soils

A summary of the findings of the evaluation of the effects of the proposed Gathabawn Windfarm Project on Soils are listed in the table below. The relevant phases of the development are the construction, operational and decommissioning phases which are denoted by C, O and D respectively.

The evaluations follow this summary table

The following effects are evaluated in detail to determine whether or not they are likely to be Significant.

LOCAL SOILS, SUBSOILS & BEDROCK IMPACTS	EIAR Section:
Excavation & Relocation of Soils, Subsoils & Bedrock (C)	7.4.5.1
Contamination by Oils, Fuels & Cementitious Materials (C)	7.4.5.2
Impact on Karst Features from construction works (C)	7.4.5.3

All of the remaining effects of the proposed Gathabawn Windfarm Project on Soils will have no likelihood of causing significant adverse effects to Soils receptors. A short evaluation of these effects is provided in Section EIAR 7.4.6, with a list of these impacts provided below.

Table 7-5: List of effects to Soils which will not be significant

Effects of the Proposed Development which will not be significant (<i>no mitigation required</i>)	Phase	Impact Significance – See Section EIAR 7.4.6
LOCAL SOILS, SUBSOILS AND BEDROCK IMPACTS		
Soil degradation due to erosion or weathering	C	Slight
Ground instability in soils and subsoils	C	Imperceptible
Soil degradation due to compaction	C	Imperceptible
Contamination of soil due to backfilling material	C	Imperceptible
Reduction in soil quantity and soil degradation due to sealing	C, O, D	Imperceptible
Soil degradation due to excavation, relocation, erosion or compaction of soils and subsoils, or due to contamination by hydrocarbons	O, D	Imperceptible

SOILS, SUBSOILS AND BEDROCK IN DESIGNATED SITES IMPACTS		
Impacts on soils, subsoils and bedrock in Designated Sites	C, O, D	Imperceptible (windfarm) – Slight (CGGC)
SOILS, SUBSOILS AND BEDROCK IN GEOLOGICAL HERITAGE SITES IMPACTS		
Impacts on soils, subsoils and bedrock in Geological Heritage Sites	C. O, D	Negligible

EIAR 7.4.5 Evaluation of Impacts to Soils with Potential to be Significant

EIAR 7.4.5.1 Excavation & Relocation of Soils, Subsoil & Bedrock

Sensitive Aspect:	Local Soils, Subsoils & Bedrock
Importance:	Low to Medium (as per Section EIAR 7.3.3)
Impact Source(s)	Excavation, relocation and storage of soil, subsoil and bedrock; groundworks; extraction from borrow pits
Impact Pathway(s)	Excavation, movement and storage of overburden
Project Stage	Construction Phase

Overview of Impact (general):

Topsoil is a non-renewable resource and when removed or stored can result in a permanent irreversible negative impact. In addition, materials that are stockpiled incorrectly can be exposed to erosion and weathering which reduces the quality of the resource.

The excavation, relocation and storage of material is an inevitable part of the development and will be required for all groundworks; including site levelling, the installation of infrastructure (e.g. turbine foundations, borrow pits, substation foundation, hardstands and from cable trenches to install electrical cabling) and for access track formation and will, therefore, give rise to direct effects on these receptors.

Examination of the Impact:

Proposed Gathabawn Windfarm Impact: According to Chapter 5: Description of the Development, the turbine foundations will be a reinforced concrete gravity design and will be constructed on the underlying bedrock substrate. Foundations depths are expected to be c.3.2m deep, depending on ground conditions at each turbine location, with an approximate diameter of 20m.

The trenches, within which the windfarm cabling will be placed, will be typically 0.6m to 0.75m wide by 1.25m deep. The Windfarm Cabling will be 8km in length, all of which will be under windfarm site roads (either upgraded existing farm tracks or new windfarm roads), crossing the public road L58141 and under the public road L18062.

Bedrock will be encountered at most locations on the windfarm site at Ballylehaun due to its relatively shallow nature, as evidenced by the results of the preliminary site investigations undertaken. Rock for windfarm construction purposes will be sourced from 2 no. on-site borrow pits and from the turbine foundation excavations where shallow rock is available. These works will result in a direct, permanent loss of soil, subsoil and bedrock at excavated locations. In total, approximately **116,000m³ of soils and rock material** will be excavated during groundworks associated with the Proposed Gathabawn Windfarm (including the borrow pits):

- the majority (c.90,000m³) is associated with the main excavations at the windfarm site (i.e. for turbine hardstands and foundations, internal windfarm cabling, windfarm control buildings and for the windfarm site roads);
- c.26,000m³ from the 2 no. borrow pits for use as building material for windfarm roads and hardstands
- In addition, 8,000m³ of hardwearing capping stone will be imported from a local quarry.

Approximately 80-90% of the subsoil excavated during project groundworks will be suitable for use as construction material at hardstand areas, access roads, to backfill cable trenches. The remaining unsuitable material will be used to reinstate the 2 no. borrow pits and be stored permanently in berms alongside the turbine hardstands and along some of the access roads.

Following the completion of the construction phase, the dedicated overburden storage areas and 2 no. borrow pits will be graded and reseeded. Borrow pits will be graded to match existing profiles.

Due to the volumes of soil removed and the localised nature of effects, with no part of the windfarm within designated sites, ecological features or geological heritage sites, the magnitude of effects on soils, subsoils and bedrock at the windfarm site will be of **low adverse** magnitude.

Candidate Gathabawn Grid Connection Impact: Ballylehaun-Ballyring UGC is c.5.6km in length, located in Windfarm Site Roads and in the Public Road network. The trench within which the Ballyring-Parksgrove UGC will be placed will be 8.8km in length, 1.25m deep and 0.75m wide. The Parksgrove-Moatpark UGC will be c.1.5km in length, with cables, ducts and other apparatus laid in a trench c.1.3m deep and 0.6m wide. This cabling will be installed under agricultural lands, hardcore areas including farm tracks and within the Ballyring site, will cross the River Nore and will be laid within the public road corridor. The Parksgrove Substation is proposed for an area of scrubland/vacant land.

Approximately 16,000m³ of soils and rock material will be excavated during groundworks associated with the Candidate Gathabawn Grid Connection:

- The majority (c.9,200m³) is associated with the excavations for the Ballyring-Parksgrove UGC and Parksgrove-Moatpark UGC trenches;
- The remainder (c.6,800m³) will arise from excavations for the Parksgrove Substation.

Due to the volumes of soil removed and the localised nature of effects, with trenching works within the boundary of the River Barrow and River Nore SAC and River Nore/Abbeyleix Woods Complex pNHA, and horizontal directional drilling (HDD) works additionally within the River Nore SPA, the magnitude of effects on soils, subsoils and bedrock from the Candidate Gathabawn Grid Connection works will be of **low adverse** magnitude.

Whole Project Impact: The only area where excavations associated with the Proposed Gathabawn Wind Farm and the Candidate Gathabawn Grid Connection overlap spatially is within the Ballyring section and at the Ballylehaun Control Building. In these areas, the Ballylehaun-Ballyring UGC and the Ballyring-Parksgrove UGC will be installed within site roads and beneath hardcore at the windfarm control buildings. Given the limited extent of this overlap, the effects of the overall project are considered to be localised. Under a worst-case scenario, these effects are expected to be temporary, short-term, negative, and of negligible significance of low adverse impact.

Impact Magnitude	Low adverse	Impact Significance: (pre-mitigation)	Slight
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Mitigation and Monitoring Measures: Even though Significant impacts are not predicted; the following mitigation and monitoring measures will be implemented as best practice environmental management.

WM01 GM01	<u>Engineering Review:</u> A suitably qualified engineer will review and approve the civil contractor's method statements and final detailed design prior to the commencement of construction works.
WM14 GM14	<u>Engineer Supervision:</u> a suitably qualified engineer will supervise all site excavations and construction works.
WM33 GM30	<u>Excavation of Materials:</u> The excavation of earth materials during the construction stage will be kept to a minimum. The excavation of materials will be completed in accordance with best practices for the management and treatment of such materials. (i.e. British Standards BS6031:2009 Code of Practice for Earthworks) and MAFF (2000) Good Practice for Handling Soils).
WM34 GM31	<u>Storage of Overburden:</u> During construction works, excavated material will be removed for temporary or permanent storage at designated berms. All storage berms will be placed more than 50m away from any watercourse or wet drainage channel. Temporary silt control methods such as silt fencing or curtains will be placed around all overburden storage areas and/or installed between the berms and local watercourses or wet drainage channel, depending on the locations, and the existing vegetative between the berms and watercourse / drainage feature will be left in place.
WM31	<u>Control of Movement of Machinery/Vehicles:</u> Construction traffic, personnel and materials will be restricted to the hardcore surfaces, particularly with respect to the newly constructed access roads. This means that machinery will be kept on the windfarm site roads and hardstanding areas, and, aside from advancing excavations, will avoid moving onto areas not delineated on the site drawings.
GM28	<u>Control of Movement of Machinery/Vehicles:</u> Construction traffic, personnel and materials will be restricted to within the construction works area fence and will avoid moving onto areas not delineated on the site drawings.

Effectiveness of Mitigation:

The disturbance, excavation, and relocation of soil, subsoil, and bedrock materials are necessary elements of the development process. Given the nature of these activities, mitigation is limited to the application of standard construction best practice and environmental management procedures. Accordingly, the residual effects associated with the loss and disturbance of soil, subsoil, bedrock, and land use are not anticipated to differ from the predicted pre-mitigation effects and are assessed as low adverse within the wind farm site.

Residual Impact Significance (*post-mitigation*):

Slight

EIAR 7.4.5.2 Contamination by Oils, Fuels & Cementitious Materials

Sensitive Aspect:	Local Soils, Subsoils & Bedrock
Importance:	Low to Medium (as per Section EIAR 7.3.3)
Impact Source(s)	Oils, Fuels & Chemicals
Impact Pathway(s)	Soil, subsoils and bedrock pore space
Project Stage	Construction Phase

Overview of Impact (general):

The plant and equipment that will be used during the construction phase will be run on fuels and oils. This creates the potential for spillage and leakage of hydrocarbons from plant during refuelling or storage of oils and fuels which can impact on downstream surface water bodies and can significantly contaminate lands, soils and bedrock. Cement-based compounds, such as the concrete used for the turbine foundations, have the potential to affect the pH of soils, therefore altering soil chemistry.

Examination of the Impact:

Proposed Gathabawn Windfarm Impact: Only relatively small volumes of fuels / oils will be on-site at any one time and therefore no significant spills/leakages are expected. Therefore, any incidents that do occur will largely be limited to small, isolated, low volume spills / leaks that may occur along the development site construction works areas. Several procedures relating to refuelling, accident/spill response and the storage of contaminative liquids will be implemented as part of the mitigation and monitoring measures.

Considerable volumes of cement-based compounds will be used at turbine locations, however potential impacts are localised at 15 no. discrete and spread-out locations (i.e. 12 turbine foundations, 2 windfarm control buildings and met mast). In addition, these locations are spread over a large geographical area. Any increase in soil pH will be temporary and reversible.

The magnitude of potential contamination is evaluated as medium adverse.

Candidate Gathabawn Grid Connection Impact: Only relatively small volumes of fuels / oils will be on-site at any one time and therefore no significant spills/leakages are expected. Several procedures relating to refuelling, accident/spill response and the storage of contaminative liquids will be implemented as part of the mitigation and monitoring measures.

Cement-based compounds will be used at the Parksgrove Substation location, along the route of the Ballylehaun-Ballyring UGC within the public road, as well as in section of the Ballyring-Parksgrove UGC which trench within the public road. Cement-based compounds will also be used within all of the trenching for the Parksgrove-Moatpark UGC, including a section of trenching within the boundary of the River Barrow and River Nore SAC, River Nore SPA and the River Nore/Abbeyleix Woods Complex pNHA. Due to the linear nature of the underground cabling and much smaller scale of works compared to the windfarm, it is considered that the potential worst-case impact of the Candidate Gathabawn Grid Connection will be low adverse.

Whole Project Impact: The only area where excavations associated with the Proposed Gathabawn Wind Farm and the Candidate Gathabawn Grid Connection overlap spatially is within the Ballyring Control Building and at the Ballylehaun Control Building. In these areas, the Ballylehaun-Ballyring UGC and the Ballyring-Parksgrove UGC will be installed within site roads and beneath hardcore at the wind farm control buildings. Given the limited extent of this overlap, the effects of the overall project are considered to be localised. Under a worst-case scenario, these effects are expected to be temporary, short-term, negative, and of negligible significance of low to medium adverse impact.

Impact Magnitude	low to medium adverse	Impact Significance: (pre-mitigation)	Slight to Moderate
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Mitigation and Monitoring Measures: Even though Significant impacts are not predicted; the following mitigation and monitoring measures will be implemented as best practice environmental management.

WM18 GM18	<u>Fit for Purpose</u> : All plant and machinery which will be used during construction will be fit for purpose and in good working order prior to mobilisation to works areas. The plant and machinery will be regularly inspected by the Contractor for leaks and maintained in good working order for the duration of the works.
WM31	<u>Control of Movement of Machinery/Vehicles</u> : Construction traffic, personnel and materials will be restricted to the hardcore surfaces, particularly with respect to the newly constructed access roads. This means that machinery will be kept on the windfarm site roads and hardstanding areas, and, aside from advancing excavations, will avoid moving onto areas not delineated on the site drawings.
WM34 GM31	<u>Storage of Overburden</u> : During windfarm construction works, excavated material will be removed for temporary or permanent storage at designated berms. All storage berms will be placed more than 50m away from any watercourse or wet drainage feature. Temporary silt control methods such as silt fencing or curtains will be placed around all overburden storage areas and/or installed between the berms and local watercourses or wet drainage channel, depending on the locations, and the existing vegetative between the berms and watercourse / drainage feature will be left in place.
WM47	<u>Concrete control procedures</u> will be implemented and will include the following: • No concrete batching will take place on site, all concrete will be ready-mixed and delivered just-in-time; • The pouring of concrete will be scheduled for dry days. If a sudden rainfall event should occur, then suitable covers will be ready and available at the pour site to cover the concrete. • The pour site will be kept free of standing water; • All operators involved in pouring concrete will be trained and experienced in working with concrete; • Run-off from wind turbine foundation concrete pours will not be permitted to flow over adjacent lands or enter drainage channels. The run-off will be contained within the foundation area and pumped into a skip to settle out; settled solids will be appropriately disposed of off-site. • The Contractor will not permit the discharge of cement contaminated waters to the construction phase drainage system, onto adjacent lands or directly to any artificial drain or watercourse. • Concrete trucks will be washed out at the supplier's facilities and not on site. The only concrete washing that will occur on site is the hand washing of the chutes at the rear of the trucks. Washing of chutes will only take place at the designated area and into a Roadside Concrete Washout unit.
GM44	<u>Concrete control procedures</u> will be implemented and will include the following: • All concrete will be ready-mixed and delivered to site just-in-time; • Dry granular cement will be used in UGC cable trenches; • The pouring of concrete will be scheduled for dry days. If a sudden rainfall event should occur, then plastic covers will be ready and available at the pour site to cover the concrete. • The pour site will be kept free of standing water; • Designated trained operator experienced in working with concrete will be employed during concrete pouring; • Concrete trucks will be washed out at the supplier's facilities and not on site. The only concrete washing that will occur on site is the hand washing of the chutes at the rear of the trucks. Washing of chutes will only take place at the designated area and into a Roadside Concrete Washout unit. • No discharge of cement contaminated waters to any artificial drain or watercourse will be allowed.
WM48	<u>Refuelling control procedures</u> will be implemented and will include the following: • On site re-fuelling of machinery will be carried out using a mobile double skinned fuel bowser. The fuel bowser carried on a double axel refuelling trailer, will be refuelled off-site, and will be towed around the site by a 4x4 vehicle to where machinery is located. The 4x4 vehicle will carry fuel absorbent material and pads in the event of any accidental spillage. Mobile measures such as drip trays and fuel absorbent mats will be used during all refuelling operations. • In addition, spill response apparatus including spill-kits and fuel absorbent mats will be stored in the cabin of each vehicle and operators will be fully trained in the use of this equipment and in the implementation of the Emergency Response Plan, as contained in the Environmental

	Management Plan. • The fuel bowser will be parked on a level area, away from main traffic activity, in a designated part of the construction compounds when not in use. Taps, nozzles or valves associated with mobile fuel bowser will be fitted with a lock system. Only designated trained and competent operatives will be authorised to refuel plant on site. A Permit to Fuel system will be put in place. • There will be no refuelling of vehicles or plant permitted within 100m of a watercourse or wet drainage channel or local spring/well.
GM45	<u>Fuel/Oil control procedures</u> will be implemented and will include the following: On site re-fuelling of machinery will be carried out using a mobile double skinned fuel bowser. The fuel bowser, a double axel custom-built refuelling trailer, will be refuelled off-site, and will be towed around the site by a 4x4 jeep to where machinery is located. The 4x4 jeep will carry fuel absorbent material and pads in the event of any accidental spillage. Mobile measures such as drip trays and fuel absorbent mats will be used during all refuelling operations. In addition, spill response apparatus including spill-kits and fuel absorbent mats will be stored in the cabin of each vehicle and operators will be fully trained in the use of this equipment and in the implementation of the Emergency Response Plan, as contained in the Environmental Management Plan. The fuel bowser will be parked on a level area, away from main traffic activity, in a designated part of the construction compound when not in use. Taps, nozzles or valves associated with mobile fuel bowser will be fitted with a lock system. Only designated trained and competent operatives will be authorised to refuel plant on site. A Permit to Fuel system will be put in place.
GM46	<u>Along the cable routes, there will be no refuelling</u> of plant or machinery within 100m of a watercourse or wet drainage channel or local spring/well.
WM49 GM47	<u>Storage of Fuels, Oils and Chemicals:</u> All fuels or oils or chemicals, required during construction, will be stored in a designated, bunded, locked storage area within the temporary compounds. All fuel, oil and chemical storage areas will be bunded appropriately to 110% of the volume of oils/fuels each area contains for the duration of the construction phase. All bunded areas will be fitted with a storm drainage system and an appropriate oil interceptor. Ancillary equipment such as hoses, pipes will be contained within the bunded area. Fuel, oil and chemical stores including tanks and drums will be regularly inspected for leaks and signs of damage. Safety data sheets for all chemicals used will be kept on-site. An emergency response plan for the construction phase to deal with accidental spillages will be contained within the Environmental Management Plan.
<u>Effectiveness of Mitigation:</u> The use and storage of hydrocarbons, concrete and small volumes of chemicals is a standard risk associated with all construction sites. Proven and effective measures to mitigate the risk of spills and leaks have been proposed above and will break the pathway between the potential source and the receptor. The residual effect will be negative, imperceptible, direct, short-term and unlikely to have an effect on soil, subsoils and bedrock.	
Residual Impact Significance (<i>post-mitigation</i>):	
Imperceptible	

ElAR 7.4.5.3 Impact on Karst Features

Sensitive Aspect:	Karst features in the bedrock limestone
Importance:	Medium (as per Section ElAR 7.3.3)
Impact Source(s)	Ground instability and contaminative spills
Impact Pathway(s)	Soil, subsoils and bedrock pore space
Project Stage	Construction Phase

Overview of Impact (general):

The western windfarm site is situated upon Ballylehaun hill which is underlain by limestone bedrock which potentially holds karstic features. The potential impact is twofold;

- contaminative materials potentially may spill or leak into the karstic fracture network, infilling or chemically weathering the features and changing the flow regime; and
- potential ground instability caused by loading of turbines on karst limestone.

Examination of the Impact:

Proposed Gathabawn Windfarm Impact: The geology identified by the GSI to be underlying the Ballylehaun section primarily comprises limestone which is identified to specifically underlay five of the seven turbines in this section. The 2021 ground investigation identified competent limestone at, or very near to, surface in the area immediately surrounding the section, with strong bedrock limestone (with occasional to rare fractures) encountered. A karstic feature was only encountered in one borehole from 17m BGL however the feature was observed to be infilled with clay materials, showing secondary weathering.

The nearest GSI-identified karstic features are noted to be c.2.3km to the south-west of the Ballylehaun section.

Each turbine foundation will have a depth of 3.2 metres below ground level, and therefore based on the available information are not expected to directly encounter main karstic pathways. The relatively minor footprint of the turbines relative to the regional spread of the limestone, would suggest that the groundwater flow regime through the karsts would also not be significantly impacted by each excavation. Final design of the turbine foundations will be approved by a suitably qualified geotechnical engineer and will be informed through pre-construction detailed geotechnical investigations.

In the event of Karst features being present at shallow depth and unless sufficiently managed, the construction works have the potential to impact karstic features through the pouring of cement across an exposed fracture network, and potential spillage/leaks of contaminative materials. It is possible that the karst features may result in ground instability issues with loading, if not properly managed.

The magnitude of potential impact is evaluated as medium adverse.

Candidate Gathabawn Grid Connection Impact: The Ballylehaun-Ballyring UGC at the Ballylehaun Control Building, and the eastern half of the candidate grid connection route, specifically the Ballyring-Parksgrove cabling route, is underlain by the same limestone bedrock formation as Ballylehaun Hill. The cabling would comprise a trench of 0.3m depth by up to 0.75m width. Due to the shallow nature of the cable route, ground stability is not considered to be an issue. The potential impact along the grid connection route comprises the use of contaminative and cementitious materials.

The magnitude of potential impact is evaluated as low adverse.

Whole Project Impact: The bedrock limestone is regional extensive and underlies an approximate area of 4,000km² to the north-west of Kilkenny. The only area where excavations associated with the Proposed Gathabawn Windfarm and the Candidate Gathabawn Grid Connection overlap spatially is the trenching associated with the Ballylehaun-Ballyring UGC and Ballyring-Parksgrove UGC route at the windfarm control buildings. The Ballyring Section is underlain predominantly by siltstone bedrock beneath firm to stiff silt subsoils, with depth to bedrock recorded between 0.75m and 2.15m across trial pit locations, generally providing greater cover of lower permeability till than at Ballylehaun.

Given the limited extent of this overlap, the effects of the overall project are considered to be localised. Under a worst-case scenario, these effects are expected to be temporary, short-term, negative, and of negligible significance of low to medium adverse impact.

Impact Magnitude	low to medium adverse	Impact Significance: (pre-mitigation)	Slight to Moderate
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Mitigation and Monitoring Measures:

Detailed geotechnical investigations will be undertaken prior to construction commencing and shall comprise:

- Intrusive investigation at location of turbines to confirm lack of any near surface karst features;
- Identify appropriate mitigation measures if karst features or significant fracturing are identified;
- Design turbine foundations and method of construction to prevent cementitious material leaching into the bedrock ;
- Inspect each turbine foundation for evidence of fracture

Even though Significant impacts are not predicted; the following mitigation and monitoring measures will be implemented as best practice environmental management.

WM47	<u>Concrete control procedures</u> will be implemented and will include the following: • No concrete batching will take place on Site, all concrete will be ready-mixed and delivered just-in-time; • The pouring of concrete will be scheduled for dry days. If a sudden rainfall event should occur, then suitable covers will be ready and available at the pour Site to cover the concrete. • The pour Site will be kept free of standing water; • All operators involved in pouring concrete will be trained and experienced in working with concrete; • Run-off from wind turbine foundation concrete pours will not be permitted to flow over adjacent lands or enter drainage channels. The run-off will be contained within the foundation area and pumped into a skip to settle out; settled solids will be appropriately disposed of off-Site. • The Contractor will not permit the discharge of cement contaminated waters to the construction phase drainage system, onto adjacent lands or directly to any artificial drain or watercourse. • Concrete trucks will be washed out at the supplier's facilities and not on Site. The only concrete washing that will occur on Site is the hand washing of the chutes at the rear of the trucks. Washing of chutes will only take place at the designated area and into a Roadside Concrete Washout unit.
WM48	<u>Refuelling control procedures</u> will be implemented and will include the following: • On Site re-fuelling of machinery will be carried out using a mobile double skinned fuel bowser. The fuel bowser carried on a double axel refuelling trailer, will be refuelled off-Site, and will be towed around the Site by a 4x4 vehicle to where machinery is located. The 4x4 vehicle will carry fuel absorbent material and pads in the event of any accidental spillage. Mobile measures such as drip trays and fuel absorbent mats will be used during all refuelling operations. • In addition, spill response apparatus including spill-kits and fuel absorbent mats will be stored in the cabin of each vehicle and operators will be fully trained in the use of this equipment and in the implementation of the Emergency Response Plan, as contained in the Environmental Management Plan. • The fuel bowser will be parked on a level area, away from main traffic activity, in a designated part of the construction compounds when not in use. Taps, nozzles or valves associated with mobile fuel bowser will be fitted with a lock system. Only designated trained and competent operatives will be authorised to refuel plant on Site. A Permit to Fuel system will be put in place. • There will be no refuelling of vehicles or plant permitted within 100m of a watercourse or wet drainage channel or local spring/well.
WM49 GM47	<u>Storage of Fuels, Oils and Chemicals:</u> All fuels or oils or chemicals, required during construction, will be stored in a designated, bunded, locked storage area within the temporary compounds. All fuel, oil and chemical storage areas will be bunded appropriately to 110% of the volume of oils/fuels each area contains for the duration of the construction phase. All bunded areas will be fitted

	with a storm drainage system and an appropriate oil interceptor. Ancillary equipment such as hoses, pipes will be contained within the bunded area. Fuel, oil and chemical stores including tanks and drums will be regularly inspected for leaks and signs of damage. Safety data sheets for all chemicals used will be kept on-Site. An emergency response plan for the construction phase to deal with accidental spillages will be contained within the Environmental Management Plan.
WM36	<u>Protection of Karst:</u> A suitably qualified geotechnical engineer who is experienced with limestone and karst conditions will review the results of the pre-construction detailed geotechnical investigations, and will design the turbine foundations taking into account the results of the detailed investigations. The geotechnical engineer will inspect each turbine foundation excavation for evidence of a fracture network and will set out the required methods and mitigation measures to prevent cementitious material leaching into the bedrock.
<u>Effectiveness of Mitigation:</u> Following the completion of each excavation into the limestone bedrock, a suitably trained engineering geologist will inspect the limestone bedrock for evidence of a fracture network or karstic features. As outlined within Chapter 20 of this EIA, a robust mitigation plan has been developed for the construction works which would significantly reduce the potential for contaminative pollution events to occur which may impact the karstic limestone. In addition to this, all construction works would be undertaken in line with an agreed Environmental Management Plan, to ensure no offsite impact from the proposed works. With consideration for the proposed mitigation, impacts to karstic features during the construction works will be Imperceptible.	
Residual Impact Significance (<i>post-mitigation</i>):	
Imperceptible	

EIAR 7.4.6 Impacts to Soils which will not be Significant

All of the remaining effects of the proposed Gathabawn Windfarm Project on Soils will not be significant. A short evaluation of these effects is provided below.

EIAR 7.4.6.1 Evaluation of the Effects on Local Soils, Subsoils and Bedrock

Soil Degradation due to erosion or weathering (C): Slight impact (Proposed Gathabawn Windfarm); Slight impact (CGGC); Slight impact (Whole Project). The exposure of soil and subsoils at locations of excavation and of overburden storage can increase the likelihood of soil erosion resulting in a direct physical effect on land and soil. However, given the relatively small footprint, and temporary nature of the proposed excavation areas and overburden storage associated with the Proposed Gathabawn Windfarm and Candidate Gathabawn Grid Connection in the context of the overall site landholding, the pre-mitigation effect is evaluated as Small Adverse.

Ground instability of Soils and Subsoils (C): Imperceptible impact. Due to the absence of peat throughout the site, and the inherent stability of the sub-soils there will be no particular risk to ground stability on any part of the windfarm site. Site investigations by Fehily Timoney and Company as part of the Geotechnical Assessment Report ([Appendix 7.3](#)) identified no evidence of slope failures or signs of instability, while a slope stability assessment undertaken at two of the turbine hardstands with the largest cut/fill requirements (T4 and T9) also identified no stability issues. It is considered that due to the shallow nature of the cable trench excavations for the candidate grid connection, there will be no particular risk to ground stability from these works.

Soil degradation due to compaction (C): Imperceptible impact (Proposed Gathabawn Windfarm); Imperceptible impact (CGGC); Imperceptible impact (Whole Project). Most of the traffic movement within the site during the construction phase will be over agricultural lands and farm tracks. Machinery will traverse the ground surface or excavate into the soil and subsoil in the course of construction of new access roads, widening of existing roads and construction of turbine bases, crane hardstands, windfarm control buildings and temporary construction compound for the Proposed Gathabawn Windfarm. Vehicle movements for the construction of the Candidate Gathabawn Grid Connection will also be mainly over agricultural lands and farm tracks, with the Parksgrove Substation proposed for an area of scrubland/vacant land. There is a potential for soil compaction to occur which may reduce the ability of the soil to store water and support vegetation and can lead to an increase in run-off and erosion. As part of the Proposed Project, existing agricultural tracks will be upgraded, and new access roads will be constructed. Excavate and fill methodology will be used for the construction and upgrade of all access roads. Construction haulage will be directed to use these routeways to allow minimisation of works with unfinished surface areas. The machinery/vehicular movements will have a direct, short-term, slight negative, impact on the in-situ surface and subsurface materials.

Contamination of soil due to backfilling material (C): Imperceptible impact (Proposed Gathabawn Windfarm); Imperceptible impact (CGGC); Imperceptible impact (Whole Project). Backfilling activities will be limited to the backfilling of the 2 no. borrow pits following construction phase of the Proposed Gathabawn Windfarm. The material used to backfill the borrow pits will consist of soil and stone excavated on-site during groundworks associated with the construction of the windfarm. It is considered that backfilling material will be inert as site surveys did not identify any existing sources of contamination to local soils, subsoils and bedrock, and any potential contamination effects from construction activities (if they occur) are expected to be localised and minor. Trenches for the construction of the Ballyring-Parksgrove UGC will be backfilled with excavated material (where not in the public road). All other excavated material from trenching works for the Candidate Gathabawn Grid Connection will be used to create berms at the Parksgrove Substation site.

Reduction in soil quantity and soil degradation due to sealing (C, O, D): Imperceptible impact (Proposed Gathabawn Windfarm); Imperceptible impact (CGGC); Imperceptible impact (Whole Project). Soil sealing is the destruction, degrading or covering of the natural ground by an impermeable material. The provision of hardstanding areas at turbines and in compounds, the provision of access roads and backfilling of cable trenches will use aggregate materials which will be permeable and will therefore not result in the sealing of the soils/lands below. A very limited footprint of concrete shall be used in the base of trenches (where the Ballylehaun-Ballyring UGC and Ballyring-Parksgrove UGC are within the public road, and for the entire length of the trench for the Parksgrove-Moatpark UGC). However, this footprint area is of such limited area that it is not considered to impact the overall value of the soils.

Soil degradation due to excavation, relocation, erosion or compaction of soils and subsoils, or due to contamination by hydrocarbons (O, D): Imperceptible impact (Proposed Gathabawn Windfarm); Imperceptible impact (CGGC); Imperceptible impact (Whole Project). Due to the negligible volumes of excavations/relocation of soils during operation and decommissioning – relating to the site roads and drainage during operational maintenance and at turbine foundation/hardstand locations during the decommissioning phase. The movement of soils during decommissioning reinstatement works will be predominately on areas underlain by hardcore and using soils stored in berms. However, these areas are very small areas with soils reinstated following the transport of components, therefore the magnitude of impacts will be negligible.

The proposed mitigation relating to the contaminative risk posed by the site is considered to be robust. Any minor accidental leaks or spills of fuel/oil from vehicles associated with the maintenance or decommissioning of the wind farm will be negligible. In relation to contamination risk, oil used in transformer (at the substation) and any storage of oils at the substation compound will be located in a concrete bund capable of holding 110% of the stored oil volume. Oil within the turbine transformers will be located within the turbines, and any leaks will be fully contained within the turbine thus eliminating any pathway for leakages to affect land and soil. The Parksgrove Substation and Parksgrove-Moatpark UGC will not be decommissioned and will remain as assets on the national grid. Overall, impacts to soils during the operational and decommissioning phases will be Imperceptible.

EIAR 7.4.6.2 Evaluation of the Effects on Soils, Subsoils and Bedrock in Designated Sites

Impacts on soils, subsoils and bedrock in Designated Sites (C, O, D): Imperceptible impact (Proposed Gathabawn Windfarm); Slight impact (CGGC); not significant impact (Whole Project). The Proposed Gathabawn Windfarm is not located within any Designated Sites, however Cullahill Mountain SAC and pNHA and Gales Hill Nature Reserve is located adjacent to the site boundary at the Ballylehaun Area. As only direct impacts on soils are anticipated, soils, subsoils and bedrock in Designated Sites will not be negatively impacted by the Proposed Gathabawn Windfarm.

The Ballylehaun-Ballyring UGC is adjacent to Cullahill Mountain SAC and pNHA and Gales Hill Nature Reserve at the Ballylehaun Area. The UGC comprises localised and limited extraction of soils with only direct impacts in the immediate vicinity of the UGC. As only direct impacts on soils are anticipated, soils, subsoils and bedrock in Designated Sites will not be negatively impacted

A section of the Candidate Gathabawn Grid Connection is located within the boundary of the River Barrow and River Nore SAC and River Nore/Abbeyleix Woods Complex pNHA where c.770m of the Parksgrove-Moatpark UGC is within the boundary of these designated sites. The Parksgrove-Moatpark UGC is also within the boundary of the River Nore SPA as it crosses the River Nore by horizontal direction drilling (HDD). Whilst 770m of the cabling falls within these designated sites the majority (>660m) will be located beneath the public highway with the majority of the remaining area being routed beneath the River Nore via HDD.

HDD provides significantly reduced risk of soil disturbance compared to open trenching. The primary risk would be associated with Frac-Out within fractures or karst bedrock. As outlined above there is no indication of Karst features in this area whilst the risk Frac-Out would be mitigated through development of a drilling fluid management plan which would assess risk of frac-out and outline appropriate frac-out contingency measures where required.

EIAR 7.4.6.3 Evaluation of the Effects on Soils, Subsoils and Bedrock in Geological Heritage Sites

Impacts on soils, subsoils and bedrock in Geological Heritage Sites (C, O, D): Negligible impact (Proposed Gathabawn Windfarm); negligible impact (CGGC); negligible impact (Whole Project). The Proposed Gathabawn Windfarm and Candidate Gathabawn Grid Connection are not located within any Geological Heritage Site, with the closest, Lisdowney Quarry, located c.1.9km from the Proposed Gathabawn Windfarm site boundary and c.230m from the Candidate Gathabawn Grid Connection construction works boundary. As only direct impacts on soils are anticipated, soils, subsoils and bedrock in Geological Heritage Sites will not be negatively impacted the Gathabawn Windfarm or Candidate Gathabawn Grid Connection.

EIAR 7.4.6.4 Summary of Impacts

There are **no likely Moderate, Significant, Very Significant or Profound impacts** to Soils arising from the construction, operation or decommissioning of the Whole Gathabawn Windfarm Project.

All of the effects of the Proposed Gathabawn Windfarm, and the Whole Gathabawn Windfarm Project on Human Health will **not be significant**.

ElAR 7.4.7 Environmental Protection Measures

In addition to the mitigation measures identified in Section ElAR 7.4.5, additional measures which form part of standard windfarm construction/operation will be implemented during the construction/operation/decommissioning of the Gathabawn Windfarm development to protect the Soils environment and avoid/reduce these not significant effects. These environmental protection measures are identified below and are included in the Environmental Management Plan 2026 for the Gathabawn Windfarm Project which accompanies the subject planning application.

Table 7-6: Environmental Protection Measures for Non-Significant Effects

WM30 GM27	<u>Fencing of works areas</u> : The boundaries of construction works areas in agricultural lands will be fenced to prevent the encroachment of construction phase personnel, machinery or materials beyond this boundary. Livestock proof fencing will be used, with landowner access maintained through the provision of gates along the boundary fences.
WM19 GM19	<u>Fuel, oil and chemical stores</u> including tanks and drums will be regularly inspected for leaks and signs of damage.
WM31	<u>Control of Movement of Machinery/Vehicles</u> : Construction traffic, personnel and materials will be restricted to the hardcore surfaces, particularly with respect to the newly constructed access roads. This means that machinery will be kept on the windfarm site roads and hardstanding areas, and, aside from advancing excavations, will avoid moving onto areas not delineated on the site drawings.
WM35	<u>Protection of Soils in Berms</u> ; All storage berms will be graded and sealed following emplacement. Topsoil and subsoil will be stockpiled separately. Where possible, the upper vegetative layer (where still present) of excavated soil will be stored with the vegetation part of the sod facing the right way up to encourage growth of plants and vegetation at the surface of the stored spoil within the storage areas. Re-seeding will also be carried out in these areas. Measures such as interceptor ditches around the bases of these areas, and silt curtains will also be incorporated where required to prevent runoff of suspended solids, dust and soil erosion.
GM32	<u>Protection of Soils in Berms</u> ; All storage berms will be graded and sealed following emplacement. Topsoil and subsoil will be stockpiled separately. Re-seeding of permanent berms will be carried out as soon as practical in these areas. Construction works areas along cable routes in agricultural lands will be reseeded as soon as practical after reinstatement. Measures such as silt curtains around the bases of these areas and sediment traps will also be incorporated to prevent runoff of suspended solids, dust and soil erosion, if required.
GM28	<u>Control of Movement of Machinery/Vehicles</u> : Construction traffic, personnel and materials will be restricted to within the construction works area fence and will avoid moving onto areas not delineated on the site drawings.
WM44	<u>On-Site Borrow Pits</u> : It is proposed that bedrock won from the on-site borrow pits during the construction phase will be used to construct the sub-base layer of proposed upgraded and new access roads and hardstand areas. Once installed the sub-base layer will be overlain by a capping layer of clean high-grade bedrock, such as limestone.
WM111	<u>WQ and Soil Protection at Turbine Delivery Facilitating Works locations</u> : During any reopening/re-widening of site entrances or haul route works locations, the topsoil removed to reveal the hardcore underneath will be stored in an adjacent temporary deposition area, sealed to prevent erosion, and a silt curtain will be erected around this deposition area. Following the completion of the transportation, the hardcore area will be covered over once again using the soil in the deposition area. The area will be reseeded/replanted as appropriate to the location. The area will be fenced from livestock until revegetation has occurred.

WM112	<u>Control of vehicle/machinery movement</u> : Operational phase traffic, personnel and materials will be restricted to the windfarm site roads and hardstanding areas.
WM114 GM89	<u>Vegetation Monitoring</u> : The rate of re-vegetation of exposed soils and growth of newly planted hedgerows and trees will be checked by the Asset Manager during quarterly site inspections. Where revegetation is slower than expected, that area will be prepared and re-seeded or replanted in an appropriate manner, as advised by a suitably qualified ecologist.
WM115	<u>Fuel/Oil control procedures</u> will be implemented and will include the following: On site re-fuelling of machinery (if required) will be carried out using a mobile double skinned fuel bowser. The fuel bowser, double-axle custom-built refuelling trailer, will be refuelled off-site, and will be towed onto the site by a 4x4 vehicle to where machinery is located. The 4x4 vehicle will carry fuel absorbent material and pads in the event of any accidental spillage. Mobile measures such as drip trays and fuel absorbent mats will be used during all refuelling operations. In addition, spill response apparatus including spill-kits and fuel absorbent mats will be stored in each turbine and stored in the cabin of each vehicle and operators will be fully trained in the use of this equipment and in the implementation of the Emergency Response Plan, as contained in the Environmental Management Plan. All fuels or oils, required during operation, will be stored in a designated, bunded, locked storage area at the control buildings. All bunded areas will be fitted with a storm drainage system and an appropriate oil interceptor. Ancillary equipment will be contained within the bunded area. Fuel, oil and chemical stores including tanks and drums will be regularly inspected for leaks and signs of damage. Safety data sheets for all chemicals used will be kept on-site.
WM130	<u>Control of Machinery/Vehicular Movements</u> : Decommissioning traffic, personnel and materials will be restricted to the decommissioning works areas. Machinery will be kept on the windfarm site roads and hardstanding areas, and, aside from reinstatement works, will avoid moving off the hardstanding areas where possible.
WM128 GM104	<u>Weather forecasting</u> warnings will be consulted in advance of works, and decommissioning works will not take place during periods of prolonged heavy rain or exceptional rainfall events.
WM131 GM97	<u>Fit for purpose</u> : All plant and machinery which will be used during decommissioning works will be fit for purpose and in good working order prior to mobilisation to works areas.
WM133	<u>Fuel Controls</u> : Overnight parking of plant and machinery will only be permitted at the turbine locations. There will be no refuelling of vehicles or plant permitted within 100m of a watercourse or drainage feature or within 100m of the Cullahill Mountain SAC or the Gales Hill Nature Reserve. Any re-fuelling of machinery on site will be carried out using a mobile double skinned fuel bowser which will carry fuel absorbent material and pads in the event of any accidental spillages. In addition, spill response apparatus including 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.
GM105	There will be no <u>refuelling of plant or machinery</u> within 100m of a watercourse, wet drainage channel or private well/spring. Any re-fuelling of machinery on site will be carried out using a mobile double skinned fuel bowser. Spill response apparatus including 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.
WM134 GM103	<u>Protection of WQ and Soils</u> : During decommissioning works, topsoil removed will be stored in an adjacent temporary deposition area, sealed to protect it from weathering, and a silt curtain will be erected around this deposition area.
WM135	<u>Land reinstatement</u> : Following the completion of decommissioning, the hardcore areas at the turbines and at widened site entrances and haul route works locations will be

	covered over, using the soil in the deposition areas. The areas will be reseeded/replanted as appropriate to the location. The areas will be fenced from livestock until revegetation has occurred. Land reinstatement works will not take place during periods of prolonged heavy rain or exceptional rainfall events or when the soil is waterlogged.
WM136 GM107	<u>Revegetation Monitoring</u> : The Asset Manager and Project Ecologist will check the rate of re-vegetation of exposed soils and reinstated areas quarterly for a period of 2 years following decommissioning works. Where revegetation is slower than expected, that area will be prepared and re-seeded or replanted in an appropriate manner.

EIAR 7.5 CUMULATIVE EFFECTS WITH OTHER PROJECTS

Other existing and permitted projects and projects advanced in the planning system were examined for their potential to cumulatively affect Soils with the Proposed Gathabawn Windfarm and the Candidate Gathabawn Grid Connection. These projects are referred to as 'Other Projects' herein. The potential for off-site and secondary consequential development is also considered.

A Cumulative Study Area is set out below and Other Projects located within this Study Area are identified and examined for in-combination effects.

Cumulative Study Areas: Cumulative developments within the distance of 5km from the Ballylehaun Area and 2km from the Ballyring Area have been considered.

The Other Projects located are identified on **Figure 7.6: Other Projects Scoped-In for the Soils Cumulative Evaluations** (included at the end of this chapter), and listed below:

Proposed Gathabawn Windfarm

- Lisdowney Wind Farm (operational)
- Littleton WF Grid Connection (in planning)
- Killoshulan Wind Farm and Grid Connection (potential)

Candidate Gathabawn Grid Connection

- Ballynalacken WF Grid Connection (consented)
- Briskalagh WF Grid Connection (consented)
- Seskin WF [Laois/Kilkenny] Grid Connection (under appeal, ACP)
- Littleton WF Grid Connection (in planning)
- Battery Energy Storage System (BESS) 1 at Moatpark (consented)
- BESS 2 at Moatpark (consented)
- Killoshulan WF Grid Connection (potential)

EIAR 7.5.1 Evaluation of Cumulative Impacts with Individual Other Projects

The potential for cumulative effects with each of the Other Projects is evaluated individually and then collectively. The evaluation takes into account existing sources of pollution or damage identified in Section 7.3.2.

Table 7-7: Evaluation of cumulative impacts with Other Projects

Other Project	Evaluation of Cumulative impact
Proposed Gathabawn Windfarm	
Lisdowney Wind Farm (operational) Killoshulan Wind Farm and Grid Connection (potential) Littleton WF Grid Connection (in planning)	<u>Neutral cumulative impact:</u> The proposed Gathabawn Windfarm does not spatially overlap any of these projects, and as only direct impacts on soils are anticipated, it is not considered that the proposed Gathabawn Windfarm will result in significant cumulative impacts to soils, subsoils and bedrock with these Other Projects.
Candidate Gathabawn Grid Connection	
Ballynalacken WF Grid Connection (consented)	<u>Neutral cumulative impacts:</u> The Candidate Gathabawn Grid Connection is routed to spatially cross these grid connections, and will be in close proximity to the BESS

Other Project	Evaluation of Cumulative impact
Briskalagh WF Grid Connection (consented) Seskin WF [Laois/Kilkenny] Grid Connection (under appeal, ACP) BESS 1 & 2, Moatpark (consented) Littleton WF Grid Connection (in planning) Killoshulan WF Grid Connection (potential)	projects, however Candidate Gathabawn Grid Connection construction works which occur in proximity to these Other Projects relate to trenching works in agricultural lands, the public road and within the hardcore compound area of the EirGrid Ballyragget Substation. Although overall soils in designated sites have a very high importance these trenching works have purposefully been located in areas where the soils will have low value. It is also noted that volumes will be negligible due to the shallow nature of grid connection cabling works. These Other Projects also involve trenching works in the public road and in the hardcore compound, along with excavation works in agricultural lands. All developments, with the exception of Ballynalacken WF, include HDD of the River Nore. However as outlined above HDD is considered to pose a significantly lower risk to soils and geology than open-cut trenching as it leaves the shallow soils largely intact, as the risk of Karst features is low the overall impact on geology is therefore low and any potential impact is limited to risk from Frac-out which can be appropriately managed and only poses a risk during construction, as these operations will not be completed at the same time the potential cumulative impact is considered to be neutral.

EIAR 7.5.2 Cumulative Evaluation - all Other Projects considered collectively

As detailed in the evaluations in the table above, the Proposed Gathabawn Windfarm and Candidate Gathabawn Grid Connection will not result in significant cumulative impacts with any of the Other Projects within the Cumulative Study Area – the cumulative effects with the Other Project (individually) will be no greater than Neutral.

EIAR 7.5.3 Cumulative Evaluation Summary

Overall, it is evaluated that **adverse cumulative impacts to Soils of the Gathabawn Windfarm cumulatively as a whole project and with Other Projects will be Not Significant.**

EIAR 7.6 SUMMARY CONCLUSION

The soils at the Gathabawn Windfarm site consist of a loamy soil. No peat deposits occur directly on the site with the nearest deposits located 0.4km west of the Ballylehaun red line boundary. The soils are not designated NHA, SAC, SPA or Geological Heritage Sites. In the Ballylehaun section, the subsoils are identified as primarily comprising quaternary glacial tills of limestone origin. Extensive areas of bedrock at or near surface were identified around five of the seven turbines. Across the Ballyring Section the principal subsoil is shale and sandstone till, interspersed with areas of exposed bedrock or present at shallow depths (0.7 – 0.9m below ground level. For the Candidate Gathabawn Grid Connection between Ballyring and Moatpark, soils are mainly associated with the Crosstown, Elton, and River Association Groups. Overall the subsoils are considered to have moderate permeability. Bedrock in the vicinity of the proposed development site consists of limestone, mudstone and sandstone, as confirmed through trial hole investigations completed at the site. The areas immediately surrounding Ballylehaun Hill are comprised of karstic limestone bedrock at surface and bedrock at surface. The nearest karstic features are noted c. 2.3km to the south-west of the Ballylehaun site. The 2021 borehole ground investigations identified the limestone bedrock surrounding the Ballylehaun turbines as present at, or very near to, surface, and primarily comprising competent strong to very strong, bedded limestone with occasional-to-rare fractures. A clay-infilled potential karstic feature was identified in a single borehole from 17m depth.

LOCAL SOILS, SUBSOILS & BEDROCK: The evaluation of the effects on local soils, subsoils and bedrock concludes that while effects to Soils due to the volumes of excavations and risk of contamination will be Moderate, this impact will not be significant. All other construction stage effects will be Neutral to Slight adverse and will not be significant. Similarly, operational stage and decommissioning stage effects to Soil will be Slight or Imperceptible, and therefore the effects will be Not Significant.

Due to the separation distances between the Ballylehaun Section and the Ballyring Sections, it is considered that there would be no cumulative effects as a result of the Whole Gathabawn Windfarm Project are predicted.

Given that all likely effects relating to the Gathabawn Windfarm project are assessed to be direct, contained within the immediate vicinity of the windfarm and candidate grid connection, and unlikely to extend beyond the site, it is assessed that there is no pathway for the Gathabawn Windfarm to act in combination with other existing, permitted or proposed developments, and therefore no significant cumulative effects with Other Projects are predicted.

SOILS, SUBSOILS & BEDROCK IN DESIGNATED SITES AND GEOLOGICAL HERITAGE SITES: There are 8 no. Designated Sites and 2 no. Geological Heritage Sites within the study area. The construction works areas of the Proposed Gathabawn Windfarm does not overlap any of these sites, with the closest Designated Site, Cullahill Mountain SAC and pNHA located adjacent to the site boundary at the Ballylehaun Area, and closest Geological Heritage Site, Lisdowney Quarry, at a distance of c.1.9km from the windfarm site respectively. The Candidate Gathabawn Grid Connection is c.0.23km from the Lisdowney Quarry GHS, and while it does spatially overlap the River Barrow and River Nore SAC, River Nore SPA and River Nore/Abbeyleix Woods Complex pNHA, it is determine that the potential magnitude of impact is slight. As only direct impacts to soils, subsoils and bedrock are anticipated, there is no potential for impacts to Soils within Designated Sites or Geological Heritage Sites.

MITIGATION MEASURES: Measures to minimise the impact on local soils, subsoils and bedrock include excavating materials in accordance with best practices for the management and treatment of such materials, reusing excavated materials at the site in an environmentally appropriate and safe manner, restricting the

movement of machinery and vehicles to the hardcore surfaces, and implementing fuel/oil and concrete control measures.

CLIMATE CHANGE: It is noted that climate change is not likely to significantly alter soils.

Overall, it is evaluated that the impact of the Gathabawn Windfarm on Soils, both alone and in-combination with Other Elements of the Whole Project and cumulatively with Other Projects, will be Imperceptible and therefore **Not Significant**.

EIAR 7.7 Glossary, List of Abbreviations

Glossary of Terms

Term	Definition
Glacial Till	Glacial sediment that is deposited directly from glacial ice and therefore not sorted. Also can be called overburden or boulder clay.
Gathabawn Windfarm	Twelve wind turbines are proposed for two areas – seven turbines in the Ballylehaun area and five turbines in the Ballyring area. In addition to the turbines and their hardstanding areas, the windfarm also includes site access roads, two Control Buildings; a met mast, underground cabling, temporary works to facilitate turbine deliveries, and other associated and ancillary works.
Candidate Gathabawn Grid Connection	Underground cabling between the Ballylehaun and Ballyring Areas (Ballylehaun-Ballyring UGC), underground cabling from the Ballyring Area (from Ballyring Control Building) to a new substation at Parksgrove (Ballyring-Parksgrove UGC), the Parksgrove Substation, and underground cabling from the substation to the existing Eirgrid Ballyragget Substation in Moatpark (Parksgrove-Moatpark UGC). The Candidate Gathabawn Grid Connection is not included as part of this Planning Application, it will be subject of a separate Planning Application, at a future date. The Candidate Gathabawn Grid Connection is considered in this EIA Report in order to facilitate the cumulative evaluation of the Whole Project.
Whole Gathabawn Windfarm Project	Gathabawn Windfarm and Candidate Gathabawn Windfarm Grid Connection
Limestone	A sedimentary rock composed of calcium carbonate. Some 10% to 15% of all sedimentary rocks are limestones. Limestone is usually organic, but may also be inorganic.
Mineral Subsoil	Subsoil derived from parent bedrock material such as sandstone and limestone
Mudstone	Argillaceous or clay-bearing sedimentary rock which is non-plastic and has a massive non-foliated appearance.
Peat	Surface organic layer of a soil that consists of partially decomposed organic matter, derived mostly from plant material.
Sandstone	A clastic rock composed of particles that range in diameter from 1/16 millimetre to 2 millimetres in diameter. Sandstones make up about 25% of all sedimentary rocks.
Shale	A rock formed from fine-grained clay-size sediment.
Siltstone	A typically layered and flaggy rock composed of two thirds silt-sized particles
Topsoil	The uppermost mineral or organic layer

List of Abbreviations

Abbreviation	Full Term
AAR	Annual Average Rainfall
AE	Actual Evaporation
AEP	Annual Exceedance Probability
CGGC	Candidate Gathabawn Grid Connection
CGS	County Geological Sites
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
EMS	Environmental Management System
EPA	Environmental Protection Agency
ER	Effective Rainfall
GSI	Geological Survey Ireland
GWB	Groundwater Body
GWL	Groundwater Level
IFS	Irish Forestry Soils
IGH	Irish Geological Heritage
IGI	Institute of Geologists of Ireland
ISIS	The Irish Soil Information System
ITM	Irish Transverse Mercator
LI	The Locally Important Aquifer
LTA	Long Term Average
m AOD	meters Above Ordnance Datum
m bgl	meters below ground level
MP	Management Plan
NPWS	National Parks and Wildlife Services
PE	Potential Evapotranspiration
PI	Poor Aquifer
pNHA	Proposed Natural Heritage Areas
PPG	Pollution Prevention Guidelines
PWS	Public Water Supply
Rkd	Regionally Important Aquifer
SAC	Special Area of Conservation

Abbreviation	Full Term
SPA	Special Protected Area
SSSI	Site of Special Scientific Interest
WFD	Water Framework Directive

EIAR 7.8 Reference List

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EIAR 7.9 List of Figures

FIGURES (overleaf)

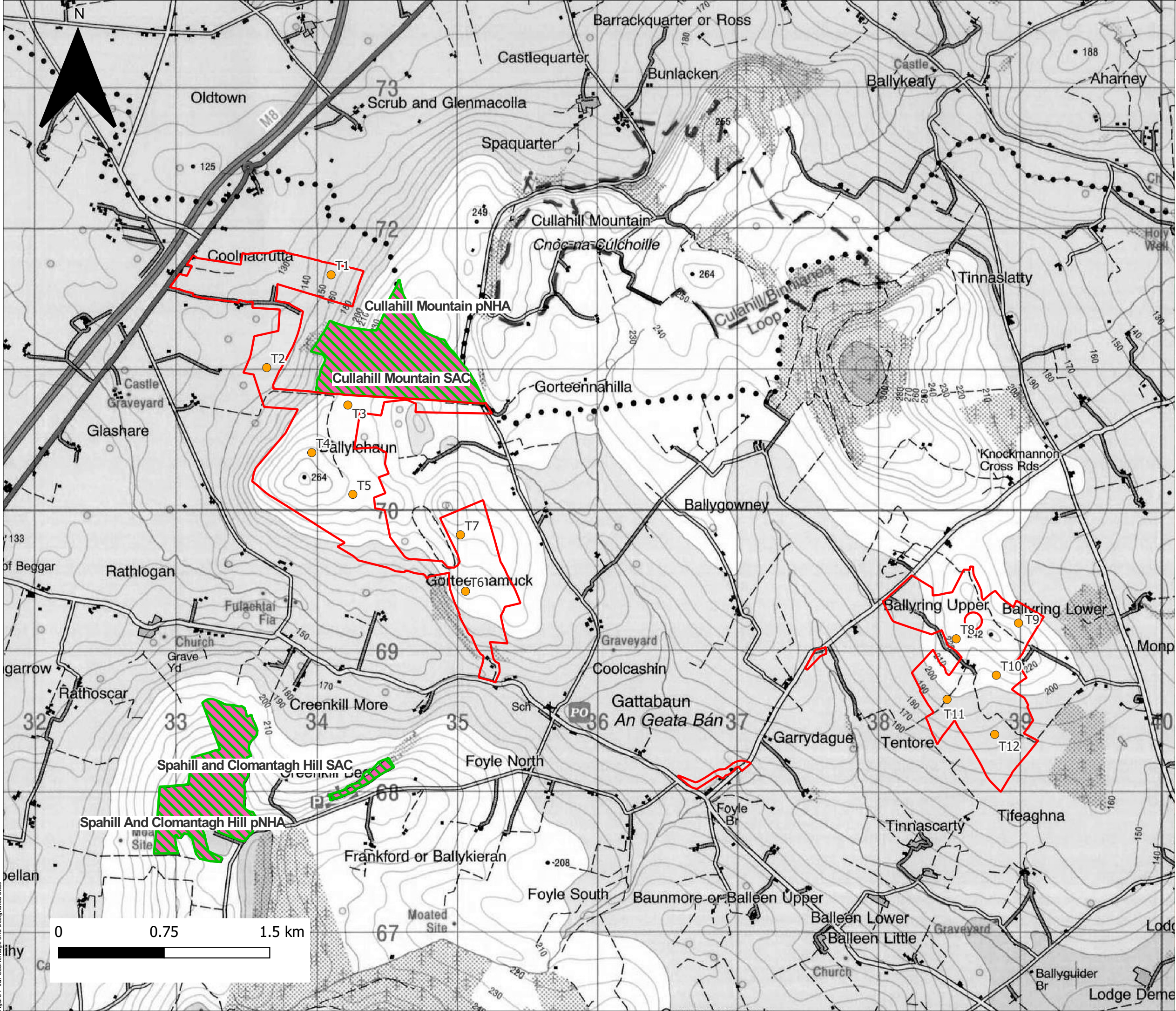
Figure 7-1a	Proposed Gathabawn Windfarm: Geological Heritage & Designated Sites
Figure 7-1b	Candidate Gathabawn Grid Connection: Geological Heritage & Designated Sites
Figure 7-2a	Proposed Gathabawn Windfarm: Land Use Cover
Figure 7-2b	Candidate Gathabawn Grid Connection: Land Use Cover
Figure 7-3a	Proposed Gathabawn Windfarm: ISIS Soils Association
Figure 7-3b	Candidate Gathabawn Grid Connection: ISIS Soils Association
Figure 7-4a	Proposed Gathabawn Windfarm: Subsoils
Figure 7-4b	Candidate Gathabawn Grid Connection: Subsoils
Figure 7-5a	Proposed Gathabawn Windfarm: Bedrock Geology 100k
Figure 7-5b	Candidate Gathabawn Grid Connection: Bedrock Geology 100k
Figure 7.6	Other Projects Scoped-In for the Soils Cumulative Evaluations

EIAR 7.10 List of Appendices

APPENDICES (overleaf)

Appendix 7.1	Methodology for the evaluation of Soils
Appendix 7.2	Trial Pit Investigation results
Appendix 7.3	Geotechnical Assessment Report

Figures



Notes:
1. Basemap: OSI Discovery Series Sheet 60
2. Ecological Designation Data: EPA
3. Geological Heritage Data: GSI
4. Infrastructure: Supplied By Ecopower Ltd.

LEGEND:

- Proposed Gathabawn Turbines
- Red Line Boundary

Geological Heritage & Designated Sites

- Special Area of Conservation (SAC)
- proposed Natural Heritage Area (pNHA)



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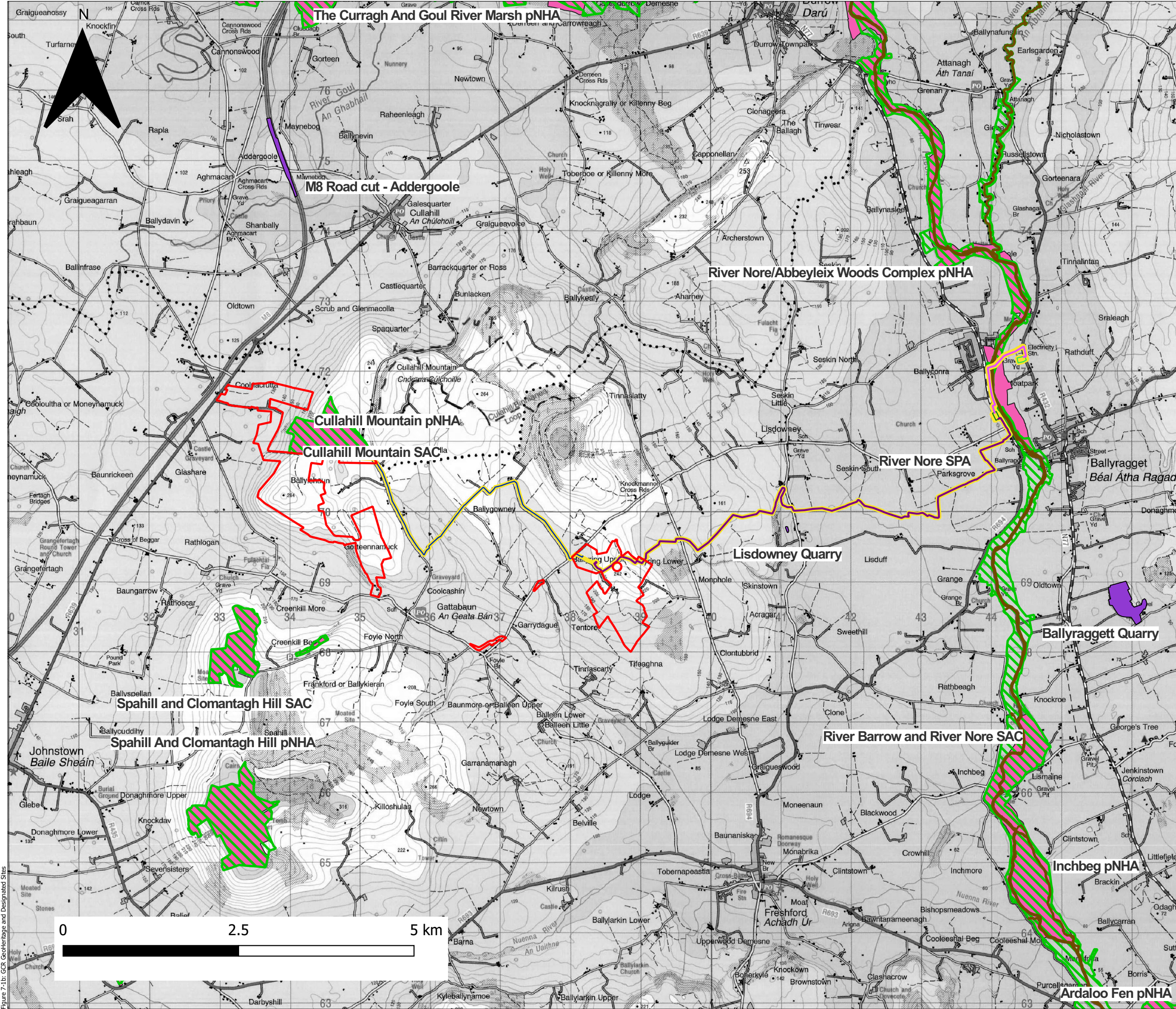
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Date 09/2026	Date 09/2026	Date 09/2026	Date 09/2026

Drawing Number
Figure 7-1a

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Figure 7-1a: Geological Heritage and Designated Sites



- Notes:
1. Basemap: OSI Discovery Series Sheet 60
 2. Ecological Designation Data: EPA
 3. Geological Heritage Data: GSI
 4. Infrastructure: Supplied By Ecopower Ltd.

LEGEND:

- Red Line Boundary
- Ballylehaun-Ballyring Underground Cabling
- Ballyring - Parksgrove Underground Cabling
- Parksgrove - Moatpark Underground Cabling
- EirGrid Ballyragget Substation
- Parksgrove Substation
- Construction Works Boundary - Candidate Grid Connection

Geological Heritage & Designated Sites

- GSI Geoheritage Audited Sites
- Special Protection Area (SPA)
- Special Area of Conservation (SAC)
- proposed Natural Heritage Area (pNHA)



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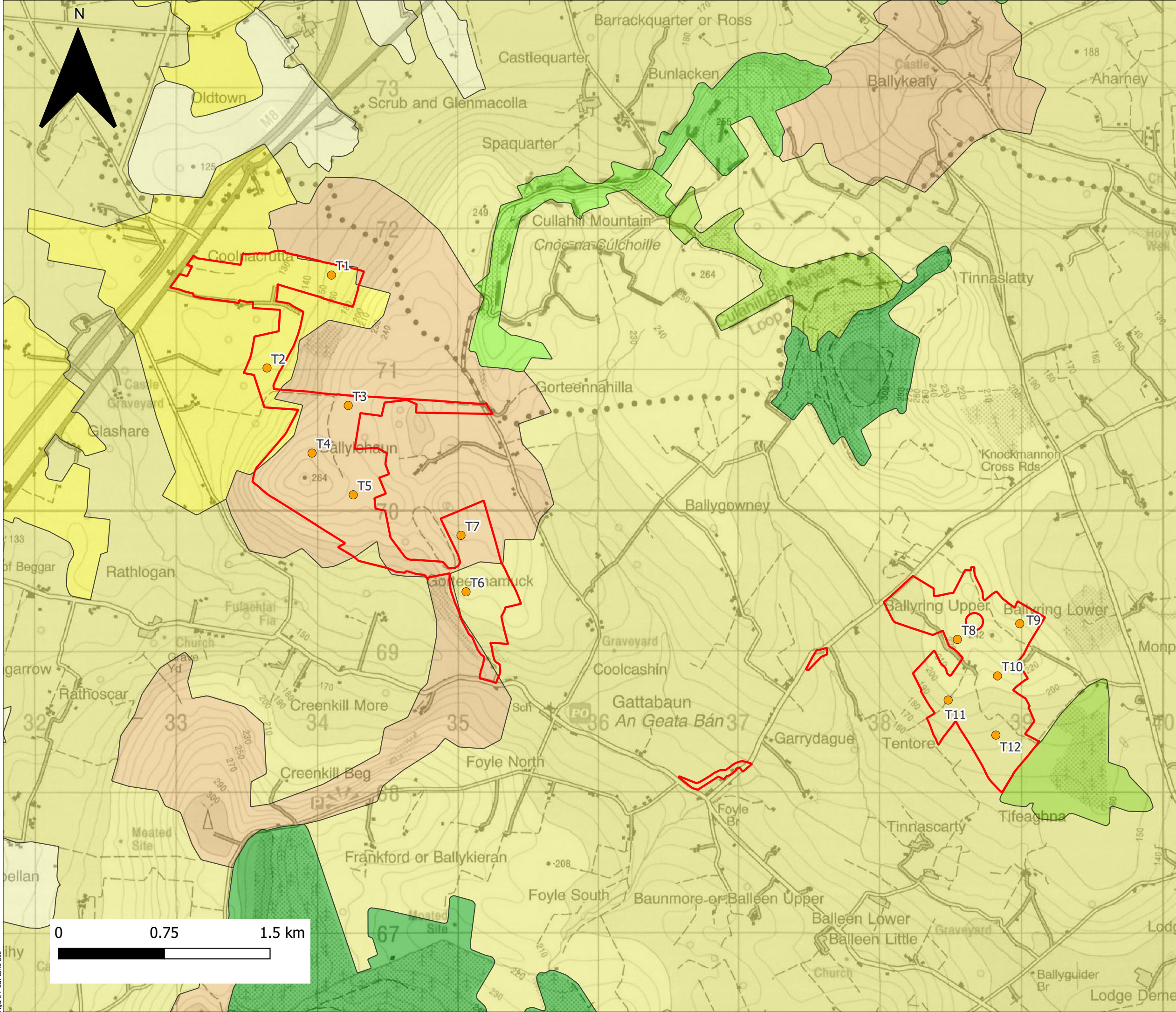
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Geological Heritage & Designated Sites

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Date 09/2026	Date 09/2026	Date 09/2026	Date 09/2026

Drawing Number
Figure 7-1b

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01

Figure 7-1b: GCI Geoheritage and Designated Sites



Notes:
1. Basemap: OSI Discovery Series Sheet 60
2. Land Use Layer Source: Tailte Eireann
3. Infrastructure: Supplied By Ecopower Ltd.

LEGEND:

● Proposed Gathabawn Turbines

Red Line Boundary

Land Use Cover

- Broad-leaved forest
- Complex cultivation patterns
- Coniferous forest
- Land principally occupied by agriculture, with significant areas of natural vegetation
- Mixed forest
- Non-irrigated arable land
- Pastures
- Transitional woodland-shrub

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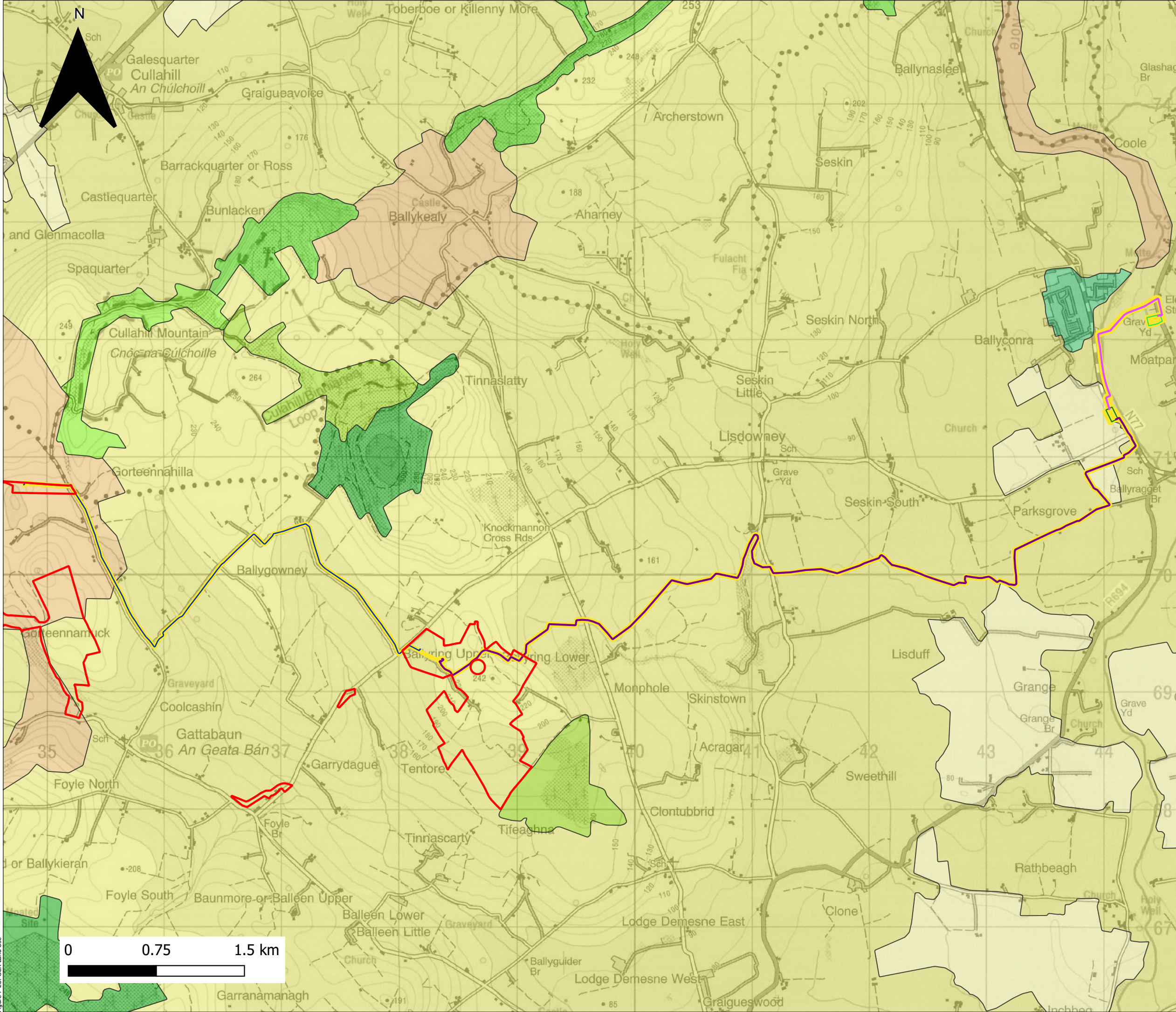
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Date 09/2026	Date 09/2026	Date 09/2026	Date 09/2026

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- Notes:
- 1. Basemap: OSI Discovery Series Sheet 60
 - 2. Land Use CoverLayer Source: Tailte Éireann
 - 3. Infrastructure: Supplied By Ecopower Ltd.

LEGEND:

- Red Line Boundary
- Ballylehaun-Ballyring Underground Cabling
- Ballyring - Parksgrove Underground Cabling
- Parksgrove - Moatpark Underground Cabling
- EirGrid Ballyragget Substation
- Parksgrove Substation
- Construction Works Boundary - Candidate Grid Connection

Land Use Cover

- Broad-leaved forest
- Coniferous forest
- Industrial or commercial units
- Land principally occupied by agriculture, with significant areas of natural vegetation
- Mixed forest
- Non-irrigated arable land
- Pastures
- Transitional woodland-shrub



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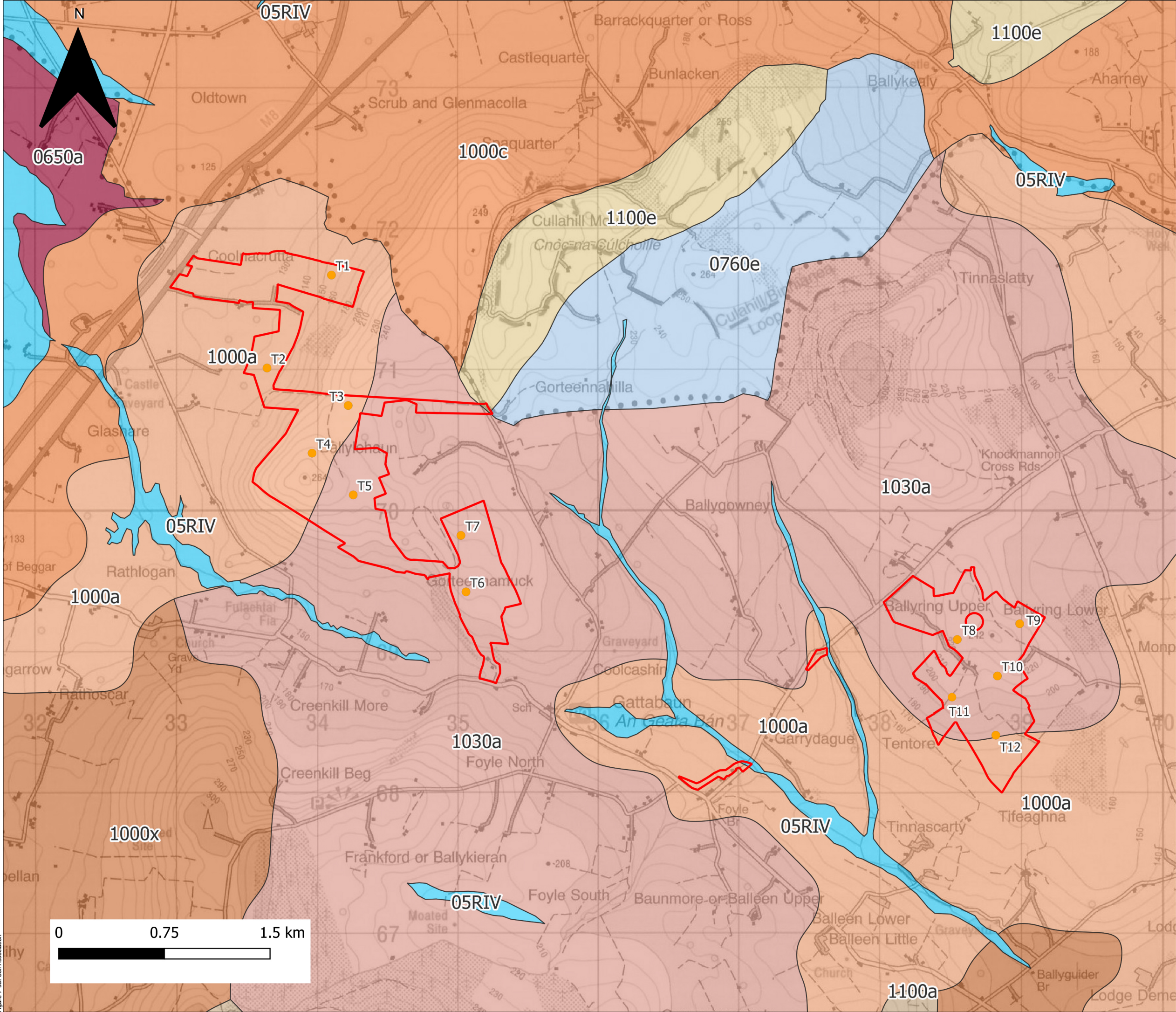
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Drawing Title
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Date 09/2026	Date 09/2026	Date 09/2026	Date 09/2026
Drawing Number Figure 7-2b			Rev. 02



Notes:
1. Basemap: OSI Discovery Series Sheet 60
2. Soil Layer Source: Teagasc Irish Soil Information System
3. Infrastructure: Supplied By Ecopower Ltd.

LEGEND:

Red Line Boundary

● Proposed Gathabawn Turbines

SIS Soils Association

- 05RIV - River
- 0650a - Mylerstown
- 0760e - Ballinamore
- 1000a - Elton
- 1000c - Elton
- 1000x - Elton
- 1030a - Crosstown
- 1100a - Clonroche
- 1100e - Ballylanders



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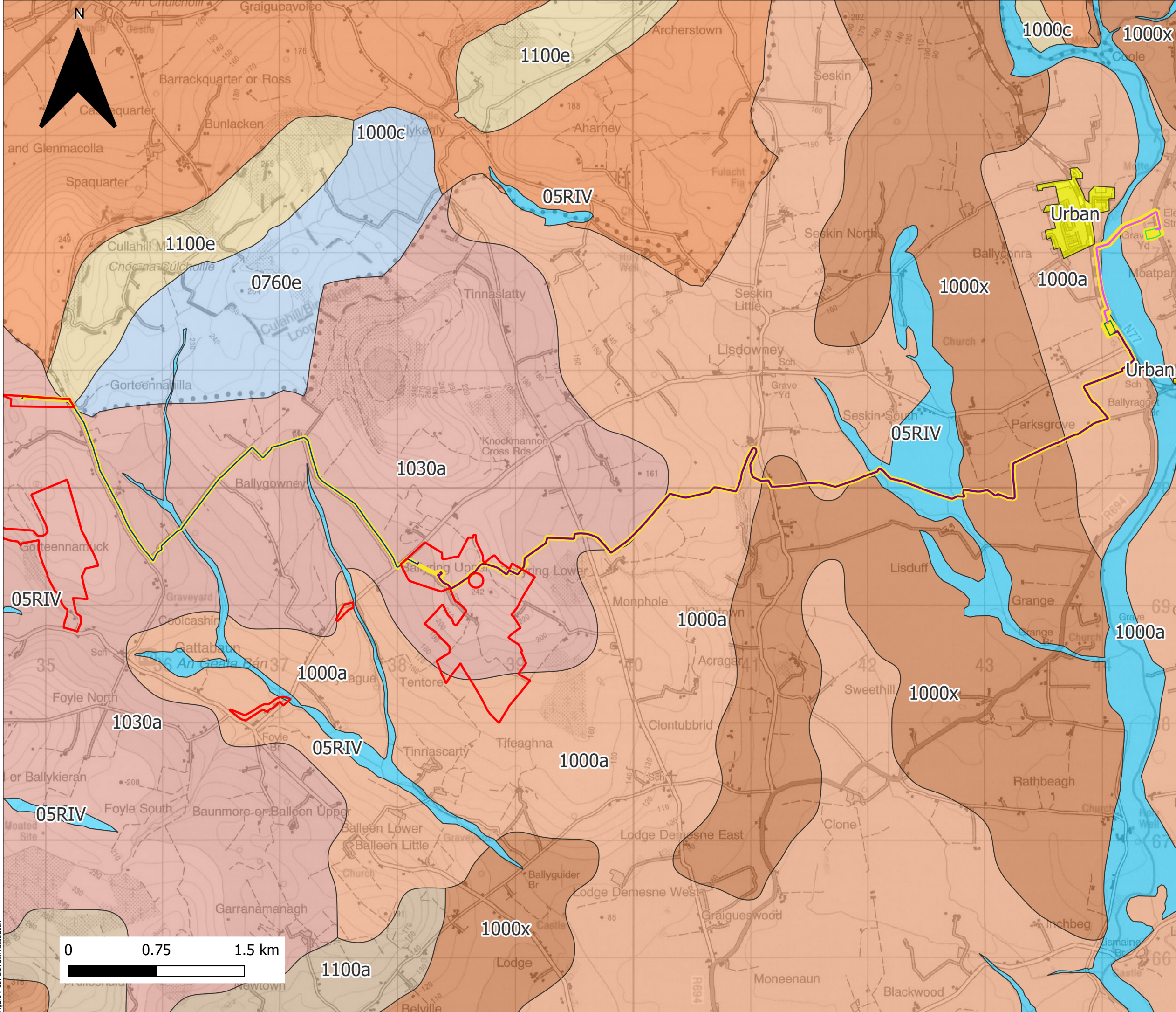
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Project
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Drawing Title
Proposed Gathabawn Windfarm: ISIS Soils Association

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Designed MCOB	Drawn MCOB	Checked SM	Authorised SM
Date 09/2026	Date 09/2026	Date 09/2026	Date 09/2026
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Notes:
1. Basemap: OSI Discovery Series Sheet 60
2. Soil Layer Source: Teagasc Soil Information System
3. Infrastructure: Supplied By Ecopower Ltd.

LEGEND:

- Red Line Boundary
- Ballylehaun-Ballyring Underground Cabling
- Ballyring - Parksgrove Underground Cabling
- Parksgrove - Moatpark Underground Cabling
- EirGrid Ballyragget Substation
- Parksgrove Substation
- Construction Works Boundary - Candidate Grid Connection

SIS Soils Association

- 05RIV - River
- 0760e - Ballinamore
- 1000a - Elton
- 1000c - Elton
- 1000x - Elton
- 1030a - Crosstown
- 1100a - Clonroche
- 1100e - Ballylanders
- Urban



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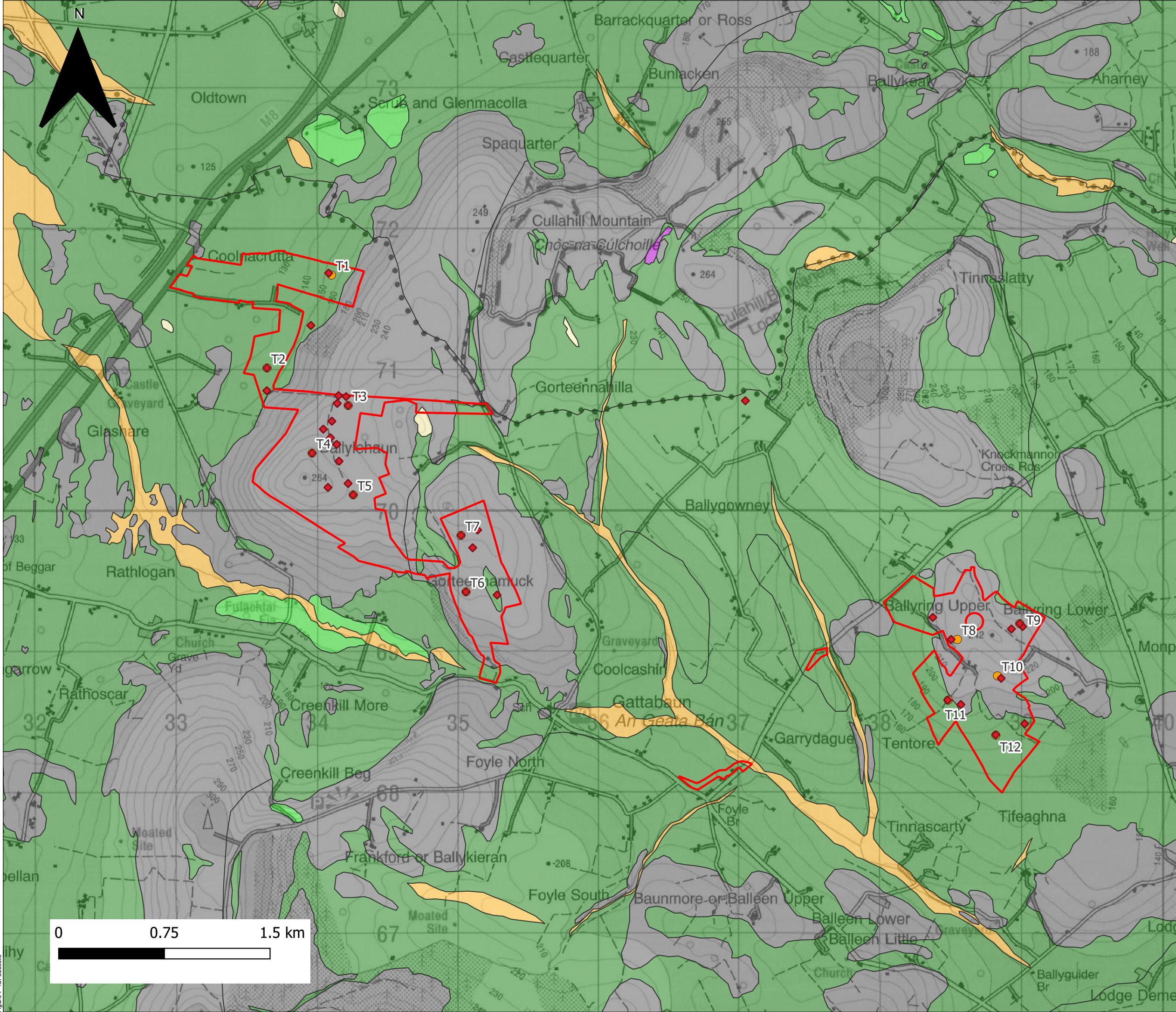
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Drawing Title
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Soils Association

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Date 09/2026	Date 09/2026	Date 09/2026	Date 09/2026

Drawing Number Figure 7-3b	Rev. 02
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Notes:

1. Basemap: OSI Discovery Series Sheet 60
2. Soil Layer Source: EPA
3. Infrastructure: Supplied By Ecopower Ltd.

LEGEND:

- Red Line Boundary
- Proposed Gathabawn Turbines
- Trial Pit Locations

Subsoils

- Bedrock at surface
- Glacial till
- Post glacial sand and gravel alluvium
- Peat subsoils
- Sand and gravel
- Lacustrine sediments

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Proposed Gathabawn windfarm: Subsoils

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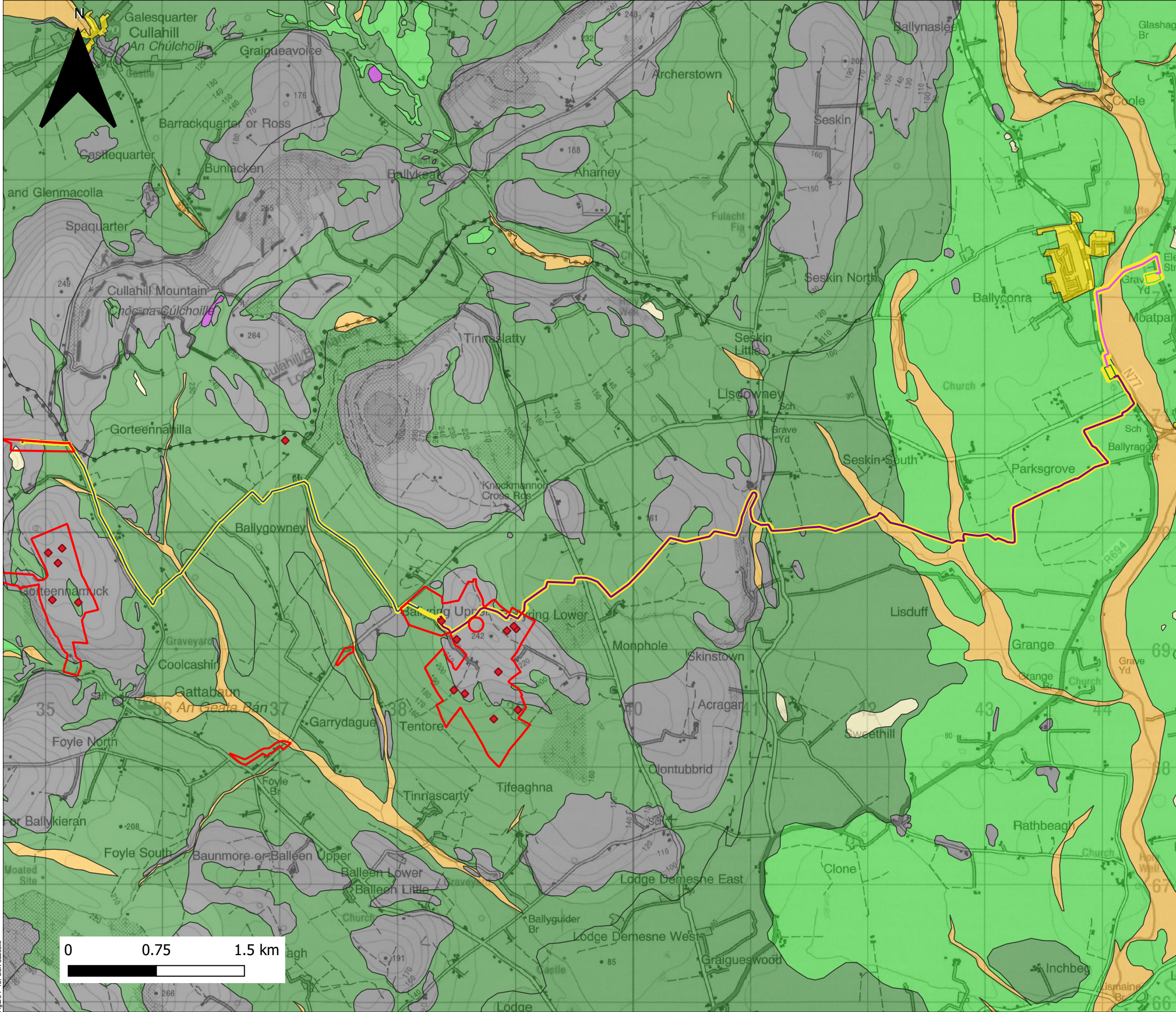
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Figure 7-4a: Subsoils



Notes:

1. Basemap: OSI Discovery Series Sheet 60
2. Soil Layer Source: EPA
3. Infrastructure: Supplied By Ecopower Ltd.

LEGEND:

- Red Line Boundary
- Trial Pit Locations
- Ballylehaun-Ballyring Underground Cabling
- Ballyring - Parksgrove Underground Cabling
- Parksgrove - Moatpark Underground Cabling
- EirGrid Ballyragget Substation
- Parksgrove Substation
- Construction Works Boundary - Candidate Grid Connection

Subsoils

- Bedrock at surface
- Artificial surface.
- Glacial till
- Post glacial sand and gravel alluvium
- Peat subsoils
- Sand and gravel
- Lacustrine sediments

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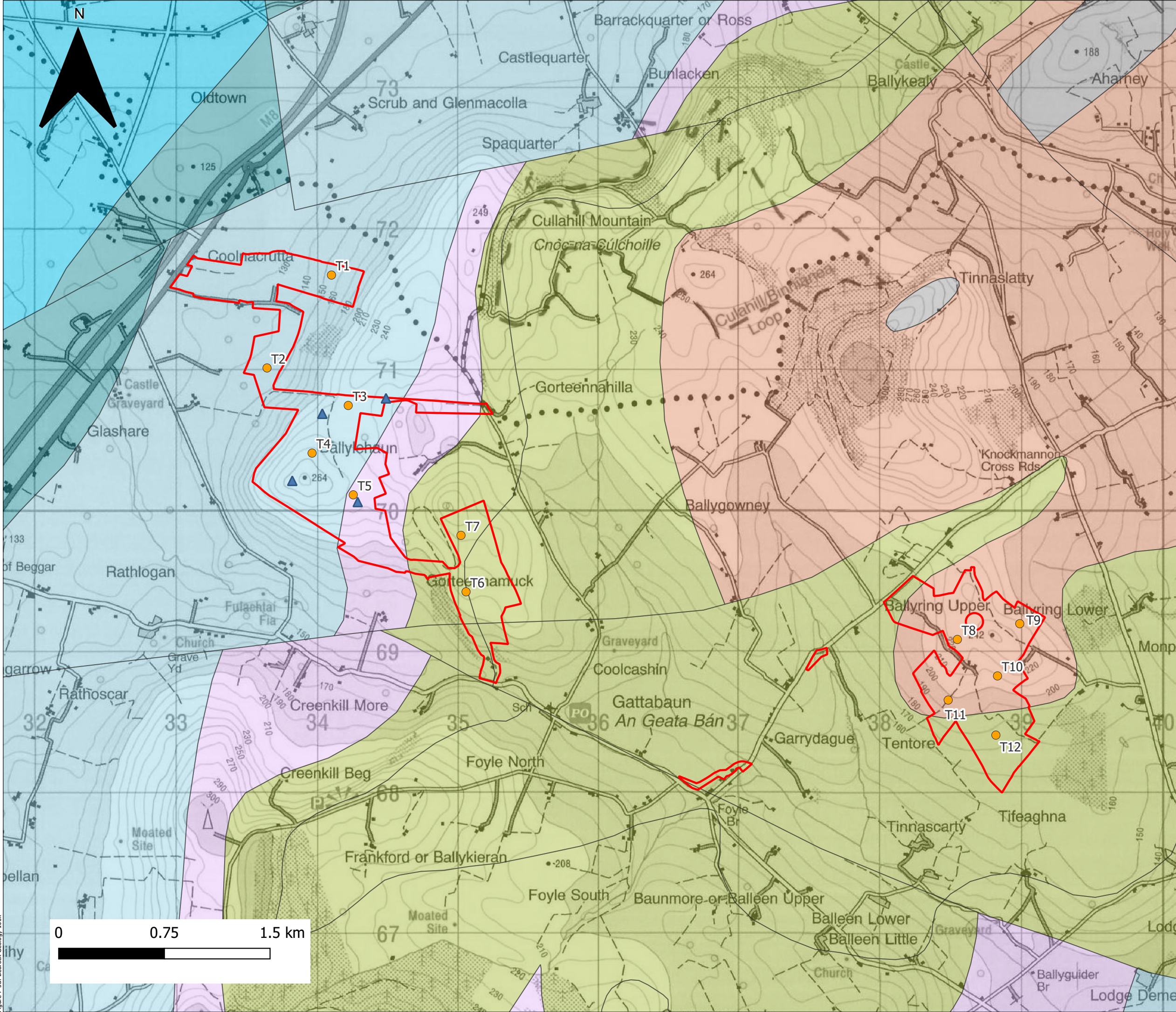
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Subsoils**

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Date 09/2026	Date 09/2026	Date 09/2026	Date 09/2026
Drawing Number Figure 7-4b			Rev. 02

Figure 7-4b: GCA Subsoils



Notes:
1. Basemap: OSI Discovery Series Sheet 60
2. Geology Layer Source: Geological Survey Ireland
3. Infrastructure: Supplied By Ecopower Ltd.

- LEGEND:
- Red Line Boundary
 - Proposed Gathabawn Turbines
 - Borehole Locations
- GSI Bedrock Geology 100k
- Aghmacart Formation
 - Ballyadams Formation
 - Bregaun Flagstone Formation
 - Clogrenan Formation
 - Durrow Formation
 - Killeshin Siltstone Formation
 - Moyadd Coal Formation



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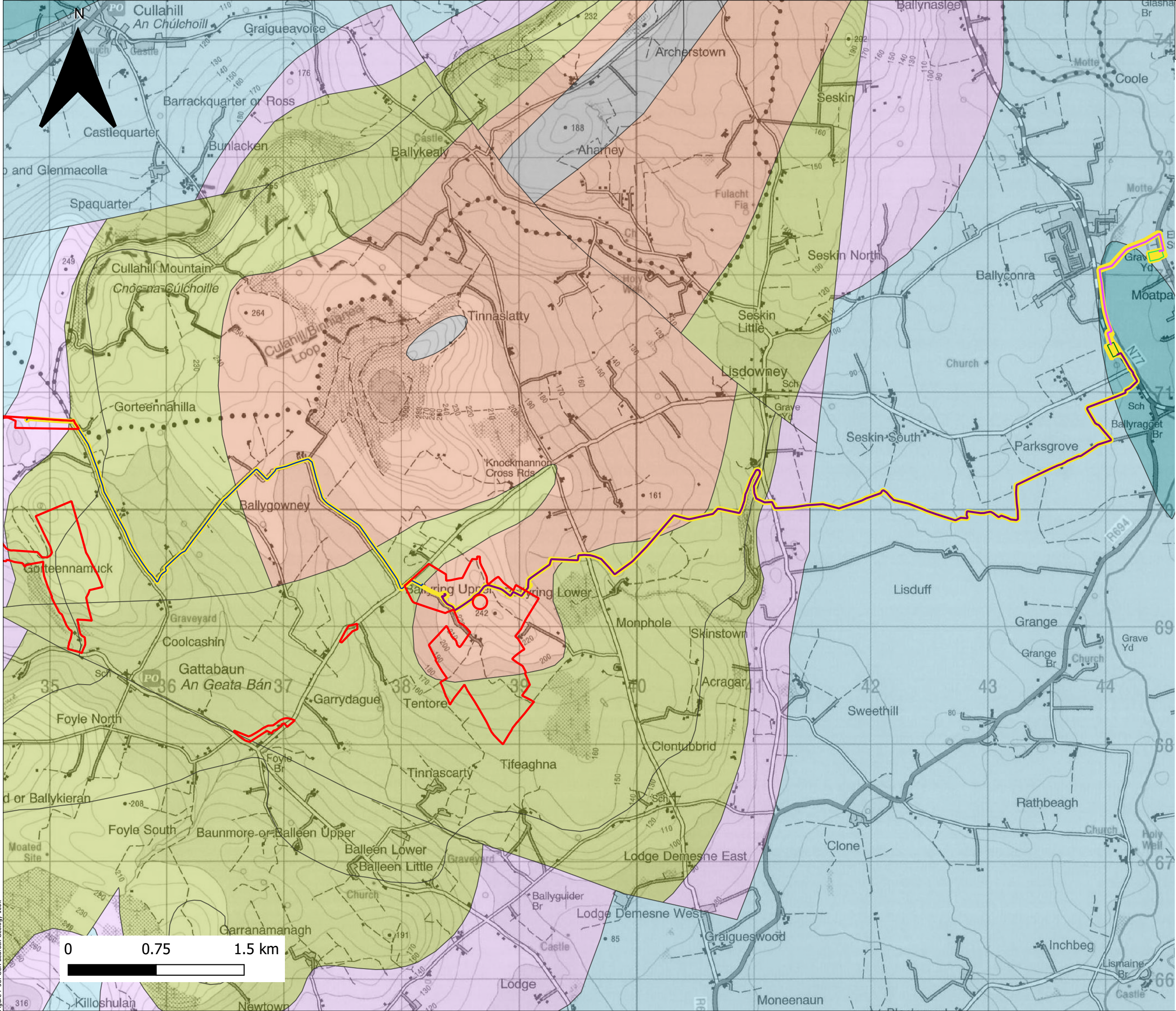
Project
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Drawing Title
Proposed Gathabawn Windfarm: Bedrock
Geology 100k

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Designed MCOB	Drawn MCOB	Checked SM	Authorised SM
Date 09/2026	Date 09/2026	Date 09/2026	Date 09/2026

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Figure 7-5a

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Notes:
1. Basemap: OSI Discovery Series Sheet 60
2. Geology Layer Source: Geological Survey Ireland
3. Infrastructure: Supplied By Ecopower Ltd.

- LEGEND:
- Red Line Boundary
 - Ballylehaun-Ballyring Underground Cabling
 - Ballyring - Parksgrove Underground Cabling
 - Parksgrove - Moatpark Underground Cabling
 - EirGrid Ballyragget Substation
 - Parksgrove Substation
 - Construction Works Boundary - Candidate Grid Connection

- GSI Bedrock Geology 100k
- Ballyadams Formation
 - Bregaun Flagstone Formation
 - Clogrenan Formation
 - Durrow Formation
 - Killeshin Siltstone Formation
 - Moyadd Coal Formation



Zetec House,
Purcellsinn IDA Business Park,
Dublin Road, Kilkenny,
R95 PX5X, Ireland

2		09/26	MCOB	SM	SM
Rev	Amendments	Date	By	Chk	Auth



SLR Consulting Ireland
7 Dundrum Business Park,
Windy Arbour,
Dublin,
Ireland,
D14 N2YZ

www.slrconsulting.com

Client
Ecopower Ltd.

Project
Gathabawn Wind Farm

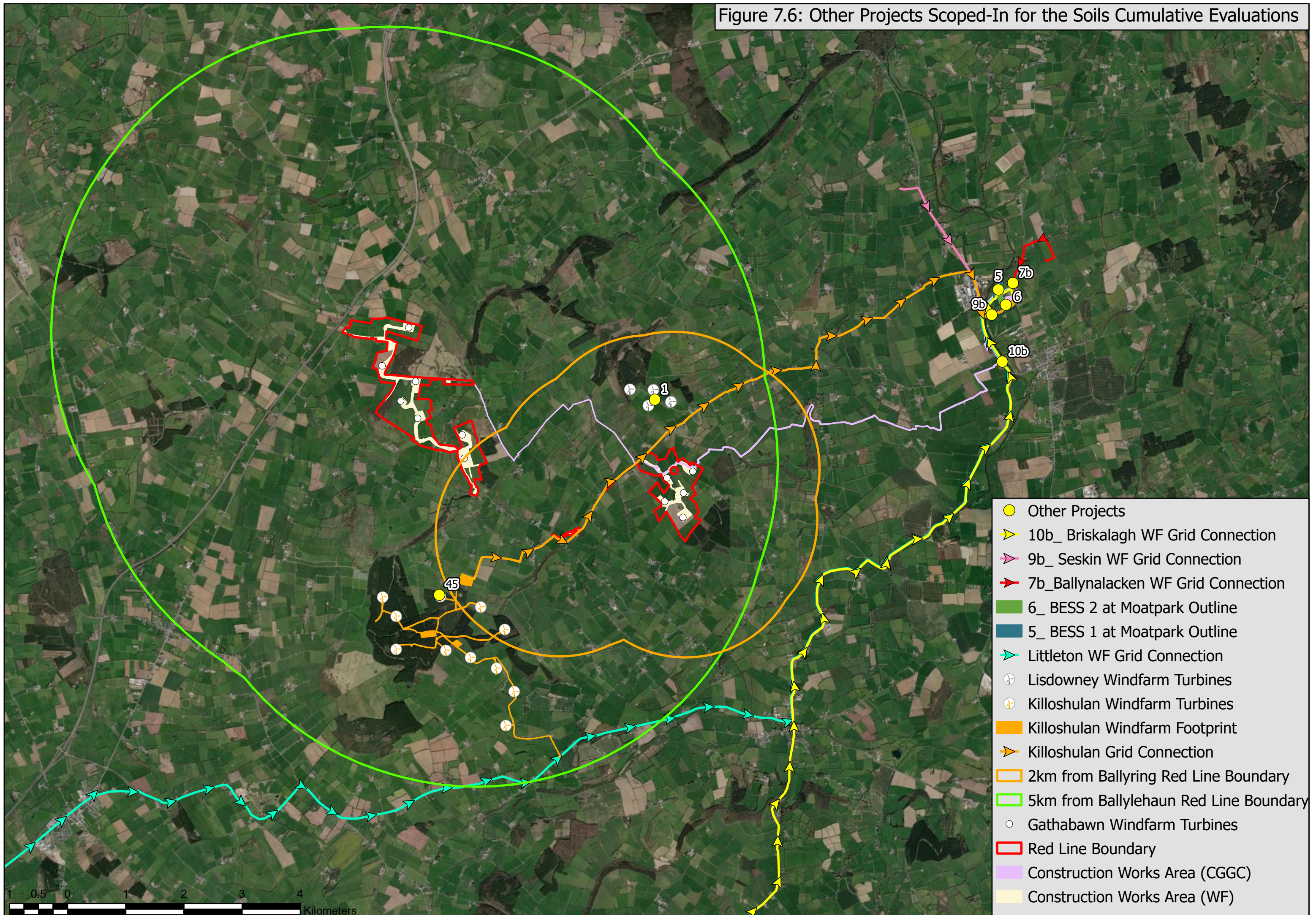
Drawing Title
Candidate Gathabawn Grid Connection:
Bedrock Geology 100k

Scale 1:30,000 @A3		SLR Project No. 501.065883.00001	
Designed MCOB	Drawn MCOB	Checked SM	Authorised SM
Date 09/2026	Date 09/2026	Date 09/2026	Date 09/2026

Drawing Number
Figure 7-5b

Rev.
02

Figure 7.6: Other Projects Scoped-In for the Soils Cumulative Evaluations



Appendix to Chapter 7: Soils

Appendix 7.1: Methodology for the evaluation of Soils

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A7.1.8	Significance of Effect	4

A7.1 Methodology for the evaluation of Soils

This Appendix has been prepared to outline the methodology for the evaluation of land, soils and geology, including the legislation, policy and guidance that is relevant to the assessment for the Proposed Development; and the criteria for determining sensitivity and significance.

This Appendix should be read in conjunction with **Chapter 7: Soils** of the Environmental Impact Assessment (EIA) Report which contains a detailed description of the local soils, subsoils and geology, the embedded mitigation incorporated in the Proposed Development design, and an assessment of potential impacts on receptors.

A7.1.1 EU Directives

- Directive 2006/21/EC of the European Parliament and of the Council of 15 March 2006 on the management of waste from extractive industries ('Management of Waste Directive' as amended); and Directive 2004/35/EC of the European Parliament and of the Council of 21 April 2004 on environmental liability with regard to the prevention and remedying of environmental damage ('Environmental Liability Directive' as amended).
- Directive 2014/52/EU of the European Parliament and of the Council of 16 April 2014 amending Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment ('the EIA Directive').
- The EIA Directive sets out the information required in an EIAR.
- The Management of Waste Directive and the Environmental Liability Directive.

A7.1.2 Irish Legislation

- The Planning and Development Act 2000 as amended.
- S.I. No. 272/2009 – European Communities Environmental Objectives (Surface Waters) Regulations 2009, and subsequent amendments.
- S.I. No. 9/2010 – European Communities Environmental Objectives (Groundwater) Regulations) 2010, and subsequent amendments.
- S.I. No. 473 of 2011, European Union (Environmental Impact Assessment and Habitats) Regulations 2011.
- S.I. No. 584 of 2011, European Union (Environmental Impact Assessment and Habitats) (No.2) Regulations 2011.
- S.I. No. 296 of 2018, European Communities (Planning and Development) (Environmental Impact Assessment) Regulations 2018.

A7.1.3 Guidelines

- Good Practice Guide for Handling Soils. Sheets 1 & 2. Ministry of Agriculture, Fisheries and Food (UK) (2000).
- Wind Energy Development Guidelines; Department of Housing, Local Government and Heritage (2006).
- Environmental Impact Assessment of National Road Schemes - A Practical Guide; National Roads Authority (2008).
- Geological Survey of Ireland, Irish Concrete Federation Geological Heritage Guidelines for the Extractive Industry (2008).
- Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes; National Roads Authority (2009).
- Best Practice Guidelines for the Irish Wind Energy; Irish Wind Energy Association (2012).
- Guidelines for the Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements; Institute of Geologists of Ireland (2013).

- Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment; Department of Housing, Planning and Local Government (2018).
- Guidelines on the Information to be Contained in Environmental Impact Assessment Reports. Environmental Protection Agency (2022).
- Draft Revised Wind Energy Development Guidelines December 2019; Department of Housing, Planning and Local Government (2019).

A7.1.4 Assessing Significance

The significance of likely effects of the project has been assessed by considering two factors: the sensitivity of the receiving environment and, the magnitude of impact should that effect occur. The assessment methodology has also been informed by the assessor's experience of carrying out such assessments for renewable energy developments, knowledge of water environment characteristics in Ireland and cognisance of good practice.

This approach provides a mechanism for identifying the areas where mitigation measures are required and for identifying mitigation measures appropriate to the significance of effects presented by the proposed development. Criteria for determining the significance of effect are presented in Table 1, Table 2, and Diagram 1^{1,2}.

A7.1.5 Sensitivity of Receptor

The sensitivity of the receiving environment (i.e. baseline quality of the receiving environment) is defined as its ability to absorb an effect without a detectable change and can be considered through a combination of professional judgement and a set of pre-defined criteria which are set out in Table 1. Receptors in the receiving environment only need to meet one of the defined criteria to be categorised at the associated level of sensitivity.

Table 1: Criteria for Assessing Sensitivity of Receptor

Sensitivity	Definition
HIGH	• Receptor is of high ecological importance or national or international value (e.g. Special Area of Conservation (SAC) or habitat for protected species) which may be dependent upon the land, soil or geology of the development area; and • Land, soil and geology is considered to be of high importance at the local and regional scale, where degree or extent of soil contamination is significant on a local scale, and/or volume of peat and/or soft organic soil underlying route is significant on a local scale.
MEDIUM	• Land, soil and geology is considered to be of medium / moderate importance at the local and regional scale, where degree or extent of soil contamination is moderate on a local scale, and/or volume of peat and/or soft organic soil underlying route is moderate on a local scale.
LOW	• Land, soil and geology is considered to be of low importance at the local and regional scale, where degree or extent of soil contamination is minor on a local scale, and/or volume of peat and/or soft organic soil underlying route is minor on a local scale.

¹ Guidelines on procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes (NRA, 2009)

² Guidelines on the Information to be Contained in Environmental Impact Assessment Reports (EPA, 2022).

A7.1.6 Magnitude of impact

The magnitude of impact would depend upon whether the likely effect would cause a fundamental, material or detectable impact. In addition, the timing, scale, size, and duration of the likely effect resulting from the project are also determining factors. The criteria that have been used to assess the magnitude of impact are defined in Table 2.

Table 2: Criteria for Assessing Magnitude of Impact

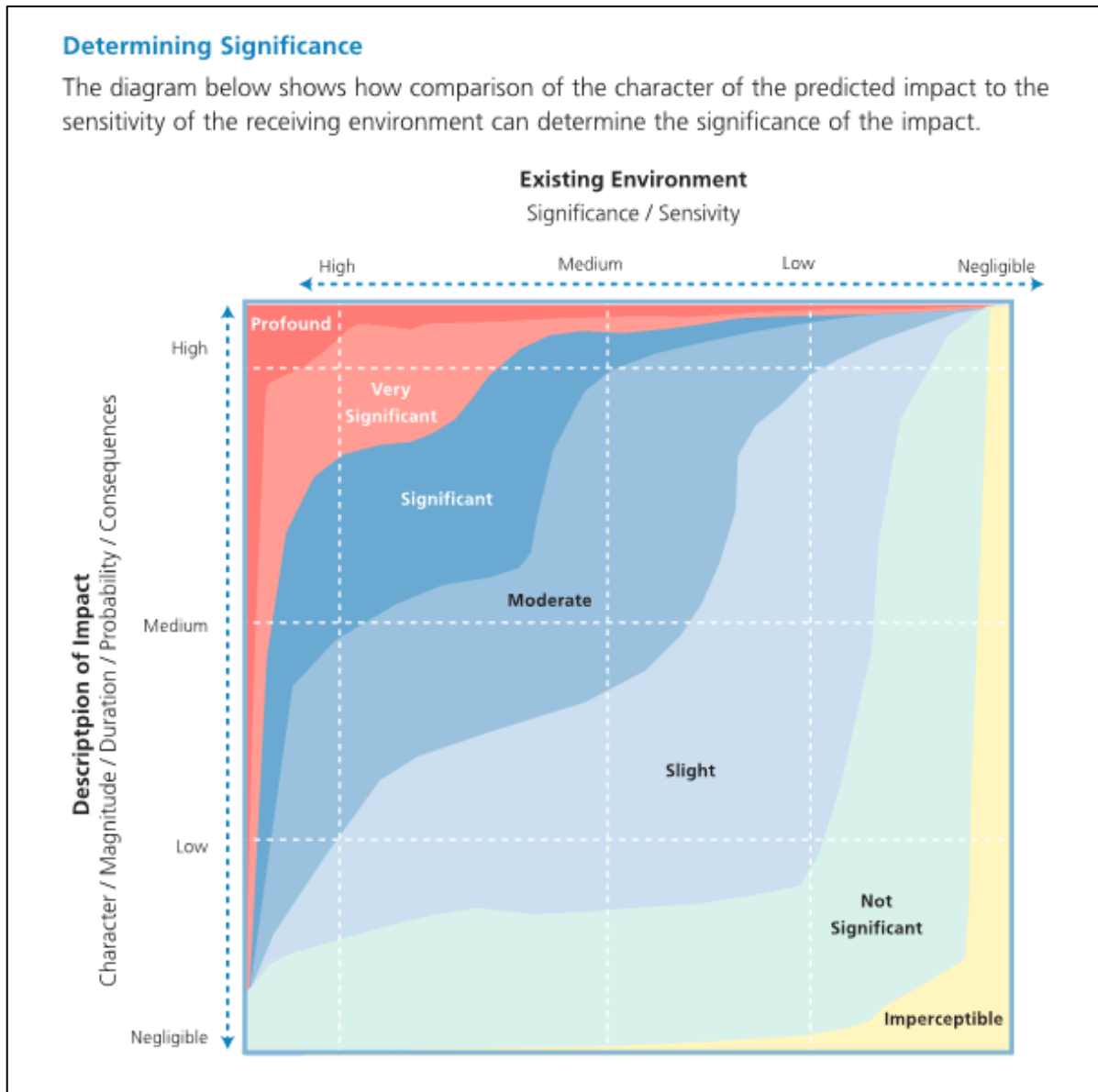
Magnitude	Criteria	Definition
Major	Results in loss of attribute	Fundamental (long term or permanent) changes to the baseline geology.
Moderate	Results in impact or integrity of attribute or loss of part of attribute	Material but non-fundamental and short to medium term changes to baseline geology.
Minor	Results in minor impacts on attribute	Detectable but non-material and transitory changes to the baseline geology.
Negligible	Results in an impact on attribute but of insufficient magnitude to affect the use/integrity	No perceptible changes to the baseline geology.

A7.1.7 Significance of Effect

The sensitivity of the receptor, together with the magnitude of impact, determines the significance of effect. This can be categorised into a level of significance as identified in **Diagram 1**

The significance of effect provides a guide to assist in decision making. However, it should not be considered as a substitute for professional judgement and interpretation. In some cases, the sensitivity of the receiving environment or the magnitude of impact cannot be quantified with certainty and therefore professional judgement remains the most robust method of identifying the significance of a likely effect.

Diagram 1: Significance of Effect



From: Guidelines on the Information to be Contained in Environmental Impact Assessment Reports (EPA, 2022).

Appendix to Chapter 7: Soils

Appendix 7.2: Trial Pit Investigation Results

Table of Contents

- Trial Pit Logs taken by Hydro Environmental Services on August 2021
- Trial Pit Logs taken by Hydro Environmental Services on March 2023
- Trial Pit Logs taken by SLR on August 2026
- Map showing the locations of the Trial Pit and Borehole Investigations

App. 7.2 Trail Pit Investigation Results

- Trial Pit Logs taken by Hydro Environmental Services on August 2021



Project No: P1518-0
Site: Ballylehaun, Co. Kilkenny
Client: Eco Power

Trial Pit Log

Date started: 25/08/2021
Date finished: 25/08/2021

Trial Pit No: TP01
Easting: 234114
Northing: 170759
Elevation: .

SUBSURFACE PROFILE

Depth	Symbol	Depth/Elev.	Description	Water Strikes	Sample Type	Comments
0.00		0.00	Ground Surface			
		0.00	Topsoil			
		-0.10				
		0.10	Firm, brown slightly sandy SILT/CLAY with cobbles			
			Refusal on broken/weathered limestone (angular/blocky)			
		-0.40				
		0.40				



Remarks:

Contractor:
Excavator type:
Logged by: DB

Scale as shown
Sheet: 1 of 1



HYDRO-ENVIRONMENTAL SERVICES

Trial Pit Log

Project No: P1518-0

Site: Ballylehaun, Co. Kilkenny

Client: Eco Power

Date started: 25/08/2021

Date finished: 25/08/2021

Trial Pit No: TP02

Easting: 234123

Northing: 170814

Elevation: .

SUBSURFACE PROFILE

Depth	Symbol	Depth/Elev.	Description	Water Strikes	Sample Type	Comments
0.00		0.00	Ground Surface			
		0.00	Topsoil with tree roots			
		-0.15				
		0.15	Firm, brown, slightly sandy, slightly gravelly SILT/CLAY with cobbles			
			Refusal on broken/weathered limestone (angular/blocky)			
		-0.45				
		0.45				



Remarks:

Contractor:

Scale as shown

Excavator type:

Sheet: 1 of 1

Logged by: DB



Project No: P1518-0
Site: Ballylehaun, Co. Kilkenny
Client: Eco Power

Trial Pit Log

Date started: 25/08/2021
Date finished: 25/08/2021

Trial Pit No: TP03
Easting: 234177
Northing: 170807
Elevation: .

SUBSURFACE PROFILE

Depth	Symbol	Depth/Elev.	Description	Water Strikes	Sample Type	Comments
0.00		0.00	Ground Surface			
		0.00	Topsoil			
		-0.15				
		0.15	Refusal on broken/weathered limestone (angular/blocky)			
		-0.20				
		0.20				



Remarks:

Contractor:
Excavator type:
Logged by: DB

Scale as shown
Sheet: 1 of 1



HYDRO-ENVIRONMENTAL SERVICES

Trial Pit Log

Project No: P1518-0

Site: Ballylehaun, Co. Kilkenny

Client: Eco Power

Date started: 25/08/2021

Date finished: 25/08/2021

Trial Pit No: TP04

Easting: 234076

Northing: 170633

Elevation: .

SUBSURFACE PROFILE

Depth	Symbol	Depth/Elev.	Description	Water Strikes	Sample Type	Comments
0.00		0.00	Ground Surface			
		0.00	Topsoil			
		-0.15				
		0.15	Firm, dark brown SILT/CLAY			
			Refusal on competent limestone			
		-0.25				
		0.25				



Remarks:

Contractor:

Excavator type:

Logged by: DB

Scale as shown

Sheet: 1 of 1



Project No: P1518-0
Site: Ballylehaun, Co. Kilkenny
Client: Eco Power

Trial Pit Log

Date started: 25/08/2021
Date finished: 25/08/2021

Trial Pit No: TP05
Easting: 234076
Northing: 170633
Elevation: .

SUBSURFACE PROFILE

Depth	Symbol	Depth/Elev.	Description	Water Strikes	Sample Type	Comments
0.00		0.00	Ground Surface			
		0.00	Topsoil			
		-0.15				
		0.15	Firm, dark brown SILT/CLAY			
			Refusal on competent limestone			
		-0.25				
		0.25				



Remarks:

Contractor:
Excavator type:
Logged by: DB

Scale as shown
Sheet: 1 of 1



Project No: P1518-0
Site: Ballylehaun, Co. Kilkenny
Client: Eco Power

Trial Pit Log

Date started: 25/08/2021
Date finished: 25/08/2021

Trial Pit No: TP06
Easting: 234015
Northing: 170576
Elevation: .

SUBSURFACE PROFILE

Depth	Symbol	Depth/Elev.	Description	Water Strikes	Sample Type	Comments
0.00		0.00	Ground Surface			
		0.00	Topsoil			
		-0.10				
		0.10	Refusal on broken/weathered limestone (angular/blocky)			
		-0.15				
		0.15				



Remarks:

Contractor:
Excavator type:
Logged by: DB

Scale as shown
Sheet: 1 of 1



Project No: P1518-0
Site: Ballylehaun, Co. Kilkenny
Client: Eco Power

Trial Pit Log

Date started: 25/08/2021
Date finished: 25/08/2021

Trial Pit No: TP07
Easting: 234119
Northing: 170461
Elevation: .

SUBSURFACE PROFILE

Depth	Symbol	Depth/Elev.	Description	Water Strikes	Sample Type	Comments
0.00		0.00	Ground Surface			
		0.00	Topsoil			
		-0.15				
		0.15	Firm, brown SILT/CLAY			
			Refusal on broken/weathered limestone (angular/blocky)			
		-0.25				
		0.25				



Remarks:

Contractor:
Excavator type:
Logged by: DB

Scale as shown
Sheet: 1 of 1



Project No: P1518-0
Site: Ballylehaun, Co. Kilkenny
Client: Eco Power

Trial Pit Log

Date started: 25/08/2021
Date finished: 25/08/2021

Trial Pit No: TP08
Easting: 234137
Northing: 170342
Elevation: .

SUBSURFACE PROFILE

Depth	Symbol	Depth/Elev.	Description	Water Strikes	Sample Type	Comments
0.00		0.00	Ground Surface			
		0.00	Topsoil			
		-0.10				
		0.10	Refusal on broken/weathered limestone (angular/blocky)			
		-0.15				
		0.15				



Remarks:

Contractor:
Excavator type:
Logged by: DB

Scale as shown
Sheet: 1 of 1



HYDRO-ENVIRONMENTAL SERVICES

Trial Pit Log

Project No: P1518-0

Site: Ballylehaun, Co. Kilkenny

Client: Eco Power

Date started: 25/08/2021

Date finished: 25/08/2021

Trial Pit No: TP09

Easting: 234194

Northing: 170180

Elevation: .

SUBSURFACE PROFILE

Depth	Symbol	Depth/Elev.	Description	Water Strikes	Sample Type	Comments
0.00		0.00	Ground Surface			
		0.00	Topsoil			
		-0.10				
		0.10	Firm, brown, SILT/CLAY			
			Refusal on competent limestone			
		-0.25				
		0.25				



Remarks:

Contractor:

Scale as shown

Excavator type:

Sheet: 1 of 1

Logged by: DB



Project No: P1518-0
Site: Ballylehaun, Co. Kilkenny
Client: Eco Power

Trial Pit Log

Date started: 25/08/2021
Date finished: 25/08/2021

Trial Pit No: TP10
Easting: 234048
Northing: 170163
Elevation: .

SUBSURFACE PROFILE

Depth	Symbol	Depth/Elev.	Description	Water Strikes	Sample Type	Comments
0.00		0.00	Ground Surface			
		0.00	Topsoil			
		-0.10				
		0.10	Refusal on broken/weathered limestone (angular/blocky)			
		-0.15				
		0.15				



Remarks:

Contractor:
Excavator type:
Logged by: DB

Scale as shown
Sheet: 1 of 1



HYDRO-ENVIRONMENTAL SERVICES

Trial Pit Log

Project No: P1561-0

Site: Ballyring, Co. Kilkenny

Client: Eco Power

Date started: 25/08/2021

Date finished: 25/08/2021

Trial Pit No: TP-T2

Easting: 238471

Northing: 169085

Elevation: .

SUBSURFACE PROFILE

Depth	Symbol	Depth/Elev.	Description	Water Strikes	Sample Type	Comments
0.00		0.00	Ground Surface			
		0.00	Topsoil			
		-0.15				
		0.15	Grey, very firm to stiff SILT			
		-0.70				
		0.70	Soft weathered SILTSTONE			
		-0.85				
		0.85				
1.00						



Remarks:

Contractor:

Scale as shown

Excavator type:

Sheet: 1 of 1

Logged by: DB



Project No: P1561-0
Site: Ballyring, Co. Kilkenny
Client: Eco Power

Trial Pit Log

Date started: 25/08/2021
Date finished: 25/08/2021

Trial Pit No: TP-T3
Easting: 238540
Northing: 168623
Elevation: .

SUBSURFACE PROFILE

Depth	Symbol	Depth/Elev.	Description	Water Strikes	Sample Type	Comments
0.00		0.00	Ground Surface			
		0.00	Topsoil			
		-0.15				
		0.15	Grey, very firm to stiff SILT			
		-0.70				
		0.70	Soft weathered SILTSTONE			
		-0.85				
		0.85				
1.00						



Remarks:

Contractor:
Excavator type:
Logged by: DB

Scale as shown
Sheet: 1 of 1



Project No: P1561-0
Site: Ballyring, Co. Kilkenny
Client: Eco Power

Trial Pit Log

Date started: 25/08/2021
Date finished: 25/08/2021

Trial Pit No: TP-T4
Easting: 238993
Northing: 168486
Elevation: .

SUBSURFACE PROFILE

Depth	Symbol	Depth/Elev.	Description	Water Strikes	Sample Type	Comments
0.00		0.00	Ground Surface			
		0.00	Topsoil			
		-0.15				
		0.15	Grey, very firm to stiff SILT with few cobbles			
		-0.90				
1.00		0.90	Soft weathered SILTSTONE			
		-1.60				
		1.60				



Remarks:

Contractor:
Excavator type:
Logged by: DB

Scale as shown
Sheet: 1 of 1



Trial Pit Log

Project No: P1561-0

Site: Ballyring, Co. Kilkenny

Client: Eco Power

Date started: 25/08/2021

Date finished: 25/08/2021

Trial Pit No: TP_Sub S

Easting: 238341

Northing: 169241

Elevation: .

SUBSURFACE PROFILE

Depth	Symbol	Depth/Elev.	Description	Water Strikes	Sample Type	Comments
0.00	0.00	0.00	Ground Surface			
	0.00	0.00	Loose weathered SILTSTONE			
	0.90	0.90				
1.00						



Remarks:

Contractor:

Excavator type:

Logged by: DB

Scale as shown

Sheet: 1 of 1

App. 7.2 Trail Pit Investigation Results

- Trial Pit Logs taken by Hydro Environmental Services on March 2023



Project No: P1518-0
Site: Gattabaun, Co. Kilkenny
Client: Eco Power

Trial Pit Log

Date started: 06/03/2023
Date finished: 06/03/2023

Trial Pit No: TP-T1 (W1)
Easting: .
Northing: .
Elevation: .

SUBSURFACE PROFILE

Depth	Symbol	Depth/Elev.	Description	Water Strikes	Sample Type	Comments
0.00		0.00	Ground Surface			
		0.00	Brown TOPSOIL			
			Firm to very firm, grey, gravelly, sandy SILT/CLAY with numerous rounded to sub-rounded cobbles and boulders			
1.00						
2.00						
		-2.50 2.50				



Remarks:

Contractor:
Excavator type:
Logged by: DB

Scale as shown
Sheet: 1 of 1



Project No: P1518-0
Site: Gattabaun, Co. Kilkenny
Client: Eco Power

Trial Pit Log

Date started: 06/03/2023
Date finished: 06/03/2023

Trial Pit No: TP-T2 (W2)
Easting: .
Northing: .
Elevation: .

SUBSURFACE PROFILE

Depth	Symbol	Depth/Elev.	Description	Water Strikes	Sample Type	Comments
0.00		0.00	Ground Surface			
		0.00	Brown TOPSOIL			
		-0.60	Firm, brown, SILT/CLAY			
1.00		0.60	Firm, grey, sandy, gravelly SILT/CLAY with numerous rounded to sub-rounded cobbles and boulders			
2.00		-2.70				
		2.70				



Remarks:

Contractor:
Excavator type:
Logged by: DB

Scale as shown
Sheet: 1 of 1



Project No: P1518-0
Site: Gattabaun, Co. Kilkenny
Client: Eco Power

Trial Pit Log

Date started: 06/03/2023
Date finished: 06/03/2023

Trial Pit No: TP-T3 (W3)
Easting: .
Northing: .
Elevation: .

SUBSURFACE PROFILE

SUBSURFACE PROFILE						
Depth	Symbol	Depth/Elev.	Description	Water Strikes	Sample Type	Comments
0.00		0.00	Ground Surface			
		0.00	Brown TOPSOIL			
		-0.10	Firm, brown, SILT/CLAY			
		0.10				
	-0.60	Very firm, grey, sandy, gravelly SILT/CLAY with sub-rounded cobbles				
	0.60					
		Refusal at 1m -LIMESTONE Bedrock				
		-1.00				
		1.00				



Remarks:

Contractor:
Excavator type:
Logged by: DB

Scale as shown
Sheet: 1 of 1



Project No: P1518-0
Site: Gattabaun, Co. Kilkenny
Client: Eco Power

Trial Pit Log

Date started: 06/03/2023
Date finished: 06/03/2023

Trial Pit No: TP-T8 (W8)
Easting: .
Northing: .
Elevation: .

SUBSURFACE PROFILE

Depth	Symbol	Depth/Elev.	Description	Water Strikes	Sample Type	Comments
0.00		0.00	Ground Surface			
		0.00	Brown TOPSOIL			
			Firm, dark brown SILT/CLAY			
		-0.75				
		0.75	Soft, weak, brittle, thinly bedded SHALE			
1.00						
			Refusal at 2.1m - SHALE bedrock			
2.00		-2.10				
		2.10				



Remarks:

Contractor:
Excavator type:
Logged by: DB

Scale as shown
Sheet: 1 of 1



Project No: P1518-0
Site: Gattabaun, Co. Kilkenny
Client: Eco Power

Trial Pit Log

Date started: 06/03/2023
Date finished: 06/03/2023

Trial Pit No: TP-T12 (W12)
Easting: .
Northing: .
Elevation: .

SUBSURFACE PROFILE

SUBSURFACE PROFILE						
Depth	Symbol	Depth/Elev.	Description	Water Strikes	Sample Type	Comments
0.00		0.00	Ground Surface			
		0.00	Brown TOPSOIL			
		-0.15	Greyish brown, stiff, gravelly CLAY with cobbles and boulders			
		0.15				
1.00						



Remarks:

Contractor:
Excavator type:
Logged by: DB

Scale as shown
Sheet: 1 of 1



Project No: P1518-0
Site: Gattabaun, Co. Kilkenny
Client: Eco Power

Trial Pit Log

Date started: 06/03/2023
Date finished: 06/03/2023

Trial Pit No: TP-T13 (W13)
Easting: .
Northing: .
Elevation: .

SUBSURFACE PROFILE

Depth	Symbol	Depth/Elev.	Description	Water Strikes	Sample Type	Comments
0.00		0.00	Ground Surface			
		0.00	Brown TOPSOIL			
		-0.40	Firm, reddish SILT/ CLAY			
		0.40	Weathered black grey SHALE			
1.00		-1.00	Soft brittle black SHALE			
		1.00				
		-2.15				
2.00		2.15				



Remarks:

Contractor:
Excavator type:
Logged by: DB

Scale as shown
Sheet: 1 of 1



Project No: P1518-0
Site: Gattabaun, Co. Kilkenny
Client: Eco Power

Trial Pit Log

Date started: 06/03/2023
Date finished: 06/03/2023

Trial Pit No: TP-T14 (W14)
Easting: .
Northing: .
Elevation: .

SUBSURFACE PROFILE

Depth	Symbol	Depth/Elev.	Description	Water Strikes	Sample Type	Comments
0.00		0.00	Ground Surface			
		0.00	Brown TOPSOIL			
		-0.30	Firm, brown CLAY			
		0.30	Grey, firm, slightly gravelly SILT			
		-0.45	Soft brittle black SHALE			
		0.45				
1.00						
2.00		-2.00				
		2.00				



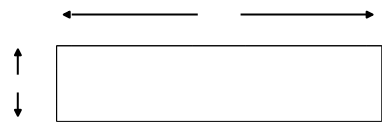
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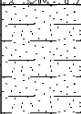
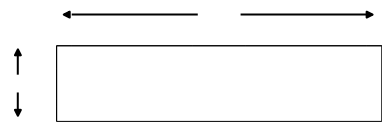
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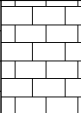
App. 7.2 Trail Pit Investigation Results

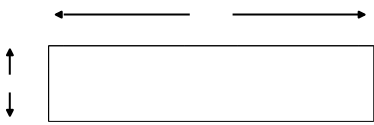
- Trial Pit Logs taken by SLR on August 2026

TRIAL PIT LOG										TRIAL PIT No TP02	
Client: Ecopower developments Limited											
Project: Gathabawn WF - Trial Pits											
Project No: 501.065883.00001			Date: 27/08/2026		Ground Level:		Co-ordinates: E633563 N671040		Sheet 1 of 1		
SAMPLES & TESTS				Water	STRATA				Instrument Backfill		
Depth	Type No	Test Type	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION			
1.00 - 1.01	B						(0.50)	TOPSOIL			
							(0.20)	Soft to firm greyish brown sandy gravelly CLAY with a medium cobble content and a low boulder content. Sand is fine to medium. Gravel and cobbles are subangular to rounded. Boulders are subrounded to rounded of limestone, up to 200mm.			
							(0.50)	Soft to firm greyish brown very sandy gravelly CLAY with a high cobble content and a medium boulder content. Sand is fine to medium. Gravel and cobbles are subangular to rounded. Boulders are subrounded to rounded of limestone, up to 200mm.			
							(0.30)	Loose to medium dense brownish grey slightly clayey gravelly SAND with a high cobble and a medium boulder content. Gravel cobbles and boulders are subangular to rounded of limestone.			
1.50 - 1.51	B						1.50	Trial Pit Complete at 1.50m			
2											
3											
GENERAL REMARKS: E.O.D at 1.5mbgl, could not excavate further, possible rockhead.						Trial Pit Dimensions: 					
KEY V = Hand Vane Shear Strength PP = Pocket Penetrometer Shear Strength J = Jar Sample D = Disturbed Sample B = Large Bulk Sample HS = Head Space Measurement											
All dimensions in metres Scale 1:25			Contractor: Plant:			Method: Trial pit/trench			Logged By: Approved By:		

TRIAL PIT LOG										TRIAL PIT No TP03	
Client: Ecopower developments Limited											
Project: Gathabawn WF - Trial Pits											
Project No: 501.065883.00001			Date: 27/08/2026		Ground Level:		Co-ordinates: E634139 N670774		Sheet 1 of 1		
SAMPLES & TESTS				Water	STRATA					Instrument Backfill	
Depth	Type No	Test Type	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION			
0.90	B						(0.20) 0.20	TOPSOIL			
							(0.30) 0.50	Soft to firm light brown sandy gravelly CLAY with a medium cobble content and a medium boulder content. Sand is fine to medium. Gravel and cobbles are subangular to subrounded. Boulders are subrounded of limestone, up to 200mm.			
							(0.40) 0.90	Loose light grey slightly clayey slightly silty slightly gravelly SAND with a medium cobble content and low boulder content. Sand is fine to medium. Gravel and cobbles are subangular to subrounded. Boulders are subrounded of limestone, up to 200mm.			
						Trial Pit Complete at 0.90m					
1											
2											
3											
GENERAL REMARKS: E.O.D at 0.9mbgl, could not excavate further, possible rockhead.						Trial Pit Dimensions: 					
KEY V = Hand Vane Shear Strength PP = Pocket Penetrometer Shear Strength J = Jar Sample D = Disturbed Sample B = Large Bulk Sample HS = Head Space Measurement											
All dimensions in metres Scale 1:25			Contractor: Plant:			Method: Trial pit/trench			Logged By:		Approved By:

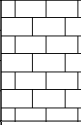
TRIAL PIT LOG				TRIAL PIT No TP04	
Client: Ecopower developments Limited					
Project: Gathabawn WF - Trial Pits					
Project No: 501.065883.00001		Date: 27/08/2026	Ground Level:	Co-ordinates: E633883 N670436	Sheet 1 of 1

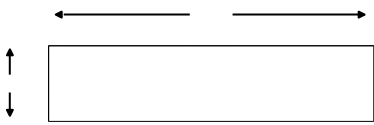
SAMPLES & TESTS				Water	STRATA				Instrument Backfill
Depth	Type No	Test Type	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	
0.50 - 0.51	B						(0.10)0.10	TOPSOIL	
							(0.40)	Medium strong, weathered light blueish grey LIMESTONE/SANDSTONE.	
							0.50	Trial Pit Complete at 0.50m	
1									
2									
3									

GENERAL REMARKS: E.O.D at 0.5mbgl, bedrock encountered.		Trial Pit Dimensions: 	
KEY V = Hand Vane Shear Strength PP = Pocket Penetrometer Shear Strength J = Jar Sample D = Disturbed Sample B = Large Bulk Sample HS = Head Space Measurement			

All dimensions in metres Scale 1:25	Contractor: Plant:	Method: Trial pit/trench	Logged By:	Approved By:
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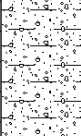
TRIAL PIT LOG				TRIAL PIT No TP05	
Client: Ecopower developments Limited					
Project: Gathabawn WF - Trial Pits					
Project No: 501.065883.00001		Date: 27/08/2026	Ground Level:	Co-ordinates: E634175 N670140	Sheet 1 of 1

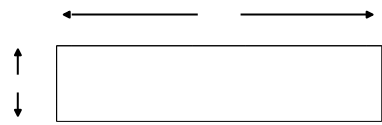
SAMPLES & TESTS				Water	STRATA				Instrument Backfill
Depth	Type No	Test Type	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	
0.50	B						(0.30) 0.30	TOPSOIL	
							(0.40) 0.70	Medium strong, slightly weathered light blueish grey LIMESTONE.	
								Trial Pit Complete at 0.70m	
1									
2									
3									

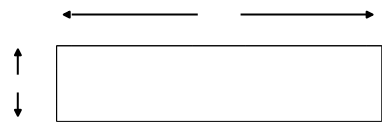
GENERAL REMARKS: E.O.D at 0.7mbgl, bedrock encountered.	Trial Pit Dimensions: 
KEY V = Hand Vane Shear Strength PP = Pocket Penetrometer Shear Strength J = Jar Sample D = Disturbed Sample B = Large Bulk Sample HS = Head Space Measurement	

All dimensions in metres Scale 1:25	Contractor: Plant:	Method: Trial pit/trench	Logged By:	Approved By:
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TRIAL PIT LOG				TRIAL PIT No TP06	
Client: Ecopower developments Limited					
Project: Gathabawn WF - Trial Pits					
Project No: 501.065883.00001	Date: 27/08/2026	Ground Level:	Co-ordinates: E634975 N669452	Sheet 1 of 1	

SAMPLES & TESTS				Water	STRATA				Instrument Backfill
Depth	Type No	Test Type	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	
1.00 - 1.01	B						(0.30) 0.30	TOPSOIL	
							(0.90) 1.20	Firm to stiff greyish brown very gravelly slightly sandy CLAY with a high cobble content and a medium boulder content. Sand is fine to medium. Gravel and cobbles are subangular to subrounded. Boulders are subrounded of limestone, up to 400mm.	
2.00 - 2.01	B						(0.30) 1.50	Firm to stiff greyish brown gravelly sandy CLAY with a medium cobble content and a medium boulder content. Sand is fine to medium. Gravel and cobbles are subangular to subrounded. Boulders are subrounded of limestone, up to 400mm.	
							(0.90) 2.40	Loose to medium dense brownish grey gravelly clayey SAND with a medium cobble content and a medium boulder content. Sand is fine to medium. Gravel and cobbles are subangular to subrounded. Boulders are subrounded of limestone, up to 400mm.	
3.00	B						(0.60) 3.00	Firm to stiff greyish brown very sandy gravelly CLAY with a medium cobble content and a medium boulder content. Sand is fine to medium. Gravel and cobbles are subangular to subrounded. Boulders are subrounded of limestone, up to 400mm.	
								Trial Pit Complete at 3.00m	

GENERAL REMARKS: E.O.D at 3mbgl. Hole unstable from 1.5mbgl, minor sidewall collapse.		Trial Pit Dimensions: 	
KEY V = Hand Vane Shear Strength PP = Pocket Penetrometer Shear Strength J = Jar Sample D = Disturbed Sample B = Large Bulk Sample HS = Head Space Measurement			
All dimensions in metres Scale 1:25	Contractor: Plant:	Method: Trial pit/trench	Logged By: Approved By:

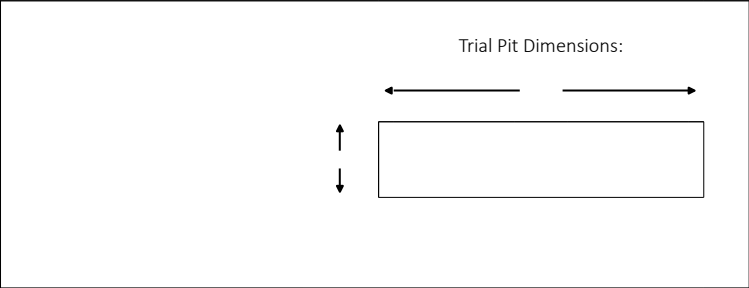
TRIAL PIT LOG								TRIAL PIT No TP07		
Client: Ecopower developments Limited										
Project: Gathabawn WF - Trial Pits										
Project No: 501.065883.00001		Date: 27/08/2026		Ground Level:		Co-ordinates: E634940 N669853		Sheet 1 of 1		
SAMPLES & TESTS				Water	STRATA				Instrument Backfill	
Depth	Type No	Test Type	Test Result		Reduced Level	Legend	Depth (Thick- ness)	DESCRIPTION		
1.00 - 1.01	B						(0.30)	TOPSOIL		
							(0.10)	0.40		Soft to firm greyish brown slightly sandy slightly silty gravelly CLAY with a high cobble content and low boulder content. Sand is fine to medium. Gravel and cobbles are subangular to subrounded. Boulders are subrounded of limestone, up to 200mm.
							(0.30)	0.70		Medium strong, weathered light blueish grey LIMESTONE.
							(0.80)	1.50		Loose to medium dense brown mottled light grey slightly sandy slightly clayey GRAVEL of weak, weathered MUDSTONE bedrock fragments.
Trial Pit Complete at 1.50m										
GENERAL REMARKS: E.O.D at 1.5mbgl, could not excavate further, possible rockhead.								Trial Pit Dimensions: 		
KEY V = Hand Vane Shear Strength PP = Pocket Penetrometer Shear Strength J = Jar Sample D = Disturbed Sample B = Large Bulk Sample HS = Head Space Measurement										
All dimensions in metres Scale 1:25		Contractor: Plant:		Method: Trial pit/trench		Logged By:		Approved By:		

TRIAL PIT LOG				TRIAL PIT No TP07a	
Client: Ecopower developments Limited					
Project: Gathabawn WF - Trial Pits					
Project No: 501.065883.00001		Date: 27/08/2026	Ground Level:	Co-ordinates: E635058 N669891	Sheet 1 of 1

SAMPLES & TESTS				Water	STRATA				Instrument Backfill
Depth	Type No	Test Type	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	
1.00 - 1.01	B						(0.40)	TOPSOIL	
							0.40 (1.10)	Loose to medium dense brown mottled light grey slightly sandy slightly clayey GRAVEL of weak, weathered MUDSTONE bedrock fragments.	
							1.50	Trial Pit Complete at 1.50m	
2									
3									

GENERAL REMARKS:
E.O.D at 1.5mbgl, could not excavate further, possible rockhead.

KEY
V = Hand Vane Shear Strength
PP = Pocket Penetrometer Shear Strength
J = Jar Sample
D = Disturbed Sample
B = Large Bulk Sample
HS = Head Space Measurement



All dimensions in metres Scale 1:25	Contractor: Plant:	Method: Trial pit/trench	Logged By:	Approved By:
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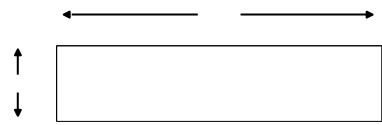
TRIAL PIT LOG				TRIAL PIT No TP09	
Client: Ecopower developments Limited					
Project: Gathabawn WF - Trial Pits					
Project No: 501.065883.00001	Date: 27/08/2026	Ground Level:	Co-ordinates: E638905 N669227	Sheet 1 of 1	

SAMPLES & TESTS				Water	STRATA				Instrument Backfill
Depth	Type No	Test Type	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	
1.00 - 1.01 1	B						(0.30) 0.30	TOPSOIL	
							(0.30) 0.60	soft to firm light brown slightly sandy slightly gravelly CLAY with a medium cobble content. Sand is fine to medium. Gravel and cobbles are subangular to subrounded.	
							(1.20) 1.80	Medium dense light brown slightly clayey slightly sandy GRAVEL of weak, weathered MUDSTONE bedrock.	
2.00 - 2.01 2	B						(0.60) 2.40	Dense light brown very clayey slightly sandy GRAVEL of weak, weathered MUDSTONE bedrock.	
3								Trial Pit Complete at 2.40m	

GENERAL REMARKS: E.O.D at 2.4mbgl, could not excavate further, possible rockhead.	Trial Pit Dimensions:
KEY V = Hand Vane Shear Strength PP = Pocket Penetrometer Shear Strength J = Jar Sample D = Disturbed Sample B = Large Bulk Sample HS = Head Space Measurement	
All dimensions in metres Scale 1:25	Contractor: Plant:
Method: Trial pit/trench	Logged By: Approved By:

TRIAL PIT LOG				TRIAL PIT No TPCB	
Client: Ecopower developments Limited					
Project: Gathabawn WF - Trial Pits					
Project No: 501.065883.00001	Date: 27/08/2026	Ground Level:	Co-ordinates: E634710 N670791	Sheet 1 of 1	

SAMPLES & TESTS				Water	STRATA				Instrument Backfill
Depth	Type No	Test Type	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	
1.00 - 1.01	B						(0.30) 0.30	TOPSOIL	
							(0.30) 0.60	Firm greyish brown slightly silty slightly sandy slightly gravelly CLAY with a low cobble content and a low boulder content. Sand is fine to medium. Gravel and cobbles are subangular to subrounded. Boulders are subrounded of limestone, up to 200mm.	
							(0.60) 1.20	Medium dense brownish grey slightly clayey gravelly SAND with a low cobble content. Sand is fine to medium. Gravel and cobbles are subangular to subrounded.	
							(0.40) 1.60	Medium dense brownish grey slightly clayey gravelly SAND with a high cobble content and a medium boulder content. Sand is fine to medium. Gravel and cobbles are subangular to subrounded. Boulders are subrounded of limestone, up to 200mm.	
2.00 - 2.01	B						(0.40) 2.00	Firm to stiff brownish grey slightly silty very sandy gravelly CLAY with a high cobble content and a low boulder content. Sand is fine to medium. Gravel and cobbles are subangular to subrounded. Boulders are subrounded of limestone, up to 200mm.	
Trial Pit Complete at 2.00m									
3									

GENERAL REMARKS: E.O.D at 2mbgl, could not excavate further, possible rockhead.		Trial Pit Dimensions: 	
KEY V = Hand Vane Shear Strength PP = Pocket Penetrometer Shear Strength J = Jar Sample D = Disturbed Sample B = Large Bulk Sample HS = Head Space Measurement			
All dimensions in metres Scale 1:25	Contractor: Plant:	Method: Trial pit/trench	Logged By: Approved By:

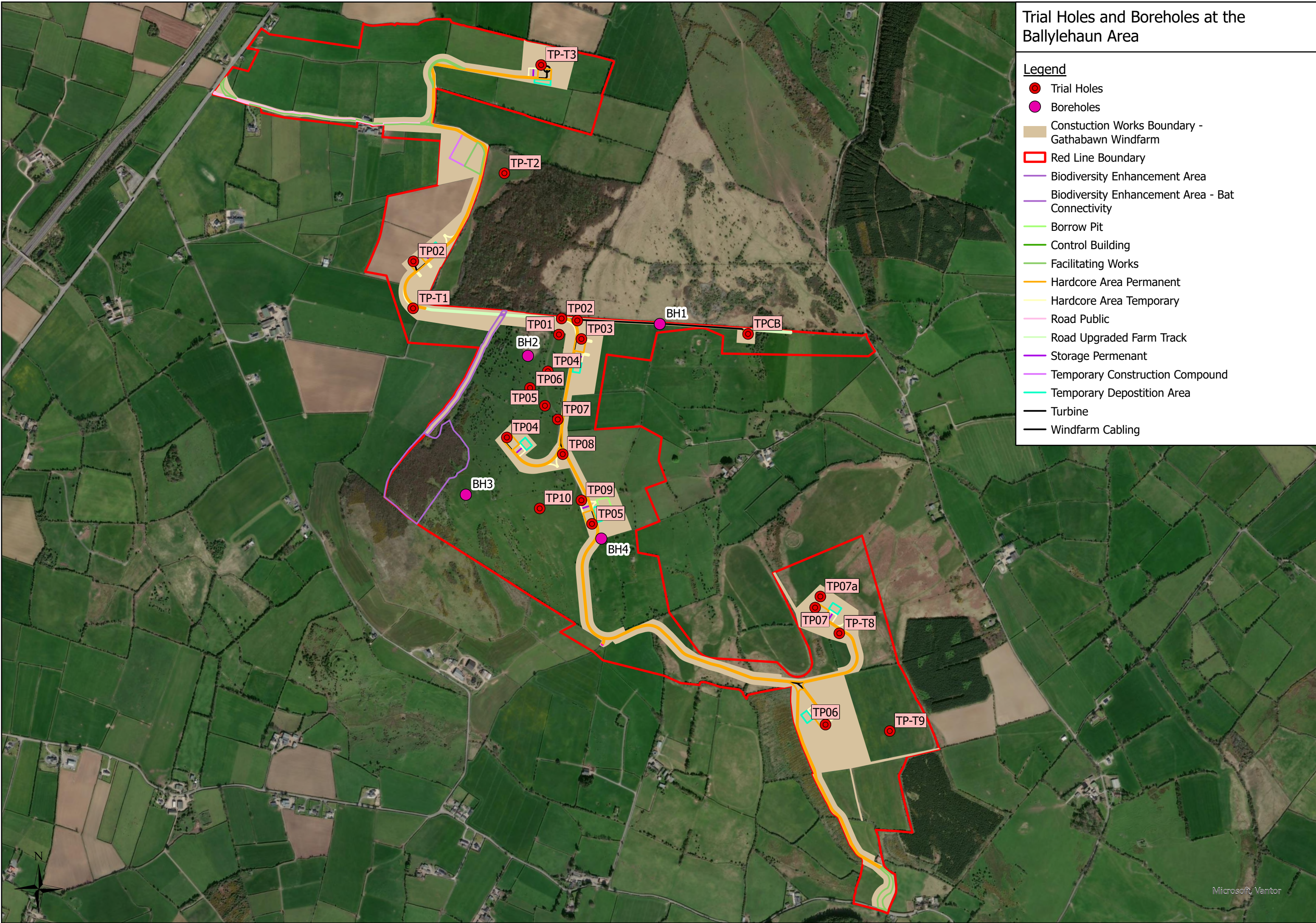
App. 7.2 Trial Pit Investigation Results

- Map showing the locations of the Trial Pit and Borehole Investigations

Trial Holes and Boreholes at the
Ballylehaun Area

Legend

- Trial Holes
- Boreholes
- Constuction Works Boundary -
Gathabawn Windfarm
- ▭ Red Line Boundary
- Biodiversity Enhancement Area
- Biodiversity Enhancement Area - Bat
Connectivity
- Borrow Pit
- Control Building
- Facilitating Works
- Hardcore Area Permanent
- Hardcore Area Temporary
- Road Public
- Road Upgraded Farm Track
- Storage Permanent
- Temporary Construction Compound
- Temporary Deposition Area
- Turbine
- Windfarm Cabling



Trial Holes at the Ballyring Area

Legend

- Trial Holes
- Constuction Works Boundary - Gathabawn Windfarm
- Red Line Boundary
- Biodiversity Enhancement Area
- Borrow Pit
- Control Building
- Existing Tracks
- Facilitating Works
- Hardcore Area Permanent
- Hardcore Area Temporary
- Road Public
- Road Upgraded Farm Track
- Storage Permenant
- Temporary Construction Compound
- Temporary Deposition Area
- Turbine
- Windfarm Cabling



GATHABAWN WINDFARM

Geotechnical Assessment Report

Prepared for:
Ecopower Limited



Date: September 2026

Document No:
P26-205-FT-XX-XX-RP-GE-0001

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Geotechnical Assessment Report

REVISION CONTROL TABLE, CLIENT, KEYWORDS AND ABSTRACT

User is responsible for Checking the Revision Status of This Document

Rev. No.	Description of Changes	Prepared by:	Checked by:	Approved by:	Date:
P01	Draft	IH	ATC	TC	17/09/2026
P02	Final	IH	ATC	TC	25/09/2026

Client: Ecopower Ltd.

Keywords: Gathabawn Wind farm, ground investigation, site reconnaissance, slope stability.

Abstract: Fehily Timoney and Company (FT) were engaged by Ecopower Limited to undertake a geotechnical assessment of the proposed Gathabawn Wind Farm site. As part of the geotechnical assessment of the wind farm site, FT completed a walkover survey at the site. The findings of the geotechnical assessment showed that the site has no stability issues and is suitable for the proposed wind farm development.

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1. INTRODUCTION

1.1 Fehily Timoney and Company

Fehily Timoney and Company (FT) is an Irish engineering, environmental science and planning consultancy with offices in Cork, Dublin and Carlow. The practice was established in 1990 and currently has c. 110 members of staff, including engineers, scientists, planners and technical support staff. FT deliver projects in Ireland and internationally in our core competency areas of Waste Management, Environment and Energy, Civils Infrastructure, Planning and GIS and Data Management.

FT have been involved in over 100 wind farm developments in both Ireland and the UK at various stages of development i.e., preliminary feasibility, planning, design, construction, and operational stage and have established themselves as one of the leading engineering consultancies in peat stability assessment, geohazard mapping in peat land areas, investigation of peat failures and site assessment of peat.

1.2 Project Description

FT was engaged in August 2026 by Ecopower Limited to undertake a geotechnical assessment of the proposed Gathabawn Windfarm.

The proposed Gathabawn Windfarm is located approximately 4km northwest of Freshford, Co. Kilkenny.

The Gathabawn Windfarm site comprises an area of approximately 2.6km². The surrounding landscape to the east and north is 'hilly-to-undulating' with land use comprising forestry, agricultural pastures, with small pockets of transitional woodland scrub within the wider landscape.

The proposed development comprises the following:

- 12 no. wind turbines with an overall tip height of 170m, except for T06, T07 and T09 which will have a tip height of 150m, and all associated ancillary infrastructure;
- Upgrades to the turbine component haul route;
- All associated and ancillary site development, excavation, construction, landscaping, and reinstatement works, including provision of site drainage infrastructure

The Candidate Gathabawn Grid Connection, which does not form part of this application, but will be subject to a separate planning application at a future date, comprises the following:

- Construction of an electricity substation and installation of c.15.9km of underground grid connection cable between Gathabawn Windfarm and the existing Eirgrid Ballyragget Substation in Moatpark

1.3 Site Description

The proposed Gathabawn Windfarm is predominately located within the townlands of Gorteenamuck, Ballyring and Ballylehaun in County Kilkenny. The proposed site is predominantly located farmland used for pasture. From a review of the OSI maps the elevation at the proposed site varies approximately between 128 and 246m OD.



2. DESK STUDY

2.1 Information Sources

The main relevant sources of interest with respect to the site include:

- Geological plans and Geological Survey of Ireland (GSI) database
- Ordnance Survey plans
- Literature review of peat and non-peat failures/landslides
- Hydrogeology/groundwater
- Geological Heritage

The Geological Survey of Ireland online dataset viewer (GSI, 2026) for the site was used to verify the soil and bedrock conditions.

The Ordnance Survey plans were reviewed to determine if any notable features or areas of particular interest (from a geotechnical point of view) are present on the site.

The desk study also includes a review of both published literature and GSI online dataset viewer (GSI, 2026) on peat failures/landslides in the vicinity of the site.

Other information from the GSI (2026) online database included a review of previous ground investigation information, hydrogeology/groundwater and geological heritage sites.

2.2 Soils, Subsoil & Bedrock

A review of the Geological Survey of Ireland online database and published documents from GSI was carried out.

The GSI subsoils map indicates that the eastern portion (Ballyring) of the site (T08-T12) is underlain predominantly by Till derived from Namurian sandstones and shales as well as bedrock outcrop or subcrop. The western portion (Ballylehaun) of the site (T01-T07) is underlain by a combination of Till derived from Namurian sandstones and shales, Till derived from Limestones (T01 and T02), bedrock outcrop or subcrop (T06 and T07) and karstified bedrock outcrop or subcrop (T03 to T05). Quaternary geology is shown on Figure 2.1.

In relation to bedrock, the site location and surrounding area is underlain by the following formations (Figure 2.2):

- Ballyadams Formation, described as crinoidal wackestone/packstone limestone. The upper beds of the Formation are noted to “have some thick irregular karstically-eroded surfaces, covered with soft weathered brown clayboards” (GSI, 1996).
- Clougrenan Formation, described as cherty, muddy calcarenitic Limestone
- Killeslin Siltstone Formation, described as muddy siltstone and silty mudstone
- Bregaun Flagstone Formation described as thick flaggy sandstone and siltstone

An unconformity runs north-south through the site passing between T05 and T06. This marks the boundary between the Siltstones/Shales to the east and the Limestones to the west.



There are no active quarries located within a 5km radius of the site.

The nearest karst feature identified is located 2.4km to the south of the Proposed Development and is described as a spring. These karst features are located along the same unconformity that runs through the site.

2.3 Ordnance Survey Data

The online ordnance survey imagery (OSI, 2026) was reviewed as part of the desk study. Analysis of aerial imagery dating back to 2000 found there has been little change in the proposed wind farm location apart from a localised increase in the forested area with some corresponding localised felling.

A review of the historical mapping for the area identified no notable features from a geotechnical point of view. Several ring forts are noted on the historical mapping in the wider area around the site.

2.4 Landslide Susceptibility

The landslide susceptibility of the site was classified by the GSI (2026) as ranging from low to moderately high, with one small area of 'High' classification, located to the west of T05. This range is expected given the undulating topography across the site. According to the GSI data, no previous failures have been recorded within 10km of the site.

2.5 Previous Ground Investigation Data

Based on a review of the information available (GSI 2026), there are no publicly available intrusive investigation points within a 2km radius of the proposed site boundary.

2.6 Hydrogeology/Hydrology

The bedrock at the Proposed Development is indicated to be a Regionally Important Aquifer (karstified) – diffuse (western portion of the site) and Poor Aquifer – generally unproductive except in local zones (eastern portion of the site).

2.7 Geological Heritage

No geological heritage sites are noted within 5km of the wind farm site. The closest geological heritage site to the wind farm site is located approximately 7km east and is described as Lisdowney Quarry, a disused historical limestone quarry with natural exposures of rock along a ridge.



3. SITE RECONNAISSANCE

3.1 Site Reconnaissance

As part of the assessment of potential peat failure at the site, FT carried out a site reconnaissance in conjunction with the desk study review described in Section 2. This comprised a walkover inspection of the site with recording of salient geomorphological features with respect to the proposed development. General photographs of the site are included at the end of the main text.

The following salient geomorphological features were considered:

- Active, incipient or relict instability
- Presence of shallow valley or drainage line
- Wet areas
- Any notable change in vegetation
- Inspection of ground conditions
- Slope inclination and break in slope

The survey covered the proposed locations for the turbine bases and associated infrastructure.

The site reconnaissance adopted for carrying out the site reconnaissance relied on experienced practitioners carrying out a visual assessment of the site supplemented with measurement of slope inclinations.

The assessment included a series of hand-held probes and hand shear vanes at proposed infrastructure locations to determine the presence/depth of peat within the proposed development site. Visual observations were also made to assess the stability of other soil slopes and rock exposures across the site.

3.2 Findings of Site Reconnaissance

The site reconnaissance undertaken by FT comprised a walkover inspection of the site on 01 and 02 September 2026. Weather conditions for the site visit were mainly dry. Subsoil maps indicate that the site is underlain predominantly by Till derived from Namurian sandstones and shales.

The main findings of the site walkover of the wind farm site are as follows:

- (1) The proposed site is predominantly located in privately owned farmland used for pasture (Appendix B – Photos 1 to 4).
- (2) The site typically comprised flat to gently sloping agricultural lands, with localised steeply inclined terrain.
- (3) Ground conditions at the site typically comprise topsoil over a cohesive overburden, which was occasionally exposed at the ground surface. Bedrock (mudstone and siltstone) was recorded to the north of T12 where an area of worked ground was present, as well as at the proposed location of the temporary construction compound at the Ballyring Area.
- (4) The overburden was typically recorded as firm to stiff gravelly Clay with occasional cobbles.



- (5) All existing access tracks on site have been constructed using a founded i.e. excavate & replace technique. The access tracks for the wind farm will comprise upgrading of existing founded access tracks and construction of new proposed access tracks using excavate and replace construction techniques.
- (6) Slope angles at the turbine locations ranged from 3 to 10 degrees. These slope angle readings were obtained using a combination of readings taken during the site reconnaissance by FT using handheld equipment, such as the Silva Clino Master which has an accuracy of +/- 0.25 degrees and from contour survey plans for the site.
- (7) No evidence of past slope failure was noted on site. One area of potential minor instability was recorded to the west of T09, comprising a localised steep slope where evidence of soil creep was noted (Photo 1). This is not considered to be a significant stability issue for the proposed development.
- (8) A summary of the site walkover findings for the wind farm are as follows:
 - (a) The ground conditions recorded on site from a limited number of exposures indicate that typically the site consists of topsoil over mineral soil over bedrock.
 - (b) All proposed access tracks for the wind farm will comprise upgrading of existing founded access tracks and construction of new proposed access tracks using excavate and replace construction techniques.
 - (c) No evidence of past slope failure was noted on site.



4. GROUND INVESTIGATION

4.1 Summary of Ground Conditions Encountered

The following section describes the ground conditions encountered during ground investigation completed across the site, including at turbine locations.

Ground investigations comprising 24 no. trial pits were undertaken by HES between August 2021 and March 2023. A further 9 trial pits were undertaken by SLR in August 2026. The trial pit logs are included in Appendix C and the locations of the trial pits are shown on Figure 4.1.

Ground conditions recorded in the trial pits comprised a firm to stiff (locally soft) brown gravelly Silt/Clay, locally sandy, and a grey firm to stiff Silt. Bedrock recorded in the trial pits ranged from an extremely weak and weak brittle black weathered Mudstone, weak weathered Siltstone and a blocky weathered Limestone. Bedrock was recorded at between 0.15 and 2.2m bgl in 29 of the trial pits. Bedrock was not recorded in four of the trial pits.

A total of four boreholes were also drilled (using an open hole technique) across the site. The boreholes recorded bedrock at between 0.3m (BH4) and 1.2m bgl (BH1). Bedrock was described as a medium strong to very strong grey Limestone. Boreholes were drilled to a depth of 40m with the exception of BH3, which was drilled to a depth of 21m bgl. BH3 recorded a clay filled void at 17m bgl and drilling could not be extended below 21m bgl. This is likely to be an infilled karst feature within the limestone bedrock.

4.2 Summary of Geotechnical Parameters

Table 4-1 contains characteristic geotechnical parameters for the main material types likely to be encountered on the Gathabawn Windfarm site. As the direct measurement of parameters has not been carried out, established correlations with measured properties have been used to derive values. Characteristic values are defined as a cautious estimate of the value affecting the occurrence of limit state based on clause 2.4.5.2 from Eurocode 7.

Table 4.1: Summary of Geotechnical Parameters

Material Type/Strata	Unit Weight	Geotechnical Parameters		
		Undrained Parameters	Drained Parameters	
	γ (kN/m ³)	c_u (kPa)	ϕ' (°)	c' (kPa)
Glacial Till	19	60	32	1
Weathered Bedrock	22	-	30	100
Intact Bedrock	22	-	30	1000

Notes

Note (1) The above parameters are indicative only and have been derived based on experience and from a review of the ground investigation carried out at the site.

Note (2) Where direct measurement of parameters has not been carried out, established correlations with measured properties have been used to derive values.



5. SUMMARY OF SITE CONDITIONS AT PROPOSED INFRASTRUCTURE LOCATIONS

As part of the site reconnaissance, details of any soft ground and slope angles were recorded throughout the site. Inspections were completed at the proposed turbine locations, access tracks, constructions compounds, substations and borrow pits.

A summary of the site conditions at the proposed infrastructure locations is given in Table 5.1. The slope angles presented in Table 5.1 were recorded on site using a hand-held Silva Clino Master.

Table 5.1: Peat Depth & Slope Angle at Proposed Infrastructure Locations

Location	Terrain/Land Use	Geology	Slope Angle (°) ⁽¹⁾
T1	Agriculture	Glacial Till over Limestone bedrock	4
T2	Agriculture	Glacial Till over Limestone bedrock	10
T3	Agriculture	Glacial Till over Limestone bedrock	4
T4	Agriculture	Glacial Till over Limestone bedrock	3
T5	Agriculture	Glacial Till over Limestone bedrock	3
T6	Agriculture	Glacial Till over Siltstone/Mudstone bedrock	5
T7	Agriculture	Glacial Till over Siltstone/Mudstone bedrock	6
T8	Agriculture	Glacial Till over Siltstone/Mudstone bedrock	4
T9	Agriculture	Glacial Till over Siltstone/Mudstone bedrock	8
T10	Agriculture	Glacial Till over Siltstone/Mudstone bedrock	10
T11	Agriculture	Glacial Till over Siltstone/Mudstone bedrock	5
T12	Agriculture	Glacial Till over Siltstone/Mudstone bedrock	4
Met Mast	Agriculture	Glacial Till over Limestone bedrock	8
Temporary Construction Compound (1)	Agriculture	Glacial Till over Limestone bedrock	5
Temporary Construction Compound (2)	Agriculture	Glacial Till over Siltstone/Mudstone bedrock	4

Note (1) The slope angles at each of the main infrastructure locations were obtained using a combination of readings taken during the site reconnaissance by FT using handheld equipment, such as the Silva Clino Master (which has an accuracy of +/- 0.25 degrees), as well from survey information. The slope angle quoted typically reflects the slope within the footprint of each infrastructure location.



6. GEOTECHNICAL CONSIDERATIONS FOR INFRASTRUCTURE ELEMENTS

6.1 Turbine Foundations

Based on a review of the GSI information for the area, findings from the site reconnaissance carried out by FT, and the results of trial pits excavated by HES and SLR, a preliminary assessment of the likely foundation types found that excavate and replace construction (gravity) would be suitable for the turbine foundations. Shallow excavations within the overburden will be stable at slopes of 1(v):1.5(h). Excavations within bedrock will typically be stable at slopes of 1(v):1(h).

At the underside of the turbine foundation, a layer of structural up-fill (class 6N/6P - in accordance with TII requirements) will be required.

6.2 Site Access Roads

The access roads on site will be constructed as excavate and replace (founded) type construction, which, given the ground conditions and type of terrain present, is deemed an appropriate construction approach.

The total length of new access roads to be constructed on site is 6.7km, with 1.3km of private farms tracks to be upgraded and widened. Shallow excavation slopes for access roads will be stable at 1(v):1.5(h) in overburden materials. No stability issues are anticipated for excavation side slopes for access roads as the excavation depth will be limited.

The typical make-up of the founded access roads is a minimum stone thickness of 500mm. The requirement for a layer of geotextile and geogrid and the necessary stone thickness will be confirmed at detailed design stage.

6.2.1 Upgrade of Existing Access Roads

This methodology includes procedures that are to be included in the construction to minimise any adverse impact on ground stability. The methodology is not intended to cover all aspects of construction such as drainage and environmental considerations.

(1) The following guidelines apply:

- (a) Excavation will be required on one or both sides of the existing access track to a competent stratum.
- (b) Granular fill to be placed in layers in accordance with the designer's specification.
- (c) The surface of the existing access track to be overlaid with up to 300mm of selected granular fill.
- (d) Access roads to be finished with a layer of capping across the full width of the road.
- (e) A layer of geogrid/geotextile may be required at the surface of the existing access road in areas of excessive rutting (to be confirmed by the site engineer).
- (f) For excavations in overburden, side slopes will be not greater than 1(v): 1.5(h). This slope inclination should be reviewed during construction, as appropriate.

(2) The finished road width will be approximately 4.5m, with wider sections at bends and junctions.



- (3) On side long sloping ground any road widening works required will be done on the upslope side of the existing access road, where possible.
- (4) A final surface layer will be placed over the existing access track, as per design requirements, to provide a suitable road profile and graded to accommodate wind turbine construction and delivery traffic.

6.2.2 Construction of New Access Roads

The excavation of topsoil & spoil and founding of access roads on competent stratum for new access roads will be carried out across the site.

This methodology includes procedures that are to be included in the construction to minimise any adverse impact on ground stability. The methodology is not intended to cover all aspects of construction such as drainage and environmental considerations.

- (1) Interceptor drains will be installed upslope of the access road alignment to divert any surface water away from the construction area.
- (2) Excavation will take place to a competent stratum beneath the topsoil (as agreed with the site designer and resident engineer).
- (3) Road construction will be carried out in sections of approximately 50m lengths i.e. no more than 50m of access road will be excavated without re-placement with stone fill.
- (4) The surface of the excavated access road will be overlaid with up to 500mm of selected granular fill. Granular fill to be placed and compacted in layers in accordance with the TII Specification for Road Works.
- (5) Access roads will be finished with a layer of capping across the full width of the road.
- (6) A layer of geogrid/geotextile may be required at the surface of the competent stratum (to be confirmed by the Site Engineer).
- (7) A final surface layer (Cl.804) will be placed over the excavated road, as per design requirements, to provide a suitable road profile and graded to accommodate wind turbine construction and delivery traffic.

6.3 Crane Hardstands

The crane hardstands will be constructed using the founded technique (i.e. not floated) technique. The hardstands will require to be founded on competent material underlying any topsoil or soft soils. The founding levels for the hardstands will be variable across the site and will be confirmed at pre-construction stage.

Crane hardstands are generally constructed using compacted Class 1/6F material (in accordance with TII requirements) on a suitable sub-formation to achieve the required bearing resistance. The hardstands will be designed for the most critical loading combinations from the crane. Any excavation slopes required for hardstands will be constructed at a 1(v):1.5(h) slope in overburden materials and 1(v):1(h) slope in weathered rock.



The typical make-up of the hardstands will include up to 750mm of granular stone fill with possibly a layer of geotextile and/or geogrid. Hardstand fill will be typically constructed to 1(v)1.5(h) side slopes. No stability issues are anticipated at hardstand locations.

6.4 Substation Foundations & Platforms

The substation platform, as part of the Parksgrove Substation element of the Candidate Gathabawn Grid Connection, will be constructed using the founded technique (i.e. not floated technique). The substation foundations will comprise strip/raft foundations under the main footprint of the building with a basement/pit for cable connections. The substation platform will require to be founded on competent material underlying any peaty topsoil or soft soils.

Substation platforms are generally constructed using compacted Class 1/6F material (in accordance with TII requirements) on a suitable sub-formation to achieve the required bearing resistance.

The typical make-up of the substation platform will include up to 750mm of granular stone fill with possibly a layer of geotextile and/or geogrid. At the underside of the substation foundations, a layer of structural up-fill (class 6N/6P - in accordance with TII requirements) will likely be required.

6.5 Temporary Construction Compounds

Two temporary construction compounds will be constructed using the founded technique (i.e. not floated technique). The construction compound platform will require to be founded on competent material underlying any topsoil or soft soils.

The construction compound platforms are generally constructed using compacted Class 1/6F material on a suitable sub-formation to achieve the required bearing resistance.

Typical founding depth for the construction compound platform may require excavation to 0.3-0.5m bgl.

The typical make-up of the construction compound platform will include up to 500mm of granular stone fill with possibly a layer of geotextile and/or geogrid.

6.6 Guidelines for Borrow Pit Construction and Spoil Placement

Upon removal of the rock from the borrow pits, it is proposed to partially restore the borrow pits using excavated spoil. The excavated rock from the borrow pits will be used in the construction of the wind farm infrastructure elements (turbine bases, access tracks etc). The contractor excavating the rock will be required to develop the borrow pits in a way which will allow the excavated spoil to be contained safely. This is to allow for the safe placement and grading of the spoil using dumper trucks and excavators. The text below provides design and construction guidelines for the borrow pits.

The borrow pits will be typically constructed as follows:

- (1) The rock within the proposed borrow pit footprint will be removed by breaking.
- (2) It is proposed to construct the borrow pits so that the base of the borrow pits are below the level of the adjacent section of access road. This may vary and as excavation progresses into the back



edge of the borrow pits, the base of the borrow pits may be raised to suit local conditions. Localised deepening of the borrow pit floor may be required depending on extraction operations.

- (3) Slopes within the excavated rock formed around the perimeter of the borrow pits should be formed at stable inclinations to suit local in-situ rock conditions. Exposed sections of the rock slopes should be left with irregular faces and declivities to promote re-vegetation and provide a naturalistic appearance.
- (4) The stability of the rock faces within the borrow pits should be inspected by competent personnel upon excavation to ensure stability during construction works and in the long term. This inspection will allow unfavourable rock conditions to be identified and suitable mitigation measures to be applied such as removal of loose rock.
- (5) Infilling of the spoil should commence at the back edge of the borrow pits and progress towards the borrow pit entrance. The contractor excavating the rock will be required to develop the borrow pits in a way which will allow the excavated spoil to be placed safely.
- (6) The use of temporary access ramps during the placement of the excavated spoil will be required.
- (7) The surface of the placed spoil will be shaped to allow efficient run-off of surface water from borrow pit areas.
- (8) An interceptor drain will also be installed upslope of the borrow pits, where necessary. This drain will divert any surface water away from the borrow pits and hence prevent water from ponding and lodging on the re-instated borrow pit areas.
- (9) Control of groundwater within the borrow pits may be required and measures will be determined as part of the ground investigation programme. A temporary pump and suitable outfall locations are likely to be required during construction.
- (10) Silting ponds will be required at the lower side/outfall location of the borrow pits.
- (11) Supervision by a geotechnical engineer or appropriately competent person is recommended for the works.
- (12) All the above general guidelines and requirements should be confirmed by the designer prior to construction. A detailed construction methodology for the borrow pits should be compiled prior to construction.

Temporary storage of excavated materials adjacent to excavations will also be undertaken. Temporary stockpiles will be limited to 1.5m in height and will be sealed and shaped to shed water. No stability issues are anticipated with the temporary storage of materials.



7. SLOPE STABILITY ASSESSMENT

7.1 Summary

The factors controlling the stability of slopes are:

- Slope geometry
- Geology
- Properties of the slope material
- Groundwater levels
- Surcharge.

From a review of the GSI Landslide Susceptibility database the proposed development and proposed infrastructure locations are generally located within areas of 'Low' and 'Moderately High' susceptibility.

Slopes at the proposed turbine locations were observed during the site walkover to be moderate to steep. Turbines T04 and T09 were selected for slope stability assessment based on a combination of existing slope geometry and the anticipated cut and fill earthworks required for turbine platform construction. These locations were considered representative of the most demanding slope conditions across the Site and were therefore assessed in accordance with the principles of Eurocode 7 (IS EN 1997-1).

Similar slopes (around 9-10 degrees) were recorded along the proposed access road between T02 and T03, however as the works in this area does not involve significant cutting, and the proposed access road is running perpendicular to slope, no stability issues are anticipated at this location.

7.2 Eurocode 7 and Partial Factors

In accordance with the principles of Eurocode 7 (IS EN 1997-1), rather than using a global factor of safety as per previous design codes, the factors of safety (termed partial factors) are applied to the chosen characteristic values to obtain design values. Actions (influences) are multiplied by the safety factor, while resistances are divided by the safety factor.

In accordance with Eurocode 7 (IS EN 1997-1), geotechnical checks must be carried out to ensure that the resistances preventing a slide are greater than or equal to the actions which cause a slide, i.e.:

$$E_d \leq R_d$$

Where:

E_d = Sum of design actions

R_d = Sum of design resistances

By adopting the methods of analysis given in Eurocode 7 (IS EN 1997-1), the factor of safety against failure is **included** in the partial factors (ranging from 1.0 to 1.3 for various parameters) applied to the analysis rather than to the end result. In order to verify that this condition is met, the resulting "safety ratio" must be equal or greater than 1.0 in order to verify that the above condition is met. i.e.: An in-situ "safety ratio" of less than 1.0



indicates that the slope currently has an inadequate factor of safety against failure and therefore is potentially unstable. Ratios greater than 1.0 indicate an adequate factor of safety against failure and are considered stable in both short and long term.

Table 7.1: Partial Factors used to Derive Design Parameters

Partial Factor	Parameter
γ_c	1.25 Effective cohesion
γ_{ϕ}	1.25 Effective angle of friction
γ_v	1 Soil density
γ_q	1.3 Loading (unfavourable)
$\gamma_{R,e}$	1 Earth resistance

Table 7.1 shows the partial factors which have been applied to the characteristic values to give the derived parameters in Table 7.2 used during the slope stability analyses. The design parameter is derived by multiplying or dividing the characteristic values by the associated partial factor, i.e. $\tan 15(\phi') / 1.25(\gamma\phi') = 12.1^\circ$.

7.3 Slope Stability Analysis Method

Slope/W software of Geo Studio International was used to assess the stability of proposed slopes at turbine locations T04 and T09. Slope/W is a general software tool for the slope stability analysis of earth structures.

It uses the limit equilibrium method of analysis by using the idea of dissecting a potential sliding mass into vertical slices. It assesses the factor of safety for both moment and force equilibrium based on various methods, including Bishop, Janbu and Morgenstern-Price.

Using this software, it is possible to deal with complex stratigraphy, highly irregular pore-water pressure conditions, a variety of linear and nonlinear shear strength models, virtually any kind of slip surface shape, concentrated loads and pressure lines. Limit equilibrium formulations based on the method of slices are also being applied more and more to the stability analysis of structures such as tieback walls, nail or fabric reinforced slopes, and even the sliding stability of structures subjected to high horizontal loading arising.

Traditionally, the factor of safety is defined as that factor by which the shear strength of the soil must be reduced in order to bring the mass of soil into a state of limiting equilibrium along a selected slip surface. The results of the analysis show the overall stability of the embankment expressed as a factor of safety.

The definition of factor of safety used within SLOPE/W is:

$$F = \frac{\text{Available restoring moment (or forces)}}{\text{Total disturbing moment (or forces)}}$$

Design values for use in the slope stability analysis have been derived using Eurocode 7 (IS EN 1997-1) Design Approach 1 Combination 2. This design approach is considered to be the most logical approach for slope



stability analysis as it includes partial factors for both material properties and variable loads (for example traffic loads).

7.4 Limitations of Slope Stability Analysis

The application of traditional stability analysis such as this can be misleading as they assume a circular slip surface is the ultimate limit state. In reality, the ultimate limit state is likely to be non-circular in nature and as such these models may not be strictly modelling the critical limit state. Slope/W allows for some optimization of the slip surface within its analysis which reduces this limitation to some extent.

Despite the limitations outlined above, this method of slope analysis is still considered to provide a conservative analysis of the ultimate limit state and its use is in accordance with current industry best practice.

7.5 Material Properties

Table 7.2 below shows the typical parameters used for the Glacial Till and bedrock encountered beneath the turbine locations T04 and T09.

Table 7.2: Characteristic Parameters for Materials

Material	Glacial Till (Cohesive)	Granular Fill (Class 1)	Limestone Bedrock (Weathered)	Mudstone Bedrock (Weathered)
Cohesion, c' , kN/m ²	1	0	250	100
Effective Friction angle, ϕ' ,	32	38	30	30
Bulk unit weight, γ , kN/m ³	19	20	22	22
Undrained Cohesion c_u , kN/m ²	50	-	-	-

7.6 Loading

A modelled loading of 200kN/m² was applied to the hardstand platforms during the analyses to simulate an outrigger pad either side of the lifting crane on the slopes. These outrigger pads were placed a minimum of 2.5m from the slope edge. The distance between each outrigger was assumed to be 3.0m.

For the purposes of the slope stability modelling all shallow soft deposits have been removed from the proposed location of the turbine foundation.

7.7 Slope Stability Analysis Models

A Slope/W model has been presented to reflect the proposed slopes at the turbine locations as outlined below:

- Model 1 - Turbine T04
- Model 2 – Turbine T09



The results of this analysis are summarised in Table 7.3.

7.8 Slope Stability Analysis Results

The lowest safety ratio for potential slope failures (Table 7.3) in the undrained case was 1.06. Analyses were undertaken for both deep-seated (rotational) type slips and shallow (translational) type although the shallow translations failures within the overburden deposits gave the lower safety ratios.

Table 7.3: Slope Analysis results

Model Name	Location	ODF (DA1C2)– Drained	ODF (DA1C2)– Undrained
1	T04	1.13	1.06
2	T09	1.11	1.11

The safety ratio for potential slope failure for drained conditions was 1.11 at proposed turbine location T09. By adopting the methods of analysis given in IS EN 1997-1, the factor of safety (FoS) against failure is included in the partial factors applied to the analysis rather than to the end result. A safety ratio of greater than 1.0 indicates that the slope is considered stable in the long-term drained conditions.

In order to maintain the safety of the slopes during the foundation and hardstands excavation works and associated cut and fill activities groundwater and surface water drainage should be maintained to mitigate the potential instability of the slopes. It is also recommended that surcharging loads i.e. construction traffic is limited to 10 kN/m² and a 1.0m exclusion zone from the edge of the crest of constructed slopes is maintained to prevent surface failures or shoulder failure at the crest of the slope.

In addition, it is recommended that the slopes are inspected after extended periods of heavy rain for any signs of instability such as tension cracks at the top of the slopes or bulging near the toe of slopes.



8. INDICATIVE FOUNDATION TYPE AND FOUNDATION DEPTH FOR TURBINES

8.1 Summary

Based on a review of the ground investigation and walkover information for the site, a preliminary assessment of the likely foundation type and founding depths for each turbine location was carried out, where possible. A summary of this assessment is provided in Table 8-1.

Table 8-1: Summary of Indicative Turbine Foundation Type and Founding Depths

Turbine No.	Turbine Foundation Type	Relevant GI	Indicative founding depth (m bgl)	Comment
T01	Gravity foundation	TP-T3 (2023)	<3.0	Limestone bedrock indicated at 1.0m bgl.
T02	Gravity foundation	TP-T1 (2023) TP02 (2026)	<3.0	Bedrock indicated at 1.5m bgl.
T03	Gravity foundation	TP01 (2023), TP03 (2026)	<3.0	Bedrock indicated at 0.9m bgl.
T04	Gravity foundation	TP04 (2026)	<3.0	Weathered Limestone bedrock indicated at 0.5m bgl.
T05	Gravity foundation	TP09 (2023), BH4 TP05 (2026)	<3.0	Weathered Limestone bedrock indicated at 0.25-0.3m bgl.
T06	Gravity foundation	TP06 (2026)	3.0	Stiff gravelly Clay to 3m bgl.
T07	Gravity foundation	TP-T8 (2023) TP07/07a (2026)	<3.0	Weathered Mudstone bedrock indicated at 0.4-0.7m bgl.
T08	Gravity foundation	TP-T2 (2023)	<3.0	Weathered Siltstone bedrock indicated at 0.7m bgl.
T09	Gravity foundation	TP-T1, TP-BP (2023) TP09 (2026)	<3.0	Weathered Mudstone bedrock indicated at 0.6m bgl.
T10	Gravity foundation	TP-T12 (2023)	<3.0	Bedrock indicated at 2.1m bgl.
T11	Gravity foundation	TP-T13 (2023)	<3.0	Weathered mudstone/shale bedrock indicated at 0.4m bgl.
T12	Gravity foundation	TP-T14 (2023)	<3.0	Weathered Shale bedrock indicated at 0.45m bgl.

Based on the findings of the ground investigation across the site, gravity type foundations are deemed suitable for turbine bases. With regards to turbine locations where bedrock was not encountered (turbine T06), based



on the findings of the ground investigation across the entire site it is anticipated that a suitable bearing stratum, either on bedrock or a stiff clay, will be encountered within 4m of the ground surface.

For gravity type turbine foundations, where the depth of excavation exceeds the required founding depth for the turbine base, up-fill material consisting of granular fill (6N) will be used to backfill the excavation to the required founding depth.

Excavation slopes for turbine bases will be stable at 1(v):1.5(h) in overburden materials and 1(v):1(h) in weathered and intact rock. No groundwater strikes were encountered during trial pit excavations, although local groundwater ingress should be anticipated during construction where excavations extend below weathered bedrock or in periods of prolonged rainfall.

Given the evidence of localised karstification at depth within the limestone bedrock, inspection of all turbine foundation excavations should be undertaken by a suitably qualified engineering geologist/geotechnical engineer to determine if any evidence of karst features is present.

It should be noted that at detailed design stage a confirmatory ground investigation will be carried out at each proposed turbine locations to confirm the turbine foundation type. The ground investigation will be in the form of a borehole with in-situ SPT testing at 1.0m intervals in the overburden and follow-on rotary core through bedrock.



9. SUMMARY & RECOMMENDATIONS

9.1 Summary

The following summary is given.

FT was engaged by Ecopower Limited to undertake a geotechnical assessment of the proposed wind farm site.

The site is typically covered in a shallow layer of Glacial Till derived from Namurian sandstones and shales with undulating terrain.

Ground conditions at the site typically comprise topsoil over a cohesive overburden, which was occasionally exposed at the ground surface. Bedrock (mudstone and siltstone) was recorded at one location to the north of T12 where an area of worked ground was present.

Slope inclinations at the main infrastructure locations range from 3 to 10 degrees.

No evidence of slope failures or signs of instability were noted at the proposed infrastructure locations during the site reconnaissance.

A network of existing tracks is present on the site. It is proposed to upgrade these existing tracks and construct additional roads to provide access to the turbine locations.

A total of two borrow pits are proposed for the site. The borrow pits are proposed to provide stone for the proposed development and also to provide suitable storage areas for spoil material generated from construction activities.

A slope stability analysis has been undertaken at two locations where the largest cut/fill is required to construct the turbine hardstands (T04 and T09). No stability issues are anticipated with the proposed design.

9.2 Recommendations

The following recommendations are given.

- Given the absence of peat on the site, all infrastructure will be founded.
- Excavations in overburden to be limited to 1(v):1.5(h) and in rock to 1(v):1(h)
- Material excavated from access tracks and other infrastructure locations will be stored in the borrow pits proposed for the site. Excavated materials may also be stored temporarily adjacent to excavations in temporary stockpiles.



10. REFERENCES

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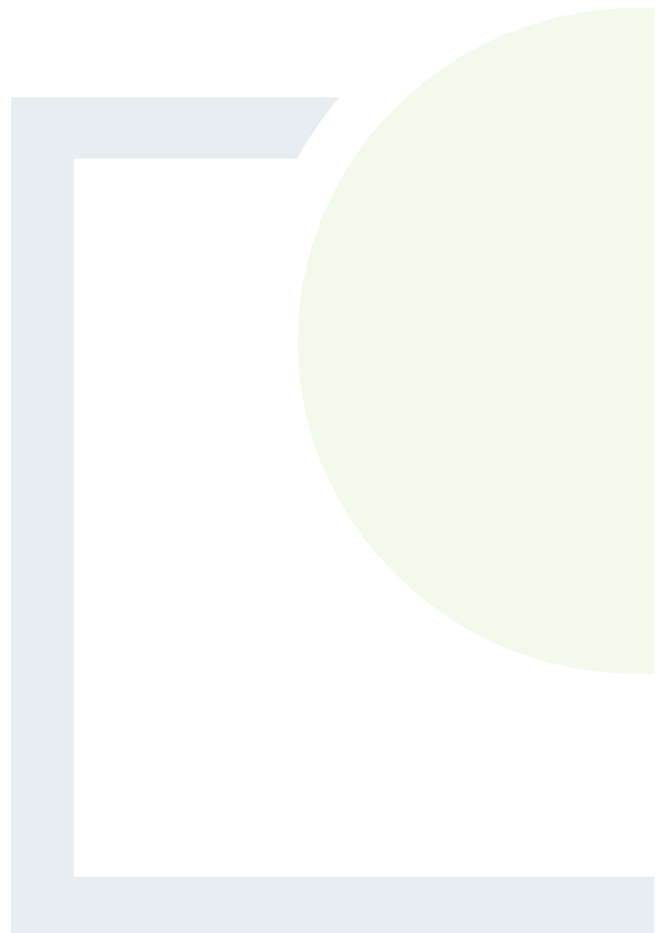
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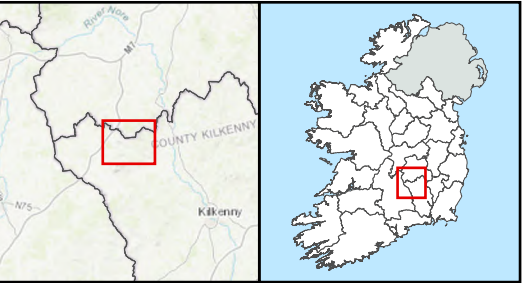
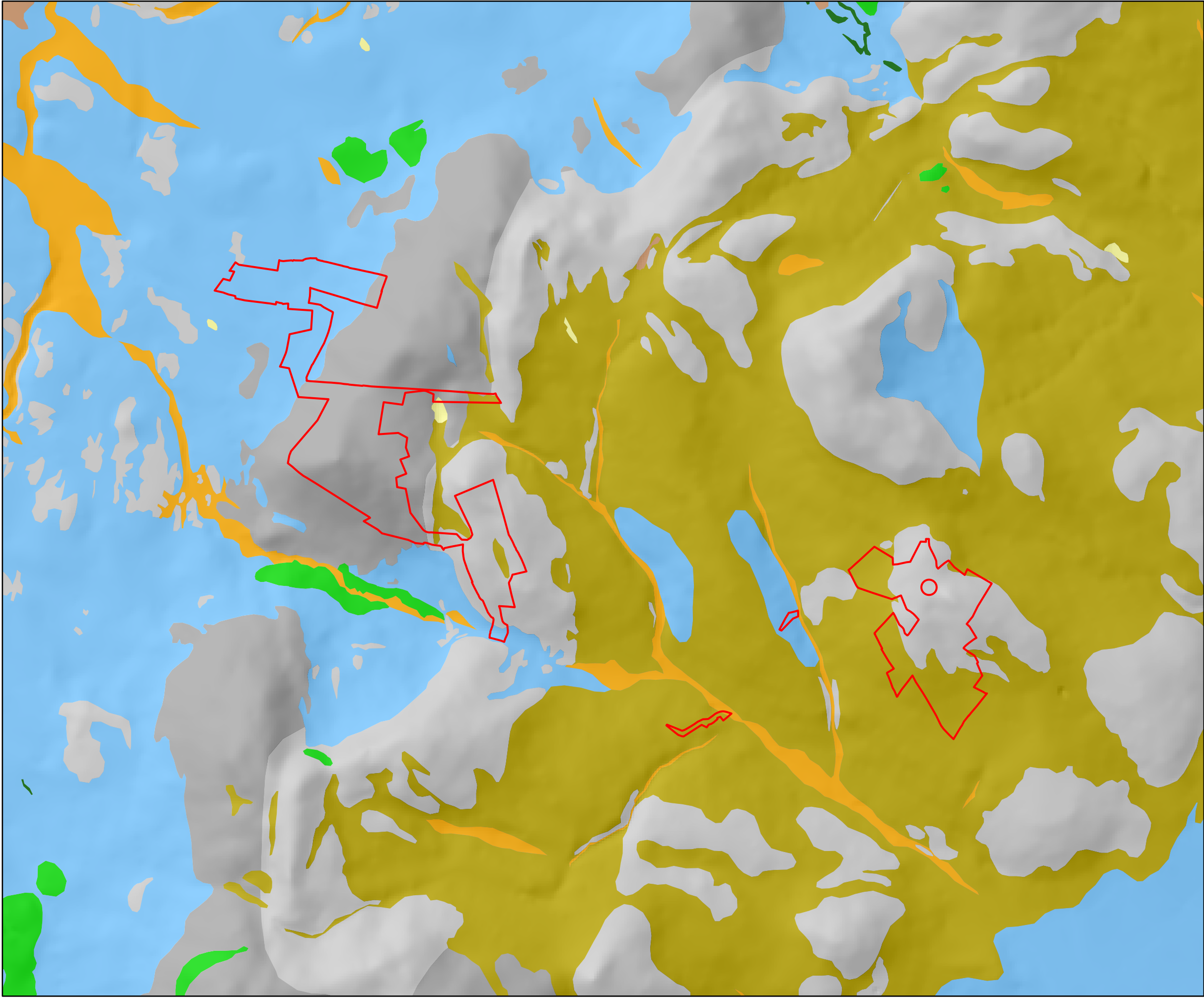


DESIGNING AND DELIVERING
A SUSTAINABLE FUTURE

APPENDIX **A**

Figures





Legend

Site Red Line Boundary

Quaternary Geology

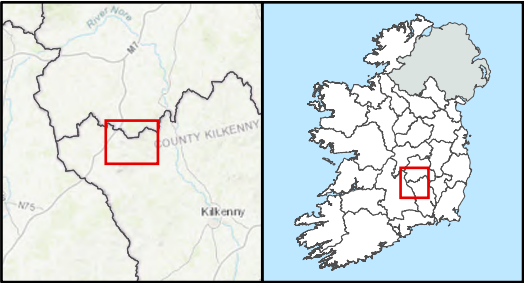
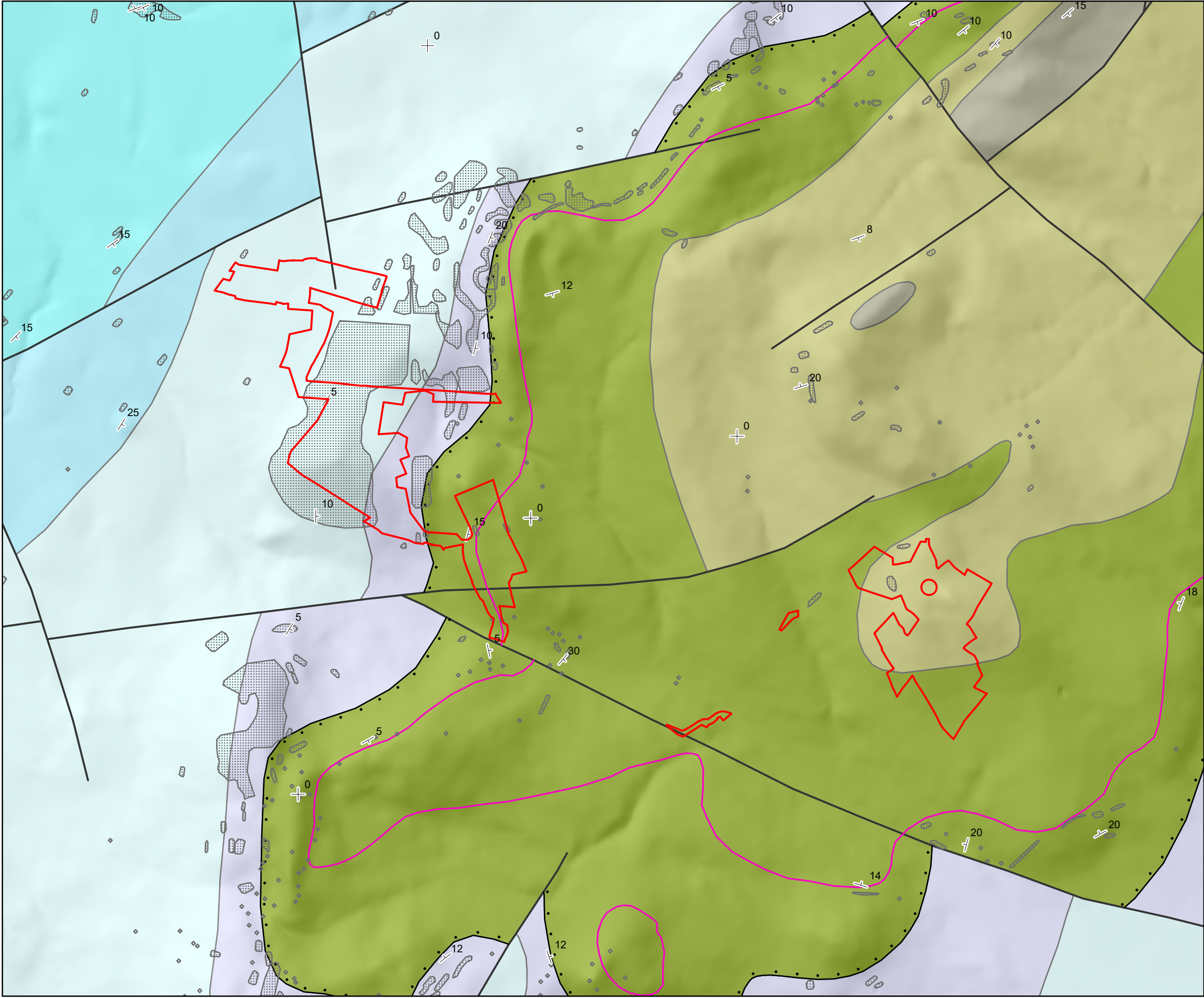
- A, Alluvium
- BasEsk, Eskers comprised of gravels of basic reaction
- FenPt, Fen Peat
- GLs, Gravels derived from Limestones
- KaRck, Kartsified bedrock outcrop or subcrop
- L, Lacustrine sediments
- Rck, Bedrock outcrop or subcrop
- TLs, Till derived from limestones
- TNSSs, Till derived from Namurian sandstones and shales

TITLE:		Quaternary Geology	
PROJECT:		Gathabawn Wind Farm	
FIGURE NO:		2.1	
CLIENT:		Ecopower Ltd.	
SCALE:	1:30,000	REVISION:	0
DATE:	25/09/2026	PAGE SIZE:	A3

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Legend

Site Red Line Boundary

Bedrock Geology

- Aghmacart Formation
- Ballyadams Formation
- Clogrenan Formation
- Durrow Formation
- Bregaun Flagstone Formation
- Killeshin Siltstone Formation
- Moyadd Coal Formation
- Bedrock Outcrops
- Fault
- Thin stratigraphical unit, diagrammatic
- Unconformity, dots on younger side
- Horizontal Bedding
- Strike and dip of bedding, way up unknown

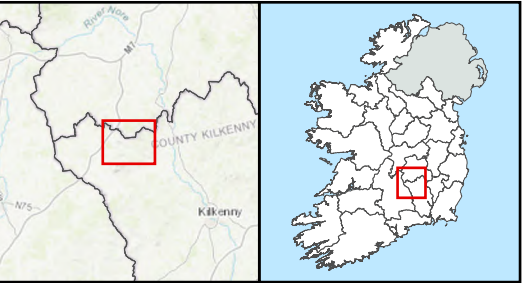
TITLE:		Bedrock Geology	
PROJECT:		Gathabawn Wind Farm	
FIGURE NO:		2.2	
CLIENT:		Ecopower Ltd.	
SCALE:	1:30,000	REVISION:	0
DATE:	25/09/2026	PAGE SIZE:	A3



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Legend

Site Red Line Boundary

Landslide Susceptibility Classification

- Low
- Low (inferred)
- Moderately Low
- Moderately High
- High

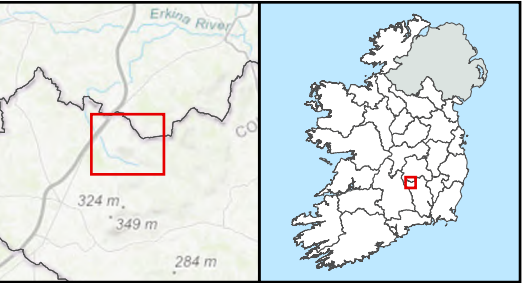
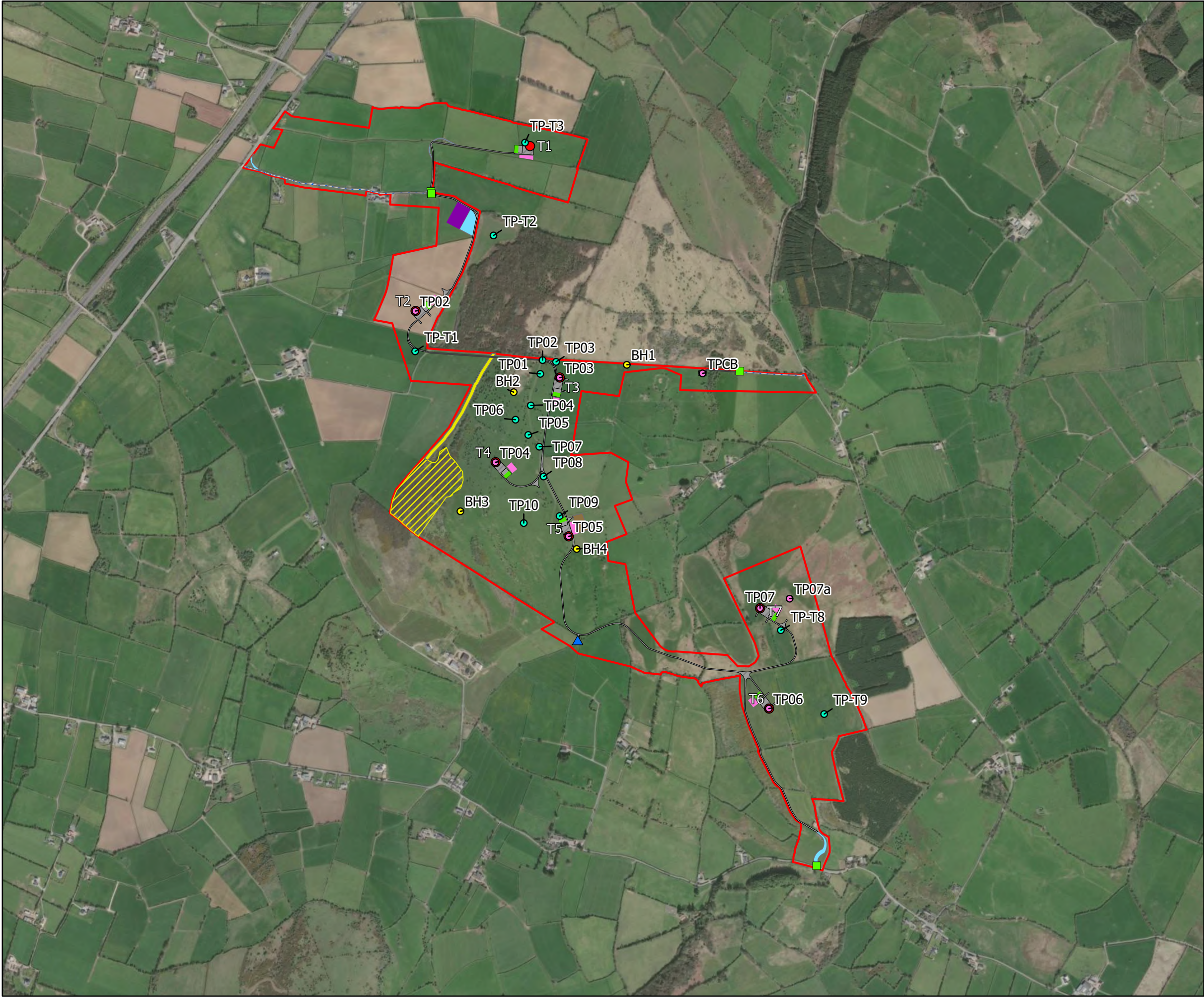
TITLE:		Landslide Susceptibility	
PROJECT:		Gathabawn Wind Farm	
FIGURE NO:		2.3	
CLIENT:		Ecopower Ltd.	
SCALE:	1:30,000	REVISION:	0
DATE:	25/09/2026	PAGE SIZE:	A3



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Legend

Site Red Line Boundary

Control Building

Temporary Deposition Area

Temporary Construction Compound

Berms

Temporary Hardcore Area

Hardcore Areas

TDR Nodes

Public Road

Access track

Biodiversity Area Corridor

Biodiversity Area

Borrow Pit

Met Mast

Site Entrance

Turbines

Boreholes (2021)

Trial Pits (2023)

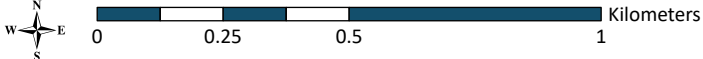
Trial Pits (2026)

TITLE:		GI Location Plan Page 1	
PROJECT:		Gathabawn Wind Farm	
FIGURE NO:		4.1	
CLIENT:		Ecopower Ltd.	
SCALE:	1:15,000	REVISION:	0
DATE:	25/09/2026	PAGE SIZE:	A3

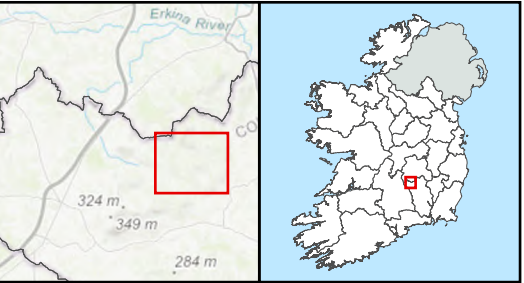
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Projection: Irish Transverse Mercator (ITM), EPSG:2157



- Legend**
- Site Red Line Boundary
 - Control Building
 - Temporary Deposition Area
 - Temporary Construction Compound
 - Berms
 - Temporary Hardcore Area
 - Hardcore Areas
 - TDR Nodes
 - Public Road
 - Access track
 - Biodiversity Area
 - Borrow Pit
 - Drain
 - Site Entrance
 - Turbines
 - Boreholes (2021)
 - Trial Pits (2023)
 - Trial Pits (2026)

TITLE:		GI Location Plan Page 2	
PROJECT:		Gathabawn Wind Farm	
FIGURE NO:		4.1	
CLIENT:		Ecopower Ltd.	
SCALE:	1:15,000	REVISION:	0
DATE:	25/09/2026	PAGE SIZE:	A3



DESIGNING AND DELIVERING
A SUSTAINABLE FUTURE

APPENDIX B

Site Photos

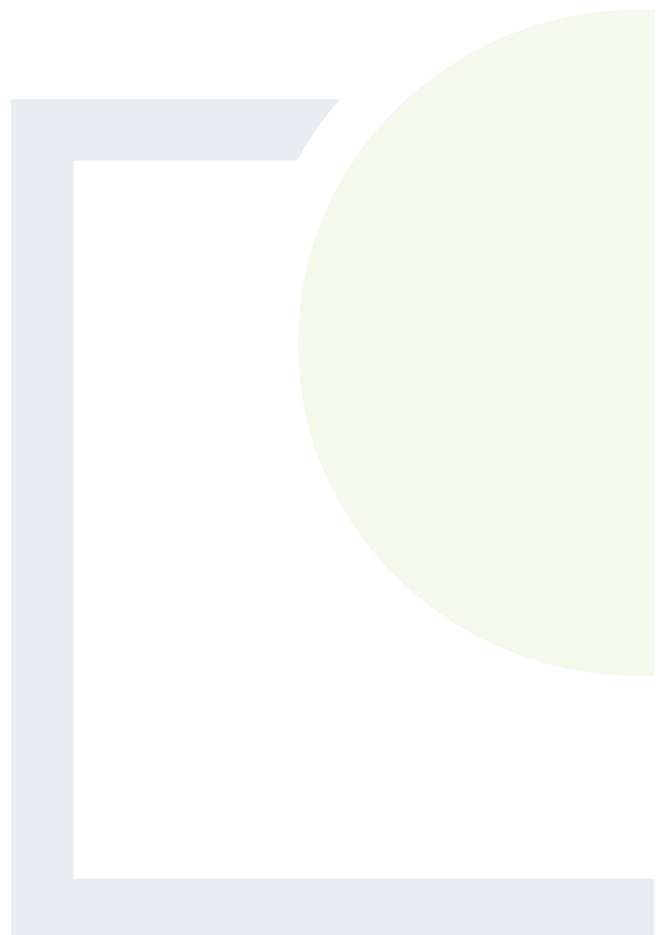




Photo 1: Evidence of soil creep west of T09



Photo 2: Conditions at T01



Photo 3: Conditions at T05



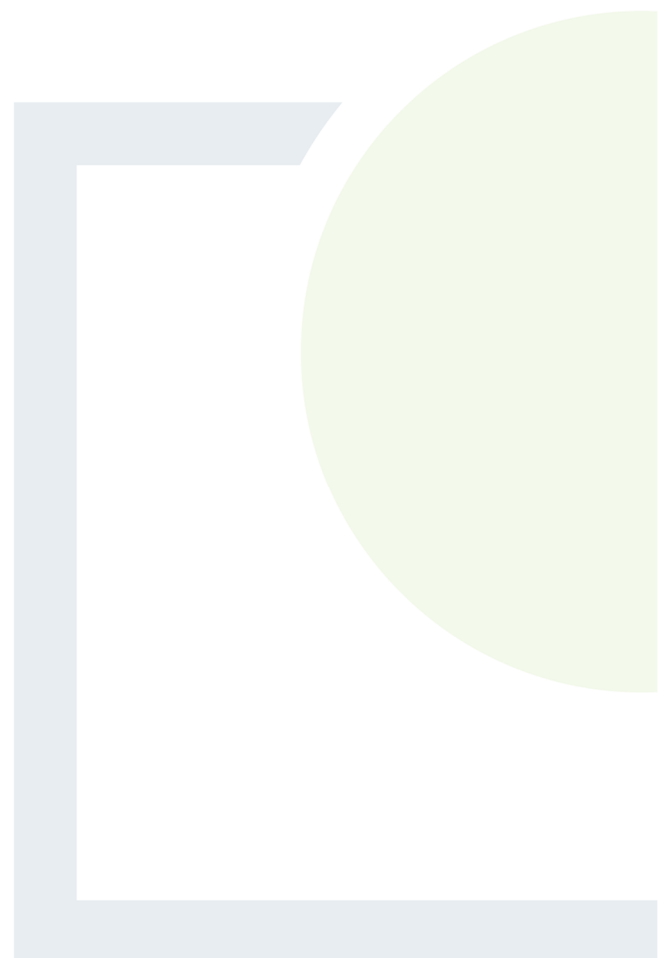
Photo 4: Conditions at T09



DESIGNING AND DELIVERING
A SUSTAINABLE FUTURE

APPENDIX C

Ground Investigation
Factual Report



Petersen Drilling Services Ltd.				on behalf of				HES / Ecopower				Rotary Drilling Log																	
Depth of Stratum Top (m)	Driller's Stratum Description			Sample / Hole / Test Details				Drilling Details				Standard Penetration Test																	
				No	Type	Insitu test	From (m)	To (m)	Liner Dia (mm)	Core run time (hhmm)	Total core Recovery (m)	Flush Return %	Flush Colour	Self Weight Pen (mm)	75 mm	150 mm	Seating Pen (mm)	75 mm	150 mm	225 mm	300 mm	Main Pen (mm)	N value	Casing Depth (m)	Water/ flush level (m)				
0.00	Firm brown TOPSOIL				RO		0.00	39.80				0000		100	grey													0.00	Dry
0.10	Firm to stiff brown sandy silty CLAY with frequent limestone boulders																												
1.20	Weak becoming Medium strong weathered grey LIMESTONE with occasional clay infill																												
2.00	Strong grey LIMESTONE occasional fractures																												
4.00	Very strong grey LIMESTONE rare fractures																												



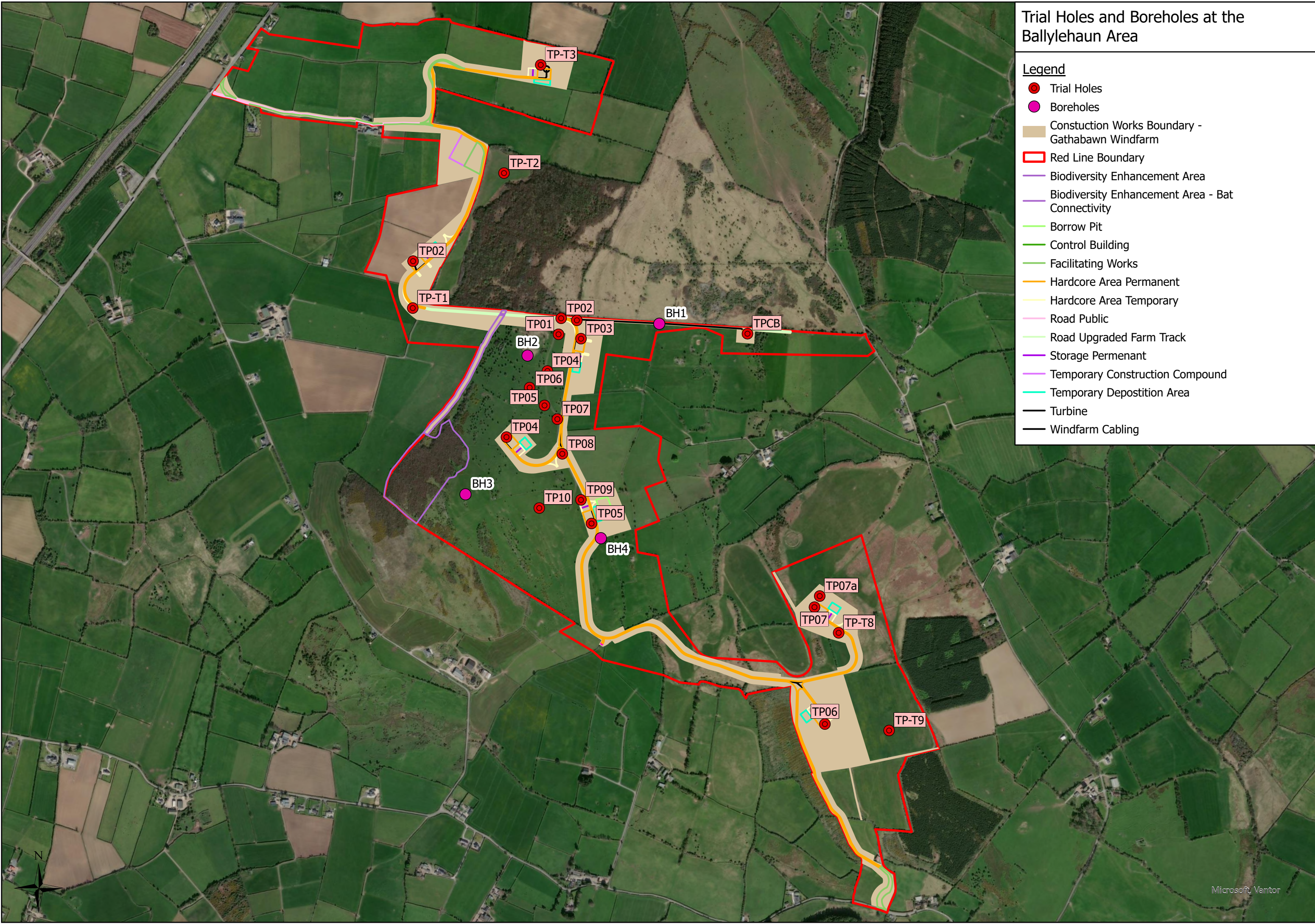




Trial Holes and Boreholes at the Ballylehaun Area

Legend

-  Trial Holes
-  Boreholes
-  Constuction Works Boundary - Gathabawn Windfarm
-  Red Line Boundary
-  Biodiversity Enhancement Area
-  Biodiversity Enhancement Area - Bat Connectivity
-  Borrow Pit
-  Control Building
-  Facilitating Works
-  Hardcore Area Permanent
-  Hardcore Area Temporary
-  Road Public
-  Road Upgraded Farm Track
-  Storage Permanent
-  Temporary Construction Compound
-  Temporary Deposition Area
-  Turbine
-  Windfarm Cabling



Trial Holes at the Ballyring Area

Legend

- Trial Holes
- Constuction Works Boundary - Gathabawn Windfarm
- Red Line Boundary
- Biodiversity Enhancement Area
- Borrow Pit
- Control Building
- Existing Tracks
- Facilitating Works
- Hardcore Area Permanent
- Hardcore Area Temporary
- Road Public
- Road Upgraded Farm Track
- Storage Permenant
- Temporary Construction Compound
- Temporary Deposition Area
- Turbine
- Windfarm Cabling





Project No: P1518-0
Site: Gattabaun, Co. Kilkenny
Client: Eco Power

Trial Pit Log

Date started: 06/03/2023
Date finished: 06/03/2023

Trial Pit No: TP-T1 (W1)
Easting: .
Northing: .
Elevation: .

SUBSURFACE PROFILE

Depth	Symbol	Depth/Elev.	Description	Water Strikes	Sample Type	Comments
0.00		0.00	Ground Surface			
		0.00	Brown TOPSOIL			
			Firm to very firm, grey, gravelly, sandy SILT/CLAY with numerous rounded to sub-rounded cobbles and boulders			
1.00						
2.00						
		-2.50 2.50				



Remarks:

Contractor:
Excavator type:
Logged by: DB

Scale as shown
Sheet: 1 of 1



Project No: P1518-0
Site: Gattabaun, Co. Kilkenny
Client: Eco Power

Trial Pit Log

Date started: 06/03/2023
Date finished: 06/03/2023

Trial Pit No: TP-T2 (W2)
Easting: .
Northing: .
Elevation: .

SUBSURFACE PROFILE

Depth	Symbol	Depth/Elev.	Description	Water Strikes	Sample Type	Comments
0.00		0.00	Ground Surface			
		0.00	Brown TOPSOIL			
		-0.60	Firm, brown, SILT/CLAY			
1.00		0.60	Firm, grey, sandy, gravelly SILT/CLAY with numerous rounded to sub-rounded cobbles and boulders			
2.00		-2.70				
		2.70				



Remarks:

Contractor:
Excavator type:
Logged by: DB

Scale as shown
Sheet: 1 of 1



Project No: P1518-0
Site: Gattabaun, Co. Kilkenny
Client: Eco Power

Trial Pit Log

Date started: 06/03/2023
Date finished: 06/03/2023

Trial Pit No: TP-T3 (W3)
Easting: .
Northing: .
Elevation: .

SUBSURFACE PROFILE

SUBSURFACE PROFILE						
Depth	Symbol	Depth/Elev.	Description	Water Strikes	Sample Type	Comments
0.00		0.00	Ground Surface			
		0.00	Brown TOPSOIL			
		-0.10	Firm, brown, SILT/CLAY			
		0.10				
	</					



Remarks:

Contractor:
Excavator type:
Logged by: DB

Scale as shown
Sheet: 1 of 1



Project No: P1518-0
Site: Gattabaun, Co. Kilkenny
Client: Eco Power

Trial Pit Log

Date started: 06/03/2023
Date finished: 06/03/2023

Trial Pit No: TP-T8 (W8)
Easting: .
Northing: .
Elevation: .

SUBSURFACE PROFILE

Depth	Symbol	Depth/Elev.	Description	Water Strikes	Sample Type	Comments
0.00		0.00	Ground Surface			
		0.00	Brown TOPSOIL			
			Firm, dark brown SILT/CLAY			
		-0.75				
		0.75	Soft, weak, brittle, thinly bedded SHALE			
1.00						
2.00			Refusal at 2.1m - SHALE bedrock			
		-2.10				
		2.10				



Remarks:

Contractor:
Excavator type:
Logged by: DB

Scale as shown
Sheet: 1 of 1



Project No: P1518-0
Site: Gattabaun, Co. Kilkenny
Client: Eco Power

Trial Pit Log

Date started: 06/03/2023
Date finished: 06/03/2023

Trial Pit No: TP-T9 (W9)
Easting: .
Northing: .
Elevation: .

SUBSURFACE PROFILE

Depth	Symbol	Depth/Elev.	Description	Water Strikes	Sample Type	Comments
0.00		0.00	Ground Surface			
		0.00	Brown TOPSOIL			
		-0.45	Light brown, firm SILT/CLAY			
		0.45	Soft to firm, gravelly SILT/CLAY with angular clasts			
1.00						
2.00						
		-2.20	Weathered black SHALE			
		2.20	Refusal at 2.4m			
		-2.40				
		2.40				



Remarks:

Contractor:
Excavator type:
Logged by: DB

Scale as shown
Sheet: 1 of 1



Project No: P1518-0
Site: Gattabaun, Co. Kilkenny
Client: Eco Power

Trial Pit Log

Date started: 06/03/2023
Date finished: 06/03/2023

Trial Pit No: TP-T12 (W12)
Easting: .
Northing: .
Elevation: .

SUBSURFACE PROFILE

SUBSURFACE PROFILE						
Depth	Symbol	Depth/Elev.	Description	Water Strikes	Sample Type	Comments
0.00		0.00	Ground Surface			
		0.00	Brown TOPSOIL			
		-0.15	Greyish brown, stiff, gravelly CLAY with cobbles and boulders			
		0.15				
1.00						



Remarks:

Contractor:
Excavator type:
Logged by: DB

Scale as shown
Sheet: 1 of 1



Project No: P1518-0
Site: Gattabaun, Co. Kilkenny
Client: Eco Power

Trial Pit Log

Date started: 06/03/2023
Date finished: 06/03/2023

Trial Pit No: TP-T13 (W13)
Easting: .
Northing: .
Elevation: .

SUBSURFACE PROFILE

Depth	Symbol	Depth/Elev.	Description	Water Strikes	Sample Type	Comments
0.00		0.00	Ground Surface			
		0.00	Brown TOPSOIL			
		-0.40	Firm, reddish SILT/ CLAY			
		0.40	Weathered black grey SHALE			
1.00		-1.00	Soft brittle black SHALE			
		1.00				
		-2.15				
2.00		2.15				



Remarks:

Contractor:
Excavator type:
Logged by: DB

Scale as shown
Sheet: 1 of 1



Project No: P1518-0
Site: Gattabaun, Co. Kilkenny
Client: Eco Power

Trial Pit Log

Date started: 06/03/2023
Date finished: 06/03/2023

Trial Pit No: TP-T14 (W14)
Easting: .
Northing: .
Elevation: .

SUBSURFACE PROFILE

Depth	Symbol	Depth/Elev.	Description	Water Strikes	Sample Type	Comments
0.00		0.00	Ground Surface			
		0.00	Brown TOPSOIL			
		-0.30	Firm, brown CLAY			
		0.30	Grey, firm, slightly gravelly SILT			
		-0.45	Soft brittle black SHALE			
1.00		0.45				
2.00		-2.00				
		2.00				



Remarks:

Contractor:
Excavator type:
Logged by: DB

Scale as shown
Sheet: 1 of 1



Project No: P1518-0
Site: Ballylehaun, Co. Kilkenny
Client: Eco Power

Trial Pit Log

Date started: 25/08/2021
Date finished: 25/08/2021

Trial Pit No: TP01
Easting: 234114
Northing: 170759
Elevation: .

SUBSURFACE PROFILE

Depth	Symbol	Depth/Elev.	Description	Water Strikes	Sample Type	Comments
0.00		0.00	Ground Surface			
		0.00	Topsoil			
		-0.10				
		0.10	Firm, brown slightly sandy SILT/CLAY with cobbles			
			Refusal on broken/weathered limestone (angular/blocky)			
		-0.40				
		0.40				



Remarks:

Contractor:
Excavator type:
Logged by: DB

Scale as shown
Sheet: 1 of 1



HYDRO-ENVIRONMENTAL SERVICES

Trial Pit Log

Project No: P1518-0

Site: Ballylehaun, Co. Kilkenny

Client: Eco Power

Date started: 25/08/2021

Date finished: 25/08/2021

Trial Pit No: TP02

Easting: 234123

Northing: 170814

Elevation: .

SUBSURFACE PROFILE

Depth	Symbol	Depth/Elev.	Description	Water Strikes	Sample Type	Comments
0.00		0.00	Ground Surface			
		0.00	Topsoil with tree roots			
		-0.15				
		0.15	Firm, brown, slightly sandy, slightly gravelly SILT/CLAY with cobbles			
			Refusal on broken/weathered limestone (angular/blocky)			
		-0.45				
		0.45				



Remarks:

Contractor:

Scale as shown

Excavator type:

Sheet: 1 of 1

Logged by: DB



Project No: P1518-0
Site: Ballylehaun, Co. Kilkenny
Client: Eco Power

Trial Pit Log

Date started: 25/08/2021
Date finished: 25/08/2021

Trial Pit No: TP03
Easting: 234177
Northing: 170807
Elevation: .

SUBSURFACE PROFILE

Depth	Symbol	Depth/Elev.	Description	Water Strikes	Sample Type	Comments
0.00		0.00	Ground Surface			
		0.00	Topsoil			
		-0.15				
		0.15	Refusal on broken/weathered limestone (angular/blocky)			
		-0.20				
		0.20				



Remarks:

Contractor:
Excavator type:
Logged by: DB

Scale as shown
Sheet: 1 of 1



Project No: P1518-0
Site: Ballylehaun, Co. Kilkenny
Client: Eco Power

Trial Pit Log

Date started: 25/08/2021
Date finished: 25/08/2021

Trial Pit No: TP04
Easting: 234076
Northing: 170633
Elevation: .

SUBSURFACE PROFILE

Depth	Symbol	Depth/Elev.	Description	Water Strikes	Sample Type	Comments
0.00		0.00	Ground Surface			
		0.00	Topsoil			
		-0.15				
		0.15	Firm, dark brown SILT/CLAY			
			Refusal on competent limestone			
		-0.25				
		0.25				



Remarks:

Contractor:
Excavator type:
Logged by: DB

Scale as shown
Sheet: 1 of 1



HYDRO-ENVIRONMENTAL SERVICES

Trial Pit Log

Project No: P1518-0

Site: Ballylehaun, Co. Kilkenny

Client: Eco Power

Date started: 25/08/2021

Date finished: 25/08/2021

Trial Pit No: TP05

Easting: 234076

Northing: 170633

Elevation: .

SUBSURFACE PROFILE

Depth	Symbol	Depth/Elev.	Description	Water Strikes	Sample Type	Comments
0.00		0.00	Ground Surface			
		0.00	Topsoil			
		-0.15				
		0.15	Firm, dark brown SILT/CLAY			
			Refusal on competent limestone			
		-0.25				
		0.25				



Remarks:

Contractor:

Excavator type:

Logged by: DB

Scale as shown

Sheet: 1 of 1



Project No: P1518-0
Site: Ballylehaun, Co. Kilkenny
Client: Eco Power

Trial Pit Log

Date started: 25/08/2021
Date finished: 25/08/2021

Trial Pit No: TP06
Easting: 234015
Northing: 170576
Elevation: .

SUBSURFACE PROFILE

Depth	Symbol	Depth/Elev.	Description	Water Strikes	Sample Type	Comments
0.00		0.00	Ground Surface			
		0.00	Topsoil			
		-0.10				
		0.10	Refusal on broken/weathered limestone (angular/blocky)			
		-0.15				
		0.15				



Remarks:

Contractor:
Excavator type:
Logged by: DB

Scale as shown
Sheet: 1 of 1



Project No: P1518-0
Site: Ballylehaun, Co. Kilkenny
Client: Eco Power

Trial Pit Log

Date started: 25/08/2021
Date finished: 25/08/2021

Trial Pit No: TP07
Easting: 234119
Northing: 170461
Elevation: .

SUBSURFACE PROFILE

Depth	Symbol	Depth/Elev.	Description	Water Strikes	Sample Type	Comments
0.00		0.00	Ground Surface			
		0.00	Topsoil			
		-0.15				
		0.15	Firm, brown SILT/CLAY			
			Refusal on broken/weathered limestone (angular/blocky)			
		-0.25				
		0.25				



Remarks:

Contractor:
Excavator type:
Logged by: DB

Scale as shown
Sheet: 1 of 1



Project No: P1518-0
Site: Ballylehaun, Co. Kilkenny
Client: Eco Power

Trial Pit Log

Date started: 25/08/2021
Date finished: 25/08/2021

Trial Pit No: TP08
Easting: 234137
Northing: 170342
Elevation: .

SUBSURFACE PROFILE

Depth	Symbol	Depth/Elev.	Description	Water Strikes	Sample Type	Comments
0.00		0.00	Ground Surface			
		0.00	Topsoil			
		-0.10				
		0.10	Refusal on broken/weathered limestone (angular/blocky)			
		-0.15				
		0.15				



Remarks:

Contractor:
Excavator type:
Logged by: DB

Scale as shown
Sheet: 1 of 1



Project No: P1518-0
Site: Ballylehaun, Co. Kilkenny
Client: Eco Power

Trial Pit Log

Date started: 25/08/2021
Date finished: 25/08/2021

Trial Pit No: TP09
Easting: 234194
Northing: 170180
Elevation: .

SUBSURFACE PROFILE

Depth	Symbol	Depth/Elev.	Description	Water Strikes	Sample Type	Comments
0.00		0.00	Ground Surface			
		0.00	Topsoil			
		-0.10				
		0.10	Firm, brown, SILT/CLAY			
			Refusal on competent limestone			
		-0.25				
		0.25				



Remarks:

Contractor:
Excavator type:
Logged by: DB

Scale as shown
Sheet: 1 of 1



Project No: P1518-0
Site: Ballylehaun, Co. Kilkenny
Client: Eco Power

Trial Pit Log

Date started: 25/08/2021
Date finished: 25/08/2021

Trial Pit No: TP10
Easting: 234048
Northing: 170163
Elevation: .

SUBSURFACE PROFILE

Depth	Symbol	Depth/Elev.	Description	Water Strikes	Sample Type	Comments
0.00		0.00	Ground Surface			
		0.00	Topsoil			
		-0.10				
		0.10	Refusal on broken/weathered limestone (angular/blocky)			
		-0.15				
		0.15				



Remarks:

Contractor:
Excavator type:
Logged by: DB

Scale as shown
Sheet: 1 of 1



HYDRO-ENVIRONMENTAL SERVICES

Trial Pit Log

Project No: P1561-0

Site: Ballyring, Co. Kilkenny

Client: Eco Power

Date started: 25/08/2021

Date finished: 25/08/2021

Trial Pit No: TP-T2

Easting: 238471

Northing: 169085

Elevation: .

SUBSURFACE PROFILE

Depth	Symbol	Depth/Elev.	Description	Water Strikes	Sample Type	Comments
0.00		0.00	Ground Surface			
		0.00	Topsoil			
		-0.15				
		0.15	Grey, very firm to stiff SILT			
		-0.70				
		0.70	Soft weathered SILTSTONE			
		-0.85				
		0.85				
1.00						



Remarks:

Contractor:

Scale as shown

Excavator type:

Sheet: 1 of 1

Logged by: DB



Project No: P1561-0
Site: Ballyring, Co. Kilkenny
Client: Eco Power

Trial Pit Log

Date started: 25/08/2021
Date finished: 25/08/2021

Trial Pit No: TP-T3
Easting: 238540
Northing: 168623
Elevation: .

SUBSURFACE PROFILE

SUBSURFACE PROFILE						
Depth	Symbol	Depth/Elev.	Description	Water Strikes	Sample Type	Comments
0.00		0.00	Ground Surface			
		0.00	Topsoil			
		-0.15	Grey, very firm to stiff SILT			
		0.15				
		-0.70				
		0.70				
		-0.85	Soft weathered SILTSTONE			
		0.85				
1.00						



Remarks:

Contractor:
Excavator type:
Logged by: DB

Scale as shown
Sheet: 1 of 1



HYDRO-ENVIRONMENTAL SERVICES

Trial Pit Log

Project No: P1561-0

Site: Ballyring, Co. Kilkenny

Client: Eco Power

Date started: 25/08/2021

Date finished: 25/08/2021

Trial Pit No: TP-T4

Easting: 238993

Northing: 168486

Elevation: .

SUBSURFACE PROFILE

Depth	Symbol	Depth/Elev.	Description	Water Strikes	Sample Type	Comments
0.00		0.00	Ground Surface			
		0.00	Topsoil			
		-0.15				
		0.15	Grey, very firm to stiff SILT with few cobbles			
		-0.90				
1.00		0.90	Soft weathered SILTSTONE			
		-1.60				
		1.60				



Remarks:

Contractor:

Excavator type:

Logged by: DB

Scale as shown

Sheet: 1 of 1



Trial Pit Log

Project No: P1561-0

Site: Ballyring, Co. Kilkenny

Client: Eco Power

Date started: 25/08/2021

Date finished: 25/08/2021

Trial Pit No: TP_Sub S

Easting: 238341

Northing: 169241

Elevation: .

SUBSURFACE PROFILE

[illegible]

Remarks:

Contractor:

Excavator type:

Logged by: DB

Scale as shown

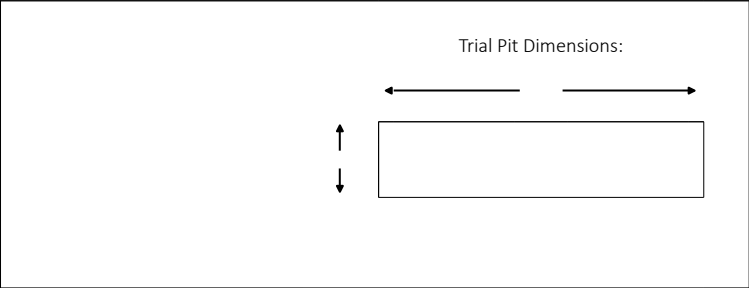
Sheet: 1 of 1

TRIAL PIT LOG				TRIAL PIT No TP02	
Client: Ecopower developments Limited					
Project: Gathabawn WF - Trial Pits					
Project No: 501.065883.00001	Date: 27/08/2026	Ground Level:	Co-ordinates: E633563 N671040	Sheet 1 of 1	

SAMPLES & TESTS				Water	STRATA				Instrument Backfill
Depth	Type No	Test Type	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	
1.00 - 1.01	B						(0.50) 0.50	TOPSOIL	
							(0.20) 0.70	Soft to firm greyish brown sandy gravelly CLAY with a medium cobble content and a low boulder content. Sand is fine to medium. Gravel and cobbles are subangular to rounded. Boulders are subrounded to rounded of limestone, up to 200mm.	
							(0.50) 1.20	Soft to firm greyish brown very sandy gravelly CLAY with a high cobble content and a medium boulder content. Sand is fine to medium. Gravel and cobbles are subangular to rounded. Boulders are subrounded to rounded of limestone, up to 200mm.	
							(0.30) 1.50	Loose to medium dense brownish grey slightly clayey gravelly SAND with a high cobble and a medium boulder content. Gravel cobbles and boulders are subangular to rounded of limestone.	
1.50 - 1.51	B							Trial Pit Complete at 1.50m	
2									
3									

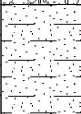
GENERAL REMARKS:
E.O.D at 1.5mbgl, could not excavate further, possible rockhead.

KEY
V = Hand Vane Shear Strength
PP = Pocket Penetrometer Shear Strength
J = Jar Sample
D = Disturbed Sample
B = Large Bulk Sample
HS = Head Space Measurement



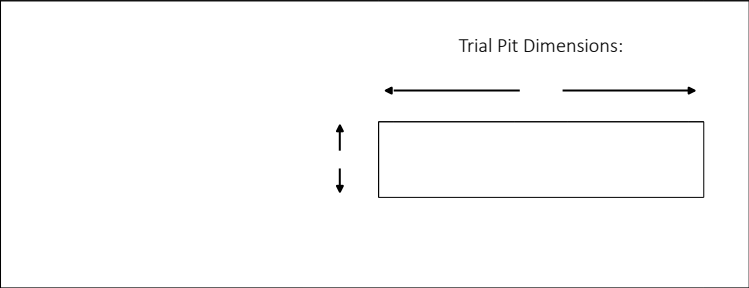
All dimensions in metres Scale 1:25	Contractor: Plant:	Method: Trial pit/trench	Logged By:	Approved By:
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TRIAL PIT LOG				TRIAL PIT No TP03	
Client: Ecopower developments Limited					
Project: Gathabawn WF - Trial Pits					
Project No: 501.065883.00001		Date: 27/08/2026	Ground Level:	Co-ordinates: E634139 N670774	Sheet 1 of 1

SAMPLES & TESTS				Water	STRATA				Instrument Backfill
Depth	Type No	Test Type	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	
0.90	B						(0.20) 0.20	TOPSOIL	
							(0.30) 0.50	Soft to firm light brown sandy gravelly CLAY with a medium cobble content and a medium boulder content. Sand is fine to medium. Gravel and cobbles are subangular to subrounded. Boulders are subrounded of limestone, up to 200mm.	
							(0.40) 0.90	Loose light grey slightly clayey slightly silty slightly gravelly SAND with a medium cobble content and low boulder content. Sand is fine to medium. Gravel and cobbles are subangular to subrounded. Boulders are subrounded of limestone, up to 200mm.	
								Trial Pit Complete at 0.90m	
1									
2									
3									

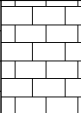
GENERAL REMARKS:
E.O.D at 0.9mbgl, could not excavate further, possible rockhead.

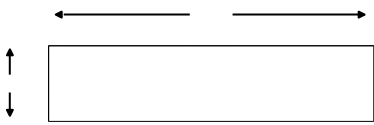
KEY
V = Hand Vane Shear Strength
PP = Pocket Penetrometer Shear Strength
J = Jar Sample
D = Disturbed Sample
B = Large Bulk Sample
HS = Head Space Measurement



All dimensions in metres Scale 1:25	Contractor: Plant:	Method: Trial pit/trench	Logged By:	Approved By:
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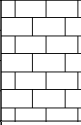
TRIAL PIT LOG				TRIAL PIT No TP04	
Client: Ecopower developments Limited					
Project: Gathabawn WF - Trial Pits					
Project No: 501.065883.00001		Date: 27/08/2026	Ground Level:	Co-ordinates: E633883 N670436	Sheet 1 of 1

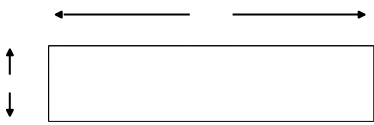
SAMPLES & TESTS				Water	STRATA				Instrument Backfill
Depth	Type No	Test Type	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	
0.50 - 0.51	B						(0.10)0.10	TOPSOIL	
							(0.40)	Medium strong, weathered light blueish grey LIMESTONE/SANDSTONE.	
							0.50	Trial Pit Complete at 0.50m	
1									
2									
3									

GENERAL REMARKS: E.O.D at 0.5mbgl, bedrock encountered.		Trial Pit Dimensions: 	
KEY V = Hand Vane Shear Strength PP = Pocket Penetrometer Shear Strength J = Jar Sample D = Disturbed Sample B = Large Bulk Sample HS = Head Space Measurement			

All dimensions in metres Scale 1:25	Contractor: Plant:	Method: Trial pit/trench	Logged By:	Approved By:
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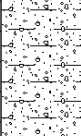
TRIAL PIT LOG				TRIAL PIT No TP05	
Client: Ecopower developments Limited					
Project: Gathabawn WF - Trial Pits					
Project No: 501.065883.00001		Date: 27/08/2026	Ground Level:	Co-ordinates: E634175 N670140	Sheet 1 of 1

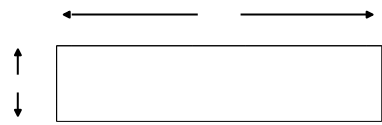
SAMPLES & TESTS				Water	STRATA				Instrument Backfill
Depth	Type No	Test Type	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	
0.50	B						(0.30) 0.30	TOPSOIL	
							(0.40) 0.70	Medium strong, slightly weathered light blueish grey LIMESTONE.	
								Trial Pit Complete at 0.70m	
1									
2									
3									

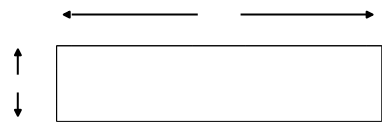
GENERAL REMARKS: E.O.D at 0.7mbgl, bedrock encountered.	Trial Pit Dimensions: 
KEY V = Hand Vane Shear Strength PP = Pocket Penetrometer Shear Strength J = Jar Sample D = Disturbed Sample B = Large Bulk Sample HS = Head Space Measurement	

All dimensions in metres Scale 1:25	Contractor: Plant:	Method: Trial pit/trench	Logged By:	Approved By:
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TRIAL PIT LOG				TRIAL PIT No TP06	
Client: Ecopower developments Limited					
Project: Gathabawn WF - Trial Pits					
Project No: 501.065883.00001	Date: 27/08/2026	Ground Level:	Co-ordinates: E634975 N669452	Sheet 1 of 1	

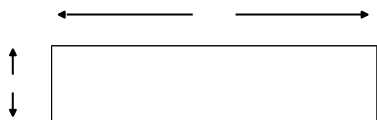
SAMPLES & TESTS				Water	STRATA				Instrument Backfill
Depth	Type No	Test Type	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	
1.00 - 1.01	B						(0.30)	TOPSOIL	
							0.30 (0.90) 1.20	Firm to stiff greyish brown very gravelly slightly sandy CLAY with a high cobble content and a medium boulder content. Sand is fine to medium. Gravel and cobbles are subangular to subrounded. Boulders are subrounded of limestone, up to 400mm.	
2.00 - 2.01	B						(0.30) 1.50	Firm to stiff greyish brown gravelly sandy CLAY with a medium cobble content and a medium boulder content. Sand is fine to medium. Gravel and cobbles are subangular to subrounded. Boulders are subrounded of limestone, up to 400mm.	
							(0.90) 2.40	Loose to medium dense brownish grey gravelly clayey SAND with a medium cobble content and a medium boulder content. Sand is fine to medium. Gravel and cobbles are subangular to subrounded. Boulders are subrounded of limestone, up to 400mm.	
3.00	B						(0.60) 3.00	Firm to stiff greyish brown very sandy gravelly CLAY with a medium cobble content and a medium boulder content. Sand is fine to medium. Gravel and cobbles are subangular to subrounded. Boulders are subrounded of limestone, up to 400mm.	
								Trial Pit Complete at 3.00m	

GENERAL REMARKS: E.O.D at 3mbgl. Hole unstable from 1.5mbgl, minor sidewall collapse.		Trial Pit Dimensions: 	
KEY V = Hand Vane Shear Strength PP = Pocket Penetrometer Shear Strength J = Jar Sample D = Disturbed Sample B = Large Bulk Sample HS = Head Space Measurement			
All dimensions in metres Scale 1:25	Contractor: Plant:	Method: Trial pit/trench	Logged By: Approved By:

TRIAL PIT LOG								TRIAL PIT No TP07	
Client: Ecopower developments Limited									
Project: Gathabawn WF - Trial Pits									
Project No: 501.065883.00001		Date: 27/08/2026		Ground Level:		Co-ordinates: E634940 N669853		Sheet 1 of 1	
SAMPLES & TESTS				Water	STRATA				Instrument Backfill
Depth	Type No	Test Type	Test Result		Reduced Level	Legend	Depth (Thick- ness)	DESCRIPTION	
1.00 - 1.01	B						(0.30)	TOPSOIL	
							(0.10) 0.40	Soft to firm greyish brown slightly sandy slightly silty gravelly CLAY with a high cobble content and low boulder content. Sand is fine to medium. Gravel and cobbles are subangular to subrounded. Boulders are subrounded of limestone, up to 200mm.	
							(0.30)	0.70 Medium strong, weathered light blueish grey LIMESTONE.	
							(0.80)	1.50 Loose to medium dense brown mottled light grey slightly sandy slightly clayey GRAVEL of weak, weathered MUDSTONE bedrock fragments.	
Trial Pit Complete at 1.50m									
GENERAL REMARKS: E.O.D at 1.5mbgl, could not excavate further, possible rockhead.								Trial Pit Dimensions: 	
KEY V = Hand Vane Shear Strength PP = Pocket Penetrometer Shear Strength J = Jar Sample D = Disturbed Sample B = Large Bulk Sample HS = Head Space Measurement									
All dimensions in metres Scale 1:25		Contractor: Plant:		Method: Trial pit/trench		Logged By:		Approved By:	

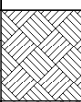
TRIAL PIT LOG				TRIAL PIT No TP07a	
Client: Ecopower developments Limited					
Project: Gathabawn WF - Trial Pits					
Project No: 501.065883.00001		Date: 27/08/2026	Ground Level:	Co-ordinates: E635058 N669891	Sheet 1 of 1

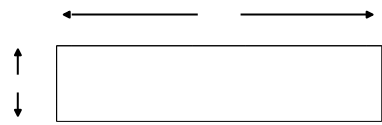
SAMPLES & TESTS				Water	STRATA				Instrument Backfill
Depth	Type No	Test Type	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	
1.00 - 1.01	B						(0.40)	TOPSOIL	
							0.40 (1.10)	Loose to medium dense brown mottled light grey slightly sandy slightly clayey GRAVEL of weak, weathered MUDSTONE bedrock fragments.	
							1.50	Trial Pit Complete at 1.50m	
2									
3									

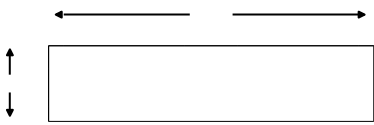
GENERAL REMARKS: E.O.D at 1.5mbgl, could not excavate further, possible rockhead.		Trial Pit Dimensions: 
KEY V = Hand Vane Shear Strength PP = Pocket Penetrometer Shear Strength J = Jar Sample D = Disturbed Sample B = Large Bulk Sample HS = Head Space Measurement		

All dimensions in metres Scale 1:25	Contractor: Plant:	Method: Trial pit/trench	Logged By:	Approved By:
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TRIAL PIT LOG				TRIAL PIT No TP09	
Client: Ecopower developments Limited					
Project: Gathabawn WF - Trial Pits					
Project No: 501.065883.00001	Date: 27/08/2026	Ground Level:	Co-ordinates: E638905 N669227	Sheet 1 of 1	

SAMPLES & TESTS				Water	STRATA				Instrument Backfill
Depth	Type No	Test Type	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	
1.00 - 1.01 1	B						(0.30) 0.30	TOPSOIL	
							(0.30) 0.60	soft to firm light brown slightly sandy slightly gravelly CLAY with a medium cobble content. Sand is fine to medium. Gravel and cobbles are subangular to subrounded.	
							(1.20) 1.80	Medium dense light brown slightly clayey slightly sandy GRAVEL of weak, weathered MUDSTONE bedrock.	
2.00 - 2.01 2	B						(0.60) 2.40	Dense light brown very clayey slightly sandy GRAVEL of weak, weathered MUDSTONE bedrock.	
3								Trial Pit Complete at 2.40m	

GENERAL REMARKS: E.O.D at 2.4mbgl, could not excavate further, possible rockhead.		Trial Pit Dimensions: 		
KEY V = Hand Vane Shear Strength PP = Pocket Penetrometer Shear Strength J = Jar Sample D = Disturbed Sample B = Large Bulk Sample HS = Head Space Measurement				
All dimensions in metres Scale 1:25	Contractor: Plant:	Method: Trial pit/trench	Logged By:	Approved By:

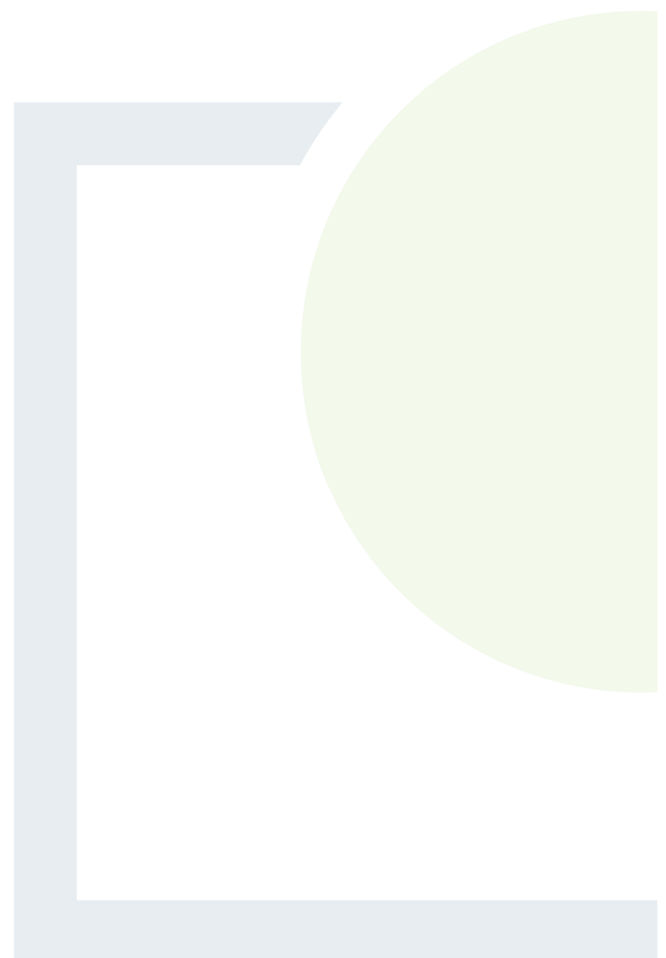
TRIAL PIT LOG										TRIAL PIT No TPCB	
Client: Ecopower developments Limited											
Project: Gathabawn WF - Trial Pits											
Project No: 501.065883.00001			Date: 27/08/2026		Ground Level:		Co-ordinates: E636958 N670808		Sheet 1 of 1		
SAMPLES & TESTS				Water	STRATA					Instrument Backfill	
Depth	Type No	Test Type	Test Result		Reduced Level	Legend	Depth (Thick- ness)	DESCRIPTION			
1.00 - 1.01 1	B						(0.30) 0.30	TOPSOIL			
							(0.30) 0.60	Firm greyish brown slightly silty slightly sandy slightly gravelly CLAY with a low cobble content and a low boulder content. Sand is fine to medium. Gravel and cobbles are subangular to subrounded. Boulders are subrounded of limestone, up to 200mm.			
							(0.60) 1.20	Medium dense brownish grey slightly clayey gravelly SAND with a low cobble content. Sand is fine to medium. Gravel and cobbles are subangular to subrounded.			
							(0.40) 1.60	Medium dense brownish grey slightly clayey gravelly SAND with a high cobble content and a medium boulder content. Sand is fine to medium. Gravel and cobbles are subangular to subrounded. Boulders are subrounded of limestone, up to 200mm.			
							(0.40) 2.00	Firm to stiff brownish grey slightly silty very sandy gravelly CLAY with a high cobble content and a low boulder content. Sand is fine to medium. Gravel and cobbles are subangular to subrounded. Boulders are subrounded of limestone, up to 200mm.			
2.00 - 2.01 2	B						Trial Pit Complete at 2.00m				
3											
GENERAL REMARKS: E.O.D at 2mbgl, could not excavate further, possible rockhead.										Trial Pit Dimensions: 	
KEY V = Hand Vane Shear Strength PP = Pocket Penetrometer Shear Strength J = Jar Sample D = Disturbed Sample B = Large Bulk Sample HS = Head Space Measurement											
All dimensions in metres Scale 1:25			Contractor: Plant:			Method: Trial pit/trench			Logged By:	Approved By:	

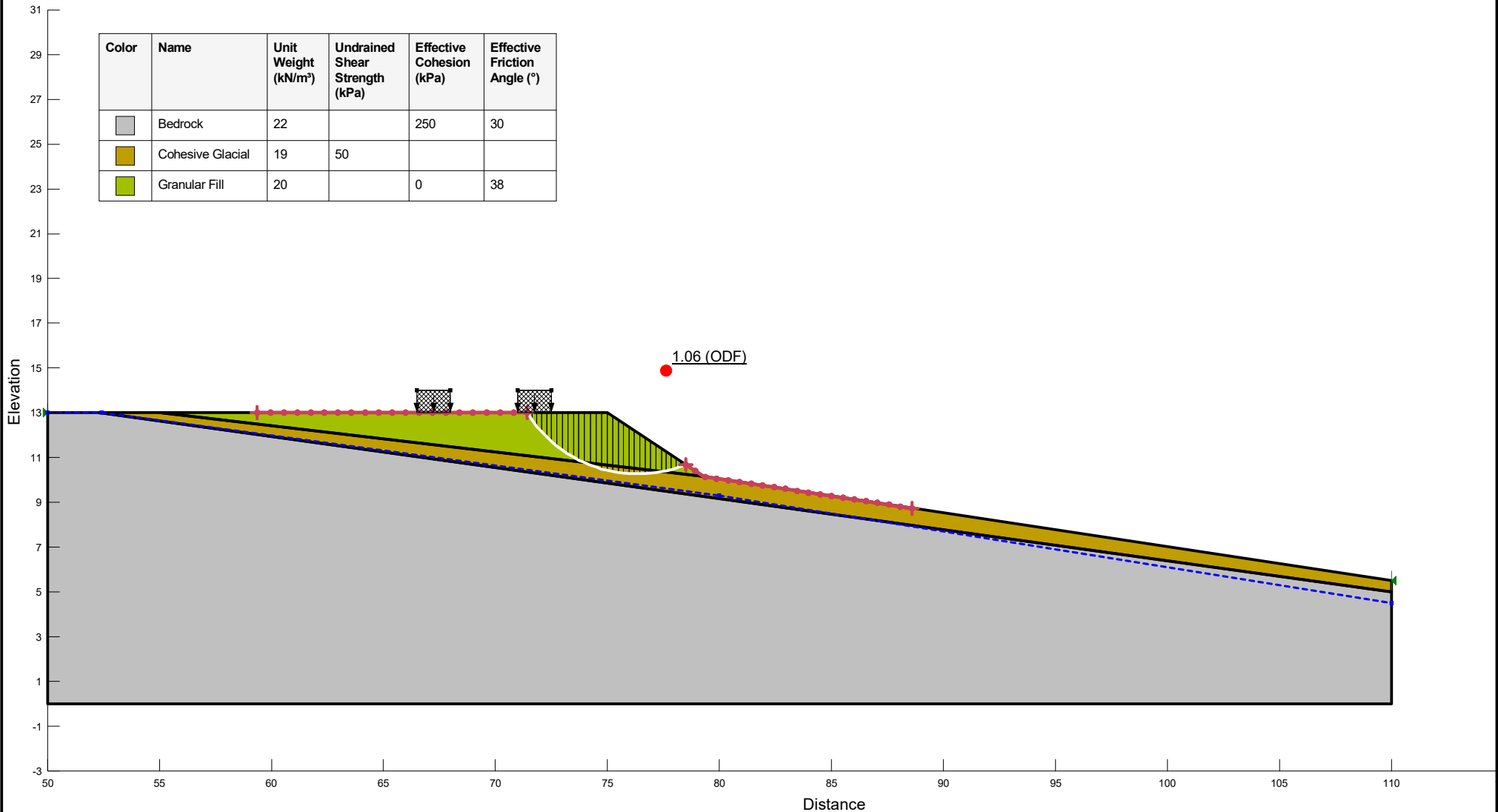


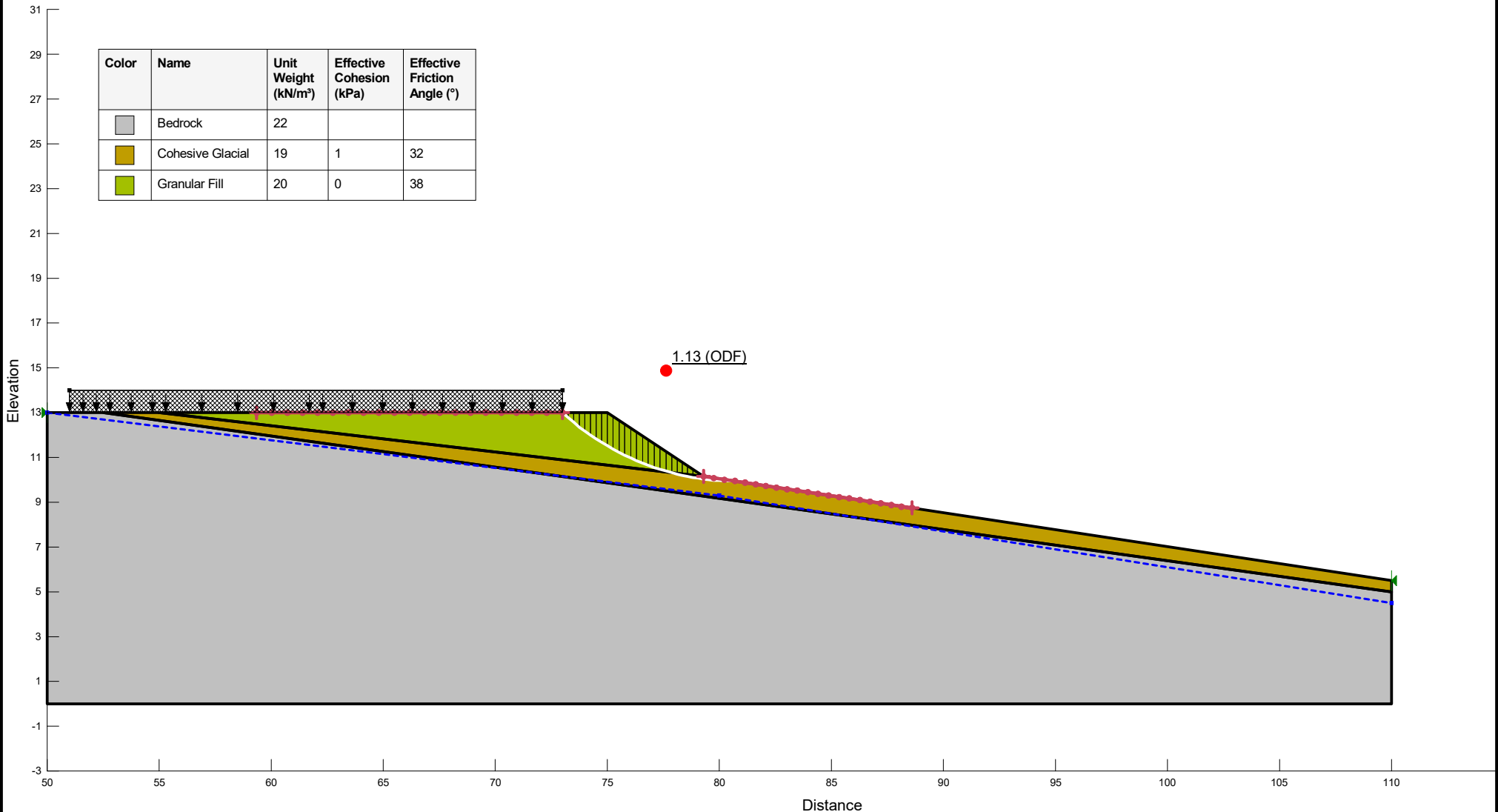
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A SUSTAINABLE FUTURE

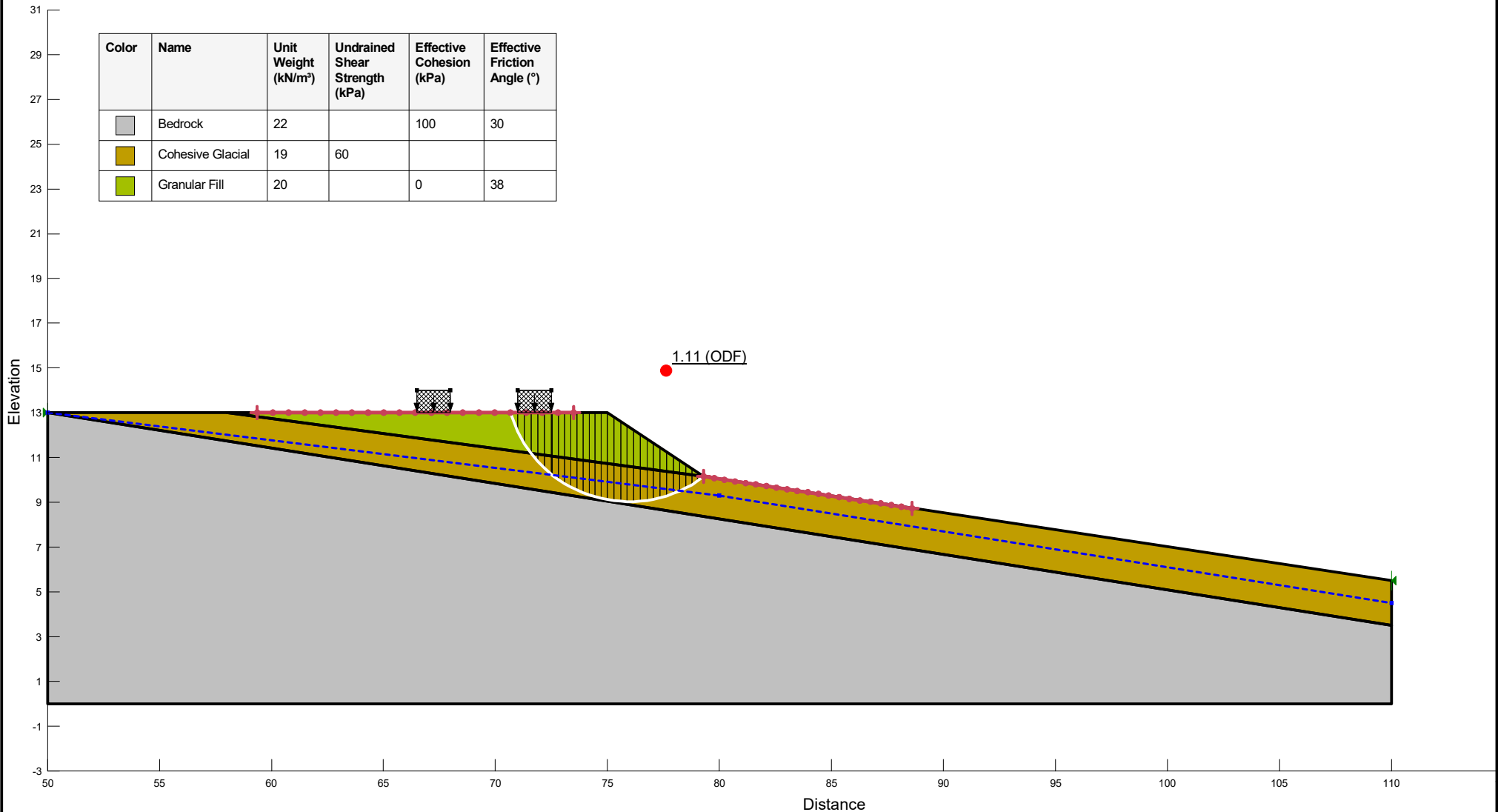
APPENDIX **D**

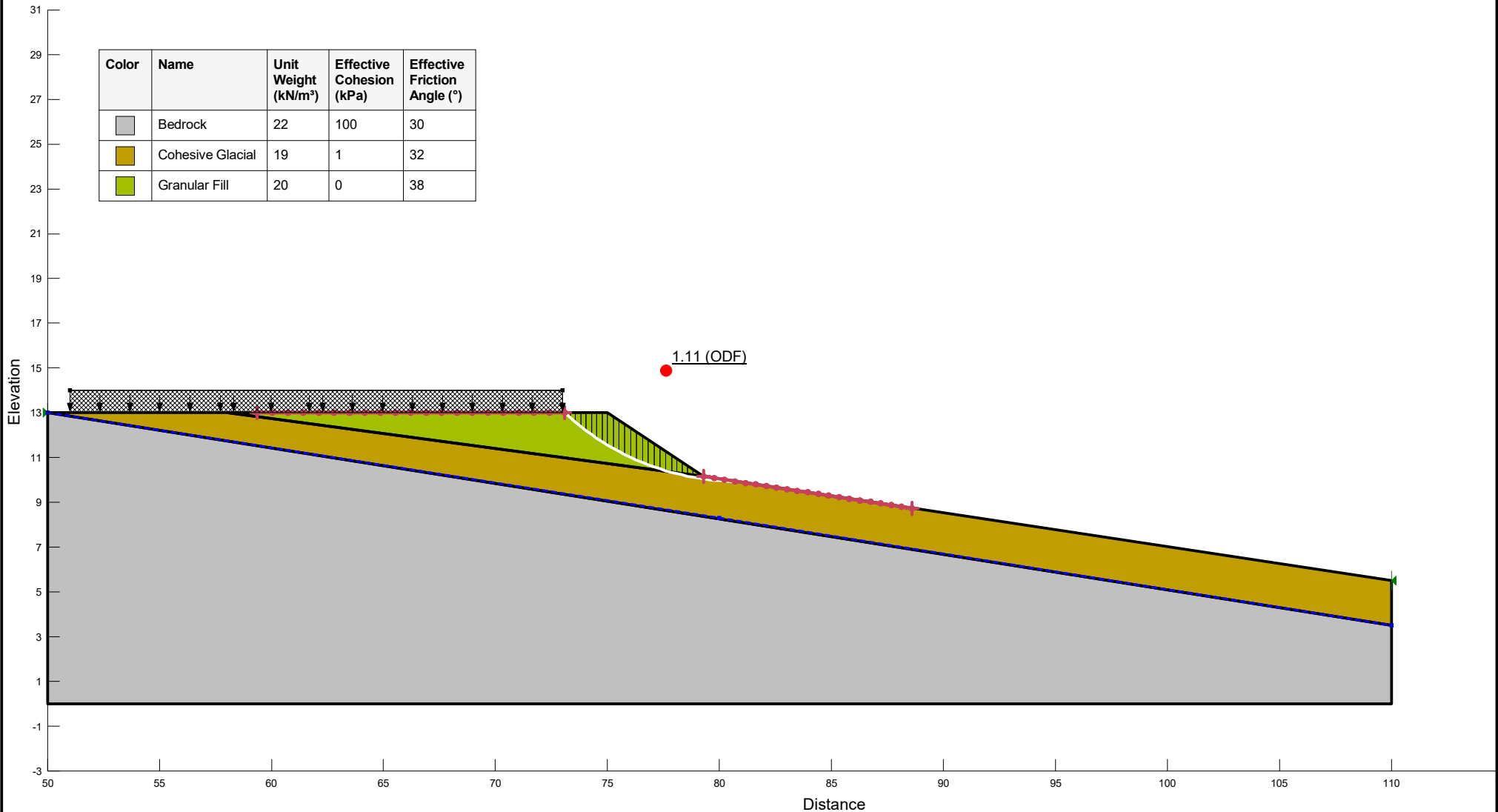
SlopeW Outputs













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