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DESIGNING AND DELIVERING
A SUSTAINABLE FUTURE

APPENDIX 8

Land, Soils and Geology

Appendix 8.1 – Geotechnical and Peat Stability Assessment Report

Appendix 8.2 – Peat and Spoil Management Plan

APPENDIX 8.1

GEOTECHNICAL AND PEAT STABILITY ASSESSMENT REPORT

FEHILY TIMONEY

DESIGNING AND DELIVERING
A SUSTAINABLE FUTURE

GEOTECHNICAL AND PEAT STABILITY ASSESSMENT REPORT

Littleton Windfarm, Co. Tipperary

Prepared for:
Littleton Wind Farm DAC

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Geotechnical & Peat Stability Assessment Report
Littleton Wind Farm

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Abstract: Fehily Timoney and Company (FT) were engaged by Littleton Wind Farm DAC to undertake a geotechnical assessment of the proposed Littleton Wind Farm with respect to peat stability. As part of the geotechnical assessment of the Proposed Project, FT completed a walkover survey at the site as well as a ground investigation comprising peat probes, boreholes and trial pits. The findings of the geotechnical and peat stability assessment showed that the site has an acceptable margin of safety and is suitable for the proposed wind farm development.

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1. NON-TECHNICAL SUMMARY

Fehily Timoney and Company (FT) was engaged by Littleton Wind Farm DAC (the Applicant) to undertake a geotechnical and peat stability assessment of the proposed Littleton Wind Farm. In accordance with planning guidelines compiled by the Department of the Housing, Planning and Local Government (Draft Guidelines, DoHPLG, 2019), where peat >0.5m in thickness is present on a proposed wind farm development, a peat stability assessment is required.

As detailed in Section 1.1.1 in Chapter 1, for the purposes of this EIAR, the various project components are described and assessed using the following references: 'Proposed Project', 'Proposed Wind Farm', 'Proposed Grid Connection', 'Proposed Project site' and the 'site'.

Site walkover surveys (including intrusive peat depth probing), desk study, stability analysis and risk assessment were carried out to assess the susceptibility of the site to peat failure following the principles in Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Developments (PLHRAG, Scottish Government, 2nd Edition, 2017).

The findings, which involved a stability analysis of 221 locations across the Proposed Project site, carried out by FT to record peat depth, slope inclination, vegetation type and ground water, show that the site has an acceptable margin of safety and is suitable for the Proposed Project. The findings include recommendations and control measures for construction work in peat lands to ensure that all works adhere to an acceptable standard of safety. It is noted that there have been numerous wind farms successfully constructed on cutaway and cutover bog sites over the past 15 years without any issues relating to peat failure, such as Mount Lucas, Derrinlough and Cloncreen (Co. Offaly) and Bruckana (Co.'s, Kilkenny, Laois and Tipperary)

The site, which is typically flat, consists predominantly of bare locally re-vegetated cut-away peat and intact peat. The site was subject to historical peat extraction activities by Bord na Mona, with the cessation of peat extraction occurring in 2017.

The Proposed Project comprises 11 no. wind turbines, a proposed onsite 110kv substation, 1 no. meteorological mast and all associated infrastructure. A detailed description of the Proposed Project is included in Chapter 4 Description of the Proposed Project of the EIAR. The site is undulating with drainage channels running typically southwest-northeast in the southern section of the Site, and north-south and northwest-southeast direction in the norther section of the Site. The land use within the Proposed Project site comprises predominately of vegetated peatlands (milled in some areas) and agricultural lands. Several disused Bord na Mona rail lines also pass through the site.

Slope inclinations at the main infrastructure locations range from 2 to 4 degrees. The flat topography/nature of the terrain on site reflects the low risk of peat failure. Ground conditions comprised mainly of peat overlying till derived from limestone.

A combined total of 556 no. peat probes were carried out by FT and BnM to determine the depth of peat across the site. The peat depth data was collected from June 2021 to July 2025 and has been used in the assessment of peat stability for the Proposed Project site. Exploratory ground investigations, comprising 7 no. boreholes and 50 no. trial pits, were carried out on the Proposed Project site by Ground Investigations Ireland (GII) in August 2022, April 2023 and December 2023.

The purpose of the stability analysis was to determine the stability i.e. Factor of Safety (FoS), of the peat slopes. The FoS provides a direct measure of the degree of stability of a peat slope. A FoS of less than 1.0 indicates that a slope is unstable; a FoS of greater than 1.0 indicates a stable slope. An acceptable FoS for slopes is generally taken as a minimum of 1.3. The stability analysis for this project, which analysed the turbine locations, internal roads and substation, resulted in FoS above the minimum acceptable value of 1.3 and hence the site has a satisfactory margin of safety.

The risk assessment uses the results of the stability analysis in combination with qualitative factors, which cannot be reasonably included in a stability calculation but nevertheless may affect the occurrence of peat instability, to assess the risk of peat failure at the site. The results of the risk assessment are given in Appendix B.

A construction buffer zone plan based on qualitative factors identified during the site walkover is included as drawings P20-211-0600-0004 to 0006.

The findings of the peat assessment (which combines the FOS and the risk assessment), which involved analysis of 221 peat probing no. locations collected by FT, showed that the Proposed Project site has an acceptable margin of safety and that the site is suitable for the Proposed Project. Notwithstanding the above, the management of peat stability and appropriate construction practices will be inherent in the construction phase of the Proposed Project to ensure peat failures do not occur on site.

In summary, the Proposed Project site has an acceptable margin of safety and is considered to be at **low** risk of peat failure providing appropriate mitigation measures and construction controls are implemented and is suitable for wind farm development.

2. INTRODUCTION

2.1 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.100 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.

This report was written by Doireann Tarrant, MSc. Doireann is a Senior Project Engineer with FT and has 3 years' experience in geotechnical engineering. This report was reviewed by Aaron Clarke, BSc, MSc, MCSM, PGeo, EurGeol. Aaron is a Chartered Principal Geologist with FT and has over 20 years' experience in engineering geology and geoscience projects.

Site visits were undertaken by Doireann Tarrant, MSc, and Julian Borlado, MSc. Julian is a Senior Project Engineer with FT and has over 10 years' experience in geotechnical engineering.

2.2 Project Description

FT was engaged in October 2020 by Bord na Móna (BnM) on behalf of Littleton Wind Farm DAC (the Applicant) to undertake a geotechnical & peat stability assessment of the proposed Littleton Wind Farm. As detailed in Section 1.1.1 in Chapter 1, for the purposes of this EIAR, the various project components are described and assessed using the following references: 'Proposed Project', 'Proposed Wind Farm', 'Proposed Grid Connection', 'Proposed Project site' and the 'site'.

The Proposed Project site is located in County Tipperary approximately 2 kilometres (km) west of Twomileborris, approx. 2.5km east of Gortnahoe, approx. 5km northeast of Urlingord and 9km west of Thurles.

The site is relatively flat-lying with drainage channels running in both southeast-northwest and southwest-northeast directions. The R639 regional road and the Longford Pass local road run to the north of the Proposed Wind Farm and the site crosses the L2111 Derryvella local road at the southern end of the site. Several disused Bord na Mona rail lines also pass through the site. Land uses within the site are a mixture of bare cutover and cutaway peat, re-vegetation of bare peat and commercial Bord na Móna operated bog land. Several disused Bord na Mona rail lines also pass through the site.

The Proposed Project comprises 11 no. wind turbines and associated infrastructure including a proposed onsite 110kv substation and associated grid connection infrastructure, 1 no. meteorological mast, internal access tracks, 1 no. Borrow Pit and 6 no. Peat Repository Areas. A detailed description of the Proposed Project is included in Chapter 4 Description of the Proposed Project of the EIAR.

2.3 Peat Stability Assessment Methodology

FT undertook the assessment following the principles in Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Developments (2nd edition, PLHRAG, 2017). The Peat Landslide Hazard and Risk Assessment Guide (PLHRAG) is used in this report as it provides best practice methods to identify, mitigate and manage peat slide hazards and associated risks in respect of consent applications for electricity generation projects.

The aforementioned best practice guide was produced following peat failures in the Shetland Islands, Scotland in September 2003, but more pertinently following the peat failure in October 2003, during the construction of a wind farm at Derrybrien, County Galway, Ireland.

This peat stability assessment has been undertaken considering peat failures that have occurred on wind farm sites located on peatland (such as recent failures at Shass Mountain 2020, Co. Leitrim and Meenbog 2020, Co. Donegal). The lessons learned from both peat slide events have been incorporated into the design of this Proposed Project and the construction methodologies to be implemented. The Meenbog failure occurred during the construction of a section of floating road on sidelong ground in an area of weak peat. The slope angles on the Proposed Project site are lower than those at Meenbog, and no significant areas of sidelong ground are present. It is important that the existing site drainage is maintained during construction to avoid a similar failure to that on Shass Mountain, which occurred following heavy rainfall, and this is referenced in the Risk Assessments. The peat failures which took place at Shass Mountain and Meenbog occurred on upland blanket bog; the Proposed Project site is a mixture of bare cutaway peat, re-vegetated bare peat, degraded raised bog, and remnants of high bog which is a significantly different topography than that found at Shass Mountain and Meenbog. It is also noted that there have been numerous wind farms successfully constructed on bogland sites over the past 15 years with any issues relating to peat failure, such as Derrinlough (Co. Offaly), Galway Wind Park and Arderroo Wind Farm (both Co. Galway).

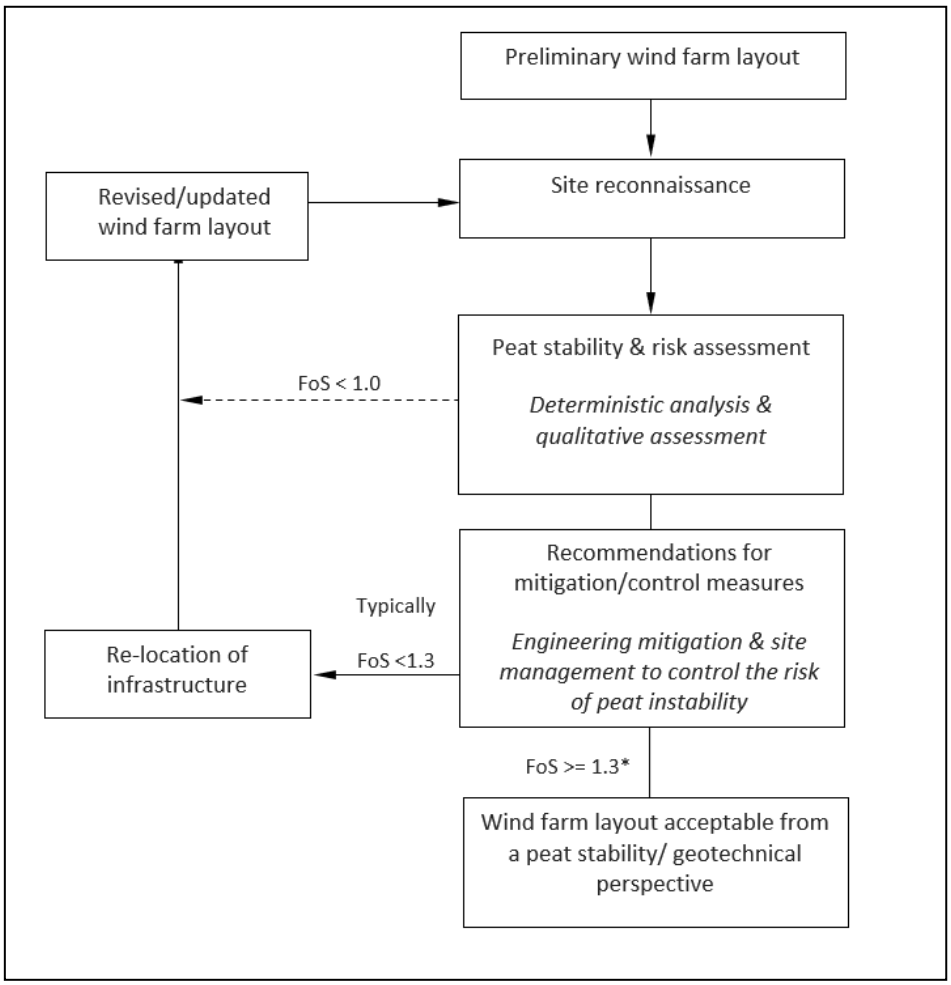
A constraints study was initially undertaken by the Environmental, Hydrogeological and Ecological members of the design team to determine the developable area on the site, prior to the site reconnaissance by engineering geologists/geotechnical engineers from FT. The extent and depth of ground investigation and peat stability analysis by FT have been undertaken in accordance with guidance within Eurocode 7 and PLHRAG, 2017 to investigate peat slopes that have the potential to impact on the Proposed Project, as applicable. Sufficient peat depth data has been recorded during the site walkovers to enable the characterisation of the peat depth across the site, with additional detail at infrastructure locations. The peat stability assessment is undertaken within the site to identify peat slope at risk from the Proposed Project, and to identify peat slopes that may pose a risk to the Proposed Project.

The geotechnical and peat stability assessment at the site included the following activities:

1. Desk study involving the review of publicly available soils and geology maps, records of historical peat failures, and aerial photography.
2. Site reconnaissance including shear strength and peat depth measurements undertaken following initial constraints study (by design team) to determine the proposed construction envelope within the site, i.e., the area within the overall site where development is possible following multidisciplinary review and assessment of constraints (refer to Chapter 3 of the EIAR).
3. Peat stability assessment of the peat slopes on site using a deterministic and qualitative approach.
4. Peat contour depth plan – compiled based on the 556 no. peat depth probes carried out across the site by FT (2024 and 2025) and BnM (2021).
5. Factor of safety plan – compiled for the short-term critical condition (undrained) for 221 no. FoS points analysed along the proposed infrastructure envelope on site.

6. Construction buffer zone plan – identifies areas with an elevated or higher construction risk where mitigation/control measures will need to be implemented during construction to minimise the potential risks and ensure they are kept within an acceptable range.
7. A peat stability risk register was compiled to assess the potential design/construction risks at the infrastructure locations and determine adequate mitigation/control measures for each location to minimise the potential risks and ensure they are kept within an acceptable range, where necessary.
8. Review of ground investigation carried out at the site by Ground Investigations Ireland (GII) between 2022 and 2024.
9. Preliminary assessment of foundation type for turbines.
10. Commentary of founding details for other infrastructure elements such as internal roads, crane hardstands, onsite substation, temporary construction compound platforms and met mast foundation.

A flow diagram showing the general methodology for the peat stability assessment is shown in Figure 2-1. The methodology illustrates the optimisation of the wind farm layout based on the findings from the site reconnaissance and stability analysis and subsequent feedback.



*An FoS of between 1.0 and 1.3 does not mean that a failure will occur, but that the area requires attention. Mitigation measures can be provided for areas with an FoS of between 1.0 and 1.3 to reduce the risk of failure.

Figure 2-1: Methodology for Peat Stability Assessment

As for all construction projects, a detailed engineering construction design must be carried out by the appointed construction stage designer prior to any construction work commencing on site. This must take account of the consented project details and any conditions imposed by that consent. This must include a confirmatory peat stability assessment to account for any changes in the environment which may have occurred in the time leading up to the commencement of construction and a peat and spoil management plan to allow for the most appropriate geotechnical and environmental led solutions to be developed for the management of peat and spoil.

2.4 Peat Failure Definition

Peat failure in this report refers to a significant mass movement of a body of peat that would have an adverse impact on a proposed wind farm development or the surrounding environment. Peat failure excludes localised movement of peat that would occur below an internal road, creep movement or erosion type events.

The potential for peat failure at the Proposed Project site is examined with respect to wind farm construction and associated activity.

2.5 Main Approaches to Assessing Peat Stability

The main approaches for assessing peat stability for wind farm developments include the following:

1. Geomorphological
2. Qualitative (judgement)
3. Index/Probabilistic (probability)
4. Deterministic (factor of safety)

Approaches (1) to (3) listed above are considered subjective and do not provide a definitive indication of stability; in addition, a high level of judgement/experience is required which makes it difficult to relate the findings to real conditions. FT apply a more objective approach, the deterministic approach (as discussed in Section 2.6).

As part of FT's deterministic approach, a qualitative risk assessment is also carried out taking into account qualitative factors, which cannot necessarily be quantified, such as the presence of mechanically cut peat, quaking peat, bog pools, sub peat water flow, slope characteristics and numerous other factors. The qualitative factors used in the risk assessment are compiled based on FT's experience of assessments and construction in peat land sites and peat failures throughout Ireland and the UK. FT have been involved with in excess of 100 wind farm developments across Ireland and the UK at various stages of development, from preliminary feasibility stage through planning and from scheme development at tender design and detailed design stage, through to the construction and operational stages. This approach follows the guidelines for geotechnical risk management as given in Clayton (2001), as referenced in the best practice for Peat Landslide Hazard and Risk Assessment Guide (PLHRAG, 2017) and considers the approach of MacCulloch (2005).

The risk assessment uses the results of the deterministic approach in combination with qualitative factors, which cannot be reasonably included in a stability calculation but nevertheless may affect the occurrence of peat instability to assess the risk of instability on a peat land site.

2.6 Peat Stability Assessment – Deterministic Approach

The peat stability assessment is carried out across a wide area of peatland to determine the stability of peat slopes and to identify areas of peatland that are suitable for development; this allows the layout of infrastructure on a particular wind farm site to be optimised. The assessment provides a numerical value (factor of safety (FoS)) of the stability of individual parcels of peatland. The findings of the assessment discriminate between areas of stable and unstable peat, and areas of marginal stability where restrictions may apply. This allows for the identification of the most suitable locations for turbines, internal roads and infrastructure.

A deterministic assessment requires geotechnical information and site characteristics which are obtained from desk study and site walkover, e.g. properties of peat/soil/rock, slope geometry, depth of peat, underlying strata, groundwater, etc. An adverse combination of the factors listed above could potentially result in instability. Using the information above, a factor of safety is calculated for the stability of individual parcels of peatland on a site (as discussed in Section 7).

The FoS is a measure of the stability of a particular slope. For any slope, the degree of stability depends on the balance of forces between the weight of the soil/peat working downslope (destabilising force) and the inherent strength of the peat/soil (shear resistance) to resist the downslope weight, see Figure 2-2.

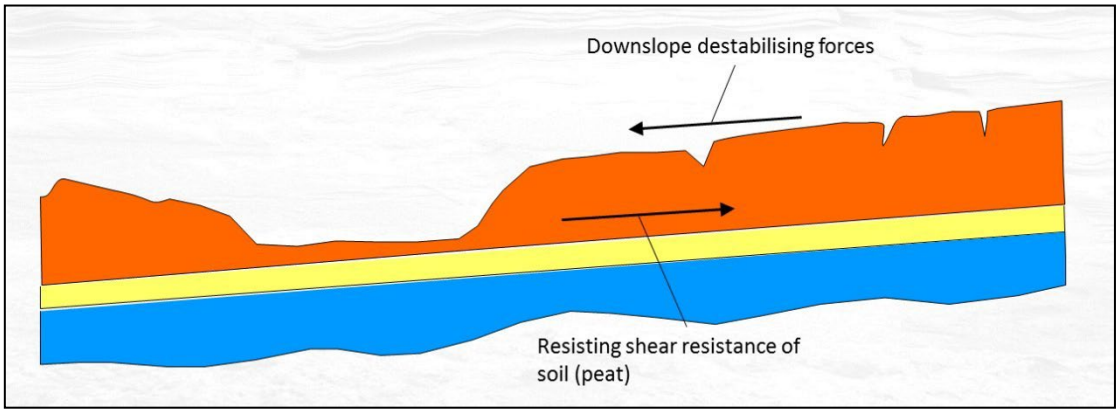


Figure 2-2: Peat Slope Showing Balance of Forces to Maintain Stability

The FoS provides a direct measure of the degree of stability of a slope and is the ratio of the shear resistance over the downslope destabilising force. Provided the available shear resistance is greater than the downslope destabilising force then the FoS will be greater than 1.0 and the slope will remain stable. If the FoS is less than 1.0 the slope is unstable and liable to fail. The acceptable factor of safety for assessment purposes is 1.3 (BS6031, 1981).

2.7 Applicability of the Factor of Safety (Deterministic) Approach for Peat Slopes

The factor of safety approach is a standard engineering approach in assessing slopes which is applied to many engineering materials, such as peat, soil, rock, etc.

The FoS approach is included in the Peat Landslide Hazard and Risk Assessments Best Practice Guide for Proposed Electricity Generation Developments (PLHRAG, 2017); see Section 5.3.1 of the guide. This guide provides best practice methods to identify, mitigate and manage peat slide hazards and associated risks in respect of consent applications for electricity generation projects.

Furthermore, the best practice guide notes that the results from the FoS approach '*has provided the most informative results'* with respect to analysing peat stability (Section 5.3.1 of the guide).

The FoS approach in this report includes undrained (short-term stability) and drained (long-term stability) analyses. The undrained condition is the critical condition for a development. The purpose of the drained analysis is to identify the relative susceptibility of rainfall-induced failures at the Proposed Project site.

Notwithstanding the above, the stability analysis used by FT in this report also includes qualitative factors to determine the potential for peat stability i.e. the analysis used does not solely rely on the factor of safety approach.

The deterministic analysis is considered an acceptable engineering design approach. This concurs with the best practice guide referenced above.

2.8 Assessment of Change in Water Level on the Peat Slope

The deterministic approach includes undrained (short-term stability) and drained (long-term stability) analysis to assess the FoS for the peat slopes against a peat failure.

The drained loading condition applies in the long-term. This condition examines the effect of the change in groundwater level as a result of rainfall on the existing stability of the natural peat slopes. For the drained analysis the level of the water table above the failure surface is required to calculate the FoS for the peat slope.

In order to represent varying water levels within the peat slopes, a sensitivity analysis is carried out which assesses varying water level in the peat slopes i.e. water levels ranging from 0 to 100% of the peat depth is conducted, where 0% equates to the peat been completely dry and 100% equates to the peat being fully saturated. The results of this analysis are presented in Section 7 of this report.

3. DESK STUDY

3.1 Desk Study

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

- Geological plans and Geological Survey of Ireland database
- Ordnance survey plans
- Literature review of peat failures

The Geological Survey of Ireland online dataset viewer (GSI, 2025) and geological plans (GSI, 1999) for the site were 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, 2025) on peat failures/landslides in the vicinity of the site.

3.2 Soils, Subsoil & Bedrock

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

The GSI subsoils maps (Figure 8.2, Vol. 4) indicates that the Proposed Project site is underlain by a combination of predominantly cut over raised peat with small pockets of till derived from limestones and an area of bedrock outcrop or subcrop.

In relation to bedrock, the Proposed Project site is underlain by 4 no. geological formations (Figure 8.3, Vol.4). The northern region of the Site including T01, T02, T03, T04 and T05, is underlain by Ballysteen Formation described as a dark muddy limestone shale. The Lisduff Oolite Member (Ballysteen Formation) is located in an area within the Ballysteen Formation in the northeast region of the site which includes the footprint of the Borrow Pit and comprises thick bedded, pale blue-grey, cross-bedded, well jointed oolite, with some crinoid ossicles and rare well-preserved calices The southern region of the Site which includes the footprints of turbines T06, T07, T08, T09 and T10 is underlain by Waulsortian Limestones, a massive un-bedded lime-mudstone (WA). The Aghmacart Formation, a dark shaly micrite, peloidal limestone (AG) is located in a small area at the most southern region of the Site, within the footprint of turbine T11.

Ther are no surface karst features identified in the survey area on the GSI database (Figure 8.4, Vol. 4). The nearest karst features are 2 no. swallow holes located approx. 2km southeast of the Site boundary near T08 (approx. 2.1km from this turbine). There are also 2 no. swallow holes located 3km west of the Site, an enclosed depression 4km northeast of the site boundary.

The GSI Online Irish Geological Heritage database (Figure 8.5, Vol. 4) indicates that the Site is located within an area of specific geological heritage interest. Littleton Bog including Templeuohy Bog, Derryhogan Bog and Derryvilla Bog is considered a County Geological Site (CGS). The heritage site has been described as a bog which exists due to the geological and hydrogeological process of peat growth and may be designated a geological NHA owing to the importance of the vegetation record held within the pollen of the peat.

3.3 Previous Failures

There are no recorded peat failures within the Littleton wind farm site (GSI, 2025) which is as expected for a flat site. The nearest recorded failure occurred at Cullahill Mountain which is located 7km north of the TDR and 16km northeast of the wind farm site. There are no details provided of the landslide mechanism or the year that this landslide occurred. A landslide was recorded in Cappamura Bog, Dundrum on cutover peat approximately 19km southwest of the study area. The landslide mechanism is noted as a burst of peat. It occurred in 1788 and there have been no other recorded failures since.

The landslide susceptibility (Figure 8.8, Vol. 4) of the site was classified by the GSI (2025) as '**low**' susceptibility, which is expected given the flat terrain present.

The presence, or otherwise, of relict peat failures or clustering of relict failures within an area is an indicator that particular site conditions exist that pre-dispose a site to failure or not as the case may be. Hence based on the historical data reviewed and the terrain and ground conditions present on site it can be concluded that site conditions in the area of the Littleton site have a limited potential of peat failure.

4. FINDINGS PF SITE RECONNAISSANCE

4.1 Site Reconnaissance

As part of the assessment of potential peat failure at the Proposed Project site, FT carried out a site reconnaissance in conjunction with the desk study review described in Section 3. This comprised walkover inspections of the site with recording of salient geomorphological features with respect to the Proposed Project, which included peat depth and preliminary assessment of peat strength. The information gathered from these site visits provide sufficient information for a site-wide assessment of the extent, depth and strength of peat present at the Proposed Project site.

The following salient geomorphological features were considered:

- Active, incipient or relict instability (where present) within the peat deposits
- Presence of shallow valley or drainage line
- Wet areas
- Any change in vegetation
- Peat depth
- Slope inclination and break in slope

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

The method 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.

4.2 Findings of Site Reconnaissance

The site reconnaissance comprised a walkover inspection of the site by engineers from FT between June 2024 to July 2025. Weather conditions for the site visits ranged from dry to wet. The dates of each site reconnaissance and the associated FT personal are listed below.

- June 2024 (undertaken by FT's Senior Project Geotechnical Engineer Julian Borlado)
- July 2025 (undertaken by FT's Principal Geologist Aaron Clarke)

The findings from the site walkover have been used to optimise the layout of the infrastructure on site. The main findings of the site walkover of the Proposed Project site are as follows:

1. The site is typically covered in a layer of peat and is relatively flat. Bare cutover and cutaway peat, re-vegetation of bare peat and degraded raised bog from historical peat extraction activities are present across the site (see Appendix A).
2. A total of 556 no. peat depth probes were carried out by FT and BnM on site. Peat depths recorded from peat probing across the site ranged from 0.1m to >6m with an average depth of 1.6m (drawings P20-211-0600-0001 to 0003). Approximately 90% of peat depth probes recorded peat depths of less than 3.0m. A number of localised readings were recorded where peat depths ranged from 3 to >6m, however these were not located near any infrastructure locations.

3. The peat depths recorded at the turbine locations varied from 0.6m to 2m with an average depth of 1m. The ground investigation identified that at turbine locations T07, T09 and T10, the peat was underlain by soft clay or silt deposits (lacustrine deposits), ranging from 1.2m to 3.1m in thickness.
   (1) With respect to the new proposed internal roads, peat depths ranged from 0 to 3.7m.
   (2) Slope angles at the turbine locations ranged from 2 to 4 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.
   (3) The slope angle quoted typically reflects the slope within the footprint of each infrastructure location. The flat topography/nature of the terrain on site highlights the low risk of peat failure.
   (4) Localised areas of ponded water were recorded. This is not unexpected given the ground conditions and the flat terrain present across the site.
   (5) No evidence of past failures or any significant signs of peat instability were noted on site.
   (6) A summary of the site walkover findings for the Proposed Project site are as follows:
      (a) The site is typically covered in a layer of peat with typically flat terrain and open peatland. Peat depths recorded across the site by means of peat probing ranged from 0.1 to 6.0m with an average depth of 1.6m.
      (b) A construction buffer zone plan has been produced for the site (drawings P20-211-0600-0004 to 0006). This shows areas on the site where no development is advised and areas with an elevated or higher construction risk.
      (c) The results of the peat depth probing, shear strength testing of the peat and qualitative factors identified on site have been used in the stability and risk assessments, see Sections 6, 7 and 8 of this report for details.
      (d) Based on the findings from the walkover survey, the Proposed Project is considered to have a **low** risk of peat failure.

5. GROUND INVESTIGATION

Ground investigations (GI) in the form of trial pits and rotary boreholes were carried out at the Proposed Project site by Ground Investigations Ireland (GII) in August 2022, March 2023 and December 2023. The ground investigations by GII comprised a total of 50 no. trial pits and 7 no. rotary boreholes with associated laboratory testing.

The laboratory testing included the following:

- Classification testing for overburden material
- Minimum and maximum density values for overburden material
- Determination of dry density/moisture content relationship

The trial pits logs, photographs and associated laboratory testing are included within Appendix E, F and G of this report.

The purpose of the ground investigation was to assess the ground conditions at the main infrastructure locations and potential borrow pit locations across the site. A ground investigation location plan is included as drawings P20-216-0600-0007 to 0009) in this report.

5.1 Summary of Ground Conditions

The ground conditions at the Proposed Project site can be typically categorised into the following deposits:

Peat – Typically described as Very soft or firm black dark brownish amorphous or pseudo fibrous or fibrous PEAT. Peat thicknesses ranged from 0.2m to 4.9m from trial pits and 4.1 to 7.1m in the boreholes.

Lacustrine Clay & Silt – Typically described as soft blueish-grey or yellowish brown silty very sandy or slightly sandy or slightly gravelly sandy silt with fibres or shell fragments. The thickness of the layer is variable across the site.

Coarse-grained Till – Typically described as grey slightly sandy Gravel or sandy very silty Gravel or silty Sand with boulders and cobbles. Sand is fine to coarse, and gravel is angular to subrounded. The thickness of the layer is variable across the site.

Limestone Bedrock – Strong locally very strong thinly bedded grey and dark grey sparry bioclastic fine- and coarse-grained LIMESTONE massive dark blackish grey fine grained calp limestone. Upper 1.0 to 4.0m possible weathered rock described as subrounded to subangular fine to coarse assorted light grey and dark grey limestone GRAVEL with rare cobble some grey slightly sandy slightly gravelly silt. This is consistent with the GSI bedrock mapping which indicates that the site is underlain by dark muddy Limestone or Dark Limestone, Mudstone, Sandstone.

Groundwater was recorded in 40 no. of the trial pits on site and varied between 0.6m and 3.9mbgl.

5.2 Summary of Laboratory Tests

Following completion of intrusive site investigations by GII laboratory testing was scheduled by FT and undertaken by Ground Investigations Ireland (GII). Soil testing was carried out by Professional Soils Laboratory (PSL) in the United Kingdom (UK) in accordance with BS1377 (1990) - *Methods of Test for Soils for Civil Engineering Purposes*. This laboratory is accredited in accordance with the Irish National Accreditation Board (INAB).

The samples of the overburden material were analysed for a range of parameters which included Particle Size Distribution (PSD), Moisture Content and Atterberg Limits.

The results are summarised in Table 5-1. Atterberg limit tests carried out on the samples classify the material as Clay of low to intermediate plasticity, or non-plastic. No elevated sulphate levels were detected in the samples tested. The results indicate that the fine-grained soils tested are predominantly low to intermediate plasticity Clays. The moisture content was typically lower for granular soils than cohesive soils.

Table 5-1: Laboratory Testing

Type	N	Min	Max	Remarks
Natural Moisture Content (%)	27	6.7	463	Typical % from gravel and silt dominated soil ranged from 6.7% to 29%. Peat soil recorded % from 340% to 463%.
Atterberg Limits (plasticity index %)	23	-	-	Low to Intermediate plasticity Clay
Particle Size Distribution	12	-	-	% passing 63 µm ranged from 0 to 56%
Point Load Strength Index	15	0.64	6.43	Strength is classified as Medium Strong to Very Strong.
California Bearing Ratio (CBR) (%)	5	0.1	1.6	
Loss on Ignition (%)	4	<1.0	1.3	
Soil Organic Content (%)	13	<0.2	88.7	
Sulphate Total (%)	13	<0.01	0.02	
Water Soluble Sulphate as SO4 (g/L)	13	0.0029	0.0297	
Sulphur as S (%)	13	0.01	0.15	
pH	13	5.20	8.67	

5.3 Summary of Geotechnical Parameters

Table 5-2 contains characteristic geotechnical parameters for the main material types likely to be encountered on the Proposed Project site. Where 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 5-2: Summary of Geotechnical Parameters

Material Type/Strata	Unit Weight	Geotechnical Parameters		
		Undrained Parameters	Drained Parameters	
	γ (kN/m³)	cu (kPa)	ϕ' (°)	c' (kPa)
Peat	11	6 (3)	25	4
Lacustrine Soil	18	20	26	0
Coarse-grained Till	20	-	32	0

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.
Note (3) A lower bound undrained shear strength, cu for the peat of 6kPa was selected. The lowest recorded value on the Proposed Project site was 15kPa hence a value of 6kPa is a conservative value.

6. PEAT DEPTHS, STRENGTH & SLOPE AT PROPOSED INFRASTRUCTURE LOCATIONS

As part of the site walkover, peat depth, in-situ peat strength and slope angles were recorded at various locations across the site.

6.1 Peat Depth

Peat probes were carried out at/near to proposed turbine locations and internal roads and other main infrastructure elements to determine the peat depth on site. At all proposed turbine locations, up to 5 no. probes were carried out around the turbine location, and an average peat depth was calculated.

6.2 Peat Strength

The strength testing was carried out in-situ using a Geonor H-60 Hand-Field Vane Tester. From FT's experience hand vanes give indicative results for in-situ strength of peat and would be considered best practice for the field assessment of peat strength. Strength testing was carried out at selected locations across the site to provide representative coverage of indicative peat strengths. The results of the vane testing with depth are presented in Figure 6-1.

6.3 Slope Angle

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 and from contour survey plans for the Proposed Project site.

The slope angle quoted typically reflects the slope within the footprint of each proposed infrastructure location. It should be noted that slope angles derived from contour survey plans would be considered approximate, as such surveys are dependent on the density of survey data and do not always reflect local variations in ground topography. Slope angles recorded during the site reconnaissance by FT using handheld equipment would generally be deemed more accurate and representative of local topography.

6.4 Summary of Findings

Based on the peat depths recorded across the site by the peat probes carried out by FT and BNM and the trial pits and boreholes excavated by GII, the peat varied in depth from 0.1 to >6m with an average depth of 1.6m. All peat depth probes carried out on site have been utilised to produce a peat depth contour plan for the site (drawings P20-216-0600-0001 to 0003).

A summary of the peat depths at the proposed infrastructure locations is given in Table 6.1. The data presented in Table 6.1 is used in the peat stability assessment of the site.

Table 6-1: Peat Depth & Slope Angle at Proposed Infrastructure Locations

Proposed Infrastructure	Easting	Northing	Peat Depth Range (m) (Note 1)	Average Peat Depth (m)	Slope Angle (°) (Note 2)
Turbine 1	591665	5835865	1	1	2
Turbine 2	591350	5835352	1.2	1.2	3
Turbine 3	591232	5834744	1.2	1.2	2
Turbine 4	590660	5834737	0.6	0.6	3
Turbine 5	590455	5834074	0.95	0.95	3
Turbine 6	591111	5833791	1.1	1.1	2
Turbine 7	590118	5833568	0.75	0.75	2
Turbine 8	590679	5833125	0.7	0.7	2
Turbine 9	588625	5830434	0.65	0.65	3
Turbine 10	588951	5830105	1.2	1.2	2
Turbine 11	589162	5829699	1.95	1.95	2
Construction Compound 1	620182	651965	0.7 to 1.8	1.0	2
Construction Compound 2	621707	653881	0.9 to 2.5	1.7	2
Construction Compound 3	623010	655591	0.5 to 1.8	1.1	2
Construction Compound 4	623297	658785	1.0	1.0	2
Main CBoP and TSA Compound	622898	659710	1.6 to 2.5	1.9	2
Amenity Car Park	623216	659106	No Peat		
Substation	622793	658615	3.2 to 3.5	3.35	2
Meteorological Mast	622153	654752	0.8	0.8	2
Security Cabin (Longford Pass Entrance)	623089	659308	3.3	3.3	2
Security Cabin (L2111 Derryvella Entrance)	621234	653009	No Peat		
Borrow Pit 1	623827	658938	No Peat		
Peat Repository Area A	623502	658857	1.1 to 3.6	2.5	2
Peat Repository Area B1	623703	657699	0.5 to 2.4	1.4	2
Peat Repository Area B2	623851	657702	0.8 to 2.7	1.7	No Data
Peat Repository Area C	621191	651841	1.0	1.0	No Data
Peat Repository Area D	621083	651739	0.4 to 3.4	1.9	2
Peat Repository Area E	621216	651555	1.5 to 3.6	2.4	2

Note (1) Based on probe results from the site walkovers. The range of peat depths for the infrastructure locations are typically based on a 10m grid carried out around the infrastructure element, where accessible.
Note (2) 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) and from contour survey plans for site. The slope angle quoted typically reflects the slope within the footprint of each infrastructure location.
Note (3) The data presented in the Table above is used in the peat stability assessment of the site.

In addition to probing, in-situ shear vane testing was carried out as part of the ground investigation. Strength testing was carried out at selected locations across the site to provide representative coverage of indicative peat strengths. The results of the vane testing with depth are presented in Figure 6-1.

The hand vane results indicate undrained shear strengths in the range 15 to 75kPa, with an average value of 42kPa. The strengths recorded would be typical of well drained peat present within the site.

Peat strength at sites of known peat failures (assuming undrained loading failure) are generally very low, for example the undrained shear strength at the Derrybrien failure (AGEC, 2004) as derived from back-analysis, was estimated at 2.5kPa. The recorded undrained strength at the Proposed Project site is significantly greater than the lower bound values for Derrybrien indicating that there is no close correlation to the peat conditions at the Derrybrien site and that there is significantly less likelihood of failure on the Proposed Project site.

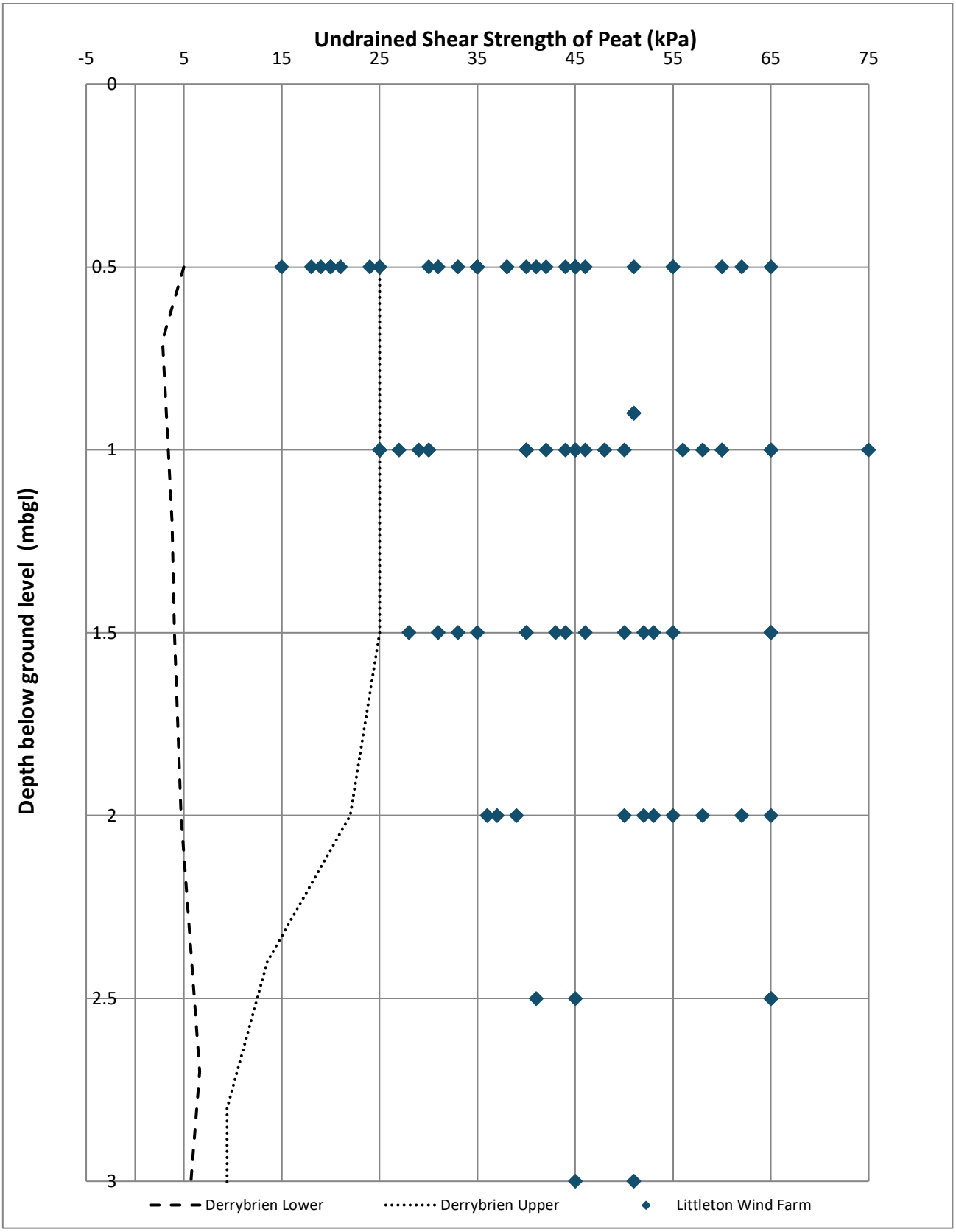


Figure 6-1: Undrained Shear Strength (cu) Profile for Peat with Depth

7. PEAT STABILITY ASSESSMENTS

The peat stability assessment includes an assessment of the stability of the natural peat slopes for individual parcels across the Proposed Project site including at the proposed turbine, substation and me mast locations and along the proposed internal roads. The assessment also analyses the stability of the natural peat slopes with a surcharge loading of 10kPa, equivalent to placing 1m of stockpiled peat on the surface of the peat slope.

7.1 Methodology for Peat Stability Assessment

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

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

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

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

Undrained shear strength values (c_u) for peat are used for the total stress analysis. Based on the findings of the 2003 Derrybrien failure and other failures in peat, undrained loading during construction was found to be the critical failure mechanism.

A drained analysis requires effective cohesion (c') and effective friction angle (ø') values for the calculations. These values can be difficult to obtain because of disturbance experienced when sampling peat and the difficulties in interpreting test results due to the excessive strain induced within the peat. To determine suitable drained strength values a review of published information on peat was carried out. Table 7.1 shows a summary of the published information on peat together with drained strength values.

From Table 7.1 the values for c' ranged from 1.1 to 8.74kPa and ø' ranged from 21.6 to 43°. The average c' and ø' values are 4.5kPa and 30° respectively. Based on the above, it was considered to adopt a conservative approach and to use design values below the averages. For design the following general drained strength values have been used for the site:

c' = 4kPa
$ø'$ = 25°

Table 7-1: List of Effective Cohesion and Friction Angle Values for Peat

Reference	Cohesion, c' (kPa)	Friction Angle, ø' (degs)	Testing Apparatus/ Comments
Hanrahan et al (1967)	5 to 7	36 to 43	From triaxial apparatus
Rowe and Mylleville (1996)	2.5	28	From simple shear apparatus
Landva (1980)	2 to 4	27.1 to 32.5	Mainly ring shear apparatus for normal stress greater than 13kPa
	5 to 6	-	At zero normal stress
Carling (1986)	6.5	0	-
Farrell and Hebib (1998)	0	38	From ring shear and shear box apparatus. Results are not considered representative.
	0.61	31	From direct simple shear (DSS) apparatus. Result considered too low therefore DSS not considered appropriate
Rowe, Maclean and Soderman (1984)	1.1	26	From simple shear apparatus
	3	27	From DSS apparatus
McGreever and Farrell (1988)	6	38	From triaxial apparatus using soil with 20% organic content
	6	31	From shear box apparatus using soil with 20% organic content
Hungr and Evans (1985)	3.3	-	Back-analysed from failure
Dykes and Kirk (2006)	3.2	30.4	Test within acrotelm
Dykes and Kirk (2006)	4	28.8	Test within catotelm
Warburton et al (2003)	5	23.9	Test in basal peat
Warburton et al (2003)	8.74	21.6	Test using fibrous peat
Hendry et al (2012)	0	31	Remoulded test specimen
Komatsu et al (2011)	8	34	Remoulded test specimen
Zwanenburg et al (2012)	2.3	32.3	From DSS apparatus
Den Haan & Grognet (2014)	-	37.4	From large DSS apparatus
O'Kelly & Zhang (2013)	0	28.9 to 30.3	Tests carried out on reconstituted, undisturbed and blended peat samples

7.2 Analysis to Determine Factor of Safety (Deterministic Approach)

The purpose of the analysis was to determine the FoS of the peat slopes using infinite slope analysis. The analysis was carried out at the proposed turbine locations, along the proposed internal roads and at various locations across the Proposed Project site.

The FoS provides a direct measure of the degree of stability of the slope. A FoS of less than unity indicates that a slope is unstable, a FoS of greater than unity indicates a stable slope.

The acceptable safe range for FoS typically ranges from 1.3 to 1.4. The previous code of practice for earthworks BS 6031:1981 (BSI, 1981), provided advice on design of earthworks slopes. It stated that for a first-time failure with a good standard of site investigation the design FoS should be greater than 1.3.

As a general guide the FoS limits for peat slopes in this report are summarised in Table 7.2.

Table 7-2: Factor of Safety Limits for Slopes

Factor of Safety (FoS)	Degree of Stability
Less than 1.0	Unstable (red)
Between 1.0 and 1.3	Marginally stable (yellow)
1.3 or greater	Acceptable (green)

Eurocode 7 (EC7) (IS EN 1997-1:2005) now serves as the reference document and the basis for design geotechnical engineering works. The design philosophy used in EC7 applies partial factors to soil parameters, actions and resistances. Unlike the traditional approach, EC7 does not provide a direct measure of stability, since global FoS are not used.

As such, and in order to provide a direct measure of the level of safety on a site, EC7 partial factors have not been used in this stability assessment. The results are given in terms of FoS.

A lower bound undrained shear strength, c_u for the peat of 6kPa was selected for the assessment based on the c_u values recorded across the Proposed Project site. It should be noted that a c_u of 6kPa for the peat is considered a conservative value for the analysis and is not representative of all peat present across the Proposed Project site. In reality the peat generally has a higher undrained strength.

The formula used to determine the factor of safety for the undrained condition in the peat (Bromhead, 1986) is as follows:

$$F = \frac{c_u}{\gamma z \sin\alpha \cos\alpha}$$

Where:

F = Factor of Safety
c_u = Undrained strength
γ = Bulk unit weight of material

z = Depth to failure plane assumed as depth of peat
α = Slope angle

The formula used to determine the factor of safety for the drained condition in the peat (Bromhead, 1986) is as follows:

$$F = \frac{c' + (\gamma z - \gamma_w h_w)\cos^2 \alpha \tan \phi'}{\gamma z \sin \alpha \cos \alpha}$$

Where:

F = Factor of Safety
c' = Effective cohesion
γ = Bulk unit weight of material
z = Depth to failure plane assumed as depth of peat
γ_w = Unit weight of water
h_w = Height of water table above failure plane
α = Slope angle
ϕ' = Effective friction angle

For the drained analysis the level of the water table above the failure surface is required to calculate the FoS for the slope. Since the water level in cutover/cutaway peatland can be variable and can be recharged by rainfall, it is not feasible to establish its precise location throughout the site. Therefore, a sensitivity analysis using water level ranging between 0% and 100% of the peat depth was conducted, where 0% equates to the peat being completely dry and 100% equates to the peat been fully saturated.

The following general assumptions were used in the analysis of peat slopes at each location:

1. Peat depths are based on the maximum peat depth recorded at each location from the walkover surveys and ground investigation.
2. The slope angles used in the peat stability assessment were obtained using a combination of readings taken during the site reconnaissance by FT using handheld equipment and from contour survey plans for the Proposed Project site. It should be noted that slope angles derived from contour survey plans would be considered approximate, as such surveys are dependent on the density of survey data and do not always reflect local variations in ground topography.
3. Slope angle at base of sliding assumed to be parallel to ground surface.

4. A lower bound undrained shear strength, c_u for the peat of 6kPa was selected for the assessment. The lowest recorded value on the Proposed Project site during the site walkover was 15kPa. It should be noted that a c_u of 6kPa for the peat is considered a conservative value for the analysis and is not representative of all peat present across the Proposed Project site. In reality, the peat has a significantly higher undrained strength as a result of the extensive drainage and extraction works which have been carried out on site.

For the stability analysis two load conditions were examined, namely

Condition (1): no surcharge loading

Condition (2): surcharge of 10 kPa, equivalent to 1m of stockpiled peat assuming a precautionary scenario

7.3 Results of Analysis

7.3.1 Undrained Analysis for the Peat

The results of the undrained analysis for the natural peat slopes are presented in Appendix C and the results of the undrained analysis for the most critical load case (load condition 2) are shown on drawings P20211-0600-0010 to 0012. The undrained analysis for load condition 2 is considered the most critical load case as most peat failures occur in the short term upon loading of the peat surface. The results from the main infrastructure locations are summarised in Table 7.3.

The calculated FoS for load condition 1 is in excess of 1.3 for each of the infrastructure locations (221 no. locations) analysed with a range of FoS of 10.42 to 57.31, indicating a low risk of peat instability.

The calculated FoS for load condition 2 is in excess of 1.3 for each of the infrastructure locations (221 no. locations) analysed with a range of FoS of 5.74 to 21.49, indicating a low risk of peat instability.

Given that the site is predominantly flat, the potential for peat instability is inherently low and no peat stability issues are anticipated.

Table 7-3: Factor of Safety Results (Undrained Condition)

Turbine No./Waypoint	Easting	Northing	Factor of Safety for Load Condition	
			Condition (1)	Condition (2)
T01	624044	657148	34.38	17.19
T02	623721	656639	28.65	15.63
T03	623595	656033	28.65	15.63
T04	623023	656034	57.31	21.49
T05	622809	655374	36.19	17.63
T06	623461	655081	31.26	16.37
T07	622465	654873	45.85	19.65
T08	623020	654421	49.12	20.23

Turbine No./Waypoint	Easting	Northing	Factor of Safety for Load Condition	
			Condition (1)	Condition (2)
T09	620928	651759	52.90	20.84
T10	621249	651425	28.65	15.63
T11	621455	651016	17.63	11.66
Construction Compound 1	620182	651965	17.19	11.46
Construction Compound 2	621707	653881	38.20	18.10
Construction Compound 3	623010	655591	11.48	5.74
Construction Compound 4	623297	658785	34.38	17.19
Main CBoP and TSA Compound	623216	659106	20.84	12.98
Amenity Car Park	622898	659710	No Peat	
Substation	622793	658615	24.56	14.33
Meteorological Mast	622153	654752	42.98	19.10
Security Cabin (Longford Pass Entrance)	623089	659308	10.42	8.00
Security Cabin (L2111 Derryvella Entrance)	621234	653009	No Peat	
Borrow Pit	623827	658938	No Peat	
Peat Repository Area A	623502	658857	12.06	8.93
Peat Repository Area B1	623703	657699	No Information	
Peat Repository Area B2	623851	657702	No Information	
Peat Repository Area C	621191	651841	34.38	17.19
Peat Repository Area D	621083	651739	16.37	11.09

Turbine No./Waypoint	Easting	Northing	Factor of Safety for Load Condition	
			Condition (1)	Condition (2)
Peat Repository Area E	621216	651555	24.56	14.33

7.3.2 Drained Analysis for the Peat

The results of the drained analysis for the peat are presented in Appendix C. The results from the main infrastructure locations are summarised in Table 7.4. As stated previously, the drained loading condition examines the effect of rainfall and water on the existing stability of the natural peat slopes.

The calculated FoS for load condition 1 is in excess of 1.3 for each of the locations (221 no. locations) analysed with a range of FoS of 6.95 to 64.92 indicating a low risk of peat instability.

The calculated FoS for load condition 2 is in excess of 1.30 for each of the locations (221 no. locations) analysed with a range of FoS of 8.28 to 41.04 , indicating a low risk of peat instability.

Given that the site is predominantly flat, the potential for peat instability is inherently low and no peat stability issues are anticipated.

Table 7-4: Factor of Safety Results (Drained Conditions)

Turbine No./Waypoint	Easting	Northing	Factor of Safety for Load Condition	
			Condition (1)	Condition (2)
T01	614198	727373	49.64	38.18
T02	614481	726939	45.82	37.13
T03	614779	726516	45.82	37.13
T04	615314	727112	64.92	41.04
T05	615978	727580	50.84	38.47
T06	615647	727935	47.55	37.63
T07	614968	727549	57.28	39.81
T08	615375	728345	59.46	40.20

Turbine No./Waypoint	Easting	Northing	Factor of Safety for Load Condition	
			Condition (1)	Condition (2)
T09	616021	728746	61.98	40.61
T10	615717	729399	19.10	22.56
T11	616379	729349	38.47	34.49
Construction Compound 1	620182	651965	12.73	17.73
Construction Compound 2	621707	653881	25.47	26.13
Construction Compound 3	623010	655591	7.65	8.28
Construction Compound 4	623297	658785	49.64	38.18
Main CBoP and TSA Compound	623216	659106	40.61	35.36
Amenity Car Park	622898	659710	No Peat	
Substation	622793	658615	16.37	20.68
Meteorological Mast	622153	654752	55.37	39.45
Security Cabin (Longford Pass Entrance)	623089	659308	6.95	11.54
Security Cabin (L2111 Derryvella Entrance)	621234	653009	No Peat	
Borrow Pit 1	623827	658938	No Peat	
Peat Repository Area A	623502	658857	34.76	32.67
Peat Repository Area B1	623703	657699	No Information	
Peat Repository Area B2	623851	657702	No Information	
Peat Repository Area C	621191	651841	49.64	38.18

Turbine No./Waypoint	Easting	Northing	Factor of Safety for Load Condition	
			Condition (1)	Condition (2)
Peat Repository Area D	621083	651739	10.92	16.01
Peat Repository Area E	621216	651555	16.37	20.68

8. PEAT STABILITY RISK ASSESSMENT

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

The risk assessment uses the results of the stability analysis (deterministic approach) in combination with qualitative factors, which cannot be reasonably included in a stability calculation but nevertheless may affect the occurrence of peat instability, to assess the risk for each infrastructure element.

For each of the main infrastructure elements, a risk rating (product of probability and impact) is calculated and rated as shown in Table 8.1. Where a subsection is rated 'Medium' or 'High', control measures are required to reduce the risk to at least a 'Low' risk rating. Where a subsection is rated 'Low' or 'Negligible', only routine control measures are required.

Table 8-1: Risk Rating Legend

17 to 25	High: avoid works in area or significant control measures required
11 to 16	Medium: notable control measures required
5 to 10	Low: only routine control measures required
1 to 4	Negligible: none or only routine control measures required

A full methodology for the peat stability risk assessment is given in Appendix D.

8.1 Summary of Risk Assessment Results

The results of the peat stability risk assessment for potential peat failure at the main infrastructure elements is presented as a Geotechnical Risk Register in Appendix B and summarised in Table 8.2.

The risk rating for each proposed infrastructure element of the Proposed Project is designated Negligible following mitigation/control measures being implemented. Sections of internal roads to the nearest proposed infrastructure element will be subject to the same mitigation/control measures that apply to the nearest proposed infrastructure element.

Given that the site is predominantly flat, the potential for peat instability is inherently low and no peat stability issues are anticipated.

Details of the required mitigation/control measures, where required, can be found in the Geotechnical Risk Register for each infrastructure element (Appendix B).

Table 8-2: Summary of Peat Stability Risk Register

Proposed Infrastructure	Pre-Control Measure Implementation Risk Rating	Pre-Control Measure Implementation Risk Rating Category	Notable Control Measures Required	Post-Control Measure Implementation Risk Rating	Post-Control Measure Implementation Risk Rating Category
T01	Negligible	1 to 4	Yes	Negligible	1 to 4
T02	Negligible	1 to 4	No	Negligible	1 to 4
T03	Negligible	1 to 4	No	Negligible	1 to 4
T04	Negligible	1 to 4	No	Negligible	1 to 4
T05	Negligible	1 to 4	No	Negligible	1 to 4
T06	Negligible	1 to 4	No	Negligible	1 to 4
T07	Low	5 to 10	Yes	Negligible	1 to 4
T08	Negligible	1 to 4	No	Negligible	1 to 4
T09	Negligible	1 to 4	No	Negligible	1 to 4
T10	Negligible	1 to 4	No	Negligible	1 to 4
T11	Negligible	1 to 4	No	Negligible	1 to 4
Construction Compound 1	Negligible	1 to 4	No	Negligible	1 to 4
Construction Compound 2	Negligible	1 to 4	No	Negligible	1 to 4
Construction Compound 3	Negligible	1 to 4	No	Negligible	1 to 4
Construction Compound 4	Negligible	1 to 4	No	Negligible	1 to 4
Main CBoP and TSA Compound	Negligible	1 to 4	No	Negligible	1 to 4
Amenity Car Park	No Peat				
Substation	Low	5 to 10	Yes	Negligible	1 to 4
Meteorological Mast	Negligible	1 to 4	No	Negligible	1 to 4
Security Cabin (Longford Pass Entrance)	Low	5 to 10	Yes	Negligible	1 to 4
Security Cabin (L2111 Derryvella Entrance)	No Peat				
Borrow Pit	No Peat				
Peat Repository Area A	Low	5 to 10	Yes	Negligible	1 to 4
Peat Repository Area B1	Negligible	1 to 4	No	Negligible	1 to 4

Proposed Infrastructure	Pre-Control Measure Implementation Risk Rating	Pre-Control Measure Implementation Risk Rating Category	Notable Control Measures Required	Post-Control Measure Implementation Risk Rating	Post-Control Measure Implementation Risk Rating Category
Peat Repository Area B2	Negligible	1 to 4	No	Negligible	1 to 4
Peat Repository Area C	Negligible	1 to 4	No	Negligible	1 to 4
Peat Repository Area D	Low	5 to 10	Yes	Negligible	1 to 4
Peat Repository Area E	Low	5 to 10	Yes	Negligible	1 to 4

9. INDICATIVE FOUNDATION TYPE AND FOUNDATION DEPTH FOR TURBINES

9.1 Summary

Based on a review of the ground investigation information for 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 9-1.

Table 9-1: Summary of Indicative Turbine and Infrastructure Foundation Type and Founding Depths

Turbine No.	Foundation Type	Relevant GI	Indicative founding depth (m bgl)	Comment
T1	Piled foundations	TP-47	>5 Note 1	The site investigation works carried out indicate that piled foundation will be required.
T2	Piled foundations	TP-05	>3.0	The site investigation works carried out indicate that piled foundation will be required.
T3	Piled foundations	TP-06	>5 Note 1	The site investigation works carried out indicate that piled foundation will be required.
T4	Piled foundations	TP-07	>5 Note 1	The site investigation works carried out indicate that piled foundation will be required.
T5	Piled foundations	TP-08	>5 Note 1	The site investigation works carried out indicate that piled foundation will be required.
T6	Piled foundations	TP-09	>3.5	The site investigation works carried out indicate that gravity or piled foundation will be required.
T7	Piled foundations	TP-10	>5 Note 1	The site investigation works carried out indicate that piled foundation will be required.
T8	Piled foundations	TP-11	>4.3	The site investigation works carried out indicate that piled foundation will be required.
T9	Gravity foundations	TP-12	3.0	The site investigation works carried out indicate that gravity foundation will be required.
T10	Gravity foundations	TP-13	2.8	The site investigation works carried out indicate that gravity foundation will be required.

Turbine No.	Foundation Type	Relevant GI	Indicative founding depth (m bgl)	Comment
T11	Piled foundations	TP-T11	>5 Note 1	The site investigation works carried out indicate that piled foundation will be required.
Note 1 - Pile design will require confirmatory ground investigation.				

It should be noted that confirmatory ground investigation will be carried out prior to construction at each proposed turbine location 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 to confirm the foundation types and founding stratums assumed in Table 9-1. It is possible that following the completion of further ground investigation prior to construction that a number of the proposed turbine bases will be deemed suitable for gravity type foundations.

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

For the piled type turbine foundations, a typical piling type and configuration could be up to 23 no. 900mm diameter rotary bored piles.

10. FOUNDING DETAILS FOR OTHER INFRASTRUCTURE ELEMENTS

This section provides a summary of the founding details for various elements of the proposed infrastructure across the Proposed Project site. The detailed methodologies for the construction of these elements of the Proposed Project are included in Chapter 4 of the EIAR. A summary of this assessment is provided in 9.2.

Table 10-1: Summary of Infrastructure Foundation Type and Founding Depths

Turbine No.	Foundation Type	Relevant GI	Indicative founding depth (m bgl)	Comment
Construction Compound 1	Floated foundations	PP-CC001, PP-CC002, PP-017, PP-016	0.0	The site investigation works carried out indicate that floated foundation is suitable.
Construction Compound 2	Floated foundations	PP-030, PP-BNM379, PP-BNM378	0.0	The site investigation works carried out indicate that floated foundation is suitable.
Construction Compound 3	Floated foundations	CC005, CC006, CC007, BNM539	0.0	The site investigation works carried out indicate that floated foundation is suitable.
Construction Compound 4	Floated foundations	PP102	0.0	The site investigation works carried out indicate that floated foundation is suitable.
Main CBoP and TSA Compound	Floated foundations	PP-103, PP-CC008, PP-CC009, PP-BNM489	0.0	The site investigation works carried out indicate that floated foundation is suitable.
Amenity Car Park	Floated foundations	PP-104	0.0	The site investigation works carried out indicate that floated foundation is suitable.
Substation	Piled foundations	BH-01, BH-02, BH-03, TP-42	10.0	The site investigation works carried out indicate that piled foundation will be required.
Meteorological Mast	Gravity foundations	PP-MM03	3.0	The site investigation works carried out indicate that gravity foundation will be required.
Security Cabin (Longford Pass Entrance)	Floated foundations	PP-077, PP-BNM487, PP-BNM486	0.0	The site investigation works carried out indicate that floated foundation is suitable.
Security Cabin (L2111 Derryvella Entrance)	Floated foundations	PP-027	0.0	The site investigation works carried out indicate that floated foundation is suitable.

10.1 Internal Roads

Floating internal roads are the predominant road construction type proposed for the site which given the ground conditions and type of terrain present is deemed an appropriate construction approach.

The total length of new proposed internal road to be constructed on site is 15.44km (see drawings P20211-0600-0013 to 0015).

The typical make-up of the floated internal roads is a minimum stone thickness of 1000mm with at least one layer of reinforcing geogrid. The necessary stone thickness will be confirmed at detailed design stage.

Refer to the Peat and Spoil Management Plan (Appendix 4-4) for further details on the proposed internal roads on site.

10.2 Substation Foundations

The substation areas will have a piled foundation due to the depth of peat exceeding 3.0m. A typical piling type and configuration could be up to 900mm diameter CFA piles. The platforms will be founded on competent material underlying the peat deposits.

Given the ground conditions present at the proposed substation and tower build areas, it is envisaged that the foundations will require to be founded on granular glacial till/bedrock. The peat and lacustrine soils will not be a suitable founding stratum for the substation foundations.

Typical founding depth for substation platform is estimated to be 10.0mBGL due to depth of rock being unproven in exploratory holes in this location. Final pile design to be subject to confirmatory ground investigation.

10.3 Temporary Construction Compound Platforms

The construction compound platforms will be constructed using a floated technique.

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

The construction compound platforms will require to be founded on material underlying the peat deposits. Typical founding depth for construction compound platforms will require excavations from 0.8m to 1.4m bgl.

Alternatively, the compounds may be floated, with a stone thickness of 1000mm with at least one layer of reinforcing geogrid. The necessary stone thickness will be confirmed at detailed design stage.

10.4 Met Mast Foundations

The met mast foundation will comprise gravity type foundation.

For a gravity foundation the met mast foundation will be founded on a competent stratum below the peat. Typical founding depth for the met mast gravity foundation is envisaged to be 3.0mbgl. At the underside of the met mast foundation, a layer of structural up-fill (class 6N) will be required.

10.5 Crane Hardstands/Pads

The crane hardstands/pads will be constructed using the founded technique (i.e. not floated technique).

Crane hardstands/pads are constructed using compacted Class 1/6F material on a suitable sub-formation to achieve the required bearing resistance. The hardstands/pads will be designed for the most critical loading combinations from the crane.

The hardstands/pads will require to be founded on competent material underlying the peat deposits. The founding levels for the hardstands/pads will be variable across the site and will be determined at pre-construction stage.

The typical make-up of the hardstands/pads will include a minimum of 1000mm of granular stone fill with possibly a layer of geotextile and/or geogrid, if deemed necessary by the Designer

11. SUMMARY AND RECOMMENDATIONS

11.1 Summary

The following summary is given.

FT was engaged by Littleton Wind Farm DAC to undertake a geotechnical and peat stability assessment of the Site.

The findings of the peat assessment showed that the site has an acceptable margin of safety and is suitable for the Proposed Project. The findings include recommendations and control measures for construction work in peat lands to ensure that all works adhere to an acceptable standard of safety.

The site which is typically flat consists predominantly of bare locally re-vegetated cut-away peat and intact shallow peat. The site was subject to historical peat extraction activities by BnM, with the cessation of peat extraction occurring in 2017.

No karst features were identified during the site walkovers or within the intrusive ground investigation. The nearest karst features are 2 no. swallow holes located approx. 2km southeast of the Site boundary near T08 (approx. 2.1km from this turbine) within the Durrow formation which is not indicated to be present within the site boundary. Therefore, the karst risk on the Site is considered to be low. .

Peat thicknesses recorded during the site walkovers ranged from 0.1 to 6.0m with an average peat depth of 1.6m. Approximately 34% of the probes recorded peat depths of less than 1.0m, with 38% of peat depth probes recorded peat depths of 1.0m to 2.0m, and 18% of peat depth probes recorded peat depths of 2.0m to 3.0m. The remaining 10% of probes recorded peat depths of between 3.0 to 6.0m.

Slope inclinations at the main infrastructure locations range from 2 to 4 degrees. The flat topography/nature of the terrain on site reflects the low risk of peat failure.

An analysis of peat sliding was carried out at the main infrastructure locations across the Proposed Project site for both the undrained and drained conditions. The purpose of the analysis was to determine the Factor of Safety (FoS) of the peat slopes.

An undrained analysis was carried out, which applies in the short-term during construction. For the undrained condition, the calculated FoS for load conditions (1) and (2) for the locations analysed, showed that all locations have an acceptable FoS of greater than 1.3, indicating a low risk of peat failure. The undrained analysis would be considered the most critical condition for the peat slopes.

A drained analysis was also carried out, which examined the effect of in particular, rainfall on the existing stability of the natural peat slopes on site. For the drained condition, the calculated FoS for load conditions (1) & (2) for the locations analysed, showed that all infrastructure locations have an acceptable FoS of greater than 1.3.

The peat stability risk assessment at each infrastructure location identified a number of mitigation/control measures to reduce the potential risk of peat failure. Sections of internal roads to the nearest infrastructure element should be subject to the same mitigation/control measures that apply to the nearest infrastructure element. See Appendix B for details of the required mitigation/control measures for each infrastructure element.

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

11.2 Recommendations

The following recommendations are given.

Notwithstanding that the site has an acceptable margin of safety a number of mitigation/control measures are proposed to ensure that all works adhere to an acceptable standard of safety for work in cutover/cutaway peatlands. Mitigation/control measures identified for each of the infrastructure elements in the risk assessment will be taken into account and implemented throughout design and construction works (Appendix B).

Recommendations and guidelines given in FT's report 'Peat & Spoil Management Plan - Littleton Wind Farm (FT 2025), included as Appendix 4-4 of the EIAR, should be implemented during the design and construction stage of the wind farm development.

To minimise the risk of construction activity causing potential peat instability the Construction Method Statements (CMSs) for the project will take into account, but not be limited, to the recommendations above. This will ensure that best practice guidance regarding the management of peat stability will be inherent in the construction phase

12. REFERENCES

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APPENDIX A

Photos from Site Walkover

Figure A- 1 Peat Probe Location T02 (June 2024)

Figure A- 2 Peat Probe Location PRA003 (June 2024)

Figure A- 3 Peat Probe Location PRA003 (June 2024)

Figure A- 4 Peat Probe Location CC008 (June 2024)

Figure A- 5 Peat Probe Location PP086 (June 2024)

Figure A- 6 Peat Probe Location CC003 (June 2024)

Figure A- 7 Peat Probe Location T07 (June 2024)

Figure A- 8 Peat Probe Location T08 (June 2024)

Figure A- 9 Peat Probe Location T10 (June 2024)

FEHILY TIMONEY

DESIGNING AND DELIVERING
A SUSTAINABLE FUTURE

APPENDIX B

Peat Stability Risk Register

Littleton Wind Farm - Peat Stability Risk Register (Rev 0)

Location:	Const. Comp. (1)

Grid Reference (Eastings, Northings):	620182	651965
Distance to Watercourse (m)	**> 150**	
Min & Max Measured Peat Depth (m):	**1.0**	
Control Required:	**Yes**	

		Pre-Control Measure Implementation						Post-Control Measure Implementation			
Ref.	Contributory/Qualitative Factors to Potential Peat Failure	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating	Control Required	Control measures to be implemented during construction	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating
1	FOS = 20.23 (u), 29.20 (d)	1	1	1	Negligible	No	See Below	1	1	1	Negligible
2	Evidence of sub peat water flow	1	1	1	Negligible	No		1	1	1	Negligible
3	Evidence of surface water flow	2	1	2	Negligible	No		1	1	1	Negligible
4	Evidence of previous failures/slips	1	1	1	Negligible	No		1	1	1	Negligible
5	Type of vegetation	2	1	2	Negligible	No		1	1	1	Negligible
6	General slope characteristics upslope/downslope from infrastructure location	2	1	2	Negligible	No		1	1	1	Negligible
7	Evidence of very soft/soft clay at base of peat	4	1	4	Negligible	No		3	1	3	Negligible
8	Evidence of mechanically cut peat	2	1	2	Negligible	No		1	1	1	Negligible
9	Evidence of quaking or buoyant peat	2	1	2	Negligible	No		1	1	1	Negligible
10	Evidence of bog pools	2	1	2	Negligible	No		1	1	1	Negligible
11	Other	0	1	0	Not Applicable	No		0	1	0	Not Applicable

	Control Measures to be Implemented Prior to/and During Construction for **Construction Compound (1)**
i	Maintain hydrology of area as far as possible;
ii	Use of experienced geotechnical staff for site investigation;
iii	Use of experienced contractors and trained operators to carry out the work;
iv	Detailed ground investigation to determine peat, mineral soil and bedrock condition and properties.
v	Inspection & approval of turbine base sub-formation by a competent person where a gravity type foundation base is constructed.

Note
(1) FOS abbreviations are: u: FOS for undrained analysis, d: FOS for drained analysis.
(2) Probability assessed as per Table A and B of Appendix E.
(3) Impact based on distance of infrastructure element to nearest watercourse.

Littleton Wind Farm - Peat Stability Risk Register (Rev 0)

Location:	Const. Comp. (2)

Grid Reference (Eastings, Northings):	621707	653881
Distance to Watercourse (m)	> 150	
Min & Max Measured Peat Depth (m):	1.7	
Control Required:	No	

		Pre-Control Measure Implementation						Post-Control Measure Implementation			
Ref.	Contributory/Qualitative Factors to Potential Peat Failure	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating	Control Required	Control measures to be implemented during construction	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating
1	FOS = 20.23 (u), 29.20 (d)	1	1	1	Negligible	No	See Below	1	1	1	Negligible
2	Evidence of sub peat water flow	1	1	1	Negligible	No		1	1	1	Negligible
3	Evidence of surface water flow	2	1	2	Negligible	No		1	1	1	Negligible
4	Evidence of previous failures/slips	1	1	1	Negligible	No		1	1	1	Negligible
5	Type of vegetation	2	1	2	Negligible	No		1	1	1	Negligible
6	General slope characteristics upslope/downslope from infrastructure location	2	1	2	Negligible	No		1	1	1	Negligible
7	Evidence of very soft/soft clay at base of peat	4	1	4	Negligible	No		3	1	3	Negligible
8	Evidence of mechanically cut peat	2	1	2	Negligible	No		1	1	1	Negligible
9	Evidence of quaking or buoyant peat	2	1	2	Negligible	No		1	1	1	Negligible
10	Evidence of bog pools	2	1	2	Negligible	No		1	1	1	Negligible
11	Other	0	1	0	Not Applicable	No		0	1	0	Not Applicable

	Control Measures to be Implemented Prior to/and During Construction for **Construction Compound (2)**
i	Maintain hydrology of area as far as possible;
ii	Use of experienced geotechnical staff for site investigation;
iii	Use of experienced contractors and trained operators to carry out the work;
iv	Detailed ground investigation to determine peat, mineral soil and bedrock condition and properties.
v	Inspection & approval of turbine base sub-formation by a competent person where a gravity type foundation base is constructed.

Note
(1) FOS abbreviations are: u: FOS for undrained analysis, d: FOS for drained analysis.
(2) Probability assessed as per Table A and B of Appendix E.
(3) Impact based on distance of infrastructure element to nearest watercourse.

Littleton Wind Farm - Peat Stability Risk Register (Rev 0)

Location:	Const. Comp. (3)

Grid Reference (Eastings, Northings):	623010	655591
Distance to Watercourse (m)	> 150	
Min & Max Measured Peat Depth (m):	1.1	
Control Required:	No	

		Pre-Control Measure Implementation						Post-Control Measure Implementation			
Ref.	Contributory/Qualitative Factors to Potential Peat Failure	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating	Control Required	Control measures to be implemented during construction	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating
1	FOS = 18.10 (u), 25.47 (d)	1	1	1	Negligible	No	See Below	1	1	1	Negligible
2	Evidence of sub peat water flow	1	1	1	Negligible	No		1	1	1	Negligible
3	Evidence of surface water flow	2	1	2	Negligible	No		1	1	1	Negligible
4	Evidence of previous failures/slips	1	1	1	Negligible	No		1	1	1	Negligible
5	Type of vegetation	2	1	2	Negligible	No		1	1	1	Negligible
6	General slope characteristics upslope/downslope from infrastructure location	2	1	2	Negligible	No		1	1	1	Negligible
7	Evidence of very soft/soft clay at base of peat	4	1	4	Negligible	No		3	1	3	Negligible
8	Evidence of mechanically cut peat	2	1	2	Negligible	No		1	1	1	Negligible
9	Evidence of quaking or buoyant peat	2	1	2	Negligible	No		1	1	1	Negligible
10	Evidence of bog pools	2	1	2	Negligible	No		1	1	1	Negligible
11	Other	0	1	0	Not Applicable	No		0	1	0	Not Applicable

	Control Measures to be Implemented Prior to/and During Construction for **Construction Compound (3)**
i	Maintain hydrology of area as far as possible;
ii	Use of experienced geotechnical staff for site investigation;
iii	Use of experienced contractors and trained operators to carry out the work;
iv	Detailed ground investigation to determine peat, mineral soil and bedrock condition and properties.
v	Inspection & approval of turbine base sub-formation by a competent person where a gravity type foundation base is constructed.

Note
(1) FOS abbreviations are: u: FOS for undrained analysis, d: FOS for drained analysis.
(2) Probability assessed as per Table A and B of Appendix E.
(3) Impact based on distance of infrastructure element to nearest watercourse.

Littleton Wind Farm - Peat Stability Risk Register (Rev 0)

Location:	Const. Comp. (4)

Grid Reference (Eastings, Northings):	623297	658785
Distance to Watercourse (m)	**> 150**	
Min & Max Measured Peat Depth (m):	**1.0**	
Control Required:	**Yes**	

		Pre-Control Measure Implementation						Post-Control Measure Implementation			
Ref.	Contributory/Qualitative Factors to Potential Peat Failure	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating	Control Required	Control measures to be implemented during construction	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating
1	FOS = 17.19 (u), 22.92 (d)	1	1	1	Negligible	No	See Below	1	1	1	Negligible
2	Evidence of sub peat water flow	1	1	1	Negligible	No		1	1	1	Negligible
3	Evidence of surface water flow	2	1	2	Negligible	No		1	1	1	Negligible
4	Evidence of previous failures/slips	1	1	1	Negligible	No		1	1	1	Negligible
5	Type of vegetation	2	1	2	Negligible	No		1	1	1	Negligible
6	General slope characteristics upslope/downslope from infrastructure location	2	1	2	Negligible	No		1	1	1	Negligible
7	Evidence of very soft/soft clay at base of peat	4	1	4	Negligible	No		3	1	3	Negligible
8	Evidence of mechanically cut peat	2	1	2	Negligible	No		1	1	1	Negligible
9	Evidence of quaking or buoyant peat	2	1	2	Negligible	No		1	1	1	Negligible
10	Evidence of bog pools	2	1	2	Negligible	No		1	1	1	Negligible
11	Relatively deep peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable

	Control Measures to be Implemented Prior to/and During Construction for **Construction Compound (4)**
i	Maintain hydrology of area as far as possible;
ii	Use of experienced geotechnical staff for site investigation;
iii	Use of experienced contractors and trained operators to carry out the work;
iv	Detailed ground investigation to determine peat, mineral soil and bedrock condition and properties.
v	Inspection & approval of turbine base sub-formation by a competent person where a gravity type foundation base is constructed.

Note
(1) FOS abbreviations are: u: FOS for undrained analysis, d: FOS for drained analysis.
(2) Probability assessed as per Table A and B of Appendix E.
(3) Impact based on distance of infrastructure element to nearest watercourse.

Littleton Wind Farm - Peat Stability Risk Register (Rev 0)

Location:	**Amenity Car Park**

Grid Reference (Eastings, Northings):	622898	659710
Distance to Watercourse (m)	**> 150**	
Min & Max Measured Peat Depth (m):	**0.0**	
Control Required:	**No**	

		Pre-Control Measure Implementation						Post-Control Measure Implementation			
Ref.	Contributory/Qualitative Factors to Potential Peat Failure	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating	Control Required	Control measures to be implemented during construction	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating
1	FOS = 5.74 (u), 7.65 (d)	0	1	0	Not Applicable	No	See Below	0	1	0	Not Applicable
2	Evidence of sub peat water flow	0	1	0	Not Applicable	No		0	1	0	Not Applicable
3	Evidence of surface water flow	0	1	0	Not Applicable	No		0	1	0	Not Applicable
4	Evidence of previous failures/slips	0	1	0	Not Applicable	No		0	1	0	Not Applicable
5	Type of vegetation	0	1	0	Not Applicable	No		0	1	0	Not Applicable
6	General slope characteristics upslope/downslope from infrastructure location	0	1	0	Not Applicable	No		0	1	0	Not Applicable
7	Evidence of very soft/soft clay at base of peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
8	Evidence of mechanically cut peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
9	Evidence of quaking or buoyant peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
10	Evidence of bog pools	0	1	0	Not Applicable	No		0	1	0	Not Applicable
11	Other	0	1	0	Not Applicable	No		0	1	0	Not Applicable

	Control Measures to be Implemented Prior to/and During Construction for **Amenity Car Park**
i	Maintain hydrology of area as far as possible;
ii	Use of experienced geotechnical staff for site investigation;
iii	Use of experienced contractors and trained operators to carry out the work;
iv	Detailed ground investigation to determine peat, mineral soil and bedrock condition and properties.
v	Inspection & approval of turbine base sub-formation by a competent person where a gravity type foundation base is constructed.

Note
(1) FOS abbreviations are: u: FOS for undrained analysis, d: FOS for drained analysis.
(2) Probability assessed as per Table A and B of Appendix E.
(3) Impact based on distance of infrastructure element to nearest watercourse.

Littleton Wind Farm - Peat Stability Risk Register (Rev 0)

Location:	Main CBoP and TSA Coumpound

Grid Reference (Eastings, Northings):	623216	659106
Distance to Watercourse (m)	> 150	
Min & Max Measured Peat Depth (m):	1.9	
Control Required:	Yes	

		Pre-Control Measure Implementation						Post-Control Measure Implementation			
Ref.	Contributory/Qualitative Factors to Potential Peat Failure	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating	Control Required	Control measures to be implemented during construction	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating
1	FOS = 7.65 (u), 11.46 (d)	1	1	1	Negligible	No	See Below	1	1	1	Negligible
2	Evidence of sub peat water flow	1	1	1	Negligible	No		2	1	2	Negligible
3	Evidence of surface water flow	1	1	1	Negligible	No		1	1	1	Negligible
4	Evidence of previous failures/slips	1	1	1	Negligible	No		1	1	1	Negligible
5	Type of vegetation	2	1	2	Negligible	No		1	1	1	Negligible
6	General slope characteristics upslope/downslope from infrastructure location	2	1	2	Negligible	No		2	1	2	Negligible
7	Evidence of very soft/soft clay at base of peat	4	1	4	Negligible	No		2	1	2	Negligible
8	Evidence of mechanically cut peat	2	1	2	Negligible	No		2	1	2	Negligible
9	Evidence of quaking or buoyant peat	1	1	1	Negligible	No		1	1	1	Negligible
10	Evidence of bog pools	1	1	1	Negligible	No		2	1	2	Negligible
11	Other	0	1	0	Not Applicable	No		0	1	0	Not Applicable

	Control Measures to be Implemented Prior to/and During Construction for **Main CBoP and TSA Coumpound**
i	Maintain hydrology of area as far as possible;
ii	Use of experienced geotechnical staff for site investigation;
iii	Use of experienced contractors and trained operators to carry out the work;
iv	Detailed ground investigation to determine peat, mineral soil and bedrock condition and properties.
v	Inspection & approval of turbine base sub-formation by a competent person where a gravity type foundation base is constructed.

Note
(1) FOS abbreviations are: u: FOS for undrained analysis, d: FOS for drained analysis.
(2) Probability assessed as per Table A and B of Appendix E.
(3) Impact based on distance of infrastructure element to nearest watercourse.

Littleton Wind Farm - Peat Stability Risk Register (Rev 0)

Location:	Substation

Grid Reference (Eastings, Northings):	622793	658615
Distance to Watercourse (m)	> 150	
Min & Max Measured Peat Depth (m):	3.4	
Control Required:	Yes	

		Pre-Control Measure Implementation						Post-Control Measure Implementation			
Ref.	Contributory/Qualitative Factors to Potential Peat Failure	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating	Control Required	Control measures to be implemented during construction	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating
1	FOS = 5.74 (u), 7.65 (d)	1	1	1	Negligible	No	See Below	1	1	1	Negligible
2	Evidence of sub peat water flow	2	1	2	Negligible	No		2	1	2	Negligible
3	Evidence of surface water flow	1	1	1	Negligible	No		1	1	1	Negligible
4	Evidence of previous failures/slips	1	1	1	Negligible	No		1	1	1	Negligible
5	Type of vegetation	2	1	2	Negligible	No		2	1	2	Negligible
6	General slope characteristics upslope/downslope from infrastructure location	2	1	2	Negligible	No		2	1	2	Negligible
7	Evidence of very soft/soft clay at base of peat	4	1	4	Negligible	No		3	1	3	Negligible
8	Evidence of mechanically cut peat	2	1	2	Negligible	No		2	1	2	Negligible
9	Evidence of quaking or buoyant peat	1	1	1	Negligible	No		1	1	1	Negligible
10	Evidence of bog pools	1	1	1	Negligible	No		2	1	2	Negligible
11	Relatively deep peat	5	1	5	Low	No		3	1	3	Negligible

	Control Measures to be Implemented Prior to/and During Construction for **Substation**
i	Due to relatively deep peat at this infrastructure location, additional - excavation side walls to be supported (e.g. boulders, sheet piles) or excavation face battered to a shallow angle - temporary works designer may be required to provide excavation support design -daily detailed inspection of excavation faces -potential for greater water inflow into excavation requiring removal of water using pumping -increased exclusion zone around excavation to avoid accidental loading of crest of slope
ii	Maintain hydrology of area as far as possible;
iii	Use of experienced geotechnical staff for site investigation;
iv	Use of experienced contractors and trained operators to carry out the work;
v	Detailed ground investigation to determine peat, mineral soil and bedrock condition and properties.
vi	Inspection & approval of turbine base sub-formation by a competent person where a gravity type foundation base is constructed.
vii	Movement monitoring posts to be installed upslope of the turbine/harsdtand excavation and monitored on a regular basis

Note
(1) FOS abbreviations are: u: FOS for undrained analysis, d: FOS for drained analysis.
(2) Probability assessed as per Table A and B of Appendix E.
(3) Impact based on distance of infrastructure element to nearest watercourse.

Littleton Wind Farm - Peat Stability Risk Register (Rev 0)

Location:	**Met Mast**

Grid Reference (Eastings, Northings):	622153	654752
Distance to Watercourse (m)	**> 150**	
Min & Max Measured Peat Depth (m):	**0.8**	
Control Required:	**Yes**	

		Pre-Control Measure Implementation						Post-Control Measure Implementation			
Ref.	Contributory/Qualitative Factors to Potential Peat Failure	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating	Control Required	Control measures to be implemented during construction	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating
1	FOS = 9.82 (u), 9.17 (d)	1	1	1	Negligible	Yes	See Below	1	1	1	Negligible
2	Evidence of sub peat water flow	2	1	2	Negligible	Yes		1	1	1	Negligible
3	Evidence of surface water flow	1	1	1	Negligible	Yes		1	1	1	Negligible
4	Evidence of previous failures/slips	1	1	1	Negligible	Yes		1	1	1	Negligible
5	Type of vegetation	2	1	2	Negligible	Yes		1	1	1	Negligible
6	General slope characteristics upslope/downslope from infrastructure location	2	1	2	Negligible	Yes		1	1	1	Negligible
7	Evidence of very soft/soft clay at base of peat	4	1	4	Negligible	Yes		3	1	3	Negligible
8	Evidence of mechanically cut peat	2	1	2	Negligible	Yes		1	1	1	Negligible
9	Evidence of quaking or buoyant peat	1	1	1	Negligible	Yes		1	1	1	Negligible
10	Evidence of bog pools	1	1	1	Negligible	Yes		1	1	1	Negligible
11	Other	0	1	0	Not Applicable	Yes		0	1	0	Not Applicable

	Control Measures to be Implemented Prior to/and During Construction for **Met Mast**
i	Maintain hydrology of area as far as possible;
ii	Use of experienced geotechnical staff for site investigation;
iii	Use of experienced contractors and trained operators to carry out the work;
iv	Detailed ground investigation to determine peat, mineral soil and bedrock condition and properties.
v	Inspection & approval of turbine base sub-formation by a competent person where a gravity type foundation base is constructed.

Note
(1) FOS abbreviations are: u: FOS for undrained analysis, d: FOS for drained analysis.
(2) Probability assessed as per Table A and B of Appendix E.
(3) Impact based on distance of infrastructure element to nearest watercourse.

Littleton Wind Farm - Peat Stability Risk Register (Rev 0)

Location:	Security Cabin (Longford Pass)

Grid Reference (Eastings, Northings):	623089	659308
Distance to Watercourse (m)	> 150	
Min & Max Measured Peat Depth (m):	3.3	
Control Required:	No	

		Pre-Control Measure Implementation						Post-Control Measure Implementation			
Ref.	Contributory/Qualitative Factors to Potential Peat Failure	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating	Control Required	Control measures to be implemented during construction	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating
1	FOS = 13.22 (u), 14.33 (d)	1	1	1	Negligible	No	See Below	1	1	1	Negligible
2	Evidence of sub peat water flow	2	1	2	Negligible	No		1	1	1	Negligible
3	Evidence of surface water flow	1	1	1	Negligible	No		1	1	1	Negligible
4	Evidence of previous failures/slips	1	1	1	Negligible	No		1	1	1	Negligible
5	Type of vegetation	2	1	2	Negligible	No		1	1	1	Negligible
6	General slope characteristics upslope/downslope from infrastructure location	2	1	2	Negligible	No		1	1	1	Negligible
7	Evidence of very soft/soft clay at base of peat	4	1	4	Negligible	No		3	1	3	Negligible
8	Evidence of mechanically cut peat	2	1	2	Negligible	No		1	1	1	Negligible
9	Evidence of quaking or buoyant peat	1	1	1	Negligible	No		1	1	1	Negligible
10	Evidence of bog pools	1	1	1	Negligible	No		1	1	1	Negligible
11	Relatively deep peat	5	1	5	Low	No		3	1	3	Negligible

	Control Measures to be Implemented Prior to/and During Construction for **Security Cabin (Longford Pass)**
i	Due to relatively deep peat at this infrastructure location, additional construction measures such as the following may be required: - excavation side walls to be supported (e.g. boulders, sheet piles) or excavation face battered to a shallow angle - temporary works designer may be required to provide excavation support design -daily detailed inspection of excavation faces -potential for greater water inflow into excavation requiring removal of water using pumping -increased exclusion zone around excavation to avoid accidental loading of crest of slope
ii	Maintain hydrology of area as far as possible;
iii	Use of experienced geotechnical staff for site investigation;
iv	Use of experienced contractors and trained operators to carry out the work;
v	Detailed ground investigation to determine peat, mineral soil and bedrock condition and properties.
vi	Inspection & approval of turbine base sub-formation by a competent person where a gravity type foundation base is constructed.
vii	Movement monitoring posts to be installed upslope of the turbine/harsdtand excavation and monitored on a regular basis

Note
(1) FOS abbreviations are: u: FOS for undrained analysis, d: FOS for drained analysis.
(2) Probability assessed as per Table A and B of Appendix E.
(3) Impact based on distance of infrastructure element to nearest watercourse.

FEHILY TIMONEY

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APPENDIX C

Calculated FOS for Peat Slopes on Site

Calculated FoS of Natural Peat Slopes for Littleton Wind Farm - Drained Analysis

Turbine No./Waypoint	Slope	Design c'	Bulk unit weight of Peat	Unit weight of Water	Depth of In situ Peat	Friction Angle	Surcharge Equivalent Placed Fill	Equivalent Total Depth of Peat (m)	Factor of Safety for Load Condition	
	α (deg)	c' (kPa)	γ (kN/m^3)	γ_w (kN/m^3)	(m)	ø' (deg)	Condition (2)	Condition (2)	Condition (1)	Condition (2)
									100% Water	100% Water
1	No peat found at this location									
2	1	4	10.0	10.0	1.80	25	1.0	2.8	**12.73**	**17.73**
3	1	4	10.0	10.0	1.30	25	1.0	2.3	**17.63**	**21.58**
4	No peat found at this location									
5	1	4	10.0	10.0	1.40	25	1.0	2.4	**16.37**	**20.68**
6	1	4	10.0	10.0	2.10	25	1.0	3.1	**10.92**	**16.01**
7	1	4	10.0	10.0	0.90	25	1.0	1.9	**25.47**	**26.13**
8	1	4	10.0	10.0	0.40	25	1.0	1.4	**57.31**	**35.46**
9	No peat found at this location									
10	2	4	10.0	10.0	0.80	25	1.0	1.8	**14.34**	**13.79**
11	1	4	10.0	10.0	2.80	25	1.0	3.8	**8.19**	**13.06**
12	1	4	10.0	10.0	1.20	25	1.0	2.2	**19.10**	**22.56**
13	1	4	10.0	10.0	2.70	25	1.0	3.7	**8.49**	**13.42**
14	1	4	10.0	10.0	2.40	25	1.0	3.4	**9.55**	**14.60**
15	1	4	10.0	10.0	1.80	25	1.0	2.8	**12.73**	**17.73**
16	1	4	10.0	10.0	1.80	25	1.0	2.8	**12.73**	**17.73**
17	1	4	10.0	10.0	0.90	25	1.0	1.9	**25.47**	**26.13**
18	1	4	10.0	10.0	0.70	25	1.0	1.7	**32.75**	**29.20**
19	1	4	10.0	10.0	0.90	25	1.0	1.9	**25.47**	**26.13**
20	1	4	10.0	10.0	1.20	25	1.0	2.2	**19.10**	**22.56**
21	No peat found at this location									
22	3	4	10.0	10.0	1.20	25	1.0	2.2	**6.38**	**7.52**
23	No peat found at this location									
24	No peat found at this location									
25	No peat found at this location									
26	No peat found at this location									
27	No peat found at this location									
28	No peat found at this location									
29	1	4	10.0	10.0	3.50	25	1.0	4.5	**6.55**	**11.03**
30	1	4	10.0	10.0	0.90	25	1.0	1.9	**25.47**	**26.13**
31	1	4	10.0	10.0	0.90	25	1.0	1.9	**25.47**	**26.13**
32	1	4	10.0	10.0	1.50	25	1.0	2.5	**15.28**	**19.86**
33	1	4	10.0	10.0	1.50	25	1.0	2.5	**15.28**	**19.86**
34	1	4	10.0	10.0	1.50	25		1.5	**15.28**	**15.28**
35	1	4	10.0	10.0	1.50	25	1.0	2.5	**15.28**	**19.86**
36	1	4	10.0	10.0	1.20	25	1.0	2.2	**19.10**	**22.56**
37	2	4	10.0	10.0	1.10	25	1.0	2.1	**10.43**	**11.82**
38	2	4	10.0	10.0	1.20	25	1.0	2.2	**9.56**	**11.28**
39	No peat found at this location									
40	1	4	10.0	10.0	1.40	25	1.0	2.4	**16.37**	**20.68**
41	1	4	10.0	10.0	0.90	25	1.0	1.9	**25.47**	**26.13**
42	No peat found at this location									
43	1	4	10.0	10.0	1.40	25	1.0	2.4	**16.37**	**20.68**
44	1	4	10.0	10.0	1.60	25	1.0	2.6	**14.33**	**19.09**
45	1	4	10.0	10.0	2.00	25	1.0	3.0	**11.46**	**16.55**
46	1	4	10.0	10.0	1.80	25	1.0	2.8	**12.73**	**17.73**
47	1	4	10.0	10.0	0.50	25	1.0	1.5	**45.85**	**33.09**
48	1	4	10.0	10.0	0.50	25	1.0	1.5	**45.85**	**33.09**
49	1	4	10.0	10.0	0.70	25	1.0	1.7	**32.75**	**29.20**
50	1	4	10.0	10.0	2.10	25	1.0	3.1	**10.92**	**16.01**
52	2	4	10.0	10.0	0.40	25	1.0	1.4	**28.67**	**17.73**
53	1	4	10.0	10.0	0.80	25	1.0	1.8	**28.65**	**27.58**
54	1	4	10.0	10.0	1.30	25	1.0	2.3	**17.63**	**21.58**
55	1	4	10.0	10.0	1.30	25	1.0	2.3	**17.63**	**21.58**
56	1	4	10.0	10.0	1.00	25	1.0	2.0	**22.92**	**24.82**
57	No peat found at this location									
58	1	4	10.0	10.0	1.00	25	1.0	2.0	**22.92**	**24.82**
59	1	4	10.0	10.0	1.00	25	1.0	2.0	**22.92**	**24.82**
60	1	4	10.0	10.0	0.70	25	1.0	1.7	**32.75**	**29.20**
61	1	4	10.0	10.0	1.20	25	1.0	2.2	**19.10**	**22.56**
62	1	4	10.0	10.0	0.80	25	1.0	1.8	**28.65**	**27.58**
63	1	4	10.0	10.0	2.40	25	1.0	3.4	**9.55**	**14.60**
64	1	4	10.0	10.0	0.80	25	1.0	1.8	**28.65**	**27.58**
65	No peat found at this location									
66	No peat found at this location									
67	No peat found at this location									
68	No peat found at this location									
69	No peat found at this location									
70	No peat found at this location									
71	1	4	10.0	10.0	0.80	25	1.0	1.8	**28.65**	**27.58**
72	1	4	10.0	10.0	0.80	25	1.0	1.8	**28.65**	**27.58**
73	1	4	10.0	10.0	0.80	25	1.0	1.8	**28.65**	**27.58**
74	1	4	10.0	10.0	0.90	25	1.0	1.9	**25.47**	**26.13**
75	1	4	10.0	10.0	0.50	25	1.0	1.5	**45.85**	**33.09**
76	1	4	10.0	10.0	0.80	25	1.0	1.8	**28.65**	**27.58**
77	1	4	10.0	10.0	3.30	25	1.0	4.3	**6.95**	**11.54**
78	1	4	10.0	10.0	2.20	25	1.0	3.2	**10.42**	**15.51**
79	1	4	10.0	10.0	2.10	25	1.0	3.1	**10.92**	**16.01**
80	No peat found at this location									
81	1	4	10.0	10.0	1.3	25	1.0	2.3	**17.63**	**21.58**
82	1	4	10.0	10.0	1.00	25	1.0	2.0	**22.92**	**24.82**
83	1	4	10.0	10.0	0.60	25	1.0	1.6	**38.20**	**31.02**
84	1	4	10.0	10.0	2.10	25	1.0	3.1	**10.92**	**16.01**
85	1	4	10.0	10.0	2.40	25	1.0	3.4	**9.55**	**14.60**
86	1	4	10.0	10.0	2.30	25	1.0	3.3	**9.97**	**15.04**
87	1	4	10.0	10.0	1.70	25	1.0	2.7	**13.48**	**18.38**
88	1	4	10.0	10.0	2.70	25	1.0	3.7	**8.49**	**13.42**
89	1	4	10.0	10.0	3.50	25	1.0	4.5	**6.55**	**11.03**
90	1	4	10.0	10.0	3.80	25	1.0	4.8	**6.03**	**10.34**
91	1	4	10.0	10.0	3.00	25	1.0	4.0	**7.64**	**12.41**
92	1	4	10.0	10.0	2.80	25	1.0	3.8	**8.19**	**13.06**
93	1	4	10.0	10.0	2.80	25	1.0	3.8	**8.19**	**13.06**
94	1	4	10.0	10.0	2.80	25	1.0	3.8	**8.19**	**13.06**
95	1	4	10.0	10.0	1.50	25	1.0	2.5	**15.28**	**19.86**
96	1	4	10.0	10.0	0.95	25	1.0	2.0	**50.84**	**38.47**

Calculated FoS of Natural Peat Slopes for Littleton Wind Farm - Drained Analysis

Turbine No./Waypoint	Slope	Design c'	Bulk unit weight of Peat	Unit weight of Water	Depth of In situ Peat	Friction Angle	Surcharge Equivalent Placed Fill	Equivalent Total Depth of Peat (m)	Factor of Safety for Load Condition	
	α (deg)	c' (kPa)	γ (kN/m^3)	γ_w (kN/m^3)	(m)	ø' (deg)	Condition (2)	Condition (2)	Condition (1)	Condition (2)
									100% Water	100% Water
97	1	4	10.0	10.0	1.15	25	1.0	2.2	**46.65**	**37.38**
98	1	4	10.0	10.0	0.15	25	1.0	1.2	**179.53**	**46.65**
99	1	4	10.0	10.0	2.85	25	1.0	3.9	**34.76**	**32.67**
100	1	4	10.0	10.0	1.65	25	1.0	2.7	**40.61**	**35.36**
101	1	4	10.0	10.0	2.20	25	1.0	3.2	**37.13**	**33.88**
102	1	4	10.0	10.0	1.00	25	1.0	2.0	**49.64**	**38.18**
103	1	4	10.0	10.0	1.65	25	1.0	2.7	**40.61**	**35.36**
104	No peat found at this location									
105	No peat found at this location									
106	1	4	10.0	10.0	0.60	25	1.0	1.6	**64.92**	**41.04**
107	1	4	10.0	10.0	1.60	25	1.0	2.6	**41.04**	**35.53**
108	1	4	10.0	10.0	1.00	25	1.0	2.0	**49.64**	**38.18**
109	1	4	10.0	10.0	0.75	25	1.0	1.8	**57.28**	**39.81**
110	1	4	10.0	10.0	0.85	25	1.0	1.9	**53.68**	**39.11**
111	1	4	10.0	10.0	1.55	25	1.0	2.6	**41.50**	**35.70**
112	1	4	10.0	10.0	1.40	25	1.0	2.4	**43.09**	**36.27**
113	1	4	10.0	10.0	1.75	25	1.0	2.8	**39.81**	**35.05**
114	No peat found at this location									
115	1	4	10.0	10.0	0.70	25	1.0	1.7	**59.46**	**40.20**
116	1	4	10.0	10.0	0.70	25	1.0	1.7	**59.46**	**40.20**
117	1	4	10.0	10.0	2.00	25	1.0	3.0	**38.18**	**34.36**
118	1	4	10.0	10.0	0.70	25	1.0	1.7	**59.46**	**40.20**
119	1	4	10.0	10.0	0.40	25	1.0	1.4	**84.02**	**43.09**
120	1	4	10.0	10.0	0.25	25	1.0	1.3	**118.41**	**45.05**
121	1	4	10.0	10.0	1.75	25	1.0	2.8	**39.81**	**35.05**
122	1	4	10.0	10.0	0.15	25	1.0	1.2	**179.53**	**46.65**
123	No peat found at this location									
124	1	4	10.0	10.0	1.90	25	1.0	2.9	**38.78**	**34.62**
125	1	4	10.0	10.0	3.35	25	1.0	4.4	**33.56**	**31.98**
126	1	4	10.0	10.0	1.00	25	1.0	2.0	**49.64**	**38.18**
127	No peat found at this location									
128	1	4	10.0	10.0	0.95	25	1.0	2.0	**50.84**	**38.47**
129	1	4	10.0	10.0	0.20	25	1.0	1.2	**141.33**	**45.82**
130	1	4	10.0	10.0	1.15	25	1.0	2.2	**46.65**	**37.38**
131	1	4	10.0	10.0	1.40	25	1.0	2.4	**43.09**	**36.27**
132	1	4	10.0	10.0	0.70	25	1.0	1.7	**59.46**	**40.20**
133	1	4	10.0	10.0	0.20	25	1.0	1.2	**141.33**	**45.82**
134	1	4	10.0	10.0	0.20	25	1.0	1.2	**141.33**	**45.82**
135	1	4	10.0	10.0	1.70	25	1.0	2.7	**40.20**	**35.20**
136	1	4	10.0	10.0	0.30	25	1.0	1.3	**103.12**	**44.35**
138	1	4	10.0	10.0	0.20	25	1.0	1.2	**141.33**	**45.82**
139	1	4	10.0	10.0	2.65	25	1.0	3.7	**35.36**	**33.00**
MM03	1	4	10.0	10.0	0.80	25	1.0	1.8	**55.37**	**39.45**
T01_2025	1	4	10.0	10.0	1.00	25	1.0	2.0	**49.64**	**38.18**
T02_2025	1	4	10.0	10.0	1.20	25	1.0	2.2	**45.82**	**37.13**
T03_2025	1	4	10.0	10.0	1.20	25	1.0	2.2	**45.82**	**37.13**
T04_2025	1	4	10.0	10.0	0.60	25	1.0	1.6	**64.92**	**41.04**
T05_2025	1	4	10.0	10.0	0.95	25	1.0	2.0	**50.84**	**38.47**
T06_2025	1	4	10.0	10.0	1.10	25	1.0	2.1	**47.55**	**37.63**
T07_2025	1	4	10.0	10.0	0.75	25	1.0	1.8	**57.28**	**39.81**
T08_2025	1	4	10.0	10.0	0.70	25	1.0	1.7	**59.46**	**40.20**
T09_2025	1	4	10.0	10.0	0.65	25	1.0	1.7	**61.98**	**40.61**
T11_2025	1	4	10.0	10.0	1.95	25	1.0	3.0	**38.47**	**34.49**
CC_001	1	4	10.0	10.0	0.70	25	1.0	1.7	**32.75**	**29.20**
CC_002	1	4	10.0	10.0	0.70	25	1.0	1.7	**32.75**	**29.20**
CC_003	1	4	10.0	10.0	0.90	25	1.0	1.9	**25.47**	**26.13**
CC_004	1	4	10.0	10.0	1.00	25	1.0	2.0	**22.92**	**24.82**
CC_005	3	4	10.0	10.0	1.00	25	1.0	2.0	**7.65**	**8.28**
CC_006	3	4	10.0	10.0	0.50	25	1.0	1.5	**15.31**	**11.03**
CC_007	3	4	10.0	10.0	1.00	25	1.0	2.0	**7.65**	**8.28**
CC_008	1	4	10.0	10.0	2.50	25	1.0	3.5	**9.17**	**14.18**
CC_009	1	4	10.0	10.0	1.60	25	1.0	2.6	**14.33**	**19.09**
PRA_001	1	4	10.0	10.0	1.80	25	1.0	2.8	**12.73**	**17.73**
PRA_002	1	4	10.0	10.0	3.60	25	1.0	4.6	**6.37**	**10.79**
PRA_003	1	4	10.0	10.0	2.00	25	1.0	3.0	**11.46**	**16.55**
PRA_004	1	4	10.0	10.0	0.80	25	1.0	1.8	**28.65**	**27.58**
PRA_005	1	4	10.0	10.0	3.00	25	1.0	4.0	**7.64**	**12.41**
SS_001	1	4	10.0	10.0	1.40	25	1.0	2.4	**16.37**	**20.68**
SS_002	1	4	10.0	10.0	1.40	25	1.0	2.4	**16.37**	**20.68**
MM_001	3	4	10.0	10.0	1.00	25	1.0	2.0	**7.65**	**8.28**
MM_002	4	4	10.0	10.0	1.50	25	1.0	2.5	**3.83**	**4.97**
T01_C	1	4	10.0	10.0	1.70	25	1.0	2.7	**13.48**	**18.38**
T01_N	1	4	10.0	10.0	1.20	25	1.0	2.2	**19.10**	**22.56**
T01_S	1	4	10.0	10.0	1.30	25	1.0	2.3	**17.63**	**21.58**
T01_E	1	4	10.0	10.0	1.70	25	1.0	2.7	**13.48**	**18.38**
T01_W	1	4	10.0	10.0	1.70	25	1.0	2.7	**13.48**	**18.38**
T02_C	1	4	10.0	10.0	1.50	25	1.0	2.5	**15.28**	**19.86**
T02_N	1	4	10.0	10.0	1.50	25	1.0	2.5	**15.28**	**19.86**
T02_S	1	4	10.0	10.0	2.50	25	1.0	3.5	**9.17**	**14.18**
T02_E	1	4	10.0	10.0	1.50	25	1.0	2.5	**15.28**	**19.86**
T02_W	1	4	10.0	10.0	2.40	25	1.0	3.4	**9.55**	**14.60**
T03_C	1	4	10.0	10.0	0.90	25	1.0	1.9	**25.47**	**26.13**
T03_N	1	4	10.0	10.0	0.90	25	1.0	1.9	**25.47**	**26.13**
T03_S	1	4	10.0	10.0	0.90	25	1.0	1.9	**25.47**	**26.13**
T03_E	1	4	10.0	10.0	1.00	25	1.0	2.0	**22.92**	**24.82**
T03_W	1	4	10.0	10.0	1.00	25	1.0	2.0	**22.92**	**24.82**
T04_C	1	4	10.0	10.0	1.30	25	1.0	2.3	**17.63**	**21.58**
T04_N	1	4	10.0	10.0	1.20	25	1.0	2.2	**19.10**	**22.56**
T04_S	1	4	10.0	10.0	1.20	25	1.0	2.2	**19.10**	**22.56**
T04_E	1	4	10.0	10.0	1.40	25	1.0	2.4	**16.37**	**20.68**
T04_W	1	4	10.0	10.0	1.20	25	1.0	2.2	**19.10**	**22.56**
T05_C	1	4	10.0	10.0	1.70	25	1.0	2.7	**13.48**	**18.38**
T05_N	1	4	10.0	10.0	1.60	25	1.0	2.6	**14.33**	**19.09**
T05_S	1	4	10.0	10.0	1.70	25	1.0	2.7	**13.48**	**18.38**
T05_E	1	4	10.0	10.0	1.60	25	1.0	2.6	**14.33**	**19.09**
T05_W	1	4	10.0	10.0	1.70	25	1.0	2.7	**13.48**	**18.38**

Calculated FoS of Natural Peat Slopes for Littleton Wind Farm - Drained Analysis

Turbine No./Waypoint	Slope	Design c'	Bulk unit weight of Peat	Unit weight of Water	Depth of In situ Peat	Friction Angle	Surcharge Equivalent Placed Fill	Equivalent Total Depth of Peat (m)	Factor of Safety for Load Condition	
	α (deg)	c' (kPa)	γ (kN/m^3)	γ_w (kN/m^3)	(m)	ø' (deg)	Condition (2)	Condition (2)	Condition (1)	Condition (2)
									100% Water	100% Water
T06_C	1	4	10.0	10.0	0.90	25	1.0	1.9	**25.47**	**26.13**
T06_N	1	4	10.0	10.0	0.80	25	1.0	1.8	**28.65**	**27.58**
T06_S	1	4	10.0	10.0	0.80	25	1.0	1.8	**28.65**	**27.58**
T06_E	1	4	10.0	10.0	0.80	25	1.0	1.8	**28.65**	**27.58**
T06_W	1	4	10.0	10.0	0.90	25	1.0	1.9	**25.47**	**26.13**
T07_C	1	4	10.0	10.0	1.70	25	1.0	2.7	**13.48**	**18.38**
T07_N	1	4	10.0	10.0	1.90	25	1.0	2.9	**12.06**	**17.12**
T07_S	1	4	10.0	10.0	1.60	25	1.0	2.6	**14.33**	**19.09**
T07_E	1	4	10.0	10.0	0.80	25	1.0	1.8	**28.65**	**27.58**
T07_W	1	4	10.0	10.0	1.60	25	1.0	2.6	**14.33**	**19.09**
T08_C	1	4	10.0	10.0	1.60	25	1.0	2.6	**14.33**	**19.09**
T08_N	1	4	10.0	10.0	1.60	25	1.0	2.6	**14.33**	**19.09**
T08_S	1	4	10.0	10.0	1.60	25	1.0	2.6	**14.33**	**19.09**
T08_E	1	4	10.0	10.0	1.70	25	1.0	2.7	**13.48**	**18.38**
T08_W	1	4	10.0	10.0	1.70	25	1.0	2.7	**13.48**	**18.38**
T09_C	1	4	10.0	10.0	0.90	25	1.0	1.9	**25.47**	**26.13**
T09_N	1	4	10.0	10.0	1.00	25	1.0	2.0	**22.92**	**24.82**
T09_S	1	4	10.0	10.0	2.50	25	1.0	3.5	**9.17**	**14.18**
T09_E	1	4	10.0	10.0	0.70	25	1.0	1.7	**32.75**	**29.20**
T09_W	1	4	10.0	10.0	0.40	25	1.0	1.4	**57.31**	**35.46**
T010_C	1	4	10.0	10.0	0.90	25	1.0	1.9	**25.47**	**26.13**
T010_N	1	4	10.0	10.0	1.20	25	1.0	2.2	**19.10**	**22.56**
T010_S	1	4	10.0	10.0	0.70	25	1.0	1.7	**32.75**	**29.20**
T010_E	1	4	10.0	10.0	0.70	25	1.0	1.7	**32.75**	**29.20**
T010_W	1	4	10.0	10.0	0.50	25	1.0	1.5	**45.85**	**33.09**
T011_C	1	4	10.0	10.0	0.40	25	1.0	1.4	**57.31**	**35.46**
T011_N	1	4	10.0	10.0	0.20	25	1.0	1.2	**114.61**	**41.36**
T011_S	1	4	10.0	10.0	0.80	25	1.0	1.8	**28.65**	**27.58**
T011_E	1	4	10.0	10.0	0.50	25	1.0	1.5	**45.85**	**33.09**
T011_W	1	4	10.0	10.0	0.50	25	1.0	1.5	**45.85**	**33.09**
								Minimum =	**3.83**	**4.97**
								Maximum =	**179.53**	**46.65**
								Average =	**31.38**	**25.63**

Notes:

(1) Assuming a bulk unit weight of peat of 10 (kN/m^3)
(2) Assuming a surcharge equivalent to fill depth of 1.0m.
(3) Slope inclination (β) based on site readings and contour survey plans of site.
(4) FoS is based on slope inclination and shear test results obtained from published data.
(5) Peat depths based on probes carried out by FT.
(6) For load conditions see Report text.
(7) Minimum acceptable factor of safety required of 1.3 for first-time failures based on BS: 6031:1981 Code of practice for Earthworks.

Calculated FoS of Natural Peat Slopes for Littleton Wind Farm - Undrained Analysis

Turbine No./Waypoint	Easting	Northing	Slope	Undrained shear strength	Bulk unit weight of Peat	Peat Depth	Surcharge Equivalent Placed Fill Depth (m)	Factor of Safety for Load Condition	
			β (deg)	c_u (kPa)	γ (kN/m^3)	(m)	Condition (2)	Condition (1)	Condition (2)
1	621659	650974	No peat found at this location						
2	621530	651126	1	6	10	1.80	2.8	**19.10**	**12.28**
3	621455	651219	1	6	10	1.30	2.3	**26.45**	**14.95**
4	621378	651313	No peat found at this location						
5	621181	651519	1	6	10	1.40	2.4	**24.56**	**14.33**
6	621104	651598	1	6	10	2.10	3.1	**16.37**	**11.09**
7	621026	651672	1	6	10	0.90	1.9	**38.20**	**18.10**
8	620955	651741	1	6	10	0.40	1.4	**85.96**	**24.56**
9	620825	651873	No peat found at this location						
10	620735	651956	2	6	10	0.80	1.8	**21.50**	**9.56**
11	620662	652032	1	8	10	2.80	3.8	**16.37**	**12.06**
12	620493	652163	1	6	10	1.20	2.2	**28.65**	**15.63**
13	620395	652224	1	6	10	2.70	3.7	**12.73**	**9.29**
14	620293	652203	1	8	10	2.40	3.4	**19.10**	**13.48**
15	620233	652125	1	6	10	1.80	2.8	**19.10**	**12.28**
16	620187	652031	1	6	10	1.80	2.8	**19.10**	**12.28**
17	620141	651931	1	6	10	0.90	1.9	**38.20**	**18.10**
18	620076	651844	1	6	10	0.70	1.7	**49.12**	**20.23**
19	619999	651791	1	6	10	0.90	1.9	**38.20**	**18.10**
20	619956	651697	1	6	10	1.20	2.2	**28.65**	**15.63**
21	619932	651598	No peat found at this location						
22	620720	652127	3	6	10	1.20	2.2	**9.57**	**5.22**
23	620746	652232	No peat found at this location						
24	620808	652322	No peat found at this location						
25	621047	652692	No peat found at this location						
26	621166	652899	No peat found at this location						
27	621217	652998	No peat found at this location						
28	621271	653094	No peat found at this location						
29	621481	653487	1	6	10	3.50	4.5	**9.82**	**7.64**
30	621745	653904	1	6	10	0.90	1.9	**38.20**	**18.10**
31	621972	654251	1	6	10	0.90	1.9	**38.20**	**18.10**
32	622232	654634	1	6	10	1.50	2.5	**22.92**	**13.75**
33	622388	654884	1	6	10	1.70	2.7	**20.23**	**12.73**
34	622715	655370	1	6	10	1.70	2.7	**20.23**	**12.73**
35	622950	655706	1	6	10	1.20	2.2	**28.65**	**15.63**
36	623510	655332	1	6	10	1.20	2.2	**28.65**	**15.63**
37	623678	655114	2	6	10	1.10	2.1	**15.64**	**8.19**
38	623632	655039	2	6	10	1.20	2.2	**14.34**	**7.82**
39	623524	654885	No peat found at this location						
40	623472	654805	4	6	10	1.40	2.4	**6.16**	**3.59**
41	623408	654715	5	6	10	0.90	1.9	**7.68**	**3.64**
42	623337	654637	No peat found at this location						
43	623262	654568	1	6	10	1.40	2.4	**24.56**	**14.33**
44	623180	654499	1	6	10	1.60	2.6	**21.49**	**13.22**
45	623168	656061	1	6	10	2.00	3.0	**17.19**	**11.46**
46	623248	656190	1	6	10	1.80	2.8	**19.10**	**12.28**
47	623165	656135	1	6	10	0.50	1.5	**68.77**	**22.92**
48	623069	656073	1	6	10	0.50	1.5	**68.77**	**22.92**
49	622982	656019	1	6	10	0.70	1.7	**49.12**	**20.23**
50	623442	656459	1	6	10	2.10	3.1	**16.37**	**11.09**
52	623682	656717	2	6	10	0.40	1.4	**43.01**	**12.29**
53	623755	656639	1	6	10	0.80	1.8	**42.98**	**19.10**
54	623767	656547	1	6	10	1.30	2.3	**26.45**	**14.95**
55	623953	656270	1	6	10	1.30	2.3	**26.45**	**14.95**
56	624094	656006	1	6	10	1.00	2.0	**34.38**	**17.19**
57	623725	656918	No peat found at this location						
58	623789	657026	1	6	10	1.00	2.0	**34.38**	**17.19**
59	623861	657126	1	6	10	1.00	2.0	**34.38**	**17.19**
60	623923	657237	1	6	10	0.70	1.7	**49.12**	**20.23**
61	624033	657219	1	6	10	1.20	2.2	**28.65**	**15.63**
62	623698	657021	1	6	10	0.80	1.8	**42.98**	**19.10**
63	623672	657123	1	6	10	2.40	3.4	**14.33**	**10.11**
64	623648	657232	1	6	10	0.80	1.8	**42.98**	**19.10**
65	623624	657332	No peat found at this location						
66	623599	657436	No peat found at this location						
67	623573	657541	No peat found at this location						
68	623547	657640	No peat found at this location						
69	623522	657741	No peat found at this location						
70	623497	657840	No peat found at this location						
71	623441	658066	1	6	10	0.80	1.8	**42.98**	**19.10**
72	623414	658173	1	6	10	0.80	1.8	**42.98**	**19.10**
73	623391	658281	1	6	10	0.80	1.8	**42.98**	**19.10**
74	623364	658385	1	6	10	0.90	1.9	**38.20**	**18.10**
75	623333	658495	1	6	10	0.50	1.5	**68.77**	**22.92**
76	623222	658970	1	6	10	0.80	1.8	**42.98**	**19.10**
77	623106	659264	1	6	10	3.30	4.3	**10.42**	**8.00**
78	623054	659358	1	6	10	2.20	3.2	**15.63**	**10.75**
79	622992	659451	1	6	10	2.10	3.1	**16.37**	**11.09**
80	622906	659644	No peat found at this location						
81	621945	654405	1	6	10	1.30	2.3	**26.45**	**14.95**
82	621861	654466	1	6	10	1.00	2.0	**34.38**	**17.19**
83	623550	658052	1	6	10	0.60	1.6	**57.31**	**21.49**
84	623658	658027	1	6	10	2.10	3.1	**16.37**	**11.09**
85	623767	658018	1	6	10	2.40	3.4	**14.33**	**10.11**
86	624301	657379	1	6	10	2.30	3.3	**14.95**	**10.42**
87	624231	657288	1	6	10	1.70	2.7	**20.23**	**12.73**
88	624213	657079	1	6	10	2.70	3.7	**12.73**	**9.29**
89	624149	656987	1	6	10	3.50	4.5	**9.82**	**7.64**
90	624091	656895	1	6	10	3.80	4.8	**9.05**	**7.16**
91	624031	656805	1	6	10	3.00	4.0	**11.46**	**8.60**
92	623976	656721	1	6	10	2.80	3.8	**12.28**	**9.05**
93	623915	656633	1	6	10	2.80	3.8	**12.28**	**9.05**
94	623855	656545	1	6	10	2.80	3.8	**12.28**	**9.05**
95	623796	656460	1	6	10	1.50	2.5	**22.92**	**13.75**
96	624296	657304	1	6	10	0.95	2.0	**36.19**	**17.63**

Calculated FoS of Natural Peat Slopes for Littleton Wind Farm - Undrained Analysis

Turbine No./Waypoint	Easting	Northing	Slope	Undrained shear strength	Bulk unit weight of Peat	Peat Depth	Surcharge Equivalent Placed Fill Depth (m)	Factor of Safety for Load Condition	
			β (deg)	c_u (kPa)	γ (kN/m^3)	(m)	Condition (2)	Condition (1)	Condition (2)
97	623658	658762	1	6	10	1.15	2.2	**29.90**	**15.99**
98	623667	658871	1	6	10	0.15	1.2	**229.23**	**29.90**
99	623525	658749	1	6	10	2.85	3.9	**12.06**	**8.93**
100	623411	658718	1	6	10	1.65	2.7	**20.84**	**12.98**
101	623436	658879	1	6	10	2.20	3.2	**15.63**	**10.75**
102	623297	658785	1	6	10	1.00	2.0	**34.38**	**17.19**
103	623216	659106	1	6	10	1.65	2.7	**20.84**	**12.98**
104	622898	659710	No peat found at this location						
105	622864	659752	No peat found at this location						
106	624029	655817	1	6	10	0.60	1.6	**57.31**	**21.49**
107	623982	655719	1	6	10	1.60	2.6	**21.49**	**13.22**
108	623929	655620	1	6	10	1.00	2.0	**34.38**	**17.19**
109	623884	655517	1	6	10	0.75	1.8	**45.85**	**19.65**
110	623830	655420	1	6	10	0.85	1.9	**40.45**	**18.59**
111	623785	655319	1	6	10	1.55	2.6	**22.18**	**13.48**
112	623732	655228	1	6	10	1.40	2.4	**24.56**	**14.33**
113	623623	655187	1	6	10	1.75	2.8	**19.65**	**12.50**
114	623554	655114	No peat found at this location						
115	623242	654462	1	6	10	0.70	1.7	**49.12**	**20.23**
116	623194	654520	1	6	10	0.70	1.7	**49.12**	**20.23**
117	623109	654465	1	6	10	2.00	3.0	**17.19**	**11.46**
118	621742	650926	1	6	10	0.70	1.7	**49.12**	**20.23**
119	621636	650901	1	6	10	0.40	1.4	**85.96**	**24.56**
120	621547	650899	1	6	10	0.25	1.3	**137.54**	**27.51**
121	621428	651120	1	6	10	1.75	2.8	**19.65**	**12.50**
122	621378	651218	1	6	10	0.15	1.2	**229.23**	**29.90**
123	621329	651404	No peat found at this location						
124	621144	651479	1	6	10	1.90	2.9	**18.10**	**11.86**
125	621165	651642	1	6	10	3.35	4.4	**10.26**	**7.90**
126	621240	651727	1	6	10	1.00	2.0	**34.38**	**17.19**
127	621344	651760	No peat found at this location						
128	621437	651820	1	6	10	0.95	2.0	**36.19**	**17.63**
129	621513	651909	1	6	10	0.20	1.2	**171.92**	**28.65**
130	621042	651604	1	6	10	1.15	2.2	**29.90**	**15.99**
131	620962	651687	1	6	10	1.40	2.4	**24.56**	**14.33**
132	620849	651819	1	6	10	0.70	1.7	**49.12**	**20.23**
133	622856	655470	1	6	10	0.20	1.2	**171.92**	**28.65**
134	623524	656121	1	6	10	0.20	1.2	**171.92**	**28.65**
135	623444	656181	1	6	10	1.70	2.7	**20.23**	**12.73**
136	623355	656257	1	6	10	0.30	1.3	**114.61**	**26.45**
138	623941	657118	1	6	10	0.20	1.2	**171.92**	**28.65**
139	624146	657114	1	6	10	2.65	3.7	**12.98**	**9.42**
MM03	622153	654752	1	6	10	0.80	1.8	**42.98**	**19.10**
T01_2025	624043	657145	1	6	10	1.00	2.0	**34.38**	**17.19**
T02_2025	623722	656642	1	6	10	1.20	2.2	**28.65**	**15.63**
T03_2025	623595	656036	1	6	10	1.20	2.2	**28.65**	**15.63**
T04_2025	623026	656033	1	6	10	0.60	1.6	**57.31**	**21.49**
T05_2025	622810	655374	1	6	10	0.95	2.0	**36.19**	**17.63**
T06_2025	623465	655080	1	6	10	1.10	2.1	**31.26**	**16.37**
T07_2025	622443	654875	1	6	10	0.75	1.8	**45.85**	**19.65**
T08_2025	623024	654420	1	6	10	0.70	1.7	**49.12**	**20.23**
T09_2025	620928	651760	1	6	10	0.65	1.7	**52.90**	**20.84**
T11_2025	621454	651016	1	6	10	1.95	3.0	**17.63**	**11.66**
CC_001	620177	651914	1	6	10	0.70	1.7	**49.12**	**20.23**
CC_002	620219	652004	1	6	10	0.70	1.7	**49.12**	**20.23**
CC_003	621729	653807	1	6	10	0.90	1.9	**38.20**	**18.10**
CC_004	621763	653856	1	6	10	1.00	2.0	**34.38**	**17.19**
CC_005	622981	655641	3	6	10	1.00	2.0	**11.48**	**5.74**
CC_006	623066	655589	3	6	10	0.50	1.5	**22.96**	**7.65**
CC_007	623039	655545	3	6	10	1.00	2.0	**11.48**	**5.74**
CC_008	623225	659181	1	6	10	2.50	3.5	**13.75**	**9.82**
CC_009	623261	659036	1	6	10	1.60	2.6	**21.49**	**13.22**
PRA_001	623395	658830	1	6	10	1.80	2.8	**19.10**	**12.28**
PRA_002	623502	658857	1	6	10	3.60	4.6	**9.55**	**7.47**
PRA_003	623555	658643	1	6	10	2.00	3.0	**17.19**	**11.46**
PRA_004	623437	658620	1	6	10	0.80	1.8	**42.98**	**19.10**
PRA_005	623470	658743	1	6	10	3.00	4.0	**11.46**	**8.60**
SS_001	623349	658973	1	6	10	1.40	2.4	**24.56**	**14.33**
SS_002	623311	658824	1	6	10	1.40	2.4	**24.56**	**14.33**
MM_001	621801	654504	3	6	10	1.00	2.0	**11.48**	**5.74**
MM_002	621782	654548	4	6	10	1.50	2.5	**5.75**	**3.45**
T01_C	624121	657241	1	6	10	1.70	2.7	**20.23**	**12.73**
T01_N			1	6	10	1.20	2.2	**28.65**	**15.63**
T01_S			1	6	10	1.30	2.3	**26.45**	**14.95**
T01_E			1	6	10	1.70	2.7	**20.23**	**12.73**
T01_W			1	6	10	1.70	2.7	**20.23**	**12.73**
T02_C	623554	656586	1	6	10	1.50	2.5	**22.92**	**13.75**
T02_N			1	6	10	1.50	2.5	**22.92**	**13.75**
T02_S			1	6	10	2.50	3.5	**13.75**	**9.82**
T02_E			1	6	10	1.50	2.5	**22.92**	**13.75**
T02_W			1	6	10	2.40	3.4	**14.33**	**10.11**
T03_C	624059	655927	1	6	10	0.90	1.9	**38.20**	**18.10**
T03_N			1	6	10	0.90	1.9	**38.20**	**18.10**
T03_S			1	6	10	0.90	1.9	**38.20**	**18.10**
T03_E			1	6	10	1.00	2.0	**34.38**	**17.19**
T03_W			1	6	10	1.00	2.0	**34.38**	**17.19**
T04_C	622863	655964	1	6	10	1.30	2.3	**26.45**	**14.95**
T04_N			1	6	10	1.20	2.2	**28.65**	**15.63**
T04_S			1	6	10	1.20	2.2	**28.65**	**15.63**
T04_E			1	6	10	1.40	2.4	**24.56**	**14.33**
T04_W			1	6	10	1.20	2.2	**28.65**	**15.63**
T05_C	623227	655458	1	6	10	1.70	2.7	**20.23**	**12.73**
T05_N			1	6	10	1.60	2.6	**21.49**	**13.22**
T05_S			1	6	10	1.70	2.7	**20.23**	**12.73**
T05_E			1	6	10	1.60	2.6	**21.49**	**13.22**
T05_W			1	6	10	1.70	2.7	**20.23**	**12.73**

Calculated FoS of Natural Peat Slopes for Littleton Wind Farm - Undrained Analysis

Turbine No./Waypoint	Easting	Northing	Slope	Undrained shear strength	Bulk unit weight of Peat	Peat Depth	Surcharge Equivalent Placed Fill Depth (m)	Factor of Safety for Load Condition	
			β (deg)	c_u (kPa)	γ (kN/m^3)	(m)	Condition (2)	Condition (1)	Condition (2)
T06_C	623561	654979	1	6	10	0.90	1.9	**38.20**	**18.10**
T06_N			1	6	10	0.80	1.8	**42.98**	**19.10**
T06_S			1	6	10	0.80	1.8	**42.98**	**19.10**
T06_E			1	6	10	0.80	1.8	**42.98**	**19.10**
T06_W			1	6	10	0.90	1.9	**38.20**	**18.10**
T07_C	622484	655013	1	6	10	1.70	2.7	**20.23**	**12.73**
T07_N			1	6	10	1.90	2.9	**18.10**	**11.86**
T07_S			1	6	10	1.60	2.6	**21.49**	**13.22**
T07_E			1	6	10	0.80	1.8	**42.98**	**19.10**
T07_W			1	6	10	1.60	2.6	**21.49**	**13.22**
T08_C	623067	654422	1	6	10	1.60	2.6	**21.49**	**13.22**
T08_N			1	6	10	1.60	2.6	**21.49**	**13.22**
T08_S			1	6	10	1.60	2.6	**21.49**	**13.22**
T08_E			1	6	10	1.70	2.7	**20.23**	**12.73**
T08_W			1	6	10	1.70	2.7	**20.23**	**12.73**
T09_C	620913	651814	1	6	10	0.90	1.9	**38.20**	**18.10**
T09_N			1	6	10	1.00	2.0	**34.38**	**17.19**
T09_S			1	6	10	2.50	3.5	**13.75**	**9.82**
T09_E			1	6	10	0.70	1.7	**49.12**	**20.23**
T09_W			1	6	10	0.40	1.4	**85.96**	**24.56**
T010_C	621246	651429	1	6	10	0.90	1.9	**38.20**	**18.10**
T010_N			1	6	10	1.20	2.2	**28.65**	**15.63**
T010_S			1	6	10	0.70	1.7	**49.12**	**20.23**
T010_E			1	6	10	0.70	1.7	**49.12**	**20.23**
T010_W			1	6	10	0.50	1.5	**68.77**	**22.92**
T011_C	621584	651035	1	6	10	0.40	1.4	**85.96**	**24.56**
T011_N			1	6	10	0.20	1.2	**171.92**	**28.65**
T011_S			1	6	10	0.80	1.8	**42.98**	**19.10**
T011_E			1	6	10	0.50	1.5	**68.77**	**22.92**
T011_W			1	6	10	0.50	1.5	**68.77**	**22.92**
							Minimum =	**5.75**	**3.45**
							Maximum =	**229.23**	**29.90**
							Average =	**36.86**	**15.48**
							Count =	196	

Notes:

(1) Assuming a bulk unit weight for peat of 10kN/m^3

(2) Assuming a surcharge equivalent to fill depth of 1m of peat i.e. 10kPa.

(3) Slope inclination (β) based on site readings and site contour plans.

(4) A lower bound undrained shear strength, cu for the peat of 6 and 8kPa was selected for the assessment. It should be noted that a cu of 6/8kPa for the peat is considered a conservative value for the analysis and is not representative of all peat present across the site. In reality the peat has a significantly higher undrained strength.

(5) Peat depths based on probes carried out by FT.

(6) For load conditions see report text.

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APPENDIX D

Methodology for Peat Stability Risk Assessment

Methodology for Peat Stability Risk Assessment

A peat stability risk assessment was carried out for each of the main infrastructure elements at the proposed wind farm development. This approach takes into account guidelines for geotechnical/peat stability risk assessments as given in PLHRAG (2nd Edition, 2017) and MacCulloch (2005). The degree of risk is determined as a Risk Rating (R), which is the product of probability (P) and impact (I). How these factors are determined and applied in the analysis is described below.

The main approaches for assessing peat stability include the following:

(a) Geomorphological

(b) Qualitative (judgement)

(c) Index/Probabilistic (probability)

(d) Deterministic (factor of safety)

Approaches (a) to (c) listed above would be considered subjective and do not provide a definitive indication of stability; in addition, a high level of judgement/experience is required which makes it difficult to relate the findings to real conditions. FT apply a more objective approach, the deterministic approach. As part of FT's deterministic approach, a qualitative risk assessment is also carried out taking into account qualitative factors, which cannot necessarily be quantified.

Probability

The likelihood of a peat failure occurring was assessed based on the results of both the quantitative results of stability calculations (deterministic approach using factors of safety) and the assessment of the severity of several qualitative factors which cannot be reasonably included in a stability calculation but nevertheless may affect the occurrence of peat instability.

The qualitative factors used in the risk assessment are outlined in Table A and have been compiled based on FT's experience of assessments and construction in peat land sites and peat failures throughout Ireland and the UK.

Table A: Qualitative Factors used to Assess Potential for Peat Failure

Qualitative Factor	Type of Feature/Indicator for each Qualitative Factor [1]	Explanation/Description of Qualitative Factor
Evidence of sub peat water flow	No	Based on site walkover observations. Sub peat water flow generally occurs in the form of natural piping at the base of peat. Where there is a constriction or blockage in natural pipes a build-up of water can occur at the base of the peat causing a reduction in effective stress at the base of the peat resulting in failure; this is particularly critical during periods of intense rainfall.
	Possibly	
	Probably	
	Yes	
Evidence of surface water flow	Dry	Based on site walkover observations. The presence of surface water flow indicates if peat in an area is well drained or saturated and if any additional loading from the ponding of surface water onto the peat is likely.
	Localised/Flowing in drains	
	Ponded in drains	
	Springs/surface water	
Evidence of previous failures/slips	No	Based on site walkover observations. The presence of clustering of relict failures may indicate that particular pre-existing site conditions predispose a site to failure.
	In general area	
	On site	
	Within 500m of location	
Type of vegetation	Grass/Crops	Based on site walkover observations. The type of vegetation present indicates if peat in an area is well drained, saturated, etc. Vegetation that indicates wetter ground may also indicate softer underlying peat deposits.
	Improved Grass/Dry Heather	
	Wet Grassland/Juncus (Rushes)	
	Wetlands Sphagnum (Peat moss)	
General slope characteristics upslope/downslope from infrastructure location	Concave	Based on site walkover observations. Slope morphology in the area of the infrastructure location is an important factor. A number of recorded peat failures have occurred in close proximity to a convex break in slope.
	Planar to concave	
	Planar to convex	
	Convex	

Qualitative Factor	Type of Feature/Indicator for each Qualitative Factor [(1)]	Explanation/Description of Qualitative Factor
Evidence of very soft/soft clay at base of peat	No	Based on inspection of exposures in general area from site walkover. Several reported peat failures identify the presence of a weak layer at the base of the peat along which shear failure has occurred.
	Yes	
Evidence of mechanically cut peat	No	Based on site walkover observations. Mechanically cut peat typically cut using a 'sausage' machine to extract
	Yes	peat for harvesting. Areas which have been cut in this manner have been linked to peat instability. The mechanical cuts can notably reduce the intrinsic strength of the peat and also allow ingress of rainfall/surface water.
Evidence of quaking or buoyant peat	No	Based on site walkover observations. Quaking/buoyant peat is indicative of highly saturated peat, which would generally be considered to have a low strength. Quaking peat is a feature on sites that have been previously linked with peat instability.
	Yes	
Evidence of bog pools	No	Based on site walkover observations. Bog pools are generally an indicator of areas of weak, saturated peat. Commonly where there are open areas of water within peat these can be interconnected, with the result that there may be sub-surface bodies of water. The presence of bog pools have been previously linked with peat instability.
	Yes	
Other	Varies	In addition to the above features/ indicators and based on site recordings the following are some of the features which may be identified: Excessively deep peat, weak peat, overly steep slope angles, etc.

Note (1) The list of features/indicators for each qualitative factor are given in increasing order of probability of leading to peat instability/failure.

It should be noted that the presence of one of the qualitative factors alone from Table A is unlikely to lead to peat instability/failure. Peat instability/failure at a site is generally the combination of a number of these factors occurring at the same time at a particular location. The probability rating assigned to the quantitative and qualitative factors is judged on a 5-point scale from 1 (indicating negligible or no probability of failure) to 5 (indicating a very likely failure), as outlined in Table B.

Table B: Probability Scale

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

Scale	Likelihood of Qualitative Factor leading to Peat Failure	Probability of Failure
1	Negligible/None	Least
2	Unlikely	
3	Probable	
4	Likely	
5	Very Likely	Greatest

Impact

The severity of the risk is also assessed qualitatively in terms of impact. The impact of a peat failure on the environment within and beyond the immediate wind farm site is assessed based on the potential travel distance of a peat failure. Where a peat failure enters a watercourse, it can travel a considerable distance downstream. Therefore, the proximity of a potential peat failure to a drainage course is a significant indicator of the likely potential impact.

The risk is determined based on the combination of hazard and impact. A qualitative scale has been derived for the impact of the hazard based on distance of infrastructure element to a watercourse (Table C).

The location of watercourses is based on topographic maps and supplemented by site observations from walkover survey. Note that not all watercourses are shown on maps.

Table C: Impact Scale

Scale	Criteria	Impact
1	Proposed infrastructure element greater than 150m of watercourse	Negligible/None
2	Proposed infrastructure element within 150 to 101m of watercourse	Low
3	Proposed infrastructure element within 100 to 51m of watercourse	Medium
4	Proposed infrastructure element within 50 m of watercourse	High
5	Proposed infrastructure element within 50 m of watercourse, in an environmentally sensitive area	Extremely High

Risk Rating

The degree of risk is determined as the product of probability (P) and impact (I), which gives the Risk Rating (R) as follows:

The Risk Rating is calculated from: R = P x I

Due to the 5-point scales used to assess Probability and Impact, the Risk Rating can range from 1 to 25 as shown in Table D.

Table D: Qualitative Risk Rating

		Probability				
		1	**2**	**3**	**4**	**5**
Impact	**5**	5	10	15	20	25
	4	4	8	12	16	20
	3	3	6	9	12	15
	2	2	4	6	8	10
	1	1	2	3	4	5

Risk Rating & Control Measures	
17 to 25	High: avoid working in area or significant control measures required
11 to 16	Medium: notable control measures required
5 to 10	Low: only routine control measures required
1 to 4	Negligible: none or only routine control measures required

The risk rating is calculated individually for each contributory factor. Control measures are required to reduce the risk to at least a 'Low' risk rating. The control measures in response to the qualitative risk ratings are included in the peat stability risk registers for each main infrastructure element in Appendix B.

The risk rating is calculated individually for each contributory factor. Control measures are required to reduce the risk to at least a 'Low' risk rating

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APPENDIX E

Ground Investigation Report (October 2022)

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Ground Investigations Ireland

Littleton Wind Farm

Fehily Timoney and Company

Ground Investigation Report

October 2022

Directors: Fergal McNamara (MD), Conor Finnerty, Aisling McDonnell & Barry Sexton
Ground Investigations Ireland Limited | Registered in Ireland Company Regsitration No.: 405726

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DOCUMENT CONTROL SHEET

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Engineer	Fehily Timoney and Company
Client	Bord na Móna
Project No	11947-06-22
Document Title	Ground Investigation Report

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C	Final	C McParland	J Cashen	B Sexton	Dublin	24 October 2022

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Appendix 1 Figures
Appendix 2 Trial Pit Records
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1.0 Preamble

On the instructions of Fehily Timoney and Company, a site investigation was carried out by Ground Investigations Ireland Ltd. (GII) between July and August 2022, at the site of the proposed wind farm in Littleton, County Tipperary.

2.0 Overview

2.1. Background

Construction of a new wind farm with associated substations and access road network is proposed at the site in Littleton, County Tipperary. At the time of the site investigation the site consisted of three interlinked boglands - Longfordpass Bog, Littleton Bog and Lanespark Bog.

2.2. Purpose and Scope

The purpose of the site investigation was to investigate subsurface conditions utilising a variety of investigative methods in accordance with the project specification. The scope of the work undertaken for this project included the following:

- Visit project site to observe existing conditions
- Carry out 28 No. Trial Pits to a maximum depth of 4.50m BGL
- Factual Report

3.0 Subsurface Exploration

3.1. General

During the ground investigation a programme of intrusive investigation specified by the Consulting Engineer was undertaken to determine the sub surface conditions at the proposed site. Regular sampling and in-situ testing were undertaken in the exploratory holes to facilitate the geotechnical descriptions and to enable laboratory testing to be carried out on the soil samples recovered during excavation and drilling.
The procedures used in this site investigation are in accordance with Eurocode 7 Part 2: Ground Investigation and testing (ISEN 1997 – 2:2007) and B.S. 5930:2015+A1:2020.

3.2. Trial Pits

The trial pits were excavated using a 12T wide tracked excavator at the locations shown in the exploratory hole location plan in Appendix 1. The locations were checked using a CAT scan to minimise the potential for encountering services during the excavation. The trial pits were sampled, logged and photographed by a Geo-Environmental Engineer prior to backfilling with arisings. Notes were made of any services,

inclusions, pit stability, groundwater encountered, and the characteristics of the strata encountered and are presented on the trial pit logs which are provided in Appendix 2 of this Report.

3.3. Surveying

The exploratory hole locations have been recorded using a KQGeo M8 GNSS System which records the coordinates and elevation of the locations to ITM as required by the project specification. The coordinates and elevations are provided on the exploratory hole logs in the appendices of this Report.

3.4. Laboratory Testing

Samples were selected from the exploratory holes for a range of geotechnical and environmental testing to assist in the classification of soils and to provide information for the proposed design.
Chemical testing, as required by the specification, including the organic matter, total sulphur, water soluble sulphate and acid soluble sulphate testing, was carried out by Element Materials Technology Laboratory in the United Kingdom (UK).
Geotechnical testing consisting of Moisture Content, Atterberg Limits, and Particle Size Distribution (PSD), California Bearing Ratio (CBR), Moisture Condition Value (MCV) and Compaction tests were carried out by Professional Soils Laboratory (PSL) in the UK.
The results of the laboratory testing are included in Appendix 3 of this Report.

4.0 Ground Conditions

4.1. General

The ground conditions encountered during the investigation are summarised below with reference to insitu and laboratory test results. The full details of the strata encountered during the ground investigation are provided in the exploratory hole logs included in the appendices of this report.

The sequence of strata encountered were consistent across the site and generally comprised;

- Topsoil / Possible Made Ground
- Peat
- Cohesive Deposits
- Granular Deposits

TOPSOIL: Topsoil was encountered in TP-05 only and was present to a depth of 0.10m BGL.

POSSIBLE MADE GROUND: Possible Made Ground deposits were encountered in exploratory holes TP-06 and TP-26 and were present to depths of 0.65m and 1.30m BGL, respectively. These deposits were described generally as *dark brown slightly clayey amorphous Peat with roots and occasional boulders*. These deposits have been referred to as possible made ground as they appeared to have been reworked.

PEAT: Peat was encountered in all the exploratory holes and was generally described as *dark brown slightly clayey pseudo-fibrous PEAT.* In several of the exploratory holes a layer of *dark brown slightly clayey amorphous PEAT* overlay the pseudo-fibrous Peat. The thickness of peat varied from 0.50m to 4.50m, with the full extent of the peat not determined at TP-02, TP-21 and TP-23.

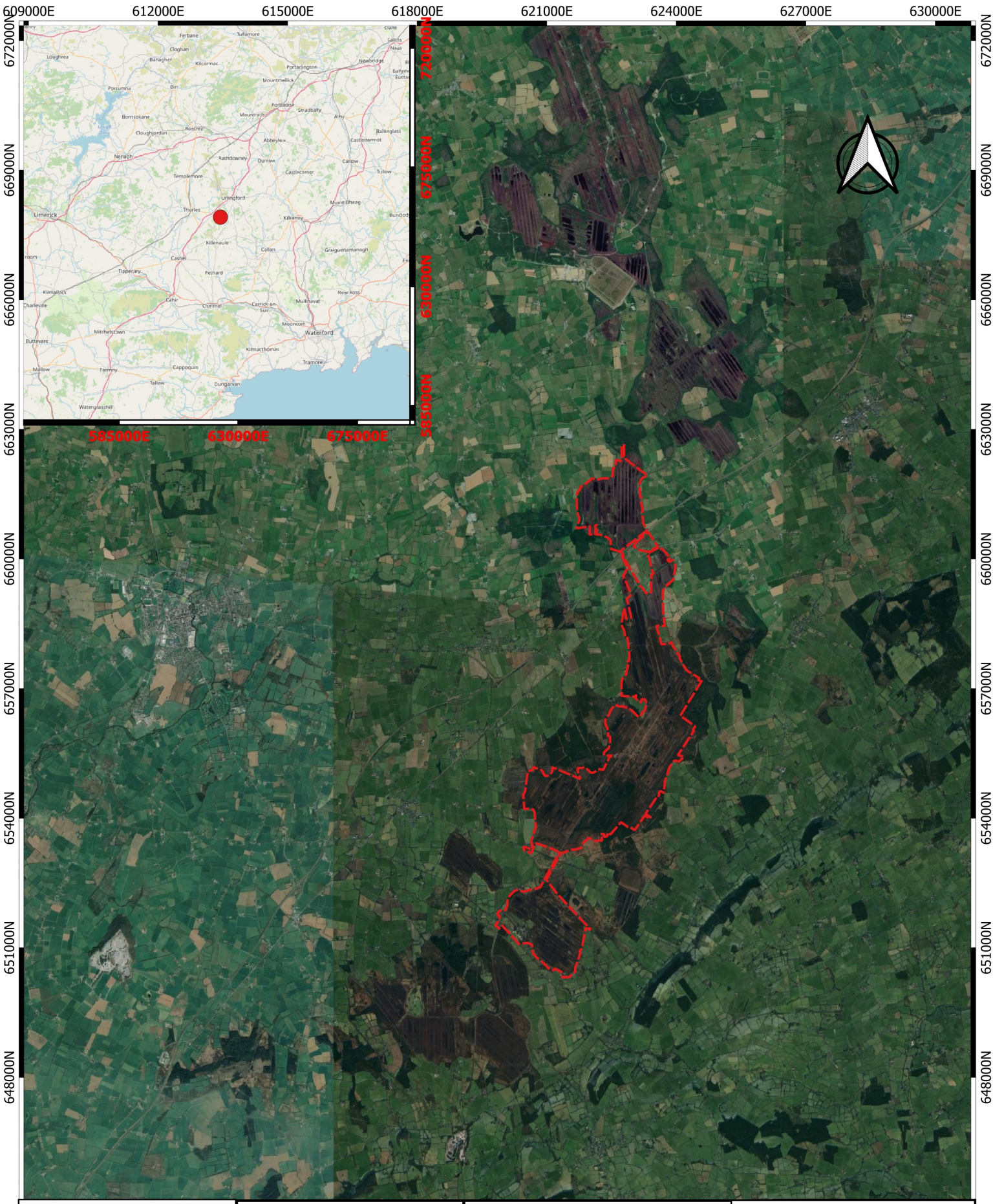
COHESIVE DEPOSITS: Cohesive deposits were encountered beneath the peat at most locations and were described typically as *grey slightly sandy slightly gravelly clayey SILT or a grey slightly sandy slightly gravelly silty CLAY.* These deposits generally had *occasional cobbles and boulders* within the mass of the material. The secondary sand and gravel constituents varied across the site and with depth, with granular lenses occasionally present in the glacial till matrix. When in contact with water, the Silt deposits appeared to partially liquify. These deposits had occasional (<5%), some (5%-20%) or many (20%-50%) cobble and boulder content, where noted on the exploratory hole logs.

GRANULAR DEPOSITS: The granular deposits were encountered below the peat deposits at TP-13 and TP-35, and below the cohesive deposits at most other locations. They were typically described as g*rey slightly sandy silty clayey subangular to subrounded fine to coarse GRAVEL with occasional cobbles and boulders.* The secondary sand and silt/clay constituents varied across the site and with depth, while occasional (<5%), some (5%-20%) or many (20%-50%) cobble and boulder content was also present, where noted on the exploratory hole logs. In TP-35, a layer of sand was encountered below the peat and was described as *grey slightly clayey gravelly silty fine to coarse SAND with occasional cobbles.* This sand layer overlay the gravel deposit.

4.2. Groundwater

Groundwater strikes are noted on the exploratory hole logs where they occurred. We would point out that these exploratory holes did not remain open for sufficiently long periods of time to establish the hydrogeological regime and groundwater levels would be expected to vary with time of year, rainfall, nearby construction, and other factors.

APPENDIX 1 - Figures



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Engineer:

FEHILY TIMONEY

0 1,000 2,000 3,000 4,000 m

Project Title:
Littleton Wind Farm

Drawing Title:
Figure 1 Proposed SI

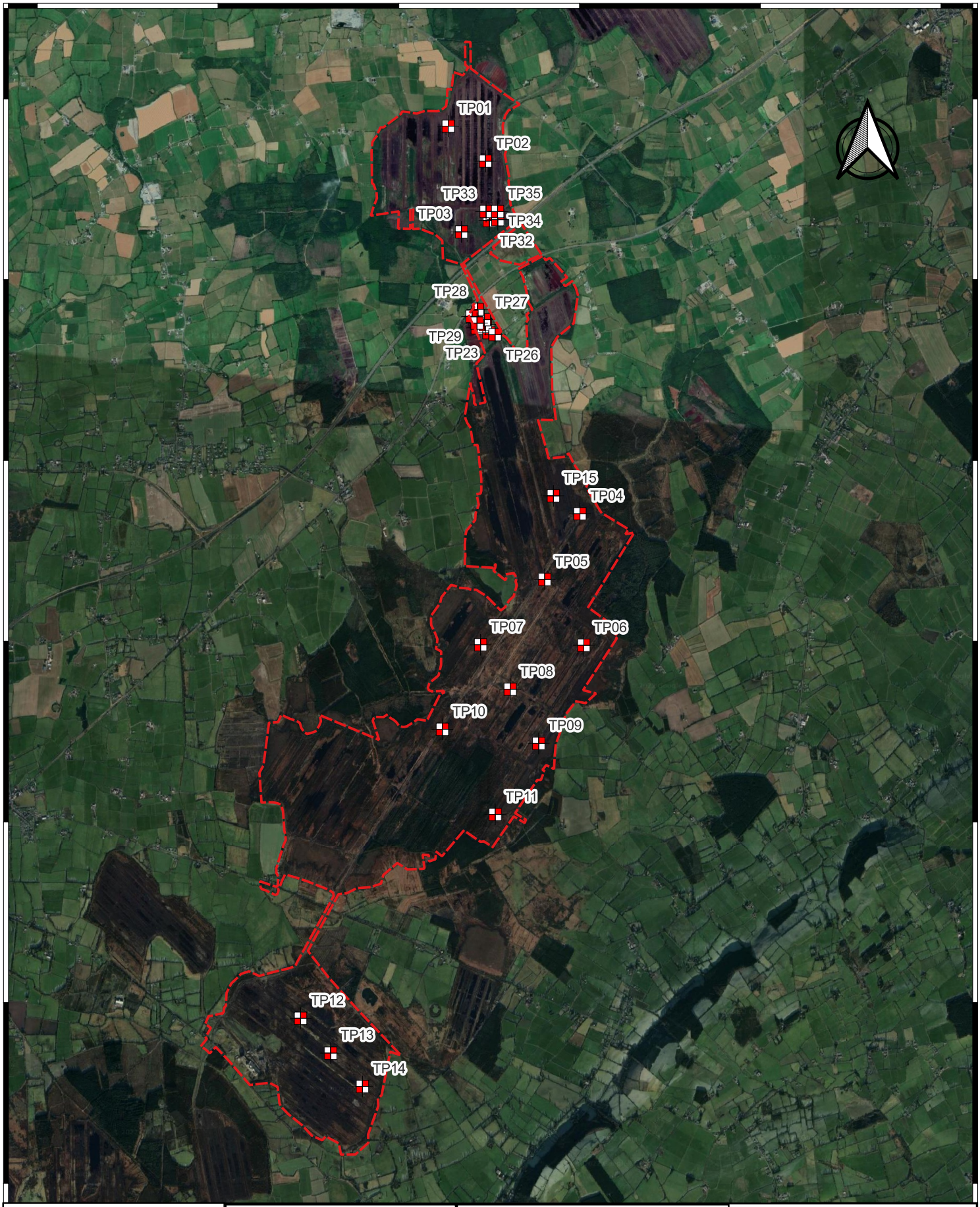
GII Project Reference:
11947-06-22

Drawn By:
JC

Date:
28/09/2022

Indicative Site Boundary

Site Location



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Engineer:

FEHILY TIMONEY

0 600 1,200 1,800 m

Project Title:
Littleton Wind Farm

Drawing Title:
Figure 2 - All Exploratory Hole Locations

GII Project Reference:
11947-06-22

Drawn By:
CMP

Date:
01/09/2022

Indicative Site Boundary

Trial Pit

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Engineer:

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0 150 300 450 m

Project Title:
Littleton Wind Farm

Drawing Title:
Figure 3 - Northern SI Plan

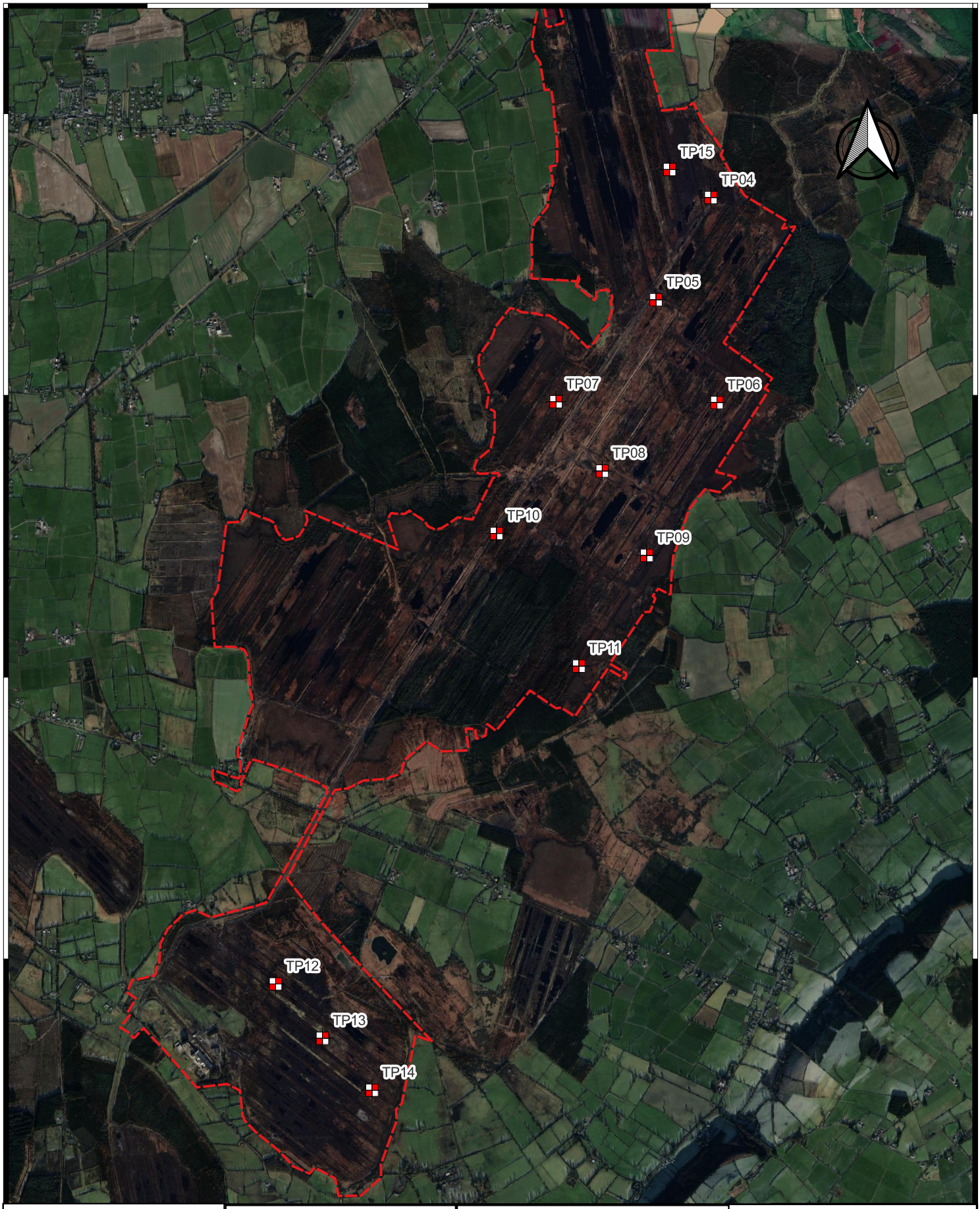
GII Project Reference:
11947-06-22

Drawn By:
CMP

Date:
01/09/2022

Indicative Site Boundary

Trial Pit



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Engineer:

FEHILY TIMONEY

Project Title:
Littleton Wind Farm

Drawing Title:
Figure 4 - Southern SI Plan

GII Project Reference:
11947-06-22

0 150 300 450 m

Drawn By:
CMP

Date:
01/09/2022

Indicative Site Boundary

Trial Pit

APPENDIX 2 – Trial Pit Records

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Site Littleton Wind Farm			**Trial Pit Number** TP-01
Machine : 12 Tonne tracked excavator **Method :** Trial Pit	**Dimensions** 5.70m x 1.00m x 4.50m (L x W x D)	**Ground Level (mOD)** 121.23	**Client** Bord na Móna	**Job Number** 11947-06-22
	Location 622546.8 E 661687.4 N	**Dates** 30/08/2022	**Engineer** Fehily Timoney	**Sheet** 1/2

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(1.60)	Very soft brown slightly clayey pseudo fibrous PEAT		
				119.63	1.60			
					(1.80)	Very soft dark brown slightly clayey pseudo fibrous PEAT with plant remains and tree limbs/trunks		
				117.83	3.40			
3.50 3.50	B T		Seepage(1) at 3.50m.		(0.60)	Soft to firm bluish grey slightly sandy slightly gravelly silty CLAY with occasional cobbles		▽1
				117.23	4.00			

Plan

Remarks

Groundwater encountered at 3.50m and 4.00m BGL; Seepage and Fast Ingress
Trial pit stable
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	CMP	11947-06-22.TP-01

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Site Littleton Wind Farm			**Trial Pit Number** TP-01
Machine : 12 Tonne tracked excavator **Method :** Trial Pit	**Dimensions** 5.70m x 1.00m x 4.50m (L x W x D)	**Ground Level (mOD)** 121.23	**Client** Bord na Móna	**Job Number** 11947-06-22
	Location 622546.8 E 661687.4 N	**Dates** 30/08/2022	**Engineer** Fehily Timoney	**Sheet** 2/2

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
4.30 4.30	B T		Fast Ingress(2) at 4.00m.	116.73	(0.50) 4.50	Grey slightly sandy slightly silty clayey subangular to subrounded fine to coarse GRAVEL with occasional cobbles and boulders Complete at 4.50m		▽2

Plan

Remarks

Scale (approx)	Logged By	Figure No.
1:25	CMP	11947-06-22.TP-01

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Site Littleton Wind Farm			**Trial Pit Number** TP-02
Machine : 12 Tonne tracked excavator **Method :** Trial Pit	**Dimensions** 5.00m x 1.00m x 4.50m (L x W x D)	**Ground Level (mOD)** 121.38	**Client** Bord na Móna	**Job Number** 11947-06-22
	Location 622959.4 E 661300.1 N	**Dates** 30/08/2022	**Engineer** Fehily Timoney	**Sheet** 1/2

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.50)	Very soft dark brown slightly clayey amorphous PEAT		
				120.88	0.50	Very soft brown slightly clayey pseudo fibrous PEAT with plant remains		
					(4.00)			

Plan

Remarks

Groundwater encounted at 4.50m BGL; Seepage
Trial pit unstable; Side walls collapsed
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	CMP	11947-06-22.TP-02

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Site Littleton Wind Farm			**Trial Pit Number** TP-02
Machine : 12 Tonne tracked excavator **Method :** Trial Pit	**Dimensions** 5.00m x 1.00m x 4.50m (L x W x D)	**Ground Level (mOD)** 121.38	**Client** Bord na Móna	**Job Number** 11947-06-22
	Location 622959.4 E 661300.1 N	**Dates** 30/08/2022	**Engineer** Fehily Timoney	**Sheet** 2/2

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
			Seepage(1) at 4.50m.	116.88	4.50	Complete at 4.50m		▽1

Plan

Remarks

Scale (approx)	Logged By	Figure No.
1:25	CMP	11947-06-22.TP-02

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Site Littleton Wind Farm			**Trial Pit Number** TP-03
Machine : 12 Tonne tracked excavator **Method :** Trial Pit	**Dimensions** 5.20m x 1.00m x 3.70m (L x W x D)	**Ground Level (mOD)** 121.55	**Client** Bord na Móna	**Job Number** 11947-06-22
	Location 622693.1 E 660517.2 N	**Dates** 30/08/2022	**Engineer** Fehily Timoney	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.70)	Very soft brown slightly clayey pseudo fibrous PEAT		
				120.85	0.70			
1.00 1.00	B T				(1.70)	Soft to firm grey slightly sandy slightly gravelly clayey SILT with occasional cobbles and boulders Occasional sand lens encountered between 0.70m and 2.40m BGL		
				119.15	2.40			
3.00 3.00	B T				(1.00)	Soft to firm slightly sandy gravelly clayey SILT with occasional cobbles and boulders		
			Medium Ingress(1) at 3.40m.	118.15	3.40			▽1
					(0.30)	Grey slightly sandy slightly silty slightly clayey subangular to subrounded fine to coarse GRAVEL with occasional cobbles and boulders Obstruction: Presumed bedrock/boulders		
				117.85	3.70	Complete at 3.70m		

Plan

Remarks

Groundwater encountered at 3.40m BGL; Medium Ingress
Trial pit stable
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	CMP	11947-06-22.TP-03

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Site Littleton Wind Farm			**Trial Pit Number** TP-04
Machine : 12 Tonne tracked excavator **Method :** Trial Pit	**Dimensions** 4.80m x 1.00m x 4.00m (L x W x D)	**Ground Level (mOD)** 125.93	**Client** Bord na Móna	**Job Number** 11947-06-22
	Location 624004.1 E 657397.4 N	**Dates** 18/07/2022	**Engineer** Fehily Timoney	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.70)	Very soft dark brown slightly clayey pseudo fibrous PEAT with roots, plant remains and rare cobbles		
			Seepage(1) at 0.70m.	125.23	0.70	Very soft grey slightly sandy slightly gravelly clayey SILT with occasional cobbles and boulders. Silt oozing when in contact with water		▽1
2.50 2.50	B T				(3.30)			
			Seepage(2) at 3.80m.					▽2
4.00	BT			121.93	4.00			

Plan

Remarks

Groundwater encountered at 0.70m and 3.80m BGL; Both Seepage
Trial pit unstable; side walls collapsed
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	CMP	11947-06-22.TP-04

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Site Littleton Wind Farm			**Trial Pit Number** TP-05
Machine : 12 Tonne tracked excavator **Method :** Trial Pit	**Dimensions** 4.50m x 1.00m x 3.20m (L x W x D)	**Ground Level (mOD)** 123.11	**Client** Bord na Móna	**Job Number** 11947-06-22
	Location 623614.5 E 656671.8 N	**Dates** 18/07/2022	**Engineer** Fehily Timoney	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
				123.01	(0.10) 0.10	TOPSOIL		
						Very soft dark brown slightly clayey pseudo fibrous PEAT with roots		
					(1.00)			
				122.01	1.10			
			Seepage(1) at 1.20m.			Very soft grey slightly sandy slightly gravelly clayey SILT with occasional cobbles. Silt oozing when in contact with water		▽1
1.50 1.50	B T				(0.90)			
				121.11	2.00	Grey slightly sandy silty subangular to subrounded fine to coarse GRAVEL with occasional cobbles		
					(1.20)			
			Fast Ingress(2) at 2.90m.					▽2
3.00 3.00	B T							
				119.91	3.20	Complete at 3.20m		

Plan

Remarks

Groundwater encountered at 1.20m and 2.90m BGL; Seepage and Fast Ingress
Trial pit unstable; side walls collapsed
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	CMP	11947-06-22.TP-05

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Site Littleton Wind Farm			**Trial Pit Number** TP-06
Machine : 12 Tonne tracked excavator **Method :** Trial Pit	**Dimensions** 4.80m x 1.00m x 4.00m (L x W x D)	**Ground Level (mOD)** 123.57	**Client** Bord na Móna	**Job Number** 11947-06-22
	Location 624047.1 E 655942.4 N	**Dates** 19/07/2022	**Engineer** Fehily Timoney	**Sheet** 1/2

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.65)	MADE GROUND: Dark brown slightly clayey amorphous Peat with roots		
				122.92	0.65			
					(0.85)	Very soft dark brown slightly clayey pseudo fibrous PEAT		
1.50 1.50	B T			122.07	1.50			
			Seepage(1) at 2.70m.		(1.50)	Very soft grey slightly sandy gravelly clayey SILT. Silt oozing when in contact with water		▽1
				120.57	3.00			
					(1.00)	Very soft grey slightly sandy gravelly silty CLAY with occasional cobbles and boulders		
4.00 4.00	T B			119.57	4.00			

Plan

Remarks

Groundwater encountered at 2.70m BGL; Seepage
Trial pit unstable; side walls collapsed
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	CMP	11947-06-22.TP-06

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Site Littleton Wind Farm			**Trial Pit Number** TP-07
Machine : 12 Tonne tracked excavator **Method :** Trial Pit	**Dimensions** 4.70m x 1.00m x 4.50m (L x W x D)	**Ground Level (mOD)** 124.19	**Client** Bord na Móna	**Job Number** 11947-06-22
	Location 622904.6 E 655947.8 N	**Dates** 19/07/2022	**Engineer** Fehily Timoney	**Sheet** 1/2

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(1.30)	Very soft dark brown slightly clayey pseudo fibrous PEAT with a tree stump		
				122.89	1.30			
2.00 2.00	B T		Seepage(1) at 2.50m.		(1.50)	Very soft grey slightly sandy slightly gravelly very clayey SILT with occasional cobbles and boulders. Silt oozing when in contact with water		▽1
				121.39	2.80			
3.50 3.50	B T		Medium Ingress(2) at 3.70m.		(1.70)	Very soft grey slightly sandy slightly silty very gravelly CLAY with many coobles and boulders		▽2

Plan

Remarks

Groundwater encountered at 2.50m and 3.70m BGL; Seepage and Medium Ingress
Trial pit unstable; side walls collapsed
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	CMP	11947-06-22.TP-10

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Site Littleton Wind Farm			**Trial Pit Number** TP-07
Machine : 12 Tonne tracked excavator **Method :** Trial Pit	**Dimensions** 4.70m x 1.00m x 4.50m (L x W x D)	**Ground Level (mOD)** 124.19	**Client** Bord na Móna	**Job Number** 11947-06-22
	Location 622904.6 E 655947.8 N	**Dates** 19/07/2022	**Engineer** Fehily Timoney	**Sheet** 2/2

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
				119.69	4.50	Complete at 4.50m		

Plan

Remarks

Scale (approx)	Logged By	Figure No.
1:25	CMP	11947-06-22.TP-10

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Site Littleton Wind Farm			**Trial Pit Number** TP-08
Machine : 12 Tonne tracked excavator **Method :** Trial Pit	**Dimensions** 4.50m x 1.00m x 4.50m (L x W x D)	**Ground Level (mOD)** 122.80	**Client** Bord na Móna	**Job Number** 11947-06-22
	Location 623232.6 E 655455.9 N	**Dates** 19/07/2022	**Engineer** Fehily Timoney	**Sheet** 1/2

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(1.20)	Very soft dark brown slightly clayey amorphous PEAT with branches		
			Seepage(1) at 1.20m.	121.60	1.20			▽1
					(0.60)	Very soft light brown slightly clayey pseudo fibrous PEAT		
				121.00	1.80			
					(0.70)	Very soft grey slightly sandy slightly gravelly clayey SILT with occasional cobbles and boulders. Silt oozing when in contact with water		
2.50 2.50	B T			120.30	2.50			
					(2.00)	Very soft grey slightly sandy slightly silty very gravelly CLAY with many cobbles and boulders		

Plan

Remarks

Groundwater encountered at 1.20m BGL; Seepage
Trial pit unstable; side walls collapsed
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	CMP	11947-06-22.TP-08

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Site Littleton Wind Farm			**Trial Pit Number** TP-08
Machine : 12 Tonne tracked excavator **Method :** Trial Pit	**Dimensions** 4.50m x 1.00m x 4.50m (L x W x D)	**Ground Level (mOD)** 122.80	**Client** Bord na Móna	**Job Number** 11947-06-22
	Location 623232.6 E 655455.9 N	**Dates** 19/07/2022	**Engineer** Fehily Timoney	**Sheet** 2/2

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
4.50 4.50	B T			118.30	4.50	Complete at 4.50m		

Plan

Remarks

Scale (approx)	Logged By	Figure No.
1:25	CMP	11947-06-22.TP-08

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Site Littleton Wind Farm			**Trial Pit Number** TP-09
Machine : 12 Tonne tracked excavator **Method :** Trial Pit	**Dimensions** 4.50m x 1.00m x 3.20m (L x W x D)	**Ground Level (mOD)** 123.96	**Client** Bord na Móna	**Job Number** 11947-06-22
	Location 623548.1 E 654856.5 N	**Dates** 19/07/2022	**Engineer** Fehily Timoney	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(1.20)	Very soft dark brown slightly clayey pseudo fibrous PEAT with roots and wood		
				122.76	1.20			
1.70 1.70	B T				(1.80)	Very soft grey slightly clayey sandy gravelly SILT with occasional cobbles and boulders. Silt oozing when in contact with water		
2.70 2.70	B T							
			Fast Ingress(1) at 3.00m.	120.96	3.00			▽1
					(0.20)	Grey slightly sandy slightly clayey subangular to subrounded fine to coarse GRAVEL with many cobbles and boulders		
				120.76	3.20	Terminated at 3.20m		

Plan

Remarks

Groundwater encountered at 3.00m BGL; Fast Ingress
Trial pit unstable; side walls collapsed
Trial pit backfilled upon completion
Trial pit terminated at 3.20m due to collapsed side walls

Scale (approx)	Logged By	Figure No.
1:25	CMP	11947-06-22.TP-06

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Site Littleton Wind Farm			**Trial Pit Number** TP-10
Machine : 12 Tonne tracked excavator **Method :** Trial Pit	**Dimensions** 4.80m x 1.00m x 4.50m (L x W x D)	**Ground Level (mOD)** 123.04	**Client** Bord na Móna	**Job Number** 11947-06-22
	Location 622481.9 E 655012.8 N	**Dates** 19/07/2022	**Engineer** Fehily Timoney	**Sheet** 1/2

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(1.60)	Very soft dark brown slightly clayey pseudo fibrous PEAT with plant remains and branches		
				121.44	1.60			
					(1.40)	Very soft grey slightly sandy slightly gravelly silty CLAY with occasional cobbles and boulders		
3.00 3.00	B T		Seepage(1) at 3.00m.	120.04	3.00			▽1
					(1.50)	Very soft grey slightly sandy slightly gravelly very clayey SILT with many coobles and boulders. Silt oozing when in contact with water		

Plan

Remarks

Groundwater encountered at 3.00m BGL; Seepage
Trial pit unstable; side walls collapsed
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	CMP	11947-06-22.TP-10

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Site Littleton Wind Farm			**Trial Pit Number** TP-10
Machine : 12 Tonne tracked excavator **Method :** Trial Pit	**Dimensions** 4.80m x 1.00m x 4.50m (L x W x D)	**Ground Level (mOD)** 123.04	**Client** Bord na Móna	**Job Number** 11947-06-22
	Location 622481.9 E 655012.8 N	**Dates** 19/07/2022	**Engineer** Fehily Timoney	**Sheet** 2/2

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
4.50 4.50	B T			118.54	4.50	Complete at 4.50m		

Plan

Remarks

Scale (approx)	Logged By	Figure No.
1:25	CMP	11947-06-22.TP-10

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Site Littleton Wind Farm			**Trial Pit Number** TP-11
Machine : 12 Tonne tracked excavator **Method :** Trial Pit	**Dimensions** 4.50m x 1.00m x 4.50m (L x W x D)	**Ground Level (mOD)** 125.46	**Client** Bord na Móna	**Job Number** 11947-06-22
	Location 623066.7 E 654070.5 N	**Dates** 19/07/2022	**Engineer** Fehily Timoney	**Sheet** 1/2

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(3.00)	Very soft dark brown slightly clayey pseudo fibrous PEAT with plant remains		
			Seepage(1) at 3.00m.	122.46	3.00			▽1
3.50 3.50	B T				(0.80)	Very soft grey slightly sandy slightly gravelly clayey SILT with occasional cobbles and boulders. Silt oozing when in contact with water		
				121.66	3.80	Grey slightly sandy slightly silty slightly clayey subangular to subrounded fine to coarse GRAVEL		

Plan

Remarks

Groundwater encountered at 3.00m BGL; Seepage
Trial pit unstable; side walls collapsed
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	CMP	11947-06-22.TP-11

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Site Littleton Wind Farm			**Trial Pit Number** TP-11
Machine : 12 Tonne tracked excavator **Method :** Trial Pit	**Dimensions** 4.50m x 1.00m x 4.50m (L x W x D)	**Ground Level (mOD)** 125.46	**Client** Bord na Móna	**Job Number** 11947-06-22
	Location 623066.7 E 654070.5 N	**Dates** 19/07/2022	**Engineer** Fehily Timoney	**Sheet** 2/2

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.70)			
4.50 4.50	B T			120.96	4.50	Complete at 4.50m		

Plan

Remarks

Scale (approx)	Logged By	Figure No.
1:25	CMP	11947-06-22.TP-11

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Site Littleton Wind Farm			**Trial Pit Number** TP-12
Machine : 12 Tonne tracked excavator **Method :** Trial Pit	**Dimensions** 4.80m x 1.00m x 3.00m (L x W x D)	**Ground Level (mOD)** 120.68	**Client** Bord na Móna	**Job Number** 11947-06-22
	Location 620912.7 E 651814.4 N	**Dates** 20/07/2022	**Engineer** Fehily Timoney	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.65)	Very soft dark brown slightly clayey pseudo fibrous PEAT with plant remains and branches		
				120.03	0.65	Very soft grey slightly sandy gravelly clayey SILT with occasional cobbles and boulders. Silt oozing when in contact with water		
					(1.35)			
2.00 2.00	B T		Seepage(1) at 2.00m.	118.68	2.00	Grey slightly sandy slightly silty clayey subangular to subrounded fine to coarse GRAVEL with many cobbles and boulders		▽1
					(1.00)			
3.00 3.00	B T		Seepage(2) at 3.00m.	117.68	3.00	Terminated at 3.00m		▽2

Plan

Remarks

Groundwater encountered at 2.00m and 3.00m BGL; Both Seepage
Trial pit unstable; side walls collapsed
Trial pit backfilled upon completion
Trial pit terminated due to excavator sinking in wet bog area

Scale (approx)	Logged By	Figure No.
1:25	CMP	11947-06-22.TP-12

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Site Littleton Wind Farm			**Trial Pit Number** TP-13
Machine : 12 Tonne tracked excavator **Method :** Trial Pit	**Dimensions** 4.80m x 1.00m x 2.80m (L x W x D)	**Ground Level (mOD)** 121.40	**Client** Bord na Móna	**Job Number** 11947-06-22
	Location 621245.6 E 651428.9 N	**Dates** 20/07/2022	**Engineer** Fehily Timoney	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.80)	Very soft dark brown slightly clayey pseudo fibrous PEAT with tree stumps		
				120.60	0.80			
1.00 1.00	B T				(1.00)	Grey slightly sandy slightly silty slightly clayey subangular to subrounded fine to coarse GRAVEL with occasional cobbles		
				119.60	1.80			
					(1.00)	Very soft grey slightly sandy gravelly clayey SILT with many cobbles and boulders. Silt oozing when in contact with water		
2.50 2.50	B T		Seepage(1) at 2.60m. Medium Ingress(2) at 2.80m.			Obstruction: No progress - Presumed Bedrock		▽1 ▽2
				118.60	2.80	Terminated at 2.80m		

Plan

Remarks

Groundwater encountered at 2.60m and 2.80m BGL; Seepage and Medium Ingress
Trial pit unstable; side walls collapsed
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	CMP	11947-06-22.TP-13

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Site Littleton Wind Farm			**Trial Pit Number** TP-14
Machine : 12 Tonne tracked excavator **Method :** Trial Pit	**Dimensions** 4.80m x 1.00m x 4.50m (L x W x D)	**Ground Level (mOD)** 124.94	**Client** Bord na Móna	**Job Number** 11947-06-22
	Location 621597.4 E 651060.1 N	**Dates** 20/07/2022	**Engineer** Fehily Timoney	**Sheet** 1/2

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.70)	Very soft dark brown slightly clayey amorphous PEAT with roots		
				124.24	0.70			
					(0.20)	Very soft light brown slightly clayey pseudo fibrous PEAT with roots		
0.90 0.90	B T			124.04	0.90	Very soft grey slightly sandy gravelly clayey SILT with occasional cobbles and boulders. Silt oozing when in contact with water		
					(1.10)			
2.00 2.00	B T			122.94	2.00	Very soft grey slightly sandy gravelly silty CLAY with many cobbles and boulders		
					(2.50)			
			Seepage(1) at 3.80m.					▽1

Plan

Remarks

Groundwater encountered at 3.80m BGL; Seepage
Trial pit unstable; side walls collapsed
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	CMP	11947-06-22.TP-14

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Site Littleton Wind Farm			**Trial Pit Number** TP-14
Machine : 12 Tonne tracked excavator **Method :** Trial Pit	**Dimensions** 4.80m x 1.00m x 4.50m (L x W x D)	**Ground Level (mOD)** 124.94	**Client** Bord na Móna	**Job Number** 11947-06-22
	Location 621597.4 E 651060.1 N	**Dates** 20/07/2022	**Engineer** Fehily Timoney	**Sheet** 2/2

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
4.50 4.50	B T			120.44	4.50	Terminated at 4.50m		

Plan

Remarks

Scale (approx)	Logged By	Figure No.
1:25	CMP	11947-06-22.TP-14

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Site Littleton Wind Farm			**Trial Pit Number** TP-15
Machine : 12 Tonne tracked excavator **Method :** Trial Pit	**Dimensions** 4.00m x 1.00m x 4.50m (L x W x D)	**Ground Level (mOD)** 126.79	**Client** Bord na Móna	**Job Number** 11947-06-22
	Location 623710.9 E 657596.2 N	**Dates** 18/07/2022	**Engineer** Fehily Timoney	**Sheet** 1/2

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.50	B				(1.40)	Very soft dark brown slightly clayey pseudo fibrous PEAT with roots		
			Seepage(1) at 1.40m.	125.39	1.40			▽1
1.50 1.50	B T				(1.60)	Very soft grey slightly sandy slightly gravelly clayey SILT with occasional cobbles and boulders. Silt oozing when in contact with water		
				123.79	3.00			
					(1.50)	Very soft grey slightly sandy slightly gravelly clayey SILT with some subangular to subrounded cobbles and occasional boulders		

Plan

Remarks

Groundwater encountered at 1.40m BGL; Seepage
Trial pit unstable; side walls collapsed
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	CMP	11947-06-22.TP-15

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Site Littleton Wind Farm			**Trial Pit Number** TP-15
Machine : 12 Tonne tracked excavator **Method :** Trial Pit	**Dimensions** 4.00m x 1.00m x 4.50m (L x W x D)	**Ground Level (mOD)** 126.79	**Client** Bord na Móna	**Job Number** 11947-06-22
	Location 623710.9 E 657596.2 N	**Dates** 18/07/2022	**Engineer** Fehily Timoney	**Sheet** 2/2

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
				122.29	4.50	Complete at 4.50m		

Plan

Remarks

Scale (approx)	Logged By	Figure No.
1:25	CMP	11947-06-22.TP-15

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Site Littleton Wind Farm			**Trial Pit Number** TP-21
Machine : 12 Tonne tracked excavator **Method :** Trial Pit	**Dimensions** 4.60m x 1.00m x 4.00m (L x W x D)	**Ground Level (mOD)** 125.90	**Client** Bord na Móna	**Job Number** 11947-06-22
	Location 622867.9 E 659455.4 N	**Dates** 29/08/2022	**Engineer** Fehily Timoney	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
						Very soft brown slightly clayey pseudo fibrous PEAT with plant remains and tree trunks/limbs		
					(4.00)			
			Seepage(1) at 3.60m.			Terminated due to maximum excavator reach. Pit completed on slight incline.		▽1
				121.90	4.00			

Plan

Remarks

Groundwater encountered at 3.60m BGL; Seepage
Trial pit stable
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	CMP	11947-06-22.TP-21

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Site Littleton Wind Farm			**Trial Pit Number** TP-23
Machine : 12 Tonne tracked excavator **Method :** Trial Pit	**Dimensions** 4.00m x 1.00m x 3.00m (L x W x D)	**Ground Level (mOD)** 126.78	**Client** Bord na Móna	**Job Number** 11947-06-22
	Location 622996.3 E 659400.5 N	**Dates** 29/08/2022	**Engineer** Fehily Timoney	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
1.50 1.50	B T		Seepage(1) at 1.90m.		(3.00)	Very soft brown slightly clayey pseudo fibrous PEAT with plant remains		▽1
				123.78	3.00	Terminated at 3.00m		

Plan

Remarks

Groundwater encountered at 1.90m BGL; Seepage
Trial pit unstable; side walls collapsed
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	CMP	11947-06-22.TP-23

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Site Littleton Wind Farm			**Trial Pit Number** TP-24
Machine : 12 Tonne tracked excavator **Method :** Trial Pit	**Dimensions** 4.60m x 1.00m x 4.50m (L x W x D)	**Ground Level (mOD)** 125.40	**Client** Bord na Móna	**Job Number** 11947-06-22
	Location 622959.3 E 659492.4 N	**Dates** 29/08/2022	**Engineer** Fehily Timoney	**Sheet** 1/2

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(2.50)	Very soft brown slightly clayey pseudo fibrous PEAT with plant remains		
				122.90	2.50			
3.00 3.00	B T				(1.50)	Very soft grey slightly sandy gravelly clayey SILT with occasional cobbles		
				121.40	4.00			

Plan

Remarks

Groundwater encountered at 4.10m and 4.50m BGL; Both Seepage
Trial pit stable
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	CMP	11947-06-22.TP-24

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Site Littleton Wind Farm			**Trial Pit Number** TP-24
Machine : 12 Tonne tracked excavator **Method :** Trial Pit	**Dimensions** 4.60m x 1.00m x 4.50m (L x W x D)	**Ground Level (mOD)** 125.40	**Client** Bord na Móna	**Job Number** 11947-06-22
	Location 622959.3 E 659492.4 N	**Dates** 29/08/2022	**Engineer** Fehily Timoney	**Sheet** 2/2

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
			Seepage(1) at 4.10m.		(0.50)	Grey slightly sandy slightly silty clayey subangular to subrounded fine to coarse GRAVEL with occasional cobbles and boulders		▽1
4.50 4.50	B T		Seepage(2) at 4.50m.	120.90	4.50	Complete at 4.50m		▽2

Plan

Remarks

Scale (approx)	Logged By	Figure No.
1:25	CMP	11947-06-22.TP-24

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Site Littleton Wind Farm			**Trial Pit Number** TP-26
Machine : 12 Tonne tracked excavator **Method :** Trial Pit	**Dimensions** 5.70m x 1.00m x 4.50m (L x W x D)	**Ground Level (mOD)** 126.71	**Client** Bord na Móna	**Job Number** 11947-06-22
	Location 623065.3 E 659379.2 N	**Dates** 29/08/2022	**Engineer** Fehily Timoney	**Sheet** 1/2

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(1.30)	POSSIBLE MADE GROUND: Very soft dark brown slightly clayey amorphous Peat with occasional boulders		
				125.41	1.30			
					(1.80)	Very soft brown slightly clayey pseudo fibrous PEAT with plant remains and tree trunks/limbs		
2.70 2.70	B T							
				123.61	3.10			
3.50 3.50	B T				(0.90)	Very soft grey slightly silty sandy gravelly CLAY with occasional cobbles		
				122.71	4.00			

Plan

Remarks

Groundwater encountered at 4.50m BGL; Seepage
Trial pit stable
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	CMP	11947-06-22.TP-26

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Site Littleton Wind Farm			**Trial Pit Number** TP-26
Machine : 12 Tonne tracked excavator **Method :** Trial Pit	**Dimensions** 5.70m x 1.00m x 4.50m (L x W x D)	**Ground Level (mOD)** 126.71	**Client** Bord na Móna	**Job Number** 11947-06-22
	Location 623065.3 E 659379.2 N	**Dates** 29/08/2022	**Engineer** Fehily Timoney	**Sheet** 2/2

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.50)	Very soft grey slightly silty slightly sandy gravelly CLAY with occasional cobbles and boulders		
4.50 4.50	B T		Seepage(1) at 4.50m.	122.21	4.50	Complete at 4.50m		▽1

Plan

Remarks

Scale (approx)	Logged By	Figure No.
1:25	CMP	11947-06-22.TP-26

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Site Littleton Wind Farm			**Trial Pit Number** TP-27
Machine : 12 Tonne tracked excavator **Method :** Trial Pit	**Dimensions** 4.90m x 1.00m x 4.50m (L x W x D)	**Ground Level (mOD)** 125.47	**Client** Bord na Móna	**Job Number** 11947-06-22
	Location 622945.6 E 659545.3 N	**Dates** 29/08/2022	**Engineer** Fehily Timoney	**Sheet** 1/2

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(2.20)	Very soft brown slightly clayey pseudo fibrous PEAT with plant remains and tree trunks/limbs		
				123.27	2.20			
2.50 2.50	B T				(1.30)	Very soft grey slightly sandy gravelly clayey SILT with occasional cobbles		
				121.97	3.50			
3.50 3.50	B T					Very soft grey slightly silty slightly sandy gravelly CLAY with occasional cobbles		

Plan

Remarks

Groundwater encountered at 4.20m BGL; Seepage
Trial pit stable
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	CMP	11947-06-22.TP-27

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Site Littleton Wind Farm			**Trial Pit Number** TP-27
Machine : 12 Tonne tracked excavator **Method :** Trial Pit	**Dimensions** 4.90m x 1.00m x 4.50m (L x W x D)	**Ground Level (mOD)** 125.47	**Client** Bord na Móna	**Job Number** 11947-06-22
	Location 622945.6 E 659545.3 N	**Dates** 29/08/2022	**Engineer** Fehily Timoney	**Sheet** 2/2

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
			Seepage(1) at 4.20m.		(1.00)			
				120.97	4.50	Complete at 4.50m		▽1

Plan

Remarks

Scale (approx)	Logged By	Figure No.
1:25	CMP	11947-06-22.TP-27

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Site Littleton Wind Farm			**Trial Pit Number** TP-28
Machine : 12 Tonne tracked excavator **Method :** Trial Pit	**Dimensions** 4.50m x 1.00m x 3.60m (L x W x D)	**Ground Level (mOD)** 125.15	**Client** Bord na Móna	**Job Number** 11947-06-22
	Location 622870.3 E 659661.1 N	**Dates** 29/08/2022	**Engineer** Fehily Timoney	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.30)	Very soft dark brown slightly clayey amorphous PEAT		
				124.85	0.30			
					(1.40)	Very soft brown slightly clayey pseudo fibrous PEAT with plant remains and tree limbs/trunks		
				123.45	1.70			
2.00 2.00	B T				(0.90)	Very soft to soft grey slightly sandy clayey gravelly SILT with occasional cobbles and boulders		
				122.55	2.60			
			Seepage(1) at 2.70m.			Grey slightly sandy silty clayey subangular to subrounded fine to coarse GRAVEL with many cobbles and boulders		▽1
3.00 3.00	B T		Medium Ingress(2) at 3.00m.		(1.00)			▽2
				121.55	3.60			
						Complete at 3.60m		

Plan

Remarks

Groundwater encountered at 2.70m and 3.00m BGL; Seepage and Medium Ingress
Trial pit stable
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	CMP	11947-06-22.TP-28

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Site Littleton Wind Farm			**Trial Pit Number** TP-29
Machine : 12 Tonne tracked excavator **Method :** Trial Pit	**Dimensions** 4.50m x 1.00m x 3.00m (L x W x D)	**Ground Level (mOD)** 124.40	**Client** Bord na Móna	**Job Number** 11947-06-22
	Location 622810.5 E 659582.8 N	**Dates** 29/08/2022	**Engineer** Fehily Timoney	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(2.50)	Very soft brown slightly clayey pseudo fibrous PEAT with plant remains and tree limbs/trunks		
				121.90	2.50			
					(0.50)	Firm bluish grey slightly sandy slightly gravelly silty CLAY with occasional cobbles and boulders		
3.00	B			121.40	3.00	Terminated at 3.00m		
3.00	T							

Plan

Remarks

No groundwater encountered
Trial pit stable
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	CMP	11947-06-22.TP-29

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Site Littleton Wind Farm			**Trial Pit Number** TP-30
Machine : 12 Tonne tracked excavator **Method :** Trial Pit	**Dimensions** 4.60m x 1.00m x 4.00m (L x W x D)	**Ground Level (mOD)** 125.50	**Client** Bord na Móna	**Job Number** 11947-06-22
	Location 622865.1 E 659507.2 N	**Dates** 29/08/2022	**Engineer** Fehily Timoney	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(3.80)	Very soft brown slightly clayey pseudo fibrous PEAT with plant remains and tree limbs/trunks		
				121.70	3.80			
					(0.20)	Firm bluish grey slightly sandy slightly gravelly silty CLAY with occasional cobbles		
				121.50	4.00			

Plan

Remarks

No groundwater encountered
Trial pit stable
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	CMP	11947-06-22.TP-30

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Site Littleton Wind Farm			**Trial Pit Number** TP-31
Machine : 12 Tonne tracked excavator **Method :** Trial Pit	**Dimensions** 4.60m x 2.00m x 0.90m (L x W x D)	**Ground Level (mOD)** 123.96	**Client** Bord na Móna	**Job Number** 11947-06-22
	Location 623032.3 E 660688.2 N	**Dates** 30/08/2022	**Engineer** Fehily Timoney	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.50)	Very soft dark brown slightly clayey amorphous PEAT with roots		
				123.46	0.50			
0.70 0.70	B T				(0.40)	Soft to firm grey mottled light brown slightly sandy slightly gravelly silty CLAY with occasional cobbles and rare boulders Obstruction: Presumed bedrock/boulders		
				123.06	0.90	Terminated at 0.90m		

Plan

Remarks

No groundwater encountered
Trial pit stable
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	CMP	11947-06-22.TP-03

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Site Littleton Wind Farm			**Trial Pit Number** TP-32
Machine : 12 Tonne tracked excavator **Method :** Trial Pit	**Dimensions** 4.90m x 1.00m x 3.30m (L x W x D)	**Ground Level (mOD)** 124.32	**Client** Bord na Móna	**Job Number** 11947-06-22
	Location 623001.4 E 660643.5 N	**Dates** 30/08/2022	**Engineer** Fehily Timoney	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(1.00)	Very soft brown slightly clayey pseudo fibrous PEAT with roots, plant remains and tree limbs/trunks		
				123.32	1.00			
					(1.10)	Soft to firm grey slightly sandy slightly gravelly silty CLAY with occasional cobbles and boulders		
2.00 2.00	B T			122.22	2.10			
					(1.20)	Grey slightly clayey slightly silty sandy subangular to subrounded fine to coarse GRAVEL with many cobbles and boulders		
3.00 3.00	B T					Obstruction: Presumed bedrock/boulders		
				121.02	3.30	Terminated at 3.30m		

Plan

Remarks

No groundwater encountered
Trial pit stable
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	CMP	11947-06-22.TP-32

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Site Littleton Wind Farm			**Trial Pit Number** TP-33
Machine : 12 Tonne tracked excavator **Method :** Trial Pit	**Dimensions** 5.20m x 1.00m x 2.10m (L x W x D)	**Ground Level (mOD)** 122.59	**Client** Bord na Móna	**Job Number** 11947-06-22
	Location 622965.5 E 660742.1 N	**Dates** 30/08/2022	**Engineer** Fehily Timoney	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.60)	Very soft dark brown slightly clayey amorphous PEAT with roots		
				121.99	0.60			
					(0.60)	Soft to firm grey slightly sandy slightly gravelly silty CLAY with occasional cobbles and boulders		
1.00 1.00	B T		Medium Ingress(1) at 1.20m.	121.39	1.20			▽1
					(0.90)	Grey slightly clayey slightly silty sandy subangular to subrounded fine to coarse GRAVEL with many cobbles and boulders Obstruction: Presumed bedrock/boulders		
				120.49	2.10			
						Complete at 2.10m		

Plan

Remarks

Groundwater encounted at 1.20m BGL; Medium Ingress
Trial pit stable
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	CMP	11947-06-22.TP-33

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Site Littleton Wind Farm			**Trial Pit Number** TP-34
Machine : 12 Tonne tracked excavator **Method :** Trial Pit	**Dimensions** 5.00m x 1.00m x 1.90m (L x W x D)	**Ground Level (mOD)** 122.73	**Client** Bord na Móna	**Job Number** 11947-06-22
	Location 623095.1 E 660652.6 N	**Dates** 30/08/2022	**Engineer** Fehily Timoney	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.50)	Very soft dark brown slightly clayey amorphous PEAT with roots		
				122.23	0.50			
					(0.80)	Soft to firm light brown mottled grey slightly sandy slightly gravelly silty CLAY with occasional cobbles		
1.00 1.00	B T							
				121.43	1.30			
			Medium Ingress(1) at 1.70m.		(0.60)	Grey slightly sandy slightly clayey slightly silty subangular to subrounded fine to coarse GRAVEL with many cobbles and boulders Obstruction: Presumed bedrock/boulders		▽1
1.90 1.90	B T			120.83	1.90	Complete at 1.90m		

Plan

Remarks

Groundwater encounted at 1.70m BGL; Medium Ingress
Trial pit stable
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	CMP	11947-06-22.TP-34

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Site Littleton Wind Farm			**Trial Pit Number** TP-35
Machine : 12 Tonne tracked excavator **Method :** Trial Pit	**Dimensions** 5.10m x 1.00m x 3.30m (L x W x D)	**Ground Level (mOD)** 122.85	**Client** Bord na Móna	**Job Number** 11947-06-22
	Location 623093.1 E 660741.8 N	**Dates** 30/08/2022	**Engineer** Fehily Timoney	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.80)	Very soft dark brown slightly clayey amorphous PEAT with roots		
				122.05	0.80	Very soft brown slightly clayey pseudo fibrous PEAT		
					(1.70)			
				120.35	2.50	Grey slightly clayey gravelly silty fine to coarse SAND with occasional cobbles		
2.70 2.70	B T				(0.60)			
			Fast Ingress(1) at 3.10m.	119.75	3.10			▽1
					(0.20)	Grey slightly sandy slightly clayey slightly silty subangular to subrounded fine to coarse GRAVEL with many cobbles and boulders		
				119.55	3.30	Complete at 3.30m		

Plan

Remarks

Groundwater encounted at 3.10m BGL; Fast Ingress
Trial pit stable
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	CMP	11947-06-22.TP-35

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Littleton Wind Farm – Trial Pit Photographs

TP-01

TP-01

Littleton Wind Farm – Trial Pit Photographs

TP-01

TP-01

Littleton Wind Farm – Trial Pit Photographs

TP-01

Littleton Wind Farm – Trial Pit Photographs

TP-02

TP-02

Littleton Wind Farm – Trial Pit Photographs

TP-02

TP-02

Littleton Wind Farm – Trial Pit Photographs

TP-02

Littleton Wind Farm – Trial Pit Photographs

TP-03

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Littleton Wind Farm – Trial Pit Photographs

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Littleton Wind Farm – Trial Pit Photographs

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Littleton Wind Farm – Trial Pit Photographs

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Littleton Wind Farm – Trial Pit Photographs

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Littleton Wind Farm – Trial Pit Photographs

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Littleton Wind Farm – Trial Pit Photographs

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Littleton Wind Farm – Trial Pit Photographs

TP-35

APPENDIX 3 – Laboratory Testing

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Ground Investigations Ireland
Catherinestown House
Hazelhatch Road
Newcastle
Co. Dublin
Ireland

Attention :	James Cashen
Date :	12th August, 2022
Your reference :	11947-06-22
Our reference :	Test Report 22/12848 Batch 1
Location :	Littleton Wind Farm
Date samples received :	9th August, 2022
Status :	Final Report
Issue :	1

Seven samples were received for analysis on 9th August, 2022 of which seven were scheduled for analysis. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.
All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

Authorised By:

Liza Klebe
Project Co-ordinator

Please include all sections of this report if it is reproduced

Element Materials Technology Environmental UK Limited
Registered in England and Wales
Registered Office: 3rd Floor Davidson Building, 5 Southampton Street, London WC2E 7HA
Company Registration No: 11371415

Element Materials Technology

Client Name: Ground Investigations Ireland
Reference: 11947-06-22
Location: Littleton Wind Farm
Contact: James Cashen
EMT Job No: 22/12848

Report : Solid

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

EMT Sample No.	1	2	3	4	5	6	7				LOD/LOR	Units	Method No.
Sample ID	TP-04	TP-05	TP-06	TP-08	TP-10	TP-13	TP-14						
Depth	2.50	1.50	1.50	4.50	3.00	1.00	0.90						
COC No / misc													
Containers	T	T	T	T	T	T	T						
Sample Date	18/07/2022	18/07/2022	19/07/2022	19/07/2022	19/07/2022	20/07/2022	20/07/2022						
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil						
Batch Number	1	1	1	1	1	1	1						
Date of Receipt	09/08/2022	09/08/2022	09/08/2022	09/08/2022	09/08/2022	09/08/2022	09/08/2022						
Total Sulphate as SO4 BRE	0.02	0.02	-	0.02	0.02	-	-				<0.01	%	TM50/PM29
Total Sulphur as SO4	0.06	0.09	-	0.15	0.06	-	-				<0.01	%	TM30/PM15
Sulphate as SO4 (2:1 Ext) #	0.0093	0.0343	-	0.0297	0.0163	-	-				<0.0015	g/l	TM38/PM20
Organic Matter	-	-	<0.2	-	-	0.2	13.4				<0.2	%	TM21/PM24

Please see attached notes for all abbreviations and acronyms

Client Name: Ground Investigations Ireland
Reference: 11947-06-22
Location: Littleton Wind Farm
Contact: James Cashen

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Analysis	Reason
No deviating sample report results for job 22/12848						

Please note that only samples that are deviating are mentioned in this report. If no samples are listed it is because none were deviating.
Only analyses which are accredited are recorded as deviating if set criteria are not met.

NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

EMT Job No.: 22/12848

SOILS and ASH

Please note we are only MCERTS accredited (UK soils only) for sand, loam and clay and any other matrix is outside our scope of accreditation.

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation has been performed on clay, sand and loam, only samples that are predominantly these matrices, or combinations of them will be within our MCERTS scope. If samples are not one of a combination of the above matrices they will not be marked as MCERTS accredited.

It is assumed that you have taken representative samples on site and require analysis on a representative subsample. Stones will generally be included unless we are requested to remove them.

All samples will be discarded one month after the date of reporting, unless we are instructed to the contrary. Asbestos samples are retained for 6 months.

If you have not already done so, please send us a purchase order if this is required by your company.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

All analysis is reported on a dry weight basis unless stated otherwise. Limits of detection for analyses carried out on as received samples are not moisture content corrected. Results are not surrogate corrected. Samples are dried at 35°C ±5°C unless otherwise stated. Moisture content for CEN Leachate tests are dried at 105°C ±5°C. Ash samples are dried at 37°C ±5°C.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

Where a CEN 10:1 ZERO Headspace VOC test has been carried out, a 10:1 ratio of water to wet (as received) soil has been used.

% Asbestos in Asbestos Containing Materials (ACMs) is determined by reference to HSG 264 The Survey Guide - Appendix 2 : ACMs in buildings listed in order of ease of fibre release.

Sufficient amount of sample must be received to carry out the testing specified. Where an insufficient amount of sample has been received the testing may not meet the requirements of our accredited methods, as such accreditation may be removed.

Negative Neutralization Potential (NP) values are obtained when the volume of NaOH (0.1N) titrated (pH 8.3) is greater than the volume of HCl (1N) to reduce the pH of the sample to 2.0 - 2.5. Any negative NP values are corrected to 0.

The calculation of Pyrite content assumes that all oxidisable sulphides present in the sample are pyrite. This may not be the case. The calculation may be an overesitimate when other sulphides such as Barite (Barium Sulphate) are present.

WATERS

Please note we are not a UK Drinking Water Inspectorate (DWI) Approved Laboratory .

ISO17025 accreditation applies to surface water and groundwater and usually one other matrix which is analysis specific, any other liquids are outside our scope of accreditation.

As surface waters require different sample preparation to groundwaters the laboratory must be informed of the water type when submitting samples.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

STACK EMISSIONS

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation for Dioxins and Furans and Dioxin like PCBs has been performed on XAD-2 Resin, only samples which use this resin will be within our MCERTS scope.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

DEVIATING SAMPLES

All samples should be submitted to the laboratory in suitable containers with sufficient ice packs to sustain an appropriate temperature for the requested analysis. The temperature of sample receipt is recorded on the confirmation schedules in order that the client can make an informed decision as to whether testing should still be undertaken.

SURROGATES

Surrogate compounds are added during the preparation process to monitor recovery of analytes. However low recovery in soils is often due to peat, clay or other organic rich matrices. For waters this can be due to oxidants, surfactants, organic rich sediments or remediation fluids. Acceptable limits for most organic methods are 70 - 130% and for VOCs are 50 - 150%. When surrogate recoveries are outside the performance criteria but the associated AQC passes this is assumed to be due to matrix effect. Results are not surrogate corrected.

DILUTIONS

A dilution suffix indicates a dilution has been performed and the reported result takes this into account. No further calculation is required.

BLANKS

Where analytes have been found in the blank, the sample will be treated in accordance with our laboratory procedure for dealing with contaminated blanks.

NOTE

Data is only reported if the laboratory is confident that the data is a true reflection of the samples analysed. Data is only reported as accredited when all the requirements of our Quality System have been met. In certain circumstances where all the requirements of the Quality System have not been met, for instance if the associated AQC has failed, the reason is fully investigated and documented. The sample data is then evaluated alongside the other quality control checks performed during analysis to determine its suitability. Following this evaluation, provided the sample results have not been effected, the data is reported but accreditation is removed. It is a UKAS requirement for data not reported as accredited to be considered indicative only, but this does not mean the data is not valid.
Where possible, and if requested, samples will be re-extracted and a revised report issued with accredited results. Please do not hesitate to contact the laboratory if further details are required of the circumstances which have led to the removal of accreditation.
Laboratory records are kept for a period of no less than 6 years.

REPORTS FROM THE SOUTH AFRICA LABORATORY

Any method number not prefixed with SA has been undertaken in our UK laboratory unless reported as subcontracted.

Measurement Uncertainty

Measurement uncertainty defines the range of values that could reasonably be attributed to the measured quantity. This range of values has not been included within the reported results. Uncertainty expressed as a percentage can be provided upon request.

Customer Provided Information

Sample ID and depth is information provided by the customer.

ABBREVIATIONS and ACRONYMS USED

#	ISO17025 (UKAS Ref No. 4225) accredited - UK.
SA	ISO17025 (SANAS Ref No.T0729) accredited - South Africa
B	Indicates analyte found in associated method blank.
DR	Dilution required.
M	MCERTS accredited.
NA	Not applicable
NAD	No Asbestos Detected.
ND	None Detected (usually refers to VOC and/SVOC TICs).
NDP	No Determination Possible
SS	Calibrated against a single substance
SV	Surrogate recovery outside performance criteria. This may be due to a matrix effect.
W	Results expressed on as received basis.
+	AQC failure, accreditation has been removed from this result, if appropriate, see 'Note' on previous page.
>>	Results above calibration range, the result should be considered the minimum value. The actual result could be significantly higher.
*	Analysis subcontracted to an Element Materials Technology approved laboratory.
AD	Samples are dried at 35°C ±5°C
CO	Suspected carry over
LOD/LOR	Limit of Detection (Limit of Reporting) in line with ISO 17025 and MCERTS
ME	Matrix Effect
NFD	No Fibres Detected
BS	AQC Sample
LB	Blank Sample
N	Client Sample
TB	Trip Blank Sample
OC	Outside Calibration Range

HWOL ACRONYMS AND OPERATORS USED

HS	Headspace Analysis.
EH	Extractable Hydrocarbons - i.e. everything extracted by the solvent.
CU	Clean-up - e.g. by florisil, silica gel.
1D	GC - Single coil gas chromatography.
Total	Aliphatics & Aromatics.
AL	Aliphatics only.
AR	Aromatics only.
2D	GC-GC - Double coil gas chromatography.
#1	EH_Total but with humics mathematically subtracted
#2	EU_Total but with fatty acids mathematically subtracted
_	Operator - underscore to separate acronyms (exception for +).
+	Operator to indicate cumulative e.g. EH+HS_Total or EH_CU+HS_Total
MS	Mass Spectrometry.

EMT Job No: 22/12848

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/SANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM21	Modified BS 7755-3:1995, ISO10694:1995 Determination of Total Organic Carbon or Total Carbon by combustion in an Eltra TOC furnace/analyser in the presence of oxygen. The CO2 generated is quantified using infra-red detection. Organic Matter (SOM) calculated as per EA MCERTS Chemical Testing of Soil, March 2012 v4.	PM24	Dried and ground solid samples are washed with hydrochloric acid, then rinsed with deionised water to remove the mineral carbon before TOC analysis.			AD	Yes
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP 6010B, Rev.2, Dec.1996; Modified EPA Method 3050B, Rev.2, Dec.1996	PM15	Acid digestion of dried and ground solid samples using Aqua Regia refluxed at 112.5 °C. Samples containing asbestos are not dried and ground.			AD	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993) – All anions comparable to BS ISO 15923-1: 2013I	PM20	Extraction of dried and ground or as received samples with deionised water in a 2:1 water to solid ratio using a reciprocal shaker for all analytes except hexavalent chromium. Extraction of as received sample using 10:1 ratio of 0.2M sodium hydroxide to soil for hexavalent chromium using a reciprocal shaker.	Yes		AD	Yes
TM50	Acid soluble sulphate (Total Sulphate) analysed by ICP-OES	PM29	A hot hydrochloric acid digest is performed on a dried and ground sample, and the resulting liquor is analysed.			AD	Yes

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Ground Investigations Ireland
Catherinestown House
Hazelhatch Road
Newcastle
Co. Dublin
Ireland

Attention :	James Cashen
Date :	29th September, 2022
Your reference :	11947-06-22
Our reference :	Test Report 22/15269 Batch 1
Location :	Littleton Wind Farm
Date samples received :	20th September, 2022
Status :	Final Report
Issue :	1

Six samples were received for analysis on 20th September, 2022 of which six were scheduled for analysis. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.
All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

Authorised By:

Bruce Leslie
Project Manager

Please include all sections of this report if it is reproduced

Element Materials Technology

Client Name: Ground Investigations Ireland
Reference: 11947-06-22
Location: Littleton Wind Farm
Contact: James Cashen
EMT Job No: 22/15269

Report : Solid

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

EMT Sample No.	1	2	3	4	5	6					LOD/LOR	Units	Method No.
Sample ID	TP-03	TP-23	TP-26	TP-27	TP-34	TP-35							
Depth	1.00	1.50	2.70	2.50	1.00	2.70							
COC No / misc													
Containers	T	T	T	T	T	T							
Sample Date	31/08/2022	30/08/2022	30/08/2022	30/08/2022	31/08/2022	31/08/2022							
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil							
Batch Number	1	1	1	1	1	1							
Date of Receipt	20/09/2022	20/09/2022	20/09/2022	20/09/2022	20/09/2022	20/09/2022							
Sulphur as S	0.02	0.27	0.28	-	-	0.02					<0.01	%	TM30/PM15
Total Sulphate as SO4 BRE	0.02	0.11	0.16	-	-	0.02					<0.01	%	TM50/PM29
Sulphate as SO4 (2:1 Ext) #	0.0093	-	-	0.0064	0.0131	0.0109					<0.0015	g/l	TM38/PM20
Sulphate as SO4 (2:1 Ext)	-	0.0461	0.0597	-	-	-					<0.0015	g/l	TM38/PM60
Organic Matter	-	80.2	76.2	-	-	-					<0.2	%	TM21/PM24

Please see attached notes for all abbreviations and acronyms

Please include all sections of this report if it is reproduced
All solid results are expressed on a dry weight basis unless stated otherwise.

Client Name: Ground Investigations Ireland
Reference: 11947-06-22
Location: Littleton Wind Farm
Contact: James Cashen

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Analysis	Reason
No deviating sample report results for job 22/15269						

Please note that only samples that are deviating are mentioned in this report. If no samples are listed it is because none were deviating.
Only analyses which are accredited are recorded as deviating if set criteria are not met.

NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

EMT Job No.: 22/15269

SOILS and ASH

Please note we are only MCERTS accredited (UK soils only) for sand, loam and clay and any other matrix is outside our scope of accreditation.

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation has been performed on clay, sand and loam, only samples that are predominantly these matrices, or combinations of them will be within our MCERTS scope. If samples are not one of a combination of the above matrices they will not be marked as MCERTS accredited.

It is assumed that you have taken representative samples on site and require analysis on a representative subsample. Stones will generally be included unless we are requested to remove them.

All samples will be discarded one month after the date of reporting, unless we are instructed to the contrary. Asbestos samples are retained for 6 months.

If you have not already done so, please send us a purchase order if this is required by your company.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

All analysis is reported on a dry weight basis unless stated otherwise. Limits of detection for analyses carried out on as received samples are not moisture content corrected. Results are not surrogate corrected. Samples are dried at 35°C ±5°C unless otherwise stated. Moisture content for CEN Leachate tests are dried at 105°C ±5°C. Ash samples are dried at 37°C ±5°C.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

Where a CEN 10:1 ZERO Headspace VOC test has been carried out, a 10:1 ratio of water to wet (as received) soil has been used.

% Asbestos in Asbestos Containing Materials (ACMs) is determined by reference to HSG 264 The Survey Guide - Appendix 2 : ACMs in buildings listed in order of ease of fibre release.

Sufficient amount of sample must be received to carry out the testing specified. Where an insufficient amount of sample has been received the testing may not meet the requirements of our accredited methods, as such accreditation may be removed.

Negative Neutralization Potential (NP) values are obtained when the volume of NaOH (0.1N) titrated (pH 8.3) is greater than the volume of HCl (1N) to reduce the pH of the sample to 2.0 - 2.5. Any negative NP values are corrected to 0.

The calculation of Pyrite content assumes that all oxidisable sulphides present in the sample are pyrite. This may not be the case. The calculation may be an overesitimate when other sulphides such as Barite (Barium Sulphate) are present.

WATERS

Please note we are not a UK Drinking Water Inspectorate (DWI) Approved Laboratory .

ISO17025 accreditation applies to surface water and groundwater and usually one other matrix which is analysis specific, any other liquids are outside our scope of accreditation.

As surface waters require different sample preparation to groundwaters the laboratory must be informed of the water type when submitting samples.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

STACK EMISSIONS

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation for Dioxins and Furans and Dioxin like PCBs has been performed on XAD-2 Resin, only samples which use this resin will be within our MCERTS scope.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

DEVIATING SAMPLES

All samples should be submitted to the laboratory in suitable containers with sufficient ice packs to sustain an appropriate temperature for the requested analysis. The temperature of sample receipt is recorded on the confirmation schedules in order that the client can make an informed decision as to whether testing should still be undertaken.

SURROGATES

Surrogate compounds are added during the preparation process to monitor recovery of analytes. However low recovery in soils is often due to peat, clay or other organic rich matrices. For waters this can be due to oxidants, surfactants, organic rich sediments or remediation fluids. Acceptable limits for most organic methods are 70 - 130% and for VOCs are 50 - 150%. When surrogate recoveries are outside the performance criteria but the associated AQC passes this is assumed to be due to matrix effect. Results are not surrogate corrected.

DILUTIONS

A dilution suffix indicates a dilution has been performed and the reported result takes this into account. No further calculation is required.

BLANKS

Where analytes have been found in the blank, the sample will be treated in accordance with our laboratory procedure for dealing with contaminated blanks.

NOTE

Data is only reported if the laboratory is confident that the data is a true reflection of the samples analysed. Data is only reported as accredited when all the requirements of our Quality System have been met. In certain circumstances where all the requirements of the Quality System have not been met, for instance if the associated AQC has failed, the reason is fully investigated and documented. The sample data is then evaluated alongside the other quality control checks performed during analysis to determine its suitability. Following this evaluation, provided the sample results have not been effected, the data is reported but accreditation is removed. It is a UKAS requirement for data not reported as accredited to be considered indicative only, but this does not mean the data is not valid.
Where possible, and if requested, samples will be re-extracted and a revised report issued with accredited results. Please do not hesitate to contact the laboratory if further details are required of the circumstances which have led to the removal of accreditation.
Laboratory records are kept for a period of no less than 6 years.

REPORTS FROM THE SOUTH AFRICA LABORATORY

Any method number not prefixed with SA has been undertaken in our UK laboratory unless reported as subcontracted.

Measurement Uncertainty

Measurement uncertainty defines the range of values that could reasonably be attributed to the measured quantity. This range of values has not been included within the reported results. Uncertainty expressed as a percentage can be provided upon request.

Customer Provided Information

Sample ID and depth is information provided by the customer.

ABBREVIATIONS and ACRONYMS USED

#	ISO17025 (UKAS Ref No. 4225) accredited - UK.
SA	ISO17025 (SANAS Ref No.T0729) accredited - South Africa
B	Indicates analyte found in associated method blank.
DR	Dilution required.
M	MCERTS accredited.
NA	Not applicable
NAD	No Asbestos Detected.
ND	None Detected (usually refers to VOC and/SVOC TICs).
NDP	No Determination Possible
SS	Calibrated against a single substance
SV	Surrogate recovery outside performance criteria. This may be due to a matrix effect.
W	Results expressed on as received basis.
+	AQC failure, accreditation has been removed from this result, if appropriate, see 'Note' on previous page.
>>	Results above calibration range, the result should be considered the minimum value. The actual result could be significantly higher.
*	Analysis subcontracted to an Element Materials Technology approved laboratory.
AD	Samples are dried at 35°C ±5°C
CO	Suspected carry over
LOD/LOR	Limit of Detection (Limit of Reporting) in line with ISO 17025 and MCERTS
ME	Matrix Effect
NFD	No Fibres Detected
BS	AQC Sample
LB	Blank Sample
N	Client Sample
TB	Trip Blank Sample
OC	Outside Calibration Range

HWOL ACRONYMS AND OPERATORS USED

HS	Headspace Analysis.
EH	Extractable Hydrocarbons - i.e. everything extracted by the solvent.
CU	Clean-up - e.g. by florisil, silica gel.
1D	GC - Single coil gas chromatography.
Total	Aliphatics & Aromatics.
AL	Aliphatics only.
AR	Aromatics only.
2D	GC-GC - Double coil gas chromatography.
#1	EH_Total but with humics mathematically subtracted
#2	EU_Total but with fatty acids mathematically subtracted
_	Operator - underscore to separate acronyms (exception for +).
+	Operator to indicate cumulative e.g. EH+HS_Total or EH_CU+HS_Total
MS	Mass Spectrometry.

EMT Job No: 22/15269

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/SANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM21	Modified BS 7755-3:1995, ISO10694:1995 Determination of Total Organic Carbon or Total Carbon by combustion in an Eltra TOC furnace/analyser in the presence of oxygen. The CO2 generated is quantified using infra-red detection. Organic Matter (SOM) calculated as per EA MCERTS Chemical Testing of Soil, March 2012 v4.	PM24	Dried and ground solid samples are washed with hydrochloric acid, then rinsed with deionised water to remove the mineral carbon before TOC analysis.			AD	Yes
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TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993) – All anions comparable to BS ISO 15923-1: 2013I	PM20	Extraction of dried and ground or as received samples with deionised water in a 2:1 water to solid ratio using a reciprocal shaker for all analytes except hexavalent chromium. Extraction of as received sample using 10:1 ratio of 0.2M sodium hydroxide to soil for hexavalent chromium using a reciprocal shaker.	Yes		AD	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993) – All anions comparable to BS ISO 15923-1: 2013I	PM60	As received solid samples are extracted with deionised water in a 2:1 ratio of water to solid.			AR	Yes
TM50	Acid soluble sulphate (Total Sulphate) analysed by ICP-OES	PM29	A hot hydrochloric acid digest is performed on a dried and ground sample, and the resulting liquor is analysed.			AD	Yes

Please include all sections of this report if it is reproduced

LABORATORY REPORT

4043

Contract Number: PSL22/5677

Report Date: 27 September 2022

Client's Reference: 11947-06-22

Client Name: Ground Investigations Ireland Ltd
Catherinestown House
Hazelhatch Road
Newcastle
Co Dublin
D22 YD52

For the attention of: James Cashen

Contract Title: Littleton Wind Farm

Date Received: 31/8/2022
Date Commenced: 31/8/2022
Date Completed: 26/09/2022

A copy of the Laboratory Schedule of accredited tests as issued by UKAS is attached to this report. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced other than in full, without the prior written approval of the laboratory.

Checked and Approved Signatories:

A Watkins
(Director)

R Berriman
(Quality Manager)

S Royle
(Laboratory Manager)

L Knight
(Assistant Laboratory Manager)

S Eyre
(Senior Technician)

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SUMMARY OF LABORATORY SOIL DESCRIPTIONS

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Description of Sample
TP-04		B	2.50		Grey slightly sandy gravelly CLAY.
TP-05		B	1.50		Grey slightly sandy gravelly CLAY.
TP-05		B	3.00		Brown silty slightly sandy GRAVEL.
TP-06		B	4.00		Brown sandy gravelly CLAY.
TP-07		B	2.00		Grey slightly sandy gravelly CLAY.
TP-07		B	3.50		Grey slightly sandy gravelly CLAY.
TP-08		B	2.50		Brown sandy gravelly CLAY.
TP-08		B	4.50		Grey sandy slightly gravelly CLAY.
TP-09		B	1.70		Grey sandy gravelly CLAY.
TP-09		B	2.70		Brown sandy GRAVEL.
TP-10		B	3.00		Brown slightly gravelly sandy CLAY.
TP-11		B	3.50		Brown sandy slightly gravelly CLAY.
TP-11		B	4.50		Brown sandy slightly gravelly CLAY.
TP-12		B	2.00		Brown sandy GRAVEL.
TP-13		B	1.00		Brown silty sandy GRAVEL.
TP-14		B	2.00		Brown sandy gravelly CLAY.
TP-14		B	4.50		Brown sandy gravelly CLAY.
TP-15		B	0.50		Dark brown PEAT.
TP-15		B	1.50		Brown slightly sandy slightly gravelly CLAY.

SUMMARY OF SOIL CLASSIFICATION TESTS

(BS1377 : PART 2 : 1990)

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Moisture Content % Clause 3.2	Linear Shrinkage % Clause 6.5	Particle Density Mg/m^3 Clause 8.2	Liquid Limit % Clause 4.3/4	Plastic Limit % Clause 5.3	Plasticity Index % Clause 5.4	Passing .425mm %	Remarks
TP-04		B	2.50		8.1			26	14	12	45	Low Plasticity CL
TP-05		B	1.50		10			24	14	10	54	Low Plasticity CL
TP-06		B	4.00		10			23	13	10	53	Low Plasticity CL
TP-07		B	2.00		6.8			24	13	11	49	Low Plasticity CL
TP-07		B	3.50		11			23	14	9	57	Low Plasticity CL
TP-08		B	2.50		8.9			25	13	12	48	Low Plasticity CL
TP-09		B	1.70		8			23	12	11	48	Low Plasticity CL
TP-09		B	2.70		13				NP			
TP-10		B	3.00		10			29	14	15	51	Low Plasticity CL
TP-11		B	3.50		8.3			26	13	13	56	Low Plasticity CL
TP-11		B	4.50		11							
TP-12		B	2.00		7							
TP-13		B	1.00		8.0							
TP-14		B	2.00		10			22	13	9	45	Low Plasticity CL
TP-14		B	4.50		10			27	14	13	55	Low Plasticity CL
TP-15		B	0.50		340							
TP-15		B	1.50		18			36	17	19	74	Intermediate Plasticity CI

SYMBOLS : **NP : Non Plastic** *** : Liquid Limit and Plastic Limit Wet Sieved.**

UKAS TESTING 4043

PSL Professional Soils Laboratory

Littleton Wind Farm

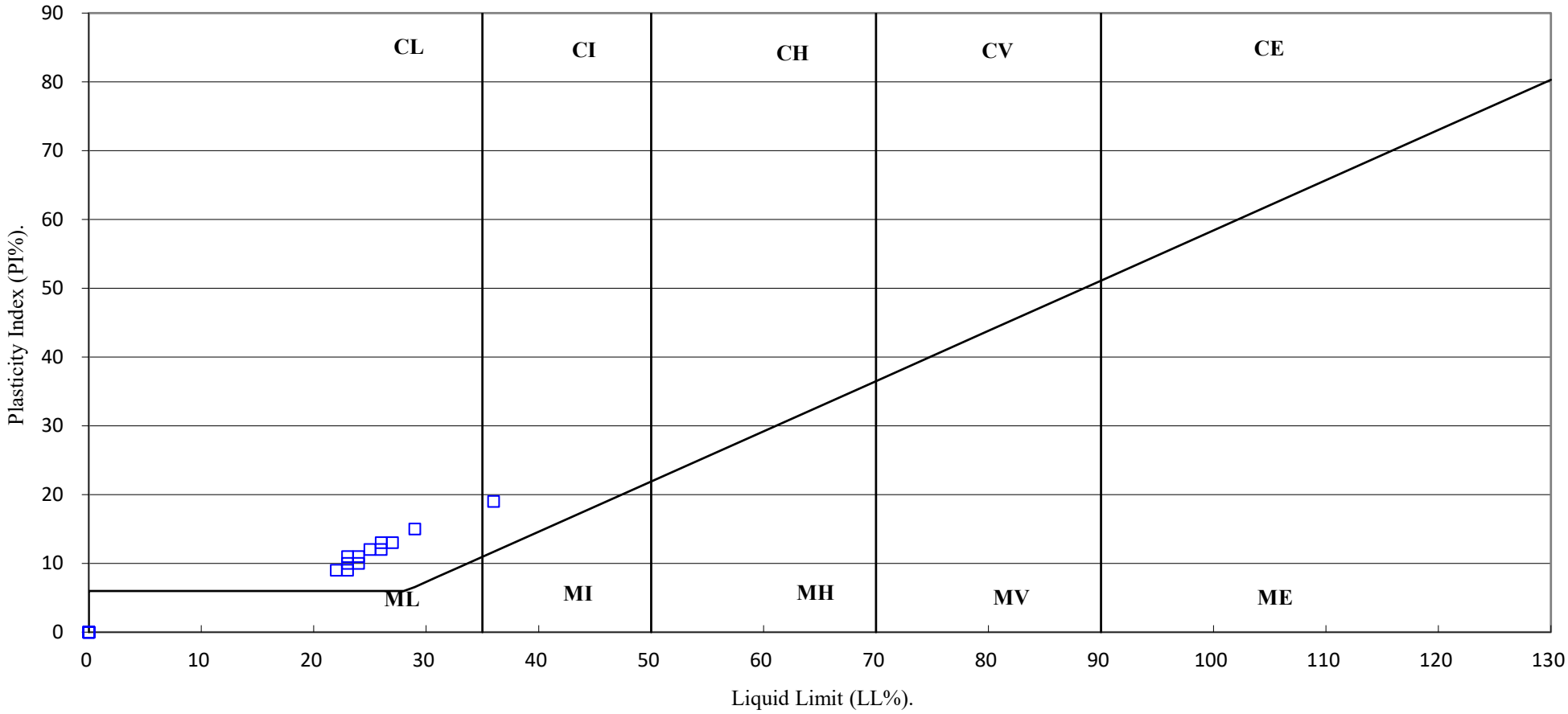
Contract No:

PSL22/5677

Client Ref:

11947-06-22

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION.



UKAS TESTING 4043	PSL Professional Soils Laboratory	Littleton Wind Farm	Contract No: PSL22/5677 Client Ref: 11947-06-22

PARTICLE SIZE DISTRIBUTION TEST

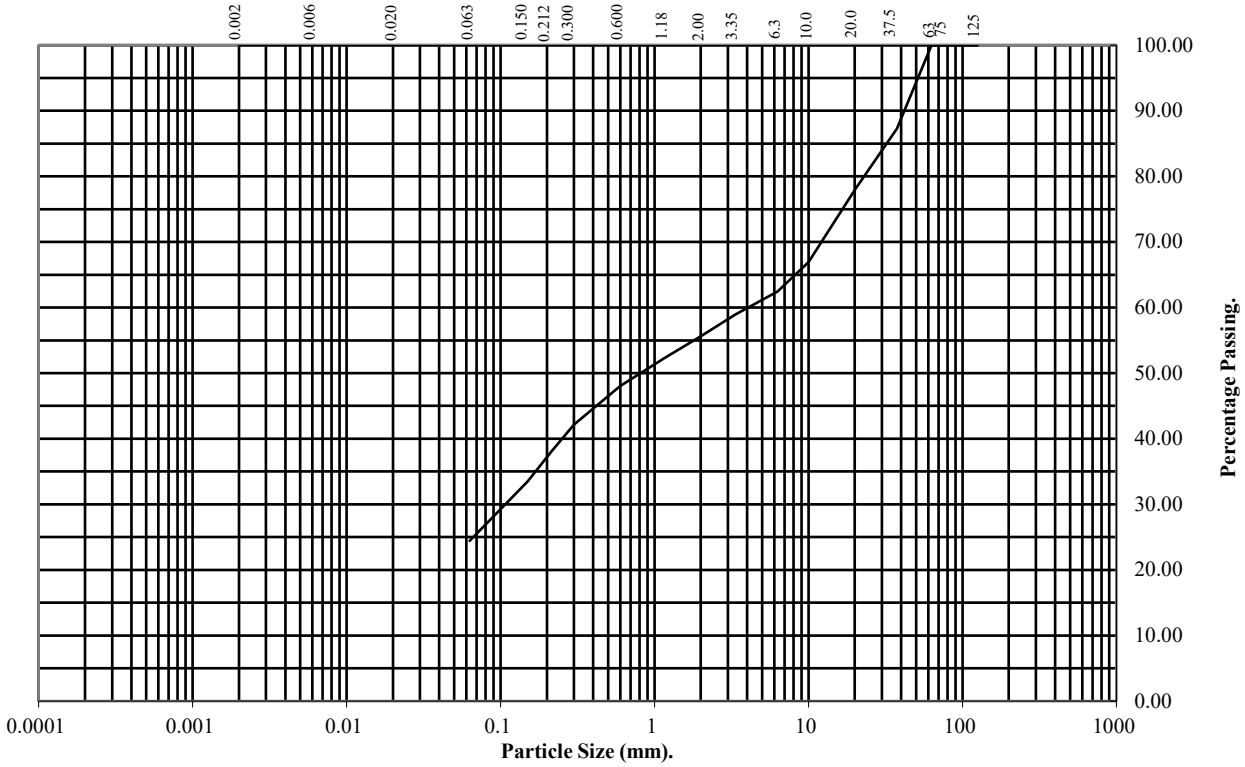
BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: TP-04 **Top Depth (m):** 2.50

Sample Number: **Base Depth(m):**

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	87
20	78
10	67
6.3	62
3.35	59
2	56
1.18	52
0.6	48
0.3	42
0.212	38
0.15	33
0.063	24

Soil Fraction	Total Percentage
Cobbles	0
Gravel	44
Sand	32
Silt/Clay	24

Remarks:

See Summary of Soil Descriptions

PARTICLE SIZE DISTRIBUTION TEST

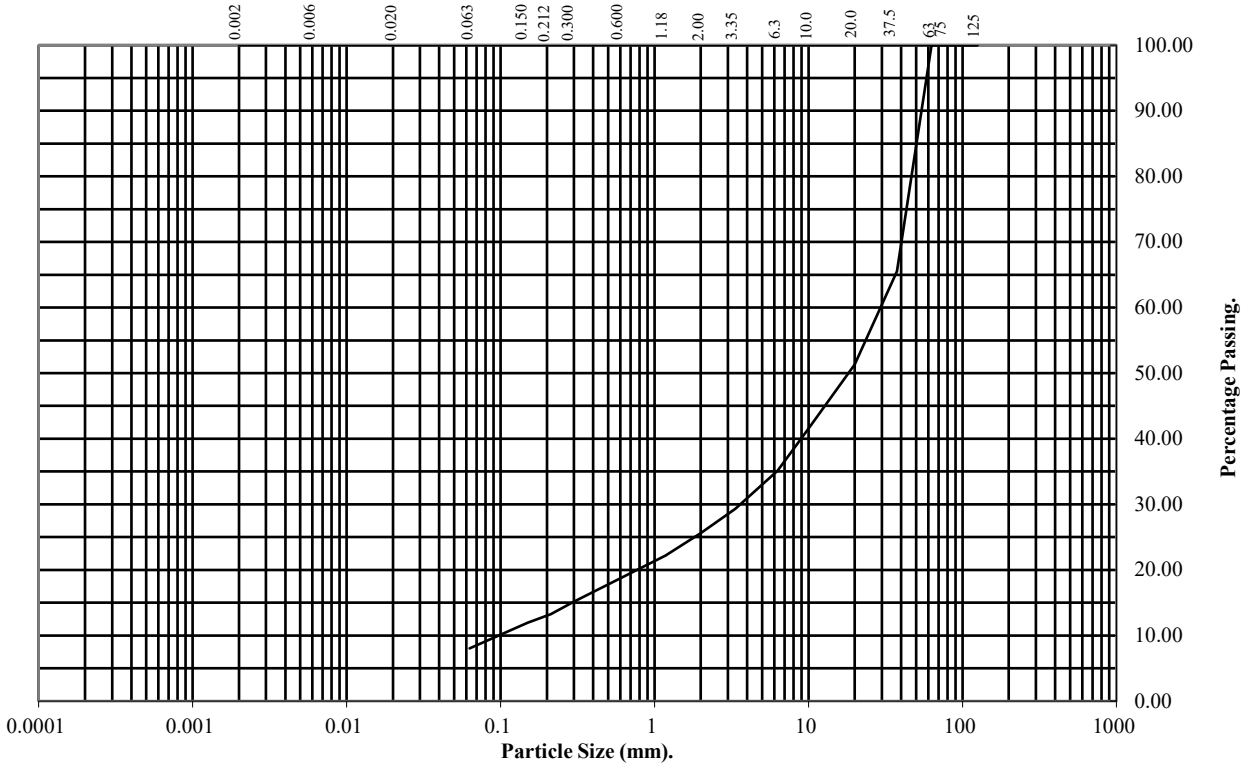
BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: **TP-05** **Top Depth (m):** **3.00**

Sample Number: **Base Depth(m):**

Sample Type: **B**



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	66
20	51
10	42
6.3	35
3.35	29
2	26
1.18	22
0.6	19
0.3	15
0.212	13
0.15	12
0.063	8

Soil Fraction	Total Percentage
Cobbles	0
Gravel	74
Sand	18
Silt/Clay	8

Remarks:

See Summary of Soil Descriptions

PARTICLE SIZE DISTRIBUTION TEST

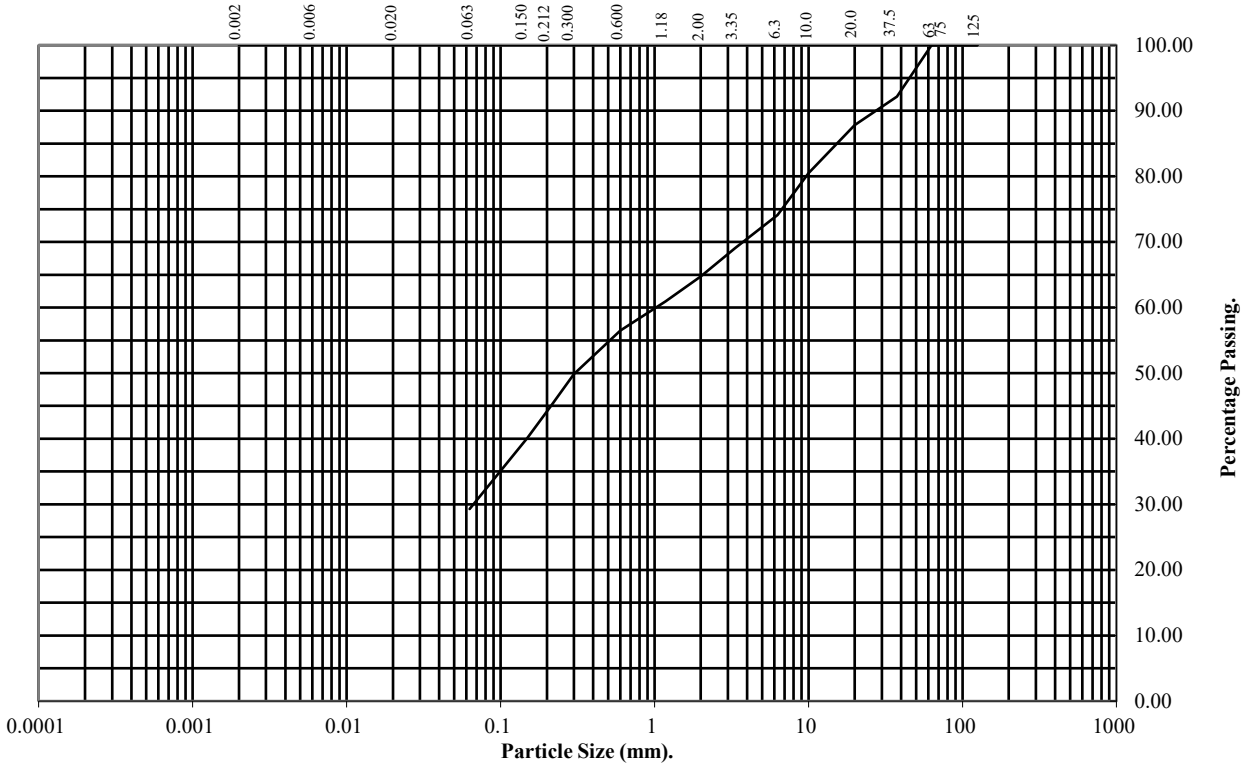
BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: TP-06 **Top Depth (m):** 4.00

Sample Number: **Base Depth(m):**

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	92
20	88
10	80
6.3	74
3.35	69
2	65
1.18	61
0.6	56
0.3	50
0.212	45
0.15	40
0.063	29

Soil Fraction	Total Percentage
Cobbles	0
Gravel	35
Sand	36
Silt/Clay	29

Remarks:

See Summary of Soil Descriptions

PARTICLE SIZE DISTRIBUTION TEST

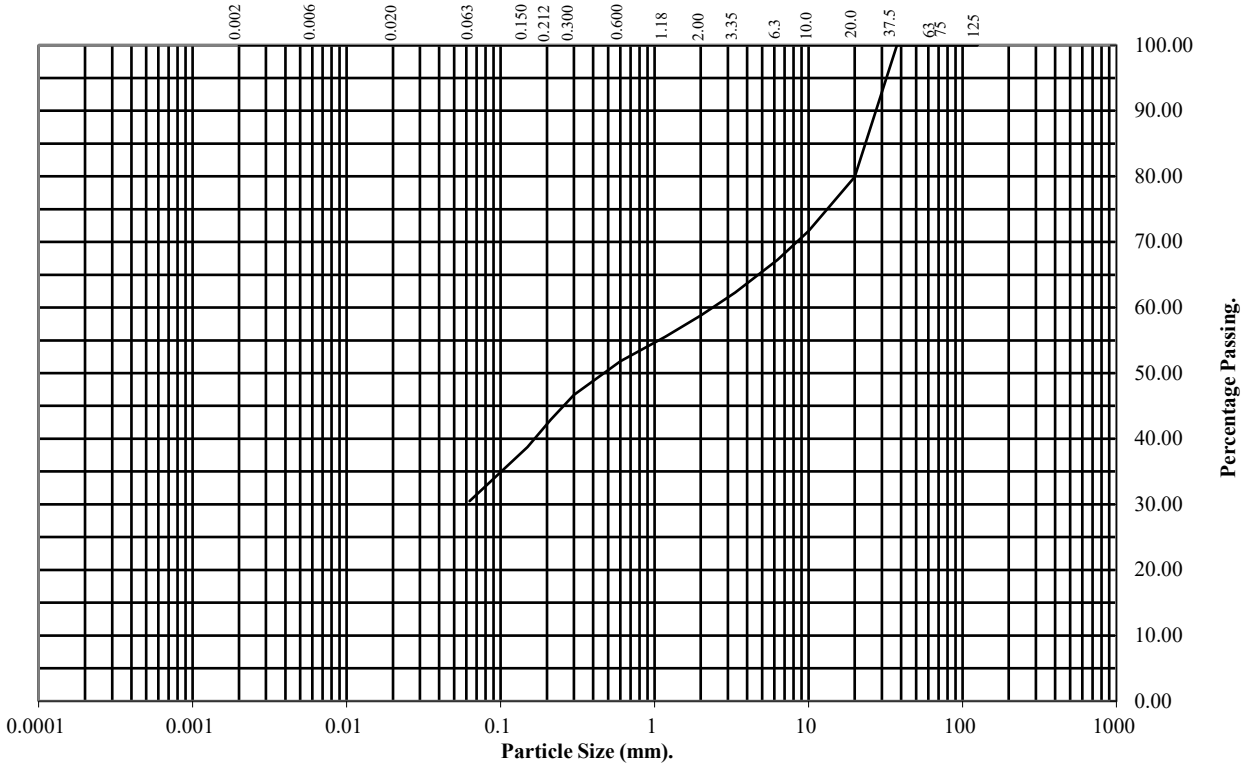
BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: TP-07 **Top Depth (m):** 2.00

Sample Number: **Base Depth(m):**

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	80
10	72
6.3	67
3.35	62
2	59
1.18	56
0.6	52
0.3	47
0.212	43
0.15	39
0.063	30

Soil Fraction	Total Percentage
Cobbles	0
Gravel	41
Sand	29
Silt/Clay	30

Remarks:

See Summary of Soil Descriptions

PARTICLE SIZE DISTRIBUTION TEST

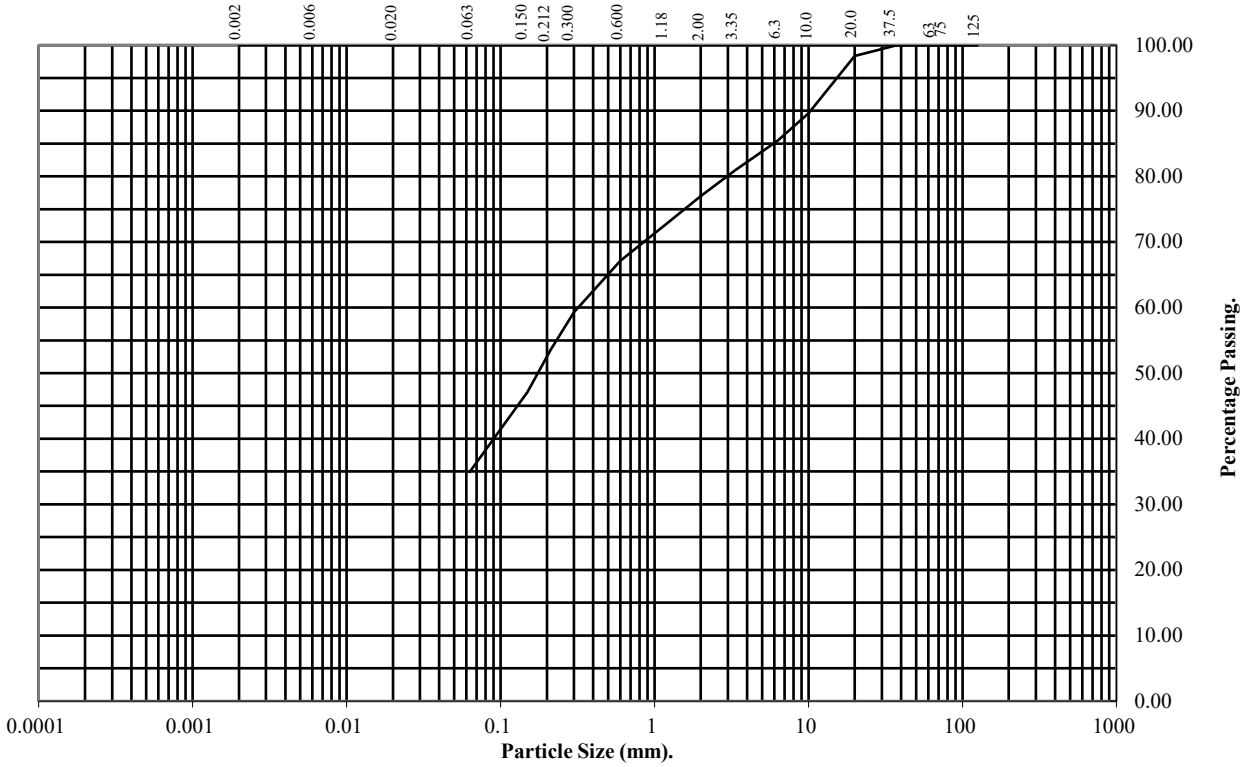
BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: **TP-08** **Top Depth (m):** **4.50**

Sample Number: **Base Depth(m):**

Sample Type: **B**



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	98
10	90
6.3	85
3.35	81
2	77
1.18	73
0.6	67
0.3	59
0.212	54
0.15	47
0.063	35

Soil Fraction	Total Percentage
Cobbles	0
Gravel	23
Sand	42
Silt/Clay	35

Remarks:

See Summary of Soil Descriptions

PARTICLE SIZE DISTRIBUTION TEST

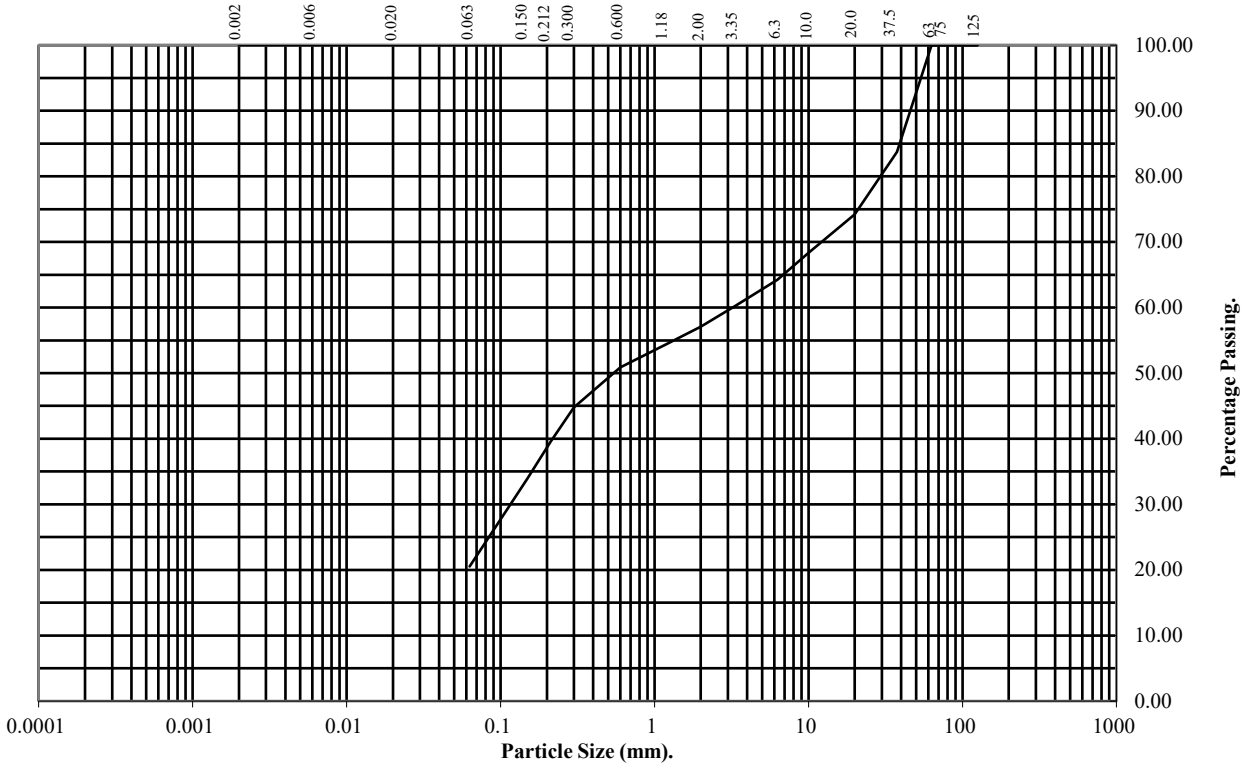
BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: TP-09 **Top Depth (m):** 1.70

Sample Number: **Base Depth(m):**

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	84
20	74
10	68
6.3	64
3.35	60
2	57
1.18	54
0.6	51
0.3	45
0.212	40
0.15	34
0.063	21

Soil Fraction	Total Percentage
Cobbles	0
Gravel	43
Sand	36
Silt/Clay	21

Remarks:

See Summary of Soil Descriptions

PARTICLE SIZE DISTRIBUTION TEST

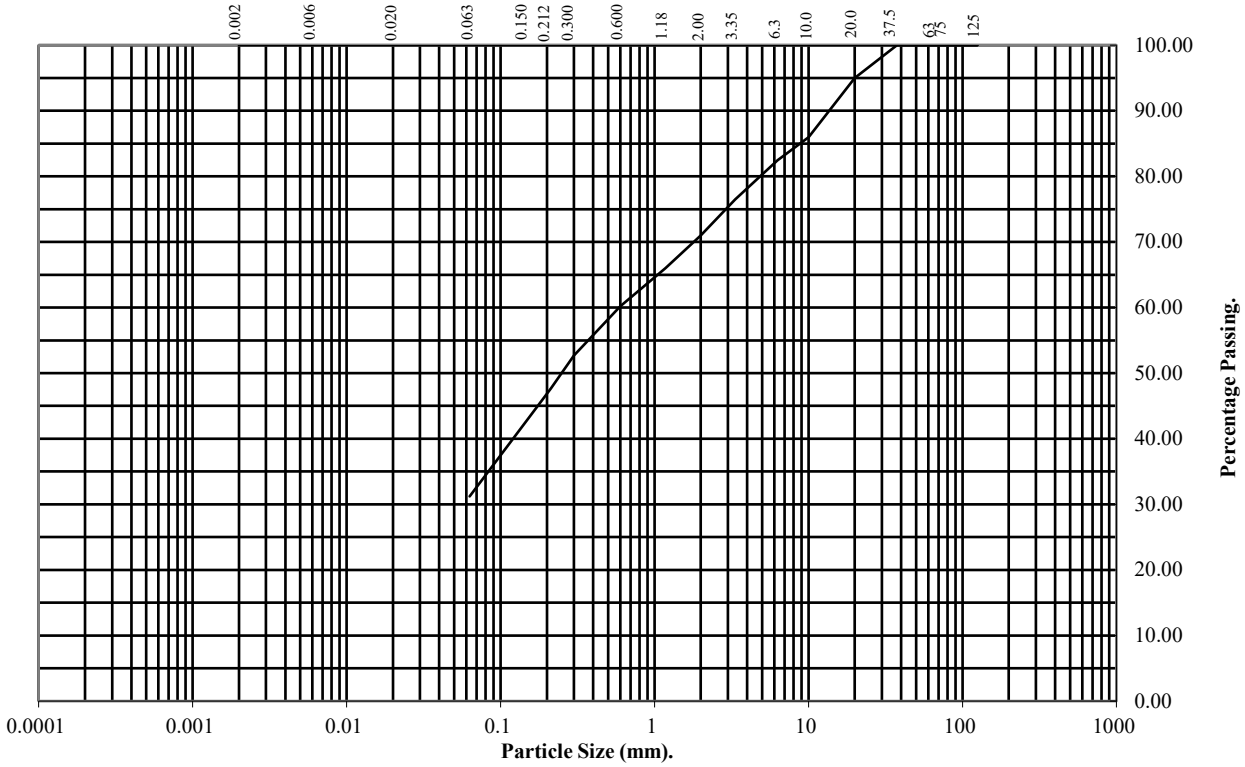
BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: **TP-11** **Top Depth (m):** **3.50**

Sample Number: **Base Depth(m):**

Sample Type: **B**



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	95
10	86
6.3	82
3.35	77
2	71
1.18	66
0.6	60
0.3	53
0.212	48
0.15	43
0.063	31

Soil Fraction	Total Percentage
Cobbles	0
Gravel	29
Sand	40
Silt/Clay	31

Remarks:

See Summary of Soil Descriptions

PARTICLE SIZE DISTRIBUTION TEST

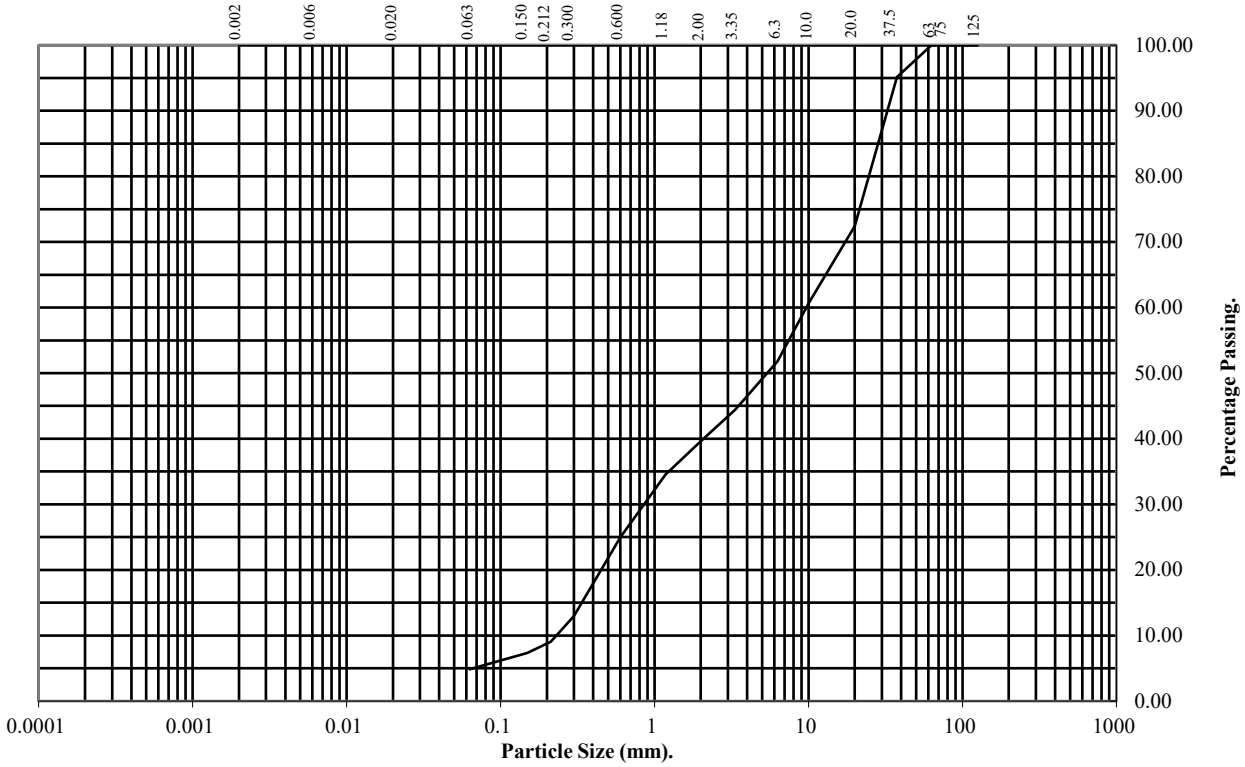
BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: **TP-13** **Top Depth (m):** **1.00**

Sample Number: **Base Depth(m):**

Sample Type: **B**



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	95
20	72
10	61
6.3	52
3.35	44
2	40
1.18	35
0.6	25
0.3	13
0.212	9
0.15	7
0.063	5

Soil Fraction	Total Percentage
Cobbles	0
Gravel	60
Sand	35
Silt/Clay	5

Remarks:

See Summary of Soil Descriptions

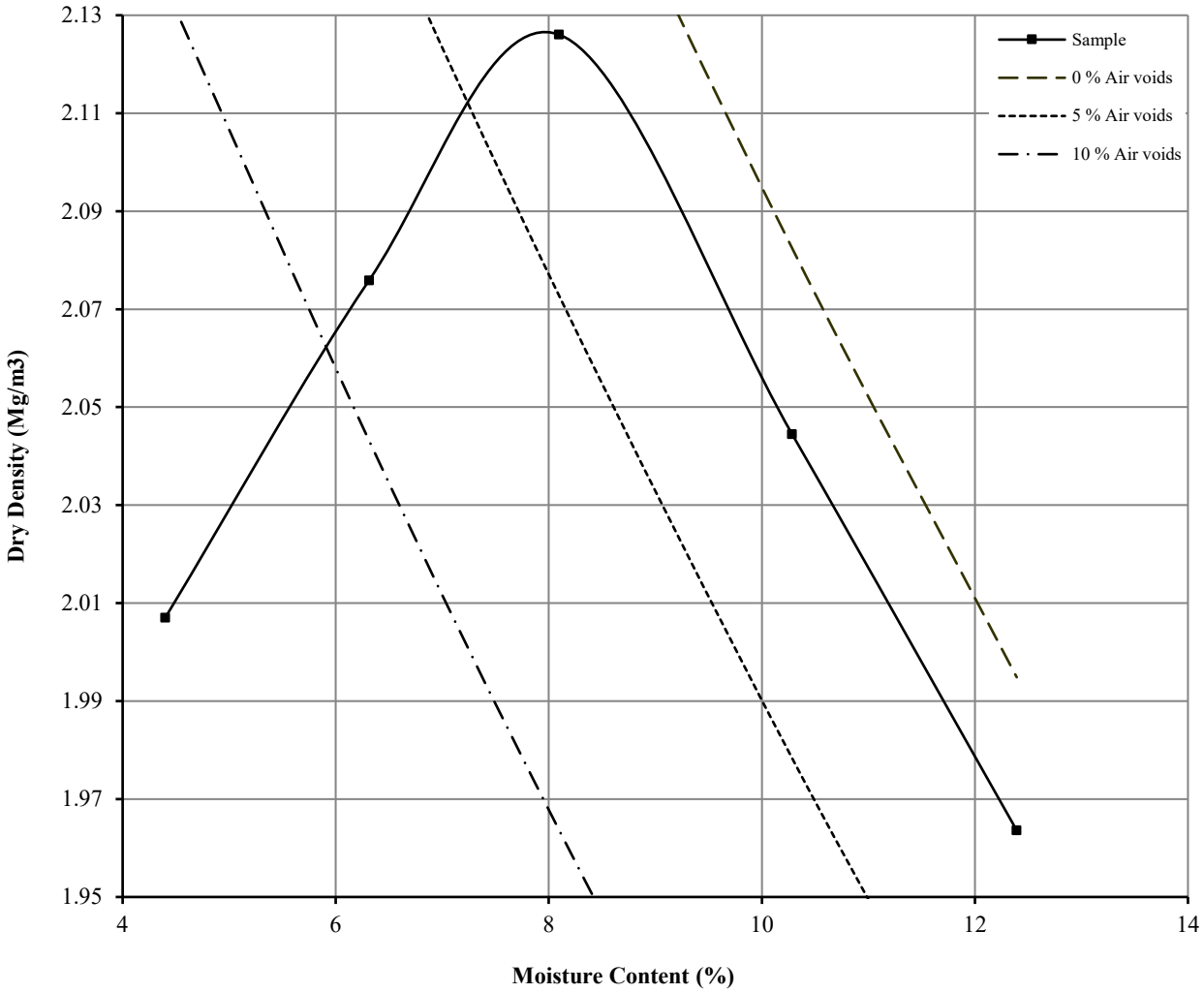
DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

BS 1377 : Part 4 : Clause 3.4 : 1990

Hole Number: TP-09 **Top Depth (m) :** 1.70

Sample Number: **Base Depth (m) :**

Sample Type: B



Initial Moisture Content:		8.1	Method of Compaction:	2.5kg	Separate Samples
Particle Density (Mg/m3):	2.65	Assumed	Material Retained on 37.5 mm Test Sieve (%):		9
Maximum Dry Density (Mg/m3):		2.13	Material Retained on 20.0 mm Test Sieve (%):		14
Optimum Moisture Content (%):		8			
Remarks See summary of soil descriptions					

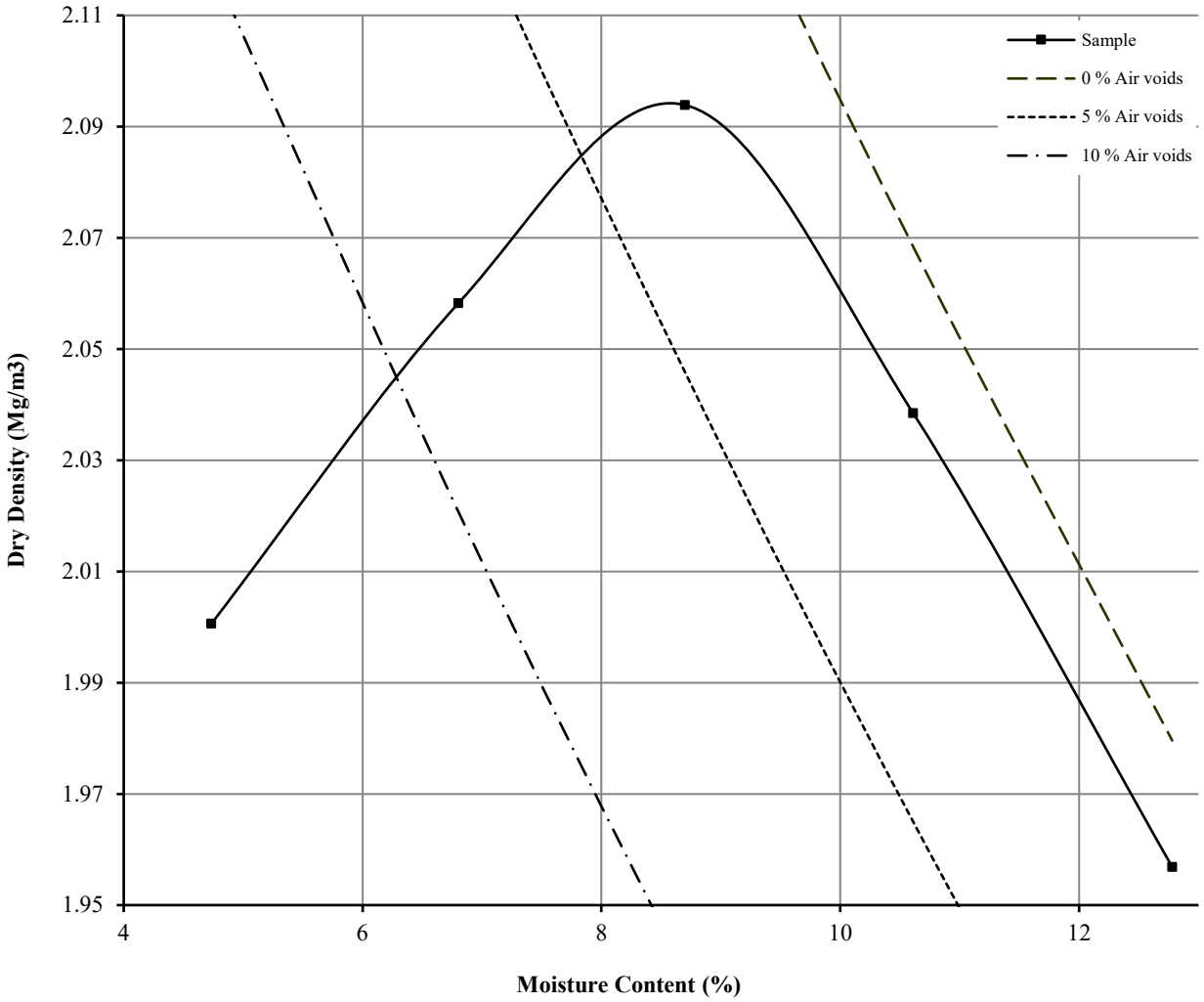
DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

BS 1377 : Part 4 : Clause 3.4 : 1990

Hole Number: TP-10 **Top Depth (m) :** 3.00

Sample Number: **Base Depth (m) :**

Sample Type: B



Initial Moisture Content:		8.1	Method of Compaction:	2.5kg	Separate Samples
Particle Density (Mg/m3):	2.65	Assumed	Material Retained on 37.5 mm Test Sieve (%):		9
Maximum Dry Density (Mg/m3):		2.09	Material Retained on 20.0 mm Test Sieve (%):		14
Optimum Moisture Content (%):		9			
Remarks See summary of soil descriptions					

LABORATORY REPORT

4043

Contract Number: PSL22/6090

Report Date: 13 October 2022

Client's Reference: 11947-06-22

Client Name: Ground Investigations Ireland Ltd
Catherinestown House
Hazelhatch Road
Newcastle
Co Dublin
D22 YD52

For the attention of: James Cashen

Contract Title: Littleton Wind Farm

Date Received: 21/9/2022
Date Commenced: 21/9/2022
Date Completed: 13/10/2022

Notes: Opinions and Interpretations are outside the UKAS Accreditation

A copy of the Laboratory Schedule of accredited tests as issued by UKAS is attached to this report. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced other than in full, without the prior written approval of the laboratory.

Checked and Approved Signatories:

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R Berriman (Quality Manager)
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SUMMARY OF LABORATORY SOIL DESCRIPTIONS

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Description of Sample
TP-01		B&T	3.50		Grey slightly sandy CLAY.
TP-01		B&T	4.30		Grey slightly sandy gravelly CLAY with cobbles.
TP-03		B&T	1.00		Grey slightly sandy gravelly CLAY.
TP-03		B&T	3.00		Brown sandy gravelly CLAY.
TP-24		B&T	3.00		Grey sandy gravelly CLAY.
TP-26		B&T	3.50		Brown very gravelly SAND.
TP-27		B&T	2.50		Grey sandy slightly gravelly CLAY.
TP-28		B&T	2.00		Grey sandy slightly gravelly CLAY.
TP-28		B&T	3.00		Grey sandy gravelly CLAY.
TP-29		B&T	3.00		Grey slightly sandy gravelly CLAY.
TP-31		B&T	0.70		Brown sandy slightly gravelly CLAY.
TP-32		B&T	2.00		Grey slightly sandy gravelly CLAY.
TP-32		B&T	3.00		Grey mottled brown clayey sandy GRAVEL.
TP-33		B&T	1.00		Brown sandy gravelly CLAY.
TP-34		B&T	1.00		Brown sandy gravelly CLAY.
TP-35		B&T	2.70		Brown sandy gravelly CLAY.

SUMMARY OF SOIL CLASSIFICATION TESTS

(BS1377 : PART 2 : 1990)

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Moisture Content % Clause 3.2	Linear Shrinkage % Clause 6.5	Particle Density Mg/m^3 Clause 8.2	Liquid Limit % Clause 4.3/4	Plastic Limit % Clause 5.3	Plasticity Index % Clause 5.4	Passing .425mm %	Remarks
TP-01		B&T	3.50		23			33	18	15	100	Low Plasticity CL
TP-03		B&T	1.00		9.0			26	14	12	54	Low Plasticity CL
TP-03		B&T	3.00		8.0			25	13	12	51	Low Plasticity CL
TP-24		B&T	3.00		13			27	14	13	54	Low Plasticity CL
TP-26		B&T	3.50		8.0				NP			
TP-27		B&T	2.50		12			25	13	12	58	Low Plasticity CL
TP-28		B&T	2.00		13			30	16	14	52	Low Plasticity CL
TP-29		B&T	3.00		21			43	22	21	57	Intermediate Plasticity CI
TP-31		B&T	0.70		16			30	15	15	90	Low Plasticity CL
TP-32		B&T	2.00		11			28	14	14	48	Low Plasticity CL
TP-33		B&T	1.00		14			26	13	13	53	Low Plasticity CL
TP-34		B&T	1.00		13			29	14	15	49	Low Plasticity CL
TP-35		B&T	2.70		12							

SYMBOLS : **NP : Non Plastic** *** : Liquid Limit and Plastic Limit Wet Sieved.**

UKAS TESTING 4043

PSL Professional Soils Laboratory

Littleton Wind Farm

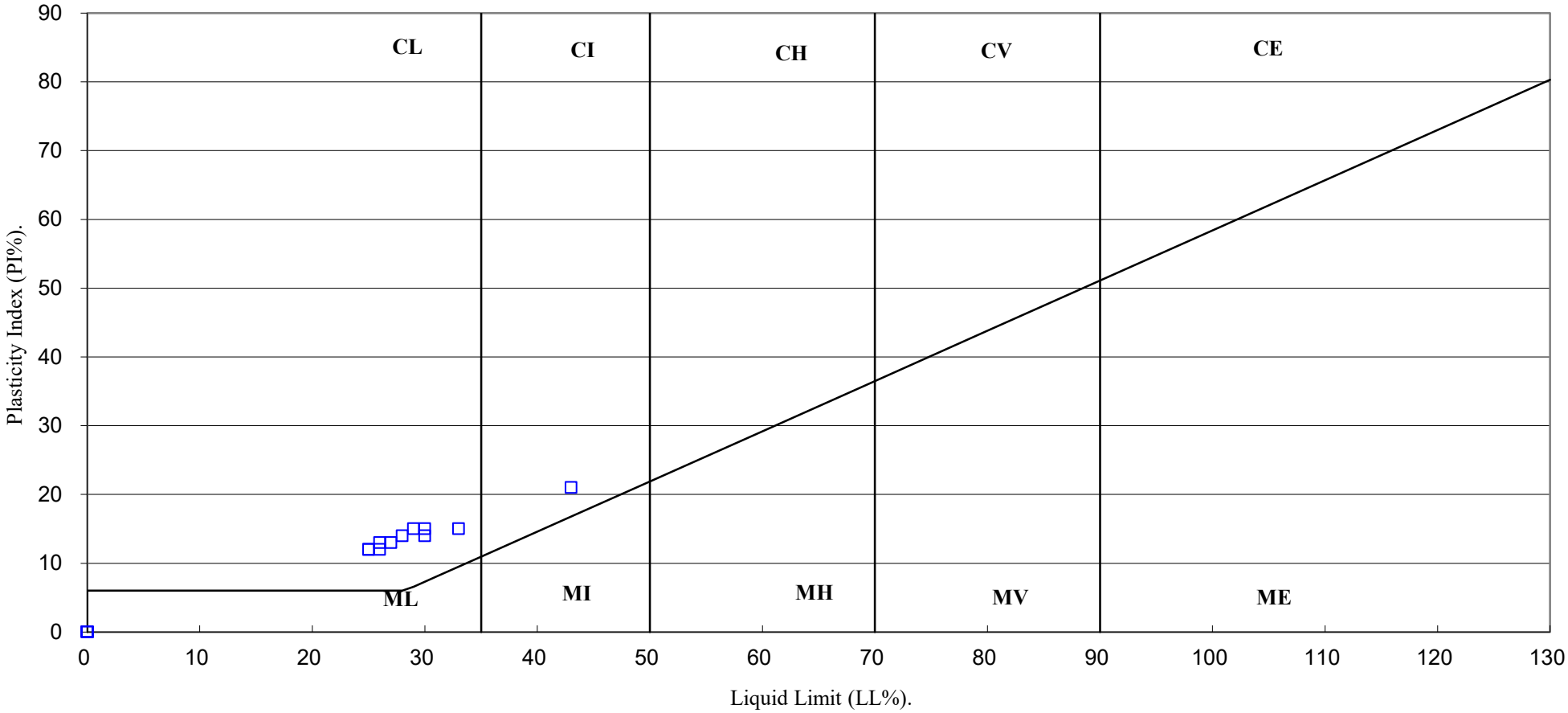
Contract No:

PSL22/6090

Client Ref:

11947-06-22

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION.



UKAS TESTING 4043	PSL Professional Soils Laboratory	Littleton Wind Farm	Contract No: PSL22/6090 Client Ref: 11947-06-22

PARTICLE SIZE DISTRIBUTION TEST

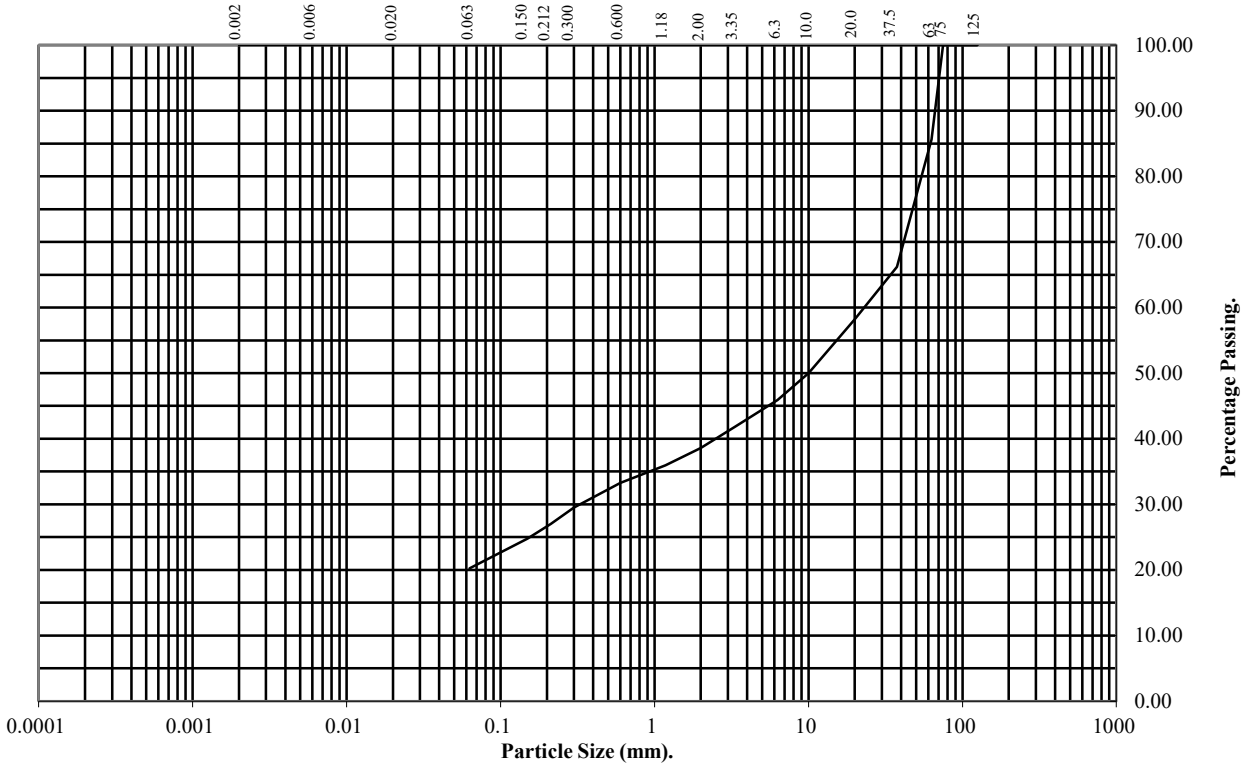
BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: **TP-01** **Top Depth (m):** **4.30**

Sample Number: **Base Depth(m):**

Sample Type: **B&T**



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	86
37.5	66
20	58
10	50
6.3	46
3.35	42
2	39
1.18	36
0.6	33
0.3	29
0.212	27
0.15	25
0.063	20

Soil Fraction	Total Percentage
Cobbles	14
Gravel	47
Sand	19
Silt/Clay	20

Remarks:

See Summary of Soil Descriptions

PARTICLE SIZE DISTRIBUTION TEST

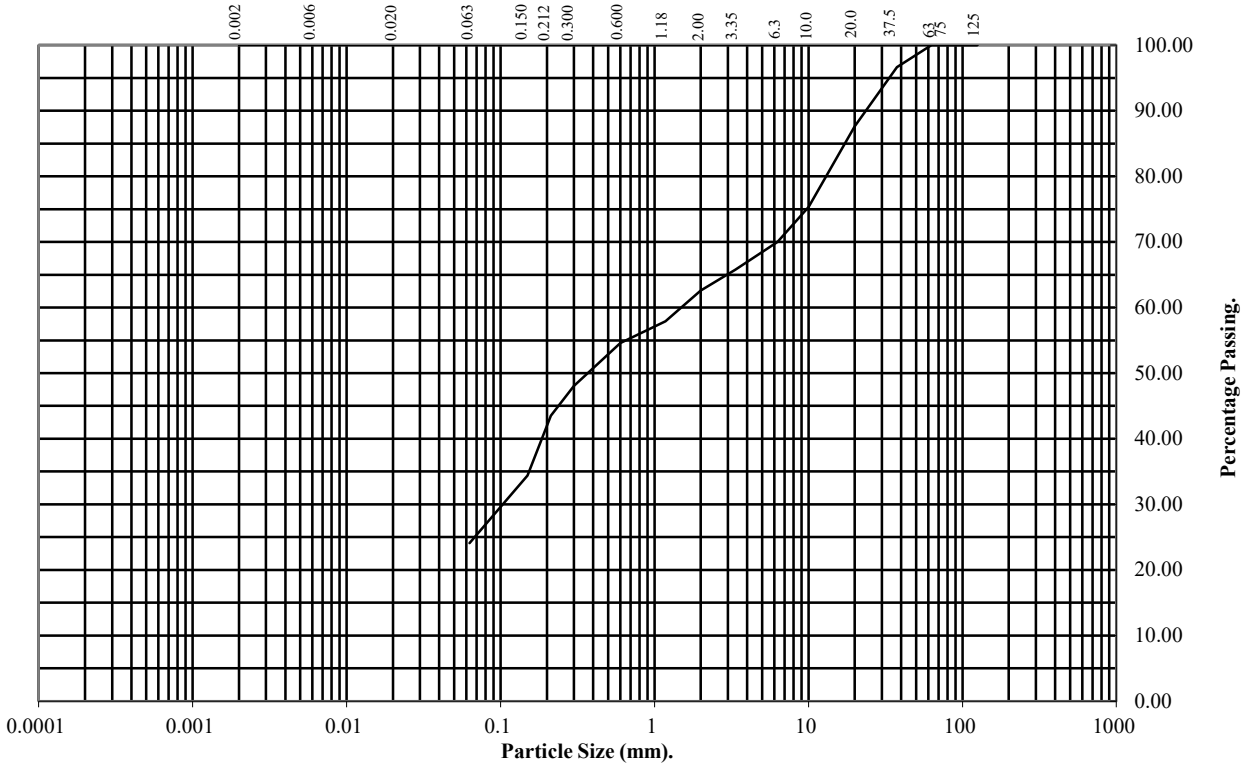
BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: **TP-03** **Top Depth (m):** **3.00**

Sample Number: **Base Depth(m):**

Sample Type: **B&T**



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	97
20	88
10	75
6.3	70
3.35	66
2	63
1.18	58
0.6	55
0.3	48
0.212	44
0.15	34
0.063	24

Soil Fraction	Total Percentage
Cobbles	0
Gravel	37
Sand	39
Silt/Clay	24

Remarks:

See Summary of Soil Descriptions

PARTICLE SIZE DISTRIBUTION TEST

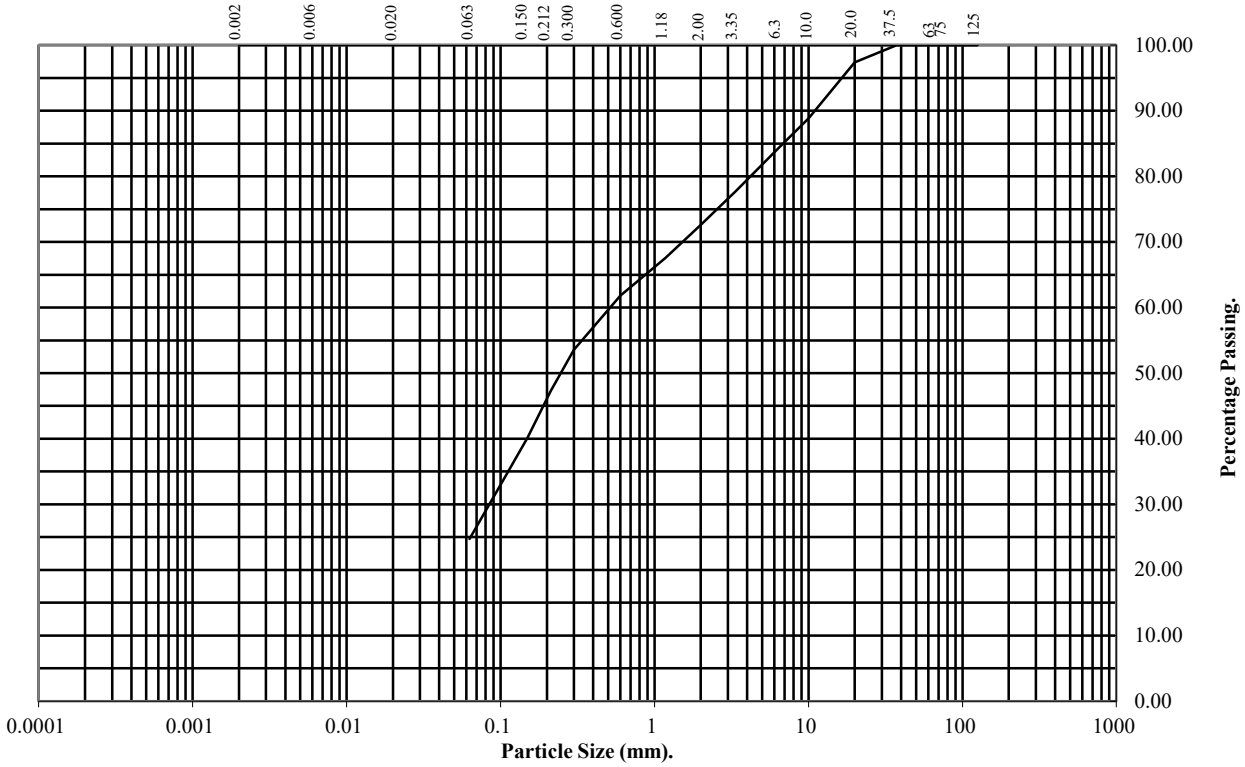
BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: **TP-27** **Top Depth (m):** **2.50**

Sample Number: **Base Depth(m):**

Sample Type: **B&T**



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	97
10	89
6.3	84
3.35	78
2	73
1.18	68
0.6	62
0.3	54
0.212	47
0.15	40
0.063	25

Soil Fraction	Total Percentage
Cobbles	0
Gravel	27
Sand	48
Silt/Clay	25

Remarks:
See Summary of Soil Descriptions

PARTICLE SIZE DISTRIBUTION TEST

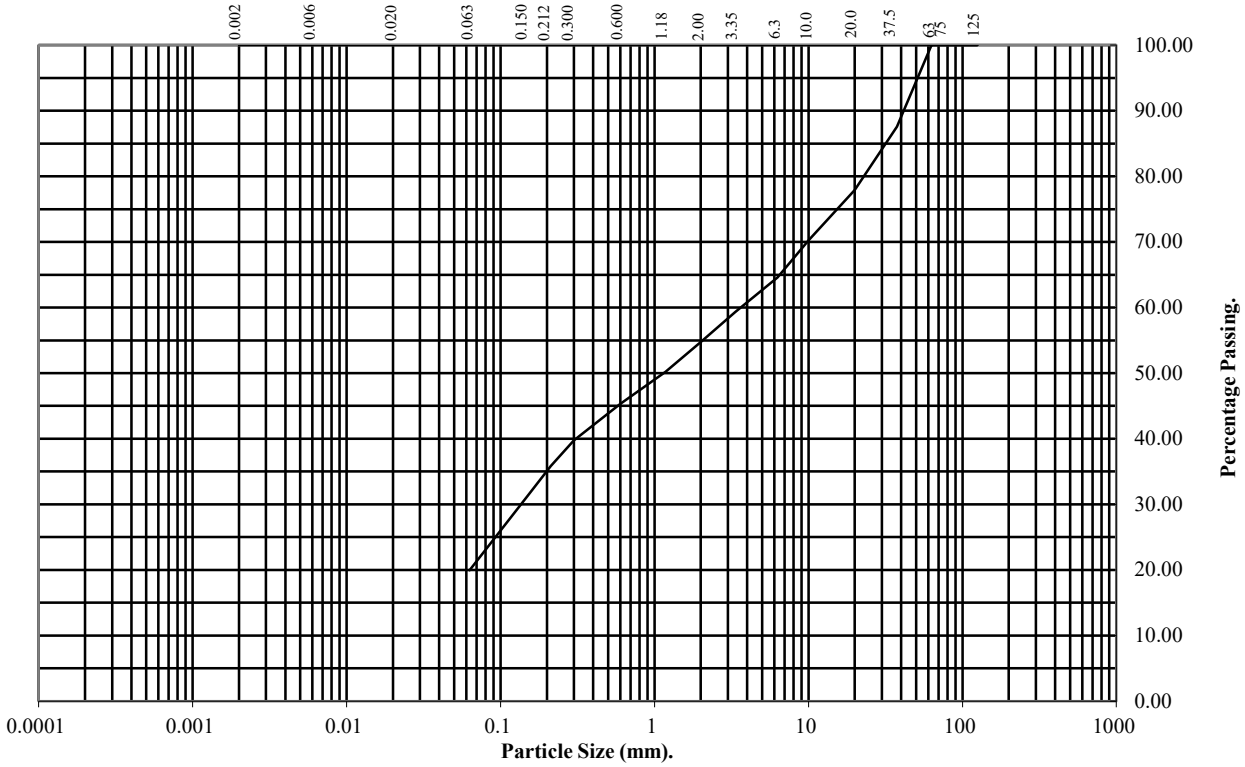
BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: **TP-28** **Top Depth (m):** **3.00**

Sample Number: **Base Depth(m):**

Sample Type: **B&T**



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	88
20	78
10	70
6.3	65
3.35	59
2	55
1.18	50
0.6	45
0.3	40
0.212	36
0.15	31
0.063	20

Soil Fraction	Total Percentage
Cobbles	0
Gravel	45
Sand	35
Silt/Clay	20

Remarks:

See Summary of Soil Descriptions

PARTICLE SIZE DISTRIBUTION TEST

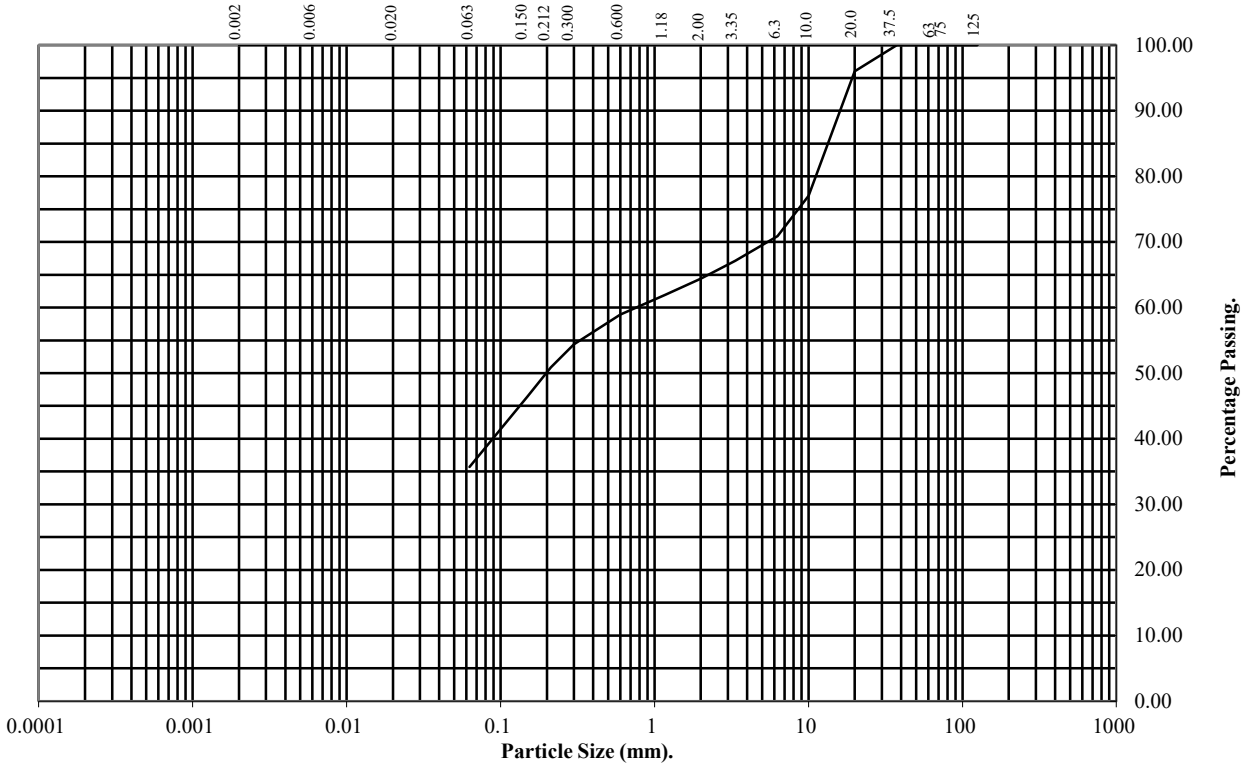
BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: **TP-29** **Top Depth (m):** **3.00**

Sample Number: **Base Depth(m):**

Sample Type: **B&T**



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	96
10	77
6.3	71
3.35	67
2	64
1.18	62
0.6	59
0.3	54
0.212	51
0.15	46
0.063	36

Soil Fraction	Total Percentage
Cobbles	0
Gravel	36
Sand	28
Silt/Clay	36

Remarks:

See Summary of Soil Descriptions

PARTICLE SIZE DISTRIBUTION TEST

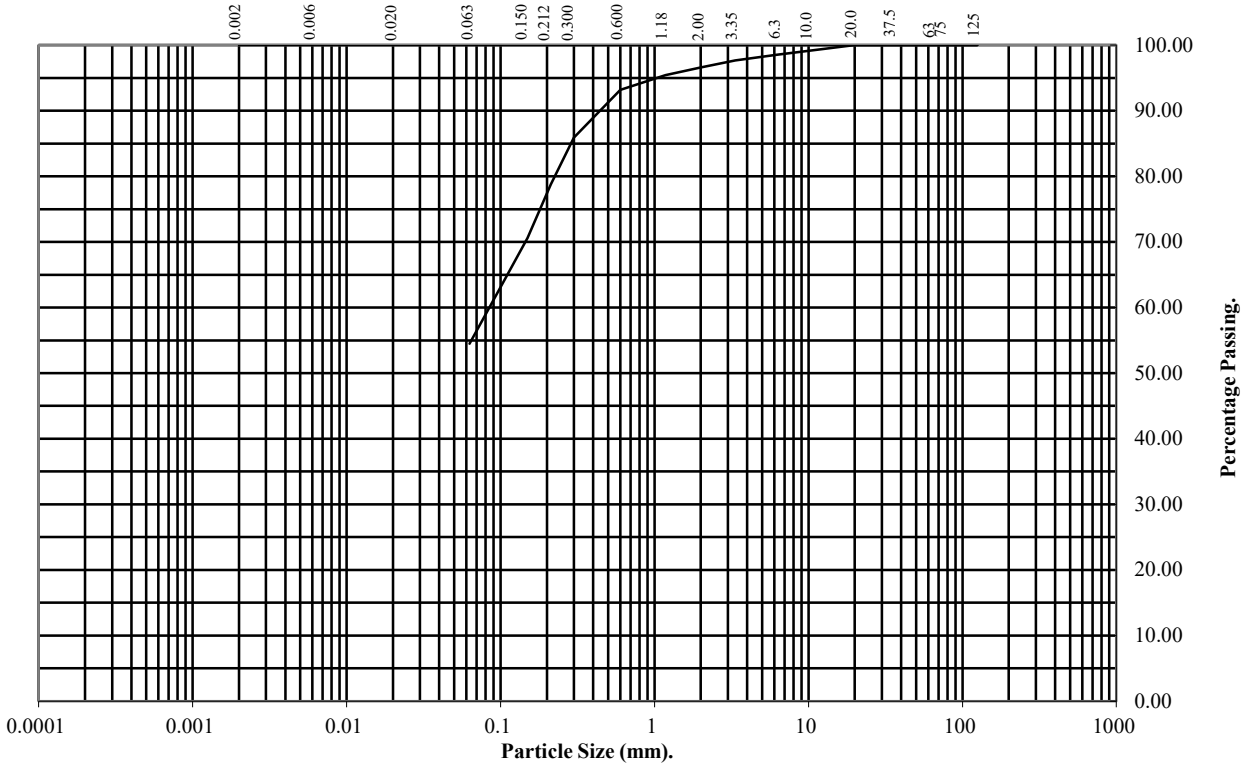
BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: **TP-31** **Top Depth (m):** **0.70**

Sample Number: **Base Depth(m):**

Sample Type: **B&T**



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	100
10	99
6.3	99
3.35	98
2	97
1.18	95
0.6	93
0.3	86
0.212	79
0.15	71
0.063	54

Soil Fraction	Total Percentage
Cobbles	0
Gravel	3
Sand	43
Silt/Clay	54

Remarks:

See Summary of Soil Descriptions

PARTICLE SIZE DISTRIBUTION TEST

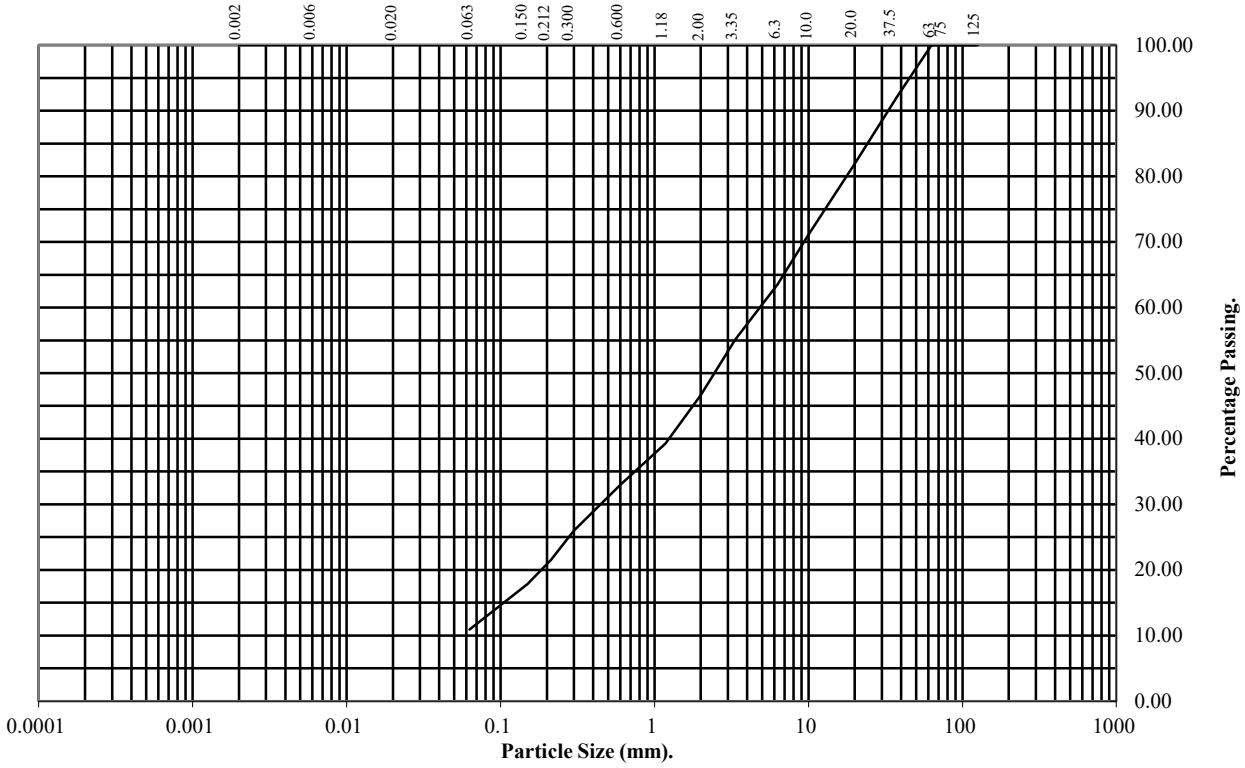
BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: **TP-32** **Top Depth (m):** **3.00**

Sample Number: **Base Depth(m):**

Sample Type: **B&T**



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	92
20	82
10	71
6.3	64
3.35	55
2	47
1.18	39
0.6	33
0.3	26
0.212	21
0.15	18
0.063	11

Soil Fraction	Total Percentage
Cobbles	0
Gravel	53
Sand	36
Silt/Clay	11

Remarks:

See Summary of Soil Descriptions

PARTICLE SIZE DISTRIBUTION TEST

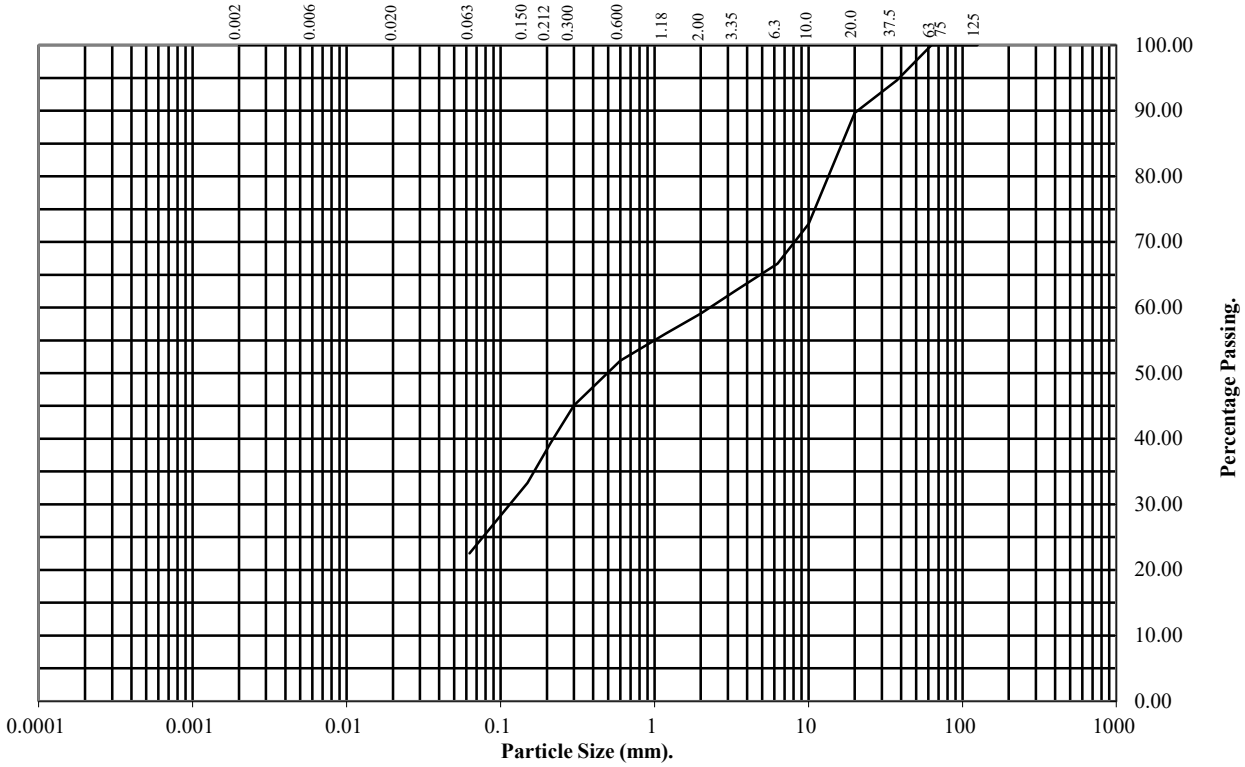
BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: **TP-35** **Top Depth (m):** **2.70**

Sample Number: **Base Depth(m):**

Sample Type: **B&T**



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	95
20	90
10	73
6.3	67
3.35	63
2	59
1.18	56
0.6	52
0.3	45
0.212	39
0.15	33
0.063	23

Soil Fraction	Total Percentage
Cobbles	0
Gravel	41
Sand	36
Silt/Clay	23

Remarks:

See Summary of Soil Descriptions

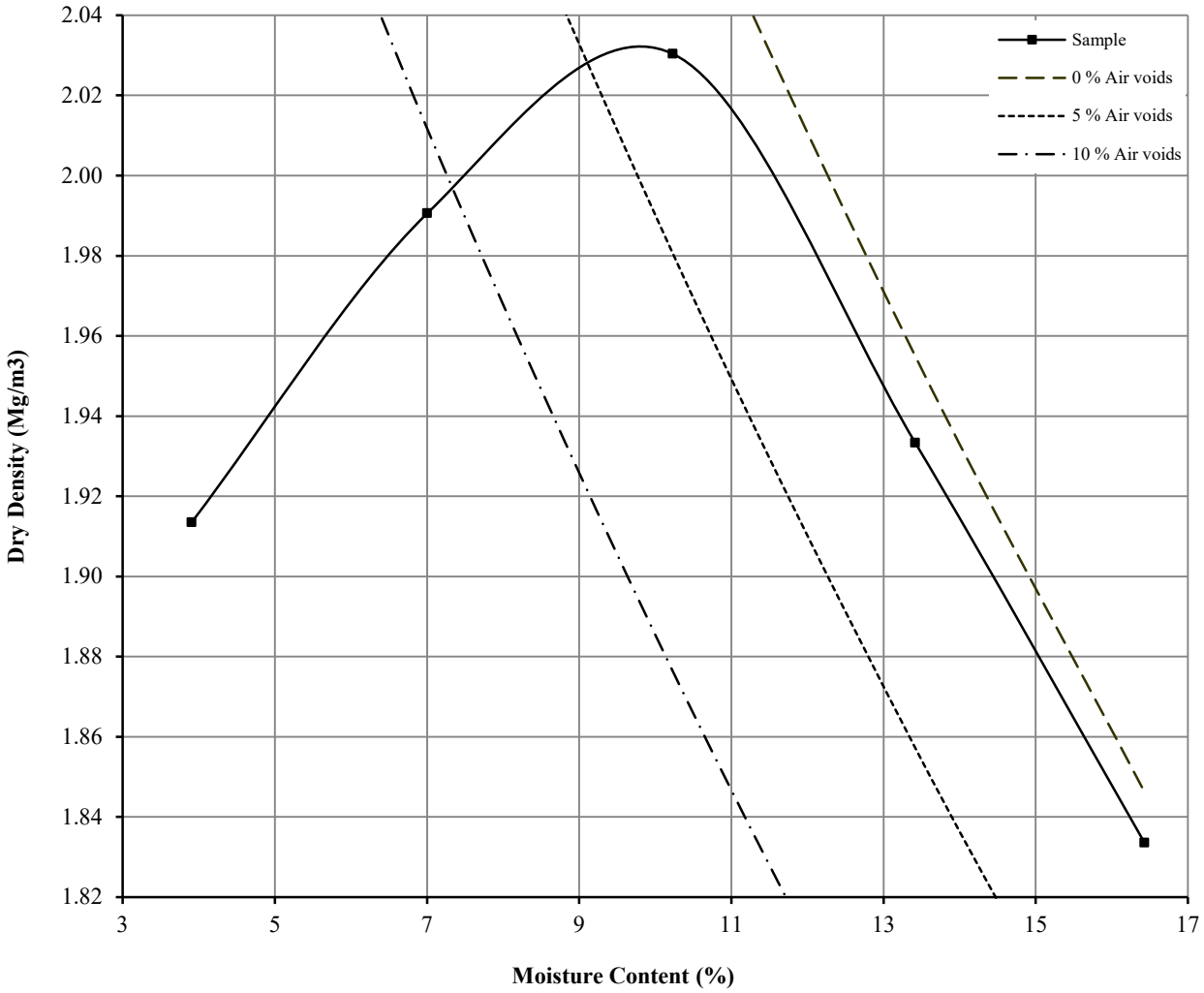
DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

Non compliance with BS 1377 : Part 4 : Clause 3.4 : 1990

Hole Number: TP-01 **Top Depth (m) :** 4.30

Sample Number: **Base Depth (m) :**

Sample Type: B&T



Initial Moisture Content:		10	Method of Compaction:	2.5kg	Separate Samples
Particle Density (Mg/m3):	2.65	Assumed	Material Retained on 37.5 mm Test Sieve (%):		34
Maximum Dry Density (Mg/m3):		2.03	Material Retained on 20.0 mm Test Sieve (%):		8
Optimum Moisture Content (%):		10			
Remarks See summary of soil descriptions					

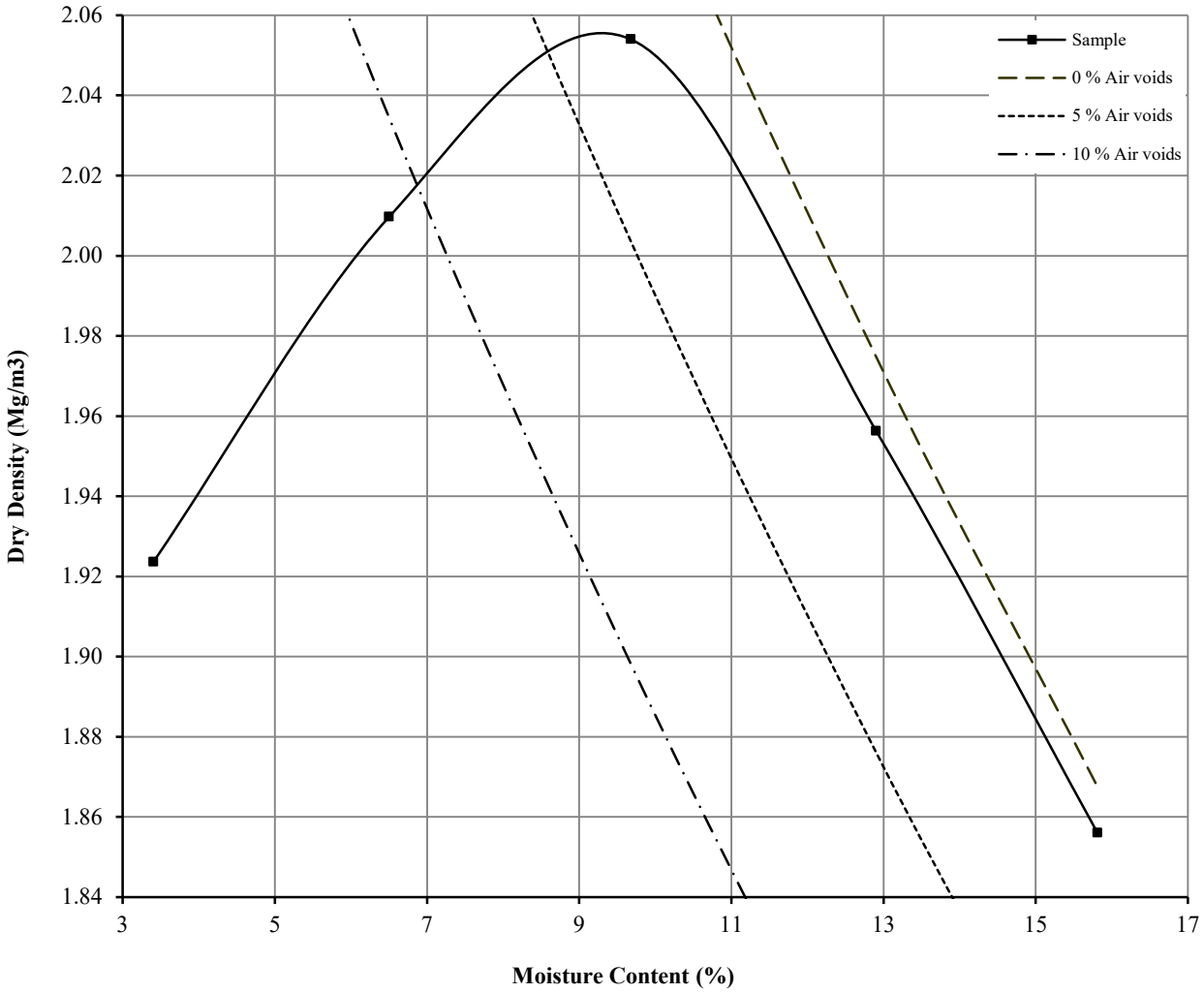
DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

Non compliance with BS 1377 : Part 4 : Clause 3.4 : 1990

Hole Number: TP-28 **Top Depth (m) :** 3.00

Sample Number: **Base Depth (m) :**

Sample Type: B&T



Initial Moisture Content:		9.7	Method of Compaction:	2.5kg	Separate Samples
Particle Density (Mg/m3):	2.65	Assumed	Material Retained on 37.5 mm Test Sieve (%):		12
Maximum Dry Density (Mg/m3):		2.05	Material Retained on 20.0 mm Test Sieve (%):		10
Optimum Moisture Content (%):		10			
Remarks See summary of soil descriptions					

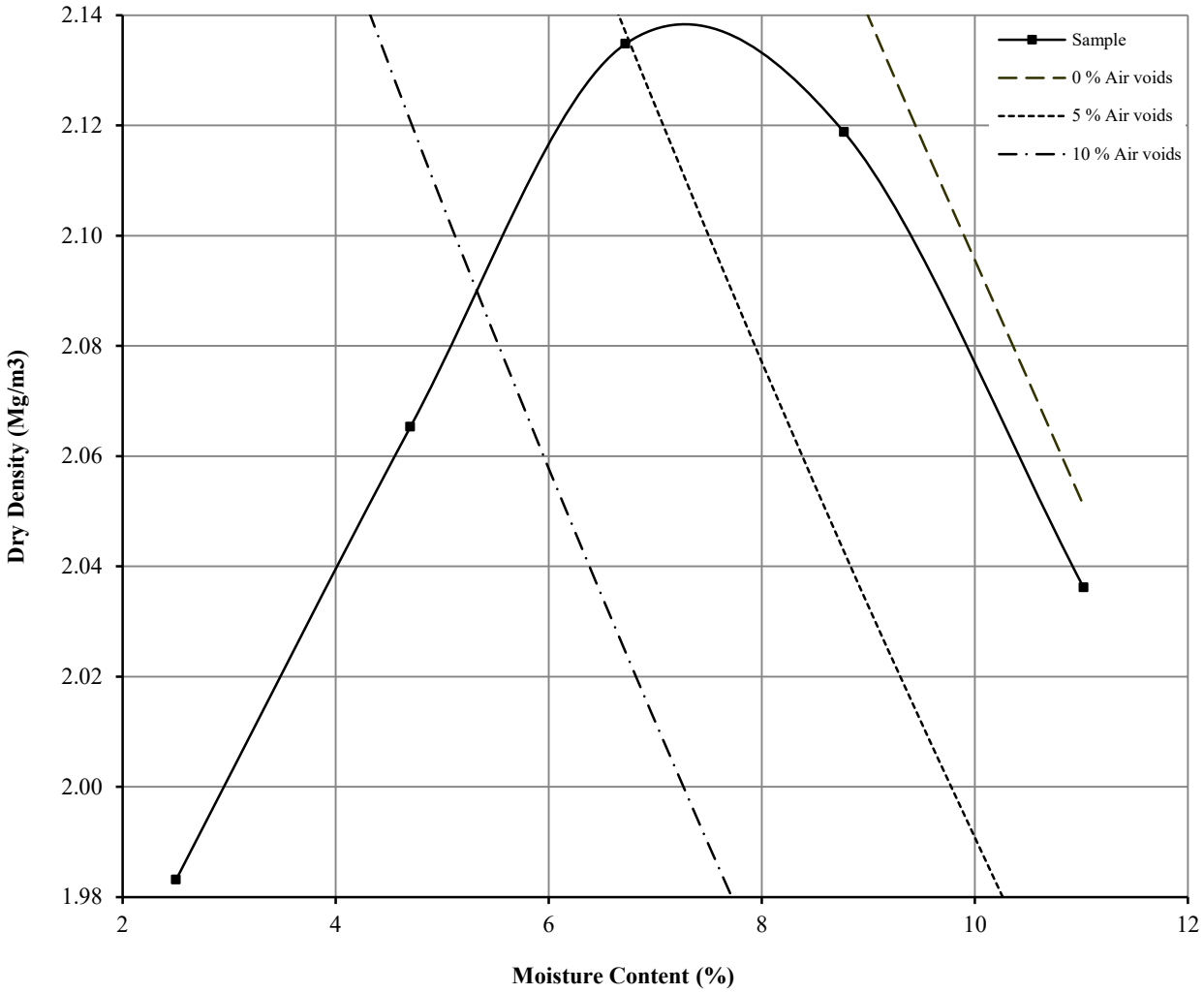
DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

BS 1377 : Part 4 : Clause 3.4 : 1990

Hole Number: TP-32 **Top Depth (m) :** 3.00

Sample Number: **Base Depth (m) :**

Sample Type: B&T



Initial Moisture Content:		8.8	Method of Compaction:	2.5kg	Separate Samples
Particle Density (Mg/m3):	2.65	Assumed	Material Retained on 37.5 mm Test Sieve (%):		8
Maximum Dry Density (Mg/m3):		2.13	Material Retained on 20.0 mm Test Sieve (%):		10
Optimum Moisture Content (%):		7			
Remarks See summary of soil descriptions					

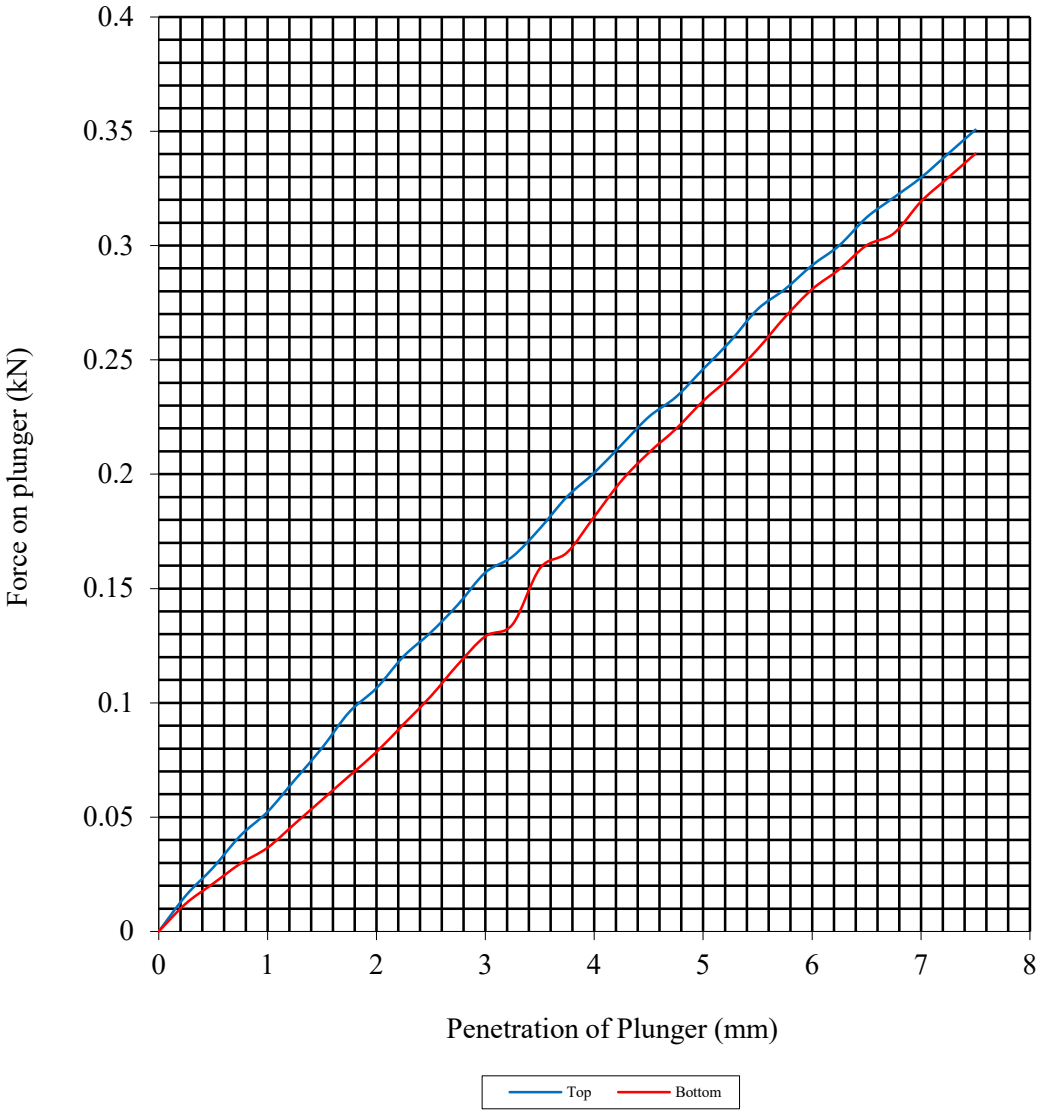
CALIFORNIA BEARING RATIO TEST

BS 1377 : Part 4 : 1990

Hole Number: TP-24 **Top Depth (m):** 3.00

Sample Number: **Base Depth (m):**

Sample Type: B&T



Initial Sample Conditions		Sample Preparation		Final Moisture Content %		C.B.R. Value %	
Moisture Content:	13	Surcharge Kg:	4.20	Sample Top	13	Sample Top	1.2
Bulk Density Mg/m3:	2.17	Soaking Time hrs	0	Sample Bottom	13	Sample Bottom	1.2
Dry Density Mg/m3:	1.92	Swelling mm:	0.00	Remarks : See Summary of Soil Descriptions.			
Percentage retained on 20mm BS test sieve:			4				
Compaction Conditions		2.5kg					

UKAS TESTING 4043

PSL Professional Soils Laboratory

Littleton Wind Farm

Contract No: PSL22/6090

Client Ref: 11947-06-22

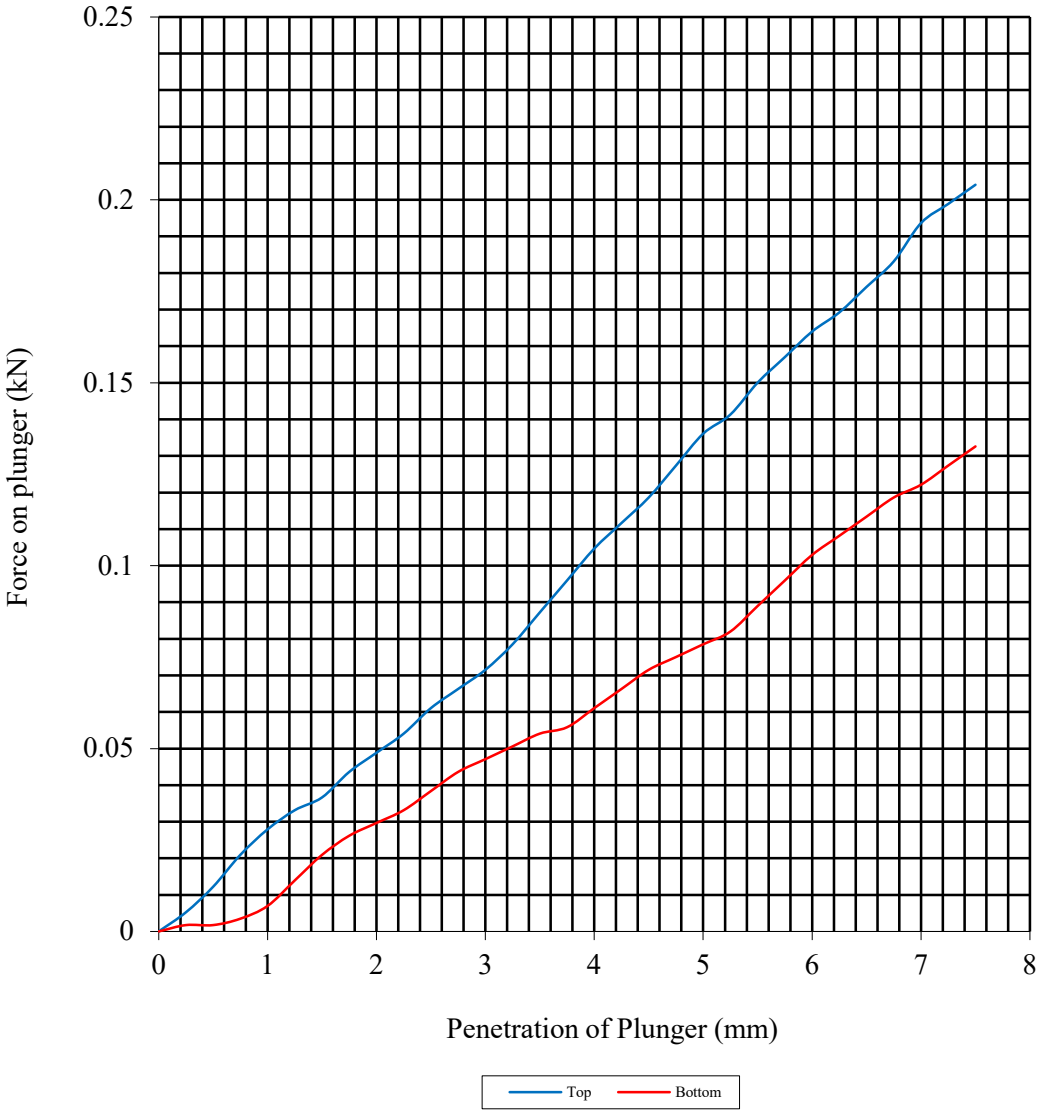
CALIFORNIA BEARING RATIO TEST

BS 1377 : Part 4 : 1990

Hole Number: TP-27 **Top Depth (m):** 2.50

Sample Number: **Base Depth (m):**

Sample Type: B&T



Initial Sample Conditions		Sample Preparation		Final Moisture Content %		C.B.R. Value %	
Moisture Content:	12	Surcharge Kg:	4.20	Sample Top	12	Sample Top	0.7
Bulk Density Mg/m3:	2.26	Soaking Time hrs	0	Sample Bottom	12	Sample Bottom	0.4
Dry Density Mg/m3:	2.01	Swelling mm:	0.00	Remarks : See Summary of Soil Descriptions.			
Percentage retained on 20mm BS test sieve:			3				
Compaction Conditions		2.5kg					

UKAS TESTING 4043

PSL Professional Soils Laboratory

Littleton Wind Farm

Contract No: PSL22/6090

Client Ref: 11947-06-22

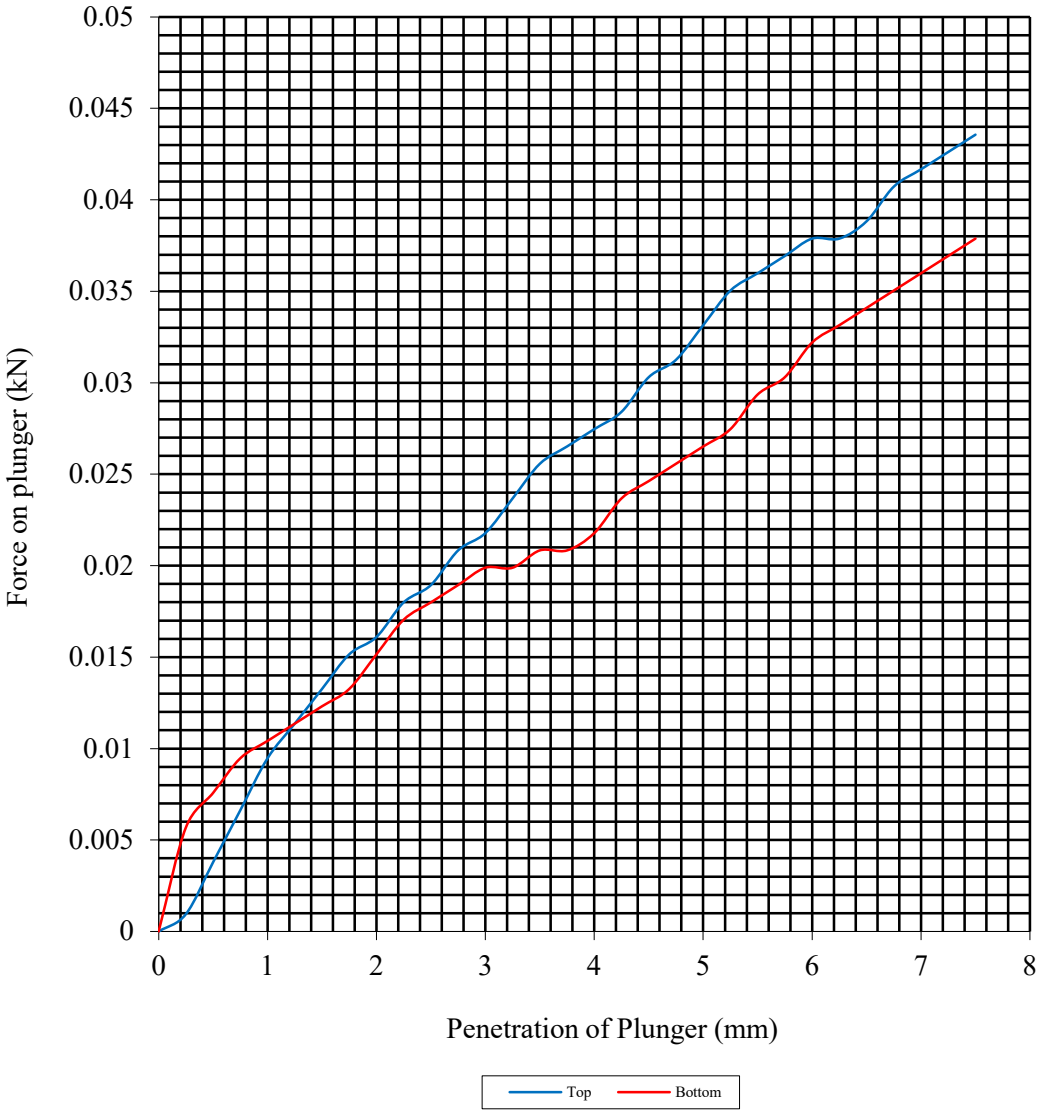
CALIFORNIA BEARING RATIO TEST

BS 1377 : Part 4 : 1990

Hole Number: TP-29 **Top Depth (m):** 3.00

Sample Number: **Base Depth (m):**

Sample Type: B&T



Initial Sample Conditions		Sample Preparation		Final Moisture Content %		C.B.R. Value %	
Moisture Content:	21	Surcharge Kg:	4.00	Sample Top	21	Sample Top	0.2
Bulk Density Mg/m3:	1.96	Soaking Time hrs	0	Sample Bottom	21	Sample Bottom	0.1
Dry Density Mg/m3:	1.62	Swelling mm:	0.00	Remarks : See Summary of Soil Descriptions.			
Percentage retained on 20mm BS test sieve:			4				
Compaction Conditions		2.5kg					

UKAS TESTING 4043

PSL Professional Soils Laboratory

Littleton Wind Farm

Contract No: PSL22/6090

Client Ref: 11947-06-22

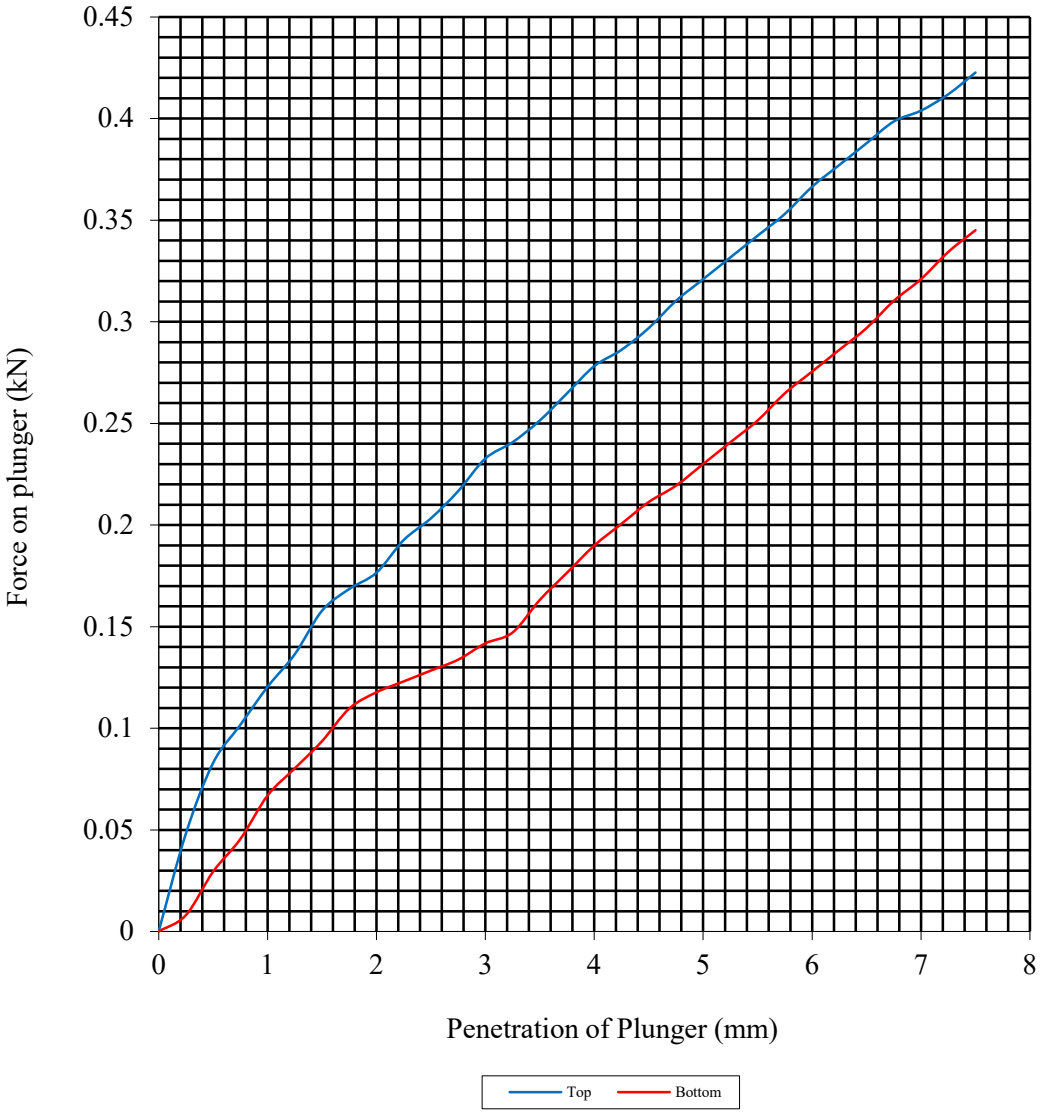
CALIFORNIA BEARING RATIO TEST

BS 1377 : Part 4 : 1990

Hole Number: TP-31 **Top Depth (m):** 0.70

Sample Number: **Base Depth (m):**

Sample Type: B&T



Initial Sample Conditions		Sample Preparation		Final Moisture Content %		C.B.R. Value %	
Moisture Content:	16	Surcharge Kg:	4.00	Sample Top	16	Sample Top	1.6
Bulk Density Mg/m3:	2.07	Soaking Time hrs	0	Sample Bottom	16	Sample Bottom	1.2
Dry Density Mg/m3:	1.79	Swelling mm:	0.00	Remarks : See Summary of Soil Descriptions.			
Percentage retained on 20mm BS test sieve:			0				
Compaction Conditions		2.5kg					

UKAS TESTING 4043

PSL Professional Soils Laboratory

Littleton Wind Farm

Contract No: PSL22/6090

Client Ref: 11947-06-22

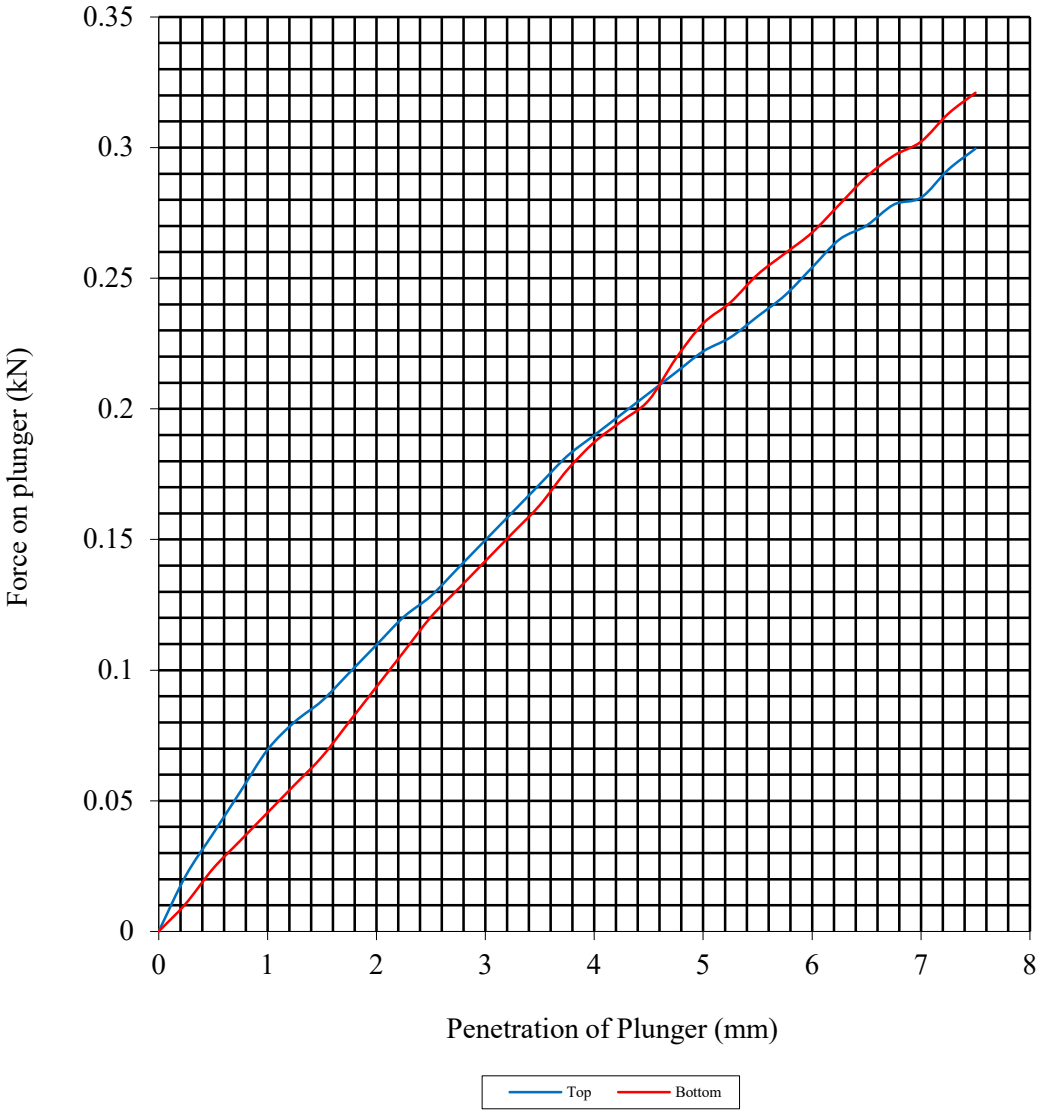
CALIFORNIA BEARING RATIO TEST

BS 1377 : Part 4 : 1990

Hole Number: TP-34 **Top Depth (m):** 1.00

Sample Number: **Base Depth (m):**

Sample Type: B&T



Initial Sample Conditions		Sample Preparation		Final Moisture Content %		C.B.R. Value %	
Moisture Content:	13	Surcharge Kg:	4.00	Sample Top	13	Sample Top	1.1
Bulk Density Mg/m3:	2.19	Soaking Time hrs	0	Sample Bottom	13	Sample Bottom	1.2
Dry Density Mg/m3:	1.94	Swelling mm:	0.00	Remarks : See Summary of Soil Descriptions.			
Percentage retained on 20mm BS test sieve:			19				
Compaction Conditions		2.5kg					

UKAS TESTING 4043

PSL Professional Soils Laboratory

Littleton Wind Farm

Contract No: PSL22/6090

Client Ref: 11947-06-22

MOISTURE CONDITION VALUE

BS1377 : Part 4 : 1990 Clause 5.4

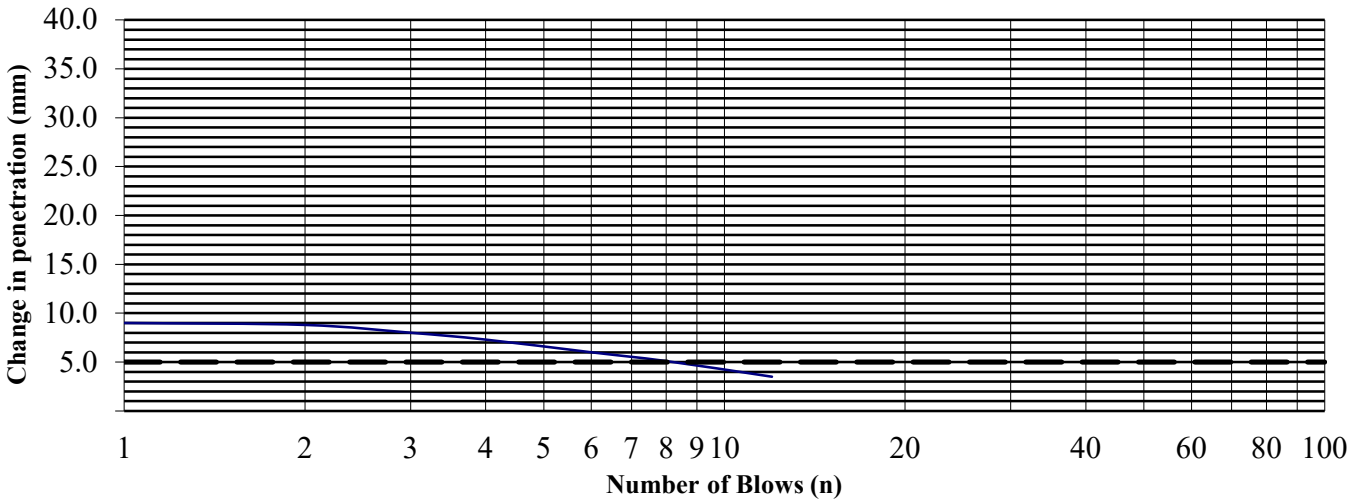
Hole Number: TP-03 **Top Depth (m):** 1.00

Sample Number: **Base Depth (m):**

Sample Type: B&T

Material Retained on the 20mm BS Test Sieve (%):	3
Interpretation based on steepest straight line intercept with 5mm change in penetration.	

MCV Determination



Blows (N)	Penetration (mm)	n to 4n (mm)
1	69.7	9.0
2	65.4	8.8
3	62.7	8.0
4	60.7	7.3
6	58.3	6.0
8	56.6	5.1
12	54.7	3.5
16	53.4	
24	52.3	
32	51.5	
48	51.2	
64		
96		
128		
192		
256		

Test Results.

Moisture Content (%)	9.0
MCV	9.1

MOISTURE CONDITION VALUE

BS1377 : Part 4 : 1990 Clause 5.4

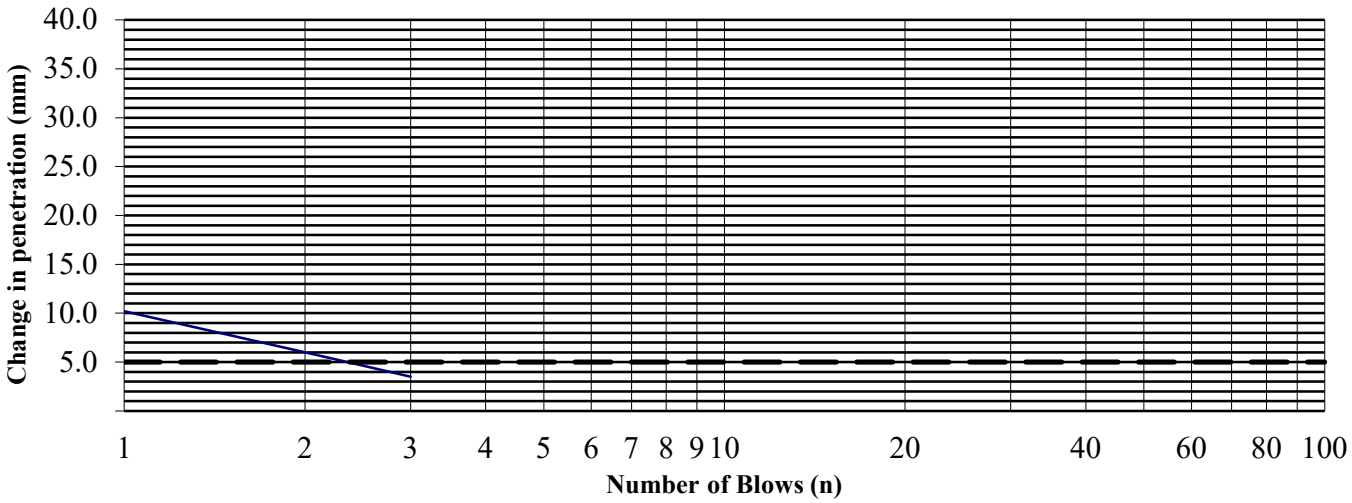
Hole Number: TP-28 **Top Depth (m):** 2.00

Sample Number: **Base Depth (m):**

Sample Type: B&T

Material Retained on the 20mm BS Test Sieve (%):	0
Interpretation based on steepest straight line intercept with 5mm change in penetration.	

MCV Determination



Blows (N)	Penetration (mm)	n to 4n (mm)
1	66.2	10.2
2	60.6	6.0
3	57.8	3.5
4	56.0	
6	54.9	
8	54.6	
12	54.3	
16		
24		
32		
48		
64		
96		
128		
192		
256		

Test Results.

Moisture Content (%)	13
MCV	3.8

MOISTURE CONDITION VALUE

BS1377 : Part 4 : 1990 Clause 5.4

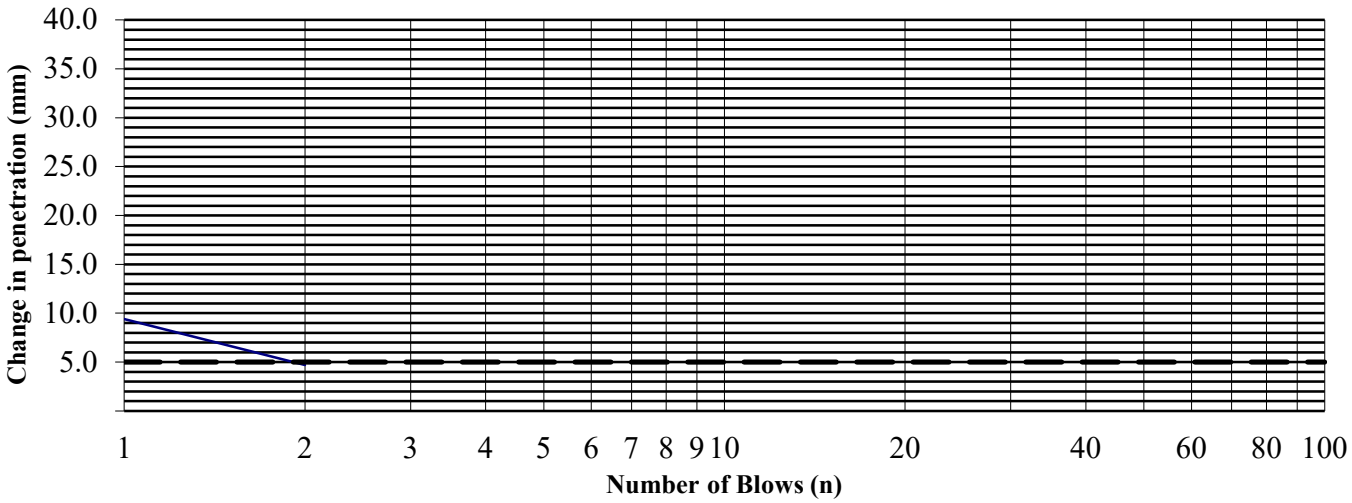
Hole Number: TP-32 **Top Depth (m):** 2.00

Sample Number: **Base Depth (m):**

Sample Type: B&T

Material Retained on the 20mm BS Test Sieve (%):	15
Interpretation based on steepest straight line intercept with 5mm change in penetration.	

MCV Determination



Blows (N)	Penetration (mm)	n to 4n (mm)
1	63.6	9.4
2	58.2	4.7
3	55.3	
4	54.2	
6	53.6	
8	53.5	
12		
16		
24		
32		
48		
64		
96		
128		
192		
256		

Test Results.

Moisture Content (%)	11
MCV	2.9

MOISTURE CONDITION VALUE

BS1377 : Part 4 : 1990 Clause 5.4

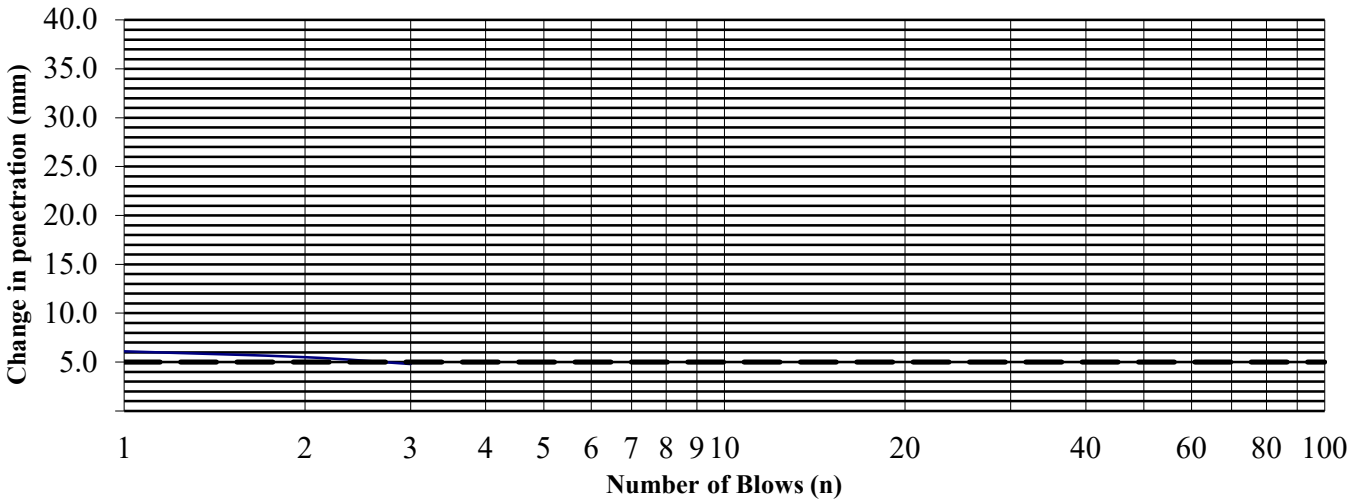
Hole Number: TP-33 **Top Depth (m):** 1.00

Sample Number: **Base Depth (m):**

Sample Type: B&T

Material Retained on the 20mm BS Test Sieve (%):	4
Interpretation based on steepest straight line intercept with 5mm change in penetration.	

MCV Determination



Blows (N)	Penetration (mm)	n to 4n (mm)
1	62.1	6.1
2	57.5	5.5
3	56.5	4.8
4	56.0	
6	55.5	
8	52.0	
12	51.7	
16		
24		
32		
48		
64		
96		
128		
192		
256		

Test Results.

Moisture Content (%)	14
MCV	3.3

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DESIGNING AND DELIVERING
A SUSTAINABLE FUTURE

APPENDIX F

Ground Investigation Report (June 2023)

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Ground Investigations Ireland

Littleton Wind Farm Additional Site Investigation

Fehily Timoney and Company

Ground Investigation Report

June 2023

Directors: Fergal McNamara (MD), Conor Finnerty, Aisling McDonnell & Barry Sexton
Ground Investigations Ireland Limited | Registered in Ireland Company Regsitration No.: 405726

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DOCUMENT CONTROL SHEET

Project Title	Littleton Wind Farm Additional Site Investigation
Engineer	Fehily Timoney and Company
Client	Bord na Móna
Project No	12613-03-23
Document Title	Ground Investigation Report

Rev.	Status	Author(s)	Reviewed By	Approved By	Office of Origin	Issue Date
A	Final	J Cashen	B Sexton	B Sexton	Dublin	26 June 2023

Ground Investigations Ireland Ltd. present the results of the fieldworks and laboratory testing in accordance with the specification and related documents provided by or on behalf of the client The possibility of variation in the ground and/or groundwater conditions between or below exploratory locations or due to the investigation techniques employed must be taken into account when this report and the appendices inform designs or decisions where such variation may be considered relevant. Ground and/or groundwater conditions may vary due to seasonal, man-made or other activities not apparent during the fieldworks and no responsibility can be taken for such variation. The data presented and the recommendations included in this report and associated appendices are intended for the use of the client and the client's geotechnical representative only and any duty of care to others is excluded unless approved in writing.

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APPENDICES

Appendix 1 Figures
Appendix 2 Trial Pit Records
Appendix 3 Laboratory Testing

1.0 Preamble

On the instructions of Fehily Timoney and Company, a site investigation was carried out by Ground Investigations Ireland Ltd. (GII) in April 2023 at the site of the proposed wind farm in Littleton, County Tipperary. A previous site investigation was completed by GII on the site between July and August 2022.

2.0 Overview

2.1. Background

Construction of a new wind farm with associated substations and access road network is proposed at the site in Littleton, County Tipperary. At the time of the site investigation the site consisted of three interlinked boglands - Longfordpass Bog, Littleton Bog and Lanespark Bog.

2.2. Purpose and Scope

The purpose of the site investigation was to investigate subsurface conditions utilising a variety of investigative methods in accordance with the project specification. The scope of the work undertaken for this project included the following:

- Visit project site to observe existing conditions
- Carry out 11 No. Trial Pits to a maximum depth of 4.50m BGL
- Factual Report

3.0 Subsurface Exploration

3.1. General

During the ground investigation a programme of intrusive investigation specified by the Consulting Engineer was undertaken to determine the sub surface conditions at the proposed site. Regular sampling and in-situ testing were undertaken in the exploratory holes to facilitate the geotechnical descriptions and to enable laboratory testing to be carried out on the soil samples recovered during excavation and drilling.
The procedures used in this site investigation are in accordance with Eurocode 7 Part 2: Ground Investigation and testing (ISEN 1997 – 2:2007) and B.S. 5930:2015+A1:2020.

3.2. Trial Pits

The trial pits were excavated using a 12T wide tracked excavator at the locations shown in the exploratory hole location plan in Appendix 1. The locations were checked using a CAT scan to minimise the potential for encountering services during the excavation. The trial pits were sampled, logged and photographed by a Geo-Environmental Engineer prior to backfilling with arisings. Notes were made of any services,

inclusions, pit stability, groundwater encountered, and the characteristics of the strata encountered and are presented on the trial pit logs which are provided in Appendix 2 of this Report.

3.3. Surveying

The exploratory hole locations have been recorded using a KQGeo M8 GNSS System which records the coordinates and elevation of the locations to ITM as required by the project specification. The coordinates and elevations are provided on the exploratory hole logs in the appendices of this Report.

3.4. Laboratory Testing

Samples were selected from the exploratory holes for a range of geotechnical and environmental testing to assist in the classification of soils and to provide information for the proposed design.
Chemical testing, as required by the specification, including pH, organic matter content, total sulphur, water soluble sulphate and acid soluble sulphate testing, was carried out by Element Materials Technology Laboratory in the United Kingdom (UK).
Geotechnical testing consisting of Moisture Content, Atterberg Limits, and Particle Size Distribution (PSD) wet sieve and hydrometer tests were carried out by Professional Soils Laboratory (PSL) in the UK.
The results of the laboratory testing are included in Appendix 3 of this Report.

4.0 Ground Conditions

4.1. General

The ground conditions encountered during the investigation are summarised below with reference to insitu and laboratory test results. The full details of the strata encountered during the ground investigation are provided in the exploratory hole logs included in the appendices of this report.

The sequence of strata encountered were consistent across the site and generally comprised;

- Peat
- Cohesive Deposits

PEAT: Peat was encountered at most exploratory holes and was generally described as *dark brown slightly clayey pseudo-fibrous PEAT.* In several of the exploratory holes a layer of *dark brown slightly clayey amorphous PEAT* overlay the pseudo-fibrous Peat. The depth of peat varied from 0.20m BGL in TP-36, to 3.10m BGL in TP-42.

COHESIVE DEPOSITS: Cohesive deposits were encountered from ground level at TP-37, and beneath the peat at all other locations and were described predominantly as *a grey sandy gravelly silty CLAY.* The secondary sand and gravel constituents varied across the site and with depth, with granular lenses occasionally present in the glacial till matrix. When in contact with water, this deposit appeared to partially

liquify. These deposits had low (<5%), medium (5%-20%) or high (20%-50%) cobble and boulder content, where noted on the exploratory hole logs.

4.2. Groundwater

Groundwater strikes are noted on the exploratory hole logs where they occurred. We would point out that these exploratory holes did not remain open for sufficiently long periods of time to establish the hydrogeological regime and groundwater levels would be expected to vary with time of year, rainfall, nearby construction, and other factors.

APPENDIX 1 - Figures

GROUND INVESTIGATIONS IRELAND
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Client:

FEHILY TIMONEY

0 900 1,800 2,700 3,600 m

Project Title:
Littleton Wind Farm Additional SI

Drawing Title:
Figure 1 - Site Location

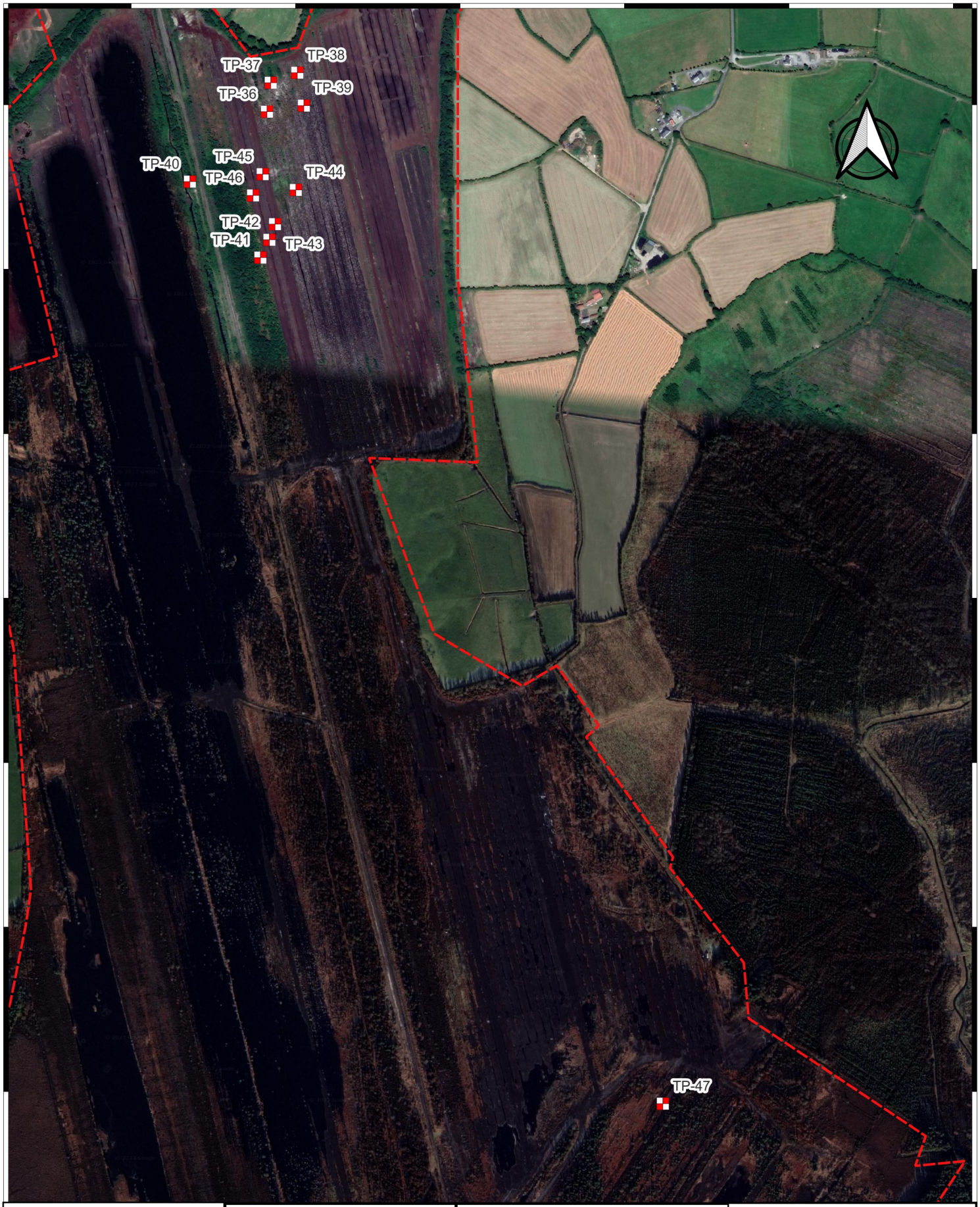
GII Project Reference:
12613-03-23

Drawn By:
JC

Date:
26-06-2023

Indicative Site Boundary

Site Location



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Newcastle, Co. Dublin
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Client:

FEHILY TIMONEY

0 80 160 240 320 m

Project Title:
Littleton Wind Farm Additional SI

Drawing Title:
Figure 2 - Site Investigation Points

GII Project Reference:
12613-03-23

Drawn By:
JC

Date:
26-06-2023

Indicative Site Boundary

Trial Pit

APPENDIX 2 – Trial Pit Records

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Site Littleton Wind Farm Additional GI			**Trial Pit Number** TP-36
Machine : 12T wide tracked excavator **Method :** Trial Pit	**Dimensions** 5.30m x 2.50m x 3.50m (L x W x D)	**Ground Level (mOD)** 125.74	**Client** Bord na Móna	**Job Number** 12613-03-23
	Location 623347.8 E 659085.5 N	**Dates** 05/04/2023	**Engineer** Fehily Timoney	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.15)	Very soft black slightly clayey amorphous PEAT		
				125.59	0.15	Soft to firm brownish grey sandy gravelly silty CLAY with high cobble content		
1.00 1.00	B T				(1.65)			
			Seepage(1) at 2.00m.	123.94	1.80	Very soft grey sandy slightly gravelly silty CLAY with medium cobble content. Soil liquified by excavation and water ingress.		▽1
					(1.70)			
				122.24	3.50	Complete at 3.50m		

Plan

Remarks

Groundwater encountered at 2.00m BGL; Seepage
Trial pit unstable; side walls collapsed
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	CMP	12613-03-23.TP-36

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Site Littleton Wind Farm Additional GI			**Trial Pit Number** TP-37
Machine : 12T wide tracked excavator **Method :** Trial Pit	**Dimensions** 5.90m x 1.20m x 3.50m (L x W x D)	**Ground Level (mOD)** 126.85	**Client** Bord na Móna	**Job Number** 12613-03-23
	Location 623354.6 E 659138.3 N	**Dates** 05/04/2023	**Engineer** Fehily Timoney	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.30)	Soft grey sandy gravelly silty CLAY with medium cobble content		
				126.55	0.30			
						Soft to firm greyish brown sandy gravelly silty CLAY with medium cobble and boulder content		
1.00 1.00	B T				(1.60)			
				124.95	1.90			
						Firm grey slightly sandy gravelly silty CLAY with high cobble and medium boulder content		
2.50 2.50	B T				(1.60)			
						Obstruction: Possible Boulders/Bedrock		
3.50 3.50	B T		Seepage(1) at 3.50m.	123.35	3.50	Complete at 3.50m		▽1

Plan

Remarks

Groundwater encountered at 3.50m BGL; Seepage
Trial pit stable
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	CMP	12613-03-23.TP-39

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Site Littleton Wind Farm Additional GI			**Trial Pit Number** TP-38
Machine : 12T wide tracked excavator **Method :** Trial Pit	**Dimensions** 5.00m x 2.50m x 4.50m (L x W x D)	**Ground Level (mOD)** 125.76	**Client** Bord na Móna	**Job Number** 12613-03-23
	Location 623403.1 E 659156.6 N	**Dates** 05/04/2023	**Engineer** Fehily Timoney	**Sheet** 1/2

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
				125.66	(0.10) 0.10	Possible MADE GROUND: Black slightly clayey amorphous Peat		
						Very soft brown clayey pseudo fibrous PEAT with occasional fragments of wood		
			Seepage(1) at 0.60m.		(0.90)			▽1
				124.76	1.00	Soft grey slightly sandy gravelly silty CLAY with medium cobble and low boulder content		
2.00 2.00	B T		Seepage(2) at 2.00m.					▽2
					(3.50)			
3.50 3.50	B T							

Plan

Remarks

Groundwater encountered at 0.60m and 2.00m BGL; Seepage
Trial pit unstable; side walls collapsed
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	CMP	12613-03-23.TP-38

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Site Littleton Wind Farm Additional GI			**Trial Pit Number** TP-38
Machine : 12T wide tracked excavator **Method :** Trial Pit	**Dimensions** 5.00m x 2.50m x 4.50m (L x W x D)	**Ground Level (mOD)** 125.76	**Client** Bord na Móna	**Job Number** 12613-03-23
	Location 623403.1 E 659156.6 N	**Dates** 05/04/2023	**Engineer** Fehily Timoney	**Sheet** 2/2

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
				121.26	4.50	Complete at 4.50m		

Plan

Remarks

Scale (approx)	Logged By	Figure No.
1:25	CMP	12613-03-23.TP-38

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Site Littleton Wind Farm Additional GI			**Trial Pit Number** TP-39
Machine : 12T wide tracked excavator **Method :** Trial Pit	**Dimensions** 5.20m x 1.20m x 4.00m (L x W x D)	**Ground Level (mOD)** 125.23	**Client** Bord na Móna	**Job Number** 12613-03-23
	Location 623415.1 E 659096.6 N	**Dates** 05/04/2023	**Engineer** Fehily Timoney	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.30)	Possible MADE GROUND: Black slightly clayey amorphous Peat		
				124.93	0.30	Very soft brown clayey pseudo fibrous PEAT with occasional fragments of wood		
			Medium Ingress(1) at 1.00m.		(1.80)			▽1
				123.13	2.10	Soft grey sandy gravelly silty CLAY with medium cobble content		
2.50 2.50	B T					Encountered multiple sand lens between 2.10m and 3.50m BGL		
					(1.90)			
4.00	BT			121.23	4.00			

Plan

Remarks

Groundwater encountered at 1.00m BGL; Medium Ingress
Trial pit unstable; side walls collapsed
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	CMP	12613-03-23.TP-39

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Site Littleton Wind Farm Additional GI			**Trial Pit Number** TP-40
Machine : 12T wide tracked excavator **Method :** Trial Pit	**Dimensions** 5.10m x 1.20m x 4.00m (L x W x D)	**Ground Level (mOD)** 124.97	**Client** Bord na Móna	**Job Number** 12613-03-23
	Location 623207 E 658957.9 N	**Dates** 06/04/2023	**Engineer** Fehily Timoney	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
				124.87	(0.10) 0.10	Possible MADE GROUND: Brown slightly sandy slightly gravelly Clay		
					(0.30)	Possible MADE GROUND: Brown slightly sandy slightly gravelly silty Clay		
				124.57	0.40	Possible MADE GROUND: Black slightly clayey amorphous Peat		
					(0.30)			
				124.27	0.70	Soft to firm brown slightly sandy gravelly silty CLAY with medium cobble content		
1.50 1.50	B T				(1.70)			
				122.57	2.40	Soft grey sandy gravelly silty CLAY with medium cobble and boulder content		
					(1.60)			
				120.97	4.00			

Plan

Remarks

No groundwater encountered
Trial pit unstable; side walls spalling
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	CMP	12613-03-23.TP-40

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Site Littleton Wind Farm Additional GI			**Trial Pit Number** TP-41
Machine : 12T wide tracked excavator **Method :** Trial Pit	**Dimensions** 5.80m x 1.20m x 4.50m (L x W x D)	**Ground Level (mOD)** 124.23	**Client** Bord na Móna	**Job Number** 12613-03-23
	Location 623335.7 E 658819.3 N	**Dates** 05/04/2023	**Engineer** Fehily Timoney	**Sheet** 1/2

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(1.40)	Very soft brown clayey pseudo fibrous PEAT with rare fragments of wood		
			Seepage(1) at 1.30m.	122.83	1.40			▽1
2.00 2.00	B T					Soft to firm grey slightly sandy gravelly silty CLAY with medium cobble content. Soil liquified by excavation and water ingress.		
			Medium Ingress(2) at 2.30m.		(2.10)			▽2
				120.73	3.50			
4.00	BT					Soft to firm grey sandy gravelly silty CLAY with medium cobble and boulder content		

Plan

Remarks

Groundwater encountered at 1.30m and 2.30m BGL; Seepage and Medium Ingress
Trial pit unstable; side walls spalling
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	CMP	12613-03-23.TP-41

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Site Littleton Wind Farm Additional GI			**Trial Pit Number** TP-41
Machine : 12T wide tracked excavator **Method :** Trial Pit	**Dimensions** 5.80m x 1.20m x 4.50m (L x W x D)	**Ground Level (mOD)** 124.23	**Client** Bord na Móna	**Job Number** 12613-03-23
	Location 623335.7 E 658819.3 N	**Dates** 05/04/2023	**Engineer** Fehily Timoney	**Sheet** 2/2

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(1.00)			
				119.73	4.50	Complete at 4.50m		

Plan

Remarks

Scale (approx)	Logged By	Figure No.
1:25	CMP	12613-03-23.TP-41

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Site Littleton Wind Farm Additional GI			**Trial Pit Number** TP-42
Machine : 12T wide tracked excavator **Method :** Trial Pit	**Dimensions** 5.40m x 1.20m x 4.50m (L x W x D)	**Ground Level (mOD)** 124.83	**Client** Bord na Móna	**Job Number** 12613-03-23
	Location 623352.2 E 658851.8 N	**Dates** 06/04/2023	**Engineer** Fehily Timoney	**Sheet** 1/2

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
			Seepage(1) at 1.20m.		(3.10)	Very soft brown clayey pseudo fibrous PEAT with occasional fragments of wood		▽1
3.50 3.50	B T			121.73 120.83	3.10 (0.90) 4.00	Soft grey sandy gravelly clayey SILT		

Plan

Remarks

Groundwater encountered at 1.20m BGL; Seepage
Trial pit stable
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	CMP	12613-03-23.TP-42

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Site Littleton Wind Farm Additional GI			**Trial Pit Number** TP-42
Machine : 12T wide tracked excavator **Method :** Trial Pit	**Dimensions** 5.40m x 1.20m x 4.50m (L x W x D)	**Ground Level (mOD)** 124.83	**Client** Bord na Móna	**Job Number** 12613-03-23
	Location 623352.2 E 658851.8 N	**Dates** 06/04/2023	**Engineer** Fehily Timoney	**Sheet** 2/2

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.50)	Soft grey sandy gravelly silty CLAY with medium cobble content		
4.50 4.50	B T			120.33	4.50	Complete at 4.50m		

Plan

Remarks

Scale (approx)	Logged By	Figure No.
1:25	CMP	12613-03-23.TP-42

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Site Littleton Wind Farm Additional GI			**Trial Pit Number** TP-43
Machine : 12T wide tracked excavator **Method :** Trial Pit	**Dimensions** 5.80m x 1.20m x 4.50m (L x W x D)	**Ground Level (mOD)** 124.88	**Client** Bord na Móna	**Job Number** 12613-03-23
	Location 623362.4 E 658880.3 N	**Dates** 06/04/2023	**Engineer** Fehily Timoney	**Sheet** 1/2

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.40)	Very soft black slightly clayey amorphous PEAT		
				124.48	0.40			
					(1.90)	Very soft brown clayey pseudo fibrous PEAT with occasional fragments of wood		
				122.58	2.30			
2.50 2.50	B T				(1.90)	Soft to firm grey sandy gravelly silty CLAY with medium cobble content		

Plan

Remarks

Groundwater encountered at 4.20m BGL; Seepage
Trial pit stable
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	CMP	12613-03-23.TP-43

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Site Littleton Wind Farm Additional GI			**Trial Pit Number** TP-43
Machine : 12T wide tracked excavator **Method :** Trial Pit	**Dimensions** 5.80m x 1.20m x 4.50m (L x W x D)	**Ground Level (mOD)** 124.88	**Client** Bord na Móna	**Job Number** 12613-03-23
	Location 623362.4 E 658880.3 N	**Dates** 06/04/2023	**Engineer** Fehily Timoney	**Sheet** 2/2

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
			Seepage(1) at 4.20m.	120.68	4.20	Soft grey sandy gravelly silty CLAY. Soil liquified by excavation and water ingress.		▽1
					(0.30)			
4.50 4.50	B T			120.38	4.50	Complete at 4.50m		

Plan

Remarks

Scale (approx)	Logged By	Figure No.
1:25	CMP	12613-03-23.TP-43

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Site Littleton Wind Farm Additional GI			**Trial Pit Number** TP-44
Machine : 12T wide tracked excavator **Method :** Trial Pit	**Dimensions** 5.40m x 1.20m x 4.50m (L x W x D)	**Ground Level (mOD)** 124.12	**Client** Bord na Móna	**Job Number** 12613-03-23
	Location 623400.4 E 658942.8 N	**Dates** 06/04/2023	**Engineer** Fehily Timoney	**Sheet** 1/2

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.20)	Very soft black slightly clayey amorphous PEAT with occasional roots		
				123.92	0.20	Very soft brown clayey pseudo fibrous PEAT		
					(0.85)			
				123.07	1.05	Firm grey sandy gravelly silty CLAY		▽1
1.50 1.50	B T		Seepage(1) at 1.10m.					
					(1.65)			
			Medium Ingress(2) at 2.30m.					▽2
				121.42	2.70	Soft grey sandy gravelly clayey SILT with medium cobble cotent. Soil liquified by excavation and water ingress.		
3.00 3.00	B T							
					(1.80)			

Plan

Remarks

Groundwater encountered at 1.10m and 2.30m BGL; Seepage and Medium Ingress
Trial pit unstable; side walls spalling
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	CMP	12613-03-23.TP-44

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Site Littleton Wind Farm Additional GI			**Trial Pit Number** TP-44
Machine : 12T wide tracked excavator **Method :** Trial Pit	**Dimensions** 5.40m x 1.20m x 4.50m (L x W x D)	**Ground Level (mOD)** 124.12	**Client** Bord na Móna	**Job Number** 12613-03-23
	Location 623400.4 E 658942.8 N	**Dates** 06/04/2023	**Engineer** Fehily Timoney	**Sheet** 2/2

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
				119.62	4.50	Complete at 4.50m		

Plan

Remarks

Scale (approx)	Logged By	Figure No.
1:25	CMP	12613-03-23.TP-44

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Site Littleton Wind Farm Additional GI			**Trial Pit Number** TP-45
Machine : 12T wide tracked excavator **Method :** Trial Pit	**Dimensions** 5.60m x 1.20m x 4.50m (L x W x D)	**Ground Level (mOD)** 125.29	**Client** Bord na Móna	**Job Number** 12613-03-23
	Location 623339.9 E 658971.5 N	**Dates** 06/04/2023	**Engineer** Fehily Timoney	**Sheet** 1/2

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.60)	Very soft black slightly clayey amorphous PEAT		
				124.69	0.60			
1.00 1.00	B T				(1.30)	Very soft brown clayey pseudo fibrous PEAT with rare fragments of wood		
				123.39	1.90			
2.50 2.50	B T				(1.30)	Soft to firm grey slightly sandy gravelly silty CLAY with medium cobble content		
				122.09	3.20			
					(1.30)	Soft to firm grey sandy gravelly silty CLAY with medium cobble content		

Plan

Remarks

No groundwater encountered
Trial pit stable
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	CMP	12613-03-23.TP-45

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Site Littleton Wind Farm Additional GI			**Trial Pit Number** TP-45
Machine : 12T wide tracked excavator **Method :** Trial Pit	**Dimensions** 5.60m x 1.20m x 4.50m (L x W x D)	**Ground Level (mOD)** 125.29	**Client** Bord na Móna	**Job Number** 12613-03-23
	Location 623339.9 E 658971.5 N	**Dates** 06/04/2023	**Engineer** Fehily Timoney	**Sheet** 2/2

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
4.50 4.50	B T			120.79	4.50	Complete at 4.50m		

Plan

Remarks

Scale (approx)	Logged By	Figure No.
1:25	CMP	12613-03-23.TP-45

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Site Littleton Wind Farm Additional GI			**Trial Pit Number** TP-46
Machine : 12T wide tracked excavator **Method :** Trial Pit	**Dimensions** 5.80m x 1.20m x 4.50m (L x W x D)	**Ground Level (mOD)** 124.43	**Client** Bord na Móna	**Job Number** 12613-03-23
	Location 623322.3 E 658932.7 N	**Dates** 05/04/2023	**Engineer** Fehily Timoney	**Sheet** 1/2

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
			Seepage(1) at 1.10m.		(2.40)	Very soft brown clayey pseudo fibrous PEAT with occasional fragments of wood		▽1
2.50 2.50	B T			122.03	2.40	Firm grey slightly sandy slightly gravelly silty CLAY with medium cobble content		
					(0.80)			
3.50 3.50	B T			121.23	3.20	Firm grey slightly sandy gravelly silty CLAY with medium cobble content		
					(1.30)			

Plan

Remarks

Groundwater encountered at 1.10m BGL; Seepage
Trial pit stable
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	CMP	12613-03-23.TP-46

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Site Littleton Wind Farm Additional GI			**Trial Pit Number** TP-46
Machine : 12T wide tracked excavator **Method :** Trial Pit	**Dimensions** 5.80m x 1.20m x 4.50m (L x W x D)	**Ground Level (mOD)** 124.43	**Client** Bord na Móna	**Job Number** 12613-03-23
	Location 623322.3 E 658932.7 N	**Dates** 05/04/2023	**Engineer** Fehily Timoney	**Sheet** 2/2

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
				119.93	4.50	Complete at 4.50m		

Plan

Remarks

Scale (approx)	Logged By	Figure No.
1:25	CMP	12613-03-23.TP-46

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Site Littleton Wind Farm Additional GI			**Trial Pit Number** TP-47
Machine : 12T wide tracked excavator **Method :** Trial Pit	**Dimensions** 5.10m x 1.20m x 4.50m (L x W x D)	**Ground Level (mOD)** 125.48	**Client** Bord na Móna	**Job Number** 12613-03-23
	Location 624070.1 E 657275.9 N	**Dates** 05/04/2023	**Engineer** Fehily Timoney	**Sheet** 1/2

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.20)	Very soft black slightly clayey amorphous PEAT		
				125.28	0.20	Very soft brown clayey pseudo fibrous PEAT with occasional fragments of wood		
1.00 1.00	B T		Seepage(1) at 1.00m.		(1.70)			▽1
				123.58	1.90	Soft grey slightly sandy slightly gravelly silty CLAY with occasional organic fibres		
2.00 2.00	B T				(0.80)			
			Medium Ingress(2) at 2.70m.	122.78	2.70	Grey sandy gravelly silty CLAY with medium cobble content. Soil liquified by excavation and water ingress.		▽2
					(1.30)			
3.50 3.50	B T							
				121.48	4.00			

Plan

Remarks

Groundwater encountered at 1.00m and 2.70m BGL; Seepage and Medium Ingress
Trial pit stable
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	CMP	12613-03-23.TP-47

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Site Littleton Wind Farm Additional GI			**Trial Pit Number** TP-47
Machine : 12T wide tracked excavator **Method :** Trial Pit	**Dimensions** 5.10m x 1.20m x 4.50m (L x W x D)	**Ground Level (mOD)** 125.48	**Client** Bord na Móna	**Job Number** 12613-03-23
	Location 624070.1 E 657275.9 N	**Dates** 05/04/2023	**Engineer** Fehily Timoney	**Sheet** 2/2

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.50)	Soft grey sandy gravelly clayey SILT with medium cobble content		
4.50 4.50	B T			120.98	4.50	Complete at 4.50m		

Plan

Remarks

Scale (approx)	Logged By	Figure No.
1:25	CMP	12613-03-23.TP-47

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Littleton Wind Farm Additional GI – Trial Pit Photographs

TP-36

TP-36

Littleton Wind Farm Additional GI – Trial Pit Photographs

TP-36

TP-36

Littleton Wind Farm Additional GI – Trial Pit Photographs

TP-36

Littleton Wind Farm Additional GI – Trial Pit Photographs

TP-37

TP-37

Littleton Wind Farm Additional GI – Trial Pit Photographs

TP-37

TP-37

Littleton Wind Farm Additional GI – Trial Pit Photographs

TP-37

Littleton Wind Farm Additional GI – Trial Pit Photographs

TP-38

TP-38

Littleton Wind Farm Additional GI – Trial Pit Photographs

TP-38

TP-38

Littleton Wind Farm Additional GI – Trial Pit Photographs

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Littleton Wind Farm Additional GI – Trial Pit Photographs

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Littleton Wind Farm Additional GI – Trial Pit Photographs

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Littleton Wind Farm Additional GI – Trial Pit Photographs

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Littleton Wind Farm Additional GI – Trial Pit Photographs

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Littleton Wind Farm Additional GI – Trial Pit Photographs

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Littleton Wind Farm Additional GI – Trial Pit Photographs

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Littleton Wind Farm Additional GI – Trial Pit Photographs

TP-41

TP-41

Littleton Wind Farm Additional GI – Trial Pit Photographs

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Littleton Wind Farm Additional GI – Trial Pit Photographs

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Littleton Wind Farm Additional GI – Trial Pit Photographs

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Littleton Wind Farm Additional GI – Trial Pit Photographs

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Littleton Wind Farm Additional GI – Trial Pit Photographs

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Littleton Wind Farm Additional GI – Trial Pit Photographs

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Littleton Wind Farm Additional GI – Trial Pit Photographs

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Littleton Wind Farm Additional GI – Trial Pit Photographs

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Littleton Wind Farm Additional GI – Trial Pit Photographs

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Littleton Wind Farm Additional GI – Trial Pit Photographs

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Littleton Wind Farm Additional GI – Trial Pit Photographs

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Littleton Wind Farm Additional GI – Trial Pit Photographs

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Littleton Wind Farm Additional GI – Trial Pit Photographs

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Littleton Wind Farm Additional GI – Trial Pit Photographs

TP-47

TP-47

Littleton Wind Farm Additional GI – Trial Pit Photographs

TP-47

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Littleton Wind Farm Additional GI – Trial Pit Photographs

TP-47

APPENDIX 3 – Laboratory Testing

Element Materials Technology
Unit 3 Deeside Point
Zone 3
Deeside Industrial Park
Deeside
CH5 2UA

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W: www.element.com

Ground Investigations Ireland
Catherinestown House
Hazelhatch Road
Newcastle
Co. Dublin
Ireland
D22 K5P8

Attention :	James Cashen
Date :	17th May, 2023
Your reference :	12613-03-23
Our reference :	Test Report 23/7422 Batch 1
Location :	Littleton Wind Farm Additional GI
Date samples received :	11th May, 2023
Status :	Final Report
Issue :	1

Nine samples were received for analysis on 11th May, 2023 of which nine were scheduled for analysis. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.
All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

Authorised By:

Liza Klebe
Project Co-ordinator

Please include all sections of this report if it is reproduced

Element Materials Technology

Client Name: Ground Investigations Ireland
Reference: 12613-03-23
Location: Littleton Wind Farm Additional GI
Contact: James Cashen
EMT Job No: 23/7422

Report : Solid

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

EMT Sample No.	1	2	3	4	5	6	7	8	9		LOD/LOR	Units	Method No.
Sample ID	TP-37	TP-39	TP-40	TP-41	TP-43	TP-44	TP-45	TP-46	TP-47				
Depth	1.00	2.50	1.50	4.00	2.50	1.50	1.00	2.50	3.50				
COC No / misc													
Containers	T	T	T	T	T	T	T	T	T				
Sample Date	09/05/2023	09/05/2023	09/05/2023	09/05/2023	09/05/2023	09/05/2023	09/05/2023	09/05/2023	09/05/2023				
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil				
Batch Number	1	1	1	1	1	1	1	1	1				
Date of Receipt	11/05/2023	11/05/2023	11/05/2023	11/05/2023	11/05/2023	11/05/2023	11/05/2023	11/05/2023	11/05/2023				
Sulphur as S	0.01	0.01	-	0.02	-	-	-	0.02	0.02		<0.01	%	TM30/PM15
Total Sulphate as SO4 BRE	0.01	<0.01	-	0.01	-	-	-	0.01	0.01		<0.01	%	TM50/PM29
Sulphate as SO4 (2:1 Ext) #	0.0029	0.0039	-	0.0053	-	-	-	0.0094	0.0111		<0.0015	g/l	TM38/PM20
Organic Matter	-	-	<0.2	<0.2	-	-	88.7	-	-		<0.2	%	TM21/PM24
pH #	8.51	8.44	-	8.24	8.48	8.67	5.20	8.39	8.09		<0.01	pH units	TM73/PM11

Please see attached notes for all abbreviations and acronyms

Client Name: Ground Investigations Ireland
Reference: 12613-03-23
Location: Littleton Wind Farm Additional GI
Contact: James Cashen

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Analysis	Reason
No deviating sample report results for job 23/7422						

Please note that only samples that are deviating are mentioned in this report. If no samples are listed it is because none were deviating.
Only analyses which are accredited are recorded as deviating if set criteria are not met.

Please include all sections of this report if it is reproduced

NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

EMT Job No.: 23/7422

SOILS and ASH

Please note we are only MCERTS accredited (UK soils only) for sand, loam and clay and any other matrix is outside our scope of accreditation.

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation has been performed on clay, sand and loam, only samples that are predominantly these matrices, or combinations of them will be within our MCERTS scope. If samples are not one of a combination of the above matrices they will not be marked as MCERTS accredited.

It is assumed that you have taken representative samples on site and require analysis on a representative subsample. Stones will generally be included unless we are requested to remove them.

All samples will be discarded one month after the date of reporting, unless we are instructed to the contrary. Asbestos samples are retained for 6 months.

If you have not already done so, please send us a purchase order if this is required by your company.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

All analysis is reported on a dry weight basis unless stated otherwise. Limits of detection for analyses carried out on as received samples are not moisture content corrected. Results are not surrogate corrected. Samples are dried at 35°C ±5°C unless otherwise stated. Moisture content for CEN Leachate tests are dried at 105°C ±5°C. Ash samples are dried at 37°C ±5°C.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

Where a CEN 10:1 ZERO Headspace VOC test has been carried out, a 10:1 ratio of water to wet (as received) soil has been used.

% Asbestos in Asbestos Containing Materials (ACMs) is determined by reference to HSG 264 The Survey Guide - Appendix 2 : ACMs in buildings listed in order of ease of fibre release.

Sufficient amount of sample must be received to carry out the testing specified. Where an insufficient amount of sample has been received the testing may not meet the requirements of our accredited methods, as such accreditation may be removed.

Negative Neutralization Potential (NP) values are obtained when the volume of NaOH (0.1N) titrated (pH 8.3) is greater than the volume of HCl (1N) to reduce the pH of the sample to 2.0 - 2.5. Any negative NP values are corrected to 0.

The calculation of Pyrite content assumes that all oxidisable sulphides present in the sample are pyrite. This may not be the case. The calculation may be an overesitimate when other sulphides such as Barite (Barium Sulphate) are present.

WATERS

Please note we are not a UK Drinking Water Inspectorate (DWI) Approved Laboratory .

ISO17025 accreditation applies to surface water and groundwater and usually one other matrix which is analysis specific, any other liquids are outside our scope of accreditation.

As surface waters require different sample preparation to groundwaters the laboratory must be informed of the water type when submitting samples.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

STACK EMISSIONS

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation for Dioxins and Furans and Dioxin like PCBs has been performed on XAD-2 Resin, only samples which use this resin will be within our MCERTS scope.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

DEVIATING SAMPLES

All samples should be submitted to the laboratory in suitable containers with sufficient ice packs to sustain an appropriate temperature for the requested analysis. The temperature of sample receipt is recorded on the confirmation schedules in order that the client can make an informed decision as to whether testing should still be undertaken.

SURROGATES

Surrogate compounds are added during the preparation process to monitor recovery of analytes. However low recovery in soils is often due to peat, clay or other organic rich matrices. For waters this can be due to oxidants, surfactants, organic rich sediments or remediation fluids. Acceptable limits for most organic methods are 70 - 130% and for VOCs are 50 - 150%. When surrogate recoveries are outside the performance criteria but the associated AQC passes this is assumed to be due to matrix effect. Results are not surrogate corrected.

DILUTIONS

A dilution suffix indicates a dilution has been performed and the reported result takes this into account. No further calculation is required.

BLANKS

Where analytes have been found in the blank, the sample will be treated in accordance with our laboratory procedure for dealing with contaminated blanks.

NOTE

Data is only reported if the laboratory is confident that the data is a true reflection of the samples analysed. Data is only reported as accredited when all the requirements of our Quality System have been met. In certain circumstances where all the requirements of the Quality System have not been met, for instance if the associated AQC has failed, the reason is fully investigated and documented. The sample data is then evaluated alongside the other quality control checks performed during analysis to determine its suitability. Following this evaluation, provided the sample results have not been effected, the data is reported but accreditation is removed. It is a UKAS requirement for data not reported as accredited to be considered indicative only, but this does not mean the data is not valid.
Where possible, and if requested, samples will be re-extracted and a revised report issued with accredited results. Please do not hesitate to contact the laboratory if further details are required of the circumstances which have led to the removal of accreditation.
Laboratory records are kept for a period of no less than 6 years.

REPORTS FROM THE SOUTH AFRICA LABORATORY

Any method number not prefixed with SA has been undertaken in our UK laboratory unless reported as subcontracted.

Measurement Uncertainty

Measurement uncertainty defines the range of values that could reasonably be attributed to the measured quantity. This range of values has not been included within the reported results. Uncertainty expressed as a percentage can be provided upon request.

Customer Provided Information

Sample ID and depth is information provided by the customer.

ABBREVIATIONS and ACRONYMS USED

#	ISO17025 (UKAS Ref No. 4225) accredited - UK.
SA	ISO17025 (SANAS Ref No.T0729) accredited - South Africa
B	Indicates analyte found in associated method blank.
DR	Dilution required.
M	MCERTS accredited.
NA	Not applicable
NAD	No Asbestos Detected.
ND	None Detected (usually refers to VOC and/SVOC TICs).
NDP	No Determination Possible
SS	Calibrated against a single substance
SV	Surrogate recovery outside performance criteria. This may be due to a matrix effect.
W	Results expressed on as received basis.
+	AQC failure, accreditation has been removed from this result, if appropriate, see 'Note' on previous page.
>>	Results above quantitative calibration range. The result should be considered the minimum value and is indicative only. The actual result could be significantly higher.
*	Analysis subcontracted to an Element Materials Technology approved laboratory.
AD	Samples are dried at 35°C ±5°C
CO	Suspected carry over
LOD/LOR	Limit of Detection (Limit of Reporting) in line with ISO 17025 and MCERTS
ME	Matrix Effect
NFD	No Fibres Detected
BS	AQC Sample
LB	Blank Sample
N	Client Sample
TB	Trip Blank Sample
OC	Outside Calibration Range

HWOL ACRONYMS AND OPERATORS USED

HS	Headspace Analysis.
EH	Extractable Hydrocarbons - i.e. everything extracted by the solvent.
CU	Clean-up - e.g. by florisil, silica gel.
1D	GC - Single coil gas chromatography.
Total	Aliphatics & Aromatics.
AL	Aliphatics only.
AR	Aromatics only.
2D	GC-GC - Double coil gas chromatography.
#1	EH_Total but with humics mathematically subtracted
#2	EU_Total but with fatty acids mathematically subtracted
_	Operator - underscore to separate acronyms (exception for +).
+	Operator to indicate cumulative e.g. EH+HS_Total or EH_CU+HS_Total
MS	Mass Spectrometry.

EMT Job No: 23/7422

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/SANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM21	Modified BS 7755-3:1995, ISO10694:1995 Determination of Total Organic Carbon or Total Carbon by combustion in an Eltra TOC furnace/analyser in the presence of oxygen. The CO2 generated is quantified using infra-red detection. Organic Matter (SOM) calculated as per EA MCERTS Chemical Testing of Soil, March 2012 v4.	PM24	Preparation of Soil and Marine Sediment Samples for Total Organic Carbon.			AD	Yes
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP 6010B, Rev.2, Dec.1996; Modified EPA Method 3050B, Rev.2, Dec.1996	PM15	Acid digestion of dried and ground solid samples using Aqua Regia refluxed at 112.5 °C. Samples containing asbestos are not dried and ground.			AD	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993) – All anions comparable to BS ISO 15923-1: 2013l	PM20	Extraction of dried and ground or as received samples with deionised water in a 2:1 water to solid ratio using a reciprocal shaker for all analytes except hexavalent chromium. Extraction of as received sample using 10:1 ratio of 0.2M sodium hydroxide to soil for hexavalent chromium using a reciprocal shaker.	Yes		AD	Yes
TM50	Acid soluble sulphate (Total Sulphate) analysed by ICP-OES	PM29	A hot hydrochloric acid digest is performed on a dried and ground sample, and the resulting liquor is analysed.			AD	Yes
TM73	Modified US EPA methods 150.1 (1982) and 9045D Rev. 4 - 2004) and BS1377-3:1990. Determination of pH by Metrohm automated probe analyser.	PM11	Extraction of as received solid samples using one part solid to 2.5 parts deionised water.	Yes		AR	No

LABORATORY REPORT

Contract Number: PSL23/3461

Report Date: 22 June 2023

Client's Reference: 12613-03-23

Client Name: Ground investigation Ireland Ltd
Catherinestown House
Hazelhatch Road
Newcastle
Co Dublin
D22 YD52

For the attention of: James Cashen/Conor McParland

Contract Title: Littleton Wind Farm Additional GI

Date Received: 10/5/2023
Date Commenced: 10/5/2023
Date Completed: 22/6/2023

Notes: Opinions and Interpretations are outside the UKAS Accreditation

A copy of the Laboratory Schedule of accredited tests as issued by UKAS is attached to this report. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced other than in full, without the prior written approval of the laboratory.

Checked and Approved Signatories:

A Watkins (Director)	R Berriman (Quality Manager)	S Royle (Laboratory Manager)
L Knight (Assistant Laboratory Manager)	S Eyre (Senior Technician)	T Watkins (Senior Technician)

5 – 7 Hexthorpe Road,
Hexthorpe,
Doncaster,
DN4 0AR
Tel: 01302 768098
Email: rberriman@prosoils.co.uk
awatkins@prosoils.co.uk

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Description of Sample
TP-36		B	1.00		Brown sandy slightly gravelly CLAY.
TP-37		B	1.00		Brown very clayey very sandy GRAVEL.
TP-38		B	2.00		Brown slightly sandy slightly gravelly CLAY.
TP-39		B	2.50		Grey very clayey very sandy GRAVEL.
TP-40		B	1.50		Brown sandy slightly gravelly CLAY.
TP-41		B	4.00		Grey sandy gravelly CLAY.
TP-42		B	4.50		Brown sandy slightly gravelly CLAY.
TP-43		B	2.50		Brown slightly sandy gravelly CLAY..
TP-44		B	1.50		Brown very clayey SAND & GRAVEL.
TP-45		B	1.00		Dark brown fibrous PEAT.
TP-46		B	2.50		Brown mottled grey slightly sandy slightly gravelly CLAY.
TP-47		B	2.00		Brown sandy slightly gravelly CLAY.
TP-47		B	3.50		Brown slightly sandy gravelly CLAY.

SUMMARY OF SOIL CLASSIFICATION TESTS

(BS1377 : PART 2 : 1990)

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Moisture Content % Clause 3.2	Linear Shrinkage % Clause 6.5	Particle Density Mg/m^3 Clause 8.2	Liquid Limit % Clause 4.3/4	Plastic Limit % Clause 5.3	Plasticity Index % Clause 5.4	Passing .425mm %	Remarks
TP-37		B	1.00		10			28	13	15	40	Low Plasticity CL
TP-38		B	2.00		8.7							
TP-40		B	1.50		11							
TP-41		B	4.00		8.4							
TP-42		B	4.50		10							
TP-44		B	1.50		7.3							
TP-45		B	1.00		463							
TP-46		B	2.50		12			30	14	16	60	Low Plasticity CL
TP-47		B	2.00		29			35	19	16	88	Intermediate Plasticity CI
TP-47		B	3.50		6.7							

SYMBOLS : **NP : Non Plastic** *** : Liquid Limit and Plastic Limit Wet Sieved.**

UKAS TESTING 4043

PSL PROFESSIONAL SOILS LABORATORY A PHENNA GROUP COMPANY

Littleton Wind Farm Additional GI

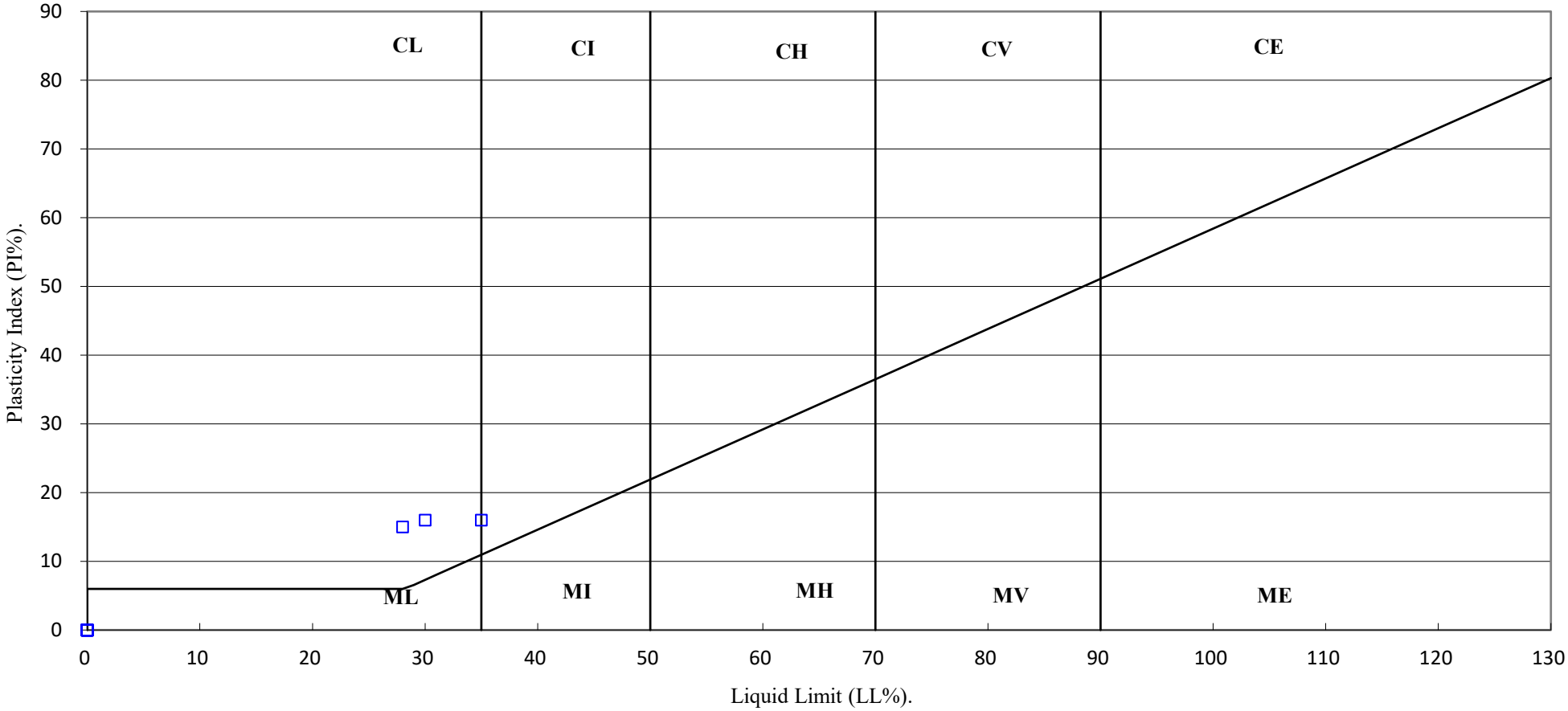
Contract No:

PSL23/3461

Client Ref:

12613-03-23

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION.



UKAS TESTING 4043 / PSL PROFESSIONAL SOILS LABORATORY A PHENNA GROUP COMPANY	Littleton Wind Farm Additional GI	Contract No: PSL23/3461 Client Ref: 12613-03-23

PARTICLE SIZE DISTRIBUTION TEST

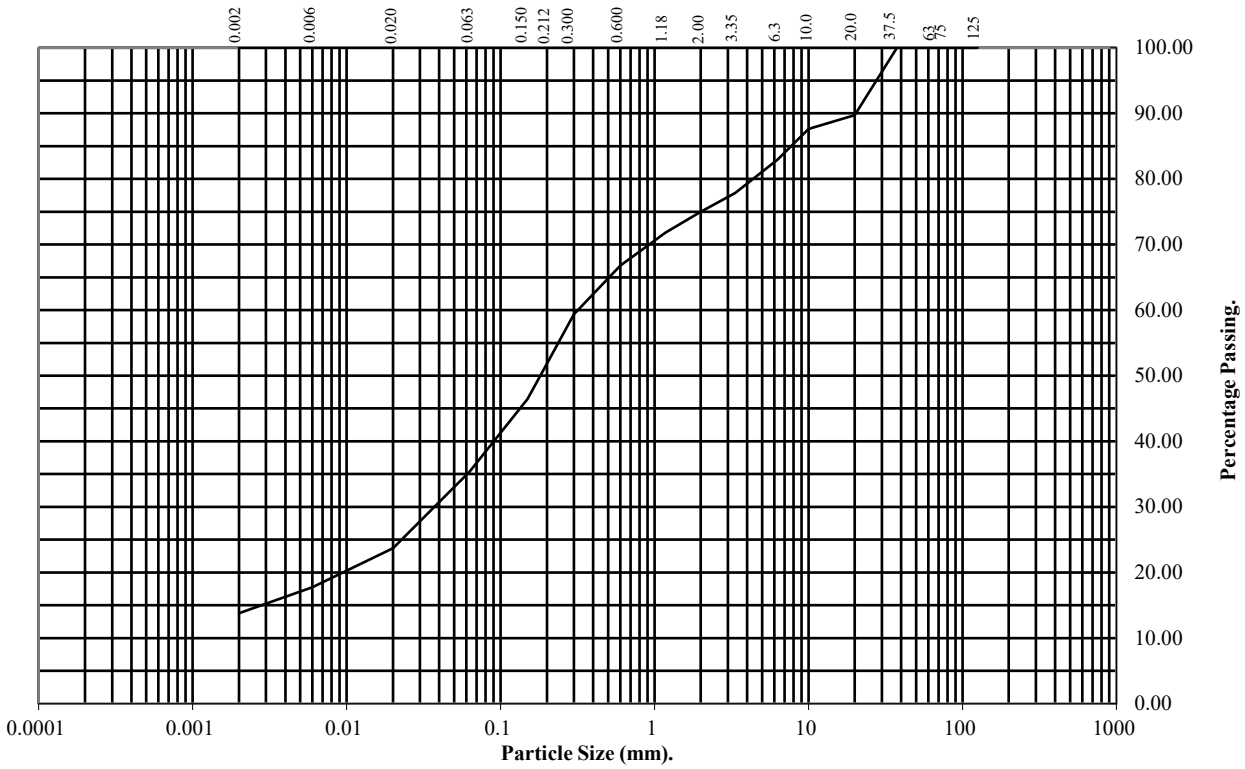
BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number: TP-36 **Top Depth (m):** 1.00

Sample Number: **Base Depth(m):**

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	90
10	88
6.3	83
3.35	78
2	75
1.18	72
0.6	67
0.3	59
0.212	53
0.15	46
0.063	35

Particle Diameter	Percentage Passing
0.02	24
0.006	18
0.002	14

Soil Fraction	Total Percentage
Cobbles	0
Gravel	25
Sand	40
Silt	21
Clay	14

Remarks:
See Summary of Soil Descriptions

UKAS TESTING 4043

PSL PROFESSIONAL SOILS LABORATORY A PHENNA GROUP COMPANY

Littleton Wind Farm Additional GI

Contract No: PSL23/3461

Client Ref: 12613-03-23

PARTICLE SIZE DISTRIBUTION TEST

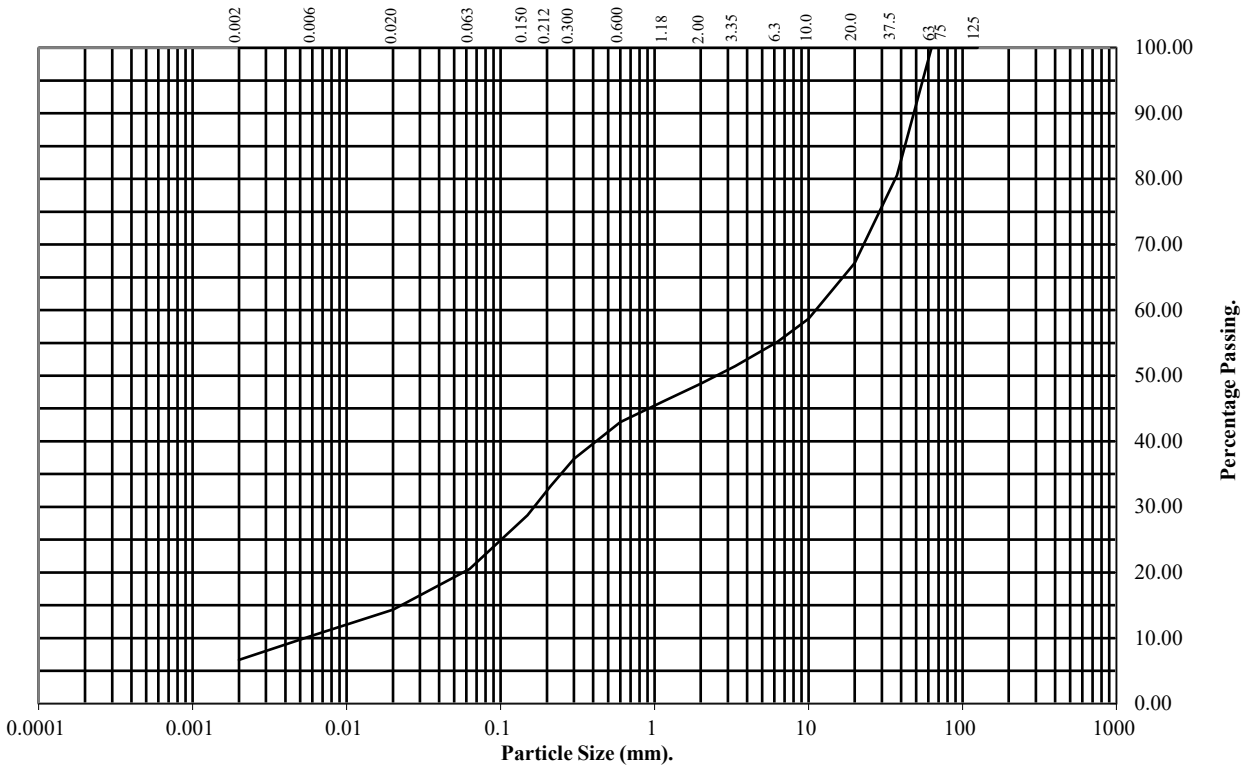
BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number: TP-37 **Top Depth (m):** 1.00

Sample Number: **Base Depth(m):**

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	81
20	67
10	59
6.3	55
3.35	51
2	49
1.18	46
0.6	43
0.3	37
0.212	33
0.15	29
0.063	21

Particle Diameter	Percentage Passing
0.02	14
0.006	10
0.002	7

Soil Fraction	Total Percentage
Cobbles	0
Gravel	51
Sand	28
Silt	14
Clay	7

Remarks:
See Summary of Soil Descriptions

UKAS TESTING 4043

PSL PROFESSIONAL SOILS LABORATORY A PHENNA GROUP COMPANY

Littleton Wind Farm Additional GI

Contract No: PSL23/3461

Client Ref: 12613-03-23

PARTICLE SIZE DISTRIBUTION TEST

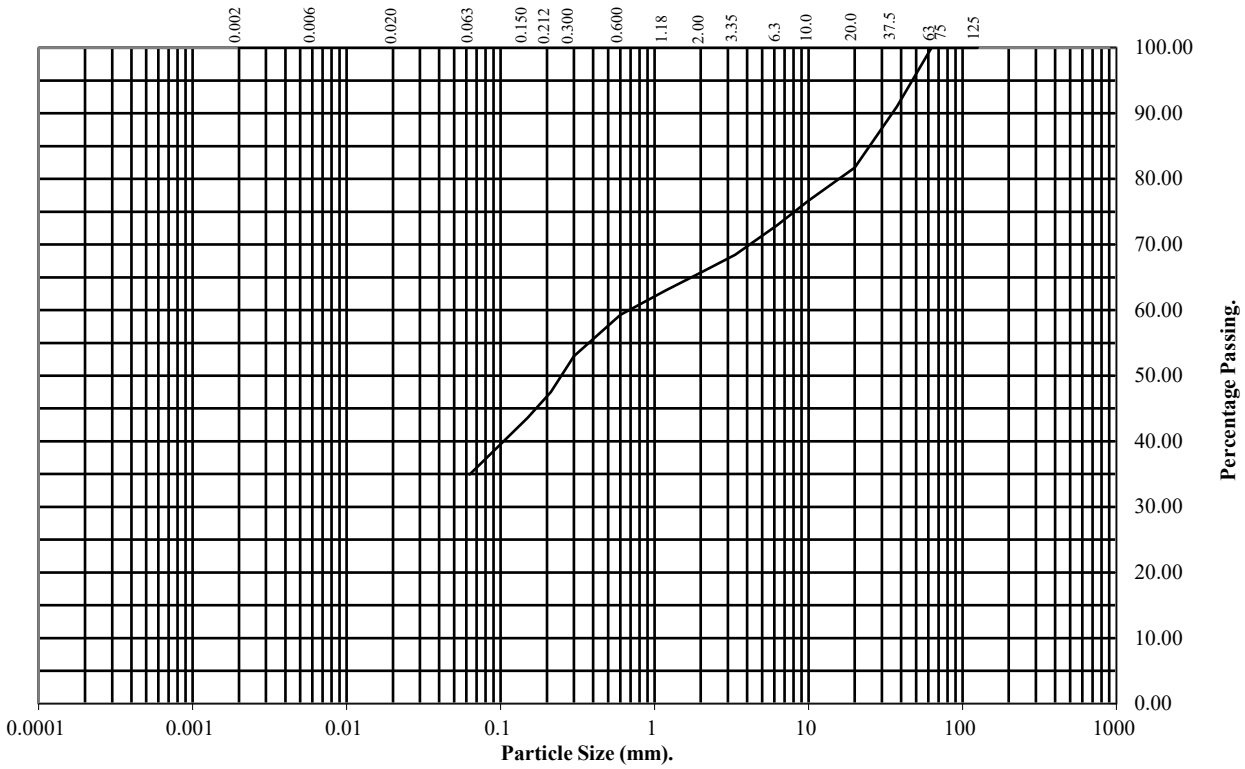
BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: TP-38 **Top Depth (m):** 2.00

Sample Number: **Base Depth(m):**

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	91
20	82
10	77
6.3	73
3.35	68
2	66
1.18	63
0.6	59
0.3	53
0.212	48
0.15	44
0.063	35

Soil Fraction	Total Percentage
Cobbles	0
Gravel	34
Sand	31
Silt/Clay	35

Remarks:
See Summary of Soil Descriptions

PARTICLE SIZE DISTRIBUTION TEST

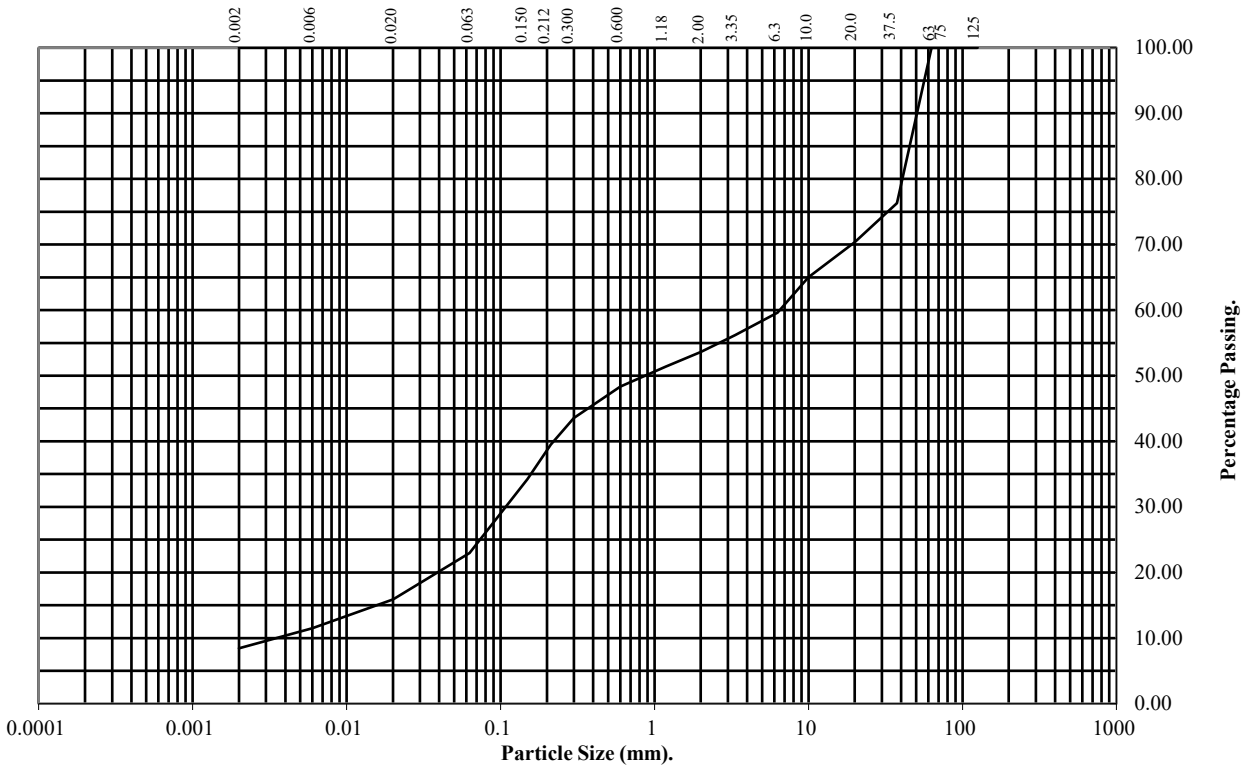
BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number: TP-39 **Top Depth (m):** 2.50

Sample Number: **Base Depth(m):**

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	76
20	70
10	65
6.3	60
3.35	56
2	54
1.18	51
0.6	48
0.3	44
0.212	39
0.15	34
0.063	23

Particle Diameter	Percentage Passing
0.02	16
0.006	12
0.002	8

Soil Fraction	Total Percentage
Cobbles	0
Gravel	46
Sand	31
Silt	15
Clay	8

Remarks:
See Summary of Soil Descriptions

UKAS TESTING 4043

PSL PROFESSIONAL SOILS LABORATORY A PHENNA GROUP COMPANY

Littleton Wind Farm Additional GI

Contract No: PSL23/3461

Client Ref: 12613-03-23

PARTICLE SIZE DISTRIBUTION TEST

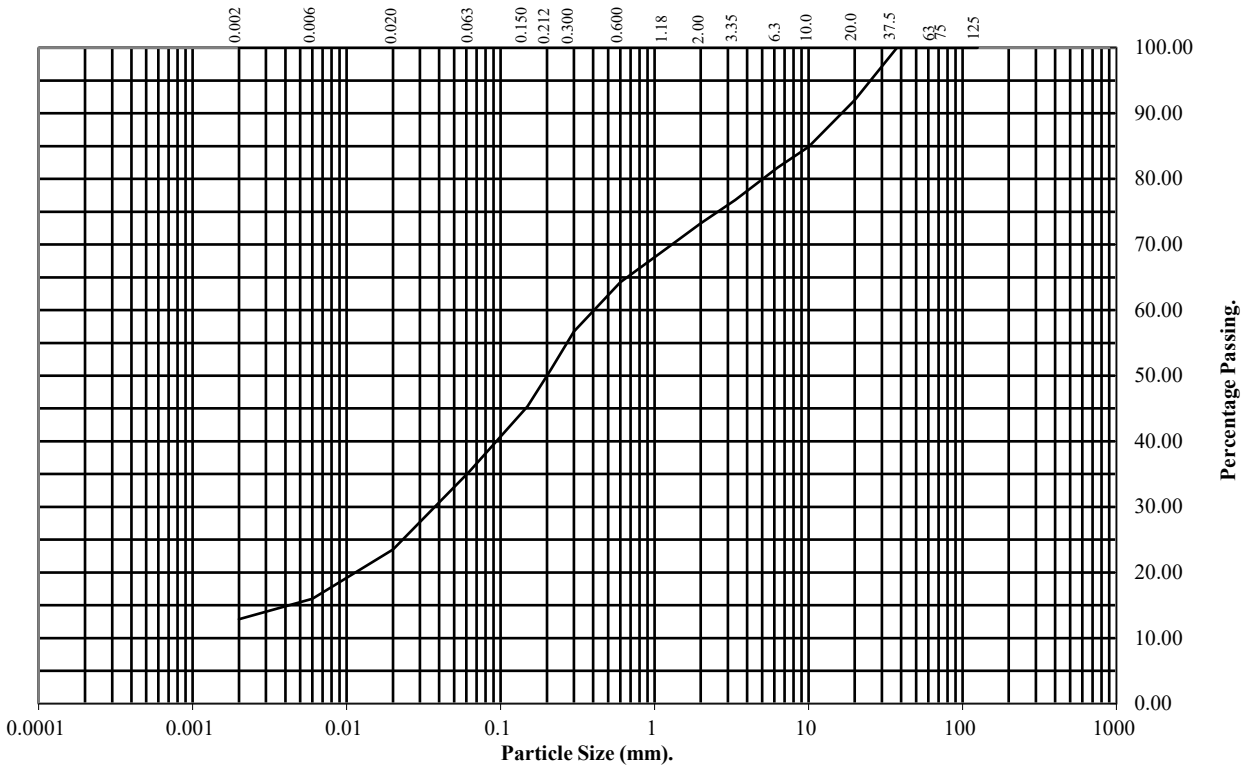
BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number: TP-40 **Top Depth (m):** 1.50

Sample Number: **Base Depth(m):**

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	92
10	85
6.3	82
3.35	77
2	73
1.18	69
0.6	64
0.3	57
0.212	51
0.15	45
0.063	35

Particle Diameter	Percentage Passing
0.02	23
0.006	16
0.002	13

Soil Fraction	Total Percentage
Cobbles	0
Gravel	27
Sand	38
Silt	22
Clay	13

Remarks:
See Summary of Soil Descriptions

UKAS TESTING 4043

PSL PROFESSIONAL SOILS LABORATORY A PHENNA GROUP COMPANY

Littleton Wind Farm Additional GI

Contract No: PSL23/3461

Client Ref: 12613-03-23

PARTICLE SIZE DISTRIBUTION TEST

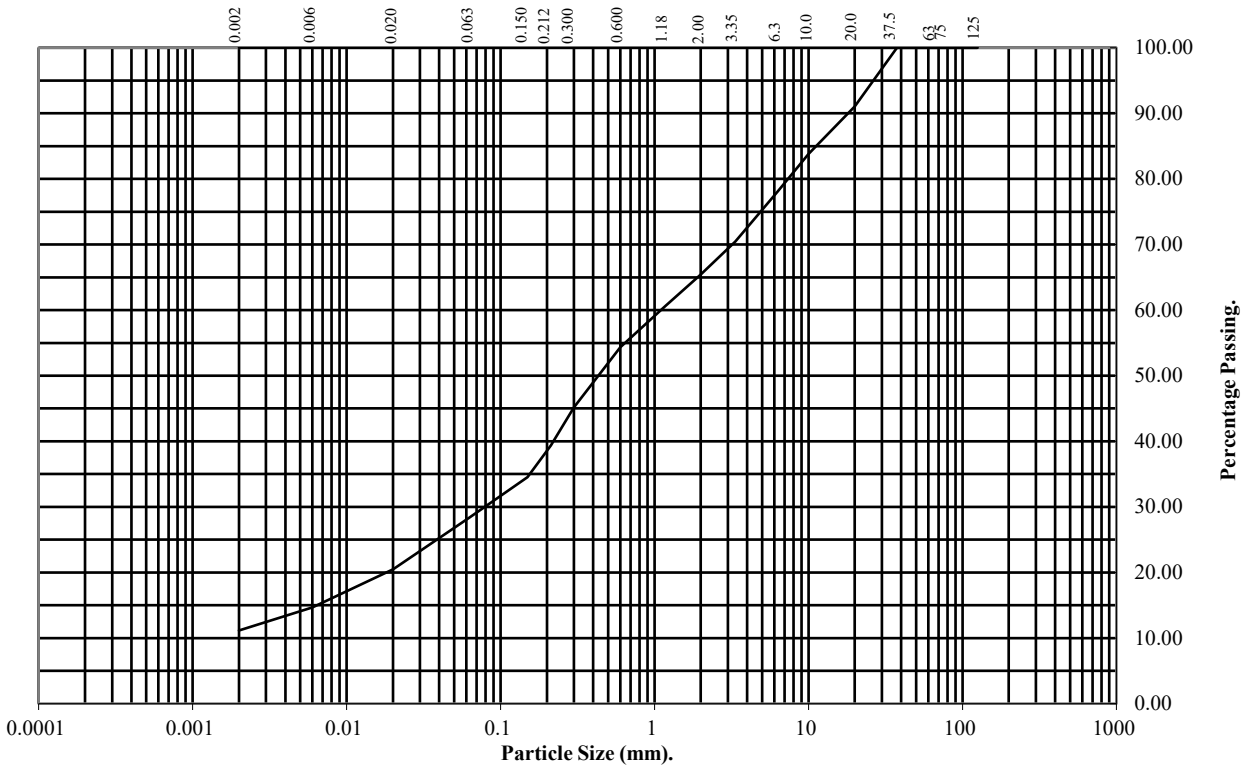
BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number: TP-41 **Top Depth (m):** 4.00

Sample Number: **Base Depth(m):**

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	91
10	84
6.3	78
3.35	70
2	65
1.18	61
0.6	54
0.3	45
0.212	39
0.15	35
0.063	28

Particle Diameter	Percentage Passing
0.02	20
0.006	15
0.002	11

Soil Fraction	Total Percentage
Cobbles	0
Gravel	35
Sand	37
Silt	17
Clay	11

Remarks:
See Summary of Soil Descriptions

UKAS TESTING 4043

PSL PROFESSIONAL SOILS LABORATORY A PHENNA GROUP COMPANY

Littleton Wind Farm Additional GI

Contract No: PSL23/3461

Client Ref: 12613-03-23

PARTICLE SIZE DISTRIBUTION TEST

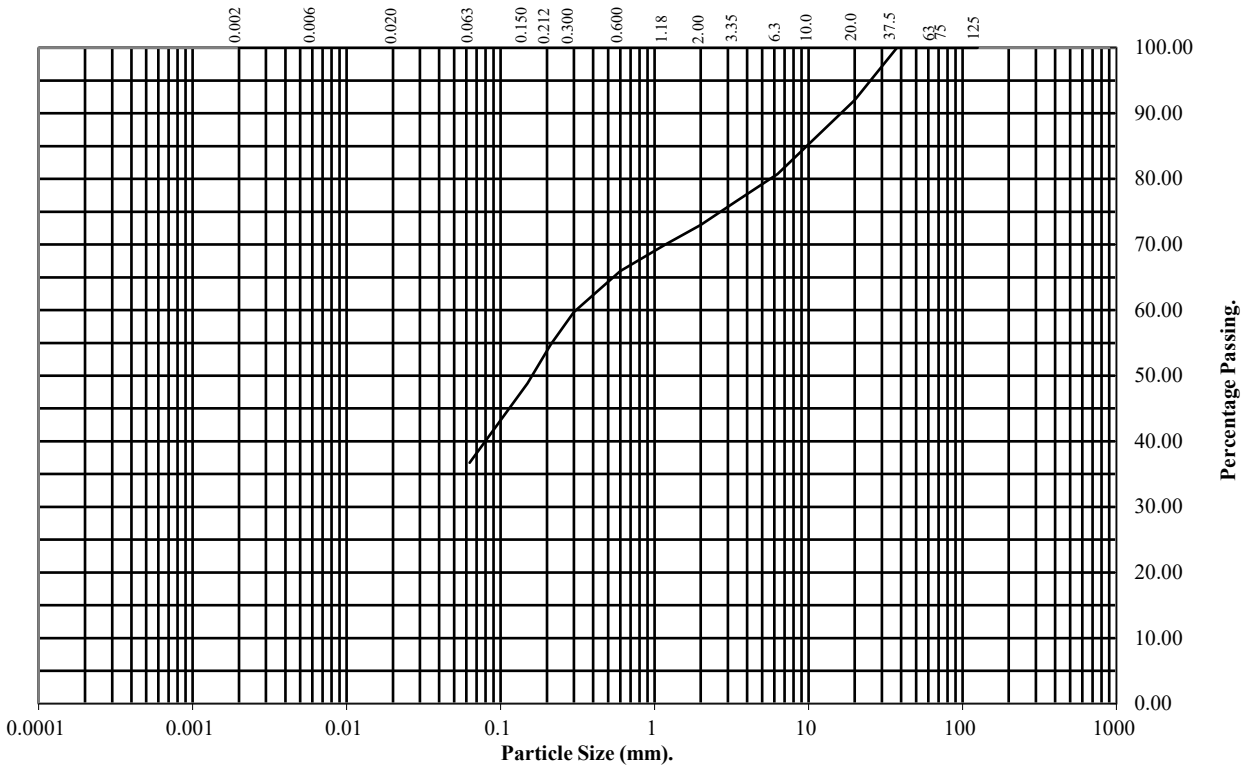
BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: TP-42 **Top Depth (m):** 4.50

Sample Number: **Base Depth(m):**

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	92
10	85
6.3	81
3.35	77
2	73
1.18	70
0.6	66
0.3	60
0.212	55
0.15	49
0.063	37

Soil Fraction	Total Percentage
Cobbles	0
Gravel	27
Sand	36
Silt/Clay	37

Remarks:
See Summary of Soil Descriptions

PARTICLE SIZE DISTRIBUTION TEST

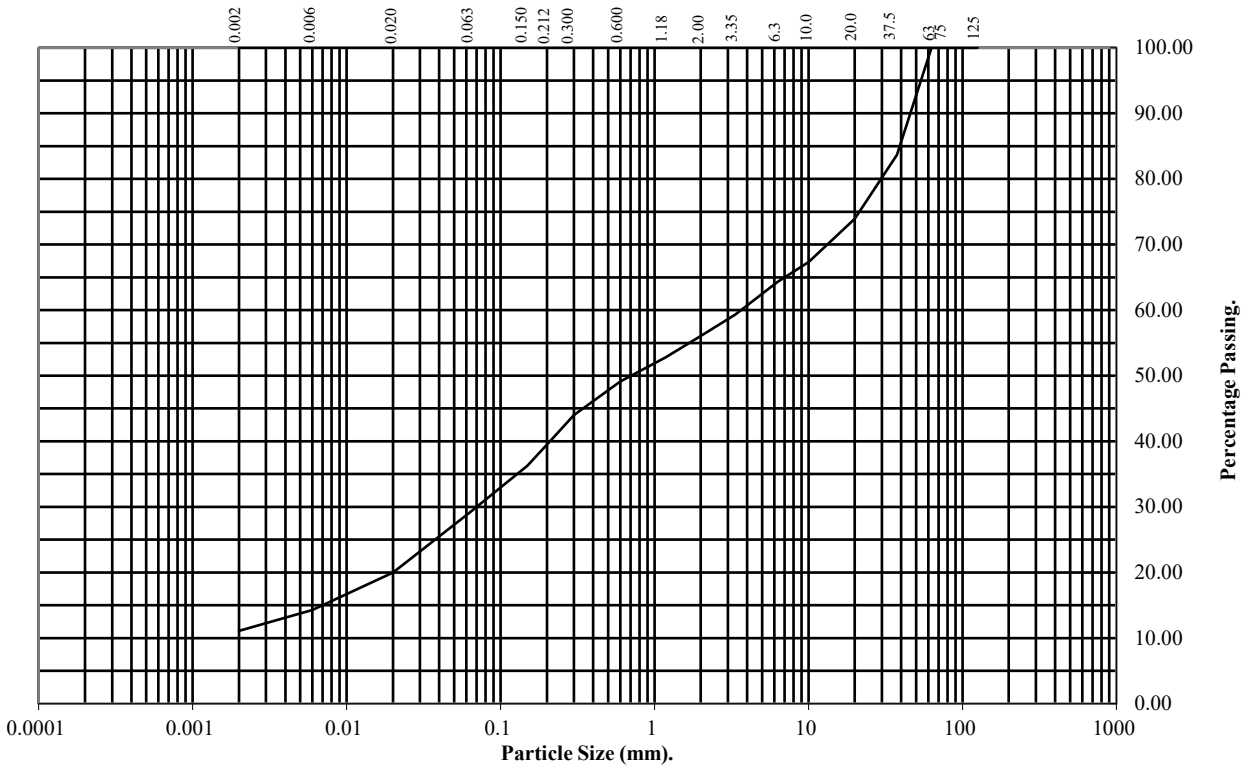
BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number: TP-43 **Top Depth (m):** 2.50

Sample Number: **Base Depth(m):**

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	84
20	74
10	67
6.3	64
3.35	59
2	56
1.18	53
0.6	49
0.3	44
0.212	40
0.15	36
0.063	29

Particle Diameter	Percentage Passing
0.02	20
0.006	14
0.002	11

Soil Fraction	Total Percentage
Cobbles	0
Gravel	44
Sand	27
Silt	18
Clay	11

Remarks:
See Summary of Soil Descriptions

PARTICLE SIZE DISTRIBUTION TEST

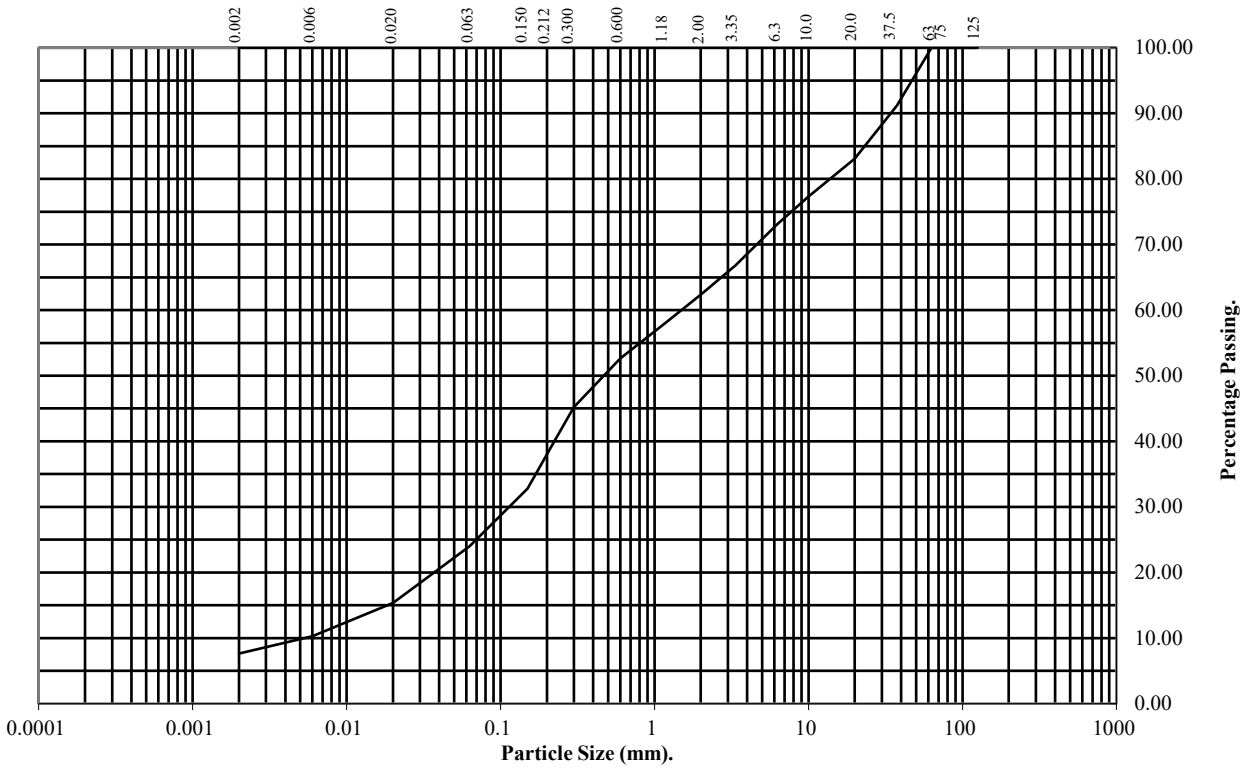
BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number: TP-44 **Top Depth (m):** 1.50

Sample Number: **Base Depth(m):**

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	91
20	83
10	77
6.3	73
3.35	67
2	62
1.18	58
0.6	53
0.3	45
0.212	39
0.15	33
0.063	24

Particle Diameter	Percentage Passing
0.02	15
0.006	10
0.002	8

Soil Fraction	Total Percentage
Cobbles	0
Gravel	38
Sand	38
Silt	16
Clay	8

Remarks:
See Summary of Soil Descriptions

PARTICLE SIZE DISTRIBUTION TEST

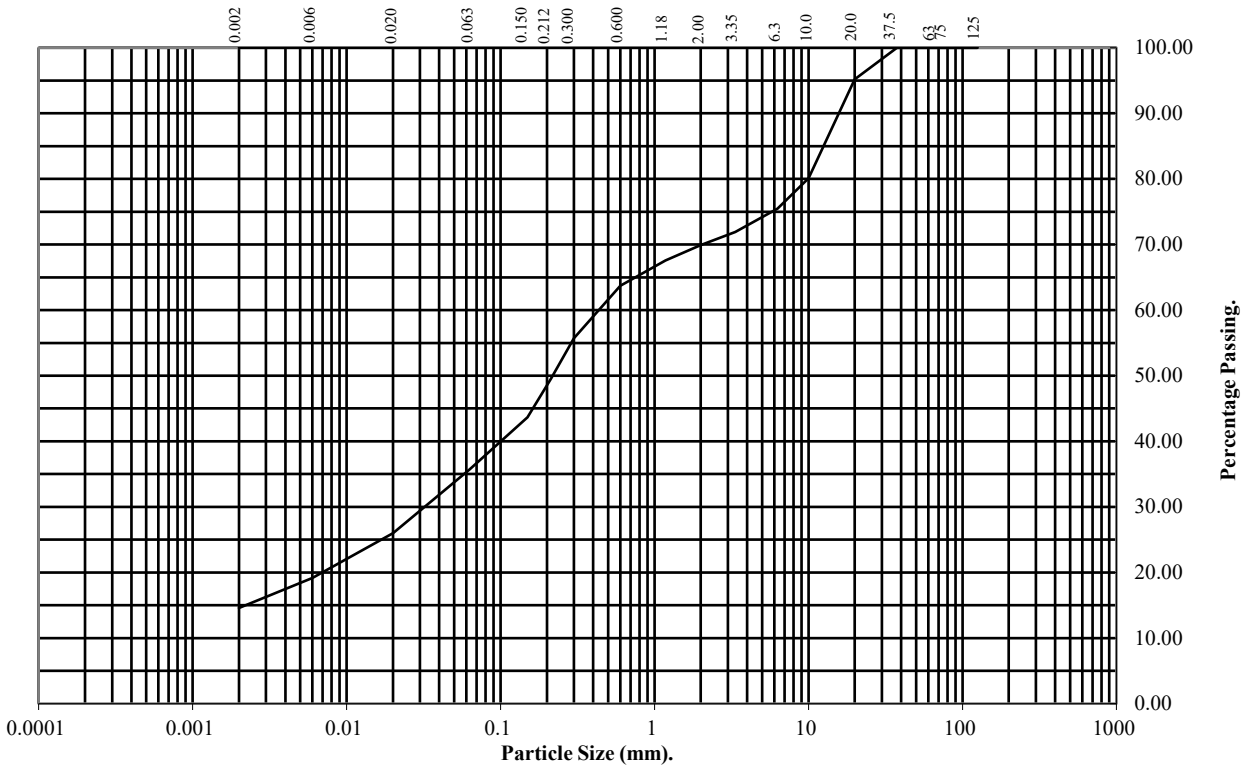
BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number: TP-46 **Top Depth (m):** 2.50

Sample Number: **Base Depth(m):**

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	95
10	80
6.3	75
3.35	72
2	70
1.18	68
0.6	64
0.3	56
0.212	50
0.15	44
0.063	36

Particle Diameter	Percentage Passing
0.02	26
0.006	19
0.002	15

Soil Fraction	Total Percentage
Cobbles	0
Gravel	30
Sand	34
Silt	21
Clay	15

Remarks:
See Summary of Soil Descriptions

UKAS TESTING 4043

PSL PROFESSIONAL SOILS LABORATORY A PHENNA GROUP COMPANY

Littleton Wind Farm Additional GI

Contract No: PSL23/3461

Client Ref: 12613-03-23

PARTICLE SIZE DISTRIBUTION TEST

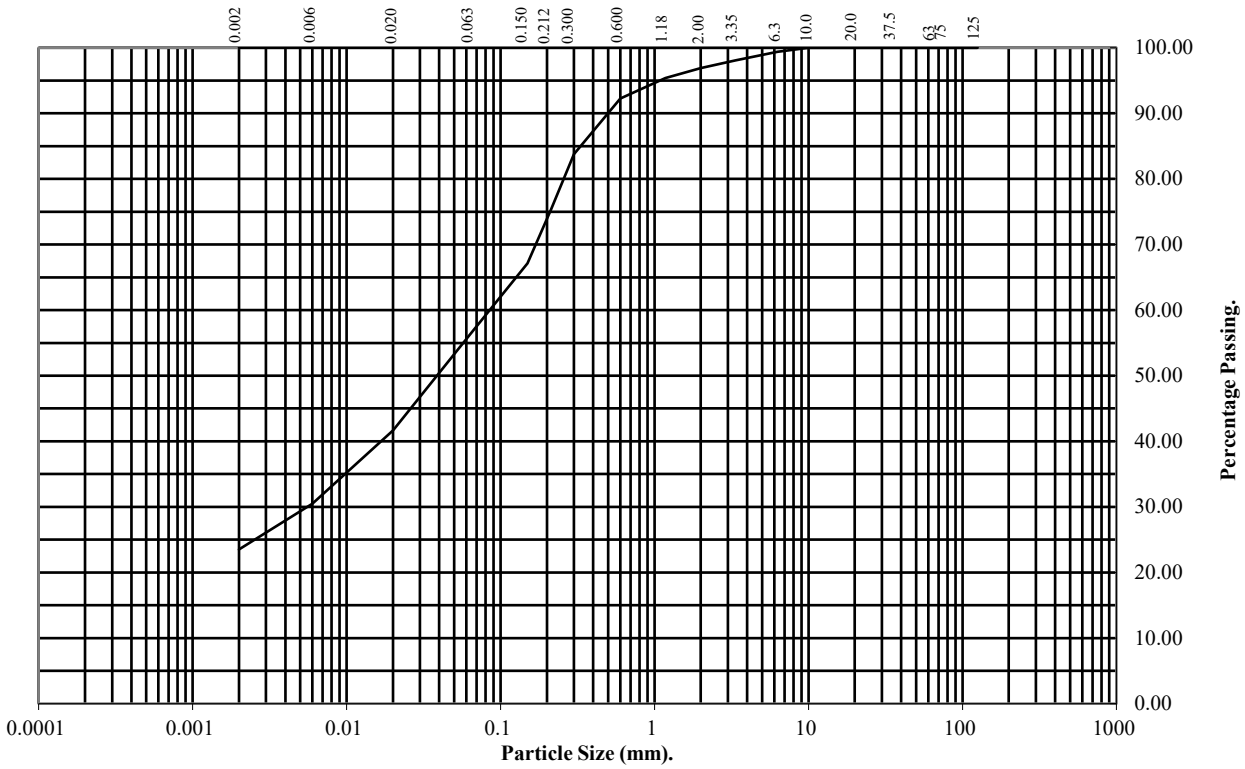
BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number: TP-47 **Top Depth (m):** 2.00

Sample Number: **Base Depth(m):**

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	100
10	100
6.3	99
3.35	98
2	97
1.18	95
0.6	92
0.3	84
0.212	75
0.15	67
0.063	56

Particle Diameter	Percentage Passing
0.02	42
0.006	30
0.002	24

Soil Fraction	Total Percentage
Cobbles	0
Gravel	3
Sand	41
Silt	32
Clay	24

Remarks:
See Summary of Soil Descriptions

UKAS TESTING 4043

PSL PROFESSIONAL SOILS LABORATORY A PHENNA GROUP COMPANY

Littleton Wind Farm Additional GI

Contract No: PSL23/3461

Client Ref: 12613-03-23

PARTICLE SIZE DISTRIBUTION TEST

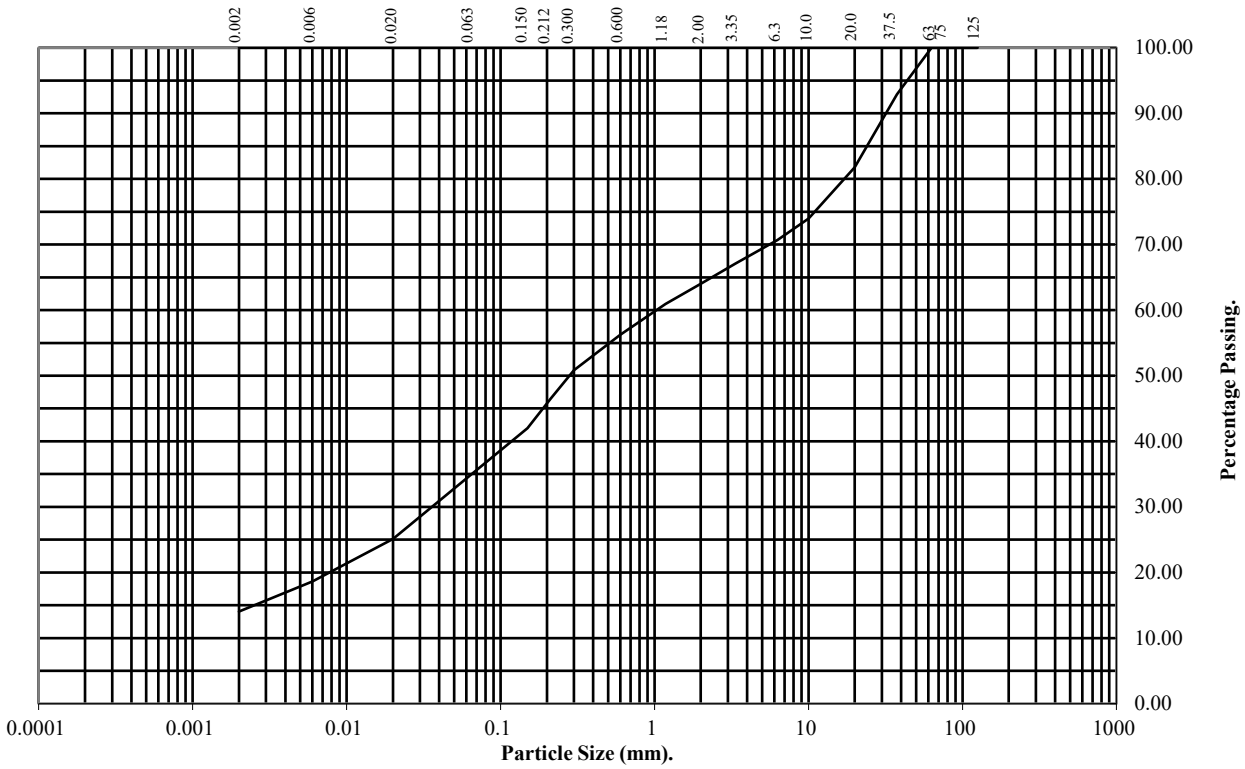
BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number: TP-47 **Top Depth (m):** 3.50

Sample Number: **Base Depth(m):**

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	93
20	82
10	74
6.3	71
3.35	67
2	64
1.18	61
0.6	56
0.3	51
0.212	47
0.15	42
0.063	35

Particle Diameter	Percentage Passing
0.02	25
0.006	19
0.002	14

Soil Fraction	Total Percentage
Cobbles	0
Gravel	36
Sand	29
Silt	21
Clay	14

Remarks:
See Summary of Soil Descriptions

FEHILY TIMONEY

DESIGNING AND DELIVERING
A SUSTAINABLE FUTURE

APPENDIX G

Ground Investigation Report (2024)

GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental

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Ground Investigations Ireland

Littleton Wind Farm Borrow Pit

Fehily Timoney and Company

Ground Investigation Report

March 2024

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1.0 Preamble

On the instructions of Fehily Timoney and Company, a site investigation was carried out by Ground Investigations Ireland Ltd. (GII) between October and December 2023 at the site of the proposed wind farm in Littleton, County Tipperary. A series of previous site investigations were completed by GII on the site between July and August 2022, and in April 2023, respectively.

2.0 Overview

2.1. Background

Construction of a new wind farm with associated substations and access road network is proposed at the site in Littleton, County Tipperary. At the time of the site investigation the site consisted of three interlinked boglands - Longfordpass Bog, Littleton Bog and Lanespark Bog and a grass field area where the borrow pit site is proposed.

2.2. Purpose and Scope

The purpose of the site investigation was to investigate subsurface conditions utilising a variety of investigative methods in accordance with the project specification. The scope of the work undertaken for this project included the following:

- Visit project site to observe existing conditions
- Carry out ten (10 No.) trial pits to a maximum depth of 4.10m BGL
- Carry out seven (7 No.) rotary core boreholes to a maximum depth of 12.40m BGL
- Installation of six (6 No.) groundwater monitoring wells
- Factual Report

3.0 Subsurface Exploration

3.1. General

During the ground investigation a programme of intrusive investigation specified by the Consulting Engineer was undertaken to determine the sub surface conditions at the proposed site. Regular sampling and in-situ testing were undertaken in the exploratory holes to facilitate the geotechnical descriptions and to enable laboratory testing to be carried out on the soil samples recovered during excavation and drilling.
The procedures used in this site investigation are in accordance with Eurocode 7 Part 2: Ground Investigation and testing (ISEN 1997 – 2:2007) and B.S. 5930:2015+A1:2020.

3.2. Trial Pits

The trial pits were excavated using 7T and 12T wide tracked excavators at the locations shown in the exploratory hole location plan in Appendix 1. The locations were checked using a CAT scan to minimise the potential for encountering services during the excavation. The trial pits were sampled, logged and photographed by a Geo-Environmental Engineer prior to backfilling with arisings. Notes were made of any services, inclusions, pit stability, groundwater encountered, and the characteristics of the strata encountered and are presented on the trial pit logs which are provided in Appendix 2 of this Report.

3.3. Rotary Boreholes

The rotary coring was carried out by a track mounted T44 Beretta rig at the locations shown on the location plan in Appendix 1. The rotary boreholes were completed from the ground surface.
The T44 Beretta is equipped with rubber tracks which allow for short travel on pavement surfaces avoiding any damage to the surface. The T44 Beretta utilises a triple tube core barrel system operated using a wireline drilling process. The outer barrel is rotated by the drill rods and at its lower end, carries the coring bit. The inner barrel is mounted on a swivel so that it does not rotate during the process. The third barrel or liner is placed within the second one to retain the core intact and to preserve as much as possible the fabric of the drilling stratum. The core is cut by the coring bit and passes to the inner liner. The core is brought up to the surface within the inner barrel on a small diameter wire rope or line attached to the “overshoot” recovery tool which is then placed into a core box in order of recovery. A drilling fluid, typically air mist or water flush is passed from the surface through hollow drill rods to the drill bit and is used to cool the drill bit. Temporary casing is used in some situations to support unstable ground or to seal off fissures or voids. It should be noted that the rotary coring can only achieve limited recovery in overburden, particularly granular or weakly cemented strata due to the flushing medium washing away the cohesive fraction during coring. The recovery achieved, where required is noted on the borehole logs and core photographs are provided to allow assessment of the core recovered. The rotary borehole logs are provided in Appendix 3 of this Report.

3.4. Surveying

The exploratory hole locations have been recorded using a KQGeo M8 GNSS System which records the coordinates and elevation of the locations to ITM as required by the project specification. The coordinates and elevations are provided on the exploratory hole logs in the appendices of this Report.

3.5. Groundwater Monitoring Installations

Groundwater Monitoring Installations were installed upon the completion of the boreholes to enable sampling and the determination of the equilibrium groundwater level. The typical groundwater monitoring installation consists of a 50mm uPVC/HDPE slotted pipe with a pea gravel response zone and bentonite seal installed to the Engineers specification. Where required the standpipe is sealed with a gas tap and

finished with a durable steel cover fixed in place with a concrete surround. The installation details are provided on the exploratory hole logs in the appendices of this Report.

3.6. Laboratory Testing

Samples were selected from the exploratory holes for a range of geotechnical and environmental testing to assist in the classification of soils and to provide information for the proposed design.
Chemical testing, as required by the specification, including pH, organic matter content, total sulphur, water soluble sulphate and acid soluble sulphate testing, was carried out by Element Materials Technology Laboratory in the United Kingdom (UK).
Geotechnical testing consisting of Moisture Content, Atterberg Limits, and Particle Size Distribution (PSD) wet sieve and hydrometer tests were carried out by Professional Soils Laboratory (PSL) in the UK.
Rock testing including Point Load (Is_{50}), Unconfined Compressive Strength (UCS), Slake Durability and Los Angelese Abrasion testing was carried out by Construction Materials Testing Laboratories (CMTL) in County Laois.
The results of the laboratory testing are included in Appendix 4 of this Report.

4.0 Ground Conditions

4.1. General

This ground investigation included an assessment of two areas of the proposed site. This included the proposed borrow pit area which is located in agricultural lands next to the bog, and the proposed substation area located within the bog. The ground conditions encountered at each location are summarised separately below with reference to insitu and laboratory test results. The full details of the strata encountered during the ground investigation are provided in the exploratory hole logs included in the appendices of this report.

At the proposed substation area, the sequence of strata encountered were consistent and generally comprised;

- Peat
- Fine-Grained Deposits
- Coarse-Grained Deposits
- Bedrock

PEAT: Peat was encountered at all exploratory and was generally described as *dark brown slightly clayey pseudo-fibrous PEAT.* In several of the exploratory holes a layer of *dark brown slightly clayey amorphous PEAT* overlay the pseudo-fibrous PEAT. The depth of peat varied from 0.30m to 2.00m BGL at the trial pit locations, while at the rotary core locations the peat may have extended to depths of between 2.00m and 3.50m BGL, based on the limited recovery and low SPT values.

FINE-GRAINED DEPOSITS: Fine-grained deposits were encountered beneath the Peat at most locations and were described as *a grey sandy gravelly clayey SILT.* The secondary sand and gravel constituents varied across the site and with depth, with granular lenses occasionally present in the glacial till matrix. When in contact with water, this deposit appeared to partially liquify. These deposits had low (<5%), medium (5%-20%) or high (20%-50%) cobble and boulder content, where noted on the exploratory hole logs.

COARSE-GRAINED DEPOSITS: Coarse-grained deposits were encountered below fine-grained deposits and were typically described as *brownish grey clayey very sandy subangular to subrounded fine to coarse GRAVEL with high cobble and boulder content.* The secondary sand and fines constituents varied across the site and with depth, while low (<5%), medium (5%-20%) or high (20%-50%) cobble and boulder content was also present, where noted on the exploratory hole logs.

BEDROCK: The rotary core borehole at BH03 recovered *medium strong to very strong very thinly to medium bedded dark grey fine to coarse grained fossiliferous argillaceous LIMESTONE.* The degree of weathering ranged from fresh to slightly weathered. The depth to rock was recorded as 9.10m BGL in BH03.

At the proposed borrow pit area, the sequence of strata encountered were relatively consistent and generally comprised;

- Topsoil
- Fine-Grained Deposits
- Coarse-Grained Deposits
- Weathered Bedrock
- Bedrock

TOPSOIL: Topsoil was encountered in all the exploratory holes and was present to a maximum depth of 0.30m BGL.

FINE-GRAINED DEPOSITS: Fine-grained deposits were encountered beneath the Topsoil and were described as *a reddish brown / light brown slightly sandy slightly gravelly silty CLAY.* The secondary sand and gravel constituents varied across the site and with depth, with granular lenses occasionally present in the glacial till matrix. These deposits had low (<5%), medium (5%-20%) or high (20%-50%) cobble and boulder content, where noted on the exploratory hole logs.

COARSE-GRAINED DEPOSITS: Coarse-grained deposits were encountered below fine-grained deposits at TP-B2 and TP-B4 and were typically described as *grey clayey sandy subangular to subrounded fine to coarse GRAVEL with high cobble content.* The secondary sand and fines constituents varied across the site and with depth, while low (<5%), medium (5%-20%) or high (20%-50%) cobble and boulder content was also present, where noted on the exploratory hole logs.

WEATHERED BEDROCK: Presumed weathered bedrock was encountered at TP-B1, TP-B5 and TP-B6 which was diggable with the large excavator to a depth of up to 0.40m below the top of the stratum. The trial pits were terminated upon encountering the more competent bedrock, in which further excavation became more difficult. This material was recovered typically as angular gravel and cobbles of Limestone, however there was some variability in the fracture spacing and the ease at which the excavator could progress. Some clay and sand/gravel were also present with the rock mass either from weathering or as infilling to fractures which were opened upon excavation.

BEDROCK: The rotary core boreholes at BH-B2 and BH-B3 recovered a *medium strong to very strong thinly to medium bedded dark grey fine to coarse grained fossiliferous argillaceous LIMESTONE.* The degree of weathering ranged from fresh to highly weathered. The depth to rock was recorded as 0.50m BGL in BH-B2 and 1.00m BGL in BH-B3. At BH-B1 and BH-B4, a *medium strong light brownish grey fine to coarse grained dolomitic LIMESTONE* was encountered at 1.50m BGL and 3.00m BGL, respectively. The degree of weathering ranged from fresh to highly weathered.

4.2. Groundwater

Groundwater strikes are noted on the exploratory hole logs where they occurred. It should be noted that these exploratory holes did not remain open for sufficiently long periods of time to establish the hydrogeological regime and groundwater levels would be expected to vary with time of year, rainfall, nearby construction, and other factors. For this reason, standpipes were installed in BH01, BH03, BH-B1, BH-B2, BH-B3, and BH-B4 to allow the equilibrium groundwater level to be determined. The groundwater monitoring is included in Appendix 5 of this Report.

APPENDIX 1 - Figures

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Client:
FEHILY TIMONEY

Project Title:
Littleton Wind Farm Borrow Pit

Drawing Title:
Figure 1 - Site Location

GII Project Reference:
13103-08-23

0 900 1,800 2,700 3,600 m

Drawn By:
JC

Date:
29-02-2024

- Site Location
- Indicative Site Boundary
- Indicative Borrow Pit Area
- Indicative Substation Area

Trial Pit

Borehole

Client:

FEHILY TIMONEY

Project Code:

13103-08-23

Project Title:

Littleton Wind Farm
Borrow Pit

Drawing Title:

Figure 2 Site Investigation Points

GROUND INVESTIGATIONS IRELAND
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0 50 100 150 200 m

Drawn By:	Date:
CMP	28/11/2023

APPENDIX 2 – Trial Pit Records

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Site Littleton Wind Farm Borrow Pit			**Trial Pit Number** TP-48
Machine : 12T wide tracked excavator **Method :** Trial Pit	**Dimensions** 4.10m x 1.20m x 3.80m (L x W x D)	**Ground Level (mOD)** 125.14	**Client** Bord na Móna	**Job Number** 13103-08-23
	Location 623640.6 E 656697 N	**Dates** 18/10/2023	**Engineer** Fehily Timoney	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.50 0.50	B D				(1.40)	Very soft brown clayey pseudo fibrous PEAT		
				123.74	1.40			
1.50 1.50	B D				(1.30)	Soft grey sandy gravelly clayey SILT with medium cobble and boulder content. Gravel is subangular to subrounded fine to coarse. Cobbles and boulders are subangular to subrounded		
2.50 2.50	B D			122.44	2.70			
			Medium Ingress(1) at 3.10m.		(1.10)	Soft grey sandy gravelly clayey SILT with high cobble and boulder content. Gravel is subangular to subrounded fine to coarse. Cobbles and boulders are subangular to subrounded. Soil liquified by excavation and water ingress		▽1
3.50 3.50	B D			121.34	3.80	Terminated at 3.80m		

Plan

Remarks

Groundwater encountered at 3.10m BGL; Medium Ingress
Trial pit unstable; Side walls collapsed
Shear hand vanes not completed at all scheduled depths due to high granular content of material
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	CMP	13103-08-23.TP-48

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Site Littleton Wind Farm Borrow Pit			**Trial Pit Number** TP-49
Machine : 12T wide tracked excavator **Method :** Trial Pit	**Dimensions** 4.30m x 1.20m x 3.20m (L x W x D)	**Ground Level (mOD)** 124.73	**Client** Bord na Móna	**Job Number** 13103-08-23
	Location 623593.9 E 654970.7 N	**Dates** 18/10/2023	**Engineer** Fehily Timoney	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.30)	Very soft dark brown slightly clayey amorphous PEAT		
				124.43	0.30			
0.50 0.50	B D				(0.40)	Grey mottled brown silty clayey sandy subangular to subrounded fine to coarse GRAVEL with medium cobble content. Cobbles are subangular to subrounded. (Visually assessed as Medium Dense)		
				124.03	0.70			
1.50 1.50	B D				(2.50)	Soft grey sandy gravelly clayey SILT with high cobble and medium boulder content. Gravel is subangular to subrounded fine to coarse. Cobbles and boulders are subangular to subrounded		
2.50 2.50	B D		Medium Ingress(1) at 2.50m.					▽1
				121.53	3.20	Terminated at 3.20m		

Plan

Remarks

Groundwater encountered at 2.50m BGL; Medium Ingress
Trial pit unstable; Side walls collapsed
Shear hand vanes not completed at all scheduled depths due to high granular content of material
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	CMP	13103-08-23.TP-49

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Site Littleton Wind Farm Borrow Pit			**Trial Pit Number** TP-50
Machine : 12T wide tracked excavator **Method :** Trial Pit	**Dimensions** 5.50m x 1.20m x 4.10m (L x W x D)	**Ground Level (mOD)** 124.71	**Client** Bord na Móna	**Job Number** 13103-08-23
	Location 623319.8 E 654712.8 N	**Dates** 18/10/2023	**Engineer** Fehily Timoney	**Sheet** 1/2

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
1.00 1.00	B D				(2.00)	Very soft brown clayey pseudo fibrous PEAT		
				122.71	2.00	Soft grey sandy gravelly clayey SILT with medium cobble and boulder content. Gravel is subangular to subrounded fine to coarse. Cobbles and boulders are subangular to subrounded		
3.00 3.00	B D				(2.10)			

Plan

Remarks

Groundwater encountered at 4.00m BGL; Seepage
Trial pit stable
Shear hand vanes not completed at all scheduled depths due to high granular content of material
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	CMP	13103-08-23.TP-50

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Site Littleton Wind Farm Borrow Pit			**Trial Pit Number** TP-50
Machine : 12T wide tracked excavator **Method :** Trial Pit	**Dimensions** 5.50m x 1.20m x 4.10m (L x W x D)	**Ground Level (mOD)** 124.71	**Client** Bord na Móna	**Job Number** 13103-08-23
	Location 623319.8 E 654712.8 N	**Dates** 18/10/2023	**Engineer** Fehily Timoney	**Sheet** 2/2

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
			Seepage(1) at 4.00m.	120.61	4.10	Complete at 4.10m		▽1

Plan

Remarks

Scale (approx)	Logged By	Figure No.
1:25	CMP	13103-08-23.TP-50

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Site Littleton Wind Farm Borrow Pit			**Trial Pit Number** TP-51
Machine : 12T wide tracked excavator **Method :** Trial Pit	**Dimensions** 4.10m x 1.20m x 4.00m (L x W x D)	**Ground Level (mOD)** 121.85	**Client** Bord na Móna	**Job Number** 13103-08-23
	Location 621783.7 E 654532.7 N	**Dates** 18/10/2023	**Engineer** Fehily Timoney	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.20)	Very soft dark brown slightly clayey amorphous PEAT		
				121.65	0.20	Very soft brown clayey pseudo fibrous PEAT		
					(1.30)			
1.00 1.00	B D		Medium Ingress(1) at 1.40m.					▽1
				120.35	1.50	Soft grey sandy gravelly clayey SILT with low cobble and boulder content. Gravel is subangular to subrounded fine to coarse. Cobbles and boulders are subangular to subrounded. Soil liquified by excavation and water ingress		
					(1.90)			
2.50 2.50	B D		Fast Ingress(2) at 3.40m.					▽2
				118.45	3.40	Brownish grey silty clayey sandy subangular to subrounded fine to coarse GRAVEL with high cobble and boulder content. Cobbles and boulders are subangular to subrounded. (Visually assessed as Medium Dense)		
					(0.60)			
4.00	BD			117.85	4.00	Complete at 4.00m		

Plan

Remarks

Groundwater encountered at 1.40m and 3.40m BGL; Medium and Fast Ingress
Trial pit unstable; Side walls spalling
Shear hand vanes not completed at all scheduled depths due to high granular content of material
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	CMP	13103-08-23.TP-51

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Site Littleton Wind Farm Borrow Pit			**Trial Pit Number** TP-B1
Machine : 8T tracked excavator **Method :** Trial Pit	**Dimensions** 4.10m x 1.20m x 1.00m (L x W x D)	**Ground Level (mOD)** 136.56	**Client** Bord na Móna	**Job Number** 13103-08-23
	Location 623969.1 E 659000.6 N	**Dates** 17/10/2023	**Engineer** Fehily Timoney	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.20)	TOPSOIL		
				136.36	0.20			
					(0.40)	Soft reddish brown slightly sandy slightly gravelly silty CLAY with high cobble and boulder content. Gravel is subangular to subrounded fine to coarse. Cobbles and boulders are angular		
0.50	HRV 16kPa		10,20,18/Av. 16.00	135.96	0.60			
0.50	B					Presumed WEATHERED BEDROCK recovered as grey angular Cobbles and Boulders of Limestone with some clay		
0.50	HV 26kPa		20,31,27/Av. 26.00					
0.50	D				(0.40)			
0.70	B					Obstruction: Presumed Bedrock at 1.00m BGL		
				135.56	1.00			
						Complete at 1.00m		

Plan

Remarks

No groundwater encountered
Trial pit stable
Shear hand vanes not completed at all scheduled depths due to high granular content of material
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	CMP	13103-08-23.TP-B1

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Site Littleton Wind Farm Borrow Pit			**Trial Pit Number** TP-B2
Machine : 8T tracked excavator **Method :** Trial Pit	**Dimensions** 5.00m x 1.20m x 4.10m (L x W x D)	**Ground Level (mOD)** 131.14	**Client** Bord na Móna	**Job Number** 13103-08-23
	Location 623803 E 659170.4 N	**Dates** 17/10/2023	**Engineer** Fehily Timoney	**Sheet** 1/2

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.20)	TOPSOIL		
				130.94	0.20	Soft reddish brown slightly sandy slightly gravelly silty CLAY. Gravel is subangular to subrounded fine to coarse		
					(0.40)			
0.50 0.50	B D			130.54	0.60	Firm light brown slightly sandy gravelly silty CLAY with high cobble and boulder content. Gravel is subangular to subrounded fine to coarse. Cobbles and boulders are subangular to subrounded		
1.50 1.50	B D				(2.20)			
2.50 2.50	B D			128.34	2.80	Brownish grey clayey very sandy subangular to subrounded fine to coarse GRAVEL with high cobble and boulder content. Cobbles and boulders are subangular to subrounded. (Visually assessed as Medium Dense)		
					(1.30)			
3.50 3.50	B D							

Plan

Remarks

No groundwater encountered
Trial pit stable
Shear hand vanes not completed at all scheduled depths due to granular content of material
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	CMP	13103-08-23.TP-B2

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Site Littleton Wind Farm Borrow Pit			**Trial Pit Number** TP-B2
Machine : 8T tracked excavator **Method :** Trial Pit	**Dimensions** 5.00m x 1.20m x 4.10m (L x W x D)	**Ground Level (mOD)** 131.14	**Client** Bord na Móna	**Job Number** 13103-08-23
	Location 623803 E 659170.4 N	**Dates** 17/10/2023	**Engineer** Fehily Timoney	**Sheet** 2/2

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
				127.04	4.10	Complete at 4.10m		

Plan

Remarks

Scale (approx)	Logged By	Figure No.
1:25	CMP	13103-08-23.TP-B2

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Site Littleton Wind Farm Borrow Pit			**Trial Pit Number** TP-B3
Machine : 8T tracked excavator **Method :** Trial Pit	**Dimensions** 4.50m x 1.20m x 1.20m (L x W x D)	**Ground Level (mOD)** 132.57	**Client** Bord na Móna	**Job Number** 13103-08-23
	Location 623755.1 E 659040.2 N	**Dates** 17/10/2023	**Engineer** Fehily Timoney	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.20)	TOPSOIL		
				132.37	0.20			
					(0.40)	Soft reddish brown slightly sandy slightly gravelly silty CLAY. Gravel is subangular to subrounded fine to coarse		
0.50 0.50	B D			131.97	0.60			
					(0.60)	Firm light brown slightly sandy gravelly silty CLAY with high cobble and boulder content. Gravel is subangular to subrounded fine to coarse. Cobbles and boulders are angular		
						Obstruction: Possible Bedrock at 1.20m BGL		
1.20 1.20	B D			131.37	1.20	Complete at 1.20m		

Plan

Remarks

No groundwater encountered
Trial pit stable
Shear hand vanes not completed at all scheduled depths due to high granular content of material
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	CMP	13103-08-23.TP-B3

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Site Littleton Wind Farm Borrow Pit			**Trial Pit Number** TP-B4
Machine : 7T tracked excavator **Method :** Trial Pit	**Dimensions** 4.70m x 1.20m x 2.80m (L x W x D)	**Ground Level (mOD)** 129.59	**Client** Bord na Móna	**Job Number** 13103-08-23
	Location 623734.1 E 658843.9 N	**Dates** 17/10/2023	**Engineer** Fehily Timoney	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.30)	TOPSOIL		
				129.29	0.30			
0.50 0.50	B D				(0.40)	Soft reddish brown slightly sandy slightly gravelly silty CLAY. Gravel is subangular to subrounded fine to coarse		
				128.89	0.70			
1.50 1.50	B D				(1.80)	Firm light brown slightly sandy gravelly silty CLAY with high cobble and medium boulder content. Gravel is subangular to subrounded fine to coarse. Cobbles and boulders are subangular to subrounded		
				127.09	2.50			
					(0.30)	Grey clayey sandy subangular to subrounded fine to coarse GRAVEL with high cobble content. Cobbles and boulders are subangular to subrounded. (Visually assessed as Medium Dense) Obstruction: Possible Bedrock at 2.80m BGL		
2.70 2.70	B D		Seepage(1) at 2.80m.	126.79	2.80	Complete at 2.80m		▽1

Plan

Remarks

Groundwater encountered at 2.80m BGL; Seepage
Trial pit stable
Shear hand vanes not completed at all scheduled depths due to high granular content of material
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	CMP	13103-08-23.TP-B4

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Site Littleton Wind Farm Borrow Pit			**Trial Pit Number** TP-B5
Machine : 8T tracked excavator **Method :** Trial Pit	**Dimensions** 4.40m x 1.20m x 0.80m (L x W x D)	**Ground Level (mOD)** 139.61	**Client** Bord na Móna	**Job Number** 13103-08-23
	Location 623925.5 E 658892.4 N	**Dates** 17/10/2023	**Engineer** Fehily Timoney	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.20)	TOPSOIL		
				139.41	0.20	Soft reddish brown slightly sandy slightly gravelly silty CLAY. Gravel is subangular to subrounded fine to coarse		
					(0.40)			
0.50 0.50	B D			139.01	0.60	Presumed WEATHERED BEDROCK recovered as grey slightly clayey slightly sandy angular fine to coarse GRAVEL with high cobble and boulder content. Cobbles and boulders are angular. (Visually assessed as Medium Dense) Obstruction: Presumed Bedrock at 0.80m BGL		
					(0.20)			
0.80 0.80	B D			138.81	0.80	Complete at 0.80m		

Plan

Remarks

No groundwater encountered
Trial pit stable
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	CMP	13103-08-23.TP-B5

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Site Littleton Wind Farm Borrow Pit			**Trial Pit Number** TP-B6
Machine : 7T tracked excavator **Method :** Trial Pit	**Dimensions** 4.60m x 1.20m x 0.80m (L x W x D)	**Ground Level (mOD)** 138.95	**Client** Bord na Móna	**Job Number** 13103-08-23
	Location 623878.1 E 658978.7 N	**Dates** 17/10/2023	**Engineer** Fehily Timoney	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.20)	TOPSOIL		
				138.75	0.20			
					(0.20)	Soft reddish brown slightly sandy slightly gravelly silty CLAY. Gravel is subangular to subrounded fine to coarse		
				138.55	0.40			
					(0.40)	Presumed WEATHERED BEDROCK recovered as grey slightly clayey sandy angular fine to coarse GRAVEL with high cobble and boulder content. Cobbles and boulders are angular. (Visually assessed as Medium Dense)		
						Obstruction: Presumed Bedrock at 0.80m BGL		
0.80	B			138.15	0.80			
0.80	D					Complete at 0.80m		

Plan

Remarks

No groundwater encountered
Trial pit stable
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	CMP	13103-08-23.TP-B4

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Littleton Wind Farm Borrow Pit – Trial Pit Photographs

TP-48

TP-48

Littleton Wind Farm Borrow Pit – Trial Pit Photographs

TP-48

TP-48

Littleton Wind Farm Borrow Pit – Trial Pit Photographs

TP-48

Littleton Wind Farm Borrow Pit – Trial Pit Photographs

TP-49

TP-49

Littleton Wind Farm Borrow Pit – Trial Pit Photographs

TP-49

TP-49

Littleton Wind Farm Borrow Pit – Trial Pit Photographs

TP-49

Littleton Wind Farm Borrow Pit – Trial Pit Photographs

TP-50

TP-50

Littleton Wind Farm Borrow Pit – Trial Pit Photographs

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Littleton Wind Farm Borrow Pit – Trial Pit Photographs

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Littleton Wind Farm Borrow Pit – Trial Pit Photographs

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Littleton Wind Farm Borrow Pit – Trial Pit Photographs

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Littleton Wind Farm Borrow Pit – Trial Pit Photographs

TP-51

Littleton Wind Farm Borrow Pit – Trial Pit Photographs

TP-B1

TP-B1

Littleton Wind Farm Borrow Pit – Trial Pit Photographs

TP-B1

TP-B1

Littleton Wind Farm Borrow Pit – Trial Pit Photographs

TP-B1

Littleton Wind Farm Borrow Pit – Trial Pit Photographs

TP-B2

TP-B2

Littleton Wind Farm Borrow Pit – Trial Pit Photographs

TP-B2

TP-B2

Littleton Wind Farm Borrow Pit – Trial Pit Photographs

TP-B2

Littleton Wind Farm Borrow Pit – Trial Pit Photographs

TP-B3

TP-B3

Littleton Wind Farm Borrow Pit – Trial Pit Photographs

TP-B3

TP-B3

Littleton Wind Farm Borrow Pit – Trial Pit Photographs

TP-B3

Littleton Wind Farm Borrow Pit – Trial Pit Photographs

TP-B4

TP-B4

Littleton Wind Farm Borrow Pit – Trial Pit Photographs

TP-B4

TP-B4

Littleton Wind Farm Borrow Pit – Trial Pit Photographs

TP-B4

Littleton Wind Farm Borrow Pit – Trial Pit Photographs

TP-B5

TP-B5

Littleton Wind Farm Borrow Pit – Trial Pit Photographs

TP-B5

TP-B5

Littleton Wind Farm Borrow Pit – Trial Pit Photographs

TP-B5

Littleton Wind Farm Borrow Pit – Trial Pit Photographs

TP-B6

TP-B6

Littleton Wind Farm Borrow Pit – Trial Pit Photographs

TP-B6

TP-B6

Littleton Wind Farm Borrow Pit – Trial Pit Photographs

TP-B6

APPENDIX 3 – Rotary Core Records

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Site Littleton Wind Farm Borrow Pit			**Borehole Number** BH01
Machine : Beretta T44 **Flush :** Water **Core Dia :** 63.5 mm **Method :** Rotary Cored	**Casing Diameter** 96mm cased to 6.50m	**Ground Level (mOD)** 124.51	**Client** Bord na Móna	**Job Number** 13103-08-23
	Location 623340.4 E 658859.9 N	**Dates** 04/12/2023	**Engineer** Fehily Timoney	**Sheet** 1/1

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.00	100						(2.00)	Very soft dark brown spongy pseudofibrous PEAT			
1.50 1.50-1.95	100				1,0/0,1,0,0 SPT(C) N=1						
2.00	67					122.51	2.00 (1.50)	Recovery consists of dark brown pseudofibrous spongy PEAT onto grey slightly sandy slightly gravelly silty CLAY. Driller notes; Peat onto Clay (Very soft)			
3.50 3.50-3.95	20				1,1/1,0,1,1 SPT(C) N=3	121.01	3.50 (1.50)	Recovery consists of grey slightly sandy slightly gravelly silty CLAY onto grey slightly sandy subangular to subrounded fine to coarse GRAVEL. Driller notes; Clay to Gravel (Very soft)			
5.00 5.00-5.45	43				4,6/9,9,11,13 SPT(C) N=42	119.51	5.00 (1.50)	Recovery consists of grey slightly sandy subangular to subrounded fine to coarse GRAVEL. Driller notes; Gravel (Dense)			
6.50 6.50-6.88					7,9/11,12,27 SPT(C) 50/225	118.01	6.50	Complete at 6.50m			

Remarks
50mm slotted standpipe with pea gravel surround installed from 6.50m to 4.00m BGL. 50mm plain standpipe with a bentonite seal installed from 4.00m to GL with a raised cover.

Scale (approx)	Logged By
1:50	LM

Figure No. 13103-08-23.BH01

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Site Littleton Wind Farm Borrow Pit			**Borehole Number** BH02
Machine : Beretta T44 **Flush :** Water **Core Dia :** 63.5 mm **Method :** Rotary Cored	**Casing Diameter** 96mm cased to 6.50m	**Ground Level (mOD)** 124.54	**Client** Bord na Móna	**Job Number** 13103-08-23
	Location 623325.5 E 658894.9 N	**Dates** 05/12/2023	**Engineer** Fehily Timoney	**Sheet** 1/1

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00	100						(2.00)	Very soft dark brown pseudofibrous spongy PEAT		
1.50 1.50-1.95	100				1,1/0,1,0,0 SPT(C) N=1					
2.00	67					122.54	2.00 (1.50)	Recovery consists dark brown pseudofibrous spongy PEAT onto grey slightly sandy subangular to subrounded fine to coarse GRAVEL. Driller notes; Peat to Gravel (Very soft)		
3.50 3.50-3.95	33				1,0/0,1,0,1 SPT(C) N=2	121.04	3.50 (1.50)	Recovery consists of grey slightly sandy slightly gravelly silty CLAY. Driller notes; silty Clay (Very soft)		
5.00 5.00-5.45	67				7,9/11,11,17,11 SPT(C) N=50	119.54	5.00 (1.50)	Recovery consists of grey slightly sandy subangular to subrounded fine to coarse GRAVEL. Driller notes; Gravel (dense)		
6.50 6.50-6.65					14,11/50 SPT(C)	118.04	6.50	Complete at 6.50m		

Remarks

Scale (approx)	Logged By
1:50	LM

Figure No. 13103-08-23.BH02

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Site Littleton Wind Farm Borrow Pit			**Borehole Number** BH03
Machine : Beretta T44 **Flush :** Water **Core Dia :** 63.5 mm **Method :** Rotary Cored	**Casing Diameter** 96mm cased to 12.40m	**Ground Level (mOD)** 124.73	**Client** Bord na Móna	**Job Number** 13103-08-23
	Location 623335.4 E 658949.8 N	**Dates** 29/11/2023-30/11/2023	**Engineer** Fehily Timoney	**Sheet** 1/2

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.00											
	67						(2.00)	Very soft dark brown pseudofibrous PEAT			
1.50 1.50-1.95	100				1,0/0,1,0,1 SPT(C) N=2						
2.00						122.73	2.00				
	33						(1.50)	Recovery consists of dark brown pseudofibrous spongy PEAT			
3.50 3.50-3.95					1,2/0,2,3,4 SPT(C) N=9	121.23	3.50				
	27						(1.50)	Recovery consists of slightly clayey slightly sandy subangular to subrounded fine to coarse GRAVEL with low cobble content. Driller notes; Gravel (Loose to medium dense)			
5.00 5.00-5.45					3,6/4,6,9,10 SPT(C) N=29	119.73	5.00				
	20						(1.50)	Recovery consists of slightly clayey slightly sandy subangular to subrounded fine to coarse GRAVEL with low cobble content. Driller notes; Gravel (Medium dense to dense)			
6.50 6.50-6.95					7,7/12,12,17,9 SPT(C) N=50	118.23	6.50				
	47						(2.60)	Recovery consists of slightly clayey slightly sandy subangular to subrounded fine to coarse GRAVEL with low cobble content. Driller notes; Gravel (Dense)			
8.00 8.00-8.15					25/50 SPT(C) 25*/75 50/75						
	73	27	21								
9.10						115.63	9.10				
9.50 9.55-9.75					U		(1.30)	Medium strong to strong very thinly to medium bedded dark grey fine to coarse grained fossiliferous argillaceous LIMESTONE. Slightly weathered (9.10m to 11.00m BGL) 1 No. Fracture set. F1: 0-30 degree fracture close to medium spaced undulating rough with clay infill			

Remarks
50mm slotted standpipe with pea gravel surround installed from 11.00m to 7.00m BGL. 50mm plain standpipe with a bentonite seal installed from 7.00m to GL with a raised cover. Bentonite seal from 12.40m to 11.00m BGL.

Scale (approx)	Logged By
1:50	LM

Figure No. 13103-08-23.BH02

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Site Littleton Wind Farm Borrow Pit			**Borehole Number** BH03
Machine : Beretta T44 **Flush :** Water **Core Dia:** 63.5 mm **Method :** Rotary Cored	**Casing Diameter** 96mm cased to 12.40m	**Ground Level (mOD)** 124.73	**Client** Bord na Móna	**Job Number** 13103-08-23
	Location 623335.4 E 658949.8 N	**Dates** 29/11/2023-30/11/2023	**Engineer** Fehily Timoney	**Sheet** 2/2

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
	88	73	59	8							
10.40-10.60					U	114.33	10.40	Strong very thinly to medium bedded dark grey fine to coarse grained fossiliferous argillaceous LIMESTONE. Fresh (11.00m to 12.40m BGL) 1 No. Fracture set. F1: 0-15 degree fracture medium spaced undulating rough			
11.00							(2.00)				
	100	85	61	7							
11.85-12.00					U						
12.40						112.33	12.40	Complete at 12.40m			

Remarks

Scale (approx)	Logged By
1:50	LM

Figure No. 13103-08-23.BH02

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Site Littleton Wind Farm Borrow Pit			**Borehole Number** BH-B1
Machine : Beretta T44 **Flush :** Water **Core Dia :** 63.5 mm **Method :** Rotary Cored	**Casing Diameter** 96mm cased to 7.50m	**Ground Level (mOD)** 133.39	**Client** Bord na Móna	**Job Number** 13103-08-23
	Location (dGPS) 623918.5 E 659094.8 N	**Dates** 08/12/2023	**Engineer** Fehily Timoney	**Sheet** 1/1

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.00						133.14	(0.25) 0.25	TOPSOIL			
	67						(1.25)	Recovery consists of grey slightly clayey slightly sandy subangular to subrounded fine to coarse GRAVEL. Driller notes; Clay onto possible bedrock.			
1.50	100	33	20	NI		131.89	1.50	Medium strong massive grey medium grained LIMESTONE. Slightly to moderately weathered (1.50m to 2.30m BGL) Non intact			
2.00 2.30							(1.50)	(2.30m to 4.25m BGL) 1 No. Fracture set. F1: 0-40 degree fracture closely spaced undulating rough			
2.75-3.00	100	61	41		U	130.39	3.00				
				8		130.09	(0.30) 3.30	Medium strong massive brownish grey medium to coarse grained dolomitic LIMESTONE. Slightly to moderately weathered	Dol		
3.50						129.64	(0.45) 3.75	Medium strong massive red medium to coarse grained LIMESTONE. Slightly to moderately weathered	Dol		
4.25	97	84	80					Medium strong massive brownish grey medium to coarse grained dolomitic LIMESTONE. Slightly to moderately weathered with occasional white mineral veins	Dol		
4.45-4.70					U		(1.50)	(4.25m to 7.50m BGL) 1 No. Fracture set. F1: 0-20 degree fracture closely spaced undulating to planar rough	Dol		
5.00 5.00-5.25					U	128.14	5.25		Dol		
5.40-5.65	100	100	98	4	U			Strong massive reddish grey medium to coarse grained dolomitic LIMESTONE. Slightly to moderately weathered with occasional white mineral veins	Dol		
6.50	100	86	86				(2.25)		Dol		
7.50						125.89	7.50	Complete at 7.50m			

Remarks
50mm slotted standpipe with pea gravel surround installed from 6.50m to 2.50m BGL. 50mm plain standpipe with a bentonite seal installed from 2.50m to GL with a raised cover. Bentonite seal from 7.50m to 6.50m BGL.

Scale (approx)	Logged By
1:50	LM

Figure No. 13103-08-23.BH-B1

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Site Littleton Wind Farm Borrow Pit			**Borehole Number** BH-B2
Machine : Beretta T44 **Flush :** Water **Core Dia:** 63.5 mm **Method :** Rotary Cored	**Casing Diameter** 96mm cased to 6.50m	**Ground Level (mOD)** 140.17	**Client** Bord na Móna	**Job Number** 13103-08-23
	Location (dGPS) 623871.4 E 658897.4 N	**Dates** 06/12/2023	**Engineer** Fehily Timoney	**Sheet** 1/1

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.00						140.17					
							(0.50)	TOPSOIL			
0.50	100	9	0	NI		139.67	0.50	Medium strong to strong thinly to medium bedded dark grey fine to coarse grained fossiliferous argillaceous LIMESTONE. Slightly weathered (1.35m to 3.05m BGL) 2 No. fracture sets. F1: 0-30 degree fracture closely spaced undulating rough. F2: 70-90 degree fracture widely spaced undulating and rough.			
1.35											
1.50	100	92	0				(2.55)				
2.00											
2.00-2.10	100	81	53	13	U						
3.05						137.12	3.05				
3.10-3.35					U			Strong thinly to medium bedded dark grey medium to coarse grained fossiliferous argillaceous LIMESTONE. Fresh (3.05m to 6.50m BGL) 1 No. Fracture set. F1: 0-40 degree fracture close to medium spaced undulating rough with clay infill on fractured surfaces			
3.50											
4.05-4.17	100	83	59	7	U		(3.45)				
5.00											
5.25-5.50	100	85	65		U						
6.50						133.67	6.50	Complete at 6.50m			

Remarks
50mm slotted standpipe with pea gravel surround installed from 5.50m to 1.00m BGL. 50mm plain standpipe with a bentonite seal installed from 1.00m to GL with a raised cover. Bentonite seal from 6.50m to 5.50m BGL.

Scale (approx)	Logged By
1:50	LM

Figure No. 13103-08-23.BH-B2

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Site Littleton Wind Farm Borrow Pit			**Borehole Number** BH-B3
Machine : Beretta T44 **Flush :** Water **Core Dia :** 63.5 mm **Method :** Rotary Cored	**Casing Diameter** 96mm cased to 7.00m	**Ground Level (mOD)** 140.09	**Client** Bord na Móna	**Job Number** 13103-08-23
	Location (dGPS) 623869 E 658810.4 N	**Dates** 07/12/2023	**Engineer** Fehily Timoney	**Sheet** 1/1

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.00											
	100	9	0			139.59	(0.50) 0.50	TOPSOIL			
							(0.50)	No recovery. Driller notes; Clay			
1.00						139.09	1.00				
1.50	100	0	0	NI			(1.65)	Medium strong thinly bedded dark grey fine grained argillaceous LIMESTONE. Highly weathered (1.00m to 2.65m BGL) Mostly non-intact			
2.00											
2.65	100	61	41			137.44	2.65				
2.95-3.00				13	U			Medium strong to strong thinly bedded dark grey fine grained slightly fossiliferous argillaceous LIMESTONE. Moderately weathered (2.65m to 4.30m BGL) 2 No. fracture sets. F1: 0-20 degree fracture closely spaced planar rough. F2: 40-60 degree fracture close to medium spaced undulating rough.			
3.50							(1.65)				
4.00											
4.00-4.25	100	83	59		U	135.79	4.30				
4.35-4.55					U			Strong thinly bedded dark grey fine grained slightly fossiliferous argillaceous LIMESTONE. Fresh (4.30 to 7.00m BGL) 2 No. Fracture sets. F1: 0-20 degree fracture medium spaced undulating rough. F2: 40-60 degree fracture medium spaced unudlating rough.			
5.00											
5.40-5.75	100	85	65	7	U		(2.70)				
6.50											
	100	100	100								
7.00						133.09	7.00	Complete at 7.00m			

Remarks
50mm slotted standpipe with pea gravel surround installed from 6.00m to 1.00m BGL. 50mm plain standpipe with a bentonite seal installed from 1.00m to GL with a raised cover. Bentonite seal from 7.00m to 5.50m BGL.

Scale (approx)	Logged By
1:50	LM

Figure No. 13103-08-23.BH-B2

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Site Littleton Wind Farm Borrow Pit			**Borehole Number** BH-B4
Machine : Beretta T44 **Flush :** Water **Core Dia :** 63.5 mm **Method :** Rotary Cored	**Casing Diameter** 96mm cased to 8.00m	**Ground Level (mOD)** 133.94	**Client** Bord na Móna	**Job Number** 13103-08-23
	Location (dGPS) 623785.4 E 659075.7 N	**Dates** 07/12/2023	**Engineer** Fehily Timoney	**Sheet** 1/1

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.00						133.64	(0.30) 0.30	TOPSOIL			
	67							Recovery consists of grey slightly clayey slightly sandy subangular to subrounded fine to coarse GRAVEL. Driller notes; clayey Gravel			
1.50	20					132.04	(1.60) 1.90				
2.00	100	33	27					Recovery consists of reddish brown slightly sandy gravelly CLAY with low cobble content			
3.00						130.94	(1.10) 3.00				
3.25-3.30					U			Medium strong brownish grey fine to coarse grained fossiliferous dolomitic LIMESTONE. Moderately weathered with clay infill and reduced recovery (3.00m to 8.00m BGL) 2 No. fracture sets. F1: 0-20 degree fracture close to medium spaced undulating rough. F2: 30-45 degree fracture close to medium spaced undulating rough.	Dol		
3.50	60	60	23				(2.00) 5.00				
5.00				7		128.94					
5.35-5.60	100	96	75		U			Medium strong brownish grey fine to coarse grained fossiliferous dolomitic LIMESTONE. Slightly to moderately weathered with clay infill and rare white minderal veins			
6.50							(3.00)				
6.60-6.75	100	83	70		U						
8.00						125.94	8.00	Complete at 8.00m			

Remarks
50mm slotted standpipe with pea gravel surround installed from 7.00m to 2.00m BGL. 50mm plain standpipe with a bentonite seal installed from 2.00m to GL with a raised cover. Bentonite seal from 8.00m to 7.00m BGL.

Scale (approx)	Logged By
1:50	LM

Figure No. 13103-08-23.BH-B4

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Littleton Wind Farm Borrow Pit – Rotary Core Photographs

BH01

BH01 – Box 1

BH01 – Box 2

Littleton Wind Farm Borrow Pit – Rotary Core Photographs

BH02

BH02 – Box 1

BH02 – Box 2

Littleton Wind Farm Borrow Pit – Rotary Core Photographs

BH03

BH03 – Box 1

BH03 – Box 2

Littleton Wind Farm Borrow Pit – Rotary Core Photographs

BH03 – Box 3

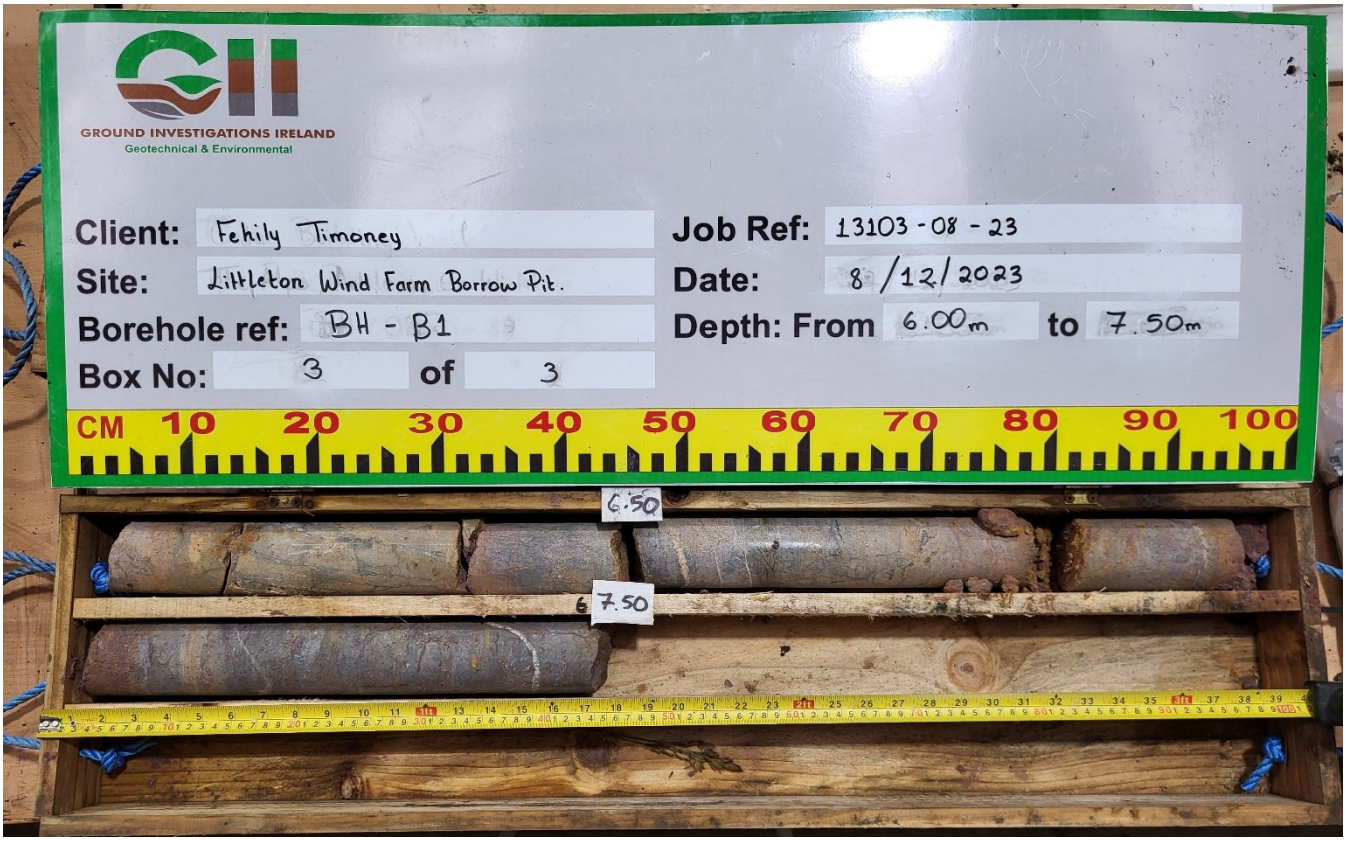
Littleton Wind Farm Borrow Pit – Rotary Core Photographs

BHB1

BHB1 – Box 1

BHB1 – Box 2

Littleton Wind Farm Borrow Pit – Rotary Core Photographs



BHB1 – Box 3

Littleton Wind Farm Borrow Pit – Rotary Core Photographs

BHB2

BHB2 – Box 1

BHB2 – Box 2

Littleton Wind Farm Borrow Pit – Rotary Core Photographs

BHB2 – Box 3

Littleton Wind Farm Borrow Pit – Rotary Core Photographs

BHB3

BHB3 – Box 1

BHB3 – Box 2

Littleton Wind Farm Borrow Pit – Rotary Core Photographs

BHB3 – Box 3

Littleton Wind Farm Borrow Pit – Rotary Core Photographs

BHB4

BHB4 – Box 1

BHB4 – Box 2

Littleton Wind Farm Borrow Pit – Rotary Core Photographs

BHB4 – Box 3

APPENDIX 4 – Laboratory Testing

Element Materials Technology
Unit 3 Deeside Point
Zone 3
Deeside Industrial Park
Deeside
CH5 2UA

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Ground Investigations Ireland
Catherinestown House
Hazelhatch Road
Newcastle
Co. Dublin
Ireland
D22 K5P8

Attention :	James Cashen
Date :	9th November, 2023
Your reference :	13103-08-23
Our reference :	Test Report 23/18517 Batch 1
Location :	Littleton Wind Farm Borrow Pit
Date samples received :	6th November, 2023
Status :	Final Report
Issue :	1

Four samples were received for analysis on 6th November, 2023 of which four were scheduled for analysis. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.
All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

The greenhouse gas emissions generated (in Carbon – Co2e) to obtain the results in this report are estimated as:

Scope 1&2 emissions - 6.661 kg of CO2

Scope 1&2&3 emissions - 15.741 kg of CO2

Authorised By:

Liza Klebe
Project Co-ordinator

Please include all sections of this report if it is reproduced

Element Materials Technology

Client Name: Ground Investigations Ireland
Reference: 13103-08-23
Location: Littleton Wind Farm Borrow Pit
Contact: James Cashen
EMT Job No: 23/18517

Report : Solid

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

EMT Sample No.	1	2	3	4							LOD/LOR	Units	Method No.
Sample ID	TP-48	TP-49	TP-50	TP-51									
Depth	3.50	1.50	3.00	4.00									
COC No / misc													
Containers	T	T	T	T									
Sample Date	02/11/2023	02/11/2023	02/11/2023	02/11/2023									
Sample Type	Soil	Soil	Soil	Soil									
Batch Number	1	1	1	1									
Date of Receipt	06/11/2023	06/11/2023	06/11/2023	06/11/2023									
Sulphur as S	0.03	0.02	0.02	0.03							<0.01	%	TM30/PM15
Total Sulphate as SO4 BRE	0.02	0.02	0.01	0.01							<0.01	%	TM50/PM29
Sulphate as SO4 (2:1 Ext) #	0.0076	0.0078	0.0033	0.0081							<0.0015	g/l	TM38/PM20
Organic Matter	0.3	<0.2	<0.2	0.8							<0.2	%	TM21/PM24
Loss on Ignition #	<1.0	<1.0	<1.0	1.3							<1.0	%	TM22/PM0
pH #	8.40	8.40	8.51	8.14							<0.01	pH units	TM73/PM11

Please see attached notes for all abbreviations and acronyms

Element Materials Technology

Notification of Deviating Samples

Client Name: Ground Investigations Ireland
Reference: 13103-08-23
Location: Littleton Wind Farm Borrow Pit
Contact: James Cashen

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Analysis	Reason
No deviating sample report results for job 23/18517						

Please note that only samples that are deviating are mentioned in this report. If no samples are listed it is because none were deviating. Only analyses which are accredited are recorded as deviating if set criteria are not met.
It is a requirement under ISO 17025 that we inform clients if samples are deviating i.e. outside what is expected. A deviating sample indicates that the sample 'may' be compromised but not necessarily will be compromised. The result is still accredited and our analytical reports will still show accreditation on the relevant analytes.

NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

EMT Job No.: 23/18517

SOILS and ASH

Please note we are only MCERTS accredited (UK soils only) for sand, loam and clay and any other matrix is outside our scope of accreditation.

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation has been performed on clay, sand and loam, only samples that are predominantly these matrices, or combinations of them will be within our MCERTS scope. If samples are not one of a combination of the above matrices they will not be marked as MCERTS accredited.

It is assumed that you have taken representative samples on site and require analysis on a representative subsample. Stones will generally be included unless we are requested to remove them.

All samples will be discarded one month after the date of reporting, unless we are instructed to the contrary. Asbestos samples are retained for 6 months.

If you have not already done so, please send us a purchase order if this is required by your company.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

All analysis is reported on a dry weight basis unless stated otherwise. Limits of detection for analyses carried out on as received samples are not moisture content corrected. Results are not surrogate corrected. Samples are dried at 35°C ±5°C unless otherwise stated. Moisture content for CEN Leachate tests are dried at 105°C ±5°C. Ash samples are dried at 37°C ±5°C.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

Where a CEN 10:1 ZERO Headspace VOC test has been carried out, a 10:1 ratio of water to wet (as received) soil has been used.

% Asbestos in Asbestos Containing Materials (ACMs) is determined by reference to HSG 264 The Survey Guide - Appendix 2 : ACMs in buildings listed in order of ease of fibre release.

Sufficient amount of sample must be received to carry out the testing specified. Where an insufficient amount of sample has been received the testing may not meet the requirements of our accredited methods, as such accreditation may be removed.

Negative Neutralization Potential (NP) values are obtained when the volume of NaOH (0.1N) titrated (pH 8.3) is greater than the volume of HCl (1N) to reduce the pH of the sample to 2.0 - 2.5. Any negative NP values are corrected to 0.

The calculation of Pyrite content assumes that all oxidisable sulphides present in the sample are pyrite. This may not be the case. The calculation may be an overesitimate when other sulphides such as Barite (Barium Sulphate) are present.

WATERS

Please note we are not a UK Drinking Water Inspectorate (DWI) Approved Laboratory .

ISO17025 accreditation applies to surface water and groundwater and usually one other matrix which is analysis specific, any other liquids are outside our scope of accreditation.

As surface waters require different sample preparation to groundwaters the laboratory must be informed of the water type when submitting samples.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

STACK EMISSIONS

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation for Dioxins and Furans and Dioxin like PCBs has been performed on XAD-2 Resin, only samples which use this resin will be within our MCERTS scope.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

DEVIATING SAMPLES

All samples should be submitted to the laboratory in suitable containers with sufficient ice packs to sustain an appropriate temperature for the requested analysis. The temperature of sample receipt is recorded on the confirmation schedules in order that the client can make an informed decision as to whether testing should still be undertaken.

SURROGATES

Surrogate compounds are added during the preparation process to monitor recovery of analytes. However low recovery in soils is often due to peat, clay or other organic rich matrices. For waters this can be due to oxidants, surfactants, organic rich sediments or remediation fluids. Acceptable limits for most organic methods are 70 - 130% and for VOCs are 50 - 150%. When surrogate recoveries are outside the performance criteria but the associated AQC passes this is assumed to be due to matrix effect. Results are not surrogate corrected.

DILUTIONS

A dilution suffix indicates a dilution has been performed and the reported result takes this into account. No further calculation is required.

BLANKS

Where analytes have been found in the blank, the sample will be treated in accordance with our laboratory procedure for dealing with contaminated blanks.

NOTE

Data is only reported if the laboratory is confident that the data is a true reflection of the samples analysed. Data is only reported as accredited when all the requirements of our Quality System have been met. In certain circumstances where all the requirements of the Quality System have not been met, for instance if the associated AQC has failed, the reason is fully investigated and documented. The sample data is then evaluated alongside the other quality control checks performed during analysis to determine its suitability. Following this evaluation, provided the sample results have not been effected, the data is reported but accreditation is removed. It is a requirement of our Accreditation Body for data not reported as accredited to be considered indicative only, but this does not mean the data is not valid.
Where possible, and if requested, samples will be re-extracted and a revised report issued with accredited results. Please do not hesitate to contact the laboratory if further details are required of the circumstances which have led to the removal of accreditation.
Laboratory records are kept for a period of no less than 6 years.

REPORTS FROM THE SOUTH AFRICA LABORATORY

Any method number not prefixed with SA has been undertaken in our UK laboratory unless reported as subcontracted.

Measurement Uncertainty

Measurement uncertainty defines the range of values that could reasonably be attributed to the measured quantity. This range of values has not been included within the reported results. Uncertainty expressed as a percentage can be provided upon request.

Customer Provided Information

Sample ID and depth is information provided by the customer.

ABBREVIATIONS and ACRONYMS USED

#	ISO17025 (UKAS Ref No. 4225) accredited - UK.
SA	ISO17025 (SANAS Ref No.T0729) accredited - South Africa
B	Indicates analyte found in associated method blank.
DR	Dilution required.
M	MCERTS accredited.
NA	Not applicable
NAD	No Asbestos Detected.
ND	None Detected (usually refers to VOC and/SVOC TICs).
NDP	No Determination Possible
SS	Calibrated against a single substance
SV	Surrogate recovery outside performance criteria. This may be due to a matrix effect.
W	Results expressed on as received basis.
+	AQC failure, accreditation has been removed from this result, if appropriate, see 'Note' on previous page.
>>	Results above quantitative calibration range. The result should be considered the minimum value and is indicative only. The actual result could be significantly higher.
*	Analysis subcontracted to an Element Materials Technology approved laboratory.
AD	Samples are dried at 35°C ±5°C
CO	Suspected carry over
LOD/LOR	Limit of Detection (Limit of Reporting) in line with ISO 17025 and MCERTS
ME	Matrix Effect
NFD	No Fibres Detected
BS	AQC Sample
LB	Blank Sample
N	Client Sample
TB	Trip Blank Sample
OC	Outside Calibration Range

HWOL ACRONYMS AND OPERATORS USED

HS	Headspace Analysis.
EH	Extractable Hydrocarbons - i.e. everything extracted by the solvent.
CU	Clean-up - e.g. by florisil, silica gel.
1D	GC - Single coil gas chromatography.
Total	Aliphatics & Aromatics.
AL	Aliphatics only.
AR	Aromatics only.
2D	GC-GC - Double coil gas chromatography.
#1	EH_Total but with humics mathematically subtracted
#2	EU_Total but with fatty acids mathematically subtracted
_	Operator - underscore to separate acronyms (exception for +).
+	Operator to indicate cumulative e.g. EH+HS_Total or EH_CU+HS_Total
MS	Mass Spectrometry.

EMT Job No: 23/18517

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/SANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM21	Modified BS 7755-3:1995, ISO10694:1995 Determination of Total Organic Carbon or Total Carbon by combustion in an Eltra TOC furnace/analyser in the presence of oxygen. The CO2 generated is quantified using infra-red detection. Organic Matter (SOM) calculated as per EA MCERTS Chemical Testing of Soil, March 2012 v4.	PM24	Preparation of Soil and Marine Sediment Samples for Total Organic Carbon.			AD	Yes
TM22	Modified BS1377-3:1990 Gravimetric determination of Loss on Ignition by temperature controlled Muffle Furnace (35C-440C). On request modified ASTM D2974-00 LOI (105C-440C)	PM0	No preparation is required.	Yes		AD	Yes
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP 6010B, Rev.2, Dec.1996; Modified EPA Method 3050B, Rev.2, Dec.1996	PM15	Acid digestion of dried and ground solid samples using Aqua Regia refluxed at 112.5 °C. Samples containing asbestos are not dried and ground.			AD	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993) – All anions comparable to BS ISO 15923-1: 2013l	PM20	Extraction of dried and ground or as received samples with deionised water in a 2:1 water to solid ratio using a reciprocal shaker for all analytes except hexavalent chromium. Extraction of as received sample using 10:1 ratio of 0.2M sodium hydroxide to soil for hexavalent chromium using a reciprocal shaker.	Yes		AD	Yes
TM50	Acid soluble sulphate (Total Sulphate) analysed by ICP-OES	PM29	A hot hydrochloric acid digest is performed on a dried and ground sample, and the resulting liquor is analysed.			AD	Yes
TM73	Modified US EPA methods 150.1 (1982) and 9045D Rev. 4 - 2004) and BS1377-3:1990. Determination of pH by Metrohm automated probe analyser.	PM11	Extraction of as received solid samples using one part solid to 2.5 parts deionised water.	Yes		AR	No

LABORATORY REPORT

Contract Number: PSL23/10530

Report Date: 10 January 2024

Client's Reference: 13103-08-23

Client Name: Ground investigation Ireland Ltd

Catherinestown House
Hazelhatch Road
Newcastle
Co Dublin
D22 YD52

For the attention of: James Cashen/Conor McParland

Project Name: Littleton Wind Farm Borrow Pit

Date Received: 15/12/2023
Date Commenced: 15/12/2023
Date Completed: 10/01/2024

Notes: **Opinions and Interpretations are outside the UKAS Accreditation**

A copy of the Laboratory Schedule of accredited tests as issued by UKAS is attached to this report. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced other than in full, without the prior written approval of the laboratory.

Checked and Approved Signatories:

A Watkins (Director)
R Berriman (Quality Manager)
S Royle (Laboratory Manager)

L Knight (Assistant Laboratory Manager)
S Eyre (Senior Technician)
M Fennell (Senior Technician)

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Hexthorpe,
Doncaster,
DN4 0AR
Tel: 01302 768098
Email: rberriman@prosoils.co.uk
awatkins@prosoils.co.uk

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Description of Sample
TP-B1		B&D	0.50		Brown slightly sandy slightly gravelly CLAY.
TP-B1		B	0.70		Brown COBBLES.
TP-B2		B&D	3.50		Brown silty SAND & GRAVEL.
TP-B3		B&D	1.20		Brown sandy slightly gravelly CLAY.
TP-B5		B&D	0.50		Brown slightly sandy very gravelly CLAY.
TP-48		B&D	3.50		Grey sandy gravelly SILT.
TP-49		B&D	1.50		Grey sandy gravelly SILT.
TP-49		B&D	2.50		Grey sandy slightly gravelly SILT.
TP-50		B&D	3.00		Grey sandy gravelly SILT.
TP-51		B&D	2.50		Grey sandy gravelly SILT.
TP-51		B&D	4.00		Brown clayey sandy GRAVEL with cobbles.

SUMMARY OF SOIL CLASSIFICATION TESTS

(BS1377 : PART 2 : 1990)

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Moisture Content % Clause 3.2	Linear Shrinkage % Clause 6.5	Particle Density Mg/m^3 Clause 8.2	Liquid Limit % Clause 4.3/4	Plastic Limit % Clause 5.3	Plasticity Index % Clause 5.4	Passing .425mm %	Remarks
TP-B1		B&D	0.50		18			36	20	16	85	Intermediate Plasticity CI
TP-B2		B&D	3.50		12							
TP-B3		B&D	1.20		13			23	15	8	81	Low Plasticity CL
TP-B5		B&D	0.50		17			45	26	19	31	Intermediate Plasticity CI
TP-48		B&D	3.50		14				NP			
TP-49		B&D	1.50		9.5				NP			
TP-50		B&D	3.00		5.3				NP			
TP-51		B&D	2.50		10				NP			

SYMBOLS : **NP : Non Plastic** *** : Liquid Limit and Plastic Limit Wet Sieved.**

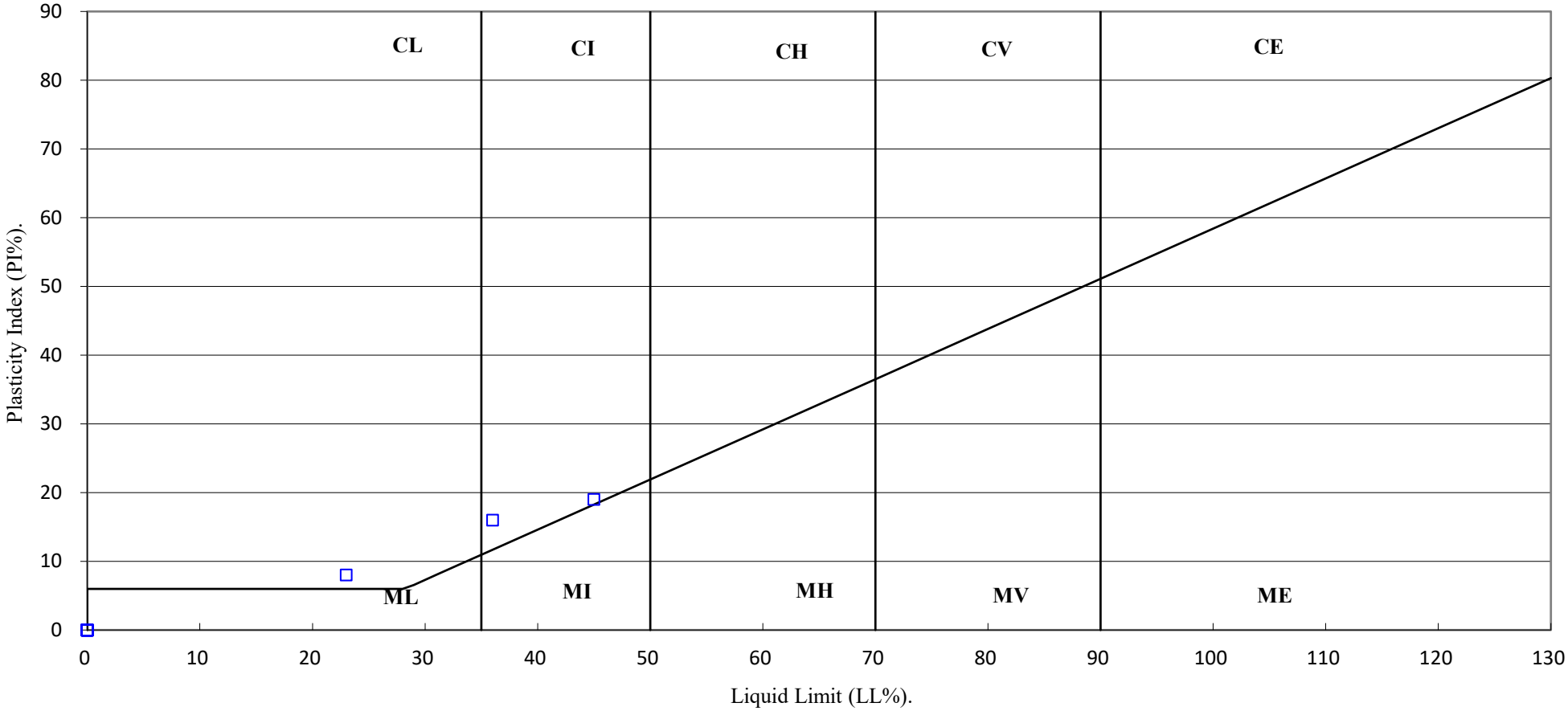
UKAS TESTING 4043

PSL PROFESSIONAL SOILS LABORATORY A PHENNA GROUP COMPANY

Littleton Wind Farm Borrow Pit

Contract No:
PSL23/10530
Client Ref:
13103-08-23

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION.



UKAS TESTING 4043	PSL PROFESSIONAL SOILS LABORATORY A PHENNA GROUP COMPANY	**Littleton Wind Farm Borrow Pit**	**Contract No:**
			PSL23/10530
			Client Ref:
			13103-08-23

PARTICLE SIZE DISTRIBUTION TEST

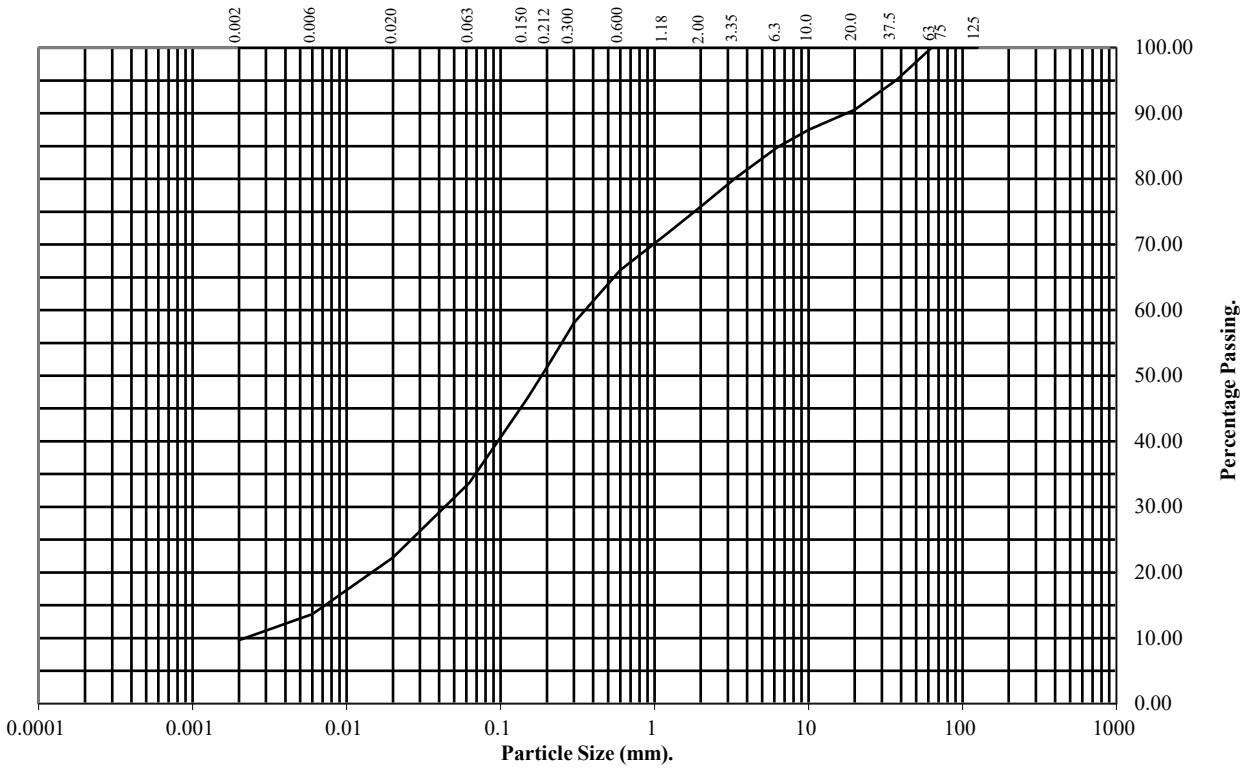
BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number: TP-49 **Top Depth (m):** 2.50

Sample Number: **Base Depth(m):**

Sample Type: B&D



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	95
20	91
10	87
6.3	85
3.35	80
2	76
1.18	71
0.6	66
0.3	58
0.212	52
0.15	47
0.063	34

Particle Diameter	Percentage Passing
0.02	22
0.006	14
0.002	10

Soil Fraction	Total Percentage
Cobbles	0
Gravel	24
Sand	42
Silt	24
Clay	10

Remarks:
See Summary of Soil Descriptions

UKAS TESTING 4043

PSL PROFESSIONAL SOILS LABORATORY A PHENNA GROUP COMPANY

Littleton Wind Farm Borrow Pit

Contract No: PSL23/10530

Client Ref: 13103-08-23

PARTICLE SIZE DISTRIBUTION TEST

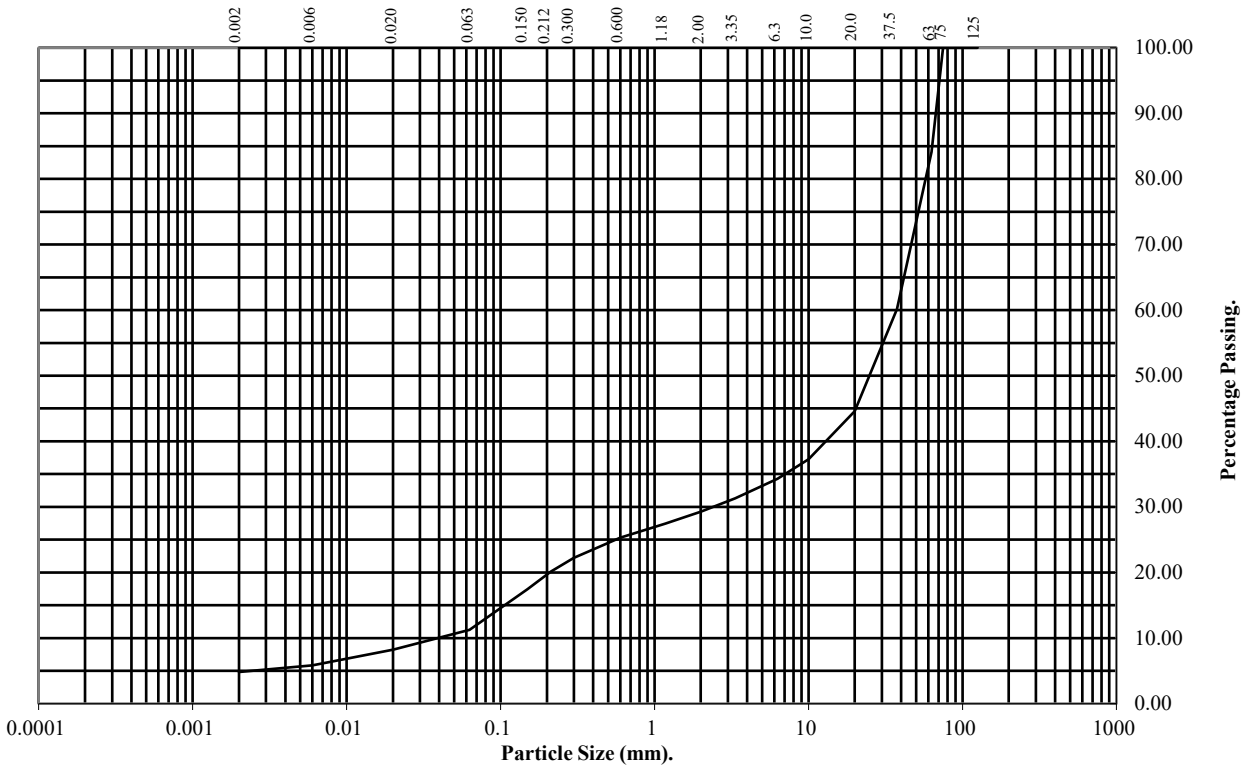
BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number: TP-51 **Top Depth (m):** 4.00

Sample Number: **Base Depth(m):**

Sample Type: B&D



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	84
37.5	60
20	45
10	37
6.3	34
3.35	31
2	29
1.18	27
0.6	25
0.3	22
0.212	20
0.15	17
0.063	11

Particle Diameter	Percentage Passing
0.02	8
0.006	6
0.002	5

Soil Fraction	Total Percentage
Cobbles	16
Gravel	55
Sand	18
Silt	6
Clay	5

Remarks:
See Summary of Soil Descriptions

UKAS TESTING 4043

PSL PROFESSIONAL SOILS LABORATORY A PHENNA GROUP COMPANY

Littleton Wind Farm Borrow Pit

Contract No:
PSL23/10530
Client Ref:
13103-08-23

PARTICLE SIZE DISTRIBUTION TEST

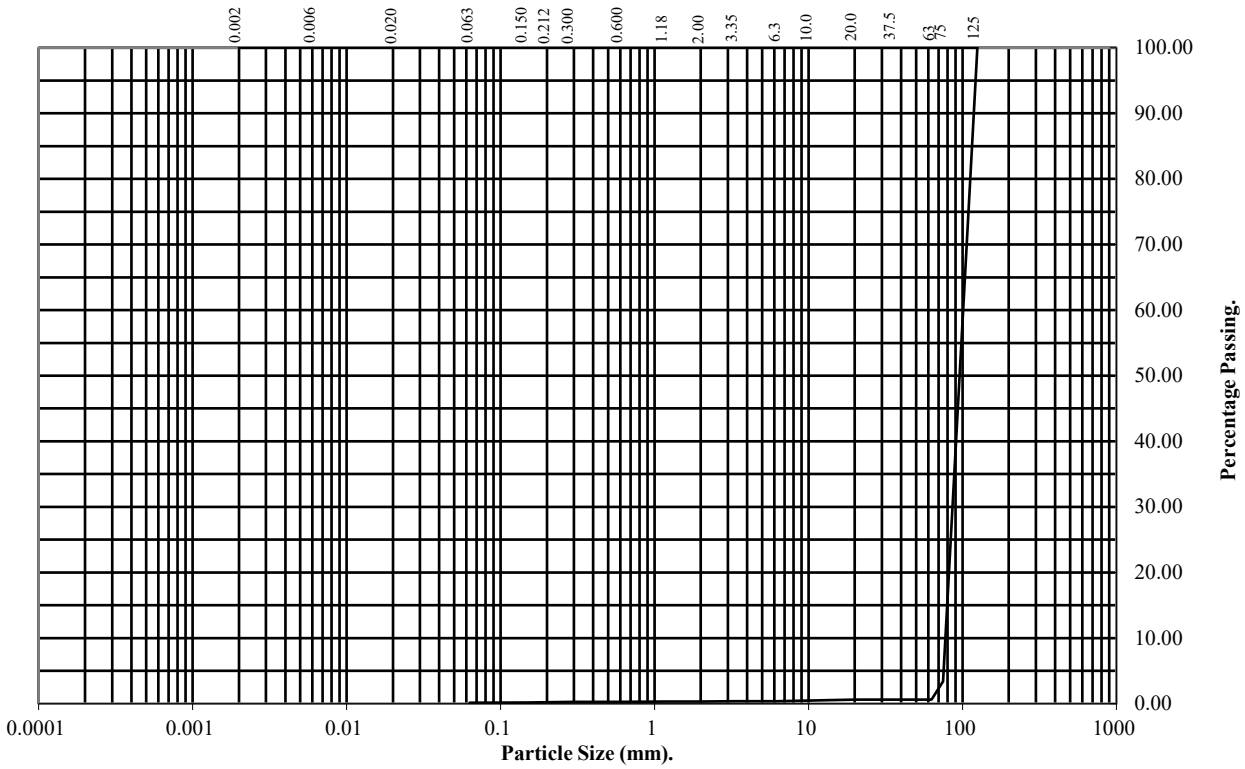
BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: TP-B1 **Top Depth (m):** 0.70

Sample Number: **Base Depth(m):**

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	3
63	1
37.5	1
20	1
10	0
6.3	0
3.35	0
2	0
1.18	0
0.6	0
0.3	0
0.212	0
0.15	0
0.063	0

Soil Fraction	Total Percentage
Cobbles	99
Gravel	1
Sand	0
Silt/Clay	0

Remarks:
See Summary of Soil Descriptions

PARTICLE SIZE DISTRIBUTION TEST

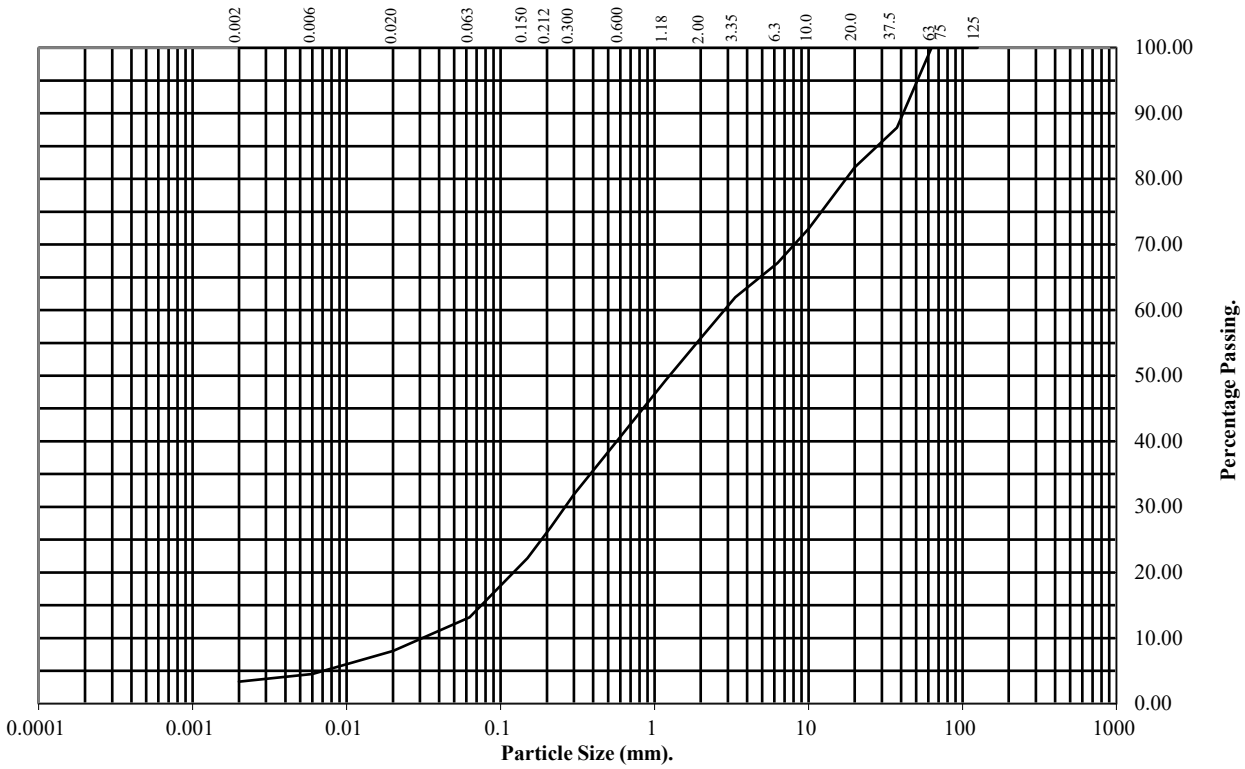
BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number: TP-B2 **Top Depth (m):** 3.50

Sample Number: **Base Depth(m):**

Sample Type: B&D



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	88
20	82
10	72
6.3	67
3.35	62
2	56
1.18	49
0.6	41
0.3	32
0.212	27
0.15	22
0.063	13

Particle Diameter	Percentage Passing
0.02	8
0.006	5
0.002	3

Soil Fraction	Total Percentage
Cobbles	0
Gravel	44
Sand	43
Silt	10
Clay	3

Remarks:
See Summary of Soil Descriptions

UKAS TESTING 4043

PSL PROFESSIONAL SOILS LABORATORY A PHENNA GROUP COMPANY

Littleton Wind Farm Borrow Pit

Contract No: PSL23/10530

Client Ref: 13103-08-23

PARTICLE SIZE DISTRIBUTION TEST

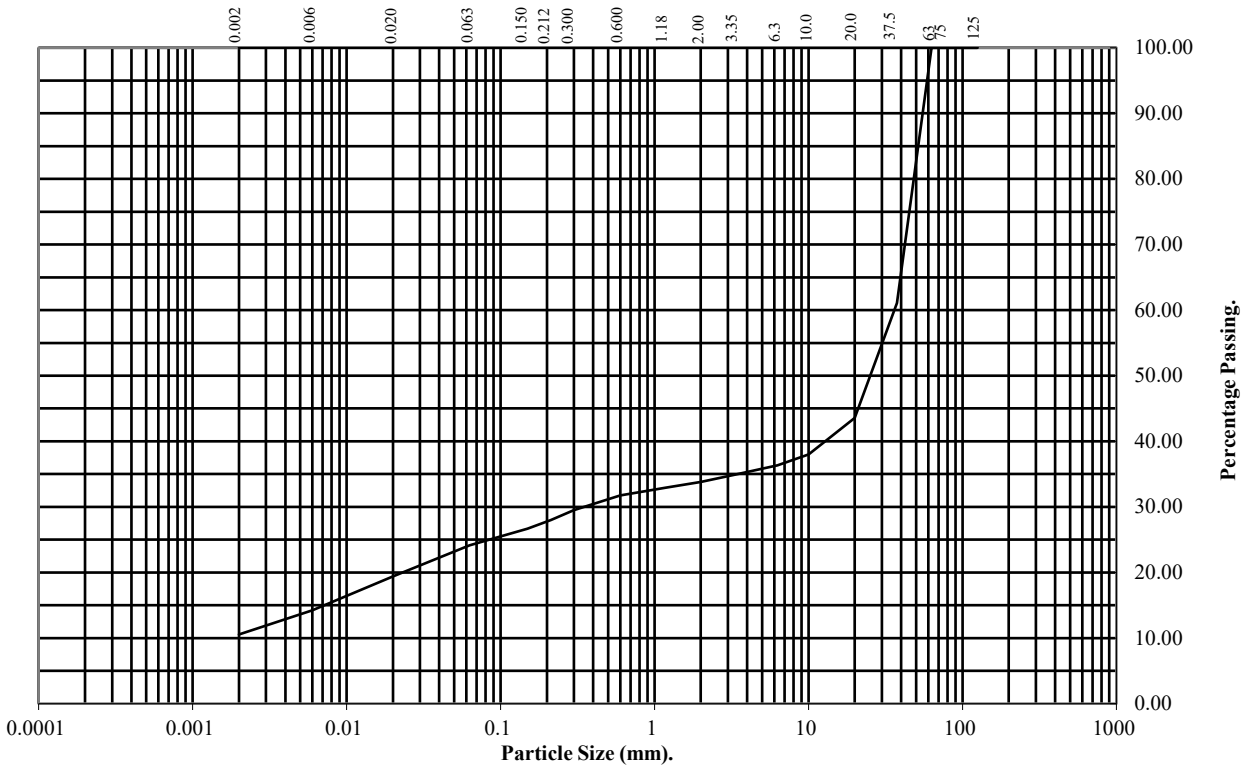
BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number: TP-B5 **Top Depth (m):** 0.50

Sample Number: **Base Depth(m):**

Sample Type: B&D



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	61
20	44
10	38
6.3	36
3.35	35
2	34
1.18	33
0.6	32
0.3	30
0.212	28
0.15	27
0.063	24

Particle Diameter	Percentage Passing
0.02	19
0.006	14
0.002	11

Soil Fraction	Total Percentage
Cobbles	0
Gravel	66
Sand	10
Silt	13
Clay	11

Remarks:
See Summary of Soil Descriptions

UKAS TESTING 4043

PSL PROFESSIONAL SOILS LABORATORY A PHENNA GROUP COMPANY

Littleton Wind Farm Borrow Pit

Contract No: PSL23/10530

Client Ref: 13103-08-23

CMTL Ireland Limited
Unit D, Zone 5, Clonminam Business Park
Portlaoise, Co. Laois R32 W30Y
Tel: 057 8664885

CONSTRUCTION MATERIALS TESTING LABORATORIES
A PHENNA GROUP COMPANY

Laboratory Test Report
Point Load Strength Index

Project :	Littleton Wind Farm Borrow Pit	**Job Number**	13103-08-23
Client :	Ground Investigations Ireland	**Lab Ref No**	ST 27246
	Catherinestown House, Hazelhatch Road	**Date Received**	17/01/2024
	Newcastle, Co. Dublin	**Date Tested**	22/01/2024
Originator :	Eoin Byrne	**Date Reported**	23/01/2024

Point Load Strength Index

Sample No:-	Depth (m)	Description	Type	Orientation	W (mm)	D (mm)	P (kN)	A	De (mm)	I_s	F	$I_{s(50)}$MN/m²
BH-03	9.55-9.75	1,2	A	⊥	63.0	63.0	23.00	3969	63.0	5.795	1.11	6.43
BH-03	10.40-10.60	1,2	A	⊥	66.0	63.0	21.00	4158	63.0	5.291	1.11	5.87
BH-03	11.85-12.00	1,2	A	⊥	63.0	63.0	5.50	3969	63.0	1.386	1.11	1.54
BH-B1	2.75-3.00	1,2,3	A	⊥	64.0	63.0	18.00	4032	63.0	4.535	1.11	5.03
BH-B1	5.00-5.25	1,2,3,4	A	⊥	65.0	63.0	18.00	3969	63.0	4.535	1.11	5.03
BH-B1	5.40-5.65	2,3,4,5	A	⊥	66.0	63.0	15.00	3969	63.0	3.779	1.11	4.19
BH-B2	2.00-2.10	1	A	⊥	64.0	63.0	19.00	3969	63.0	4.787	1.11	5.31
BH-B2	4.05-4.17	1,3	A	⊥	66.0	63.0	20.00	3969	63.0	5.039	1.11	5.59
BH-B2	5.25-5.50	1	A	⊥	64.0	63.0	21.00	3969	63.0	5.291	1.11	5.87
BH-B3	2.95-3.00	1	A	⊥	63.0	63.0	18.00	3969	63.0	4.535	1.11	5.03
BH-B3	4.35-4.55	1,2	A	⊥	65.0	63.0	14.00	3969	63.0	3.527	1.11	3.91
BH-B3	5.40-5.75	1,2	A	⊥	65.0	63.0	11.00	3969	63.0	2.771	1.11	3.08
BH-B4	3.25-3.30	2,3,4	A	⊥	63.0	63.0	2.30	3969	63.0	0.579	1.11	0.64
BH-B4	5.35-5.60	1,2,3,4	A	⊥	64.0	63.0	10.00	3969	63.0	2.520	1.11	2.80
BH-B4	6.60-6.75	1,2,3,4	A	⊥	65.0	63.0	18.00	3969	63.0	4.535	1.11	5.03

Description 1 : Grey Rock
Description 2 : Cracks
Description 3 : White Veins
Description 4: Brown Rock
Description 5 : Red Rock

$I_{s(50)}$MN/m² for	Description 1,2,3,4,5	
Min	0.64	
Mean	5.03	
Max	6.43	

Test	Relationship to planes of weakness	
A = axial	IL = irregular lump	⊥ = perpendicular
D = diametrical	II = parallel	

	Mean Value	
	$I_{s(50)}$MN/m²	U.C.S. MN/m²
Extremely Weak	<0.05	0.6-1.0
Very Weak	0.05-0.20	1.0-5.0
Weak	0.20-0.50	5.0-25.0
Medium Strong	0.50-2.00	25-50
Strong	2.00-4.50	50-100
Very Strong	4.50-9.00	100-250
Extremely Strong	9.00 +	>250

The stated result only relates to the item/location tested, this report shall not be reproduced except in full.

pp.

Approved Signature
James Ward, Operations Manager
CMTL Ireland Limited

CMTL Ireland Limited
Unit D, Zone 5, Clonminam Business Park
Portlaoise, Co. Laois R32 W30Y
Tel: 057 8664885

Laboratory Test Report
Uniaxial Compressive Strength

Project:	Littleton Wind Farm Borrow Pit	**Job Number**	13103-08-23
Client:	Ground Investigations Ireland	**Lab Ref No**	ST 27247
	Catherinestown House, Hazelhatch Road	**Date Received**	17/01/2024
	Newcastle. Co. Dublin	**Date Tested**	22/01/2024
Originator:	Eoin Byrne	**Date Reported**	23/01/2024

Sample Reference	Moisture Content	Density (Mg/m^3)	Uniaxial Compressive Strength (N/mm^2)
BH-B1 4.45-4.70 RC	2.6	2681	96.7
BH-B2 3.10-3.35 RC	0.4	2638	104.1
BH-B3 4.00-4.25 RC	2.2	2695	108.9

Remarks: Cores BH-B1 4.45-4.70 & BH-B2 3.10-3.35 Visible Cracks

pp.

Approved Signature
James Ward, Operations Manager
CMTL Ireland Limited

CMTL Ireland Limited
Unit D, Zone 5, Clonminam Business Park
Portlaoise, Co. Laois R32 W30Y
Tel: 057 8664885

CONSTRUCTION MATERIALS TESTING LABORATORIES
A PHENNA GROUP COMPANY

LABORATORY TEST REPORT

To determine Fragmentation of Aggregate - Los Angeles
Test Method in accordance with BS EN 1097-2: 2020

Project:	Littleton Wind Farm Borrow Pit	**Job No.:**	PL
Client:	Ground Investigations Ireland	**Lab Ref. No.:**	ST 27250
	Catherinestown House, Hazelhatch Road	**Date Received:**	17/01/2024
	Newcastle, Co. Dublin	**Date Reported:**	26/02/2024
		Material:	Rock Core
Order No.:	13103-08-23	**Date Tested:**	20/02/2024
Originator:	James Cashen	**Specification:**	Client

Sample Details **BH-B1 2.45 - 5.65**

Supplier:	Ground Investigations Ireland	**Date of Sampling:**	Client Info
Source:	Littleton Wind Farm Borrow Pit	**Sampled By:**	Client
Sample Location:	BH-B1 4.45 - 4.70	**Sampling Reason:**	Request

Results

Size Fraction from which the test portion was obtained:	**14mm to 12.5mm** **12.5mm to 10.0mm**
Los Angeles Coefficient (LA) =	**54**

Comments:
None

The stated result only relates to the item/location tested, this report shall not be reproduced except in full.
Tested in accordance with the above specifications
Subcontracted to a laboratory accredited for this testing

JRWard

Approved Signature
James Ward, Operations Manager
CMTL Ireland Limited

CMTL Ireland Limited
Unit D, Zone 5, Clonminam Business Park
Portlaoise, Co. Laois R32 W30Y
Tel: 057 8664885

CONSTRUCTION MATERIALS TESTING LABORATORIES
A PHENNA GROUP COMPANY

LABORATORY TEST REPORT

To determine Fragmentation of Aggregate - Los Angeles
Test Method in accordance with BS EN 1097-2: 2020

Project:	Littleton Wind Farm Borrow Pit	**Job No.:**	PL
Client:	Ground Investigations Ireland	**Lab Ref. No.:**	ST 27251
	Catherinestown House, Hazelhatch Road	**Date Received:**	17/01/2024
	Newcastle, Co. Dublin	**Date Reported:**	26/02/2024
		Material:	Rock Core
Order No.:	13103-08-23	**Date Tested:**	20/02/2024
Originator:	James Cashen	**Specification:**	Client

Sample Details **BH-B3 2.95 - 5.75**

Supplier:	Ground Investigations Ireland	**Date of Sampling:**	Client Info
Source:	Littleton Wind Farm Borrow Pit	**Sampled By:**	Client
Sample Location:	BH-B3 4.35 - 4.55	**Sampling Reason:**	Request

Results

Size Fraction from which the test portion was obtained:	**14mm to 12.5mm** **12.5mm to 10.0mm**
Los Angeles Coefficient (LA) =	**24**

Comments:
None

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Tested in accordance with the above specifications
Subcontracted to a laboratory accredited for this testing

JRWard
Approved Signature
James Ward, Operations Manager
CMTL Ireland Limited

CMTL Ireland Ltd
Unit D, Zone 5, Clonminam Business Park
Portlaoise, Co.Laois R32 W30Y
Tel: 057 8664885

CONSTRUCTION MATERIALS TESTING LABORATORIES
A PHENNA GROUP COMPANY

LABORATORY TEST REPORT

To determine Slake Durability Index of an Aggregate Sample in accordance with ASTM D 4644-16

Project:	Littleton Wind Farm Borrow Pit	**Job No.:**	N/A
Client:	Ground Investigations Ireland	**Lab Ref. No.:**	ST 27248
	Catherinestown House, Hazelhatch Road	**Date Received:**	17/01/2024
	Newcastle	**Date Reported:**	23/01/2024
	Co. Dublin	**Date Tested:**	18/01/2024
Order No.:	13103-08-23	**Material:**	Rock Core
Originator:	Eoin Byrne	**Specification:**	Client

Sample Details **BH-B1 2.45 - 5.65**

Sample Supplier:	Ground Investigations Ireland	**Date of Sampling:**	Client Info
Sample Source:	Littleton Wind Farm Borrow Pit	**Ticket No.**	N/A
Sample Location:	Littleton Wind Farm Borrow Pit	**Sampled By:**	Client
Sample Cert:	No	**Sampling Reason:**	Routine

Results

Test	Result
Slake Durability % (Second Cycle)	**98.7**
Natural Water Content (%)	1.5
Water Temperature Range (°C)	18.3 to 18.3
Average Water Temperature (°C)	18.3

The stated result only relates to the item/location tested, this report shall not be reproduced except in full.
Tested in accordance with the above specification

Description of the appearance of the fragments retained in the drum:
Type I - Retained pieces remain virtually unchanged

pp.

Approved Signature
CMTL Ireland Ltd
James Ward, Operations Manager

ISO 17025 I NAB ACCREDITED TESTING DETAILED IN SCOPE REG NO.3921

CMTL Ireland Ltd
Unit D, Zone 5, Clonminam Business Park
Portlaoise, Co.Laois R32 W30Y
Tel: 057 8664885

CONSTRUCTION MATERIALS TESTING LABORATORIES
A PHENNA GROUP COMPANY

LABORATORY TEST REPORT

To determine Slake Durability Index of an Aggregate Sample in accordance with ASTM D 4644-16

Project:	Littleton Wind Farm Borrow Pit	**Job No.:**	N/A
Client:	Ground Investigations Ireland	**Lab Ref. No.:**	ST 27249
	Catherinestown House, Hazelhatch Road	**Date Received:**	17/01/2024
	Newcastle	**Date Reported:**	23/01/2024
	Co. Dublin	**Date Tested:**	18/01/2024
Order No.:	13103-08-23	**Material:**	Rock Core
Originator:	Eoin Byrne	**Specification:**	Client

Sample Details | **BH-B3 2.95-5.75**

Sample Supplier:	Ground Investigations Ireland	**Date of Sampling:**	Client Info
Sample Source:	Littleton Wind Farm Borrow Pit	**Ticket No.**	N/A
Sample Location:	Littleton Wind Farm Borrow Pit	**Sampled By:**	Client
Sample Cert:	No	**Sampling Reason:**	Routine

Results

Test	Result
Slake Durability % (Second Cycle)	**98.6**
Natural Water Content (%)	1.0
Water Temperature Range (°C)	18.4 to 18.4
Average Water Temperature (°C)	18.4

The stated result only relates to the item/location tested, this report shall not be reproduced except in full.
Tested in accordance with the above specification

Description of the appearance of the fragments retained in the drum:
Type I - Retained pieces remain virtually unchanged

pp.

Approved Signature
CMTL Ireland Ltd
James Ward, Operations Manager

ISO 17025 I NAB ACCREDITED TESTING DETAILED IN SCOPE REG NO.3921

APPENDIX 5 – Groundwater Monitoring

GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental

Catherinestown House,
Hazelhatch Road,
Newcastle,
Co. Dublin.
D22 YD52

Tel: 01 601 5175 / 5176
Email: info@gii.ie
Web: www.gii.ie

GROUNDWATER MONITORING

Littleton Wind Farm Borrow Pit

BOREHOLE	DATE	TIME	GROUNDWATER (m BGL)	Comments
BH-01	01/03/2024	9.55am	0.85	
BH-03	01/03/2024	10.05am	1.12	
BH-B1	01/03/2024	8.55am	5.81	
BH-B2	01/03/2024	9.25am	5.19	
BH-B3	01/03/2024	9.20am	5.63	
BH-B4	01/03/2024	9.10am	6.23	

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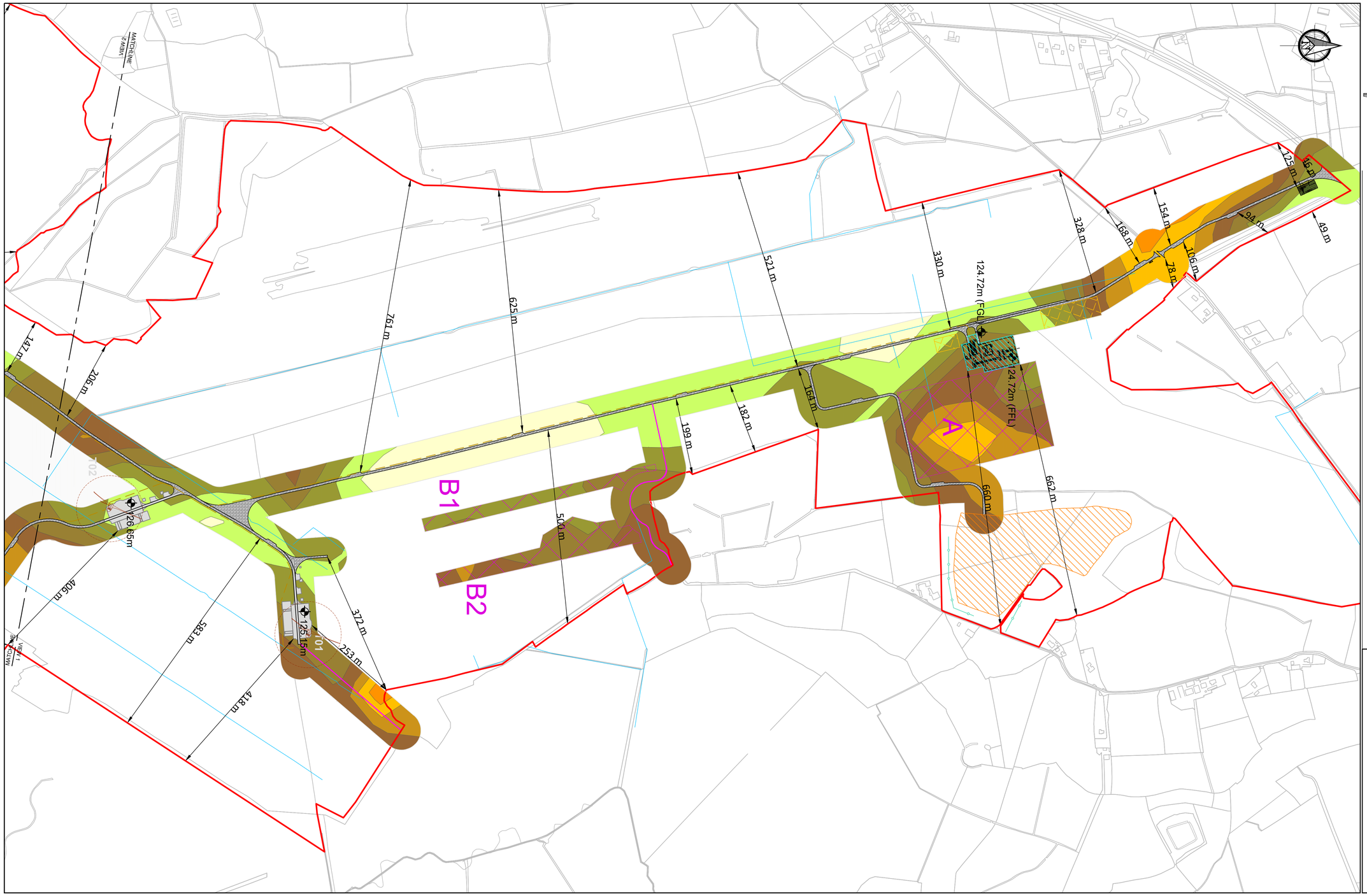
DESIGNING AND DELIVERING
A SUSTAINABLE FUTURE

APPENDIX H

Drawings

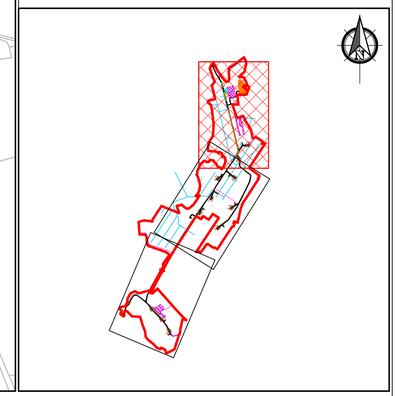


Legend

- Planning Boundary
- Proposed Wind Farm Access Track.
- Proposed Passing Bays
- Proposed Turning Areas
- Proposed Turbine And Hardstanding Areas
- Proposed Peat Deposition Areas
- Proposed Borrow Pit Area
- Proposed BEMP Area
- Proposed Construction Compound
- Existing Recreational Amenity Car Park
- Proposed Recreational Amenity Car Park
- Proposed Substation Compound
- Proposed Security Building
- Existing Drainage
- Proposed Recreational Amenity Trail
- Existing Recreational Amenity Trail
- Proposed Internal Collector Circuit
- Proposed Minimum Noise Barrier
- X.Xm Proposed Hardstand Finished Level
- PMM Permanent Metrological Mast

Peat Depth Legend

≥ 0 < 0.5	≥ 3 < 3.5
≥ 0.5 < 1	≥ 3.5 < 4
≥ 1 < 1.5	≥ 4 < 4.5
≥ 1.5 < 2	≥ 4.5 < 5
≥ 2 < 2.5	≥ 5 < 5.5
≥ 2.5 < 3	≥ 5.5 ≤ 6



PLAN
Scale 1:5000

KEYPLAN
Scale 1:100000

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Rev.	Description	App By	Date
P01	ISSUE FOR PLANNING	JH	16.04.26

PROJECT: LITTLETON WIND FARM

CLIENT: LITTLETON WIND FARM DAC

SHEET: PEAT DEPTH CONTOUR PLAN SHEET 1 OF 3

Date: 16.04.26
Project number: P20-211
Scale (@ A1): As Shown
Drawn by: POR
Drawing Number: P20-211-0600-0001
Rev: P01
Checked by: AC

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13 May 2026

Legend

- Planning Boundary
- Proposed Wind Farm Access Track.
- Proposed Passing Bays
- Proposed Turning Areas
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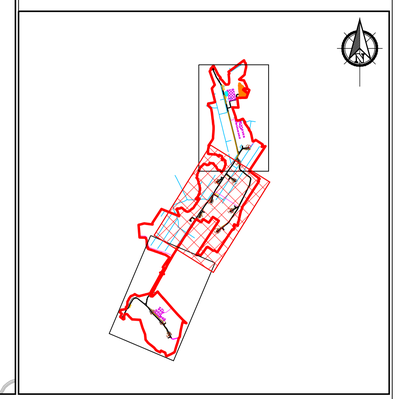
≥ 2.5 < 3	≥ 5.5 ≤ 6



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Scale 1:100000

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Rev.	Description	App By	Date
P01	ISSUE FOR PLANNING	JH	16.04.26

PROJECT	LITTLETON WIND FARM
CLIENT	LITTLETON WIND FARM DAC
SHEET	PEAT DEPTH CONTOUR PLAN SHEET 2 OF 3
Date	16.04.26
Project number	P20-211
Scale (@ A1)	As Shown
Drawn by	POR
Drawing Number	P20-211-0600-0002
Rev	P01
Checked by	AC

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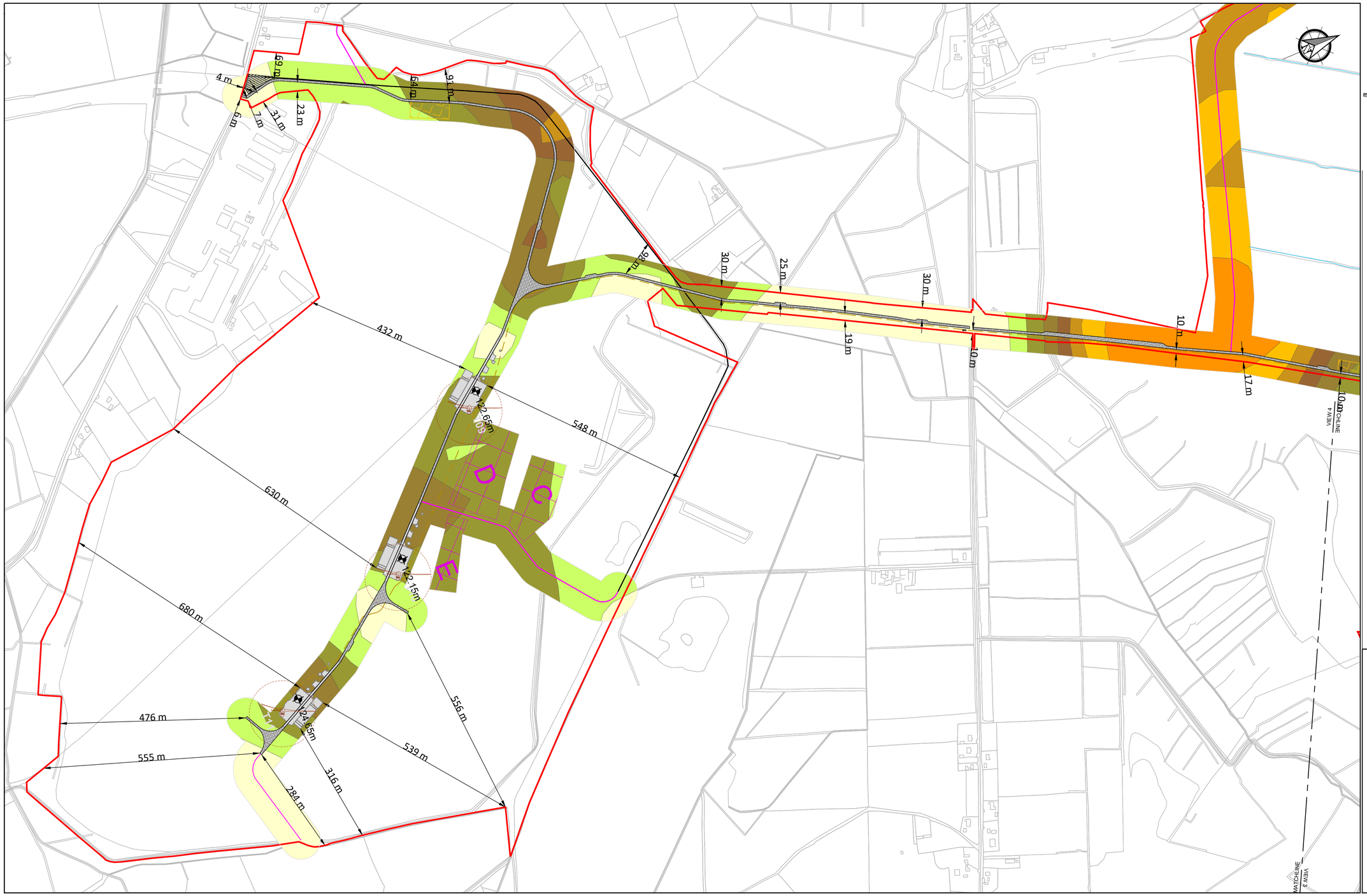

Legend

- Planning Boundary
- Proposed Wind Farm Access Track.
- Proposed Passing Bays
- Proposed Turning Areas
- Proposed Turbine And Hardstanding Areas
- Proposed Peat Deposition Areas
- Proposed Borrow Pit Area
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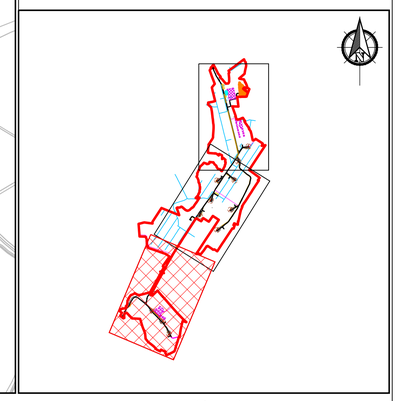
≥ 2 < 2.5	≥ 5 < 5.5
≥ 2.5 < 3	≥ 5.5 ≤ 6



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Rev.	Description	App By	Date
P01	ISSUE FOR PLANNING	JH	16.04.26

PROJECT
LITTLETON WIND FARM

CLIENT
LITTLETON WIND FARM DAC

SHEET
PEAT DEPTH CONTOUR PLAN SHEET 3 OF 3

Date 16.04.26
Project number P20-211
Scale (@ A1) As Shown
Drawn by POR
Checked by AC
Drawing Number **P20-211-0600-0003**
Rev **P01**

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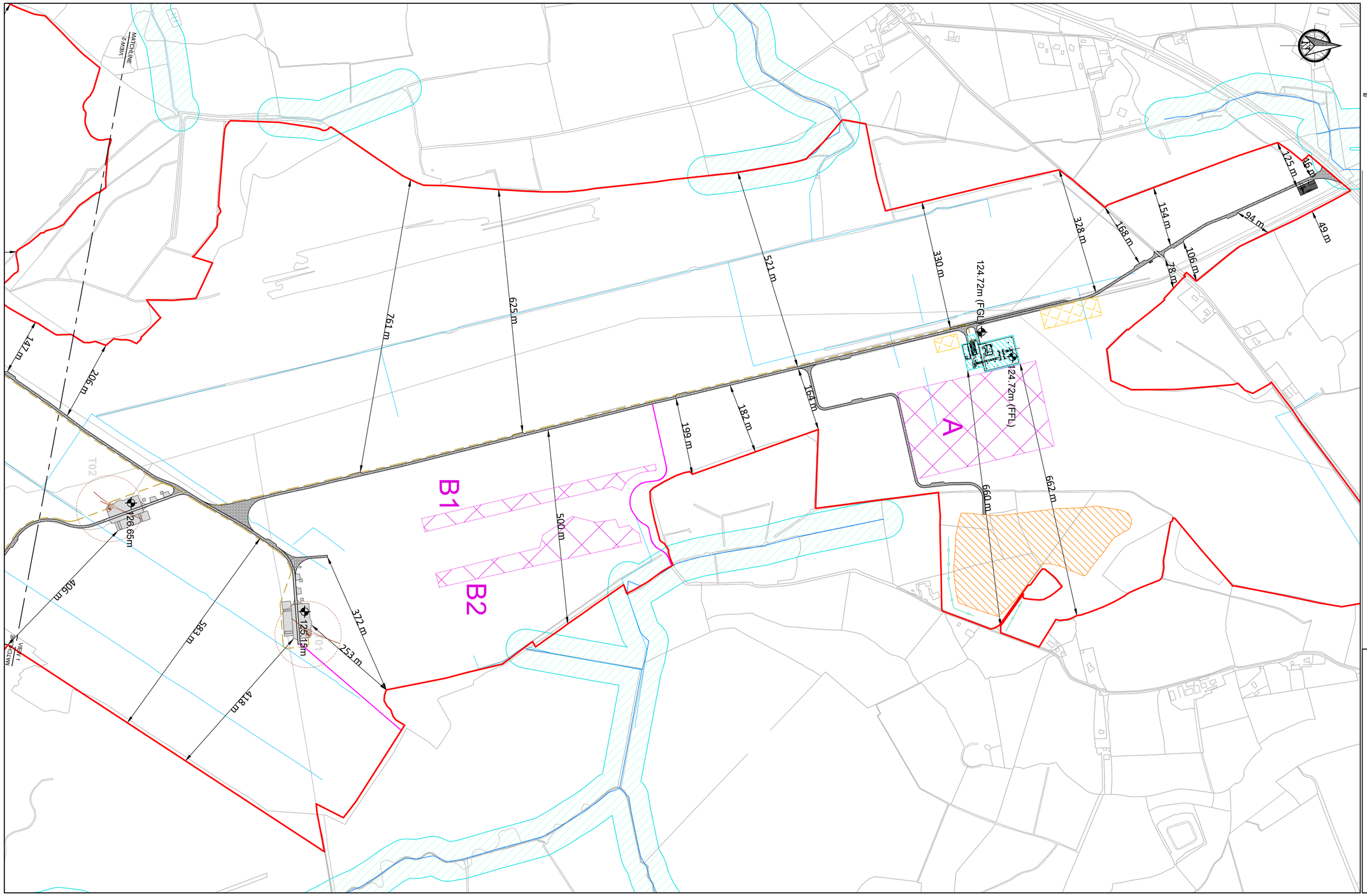
13 May 2026



Legend

- Planning Boundary
- Proposed Wind Farm Access Track.
- Proposed Passing Bays
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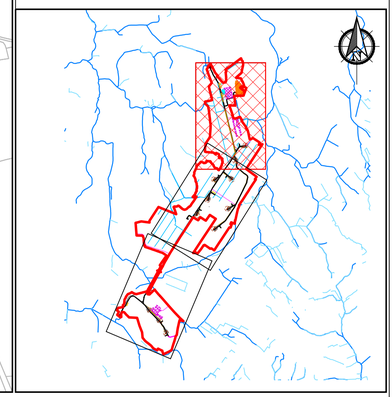
- Existing Recreational Amenity Trail
- Proposed Internal Collector Circuit
- Proposed Minimum Noise Barrier
- X.Xm Proposed Hardstand Finished Level
- PMM Permanent Metrological Mast

Construction Buffer Zone Legend:

- Existing Rivers
- Existing Streams
- 50m buffer around existing rivers / streams
- Buffer zone to areas of deep, soft peat where no construction will be undertaken.



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Rev.	Description	App By	Date
P01	ISSUE FOR PLANNING	JH	16.04.26

PROJECT	LITTLETON WIND FARM
CLIENT	LITTLETON WIND FARM DAC
SHEET	CONSTRUCTION BUFFER ZONE PLAN - SHEET 1 OF 3
Date	16.04.26
Project number	P20-211
Scale (@ A1)	As Shown
Drawn by	POR
Drawing Number	P20-211-0600-0004
Rev	P01
Checked by	AC

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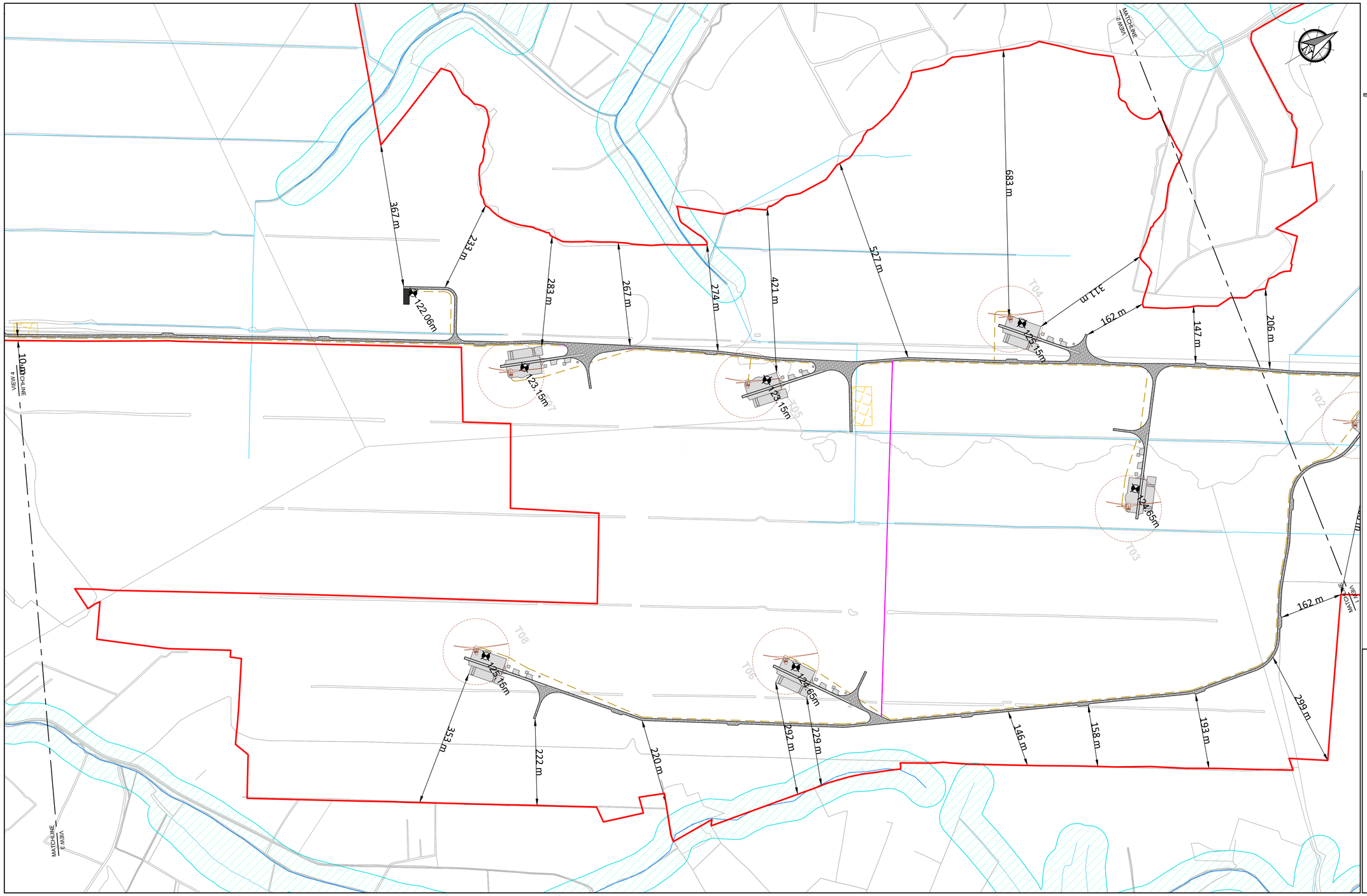
13 May 2026



PLAN

Scale 1:5000

Legend

- Planning Boundary
- Proposed Wind Farm Access Track.
- Proposed Passing Bays
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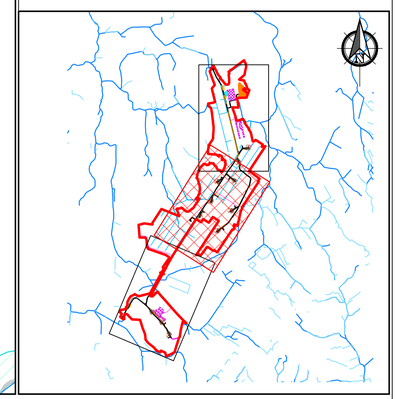

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Rev.	Description	App By	Date
P01	ISSUE FOR PLANNING	JH	16.04.26

PROJECT
LITTLETON WIND FARM

CLIENT
LITTLETON WIND FARM DAC

SHEET
CONSTRUCTION BUFFER ZONE PLAN - SHEET 2 OF 3

Date: 16.04.26
Drawn by: POR
Checked by: AC
Project number: P20-211
Scale (@ A1): As Shown
Drawing Number: **P20-211-0600-0005**
Rev: **P01**

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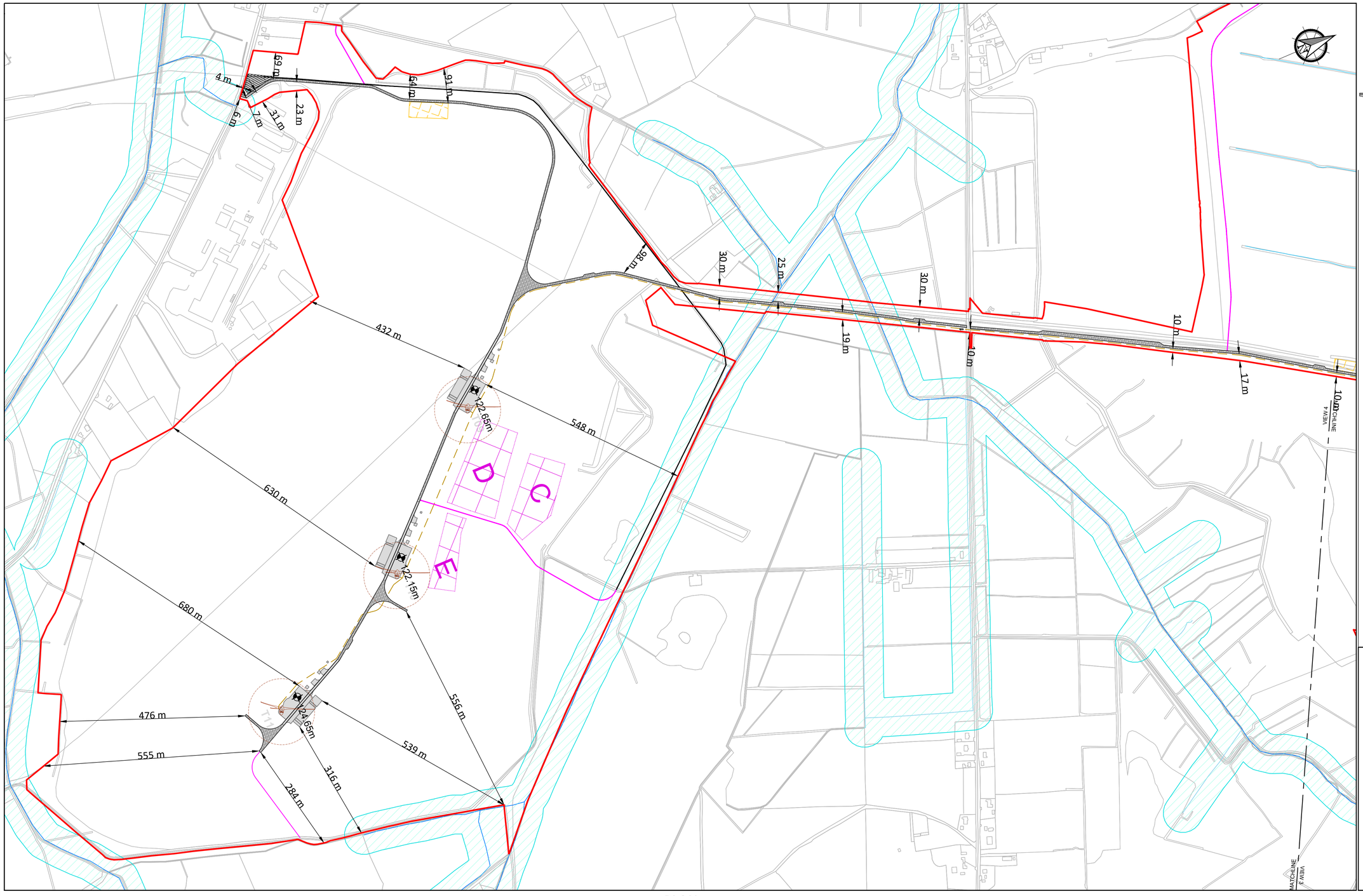
13 May 2026



PLAN

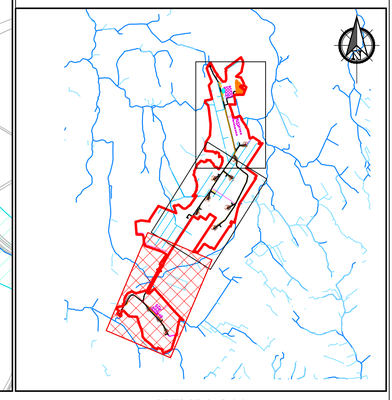
Scale 1:5000

Legend

- Planning Boundary
- Proposed Wind Farm Access Track.
- Proposed Passing Bays
- Proposed Turning Areas
- Proposed Turbine And Hardstanding Areas
- Proposed Peat Deposition Areas
- Proposed Borrow Pit Area
- Proposed BEMP Area
- Proposed Construction Compound
- Existing Recreational Amenity Car Park
- Proposed Recreational Amenity Car Park
- Proposed Substation Compound
- Proposed Security Building
- Existing Drainage
- Proposed Recreational Amenity Trail
- Existing Recreational Amenity Trail
- Proposed Internal Collector Circuit
- Proposed Minimum Noise Barrier
- X.Xm Proposed Hardstand Finished Level
- PMM Permanent Metrological Mast

Construction Buffer Zone Legend:

- Existing Rivers
- Existing Streams
- 50m buffer around existing rivers / streams
- Buffer zone to areas of deep, soft peat where no construction will be undertaken.



KEYPLAN

Scale 1:100000

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Rev.	Description	App By	Date
P01	ISSUE FOR PLANNING	JH	16.04.26

PROJECT: **LITTLETON WIND FARM**

CLIENT: **LITTLETON WIND FARM DAC**

SHEET: **CONSTRUCTION BUFFER ZONE PLAN - SHEET 3 OF 3**

Date: 16.04.26	Project number: P20-211	Scale (@ A1): As Shown
Drawn by: POR	Drawing Number: P20-211-0600-0006	Rev: P01
Checked by: AC		

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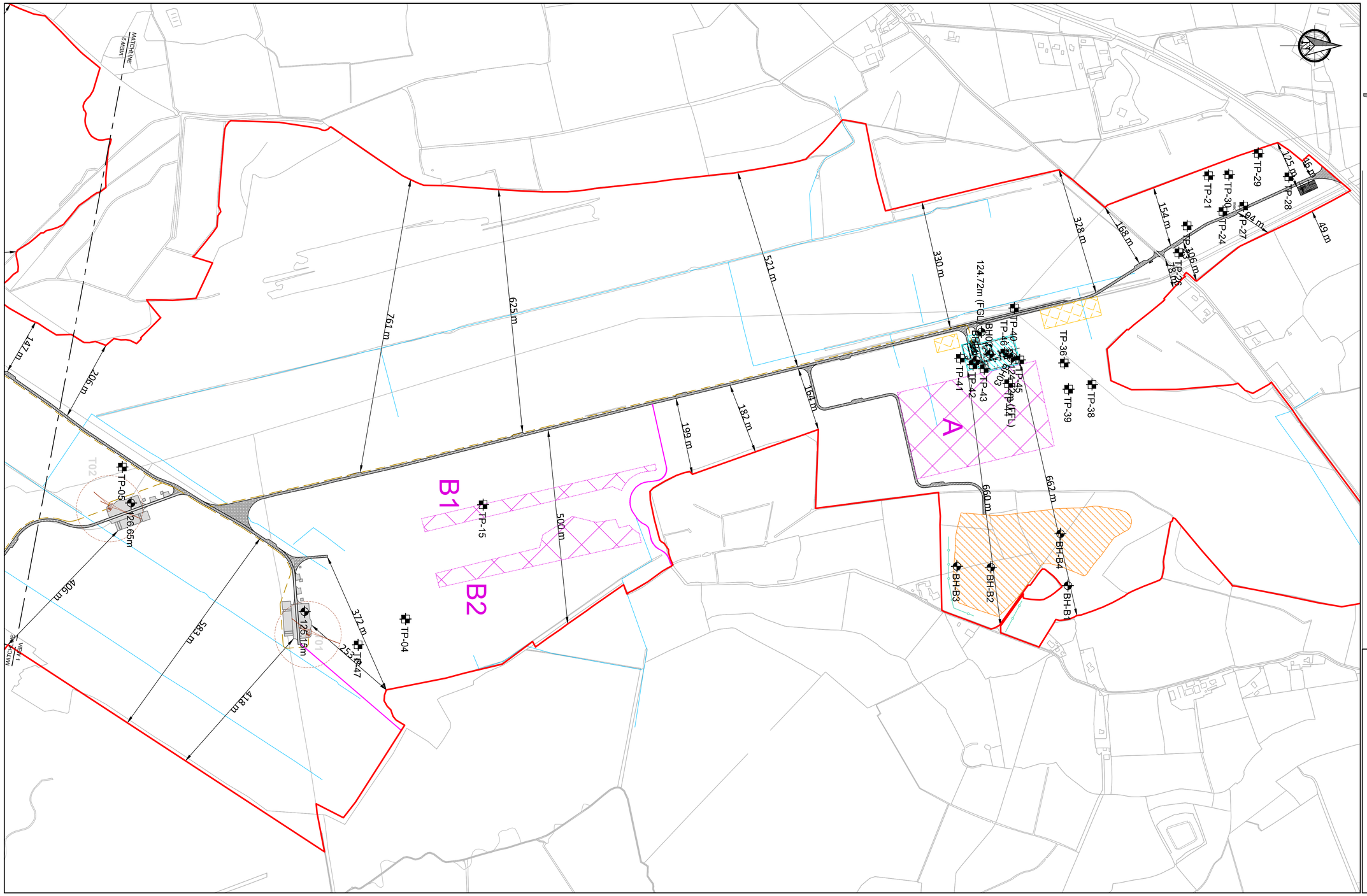
13 May 2026



Legend

- Planning Boundary
- Proposed Wind Farm Access Track.
- Proposed Passing Bays
- Proposed Turning Areas
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- Proposed Peat Deposition Areas
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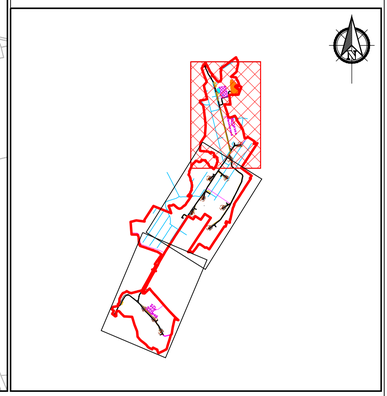
- Proposed Recreational Amenity Trail
- Existing Recreational Amenity Trail
- Proposed Internal Collector Circuit
- Proposed Minimum Noise Barrier
- X.Xm Proposed Hardstand Finished Level
- PMM Permanent Metrological Mast

Ground Investigation Legend:

- TP... Trial Pit Location
- BH-B4 Borehole Location



PLAN
Scale 1:5000

KEYPLAN
Scale 1:100000

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Rev.	Description	App By	Date
P01	ISSUE FOR PLANNING	JH	16.04.26

PROJECT	LITTLETON WIND FARM
CLIENT	LITTLETON WIND FARM DAC
SHEET	GROUND INVESTIGATION LOCATION PLAN - SHEET 1 OF 3
Date	16.04.26
Project number	P20-211
Scale (@ A1)	As Shown
Drawn by	POR
Drawing Number	P20-211-0600-0007
Rev	P01
Checked by	AC

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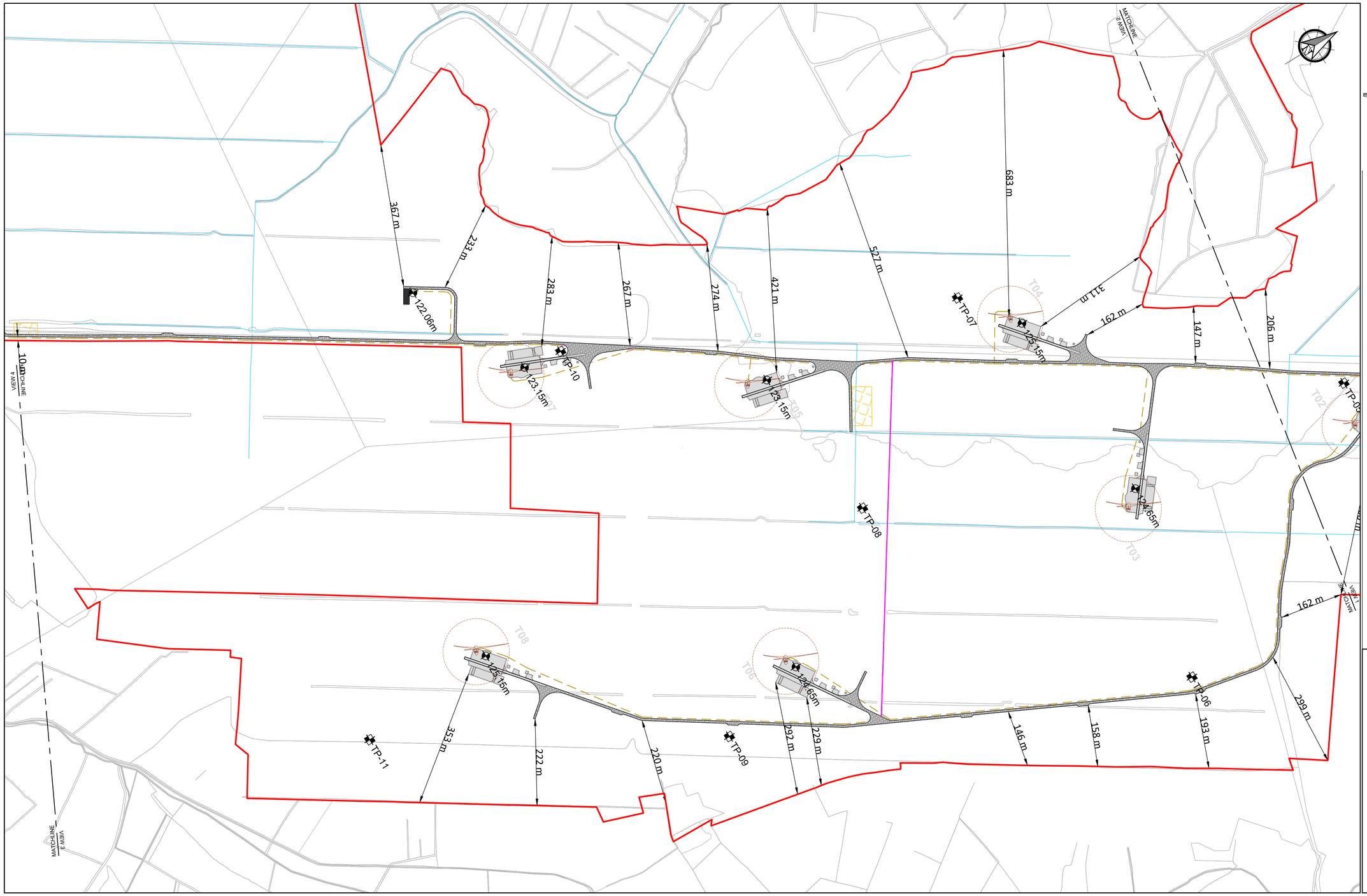
13 May 2026



Legend

- Planning Boundary
- Proposed Wind Farm Access Track.
- Proposed Passing Bays
- Proposed Turning Areas
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- Proposed Peat Deposition Areas
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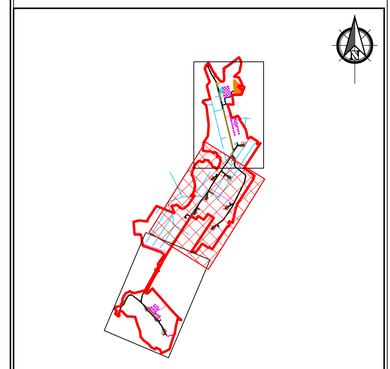
- TP... Trial Pit Location
- BH-B4 Borehole Location



PLAN
Scale 1:5000

KEYPLAN
Scale 1:100000

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Rev.	Description	App By	Date
P01	ISSUE FOR PLANNING	JH	16.04.26

PROJECT	LITTLETON WIND FARM
CLIENT	LITTLETON WIND FARM DAC
SHEET	GROUND INVESTIGATION LOCATION PLAN - SHEET 2 OF 3
Date	16.04.26
Project number	P20-211
Scale (@ A1)	As Shown
Drawn by	POR
Drawing Number	P20-211-0600-0008
Rev	P01
Checked by	AC

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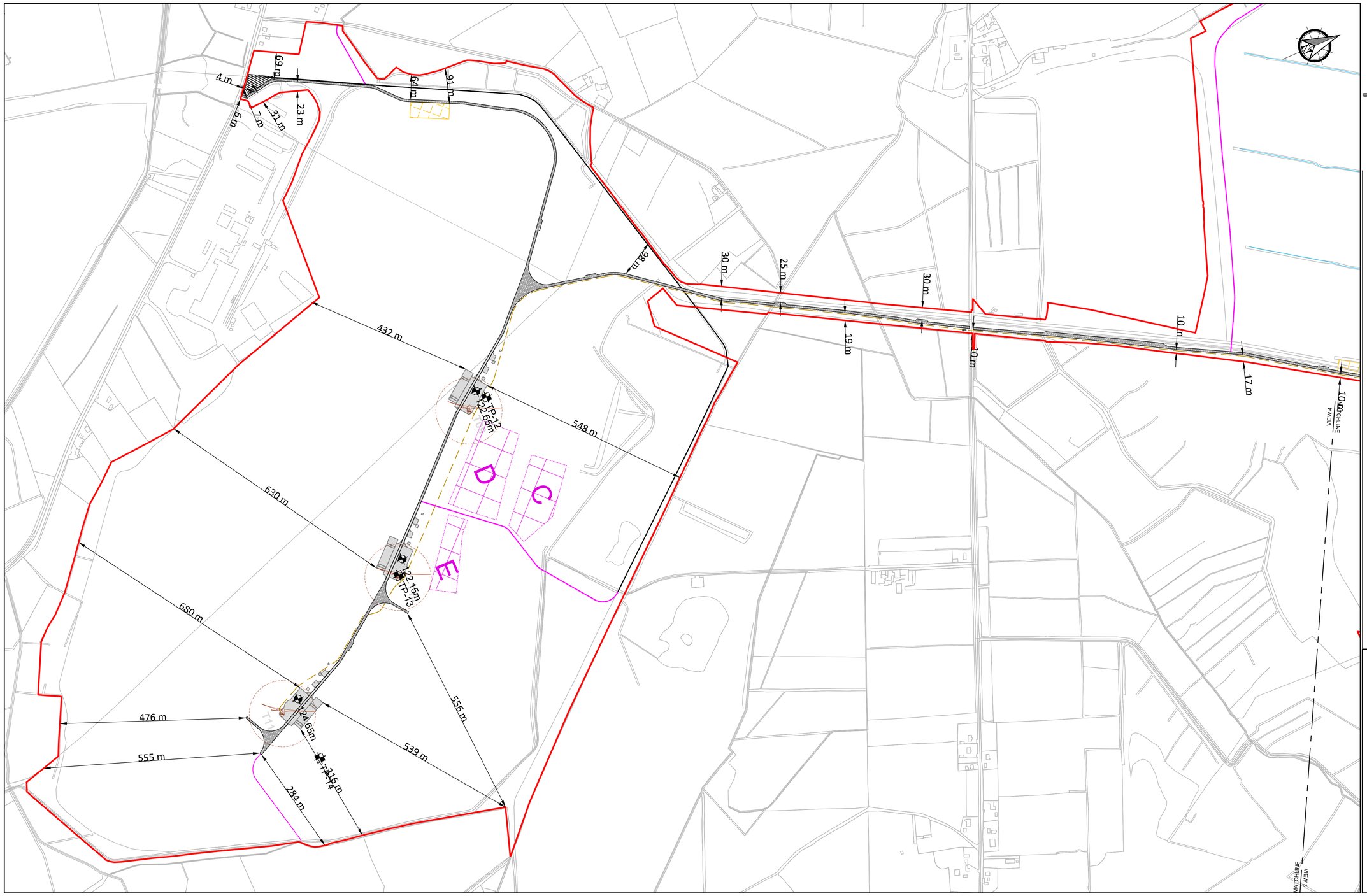
13 May 2026



PLAN

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KEYPLAN

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Rev.	Description	App By	Date
P01	ISSUE FOR PLANNING	JH	16.04.26

PROJECT	LITTLETON WIND FARM
CLIENT	LITTLETON WIND FARM DAC
SHEET	GROUND INVESTIGATION LOCATION PLAN - SHEET 3 OF 3
Date	16.04.26
Project number	P20-211
Scale (@ A1)	As Shown
Drawn by	POR
Drawing Number	P20-211-0600-0009
Rev	P01
Checked by	AC

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13 May 2026

PLAN

Scale 1:5000

Legend

- Planning Boundary
- Proposed Wind Farm Access Track.
- Proposed Passing Bays
- Proposed Turning Areas
- Proposed Turbine And Hardstanding Areas
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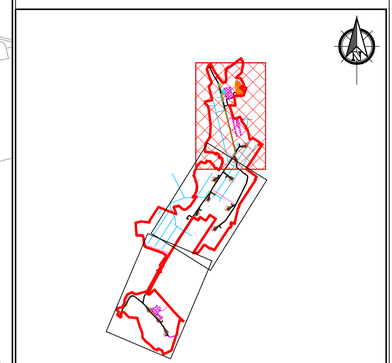
- Proposed Recreational Amenity Trail
- Existing Recreational Amenity Trail
- Proposed Internal Collector Circuit
- Proposed Minimum Noise Barrier
- X.Xm Proposed Hardstand Finished Level
- PMM Permanent Metrological Mast

Factor of Safety Legend:

- 0 < 1.0
- ≥ 1.0 < 1.3
- ≥ 1.3

Increasing Stability

No Peat Recorded At This Location



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Rev.	Description	App By	Date
P01	ISSUE FOR PLANNING	JH	16.04.26

PROJECT	LITTLETON WIND FARM
CLIENT	LITTLETON WIND FARM DAC
SHEET	FACTOR OF SAFETY PLAN – SHORT TERM CRITICAL CONDITION (UNDRAINED) SHEET 1 OF 3
Date	16.04.26
Project number	P20-211
Scale (@ A1)	As Shown
Drawn by	POR
Checked by	AC
Drawing Number	P20-211-0600-0010
Rev	P01

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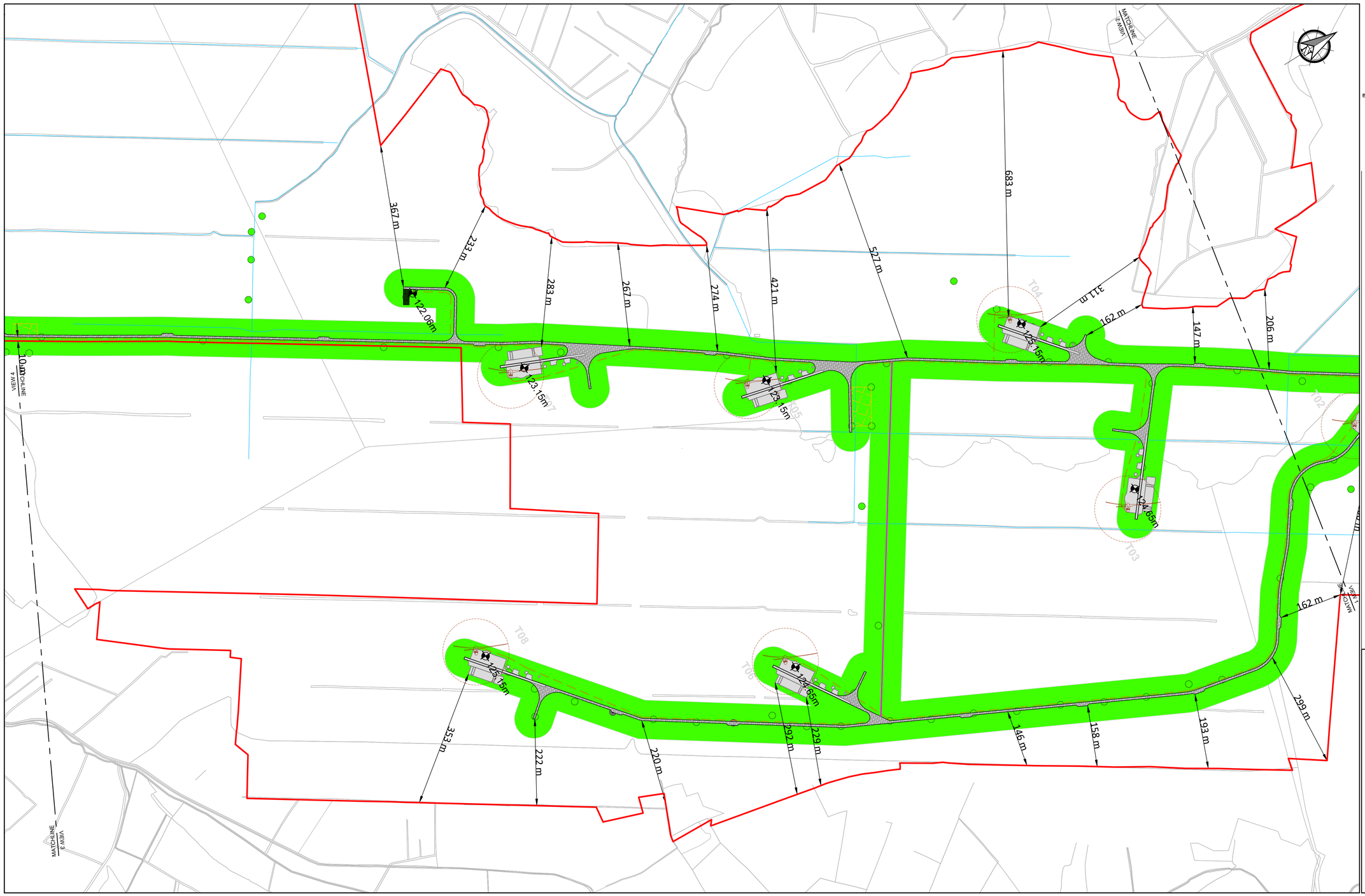
13 May 2026



Legend

- Planning Boundary
- Proposed Wind Farm Access Track.
- Proposed Passing Bays
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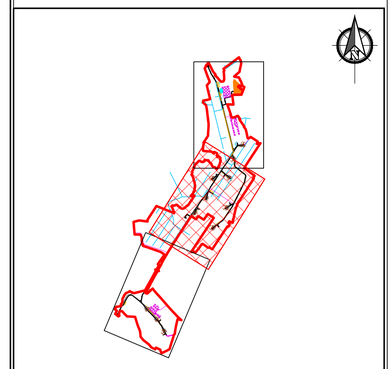
- X.Xm Proposed Hardstand Finished Level
- PMM Permanent Metrological Mast

Factor of Safety Legend:

- 0 < 1.0
- ≥ 1.0 < 1.3
- ≥ 1.3

Increasing Stability

No Peat Recorded
At This Location



PLAN
Scale 1:5000

KEYPLAN
Scale 1:100000

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Rev.	Description	App By	Date
P01	ISSUE FOR PLANNING	JH	16.04.26

PROJECT: LITTLETON WIND FARM

CLIENT: LITTLETON WIND FARM DAC

SHEET: FACTOR OF SAFETY PLAN – SHORT TERM CRITICAL CONDITION (UNDRAINED) SHEET 2 OF 3

Date: 16.04.26	Project number: P20-211	Scale (@ A1): As Shown	
Drawn by: POR	Drawing Number: P20-211-0600-0011		Rev: P01
Checked by: AC			

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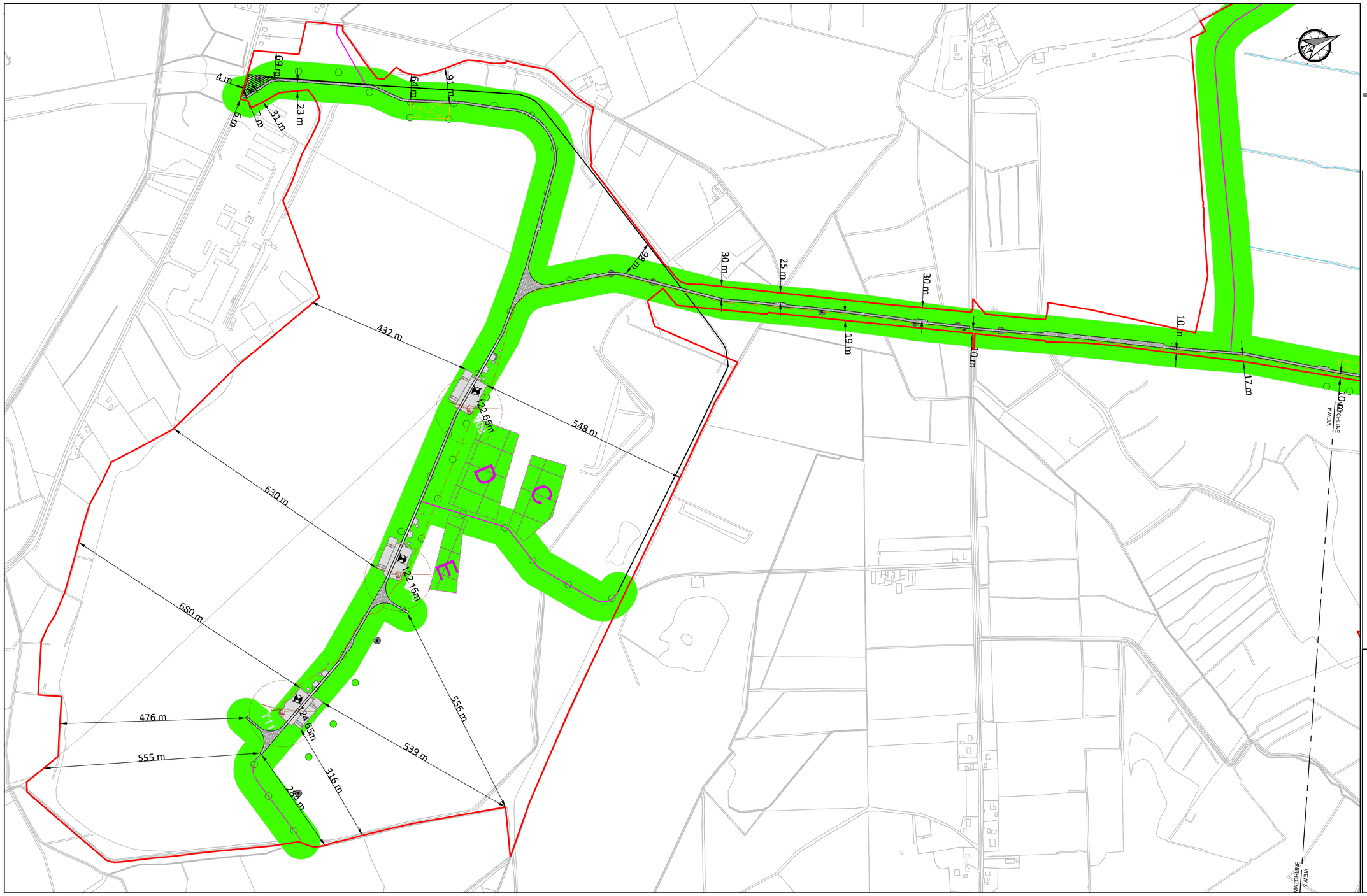
13 May 2026



Legend

- Planning Boundary
- Proposed Wind Farm Access Track.
- Proposed Passing Bays
- Proposed Turning Areas
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- Proposed Peat Deposition Areas
- Proposed Borrow Pit Area
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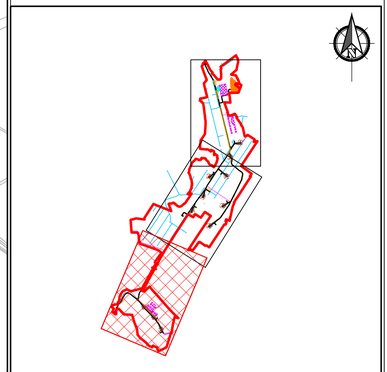
- Existing Recreational Amenity Trail
- Proposed Internal Collector Circuit
- Proposed Minimum Noise Barrier
- X.Xm Proposed Hardstand Finished Level
- PMM Permanent Metrological Mast

Factor of Safety Legend:

0 < 1.0	Increasing Stability
≥ 1.0 < 1.3	
≥ 1.3	
No Peat Recorded At This Location	



PLAN

Scale 1:5000

KEYPLAN

Scale 1:100000

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Rev.	Description	App By	Date
P01	ISSUE FOR PLANNING	JH	16.04.26

PROJECT: LITTLETON WIND FARM

CLIENT: LITTLETON WIND FARM DAC

SHEET: FACTOR OF SAFETY PLAN – SHORT TERM CRITICAL CONDITION (UNDRAINED) SHEET 3 OF 3

Date: 16.04.26	Project number: P20-211	Scale (@ A1): As Shown	
Drawn by: POR	Drawing Number: P20-211-0600-0012		Rev: P01
Checked by: AC			

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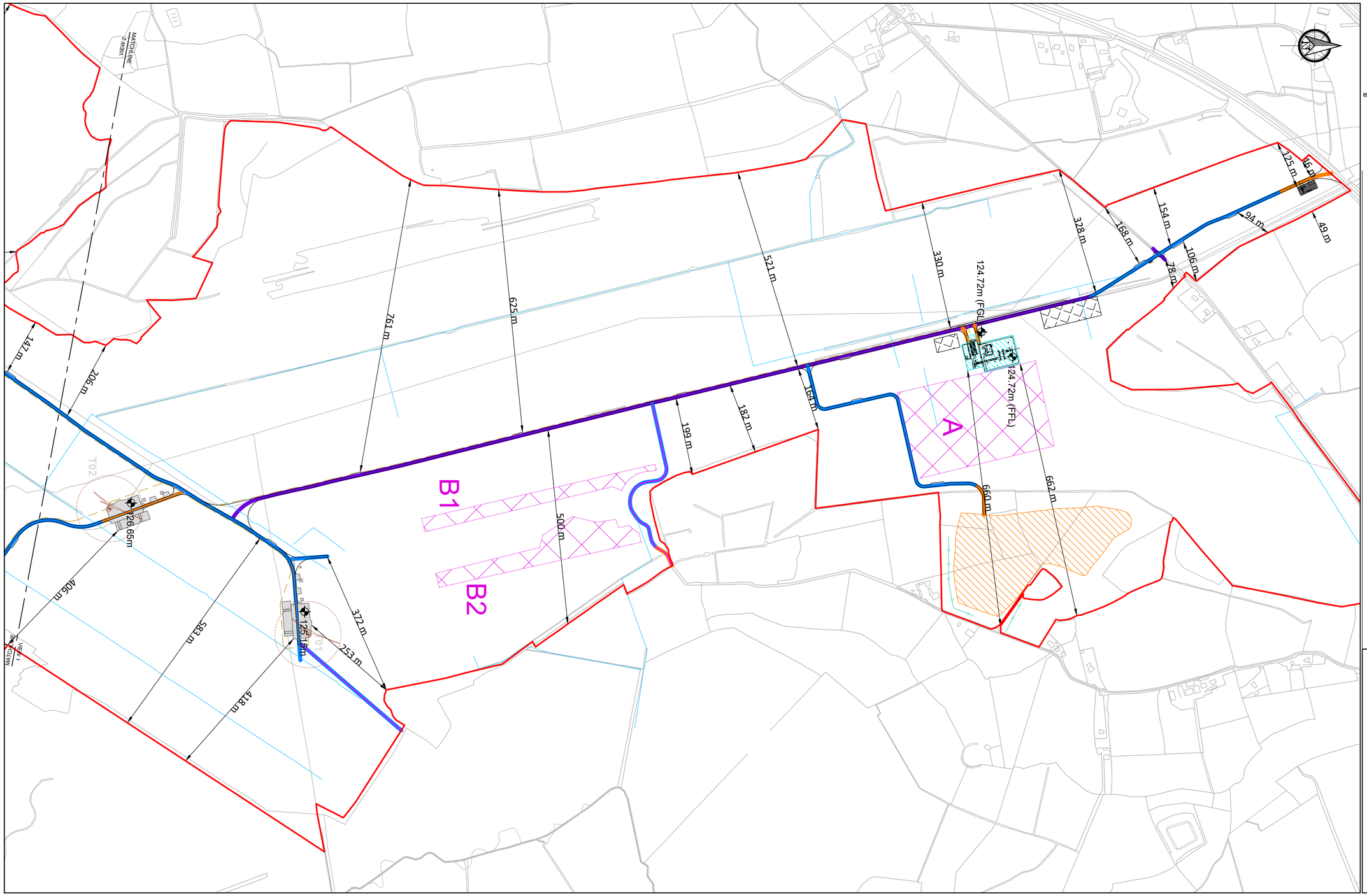

Legend

- Planning Boundary
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- Proposed Turning Areas
- Proposed Turbine And Hardstanding Areas
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- Proposed Substation Compound
- Proposed Security Building
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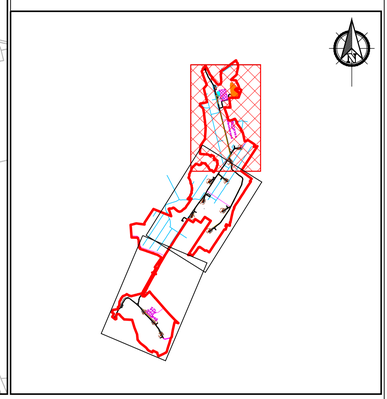
- Proposed Recreational Amenity Trail
- Existing Recreational Amenity Trail
- Proposed Internal Collector Circuit
- Proposed Minimum Noise Barrier
- X.Xm Proposed Hardstand Finished Level
- PMM Permanent Metrological Mast

Road Type Legend:

- Type A - Construction of New Excavated Access Tracks Through Peat
- Type B - Construction of New Floating Access Tracks Over Peat
- Type C - Upgrade of Existing Internal Tracks



PLAN
Scale 1:5000

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Scale 1:100000

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Rev.	Description	App By	Date
P01	ISSUE FOR PLANNING	JH	16.04.26

PROJECT	LITTLETON WIND FARM
CLIENT	LITTLETON WIND FARM DAC
SHEET	ROAD CONSTRUCTION TYPES PLAN - SHEET 1 OF 3
Date	16.04.26
Project number	P20-211
Scale (@ A1)	As Shown
Drawn by	POR
Checked by	AC
Drawing Number	P20-211-0600-0013
Rev	P01

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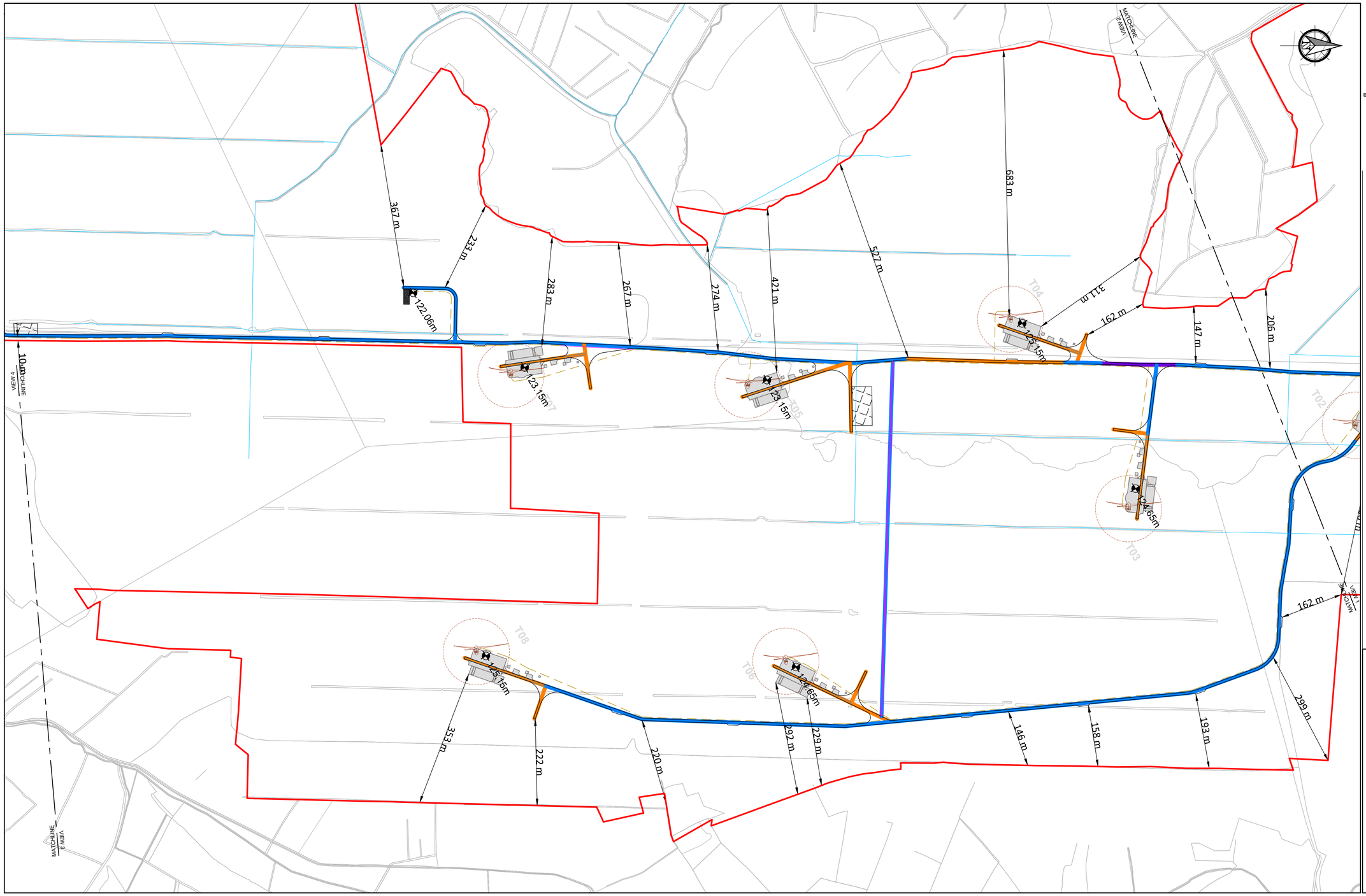
13 May 2026



Legend

- Planning Boundary
- Proposed Wind Farm Access Track.
- Proposed Passing Bays
- Proposed Turning Areas
- Proposed Turbine And Hardstanding Areas
- Proposed Peat Deposition Areas
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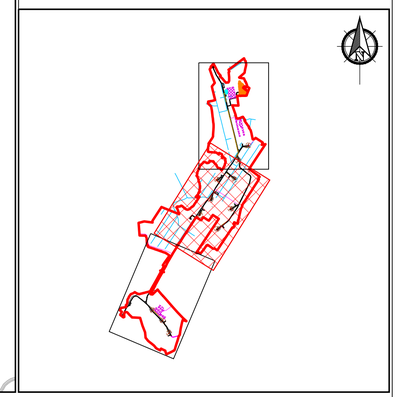

PLAN
Scale 1:5000

KEYPLAN
Scale 1:100000

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Rev.	Description	App By	Date
P01	ISSUE FOR PLANNING	JH	16.04.26

PROJECT	LITTLETON WIND FARM
CLIENT	LITTLETON WIND FARM DAC
SHEET	ROAD CONSTRUCTION TYPES PLAN - SHEET 2 OF 3
Date	16.04.26
Project number	P20-211
Scale (@ A1)	As Shown
Drawn by	POR
Drawing Number	P20-211-0600-0014
Rev	P01
Checked by	AC

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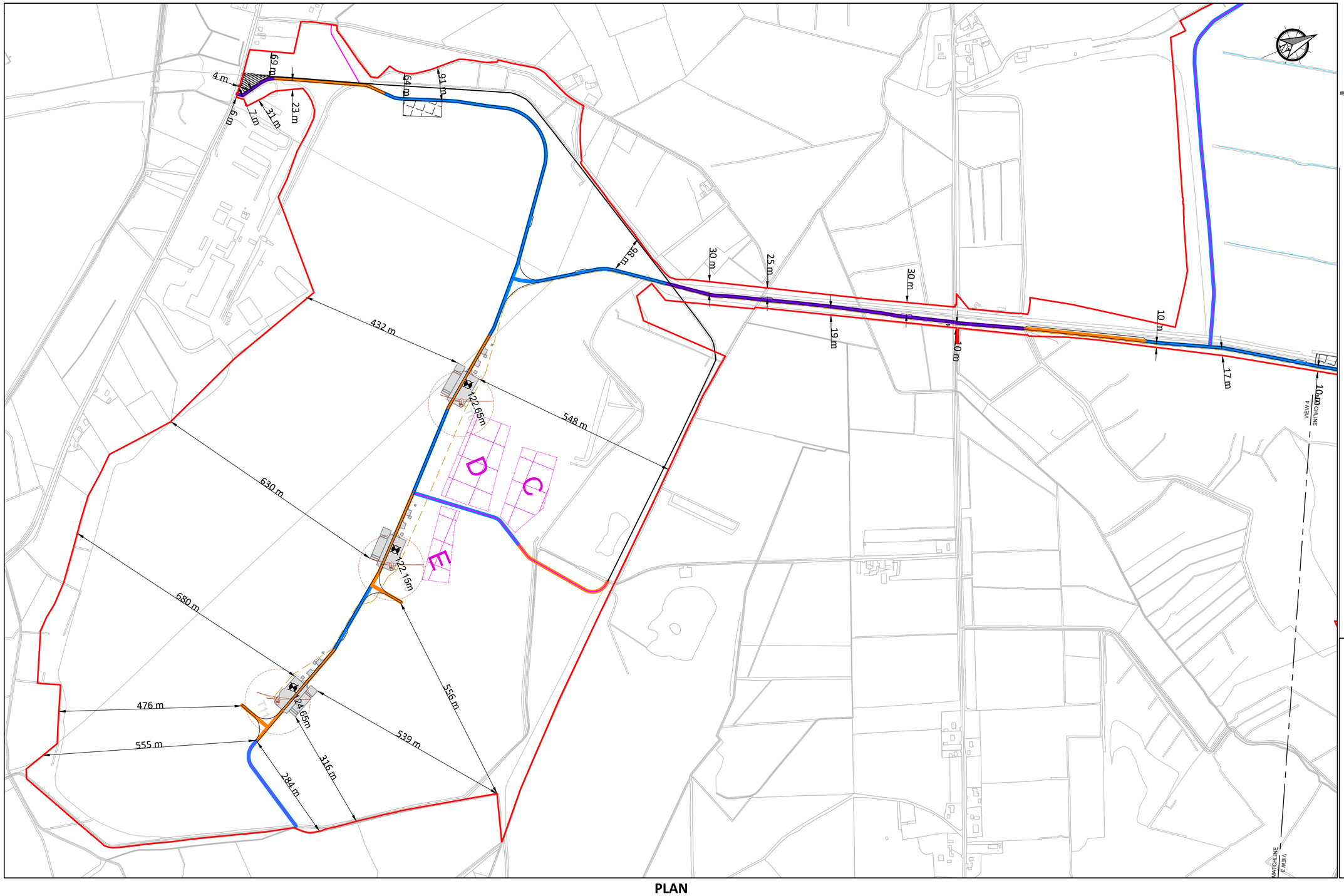
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APPENDIX 8.2

PEAT AND SPOIL MANAGEMENT PLAN

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PEAT AND SPOIL MANAGEMENT PLAN

Littleton Windfarm Co. Tipperary

Prepared for:

Littleton Wind Farm DAC

BnM | sse

Date: **May 2026**

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Peat & Spoil Management Plan, Littleton Wind Farm, Co. Tipperary

REVISION CONTROL TABLE, CLIENT, KEYWORDS AND ABSTRACT

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Abstract: Fehily Timoney and Company (FT) were engaged by Littleton Wind Farm DAC to compile a Peat and Spoil Management Plan (PSMP) for the proposed Littleton Wind Farm. The purpose of this report is to provide a Peat and Spoil Management Plan for the construction phase of the wind farm. The report describes how peat and spoil which will be excavated from infrastructure locations such as turbine bases and access tracks and will be handled and placed/reinstated onsite. The report also provides construction details for the types of access tracks which will be put in place at the site and proposed peat and spoil deposition areas which will be developed at the site.

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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.100 members of staff, including engineers, scientists, planners and technical support staff. We 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.

This Report was written by Doireann Tarrant (FT Senior Project Engineer, MSc in Geotechnical and Structural Engineering). Doireann has over 3 years' experience in geotechnical engineering, with experience in renewable energy projects and preparing EIAR chapters for wind farm sites.

This Report was reviewed by Ian Higgins and Aaron Clarke of Fehily Timoney and Company.

Ian (BSc, MSc, FGS, MIEI) is a Technical Director with FT, with over 25 years consultancy experience in Geotechnical Engineering in Ireland. Ian has completed numerous peat stability assessment and geological impact assessment for wind farms. In addition, he has significant experience in the geotechnical design of wind energy projects at construction stage.

Aaron (BSc, MSc, MCSM, PGeo, EurGeol) is a Chartered Principal Geologist with a BSc in Earth Sciences from University of Galway and a MSc in Applied Geotechnics from Camborne School of Mines (University of Exeter). He is a professional member of the Institute of Geologists of Ireland (PGeo) and the European Federation of Geologists (EurGeol). Aaron has 20 years of post-graduate experience working in the fields of geoscience and ground engineering. He has experience working on renewable energy projects within the Irish market, preparing EIAR chapters for wind farms sites.

1.2 Project Description

Fehily Timoney and Company (FT) was engaged by Littleton Wind Farm DAC (Client) to compile a Peat and Spoil Management Plan (PSMP) for the Proposed Littleton Wind Farm. As detailed in Section 1 in Chapter 1, for the purposes of this EIAR, the various project components are described and assessed using the following terms:

- The 'Proposed Wind Farm' (also referred to in this EIAR as the '**Site**');
- The 'Proposed Grid Connection' (also referred to in this EIAR as the '**GC**');
- The 'Turbine Delivery Route' (also referred to in this EIAR as the '**TDR**'); and
- The 'Biodiversity Management and Enhancement Plan Lands' (also referred to in this EIAR as the '**BEMP Lands'**)

The Proposed Project site is located in the east of County Tipperary. The closest settlements to the Site are Urlingford (ca. 5 km to the north-east), Gortnahoe (ca. 2.5 km to the east), Twomileborris (ca. 2 km to the west), Littleton to the southwest and New Birmingham (ca. 2 km to the east). The town of Thurles is located approximately 9km to the west of the Site.

The Proposed Wind Farm consists of 11 no turbines and associated infrastructure including internal access tracks, hard standings, additional amenity trails, an on-site borrow pit, peat deposition areas, a permanent meteorological mast, an onsite 110kV substation and associated grid connection infrastructure, internal electrical and communications cabling, temporary construction compounds, drainage infrastructure, biodiversity management and enhancement measures, temporary accommodation works along the Proposed Turbine Delivery Route and all associated works related to the construction of the Proposed Development. Please see Chapter 4 for a full description of the Proposed Project.

The site is relatively flat-lying with drainage channels running in both southeast-northwest and southwest-northeast directions. The R639 regional road and the Longford Pass local road run to the north of the Proposed Wind Farm and the site crosses the L2111 Derryvella local road at the southern end of the site. Several disused Bord na Mona (BnM) rail lines also pass through the site. Land uses within the site are a mixture of bare cutover and cutaway peat, re-vegetation of bare peat and historical commercial Bord na Móna operated bog land.

Bord na Móna has considerable experience in the handling of peat in these circumstances, both during production operations and during wind farm construction projects. This experience has shown that the most environmentally sensitive and stable way of handling and moving of peat is its placement across the site and at locations as close as possible to the excavation areas.

A combined total of 556 no. peat probes were carried out by FT and BnM to determine the depth of peat across the site. The peat depth data was collected from June 2021 to July 2025 and has been used in the assessment of peat stability for the Proposed Project site. Exploratory ground investigations, comprising 7 no. boreholes and 50 no. trial pits, were carried out on the Proposed Project site by Ground Investigations Ireland (GII) in August 2022, April 2023 and December 2023.

1.3 Purpose

The purpose of this report is to provide a PSMP with particular reference to peat stability for the construction phase of the Proposed Project and to describe how peat and spoil which will be excavated from infrastructure locations such as turbine bases and access tracks and will be handled and placed/reinstated onsite in an appropriate manner. Such peat and spoil management measures have been successfully implemented on numerous wind farms on cutaway peatlands over the past 15 years.

The report also provides construction details for the types of access tracks, which will be put in place at the site and associated proposed peat and spoil deposition areas which will be developed at the site

This PSMP also includes a monitoring programme which will be implemented during the construction phase of the Proposed Project and a contingency plan should peat instability/failure occur at the site.

As for all construction projects, a detailed engineering construction design must be carried out by the appointed construction stage designer prior to any construction work commencing on site. This must take account of the consented project details and any conditions imposed by that consent. This must include a detailed peat stability assessment to account for any changes in the environment which may have occurred in the time leading up to the commencement of construction and a peat and spoil management plan to allow for the most appropriate geotechnical and environmental led solutions to be developed for the management of peat and spoil.

As work is carried out on site the contents of the PSMP and peat stability monitoring programme will be implemented in full and updated (if required) in the Construction & Environmental Management Plan (CEMP) for the construction phase.

This PSMP contains some drainage guidelines for construction works and for management of peat on site. It should be noted that the control of water quality and drainage measures for the Site is outlined in detail in Chapter 4 Description of the Proposed Project and Chapter 9 Hydrology, Hydrogeology and Water Quality, of the Environmental Impact Assessment Report (EIAR).

1.4 Peat Instability Definition

Peat instability in this report is defined as a mass movement of a body of peat that would have a significant adverse impact on the surrounding environment. Peat instability excludes localised movement of peat that would occur below a floating internal access track, creep movement or localised erosion type events.

Adherence to the PSMP should reasonably minimise the potential for all such peat movements. However, it is noted that due to the soft ground nature of the peat terrain it is not possible to completely avoid localised peat movement.

2. CONSTRUCTION ACTIVITIES COVERED BY PEAT AND SPOIL MANAGEMENT

2.1 Construction Activities

For the construction phase of the Proposed Project the activities that will generate peat and spoil are as follows:

1. Upgrade of existing internal tracks (excavate and replace).
2. Construction of new excavated tracks through peat
3. Construction of floated tracks over peat (will not generate peat and spoil but the methodology for construction is included for completeness)
4. Excavation and placement of arisings
5. Excavations in peat for turbine bases, hardstands, substation and other infrastructure foundations
6. Excavations in peat for underground cables
7. Excavations of spoil for the development of the Borrow Pit

Peat and spoil management of the above construction activities are covered individually in this report.

2.2 Access Track Construction Types

To provide access within the site and to connect the wind turbines and associated infrastructure, existing tracks will need to be upgraded, and new internal tracks will need to be constructed. The track construction preliminary design has considered the following key factors:

1. Buildability considerations
2. Maximising use of existing infrastructure
3. Minimising excavation arisings
4. Serviceability requirements for construction and wind turbine delivery and maintenance vehicles
5. Requirement to minimise disruption to peat hydrology

Whilst the above key factors are used to determine the access track design the actual construction technique employed for a particular length of access track will be determined by the prevailing ground conditions encountered along that length of access track .

The general access track construction techniques to be considered are given in Table 2.1.

It should be noted that this report does not include a detailed design for the internal access tracks within the Proposed Project site. This report includes the most suitable type of access track construction envisaged for each section of internal access track based on the ground/site conditions recorded during the site walkovers. Where floating access track s are proposed in this report, a typical methodology is presented; however, a detailed design will be carried out prior to construction commencing on site. These recommendations are based on available guidance, such as 'Constructed Tracks in the Scottish Uplands (Scottish Natural Heritage, 2nd Edition ,2015) (Ref. 1), Floating Roads on Peat (Scottish Natural Heritage/Forestry Commission Scotland, 2010) (Ref. 2) and 'Dealing with Bearing Capacity Problems on Low Volume Roads Constructed on Peat (ROADEX II, 2004) (Ref. 3)

Table 2-1: General Access Track Construction Techniques

Method of Construction	Typical Site Conditions				Comment
	Construction Type	Length (km)	Typical Peat Depth (m)	Typical Slope Inclination (degs)	
Construction of new excavated access tracks through peat	Type A	2.1	Less than 2.0m	Varies	New internal access track construction technique envisaged for various locations on site – Drawings P20-211-0600-0013 to 0015
Construction of new floating access tracks over peat	Type B	13.34	>2.0	<5.0	New internal access track construction technique envisaged for various locations on site – Drawings P20-211-0600-0013 to 0015
Upgrade of existing internal tracks	Type C	2.95	Typically, less than 1.5m, locally up to 3.0m	Varies	New internal access track construction technique envisaged for various locations on site – Drawings P20-211-0600-0013 to 0015

Further details on internal access track construction Types A to C are given in Sections 3 to Section 5 of this report.

3. CONSTRUCTION OF NEW EXCAVATED ACCESS TRACKS THROUGH PEAT – TYPE A

The excavation of peat and spoil and founding of internal access tracks on competent stratum (below the peat) for new internal access tracks will be carried out at various locations within the Proposed Project site. The proposed locations for new excavated internal access tracks within the Site are shown in drawings P20-211-0600-0013 to 0015 and details are shown in drawing P20-211-0600-0016.

Excavate and replace type internal access track s are the conventional method for construction of internal tracks on peatland sites and the preferred construction technique in shallow peat provided sufficient placement/reinstatement capacity is available on site for the excavated peat.

3.1 Excavated Access Track Construction Methodology

This methodology includes procedures that are to be included in the construction phase to minimise any adverse impact on peat stability. The methodology is not intended to cover all aspects of construction such as drainage and environmental considerations, which are discussed in Chapter 4, Chapter 8 Land Soils and Geology, and Chapter 9 of the EIAR.

1. Prior to commencing the construction of the excavated access tracks movement monitoring posts will be installed in areas where the peat depth is greater than 2.0m.
2. Interceptor drains will be installed upslope of the internal access track alignment to divert any surface water away from the construction area.
3. Excavation of access tracks will be to the line and level given in the design requirements. Excavation will take place to a competent stratum beneath the peat.
4. Access track construction will be carried out in sections of approximately 50m lengths i.e. no more than 50m of internal access track should be excavated without re-placement with stone fill.
5. Excavation of materials with respect to control of peat stability:
    a) Acrotelm (where present) or the upper layer of peat (to about 0.3 to 0.4m of peat) is generally required for landscaping and will be stripped and temporarily stockpiled for re-use as required. Acrotelm stripping will be undertaken prior to main excavations.
    b) Where possible, the acrotelm shall be placed with the vegetation part of the sod facing the right way up to encourage growth of plants and vegetation.
    c) All catotelm peat or lower layers of peat (peat below about 0.3 to 0.4m depth) shall be transported immediately on excavation to the designated peat deposition areas.
6. Once excavated, non-catotelm peat will be temporarily stored in localised areas adjacent to excavations, where appropriate, for access tracks and hardstands before being placed within designated Peat Deposition Areas (PDAs). All peat placement areas will be upslope of founded access tracks/hardstands and will be inspected by the Project Geotechnical Engineer before material is stored in the area. Alternatively, peat will be side- cast local to the excavation or along adjacent internal access tracks.
7. Side slopes in peat shall be not greater than 1 (v): 3 (h). This slope inclination will be reviewed during construction, as appropriate. Where areas of weaker peat are encountered then slacker slopes will be required. Battering of the side slopes of the excavations will be carried out as the excavation progresses.
8. End-tipping of stone onto the access track during the construction/upgrading of the internal access track will be carefully monitored to ensure that excessive impact loading, which may adversely affect the adjacent peat, is limited.

9. The excavated internal access track will be constructed with a minimum of 800mm of selected granular fill. Granular fill to be placed and compacted in layers in accordance with the TII Specification for Road Works.
10. Internal access track s to be finished with a layer of capping across the full width of the access track.
11. A layer of geogrid/geotextile may be required at the surface of the competent stratum.
12. At transitions between floating and excavated access tracks a length of access track of about 10m shall have all peat excavated and replaced with suitable fill. The surface of this fill shall be graded so that the access track surface transitions smoothly from floating to excavated access track.
13. Where slopes of greater than 5 degrees are encountered along with relatively deep peat (i.e. greater than 1.5m) and where it is proposed to construct the internal access track perpendicular to the slope contours it is best practice to start construction at the bottom of the slope and work towards the top, where possible. This method avoids any unnecessary loading to the adjacent peat and greatly reduces any risk of peat instability.
14. A final surface layer will be placed over the excavated access track and graded to accommodate wind turbine construction and delivery traffic.
15. The construction and upgrading of internal access tracks in areas of deep peat (greater than 2m) will be inspected on a routine basis (by the Site manager/Ecological Clerk of Works/Project Geotechnical Engineer) during the works, particularly before/following trafficking by heavy vehicular loads.

4. CONSTRUCTION OF NEW FLOATED ACCESS TRACKS OVER PEAT – TYPE B

Floating access tracks will be the predominant access track construction type across the site and will be used in areas where the peat depth is in excess of 1m. The use of new floated internal access track s will be limited on site to areas of flatter terrain, i.e., less than a 5-degree slope. The proposed locations for floating access tracks across the are shown in drawings P20-211-0600-0013 to 0015 and details shown in drawing P20-211-0600-0017.

A confirmatory stability analysis should be carried out by the designer where it is proposed to install floating internal access tracks over the peat prior to any construction work commencing on site.

Floating access tracks minimise impact on the peat, particularly peat hydrology. As there is no excavation required no peat arisings are generated. However, where the underlying peat has insufficient bearing capacity or due to topographic restrictions an excavate and replace type internal access track may be more suitable (drawings P20-211-0600-0013 to 0015), although this is not anticipated at the location of the floated access tracks.

4.1 Floating Access Track Construction Methodology

This methodology includes procedures that are to be included in the construction phase to minimise any adverse impact on peat stability. The methodology is not intended to cover all aspects of construction such as drainage and environmental considerations, which are considered in the relevant chapter of the EIAR.

Note: Details of geogrid arrangement will be provided by the specialist geogrid provider/designer.

1. Prior to commencing floating access track construction movement monitoring posts will be installed in areas where the peat depth is greater than 2m.
2. Base geogrid to be laid directly onto the existing peat surface along the line of the access track in accordance with geogrid provider's requirements.
3. Construction of access track to be in accordance with appropriate design from the designer.
4. The typical make-up of the new floated internal access track is up to 1,000mm of selected granular fill with 2 no. layers of geogrid with possibly the inclusion of a geotextile separator (drawing P20-211-0600-0017).
5. Granular fill to be placed and compacted in layers in accordance with the TII Specification for Road Works, Series 600 (2013).
6. Following the detailed design of the floated internal access tracks it may be deemed necessary to include pressure berms either side of the internal access track in some of the deeper peat areas. The inclusion of a 2 to 5m wide pressure berm (typically 0.5m in height) either side of the internal access track will reduce the likelihood of potential bearing failures beneath the internal access track.
7. The finished access track width will be approximately 7m (6.0m running width), with wider sections on bends and corners.
8. Stone delivered to the floating access track construction will be end-tipped onto the constructed floating access track. Direct tipping of stone onto the peat shall not be carried out.
9. To avoid excessive impact loading on the peat due to concentrated end-tipping all stone delivered to the floating access track will be tipped over at least a 10m length of constructed floating access track.

10. Where it is not possible to end-tip over a 10m length of constructed floating access track then dumpers delivering stone to the floating access track will carry a reduced stone load (not greater than half full) until such time as end-tipping can be carried out over a 10m length of constructed floating access track.
11. Following end-tipping a suitable bulldozer will be employed to spread and place the tipped stone over the base geogrid along the line of the access track.
12. A final surface layer will be placed over the full width of the floating access track, as per design requirements, to provide an access track profile and graded to accommodate wind turbine construction and delivery traffic.

5. UPGRADE OF EXISTING INTERNAL ACCESS TRACK – TYPE C

Minimal, localised sections of existing internal access tracks are present on the site. Upgrading works are likely to involve both widening and resurfacing of the existing internal access tracks. The proposed locations for upgrade of the existing internal access tracks on site are shown in drawings P20-211-0600-0013 to 0015 and details shown in drawing P20-211-0600-0018.

5.1 Upgrading Existing Internal Tracks Construction Methodology

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

1. Internal access track construction shall be to the line and level requirements as per design/planning conditions.
2. For upgrading of existing excavated internal access track s (Type A) the following guidelines apply:
    a) Excavation of the widened section of internal access track should take place to a competent stratum beneath the peat (as agreed with the designer) and backfilled with suitable granular fill.
    b) Benching of the excavation may be required between the existing section of internal access track and the widened section of internal access track depending on the depth of excavation required.
    c) The surface of the existing internal access track should be overlaid with up to 500mm of selected granular fill.
    d) Internal access track s to be finished with a layer of capping across the full width of the track
    e) A layer of geogrid/geotextile may be required at the surface of the existing internal access track and at the base of the widened section of internal access track (to be confirmed by the designer).
    f) For excavations in peat, side slopes shall be not greater than 1 (v): 3 (h). This slope inclination should be reviewed during construction, as appropriate. Where areas of weaker peat are encountered then slacker slopes will be required to ensure stability.
3. The finished access track width will have a running width of 5m, with wider sections on bends and corners.
4. On side long sloping ground any access track widening works required will be done on the upslope side of the existing internal access track, where possible.
5. At transitions between new floating and existing excavated access track s a length of about 10 to 20m shall have all peat excavated and replaced with suitable fill. The surface of this fill shall be graded to accommodate wind turbine construction and delivery traffic.

6. GENERAL CONSTRUCTION GUIDELINES FOR INTERNAL ACCESS TRACKS

The following general construction guidelines are given for the internal access track s on site.

1. Where an open drain is present alongside an existing/proposed floating internal track, the drain will need to be filled prior to upgrading/constructing the internal track. The drain will be filled with suitable drainage stone. As applicable, a perforated pipe shall be laid into a drain prior to filling so as to maintain water flow within the ditch.
2. Where existing drainage crosses the access track then it will be necessary to ensure that this drainage is not affected by settlement of the upgraded internal access track. Cross drains comprising flexible perforated pipes within a permeable stone fill surround will be used to maintain the existing drainage.
3. No excavations (e.g. drainage, peat cuttings) will be carried out within 5m distance of a completed floated internal access track edge, or at a distance determined following site inspection. The presence of excavations can destabilise the access track. Temporary excavations will be excavated in short lengths and backfilled as soon as practicable.
4. Floating access tracks will not be constructed on areas of sidelong ground.
5. No stockpiling of materials will take place on or adjacent to floated internal access tracks so as to avoid bearing failure of the underlying peat.
6. End-tipping of stone onto the access track during the construction/upgrading of the internal access track will be carefully monitored to ensure that excessive impact loading, which may adversely affect the underlying peat, is limited.
7. Due to the nature of floating access track construction, it will be necessary to monitor the settlement/movement of the access track. Survey points will be located along the access track at 10m intervals in areas of deep peat (greater than 2m). These survey points will be surveyed on a weekly basis, possibly more frequently when construction activities are ongoing in the area.
8. It is recommended that the construction and upgrading of internal access tracks in areas of deep peat (greater than 2m) is inspected on a routine basis during the works, particularly before/following trafficking by heavy vehicular loads.
9. In the event of excessive vertical displacement of the access track during/following construction then mitigation measures will be required to ensure the stability of the access track. This may include:
    a) Introduction of pressure berms either side of the access track (that are 2 to 5m wide by 0.5m deep stone layer).
    b) Where peat is relatively shallow then excavate peat and replace with suitable fill.
    c) Slowing the rate of construction.
10. Settlement of a floated internal access track is expected and will likely be in the order of several 100mm in the deeper peat areas; as such it may be necessary to re-level the access track at convenient intervals during the works. The magnitude and extent of settlement is likely to be greater in areas of deeper peat with the rate of settlement reducing over time. Prior to completion of the works, it is recommended that measures are taken to re-level the access track, as necessary.

7. EXCAVATION AND STORAGE OF PEAT AND SPOIL

The site has been extensively harvested by Bord na Móna using mechanical cutting resulting in well drained and extensively trafficked peat. Bord na Móna has considerable experience in the handling of peat in these circumstances, both during peat production operations and during the rehabilitation processes associated with its cutaway bogs. This experience has shown that when the handling and moving of such peat is appropriately managed, stability or environmental issues are not expected to arise.

7.1 Excavation and Storage of Arisings Methodology

This methodology includes procedures that are to be included in the construction to minimise any adverse impact on peat stability. The methodology is not intended to cover all aspects of construction such as drainage and environmental considerations, which are described in Chapter 4, Chapter 8 and Chapter 9 of the EIAR.

1. All excavated peat and spoil shall be transported on a phased basis upon excavation, to designated deposition areas as the internal access tracks and hardstands are developed (see drawing P20-211-0600-0020 to P20-211-0600-0022). The excavated spoil from the borrow pit shall be used for its reinstatement.
2. Peat from the main Site shall not be used for reinstatement of the borrow pit.
3. Peat and non-peat spoil shall not be mixed when placed in designated storage areas.
4. Further details on the construction and reinstatement of the borrow pit are given in Section 7.5.
5. Some of the peat, in particular the acrotelm (upper layer of the peat), excavated during construction will be used for landscaping purposes.

7.2 Summary of Peat and Spoil Volumes on Site

A summary of the excavated peat and spoil volumes calculated for the Proposed Project Site are given in Table 7-1.

Table 7-1: Summary of Excavated Peat and Spoil Volumes on Site

Infrastructure Element (Note 1)	Typical Dimensions	Peat Volume (m^3) (Note 2)	Spoil (non-peat) Volume (m^3) (Note 2)	Comment
11 no. Turbines and Hardstands	37m diameter excavation footprint for turbine foundation	98,266	71,798	Hard standing area and foundation footprint
Internal Access tracks (to Include On-Site Electrical Cable Trenches)	Assumed 6m running surface with 7m wide development footprint.	2,898	15,840	Excludes proposed floating access track sections of internal access track where no excavation of peat will take place

Infrastructure Element (Note 1)	Typical Dimensions	Peat Volume (m^3) (Note 2)	Spoil (non-peat) Volume (m^3) (Note 2)	Comment
Temporary Construction Compounds	5 no. Hard standing areas (total area 12,921m^2).	0	0	Compounds assumed as floating. Dimensions of each compound varies.
Main CBoP and TSA Compound	Total area 7,500m^2	0	2,475	Assumes gravity foundation
Amenity Car Park	22m x 46m area	0	0	Assumes floated foundation
Substation	10,275m^2	12,230	3,391	Assumes piled foundation
1 no. Met Mast	Combined area (744m^2)	684	246	Assumes gravity foundation
Security Cabin (Longford Pass)	2.5m x 7.0m	68	6	Assumes gravity foundation
Security Cabin (L211 Derryvella)	2.5m x 7.0m	0	6	Assumes floated
Borrow Pit	Total area 78,090m^2	0	190,087 (Note 3)	An estimated 317,100m^3 of rock for use as general fill will be won from the borrow pit
Peat Repository Areas	Total area 81,577m^2	0	0	
	Total =	**114,146m^3**	**283,849m^3**	Total = **397,995m^3** (peat and spoil volume) (2)

Note (1) The location of the infrastructure elements on site are shown on Figure 1.2 (Vol. 4).
Note (2) A factor of 10% (bulking factor of 5% and 5% contingency) has been applied to the excavated peat and spoil volumes to allow for expected increase in volume upon excavation and to allow for a variation in ground conditions across the Site.
Note (3) All spoil derived from the borrow pit excavations shall be stored adjacent to the excavation and later used to reinstate the borrow pit.

7.3 Summary of Peat and Spoil Placement/Reinstatement Areas on Site

A summary of the potential peat and spoil placement/reinstatement areas at the Proposed Project Site are given in Table 7-2.

Table 7-2: Summary of Peat and Spoil Deposition Areas on Site

Location (Note 1)	Peat and Spoil Volume (m^3) (Note 2)	Comment
Landscaping (Note 3)	11,000	It is estimated that approximately 1,000m^3 of peat will be required for landscaping purposes at each of the 11 no. turbine locations.
Side Casting	12,000	The side casting will involve placement of peat and spoil in 1m high x 1m wide berms along along the access tracks.
Borrow Pit	190,087	The Borrow Pit will store non-peat spoil. See drawing P20-211-0600-0019 for further details.
Peat Deposition Areas	185,148	These areas will be for peat storage only. See Drawing P20-211-0600-0020 to 0022 for further details.
Total =	**398,235 m^3**	

Note (1) The location of the proposed borrow pit at the Site are shown on Drawing P20-211-0600-0019.
Note (2) Peat and non-peat spoil can be placed adjacent to each other within the designated storage areas. However, these materials shall not be mixed.
Note (3) Some of the acrotelm (if available) (upper layer of the peat) excavated during construction will be used for landscaping purposes.

7.4 Guidelines for Placements of Peat (Side Casting) alongside Infrastructure Elements

The following recommendations/best practice guidelines for the placement of peat alongside the proposed infrastructure elements will be considered and considered during construction.

1. All excavated peat will be placed/spread alongside the proposed infrastructure elements on site, where possible.
2. The peat placed adjacent to the proposed infrastructure elements should be restricted to a maximum height of 1.5m over a 10m wide corridor on both sides of the proposed infrastructure elements and 1.0m and 1.0m wide corridor on both sides along the access tracks. It should be noted that the designer should define/confirm the maximum restricted height for the placed peat.
3. The placement of excavated peat and spoil is to be avoided without first establishing the adequacy of the ground to support the load. The placement of peat within the placement areas will likely require the use of long reach excavators, low ground pressure machinery and possibly bog mats in particular for drainage works.
4. Where there is any doubt as to the stability of the peat surface then no material shall be placed on to the peat surface. The risk of peat instability is reduced by not placing any loading onto the peat surface.
5. The surface of the placed peat will be shaped to allow efficient run-off of surface water. Shaping of the surface of the peat will be carried out as placement of peat within the placement area progresses. This will reduce the likelihood of debris run-off and ensure stability of the placed peat.

6. Finished/shaped side slopes in the placed peat will be not greater than 1 (v): 3 (h). This slope inclination will be reviewed during construction, as appropriate. Where areas of weaker peat and spoil are encountered then slacker slopes will be required.
7. The acrotelm shall be placed with the vegetation part of the sod facing the right way up to encourage growth of plants and vegetation at the surface of the placed peat within the placement areas.
8. Movement monitoring instrumentation may be required adjacent to the internal access track where peat has been placed. The locations where monitoring is required will be identified by the designer on site.
9. An interceptor drain will be installed upslope of the designated peat placement areas to divert any surface water away from these areas. This will reduce the likelihood of debris run-off.
10. All the above-mentioned general guidelines and requirements should be confirmed by the designer prior to construction.

7.5 Guidelines for the Construction and Reinstatement of Borrow Pit

Within the Proposed Wind Farm, a location has been identified as a potential borrow pit and is shown on Figure 1.2 (Vol. 4). The depth of overburden within the development footprint of the proposed borrow pit is typically less than 2.7m. The proposed borrow pit location was selected based on the shallow depth of overburden.

Upon removal of the rock from the proposed borrow pit, it is proposed to reinstate the borrow pit using excavated spoil. The excavated rock from the proposed borrow pit will be used in the construction of the infrastructure elements (turbine bases, access tracks, etc.) within the Proposed Project Site. The contractor excavating the rock will be required to develop the proposed borrow pit in a way which will allow the excavated spoil to be placed safely. It is proposed to construct cells within the borrow pit for the placement of the excavated spoil. This is to allow for the safe placement and grading of the peat and spoil using dumper trucks and excavators. The text below provides design and construction guidelines for the proposed borrow pit.

It should be noted that there are significant excavation works required in order to develop the borrow pit at the Site. Excavation works will be undertaken and supervised by an experienced contractor and suitably qualified personnel. The text below provides some design and construction guidelines for the borrow pit.

Drawings P20-211-0600-0019 show typical construction details for the proposed borrow pit. The borrow pit shall be constructed as follows:

1. The rock within the proposed borrow pit footprint will be removed by hard ripping or hydraulic breaking based on assessment of its excavatability, which has been determined from a ground investigation carried out at the proposed borrow pit. Where further ground investigation is required, this shall comprise rotary core drilling with associated engineering logging including rock quality designation and strength and durability testing. A bund will be constructed around the southeastern section of the borrow pit to limit construction noise at nearby properties.
2. It is proposed to construct the borrow pit so that the base of the borrow pit are below the level of the adjacent section of internal access track. As excavation progresses into the back edge of the borrow pit, 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 pit will be formed at stable inclinations to suit local in-situ rock conditions. Exposed sections of the rock slopes will 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 pit will be inspected by the Project Geotechnical Engineer 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, in line with best practice guidelines.
5. Where it is not possible to leave upstands/segments of intact rock in place it will be necessary to construct rock buttresses founded on in-situ rock within the borrow pit to create individual cells. The rock buttresses will be constructed of rock fill from the borrow pit excavation, placed and compacted in layers. The founding stratum for each rock buttress will be inspected and approved by The Project Geotechnical Engineer.
6. The rock buttresses will be constructed in stages to allow infilling of spoil within cells. The buttress shall be constructed of selected rock fill and placed and compacted in suitable layers to form a buttress of sufficient stability to retain the placed peat and spoil.
7. Infilling of the spoil will commence at the back edge of the borrow pit and progress towards the borrow pit entrance/rock buttress, which will help to retain the placed peat spoil and will allow the borrow pit to be developed and infilled in cells. The contractor excavating the rock will be required to develop the borrow pit in a way which will allow the excavated peat and spoil to be reinstated safely.
8. A number of rock buttresses to form cells within the borrow pit will be required to ensure access for trucks and excavators can be achieved.
9. The rock buttresses shall be wide enough (up to 4m) to allow construction traffic access for tipping and grading during the placement of the excavated peat and spoil. The permanent side slopes of the rock buttress shall be constructed between 40 to 60 degrees.
10. A rock buttress will be required on the downslope side of the borrow pit to safely retain the infilled spoil. The height of the berm constructed will be greater than the height of the reinstated peat and spoil to prevent any surface peat and spoil run-off. A berm up to 8m (max.) in height will be required.
11. The rock buttress will be founded on mineral soil or bedrock i.e. competent strata. The founding stratum for the rock buttress will be inspected and approved by the Project Geotechnical Engineer.
12. A level surface in the underlying mineral soil or Weathered Bedrock will be prepared before placing and compacting the rock fill used to construct the berms.
13. In order to prevent water retention occurring behind the buttresses, the buttress will be constructed of coarse boulder fill with a high permeability. The buttress will be constructed of well graded granular rock fill of about 100mm up to typically 500mm in size. In addition, drains will be placed through the buttresses to allow excess water to drain.
14. The use of temporary access ramps and long reach excavators during the placement of the excavated peat and spoil is likely to be required.
15. The surface of the placed peat and spoil shall be shaped to allow efficient run-off of surface water from the placed arisings.
16. As the berms are slightly higher than the retained peat, drains will be provided at regular intervals through the berms, at the same level as the top of the peat surface, to prevent ponding of water around the edges of the repositories. These drains will be 150mm diameter flexible plastic drainage pipe or equivalent.
17. A layer of geogrid to strengthen the surface of the placed spoil within the borrow pit may be required.
18. An interceptor drain shall also be installed upslope of the borrow pit. This drain will divert any surface water away from the borrow pit and hence prevent water from ponding and lodging during construction and also when reinstated.
19. Temporary control of groundwater within the borrow pit 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.

20. Settlement ponds have been designed at the lower side/outfall location of the borrow pit.
21. Supervision by the Project Geotechnical Engineer is required for the development of the borrow pit.
22. All the above-mentioned general guidelines and requirements will be implemented by the Contractor during construction.

8. EXCAVATIONS IN PEAT FOR TURBINE BASES, HARDSTANDINGS AND INFRASTRUCTURE FOUNDATIONS

From the available ground investigation data, it is estimated that 11 no. turbine bases are suitable for gravity or piled foundations on competent mineral soil. Following the installation and trimming of the piles for the foundations, excavation works will be required. However, the volume of arisings would be less than with a gravity foundation option. Should piled foundations be employed the volume of peat and spoil will reduce from that quoted in Table 7-1. This will be confirmed at detailed design stage following confirmatory ground investigation.

The turbines T01, T03, T04, T05, and T07, the substation and the telecommunications tower should be considered for a piled foundation solution to reduce excavation volumes, as the depth of peat and overburden is >3.0m.

The crane hard standings are to be founded on competent mineral, which will also require excavation through peat and spoil. The temporary construction compounds are to be floated and therefore will generate no peat or spoil.

Excavations for the borrow pit will also require the removal of spoil overlying the rock.

8.1 Methodology

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

1. With respect to placement of arisings from excavations the commitments given in Section 6 are to be followed.
2. All excavations within peat are to be adequately supported or peat slopes are to be battered to a safe slope inclination typically of 1 (v): 3 (h). This slope inclination will be reviewed during construction, as appropriate. Where areas of weaker peat are encountered then slacker slopes will be required.
3. Excavations will be kept reasonably free from water at all times. Water should be prevented from being impounded within excavations by either using drainage channels cut into the excavation face or by pumping.
4. Where water is channelled or pumped from an excavation then this water is to be fed into suitable outfall locations following appropriate treatment. This process is described in greater detail within Chapter 9 (Vol. 2) and the CEMP (Appendix 3.1, Vol. 3). A temporary pump and suitable outfall locations are likely to be required during construction.

9. EXCAVATIONS FOR UNDERGOUND CABLES

A connection between the Proposed Wind Farm and the national electricity grid will be necessary to export electricity. The proposed Grid Connection (GC) route will consist entirely of underground 110kV cable and will connect the on-site substation at Littleton Bog to the existing Ballyragget 110kV substation within the townland of Ballyragget, Co. Kilkenny. The proposed GC route will be 30.9 km in length, with 28.4 km to be constructed within the existing road corridor.

Each proposed turbine will be connected to the proposed onsite 110kV substation via underground 33kV or 33kV (kilovolt) electricity cabling. Fibre-optic cables will also connect each wind turbine and the met mast to the proposed onsite 110kV substation. The electricity and fibre-optic cabling connecting to the proposed onsite 110kV substation compound will be run in cable ducts adjacent to the proposed access tracks or direct buried alongside the internal tracks approximately 1200mm beneath ground level to the top of the cable and 900mm wide. The route of the cable will follow the internal access track to each proposed turbine location; the exact number and configuration of cable may vary within the cabling trench. The cabling may be placed on either side of the access track, on both sides of the access track or within the access track. The exact configuration of the underground cabling will be set by the requirements of the electrical designers at detailed design stage. The construction methodology for the underground cables connecting proposed turbines to the proposed on-site 110kV substation, including proposals for water crossings, is described in Chapter 4 of EIAR.

The cable trench route within the Site is envisaged to encounter peat.

9.1 Methodology

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

1. With respect to placement of arisings from excavations the guidelines given in Section 7 are to be followed.
2. It is proposed to excavate the trenches for the underground cable at a uniform depth in peat or other overburden material.
3. All excavations within peat are to be adequately supported or peat slopes are to be battered to a safe slope inclination typically of 1 (v): 3 (h). This slope inclination will be reviewed during construction, as appropriate. Where areas of weaker peat are encountered then slacker slopes will be required.
4. Similarly, all excavations within non-peat overburden for the cable trench are to be adequately supported or battered to a safe slope inclination typically of 1 (v): 1.5 or 2 (h). This slope inclination will be reviewed during construction, as appropriate.
5. Excavations shall be kept reasonably free from water at all times.
6. Any material excavated from the cable trench which is deemed suitable for reinstatement of the trench will be used for this purpose i.e. stockpiled locally to the works and reused for backfilling.
7. Any material not deemed suitable for the reinstatement of the cable trench will be landscaped locally to the trench, where possible.

10. GENERAL RECOMMENDATIONS FOR GOOD CONSTRUTION PRACTICE

To minimise the risk of construction activity causing potential peat instability it is recommended that the Construction Method Statements (CMS) for the Proposed Project will also consider, but not be limited, to the general recommendations below together with the specific recommendations above.

1. Uncontrolled concentrated water discharge onto peat slopes identified as being unsuitable for such discharge will be avoided. All water discharged from excavations during work will be piped over areas specifically assessed as being unsuitable and hence directly into suitable drainage lines.
2. All excavations will be suitably supported to prevent collapse and development of tension cracks.
3. Avoidance of placing fill and excavations in the vicinity of steeper peat slopes, that is at the crest or toe of the slope.
4. Installation and regular monitoring of geotechnical instrumentation during construction in areas of possible poor ground, such as deeper peat deposits (see Section 11).
5. Site reporting procedures will be implemented to ensure that working practices are suitable for the encountered ground conditions. Ground conditions to be assessed by suitably experienced geotechnical engineer.
6. Regular briefing of all site staff (e.g. toolbox talks) to provide feedback on construction and ground performance and to promote reporting of any observed change in ground conditions.
7. Routine inspection of the Proposed Project Site by the Contractor and Project Geotechnical Engineer will be undertaken and will include an assessment of ground stability conditions (e.g. cracking, excessive floating access track settlement, disrupted surface, closed-up drains) and drainage conditions (e.g. blocked drains, absence of water in previously flowing drains, springs, etc).

11. INSTRUMENTATION

11.1 Movement Monitoring Posts

To monitor possible peat movements, it is proposed to install sighting posts upslope and downslope of the internal access track at staggered intervals at locations where the peat depth is greater than 2.0m. Additional monitoring locations may be required at infrastructure locations with deeper peat deposits. Details of sighting posts are given below.

1. A line of sighting posts shall comprise:
    a. A line of wooden stakes (typically 1 to 1.5m long) placed vertically into the peat to form a straight line.
    b. The sighting line shall comprise 6 no. posts at 5m centres that is a line some 25m long.
    c. A string line shall be attached to the first and last posts and all intervening posts shall be adjusted so they are just touching the string line.
2. Lines of sighting posts will be placed across the existing slope about 5m away from the area to be worked. It is recommended that the posts are located along the access track at 10m intervals in areas of deep peat (say greater than 2.0m). Where there are relatively steeper slopes or softer ground a sighting line shall be placed down the slope, or at any location where monitoring would be deemed useful.
3. Each line of sighting posts shall be uniquely referenced with each post in the line given a reference. The post reference shall be marked on each post (e.g. reference 1-1, 1-2, 1-3, 1-4, 1-5, 1-6 for posts in line 1).
4. The sighting lines will be monitored at the beginning of each working day, and during the day where considered appropriate (e.g. when working activity is concentrated at a specific location).
5. Monitoring of the posts will comprise sighting along the line and recording any relative movement of posts from the string line.
6. Where increased movements are recorded the frequency of monitoring shall be increased.
7. A monitoring record shall be kept of the date, time and relative movement of each post, if any. This record shall be updated and stored as a spreadsheet.

11.2 Post-Construction Monitoring

To monitor possible peat movements following the construction of the Proposed Wind Farm, it is recommended that the Site is inspected by a suitably qualified engineer once every six months for the first three years following commissioning of the Proposed Wind Farm. Particular attention should be given to the peat deposition areas, as well to any areas where the site drainage is not functioning as intended. Should any signs of instability be noted, a site visit by a suitably qualified geotechnical engineer should be arranged and suitable remediation measures enacted and the site inspections should continue on an annual basis for a further three years.

12. CONTINGENCY MEASURES

12.1 Excessive Movement

Where there is excessive movement or continuing peat movement recorded at a monitoring location or identified at any location within the Proposed Wind Farm but no apparent signs of distress to the peat (e.g. cracking, surface rippling) then the following shall be carried out.

1. All activities (if any) shall cease within the affected area.
2. Increased monitoring at the location shall be carried out. The area will be monitored, as appropriate, until such time as movements have ceased.
3. Re-commencement of activities shall only start following a cessation of movement and agreement with all parties (Contractor/Engineer/Designer).

12.2 Onset of Peat Slide

In the unlikely event where there is the onset or actual detachment of peat (e.g. cracking, surface rippling) then the following shall be carried out.

1. On alert of a peat slide incident, all activities (if any) in the area should cease and all available resources will be diverted to assist in the required mitigation procedures.
2. Action will be taken to prevent a peat slide reaching any watercourse. This will take the form of the construction of check barrages on land. Due to the terrain and the inability to predict locations it may not be possible to implement any on-land prevention measures, in this case a watercourse check barrage will be implemented.
3. All relevant authorities should be notified if a peat slide event occurs on site.
4. For localised peat slides that do not represent a risk to a watercourse and have essentially come to rest the area will be stabilised initially by rock infill, if required. The failed area and surrounding area will then be assessed by the engineering staff and stabilisation procedures implemented. The area will be monitored, as appropriate, until such time as movements have ceased.

12.3 Check Barrages

Whilst it is not anticipated from the analysis undertaken that a peat slide will occur on site, as a contingency a check barrage procedure is included below.

The check barrage procedure deals with preventing a peat slide from moving downstream within a watercourse.

The most effective method of preventing excessive peat slide debris from travelling downstream in a watercourse is the use of a check barrage. A check barrage comprises the placement of rock fill across a watercourse. The check barrage is a highly permeable construction that will allow the passage of water but will prevent peat debris from passing through. Rock fill should comprise well-graded coarse rock pieces from about 300mm up to typically 1000mm.

The rock fill for the check barrage could be sourced from locally won granular fill material on site.

The size of the barrage will vary depending on the scale of the peat debris to be contained and the geometry of the watercourse at the barrage location. In general, due to the low speed of a peat slide there is generally little impact force and most of the lateral load is due to fluid pressure on the upslope face of the barrage.

Typically, the check barrage should fill the entire channel width of the watercourse up to a height of 3 to 4m with a crest width of typically 2m and side slopes of about 45 degrees depending on the geometry of the barrage location.

The check barrage procedure is as follows:

1. Access to the check barrage location shall be along the existing internal access tracks on the Proposed Project Site and/or along public roads, where possible. When it is necessary to form the barrage then rock fill will be placed across the watercourse to effectively block the passage of peat debris.
2. Operatives employed to carry out the construction of the check barrage would need to be inducted by means of a briefing by on-site supervisors as to the proposed location of the check barrage.
3. The check barrage provides containment for peat debris in the highly unlikely event of a major peat slide. Further remedial measures, should they be required, will be assessed by the Contractor and the Project Geotechnical Engineer and carried out as soon as physically possible when the location and extent of the failure is established.
4. Where a barrage was constructed as a precaution and no peat debris reached the watercourse then the barrage should be removed as soon as any measures to prevent further peat sliding is agreed with all parties (Contractor/Engineer/Designer).

13. REFERENCES

1. Scottish Natural Heritage, 2015. Constructed Tracks in the Scottish Uplands. Scottish Natural Heritage.
2. Scottish Natural Heritage/Forestry Commission Scotland, 2010. Floating Roads on Peat.
3. Munro, R, 2004. Dealing with bearing capacity problems on low volume roads constructed on peat. Roadex II Northern Periphery.
4. G.S. Pettifer & P.G. Fookes, 1994. A Revision of the Graphical Method for Assessing the Excavatability of Rock.

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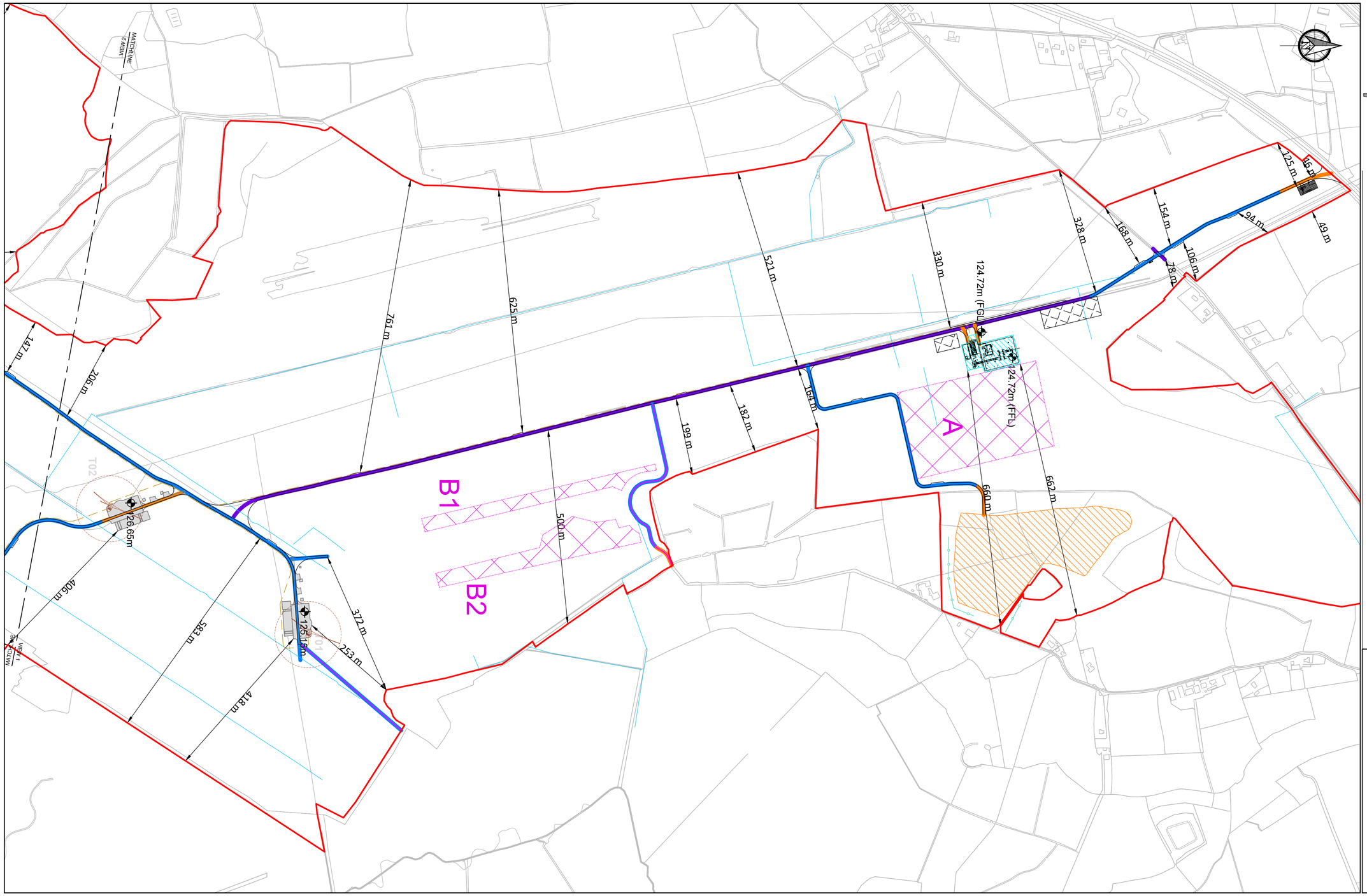
APPENDIX 1

Drawing Pack

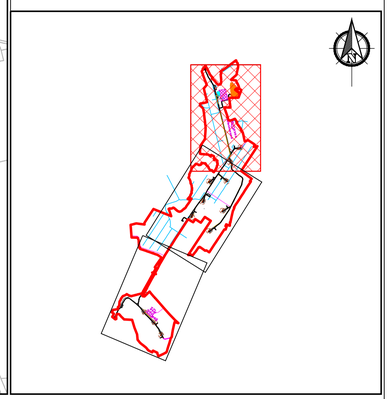


Legend

- Planning Boundary
- Proposed Wind Farm Access Track.
- Proposed Passing Bays
- Proposed Turning Areas
- Proposed Turbine And Hardstanding Areas
- Proposed Peat Deposition Areas
- Proposed Borrow Pit Area
- Proposed BEMP Area
- Proposed Construction Compound
- Existing Recreational Amenity Car Park
- Proposed Recreational Amenity Car Park
- Proposed Substation Compound
- Proposed Security Building
- Existing Drainage
- Proposed Recreational Amenity Trail
- Existing Recreational Amenity Trail
- Proposed Internal Collector Circuit
- Proposed Minimum Noise Barrier
- X.Xm Proposed Hardstand Finished Level
- PMM Permanent Metrological Mast

Road Type Legend:

- Type A - Construction of New Excavated Access Tracks Through Peat
- Type B - Construction of New Floating Access Tracks Over Peat
- Type C - Upgrade of Existing Internal Tracks



PLAN
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KEYPLAN
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Rev.	Description	App By	Date
P01	ISSUE FOR PLANNING	JH	16.04.26

PROJECT	LITTLETON WIND FARM
CLIENT	LITTLETON WIND FARM DAC
SHEET	ROAD CONSTRUCTION TYPES PLAN - SHEET 1 OF 3
Date	16.04.26
Project number	P20-211
Scale (@ A1)	As Shown
Drawn by	POR
Checked by	AC
Drawing Number	P20-211-0600-0013
Rev	P01

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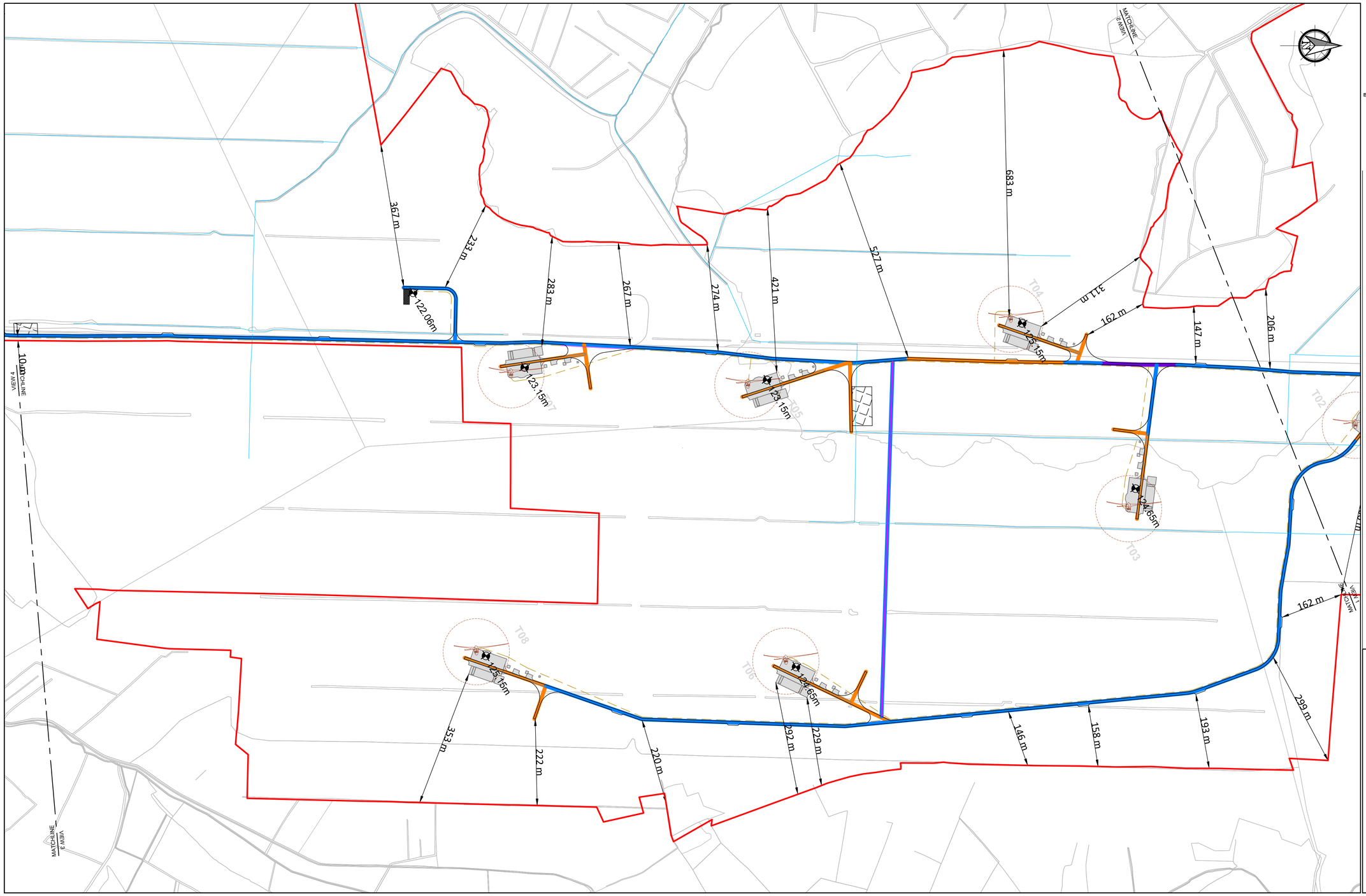
13 May 2026



Legend

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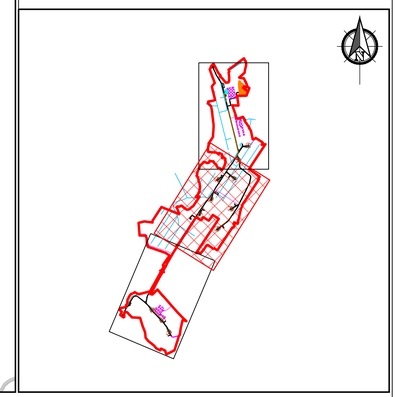

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CLIENT	LITTLETON WIND FARM DAC
SHEET	ROAD CONSTRUCTION TYPES PLAN - SHEET 2 OF 3
Date	16.04.26
Project number	P20-211
Scale (@ A1)	As Shown
Drawn by	POR
Drawing Number	P20-211-0600-0014
Rev	P01
Checked by	AC

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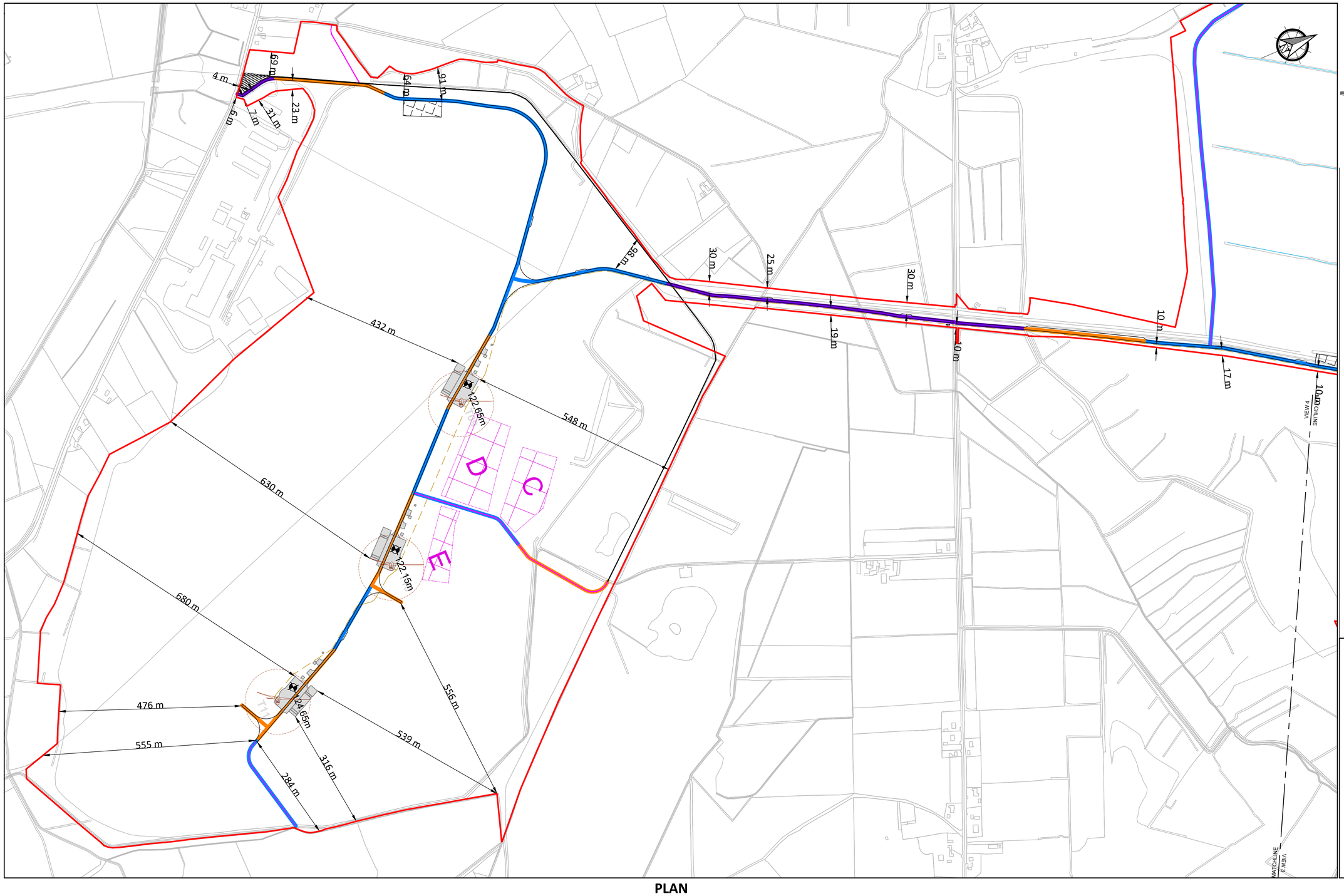
13 May 2026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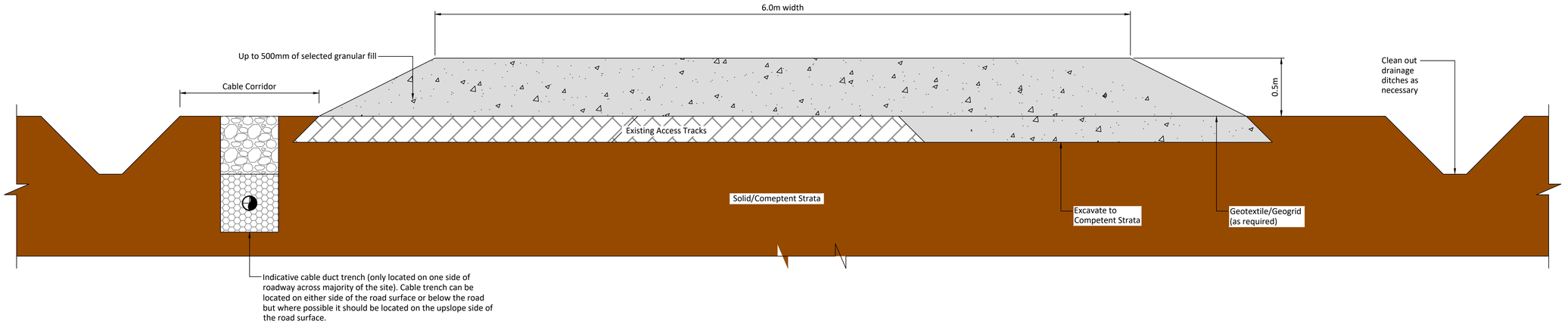

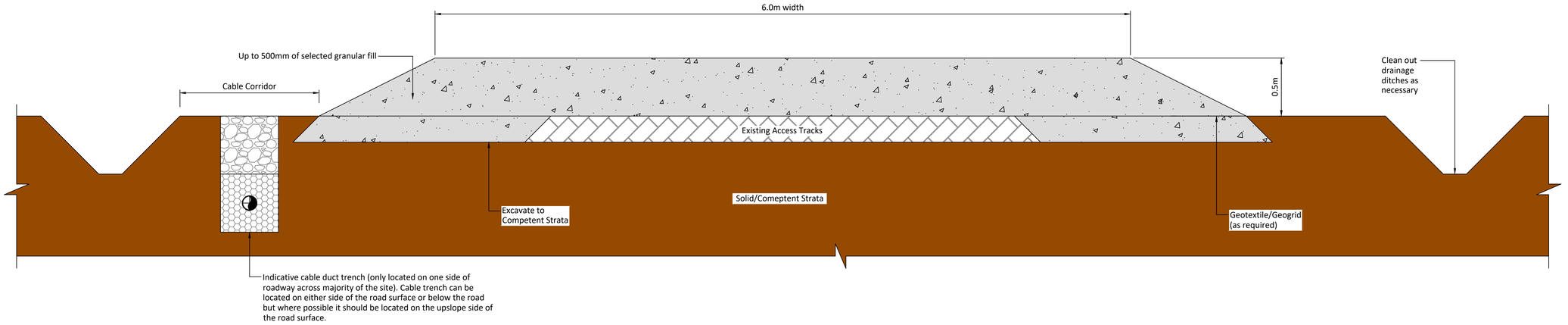

Scale 1:20

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Rev.	Description	App By	Date
P01	ISSUE FOR PLANNING	JH	16.04.26

PROJECT
LITTLETON WIND FARM

CLIENT
LITTLETON WIND FARM DAC

SHEET
TYPE C – UPGRADE OF EXISTING INTERNAL TRACKS

Date: 16.04.26	Project number: P20-211	Scale (@ A1): 1:20	
Drawn by: POR	Drawing Number: P20-211-0600-0016		Rev: P01
Checked by: AC			

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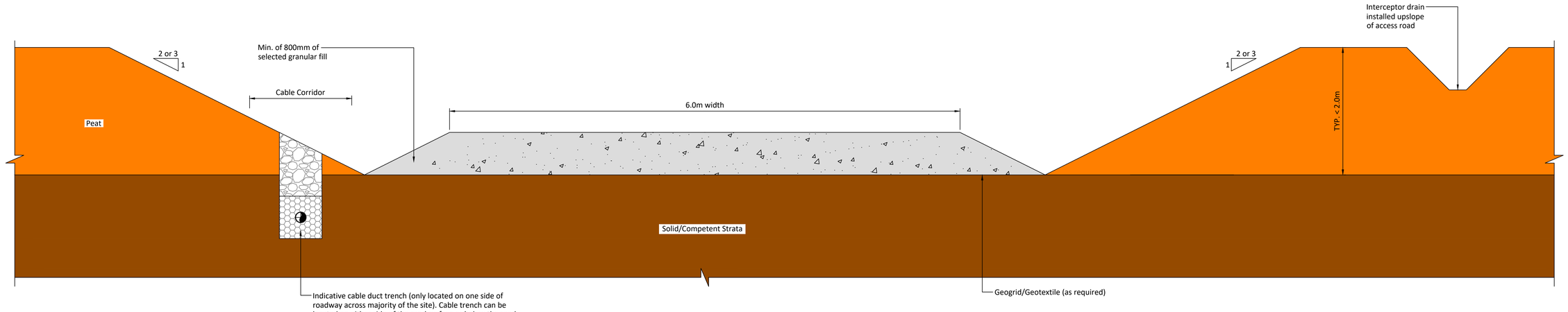
13 May 2026



Scale 1:25

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Rev.	Description	App By	Date
P01	ISSUE FOR PLANNING	JH	16.04.26

PROJECT	LITTLETON WIND FARM
CLIENT	LITTLETON WIND FARM DAC
SHEET	TYPE A – NEW EXCAVATE AND REPLACE INTERNAL TRACK
Date	16.04.26
Project number	P20-211
Scale (@ A1)	1:25
Drawn by	POR
Drawing Number	P20-211-0600-0017
Checked by	AC
Rev	P01

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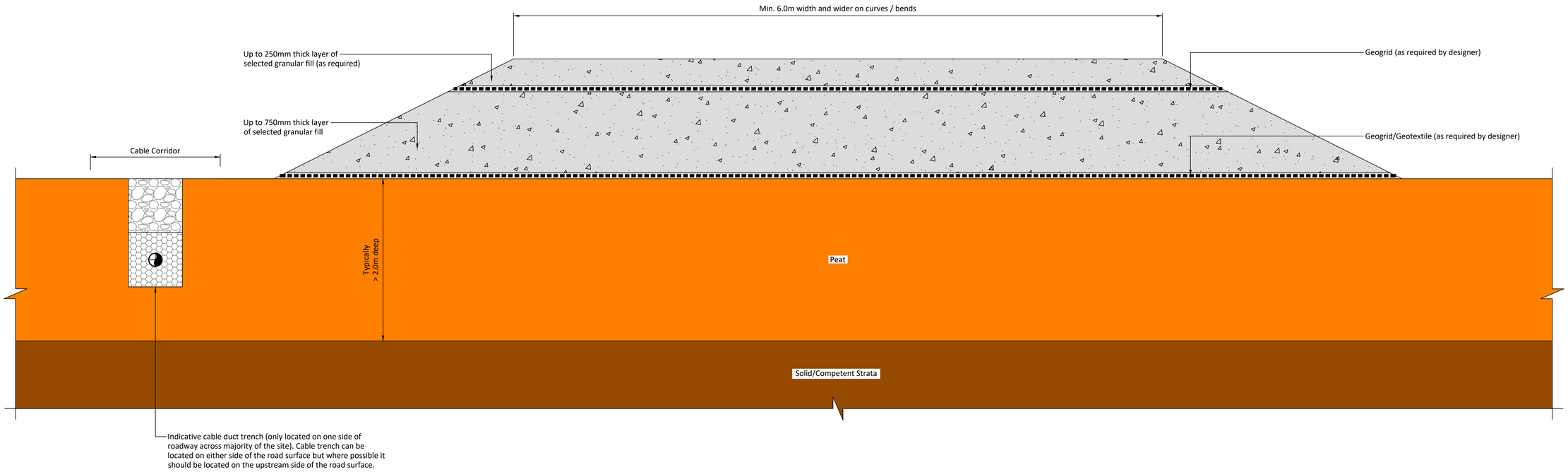
13 May 2026



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Rev.	Description	App By	Date
P01	ISSUE FOR PLANNING	JH	16.04.26

PROJECT	LITTLETON WIND FARM
CLIENT	LITTLETON WIND FARM DAC
SHEET	TYPE B – NEW FLOATED INTERNAL TRACK
Date	16.04.26
Project number	P20-211
Scale (@ A1)	1:20
Drawn by	POR
Checked by	AC
Drawing Number	P20-211-0600-0018
Rev	P01

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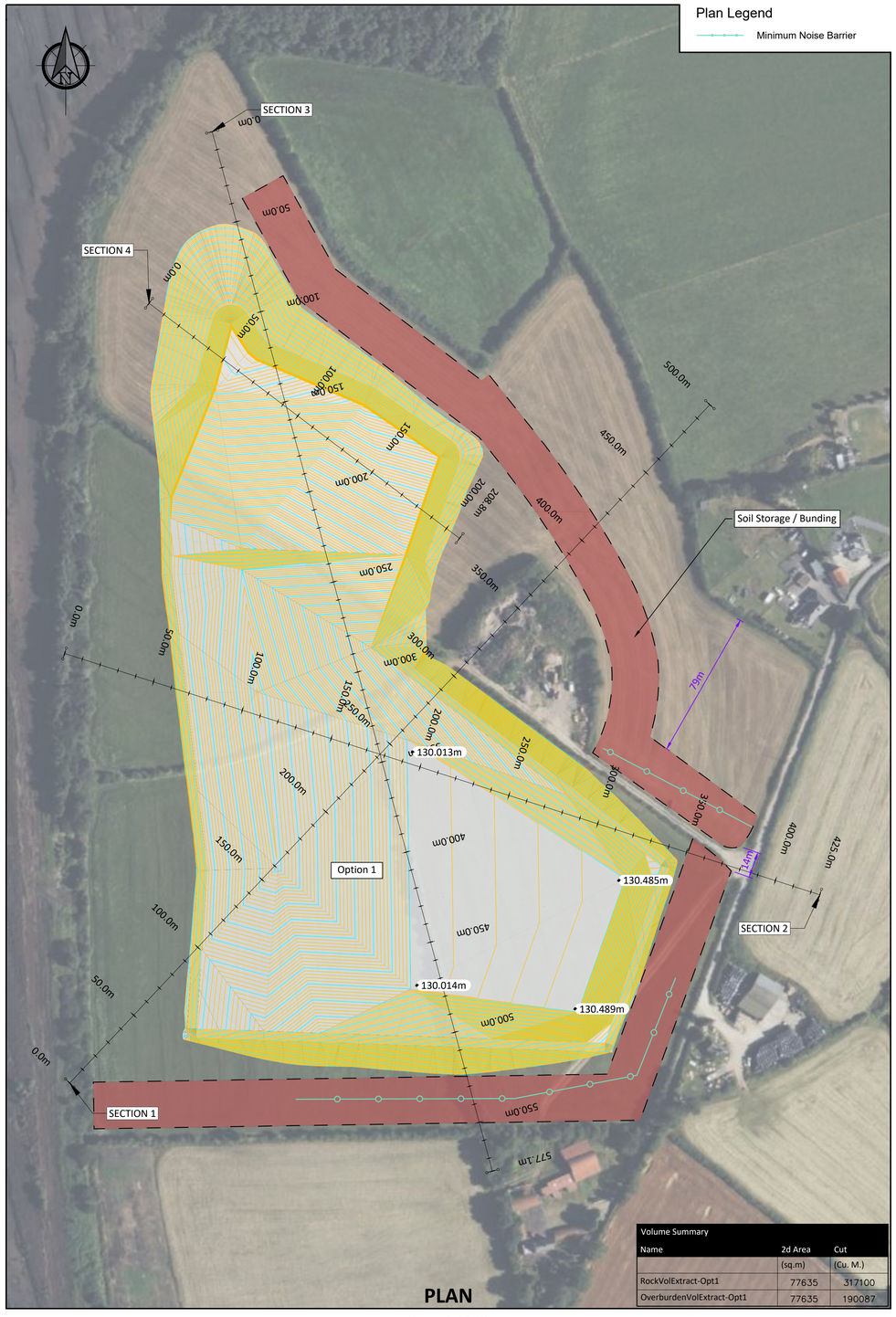
13 May 2026



PLAN

Scale 1:1500

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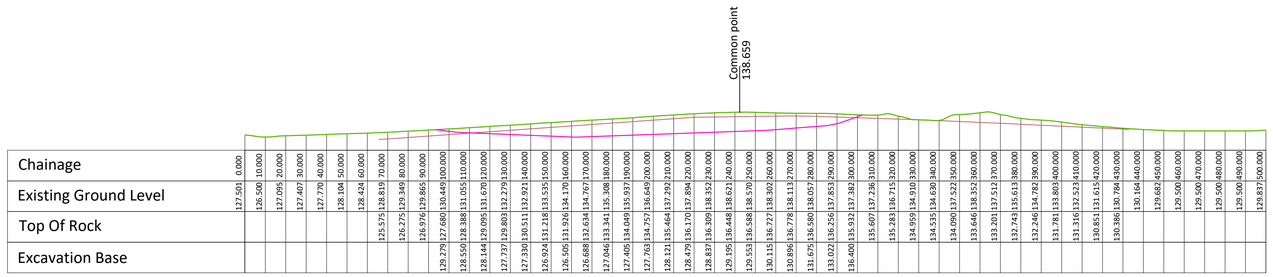
Section Legend

Existing Ground Surface

Top of Rock

Excavation Base

For soil bund requirements associated with construction noise mitigation, please refer to Figure 11.3, Volume 4 of the EIAR.
For additional construction noise mitigation requirements please refer to Chapter 11, Volume 2 of the EIAR.



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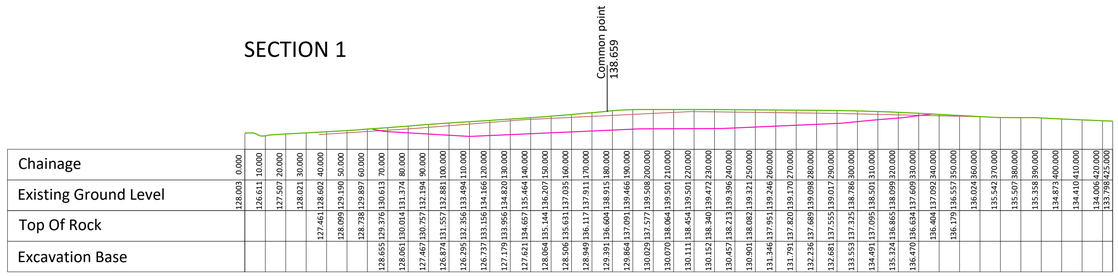
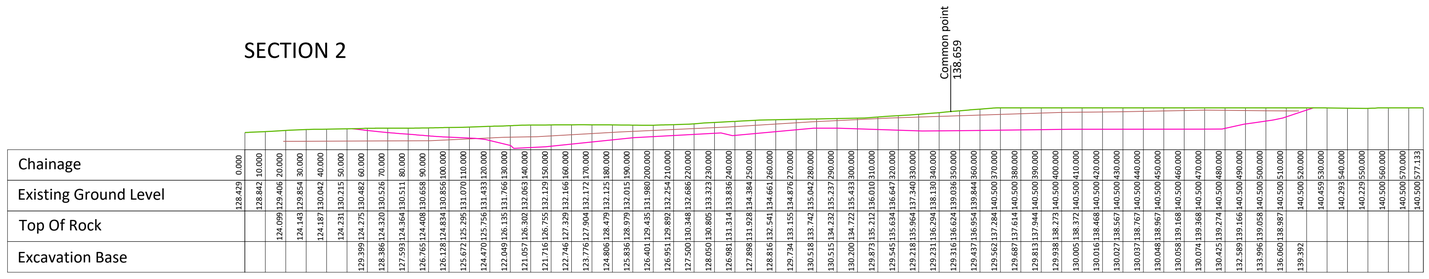
Existing Ground Level	127.501	126.500	127.095	127.407	127.770	128.104	128.424	128.819	129.349	129.865	130.449	131.055	131.670	132.279	132.921	133.535	134.170	134.767	135.398	135.937	136.649	137.292	137.894	138.352	138.570	138.302	138.113	138.057	137.853	137.382	136.715	134.910	134.638	134.090	133.646	133.352	132.743	132.246	131.781	131.316	131.613	130.784	130.164	129.682	129.500	129.500	129.500	129.500	129.500	129.837
Top Of Rock																																																						
Excavation Base																																																				

SECTION 1



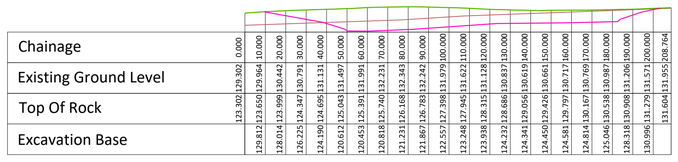
Chainage	0.000	10.000	20.000	30.000	40.000	50.000	60.000	70.000	80.000	90.000	100.000	110.000	120.000	130.000	140.000	150.000	160.000	170.000	180.000	190.000	200.000	210.000	220.000	230.000	240.000	250.000	260.000	270.000	280.000	290.000	300.000	310.000	320.000	330.000	340.000	350.000	360.000	370.000	380.000	390.000	400.000	410.000	420.000	425.000
Existing Ground Level	128.003	126.611	127.507	128.021	128.602	129.190	129.897	130.613	131.374	132.194	132.881	133.494	134.166	134.820	135.464	136.207	137.035	137.911	138.915	139.466	139.508	139.501	139.472	139.396	139.321	139.246	139.170	139.098	139.017	138.786	138.501	138.099	137.609	137.092	136.557	136.024	135.542	135.358	134.873	134.410	134.006	133.796
Top Of Rock																																																	
Excavation Base																																																

SECTION 2



Chainage	0.000	10.000	20.000	30.000	40.000	50.000	60.000	70.000	80.000	90.000	100.000	110.000	120.000	130.000	140.000	150.000	160.000	170.000	180.000	190.000	200.000	210.000	220.000	230.000	240.000	250.000	260.000	270.000	280.000	290.000	300.000	310.000	320.000	330.000	340.000	350.000	360.000	370.000	380.000	390.000	400.000	410.000	420.000	430.000	440.000	450.000	460.000	470.000	480.000	490.000	500.000	510.000	520.000	530.000	540.000	550.000	560.000	570.000	577.133
Existing Ground Level	128.429	128.842	129.406	129.854	130.042	130.215	130.482	130.526	130.511	130.658	130.856	131.070	131.433	131.766	132.063	132.129	132.166	132.172	132.125	132.015	131.980	131.892	132.254	132.686	133.323	133.836	134.384	134.661	134.876	135.042	135.337	135.433	136.010	136.647	137.340	138.130	139.036	139.844	140.500	140.500	140.500	140.500	140.500	140.500	140.500	140.500	140.500	140.500	140.500	140.500	140.500	140.500	140.500	140.500	140.500	140.500	140.500	140.500	140.500
Top Of Rock																																																																									
Excavation Base																																																																					

SECTION 3



Chainage	0.000	10.000	20.000	30.000	40.000	50.000	60.000	70.000	80.000	90.000	100.000	110.000	120.000	130.000	140.000	150.000	160.000	170.000	180.000	190.000	200.000	208.764
Existing Ground Level	129.302	129.964	130.442	130.791	131.131	131.497	131.991	132.231	132.343	132.242	131.979	131.622	131.128	130.837	130.619	130.651	130.717	130.769	130.987	131.206	131.571	131.955
Top Of Rock																						
Excavation Base	123.302	123.650	123.999	124.347	124.695	125.045	125.391	125.740	126.168	126.783	127.398	127.945	128.315	128.686	129.056	129.426	129.797	130.167	130.538	130.908	131.279	131.604

SECTION 4

SECTIONS

Scale 1:1500

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Rev.	Description	App By	Date
P01	ISSUE FOR PLANNING	TB	09.09.24
P02	ISSUE FOR PLANNING	TB	30.10.24
P03	ISSUE FOR PLANNING	TB	13.11.24
P04	ISSUE FOR PLANNING	TB	06.12.24
P05	ISSUE FOR PLANNING	TB	06.01.25
P06	ISSUE FOR PLANNING	TB	16.04.26

PROJECT: **LITTLETON WIND FARM**

CLIENT: **LITTLETON WIND FARM DAC**

SHEET: **BORROW PIT**

Date: 14.04.26

Project number: P20-211

Scale (@ A1): 1:1500

Drawn by: POR

Checked by: AW

Drawing Number: **P20-211-0600-0019**

Rev: **P06**

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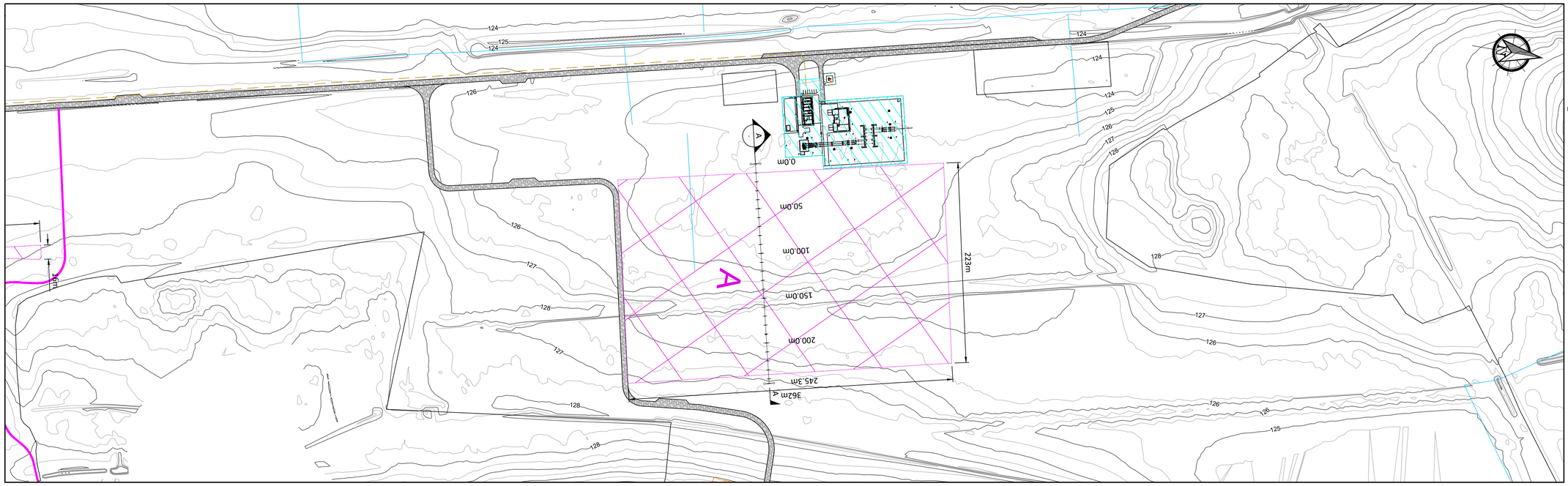
13 May 2026

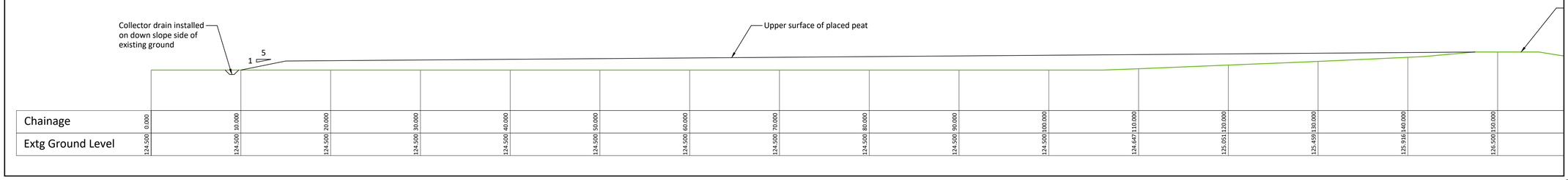


PLAN

Scale 1:2500

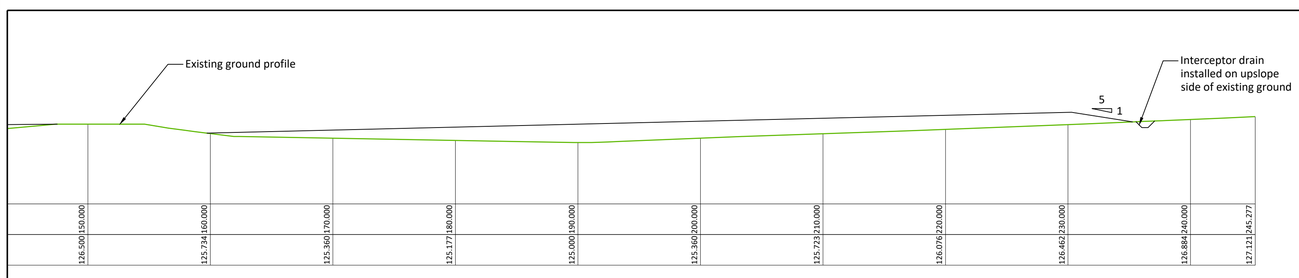
Legend

- Planning Boundary
- Proposed Wind Farm Access Track.
- Proposed Passing Bays
- Proposed Turning Areas
- Proposed Turbine And Hardstanding Areas
- Proposed Peat Deposition Areas
- Proposed Borrow Pit Area
- Proposed BEMP Area
- Proposed Construction Compound
- Existing Recreational Amenity Car Park
- Proposed Recreational Amenity Car Park
- Proposed Substation Compound
- Proposed Security Building
- Existing Drainage
- Proposed Recreational Amenity Trail
- Existing Recreational Amenity Trail
- Proposed Internal Collector Circuit
- Proposed Minimum Noise Barrier
- X.Xm Proposed Hardstand Finished Level
- PMM Permanent Metrological Mast



SECTION A - A

Scale 1:250



SECTION A - A (continued)

Scale 1:250

Construction Notes Peat / Spoil Deposition Area:

(1) An interceptor drain will also be installed upslope of the peat deposition areas.

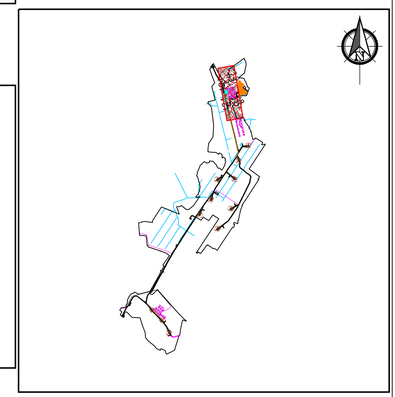
(2) A silting pond will be required at the lower side of the peat deposition areas.

(3) It is important that the surface of the stored peat be shaped to allow efficient run-off of water from the stored spoil.

(4) Supervision by a geotechnical engineer or appropriately competent person is recommended for the construction of the peat deposition area.

(5) All the above-mentioned general guidelines and requirements will be implemented during construction.

(6) Further guidelines on the construction of the peat storage area are included within Section 5.4 of the Peat & Spoil Management Plan.



KEYPLAN

Scale 1:100000

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Rev.	Description	App By	Date
P01	ISSUE FOR PLANNING	JH	16.04.26

PROJECT	LITTLETON WIND FARM
CLIENT	LITTLETON WIND FARM DAC
SHEET	PEAT DEPOSITION AREA A
Date	16.04.26
Project number	P20-211
Scale (@ A1)	As Shown
Drawn by	POR
Drawing Number	P20-211-0600-0020
Rev	P01
Checked by	AC

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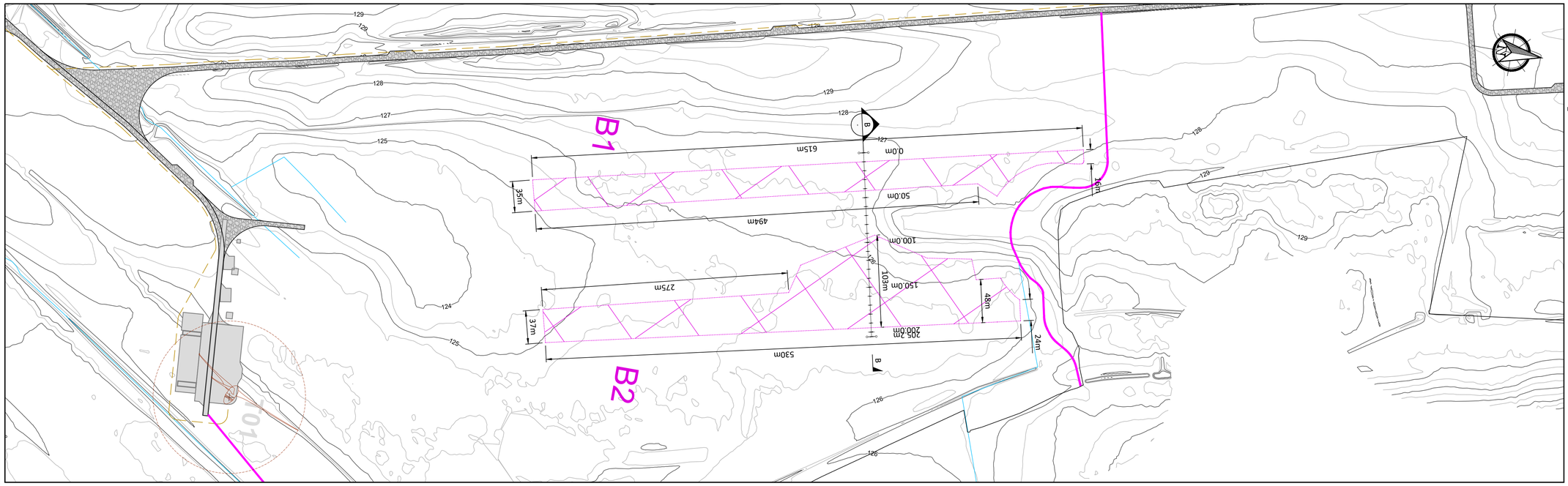
13 May 2026



PLAN

Scale 1:2500

Legend

- Planning Boundary
- Proposed Wind Farm Access Track.
- Proposed Passing Bays
- Proposed Turning Areas
- Proposed Turbine And Hardstanding Areas
- Proposed Peat Deposition Areas
- Proposed Borrow Pit Area
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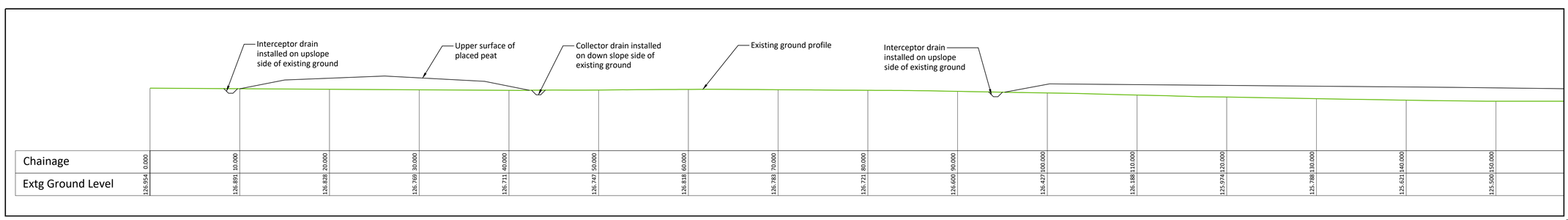
- Proposed Recreational Amenity Trail
- Existing Recreational Amenity Trail
- Proposed Internal Collector Circuit
- Proposed Minimum Noise Barrier
- X.Xm Proposed Hardstand Finished Level
- PMM Permanent Metrological Mast



SECTION B - B

Scale 1:250

Construction Notes Peat / Spoil Deposition Area:

(1) An interceptor drain will also be installed upslope of the peat deposition areas.

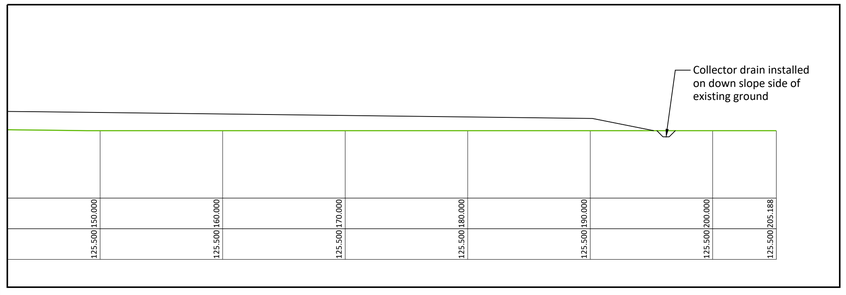
(2) A silting pond will be required at the lower side of the peat deposition areas.

(3) It is important that the surface of the stored peat be shaped to allow efficient run-off of water from the stored spoil.

(4) Supervision by a geotechnical engineer or appropriately competent person is recommended for the construction of the peat deposition area.

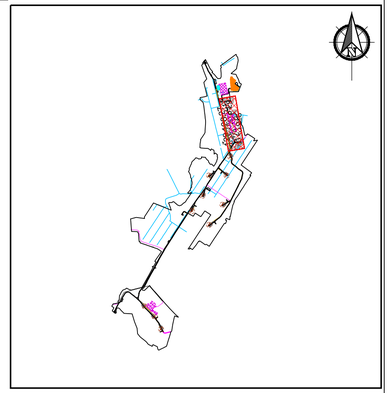
(5) All the above-mentioned general guidelines and requirements will be implemented during construction.

(6) Further guidelines on the construction of the peat storage area are included within Section 5.4 of the Peat & Spoil Management Plan.



SECTION B - B (continued)

Scale 1:250



KEYPLAN

Scale 1:100000

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Rev.	Description	App By	Date
P01	ISSUE FOR PLANNING	JH	16.04.26

PROJECT	LITTLETON WIND FARM
CLIENT	LITTLETON WIND FARM DAC
SHEET	PEAT DEPOSITION AREAS B1 & B2
Date	16.04.26
Project number	P20-211
Scale (@ A1)	As Shown
Drawn by	POR
Checked by	AC
Drawing Number	P20-211-0600-0021
Rev	P01

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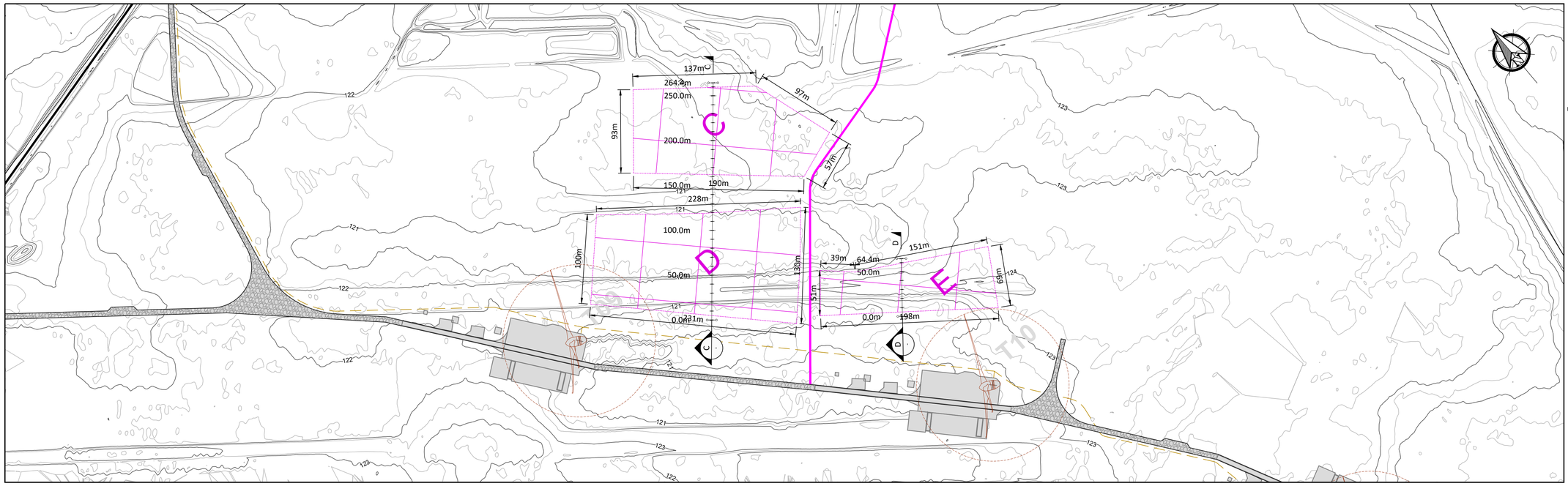
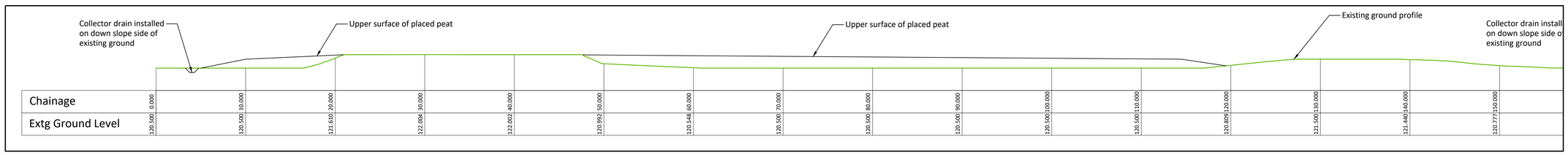
13 May 2026



PLAN

Scale 1:2500

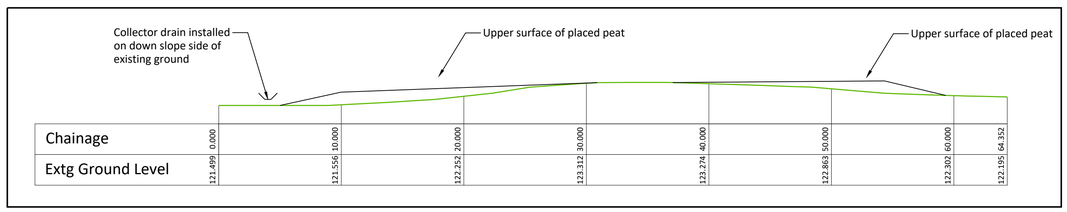


SECTION C - C

Scale 1:250

SECTION C - C (continued)

Scale 1:250



SECTION D - D

Scale 1:250

Legend

- Planning Boundary
- Proposed Wind Farm Access Track.
- Proposed Passing Bays
- Proposed Turning Areas
- Proposed Turbine And Hardstanding Areas
- Proposed Peat Deposition Areas
- Proposed Borrow Pit Area
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- Proposed Recreational Amenity Trail
- Existing Recreational Amenity Trail
- Proposed Internal Collector Circuit
- Proposed Minimum Noise Barrier
- X.Xm Proposed Hardstand Finished Level
- PMM Permanent Metrological Mast

Construction Notes Peat / Spoil Deposition Area:

(1) An interceptor drain will also be installed upslope of the peat deposition areas.

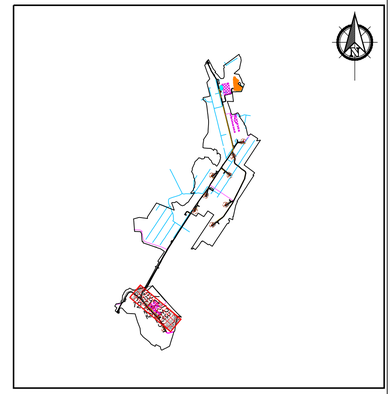
(2) A silting pond will be required at the lower side of the peat deposition areas.

(3) It is important that the surface of the stored peat be shaped to allow efficient run-off of water from the stored spoil.

(4) Supervision by a geotechnical engineer or appropriately competent person is recommended for the construction of the peat deposition area.

(5) All the above-mentioned general guidelines and requirements will be implemented during construction.

(6) Further guidelines on the construction of the peat storage area are included within Section 5.4 of the Peat & Spoil Management Plan.



KEYPLAN

Scale 1:100000

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Rev.	Description	App By	Date
P01	ISSUE FOR PLANNING	JH	16.04.26

PROJECT	LITTLETON WIND FARM
CLIENT	LITTLETON WIND FARM DAC
SHEET	PEAT DEPOSITION AREAS C, D & E
Date	16.04.26
Project number	P20-211
Scale (@ A1)	As Shown
Drawn by	POR
Drawing Number	P20-211-0600-0022
Rev	P01
Checked by	AC

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13 May 2026

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