APPENDIX 5

PEAT AND SPOIL MANAGEMENT PLAN

FEHILY TIMONEY

DESIGNING AND DELIVERING
A SUSTAINABLE FUTURE

LEMANAGHAN WIND FARM, CO. OFFALY

Peat & Spoil Management Plan

Prepared for:

MKO Ltd

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Unit 6, Bagenalstown Industrial Park, Royal Oak Road,
Muine Bheag, Co. Carlow, R21 XW81, Ireland

T: +353 59 972 3800 | E: info@ftco.ie

CORK | DUBLIN | CARLOW

www.fehilytimoney.ie

Peat & Spoil Management Plan, Lemanaghan Wind Farm, Co. Offaly

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Abstract: Fehily Timoney and Company (FT) were engaged by McCarthy Keville O'Sullivan (MKO) to compile a Peat and Spoil Management Plan (PSMP) for the proposed Lemanaghan 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 roads and will be handled and placed/reinstated onsite. The report also provides construction details for the types of roads 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) and Alan Whelan (FT Senior Project Engineer, BEng in Civil Engineering). Doireann has over 2 years' experience in geotechnical engineering, while Alan has over 6 years' experience in geotechnical engineering.

This Report was reviewed by Ian Higgins and Aaron Clarke of Fehily Timoney and Company.

Ian (BSc Engineering Geology, MSc Geotechnical Engineering, FGS, MIEI, PGeo, EurGeol) 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 in January 2021 by McCarthy Keville O'Sullivan (MKO) on behalf of Lemanaghan Wind Farm DAC (the Applicant) to compile a Peat and Spoil Management Plan (PSMP) for the Proposed Lemanaghan 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' and the 'Proposed Project site', and 'site'.

The Proposed Project site is located approximately 3 kilometres (km) northeast of Ferbane and approximately 2.5 km southwest of the village of Ballycumber in Co. Offaly. The Proposed Wind Farm consists of 15 no turbines with a blade tip height of 220 metres, and associated foundations and hard-standing areas, 1 no. meteorological mast, internal roads, 5 no. temporary construction compounds, 4 no. borrow pits, underground cabling, peat deposition areas, site drainage, amenity track and all ancillary works and apparatus. The Proposed Grid Connection includes an overhead line (OHL) cabling from the proposed onsite 220kV substation to the existing Shannonbridge-Maynooth 220kV OHL. Please see Chapter 4 for a full description of the Proposed Project.

The site is relatively flat-lying with drainage channels running typically southwest-northeast. The R436 runs to the south of the Proposed Wind Farm and a narrow existing bog track (walking trail) is located in the southern section of the site. The majority of the site is to the north of this local road. Land uses within the site are a mixture of bare cutover and cutaway peat, re-vegetation of bare peat and commercial Bord na Móna (BnM) operated bog land. Several disused BnM rail lines also pass through the site.

BnM has considerable experience in the handling of peat in these circumstances, both during peat 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 722 no. peat probes were carried out by FT, MKO and Hydro-Environmental Services (HES), to determine the depth of peat across the site. The peat depth data was carried out from April 2021 to February 2025 and has been used in the assessment of peat stability for the Proposed Project site. Exploratory ground investigations, comprising 10 no. boreholes and 54 no. trial pits, were carried out on the Proposed Project site by FT in April 2021 and Irish Drilling Ltd. (IDL) in March 2022 and October/November 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 roads 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 roads 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 peat and spoil management plan 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 site is outlined in detail in Chapter 4: Description of the Proposed Project and Chapter 9: Water of the 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 road, 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.

1.5 Relevant Guidance

The relevant guidance used and referred to throughout this report includes;

- Good Practice during Windfarm Construction (NatureScot, 2024);
- Guidance on Developments on Peatland: Site Surveys (Scottish Government, Scottish Natural Heritage and SEPA, 2017;
- Munro, R, 2004. Dealing with bearing capacity problems on low volume roads constructed on peat. Roadex II Northern Periphery;
- Scottish Natural Heritage/Forestry Commission Scotland, 2010. Floating Roads on Peat;
- Scottish Natural Heritage, 2015. Constructed Roads in the Scottish Uplands. Scottish Natural Heritage.

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 roads through peat
3. Construction of floated roads over peat (will not generate peat and spoil but the methodology for construction is included for completeness)
4. Excavation and placement of peat and spoil
5. Excavations in peat for turbine bases, hardstands, substation and other infrastructure foundations
6. Excavations in peat for underground cables
7. Excavations of peat and spoil for the development of the Borrow Pits

Peat and spoil management of the above construction activities are covered individually in this report.

2.2 Road 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 roads will need to be constructed. The road 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 road design the actual construction technique employed for a particular length of road will be determined by the prevailing ground conditions encountered along that length of road.

The general road 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 roads within the Proposed Project site. This report includes the most suitable type of road construction envisaged for each section of internal road based on the ground/site conditions recorded during the site walkovers. Where floating roads 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 Road 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 roads through peat	Type A	9.3	Less than 2.0m	Varies	New internal road construction technique envisaged for various locations on site – Drawing P20-216-0600-0017
Construction of new floating roads over peat	Type B	12.1	>2.0	<5.0	New internal road construction technique envisaged for various locations on site – Drawing P20-216-0600-0018
Upgrade of existing internal roads	Type C	2.94	Typically, less than 1.5m, locally up to 3.0m	Varies	New internal road construction technique envisaged for various locations on site – Drawing P20-216-0600-0019

Further details on internal road construction Types A to C are given in Sections 3 and Section 4 of this report.

3. CONSTRUCTION OF NEW EXCAVATED ROADS THROUGH PEAT – TYPE A

The excavation of peat and spoil and founding of internal roads on competent stratum (below the peat) for new internal roads will be carried out at various locations within the Proposed Project site. The proposed locations for new excavated internal roads within the Proposed Project site are shown in drawings P20-216-0600-0013 to 0015 and details are shown in drawing P20-216-0600-0016.

Excavate and replace type internal roads are the conventional method for construction of internal roads 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 Road 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: Description of the Proposed Project, Chapter 8: Land Soils and Geology, and Chapter 9: Water of the EIAR.

1. Prior to commencing the construction of the excavated roads 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 road alignment to divert any surface water away from the construction area.
3. Excavation of roads will be to the line and level given in the design requirements. Excavation will take place to a competent stratum beneath the peat.
4. Road construction will be carried out in sections of approximately 50m lengths i.e. no more than 50m of internal road 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 roads and hardstands before being placed into the permanent peat storage areas within the borrow pits and designated Peat Deposition Areas. All peat placement areas will be upslope of founded roads/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 roads.
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 road during the construction/upgrading of the internal road will be carefully monitored to ensure that excessive impact loading, which may adversely affect the adjacent peat, is limited.
9. The excavated internal road 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 roads to be finished with a layer of capping across the full width of the road.
11. A layer of geogrid/geotextile may be required at the surface of the competent stratum.
12. At transitions between floating and excavated roads a length of road of about 10m shall have all peat excavated and replaced with suitable fill. The surface of this fill shall be graded so that the road surface transitions smoothly from floating to excavated road.
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 road 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 shall be placed over the excavated road and graded to accommodate wind turbine construction and delivery traffic.
15. The construction and upgrading of internal roads 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. CONSRUCTION OF NEW FLOATED ROADS OVER PEAT – TYPE B

Floating roads will be the predominant road 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 roads will be limited on site to areas of flatter terrain, i.e., less than a 5-degree slope. The proposed locations for floating roads across the site are shown in drawings P20-216-0600-0013 to 0015 and details shown in drawing P20-216-0600-0017; all drawings are provided in Appendix A to this report.

A confirmatory stability analysis should be carried out by the designer where it is proposed to install floating internal roads over the peat prior to any construction work commencing on site.

Floating roads 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 road may be more suitable (see Section 3 and Drawing P20-216-0600-0016), although this is not anticipated at the location of the floated roads.

4.1 Floating Road 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 road 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 road in accordance with geogrid provider's requirements.
3. Construction of road to be in accordance with appropriate design from the designer.
4. The typical make-up of the new floated internal road is up to 1,000mm of selected granular fill with 2 no. layers of geogrid with possibly the inclusion of a geotextile separator (drawing P20-216-0600- 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 roads it may be deemed necessary to include pressure berms either side of the internal road 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 road will reduce the likelihood of potential bearing failures beneath the internal road.
7. The finished road width will be approximately 5.5m (5.0m running width), with wider sections on bends and corners.
8. Stone delivered to the floating road construction shall be end-tipped onto the constructed floating road. 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 road shall be tipped over at least a 10m length of constructed floating road.
10. Where it is not possible to end-tip over a 10m length of constructed floating road then dumpers delivering stone to the floating road shall 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 road.

11. Following end-tipping a suitable bulldozer shall be employed to spread and place the tipped stone over the base geogrid along the line of the road.
12. A final surface layer shall be placed over the full width of the floating road, as per design requirements, to provide a road profile and graded to accommodate wind turbine construction and delivery traffic.

4.2 Floating Road Construction Methodology (Crossing Archaeological Features)

This methodology includes procedures that are to be included in the construction phase to minimise any adverse impact on known archaeological features within the Proposed Development. 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. There are two known locations where internal access roads cross archaeological features (togher), one between T10 and T11 and the other to the north of T10 on the access road that leads to the on-site substation. These locations are shown in drawing P20-216-0600-0024.

1. Geotextile layer to be placed on the surface of the peat, extending 5m either side of the toghers. The extent of the togher will be confirmed on site by an archaeological specialist.
2. A layer of clean sand, 0.5m in thickness, will be placed on top of the geotextile to act as a buffer between the togher and the access road. The top of the clean sand layer will be dead rolled, without vibration.
3. Base geogrid to be laid on top of the sand layer along the line of the road in accordance with geogrid provider's requirements. Geogrid to be laid across the full width of the road, including the widened area for the cable trench.
4. Construction of road to be in accordance with appropriate design from the designer.
5. The typical make-up of the new floated internal road is up to 1,000mm of selected granular fill with 2 no. layers of geogrid (drawing P20-216-0600-0025).
6. Granular fill for the road construction to be placed and compacted in layers in accordance with the TII Specification for Road Works, Series 600 (2013).
7. The access road at these locations is to be widened to accommodate the cable trench (as per drawing P20-216-0600-0025. A minimum of 2m horizontal space is required between the edge of the access road and the edge of the cable trench.

5. UPGRADE OF EXISTING INTERNAL ROADS – TYPE C

Minimal, localised sections of existing internal roads are present on the site. Upgrading works are likely to involve both widening and resurfacing of the existing internal roads. The proposed locations for upgrade of the existing internal roads on site are shown in drawings P20-216-0600-0013 to 0015 and details shown in drawing P20-216- 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 road construction shall be to the line and level requirements as per design/planning conditions.
2. For upgrading of existing excavated internal roads (Type A) the following guidelines apply:
    a) Excavation of the widened section of internal road 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 road and the widened section of internal road depending on the depth of excavation required.
    c) The surface of the existing internal road should be overlaid with up to 500mm of selected granular fill.
    d) Internal roads 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 road and at the base of the widened section of internal road (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 road width will have a running width of 5m, with wider sections on bends and corners.
4. On side long sloping ground any road widening works required will be done on the upslope side of the existing internal road, where possible.
5. At transitions between new floating and existing excavated roads 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 ROADS

The following general construction guidelines are given for the internal roads on site.

1. Where an open drain is present alongside an existing/proposed floating internal track, the drain may need to be filled prior to upgrading/constructing the internal track. The drain shall 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 road then it will be necessary to ensure that this drainage is not affected by settlement of the upgraded internal road. 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) shall be carried out within 5m distance of a completed floated internal road edge, or at a distance determined following site inspection. The presence of excavations can destabilise the road. Temporary excavations should be excavated in short lengths and backfilled as soon as practicable.
4. Floating roads shall not be constructed on areas of sidelong ground.
5. No stockpiling of materials shall take place on or adjacent to floated internal roads so as to avoid bearing failure of the underlying peat.
6. End-tipping of stone onto the road during the construction/upgrading of the internal road should 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 road construction, it will be necessary to monitor the settlement/movement of the road. Survey points will be located along the road at 10m intervals in areas of deep peat (greater than 2m). These survey points shall 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 roads 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 road during/following construction then mitigation measures may be required to ensure the stability of the road. This may include:
    a) Introduction of pressure berms either side of the road (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 road 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 road 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 road, as necessary.

7. EXCAVATION AND STORAGE OF PEAT AND SPOIL

The site has been extensively harvested by BnM using mechanical cutting resulting in well drained and extensively trafficked peat. BnM 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 one of the 4 no. borrow pits, as borrow pits are opened and closed and as the internal roads and hardstands are developed (see drawing P20-216-0600-0019 and P20-216-0600-0020) or to designated Peat Deposition Areas.
2. Further details on the construction and reinstatement of the 4 no. borrow pits are given in Section 6.5.
3. 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 is given in Table 7-1.

Table 7-1: Summary of Excavated Peat and Spoil Volumes on Site

Infrastructure Element [1]	Typical Dimensions	Peat Volume (m^3) [2]	Spoil (non-peat) Volume (m^3) [2]	Comment
15 no. Turbines and Hardstands	32m diameter excavation footprint for turbine foundation with 49 x 75m hardstand area.	158,466	25,535	Hard standing area and foundation footprint
Internal Roads	Assumed 5m running surface with 6m wide development footprint.	9,790	37,456	Excludes proposed floating road sections of internal road where no excavation of peat will take place

Infrastructure Element (1)	Typical Dimensions	Peat Volume (m^3) (2)	Spoil (non-peat) Volume (m^3) (2)	Comment
Temporary Construction Compounds	5 no. Hard standing areas (total area 57,397m^2).	0	0	Compounds assumed as floating. Dimensions of each compound varies.
Telecoms Tower	1 no. Tower 15m x 15m foundation footprint	248	74	Assumes piled foundation
Steel Masts OHL (North of Substation)	2 no. steel masts with 20m x 20m wide and 3.0m deep foundation	3,390	282	Assumes gravity foundation
Steel Masts OHL (under OHL)	2 no. steel masts with 20m x 20m wide and 3.0m deep foundation	753	2,636	Assumes gravity foundation
Met Mast	12m x 12m foundation footprint and 40 x 40m hard standing area	2,063	248	Assuming a gravity foundation, however piled foundation is also suitable.
Crane Pad for Steel Mast OHL (North of Substation)	30 x 30m hard standing area	990	297	Assumes Founded (not floated)
Crane Pad (under OHL)	30 x 30m hard standing area	990	297	Assumes Founded (not floated)
Tower Building (North of Substation)	56m x 25m hard standing area	1,540	462	Assumes piled foundation
Tower Building (under OHL)	56m x 25m hard standing area	1,540	462	Assumes piled foundation
Substation	11,064m^2 footprint	12,170	3,651	
Borrow Pits	4 no. borrow pits. (Dimensions of each BP varies)	15,587	159,522	Depth of rock is unproven in Borrow Pit 1 and 2
	Total =	**207,527m^3**	**230,922m^3**	**Total = 438,449m^3 (peat and spoil volume)**

Note (1) The location of the infrastructure elements on site are shown on drawing P20-216-0600-0013 to 0015.
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.

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 is given in Table 7-2.

The borrow pits have the enough storage capacity for all the peat and spoil excavated from the site however landscaping at turbine locations and side casting along internal roads has been included to reduce haulage and co-ordinate with the flow of construction on site.

Borrow Pit (BP) No. 3 and Borrow Pit no. 4, located on the northeast of the site, have been designed to maximum capacity to excavate as much stone as possible for use across the site. Borrow Pit No. 1 and Borrow Pit No. 2 have been included to the east of the site to assist with the flow of construction and to minimise haulage across the site. The depth of rock has not been proven at these 2 no. BPs (BP. No. 1 and BP No. 2) It is recommended to carryout 1 no. borehole/rotary corehole at BP no. 1 and BP no. 2 to determine the depth of rock and to confirm the viability of these BP locations.

Table 7-2: Summary of Peat and Spoil Deposition Areas on site

Location (1)	Peat and Spoil Volume (m^3)	Comment
Landscaping (2)	30,000	It is estimated that approximately 2,000m^3 of peat will be required for landscaping purposes at each of the 15 no. turbine locations.
Side Casting	10,710	See Drawings P20-216-0600-0023 to 0026 for further details. The side casting will be comprised of peat and spoil placed along the access roads.
Borrow Pits	608,600	The Borrow Pits will store both peat and spoil. See Drawings P20-216-0600-0019 to 0020 for further details.
Peat Deposition Areas	175,000	These areas will be for peat storage only. See Drawing P20-216-0600-0021 to 0022 for further details.
Total =	**824,310m^3**	

Note (1) The location of the proposed borrow pits at the site are shown on Drawings P20-216-0600-0019 and 0020.
Note (2) While it is unlikely that acrotelm (upper layer of peat) will be encountered, if excavation works come across this upper layer or peat during construction, it will be used for landscaping purposes.
Note (3) The total storage volume quoted above is the maximum storage capacity within the proposed development. However, the Borrow Pits will only be partially backfilled to the required depth based on the peat and spoil generated during construction and will not be backfilled to the original ground surface.

7.4 Summary of Stone Volume Requirements

Table 7.3 below summarises the stone volume requirement for the Proposed Project, excluding the final blinding layer, all of which will come from an external source.

Table 7-3: Summary of Stone Volume Requirements

Infrastructure Element (1)	Typical Dimensions	Stone Volume (m3) (2)	Comment
15 no. Turbines and Hardstands	32m diameter excavation footprint for turbine foundation with 49 x 75m hardstand area.	159,100	Hardstanding area and foundation footprint. Allowance included for mini-crane pads and blade finger hardstands associated with the main hardstand, plus allowance for side slopes in areas of fill.
Internal Roads	Assumed 5m running surface with 6m wide development footprint.	158,100	Allowance includes for widening on bends, at junctions, laybys, and tie-ins to hardstands.
Temporary Construction Compounds	5 no. Hard standing areas (total area 57,397m2).	66,500	
Telecoms Tower	1 no. Tower 15m x 15m foundation footprint	300	
Steel Masts OHL (North of Substation)	2 no. steel masts with 20m x 20m wide and 3.0m deep foundation	3,550	Assumes gravity foundation
Steel Masts OHL (under OHL)	2 no. steel masts with 20m x 20m wide and 3.0m deep foundation	800	Assumes gravity foundation
Met Mast	12m x 12m foundation footprint and 40 x 40m hard standing area	2,200	
Crane Pad for Steel Mast OHL (North of Substation)	30 x 30m hard standing area	1,050	
Crane Pad (under OHL)	30 x 30m hard standing area	1,050	
Tower Building (North of Substation)	56m x 25m hard standing area	1,650	

Infrastructure Element (1)	Typical Dimensions	Stone Volume (m3) (2)	Comment
Tower Building (under OHL)	56m x 25m hard standing area	1,650	
Substation	11,064m^2 footprint	12,800	
Borrow Pits	4 no. borrow pits. (Dimensions of each BP varies)	0	No stone required in the Borrow Pits
	Total =	408,750m^3	

Notes
Note (1) A contingency factor of 15% has been applied to the volumes to allow for expected bulking upon excavation and to allow for a variation in ground conditions across the Site.
Note (2) It should be noted that the volumes given in Table 7.3 are subject to confirmatory design.

7.5 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. 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. Where possible, shaping of the surface of the peat should 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 shall 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 (if encountered) 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 road where peat has been placed. The locations where monitoring is required will be identified by the designer onsite.

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.

7.6 Guidelines for the Construction and Reinstatement of Borrow Pits

Within the Proposed Wind Farm, 4 no. locations have been identified as potential borrow pits and are shown on Drawings P20-216-0600-0019 and 0020. The peat depth within the development footprint of the proposed borrow pits is typically less than 1.5m. The proposed borrow pit locations were selected based on the shallow depth of peat and overburden.

The depth of overburden in proposed Borrow Pits no. 1 and 2 was not proven by ground investigation, therefore it is not confirmed if rock will be encountered before the scheduled depth of 7.0m below ground level. The location of these 2 no. borrow pits was selected to assist in the flow of construction on the east of the site.

Upon removal of the rock from the proposed borrow pits, it is proposed to partially backfill the borrow pits using excavated peat and spoil. The excavated rock from the proposed borrow pits will be used in the construction of the infrastructure elements (turbine bases, roads, etc.) within the Proposed Project site. The contractor excavating the rock will be required to develop the proposed borrow pits in a way which will allow the excavated peat and spoil to be placed safely. It is proposed to construct cells within the borrow pits for the placement of the excavated peat and 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 pits.

It should be noted that there are significant excavation works required in order to develop the borrow pits 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 P20-216-0600-0019 to 0020 show typical construction details for the proposed borrow pits. The borrow pits shall be constructed as follows:

1. The rock within the proposed borrow pit footprints will be removed by breaking based on assessment of its excavatability, which has been determined from a ground investigation carried out at the proposed borrow pits. 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.
2. It is proposed to construct the borrow pits so that the base of the borrow pits are below the level of the adjacent section of internal road. As excavation progresses into the back edge of the borrow pits, localised deepening of the borrow pit floors may be required depending on extraction operations.
3. Slopes within the excavated rock formed around the perimeter of the borrow pits 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 pits 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. Rock buttresses will be constructed within the borrow pits 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 engineered rock buttresses within the borrow pits will be constructed to form a series of cells (up to 4 no.). The cells will be opened in sequence and filled as needed.
7. The rock buttresses will be constructed in stages to allow infilling of peat and 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.
8. Infilling of the peat and spoil will commence at the back edge of the borrow pit and progress towards the borrow pit entrance/rock buttress 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 pits in a way which will allow the excavated peat and spoil to be reinstated safely.
9. A number of rock buttresses to form cells within the borrow pits will be required to ensure access for trucks and excavators can be achieved.
10. 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.
11. A rock buttress will be required on the downslope side of the borrow pits to safely retain the infilled peat and 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.
12. 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.
13. 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.
14. 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.
15. The use of temporary access ramps and long reach excavators during the placement of the excavated peat and spoil is likely to be required.
16. The surface of the placed peat and spoil shall be shaped to allow efficient run-off of surface water from the placed arisings.
17. As the buttresses are slightly higher than the retained peat, drains will be provided at regular intervals through the buttresses, at the same level as the top of the peat surface, to prevent ponding of water. These drains will be 150mm diameter flexible plastic drainage pipe or equivalent.
18. A layer of geogrid to strengthen the surface of the placed peat and spoil within the borrow pits may be required.
19. 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.
20. Temporary control of groundwater within the borrow pits may be required and measures will be determined as part of the ground investigation programme. A temporary pump and suitable outfall locations are likely to be required during construction.
21. Settlement ponds have been designed at the lower side/outfall location of the borrow pits.

22. 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 peat and spoil within the borrow pits.
23. Supervision by the Project Geotechnical Engineer is required for the development of the borrow pits.
24. 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 15 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 substation, tower buildings, telecommunications tower, steel masts and met masts should be considered for a piled foundation solution as the depth of peat and overburden is >3.0m hence piled foundations should also be considered to reduce excavation volumes.

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 pits will also require the removal of peat and 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 shall 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 an established watercourse or drainage ditch following suitable treatment, as described in Chapter 4 and Chapter 8 of the EIAR.

9. EXCAVATIONS FOR UNDERGOUND CABLES

A connection between the Proposed Wind Farm and the national electricity grid will be necessary to export electricity. It is proposed that the Proposed Wind Farm will connect to the national grid via a loop-in connection to the Shannonbridge-Maynooth 220kV OHL located approximately 0.4km north of the proposed onsite 220kV substation located in the northern end of the site. Therefore, there are no underground cables associated with the Proposed Grid Connection.

Each proposed turbine will be connected to the proposed onsite 220kV substation via internal underground 20kV or 33kV (kilovolt) electricity cabling. Fibre-optic cables will also connect each wind turbine and the met mast to the proposed onsite 220kV substation. The electricity and fibre-optic cabling connecting to the proposed onsite 220kV substation compound will be run in cable ducts adjacent to the proposed roads 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 road 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 road, on both sides of the road or within the road. 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 onsite 220kV substation, including proposals for water crossings, is described in Chapter 4 of EIAR.

The cable trench route 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 8 above).
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 road 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 road at staggered intervals at locations where the peat depth is greater than 2.5m. 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 shall 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 road 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 shall 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 shall 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 and the proposed borrow pits, 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 roads 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.

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DESIGNING AND DELIVERING
A SUSTAINABLE FUTURE

APPENDIX A

Drawings

Amenity Car Park

T10

T11

Contd. Line 1

Contd. Line 1

0m 50m 100m 150m 200m 250m 300m 350m 400m 450m 500m

Scale 1:5000

Legend:

- EIAR Site Boundary
- Proposed Turbine & Hardstanding
- Proposed Internal Track
- Proposed Upgrade to Existing Internal Track
- Proposed New Amenity Track
- Existing Amenity Track
- Proposed Construction Compound
- Proposed Substation
- Proposed Met Mast
- Existing Pump Station
- Proposed Borrow Pit
- Proposed Peat Deposition Area
- Proposed Peat / Spoil Side Casting Berms

Road Type Legend:

Type A -
New Excavate &
Replace Internal Track

Type B -
New Floated Internal Track

Type C -
Upgrade of Existing
Excavated Internal Track

PLAN

Scale 1:5000

KEYPLAN

Scale 1:60000

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Rev.	Description	App By	Date
A	FOR INFORMATION	BDH	30.05.25
B	FOR INFORMATION	BDH	27.06.25
C	FOR INFORMATION	BDH	22.07.25

PROJECT: LEMANAGHAN WIND FARM, CO. OFFALY

CLIENT: MKO

SHEET: ROAD CONSTRUCTION TYPES PLAN SHEET 1 OF 3

Date: 22.07.25
Drawn by: POR
Checked by: AC

Project number: P20-216
Scale (@ A1): 1:5000
Drawing Number: P20-216-0600-0013 (Sheet set subset 0600)
Rev: C

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9 March 2026

Contd. Line 1

Contd. Line 1

Contd. Line 2

Contd. Line 2

T08

BP4

T09

BP3

T06

T12

T13

T15

T11

T05

T14

4

0m 50m 100m 150m 200m 250m 300m 350m 400m 450m 500m

Scale 1:5000

Legend:

- EIAR Site Boundary
- Proposed Turbine & Hardstanding
- Proposed Internal Track
- Proposed Upgrade to Existing Internal Track
- Proposed New Amenity Track
- Existing Amenity Track
- Proposed Construction Compound
- Proposed Substation
- Proposed Met Mast
- Existing Pump Station
- Proposed Borrow Pit
- Proposed Peat Deposition Area
- Proposed Peat / Spoil Side Casting Berms

Road Type Legend:

Type A -
New Excavate &
Replace Internal Track

Type B -
New Floated Internal Track

Type C -
Upgrade of Existing
Excavated Internal Track

PLAN

Scale 1:5000

KEYPLAN

Scale 1:60000

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Rev.	Description	App By	Date
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PROJECT: LEMANAGHAN WIND FARM, CO. OFFALY	CLIENT: MKO		
SHEET: ROAD CONSTRUCTION TYPES PLAN SHEET 2 OF 3	Date: 22.07.25	Project number: P20-216	Scale (@ A1): 1:5000
	Drawn by: POR	Drawing Number: P20-216-0600-0014 (Sheet set subset 0600)	Rev: C
	Checked by: AC		

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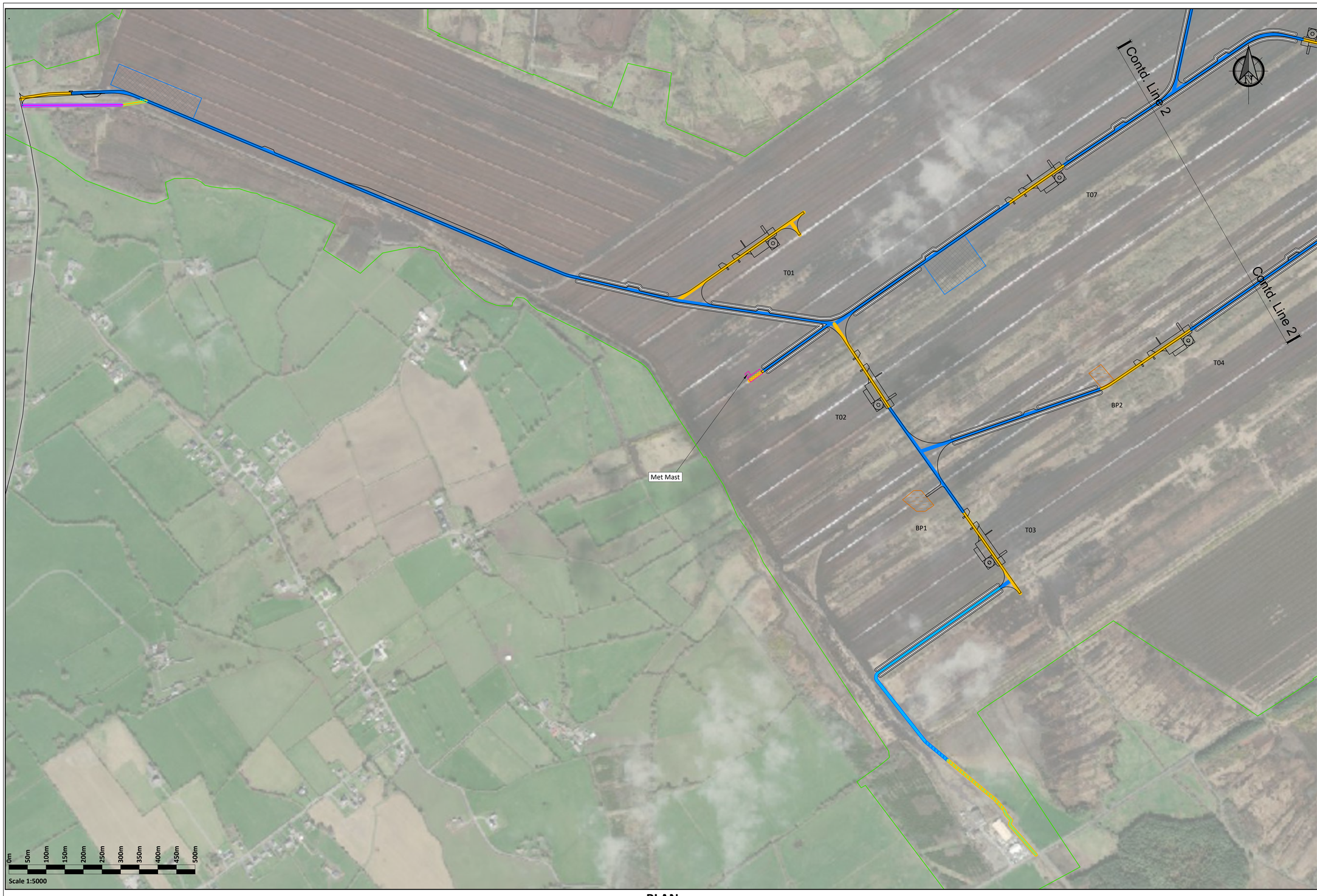
9 March 2026



Legend:

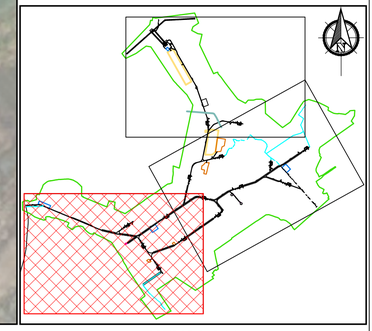
- EIAR Site Boundary
- Proposed Turbine & Hardstanding
- Proposed Internal Track
- Proposed Upgrade to Existing Internal Track
- Proposed New Amenity Track
- Existing Amenity Track
- Proposed Construction Compound
- Proposed Substation
- Proposed Met Mast
- Existing Pump Station
- Proposed Borrow Pit
- Proposed Peat Deposition Area
- Proposed Peat / Spoil Side Casting Berms

Road Type Legend:

Type A -
New Excavate &
Replace Internal Track

Type B -
New Floated Internal Track

Type C -
Upgrade of Existing
Excavated Internal Track



PLAN
Scale 1:5000

KEYPLAN
Scale 1:60000

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Rev.	Description	App By	Date
A	FOR INFORMATION	BDH	30.05.25
B	FOR INFORMATION	BDH	27.06.25
C	FOR INFORMATION	BDH	22.07.25

PROJECT: LEMANAGHAN WIND FARM, CO. OFFALY

CLIENT: MKO

SHEET: ROAD CONSTRUCTION TYPES PLAN SHEET 3 OF 3

Date: 22.07.25
Drawn by: POR
Checked by: AC
Project number: P20-216
Scale (@ A1): 1:5000
Drawing Number: P20-216-0600-0015
(Sheet set subset 0600)
Rev: C

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9 March 2026

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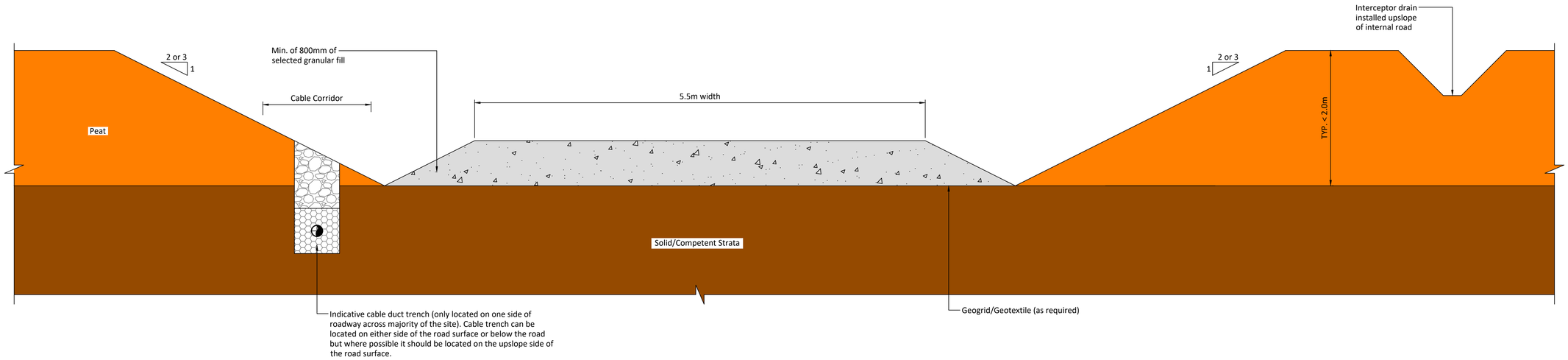

Scale 1:25

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Rev.	Description	App By	Date
A	FOR INFORMATION	BDH	30.05.25
B	FOR INFORMATION	BDH	27.06.25
C	FOR INFORMATION	BDH	22.07.25

PROJECT	LEMANAGHAN WIND FARM, CO. OFFALY
CLIENT	MKO
SHEET	TYPE A - NEW EXCAVATE AND REPLACE INTERNAL TRACK
Date	22.07.25
Drawn by	POR
Checked by	AC
Project number	P20-216
Scale (@ A1)	1:25
Drawing Number	P20-216-0600-0016 (Sheet set subset 0600)
Rev	C

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9 March 2026

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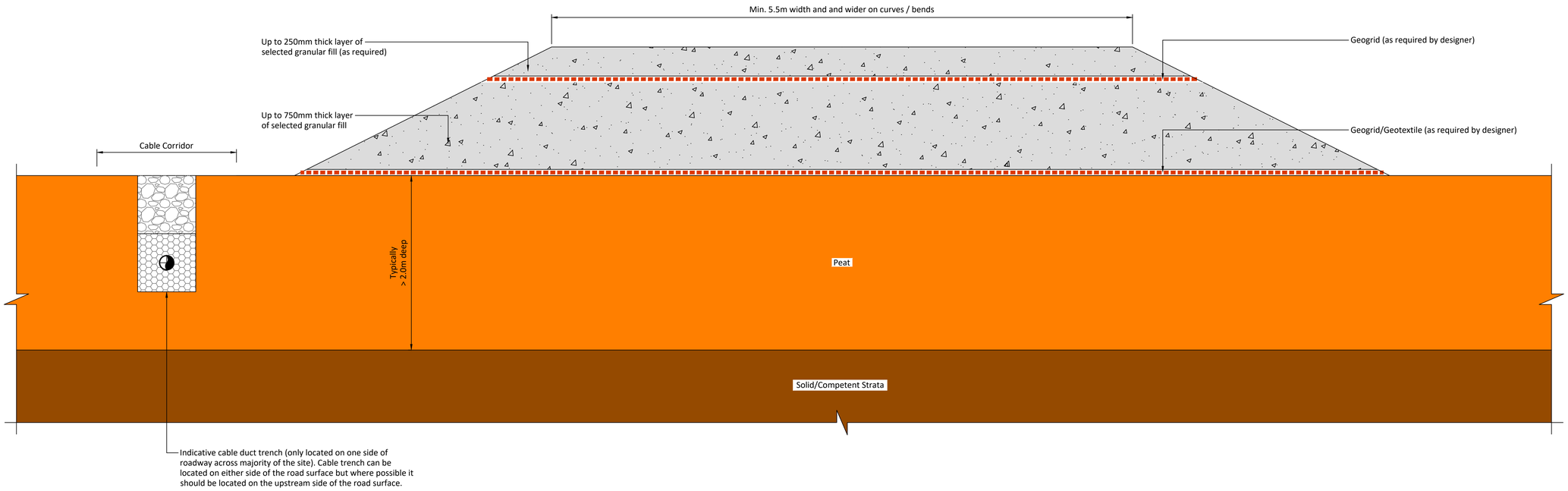

Scale 1:20

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Rev.	Description	App By	Date
A	FOR INFORMATION	BDH	30.05.25
B	FOR INFORMATION	BDH	27.06.25
C	FOR INFORMATION	BDH	22.07.25

PROJECT: LEMANAGHAN WIND FARM, CO. OFFALY		CLIENT: MKO	
SHEET: TYPE B - NEW FLOATED INTERNAL TRACK	Date: 22.07.25	Project number: P20-216	Scale (@ A1): 1:20
	Drawn by: POR	Drawing Number: P20-216-0600-0017 (Sheet set subset 0600)	Rev: C
	Checked by: AC		

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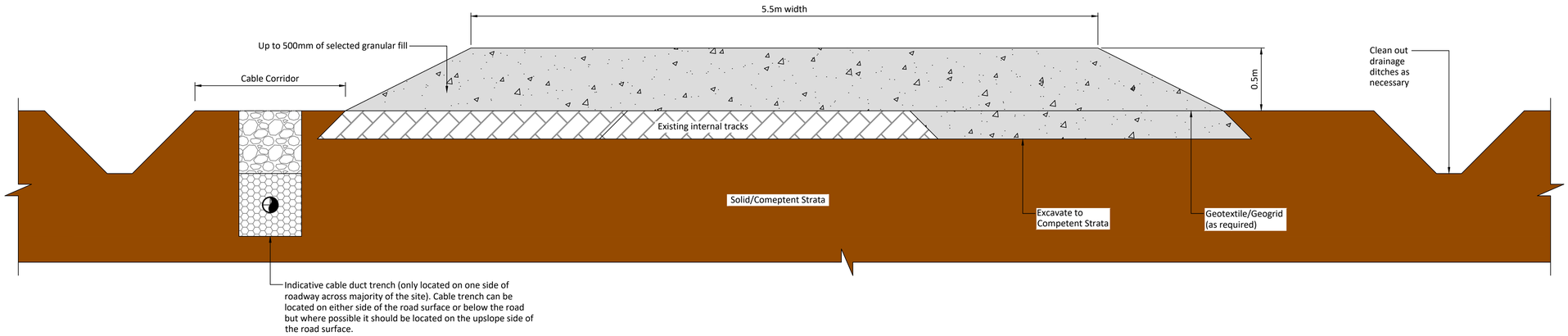
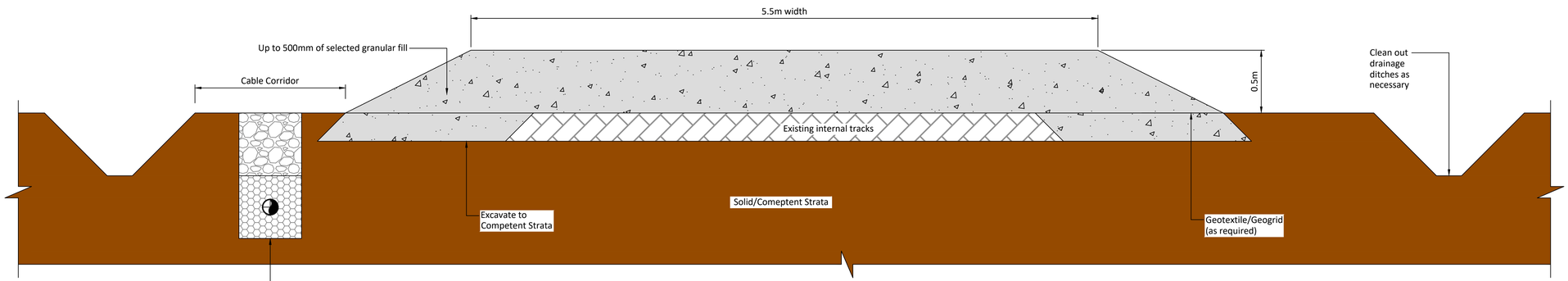
9 March 2026





Scale 1:20

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Rev.	Description	App By	Date
A	FOR INFORMATION	BDH	30.05.25
B	FOR INFORMATION	BDH	27.06.25
C	FOR INFORMATION	BDH	22.07.25

PROJECT	LEMANAGHAN WIND FARM, CO. OFFALY
CLIENT	MKO
SHEET	TYPE C - UPGRADE OF EXISTING INTERNAL TRACKS
Date	22.07.25
Drawn by	POR
Checked by	AC
Project number	P20-216
Scale (@ A1)	1:20
Drawing Number	P20-216-0600-0018 (Sheet set subset 0600)
Rev	C

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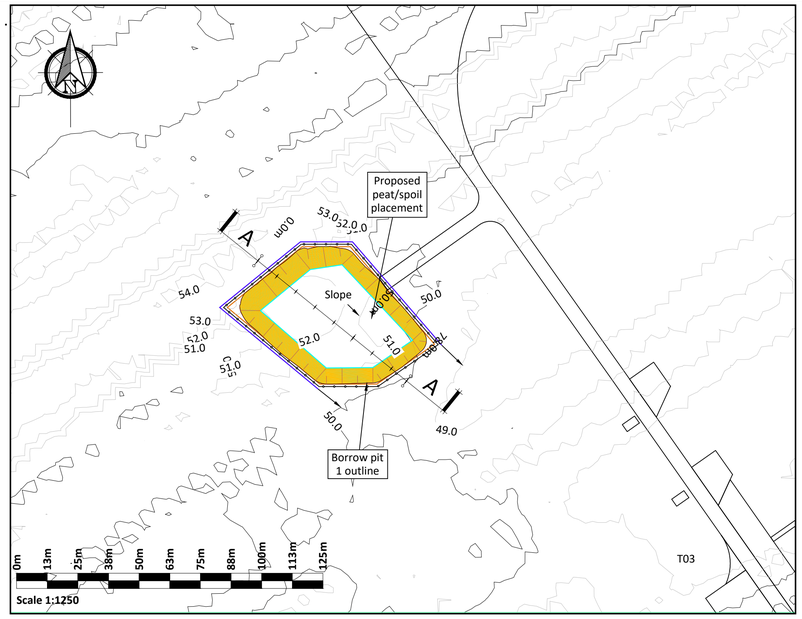
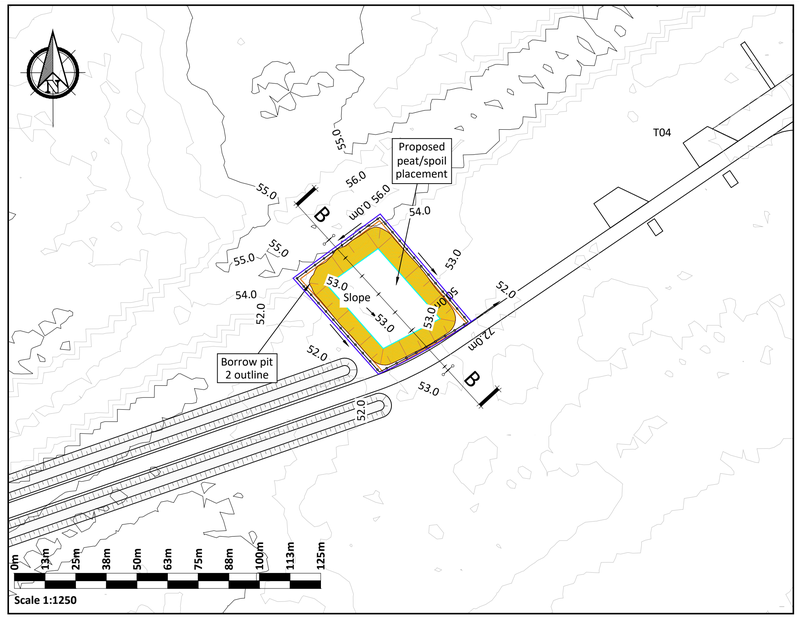
9 March 2026



PLAN
Scale 1:1250



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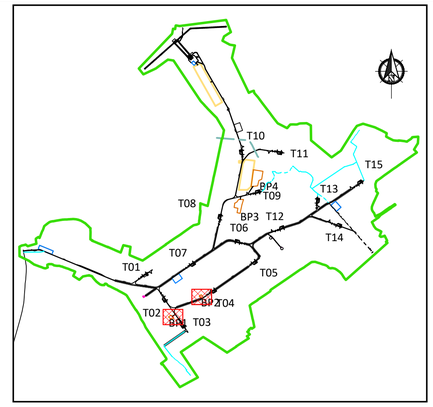
Scale 1:1250



KEYPLAN
Scale 1:50000

Legend:

- EIAR Site Boundary
- Proposed Turbine & Hardstanding
- Proposed Internal Track
- Proposed Upgrade to Existing Internal Track
- Proposed New Amenity Track
- Existing Amenity Track
- Proposed Construction Compound
- Proposed Substation
- Proposed Met Mast
- Existing Pump Station
- Proposed Borrow Pit
- Proposed Peat Deposition Area
- Proposed Peat / Spoil Side Casting Berms
- Interceptor Drain
- Borrow Pit Perimeter Fence
- 50.0 Existing Ground Contour - Major
- 50.0 Existing Ground Contour - Minor
- Togher (Archeological Feature)

Volume Summary		
Name	2d Area (sq.m)	Cut (Cu. M.)
TotalExtractionVolume-BorrowPit-1	2,823.5	16,351.5
TotalExtractionVolume-BorrowPit-2	1,992.5	10,342.6

Borrow Pit Construction Notes:

(1) It is proposed to construct the borrow pit so that the base of the borrow pit is below the level of the adjacent section of access road.

(2) 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.

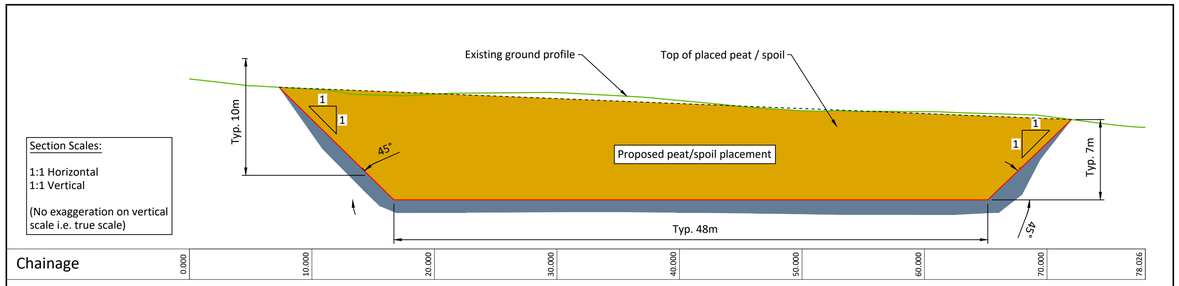
(3) Infilling of the peat & spoil will commence at the back edge of the borrow pit and progress towards the borrow pit entrance/rock buttress.

(4) The Borrow Pits will only be partially backfilled to the required depth based on the peat and spoil generated during construction and will not be backfilled to the original ground surface.

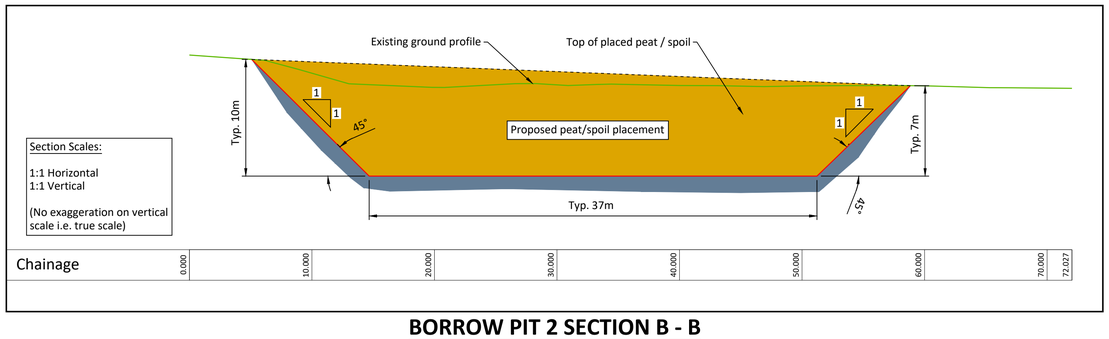
(5) The surface of the placed peat & spoil will be shaped to allow efficient run-off of surface water from the placed arising's.

(6) Control of groundwater within the borrow pit may be required and measures will be determined as part of the ground investigation programme.

(7) All the above-mentioned general guidelines and requirements will be confirmed by the designer prior to construction.



BORROW PIT 1 SECTION A - A
Scale 1:250



BORROW PIT 2 SECTION B - B
Scale 1:250

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Rev.	Description	App By	Date
B	FOR INFORMATION	BDH	17.04.25
C	FOR INFORMATION	BDH	22.05.25
D	FOR INFORMATION	BDH	30.05.25
E	FOR INFORMATION	BDH	27.06.25
F	FOR INFORMATION	BDH	22.07.25
G	FOR INFORMATION	BDH	22.01.26

PROJECT: LEMANAGHAN WIND FARM, CO. OFFALY		CLIENT: MKO	
SHEET: BORROW PITS 1 AND 2	Date: 21.01.26	Project number: P20-216	Scale (@ A1): As Shown
	Drawn by: POR	Drawing Number: P20-216-0600-0019	Rev: G
	Checked by: AC	*(Sheet set subset 0600)*	

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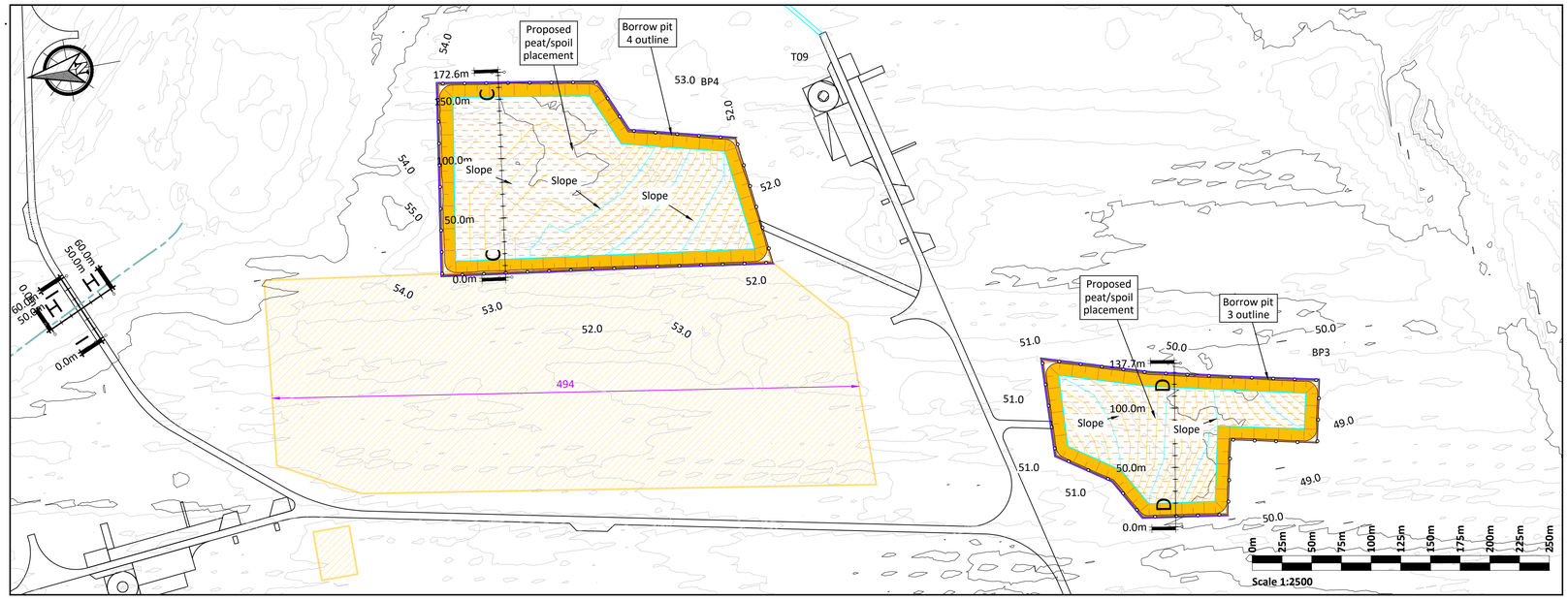
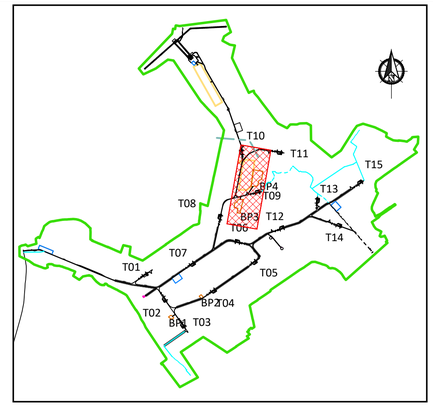
9 March 2026



PLAN

Scale 1:2500



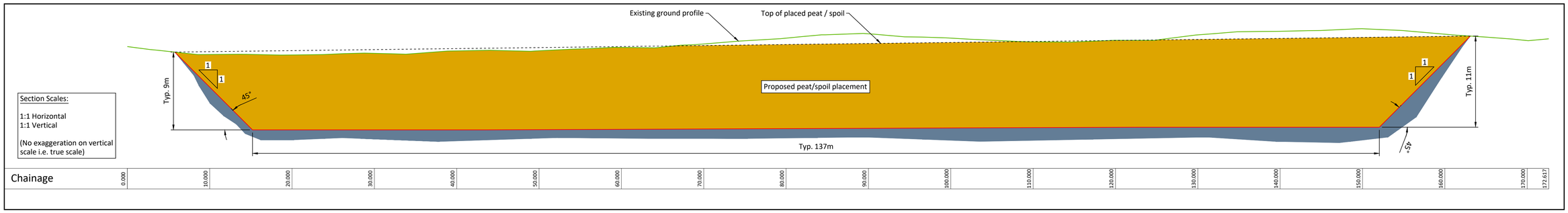
KEYPLAN

Scale 1:50000

Legend:

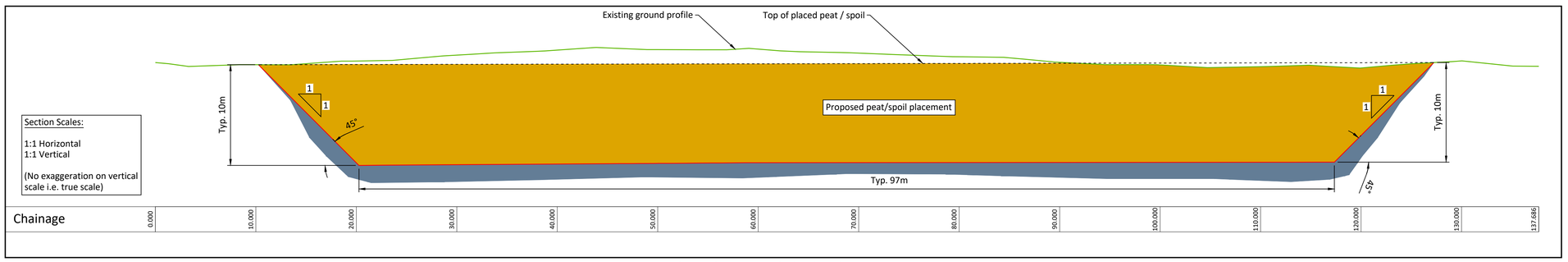
- EIAR Site Boundary
- Proposed Turbine & Hardstanding
- Proposed Internal Track
- Proposed Upgrade to Existing Internal Track
- Proposed New Amenity Track
- Existing Amenity Track
- Proposed Construction Compound
- Proposed Substation
- Proposed Met Mast
- Existing Pump Station
- Proposed Borrow Pit
- Proposed Peat Deposition Area
- Proposed Peat / Spoil Side Casting Berms
- Interceptor Drain
- Borrow Pit Perimeter Fence
- 50.0 Existing Ground Contour - Major
- 50.0 Existing Ground Contour - Minor

Volume Summary		
Name	2d Area	Cut
	(sq.m)	(Cu. M.)
TotalExtractionVolume-BorrowPit-4	35,030.2	336,200.0
TotalExtractionVolume-BorrowPit-3	19,085.5	167,558.9



BOREHOLE PIT 4 SECTION C - C

Scale 1:250



BORROW PIT 3 SECTION D - D

Scale 1:250

Borrow Pit Construction Notes:

(1) It is proposed to construct the borrow pit so that the base of the borrow pit is below the level of the adjacent section of access road.

(2) 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.

(3) Infilling of the peat & spoil will commence at the back edge of the borrow pit and progress towards the borrow pit entrance/rock buttress.

(4) The Borrow Pits will only be partially backfilled to the required depth based on the peat and spoil generated during construction and will not be backfilled to the original ground surface.

(5) The surface of the placed peat & spoil will be shaped to allow efficient run-off of surface water from the placed arising's.

(6) Control of groundwater within the borrow pit may be required and measures will be determined as part of the ground investigation programme.

(7) All the above-mentioned general guidelines and requirements will be confirmed by the designer prior to construction.

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Rev.	Description	App By	Date
C	FOR INFORMATION	BDH	17.04.25
D	FOR INFORMATION	BDH	22.05.25
E	FOR INFORMATION	BDH	30.05.25
F	FOR INFORMATION	BDH	27.06.25
G	FOR INFORMATION	BDH	22.07.25
H	FOR INFORMATION	BDH	22.01.26

PROJECT: LEMANAGHAN WIND FARM, CO. OFFALY

CLIENT: MKO

SHEET: BORROW PITS 3 AND 4

Date: 22.01.26

Project number: P20-216

Scale (@ A1): As Shown

Drawn by: POR

Checked by: AC

Drawing Number: P20-216-0600-0020

(Sheet set subset 0600)

Rev: H

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9 March 2026

PLAN

Scale 1:2500

Legend:

- EIAR Site Boundary
- Proposed Turbine & Hardstanding
- Proposed Internal Track
- Proposed Upgrade to Existing Internal Track
- Proposed New Amenity Track
- Existing Amenity Track
- Proposed Construction Compound
- Proposed Substation
- Proposed Met Mast
- Existing Pump Station
- Proposed Borrow Pit
- Proposed Peat Deposition Area
- Proposed Peat / Spoil Side Casting Berms
- Interceptor Drain
- Borrow Pit Perimeter Fence
- 50.0 Existing Ground Contour - Major
- 50.0 Existing Ground Contour - Minor
- Tougher (Archaeological Feature)

Construction Notes Peat Deposition Areas:

(1) An interceptor drain will also be installed upslope of the peat deposition areas.

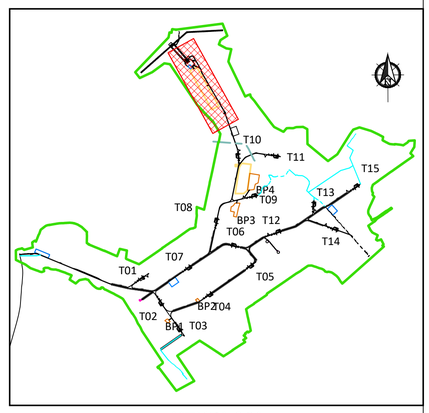
(2) A silting pond will be required at the lower side of the peat deposition areas.

(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 7.5 of the Peat & Spoil Management Plan.



KEYPLAN

Scale 1:50000

Construction Notes:

1) Spoil heap may consist of peat and overburden from local excavations.
2) Stored material should be shaped to allow suface water to run-off.
3) Placed / spread spoil should be allowed to re-vegetate naturally from plant species in the area.
4) Supervision by suitably qualified is required during the works.

TYPICAL SECTION A - A

Scale 1:250

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Rev.	Description	App By	Date
A	FOR INFORMATION	BDH	12.12.24
B	FOR INFORMATION	BDH	30.05.25
C	FOR INFORMATION	BDH	27.06.25
D	FOR INFORMATION	BDH	22.07.25

PROJECT: LEMANAGHAN WIND FARM, CO. OFFALY	CLIENT: MKO		
SHEET: PEAT DEPOSITION AREA 1	Date: 22.07.25	Project number: P20-216	Scale (@ A1): As Shown
	Drawn by: POR	Drawing Number: P20-216-0600-0021 (Sheet set subset 0600)	Rev: D
	Checked by: AC		

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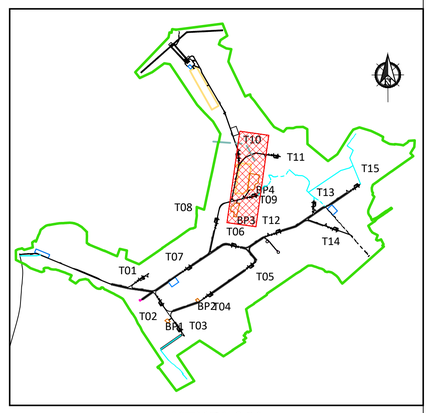
9 March 2026

PLAN

Scale 1:2500

Legend:

- EIAR Site Boundary
- Proposed Turbine & Hardstanding
- Proposed Internal Track
- Proposed Upgrade to Existing Internal Track
- Proposed New Amenity Track
- Existing Amenity Track
- Proposed Construction Compound
- Proposed Substation
- Proposed Met Mast
- Existing Pump Station
- Proposed Borrow Pit
- Proposed Peat Deposition Area
- Proposed Peat / Spoil Side Casting Berms
- Interceptor Drain
- Borrow Pit Perimeter Fence
- 50.0 Existing Ground Contour - Major
- 50.0 Existing Ground Contour - Minor
- Tougher (Archaeological Feature)



KEYPLAN

Scale 1:50000

Construction Notes Peat Deposition Areas:

(1) An interceptor drain will also be installed upslope of the peat deposition areas.

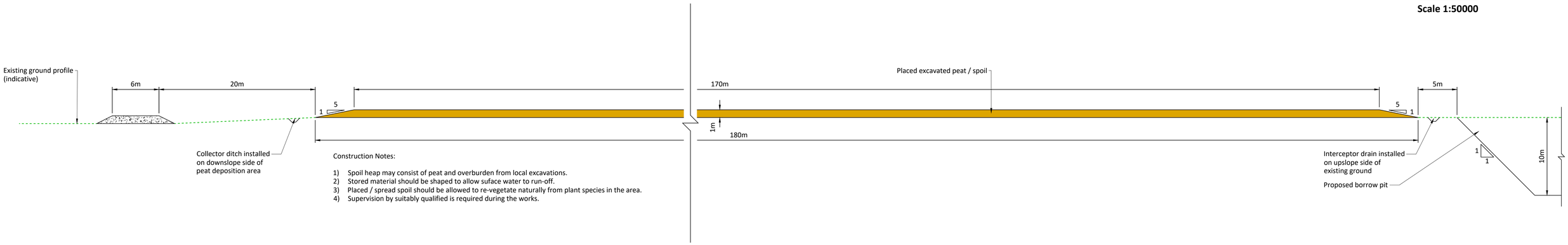
(2) A silting pond will be required at the lower side of the peat deposition areas.

(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 7.5 of the Peat & Spoil Management Plan.



Construction Notes:

1) Spoil heap may consist of peat and overburden from local excavations.
2) Stored material should be shaped to allow suface water to run-off.
3) Placed / spread spoil should be allowed to re-vegetate naturally from plant species in the area.
4) Supervision by suitably qualified is required during the works.

TYPICAL SECTION B - B

Scale 1:250

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Rev.	Description	App By	Date
A	FOR INFORMATION	BDH	12.12.24
B	FOR INFORMATION	BDH	30.05.25
C	FOR INFORMATION	BDH	27.06.25
D	FOR INFORMATION	BDH	22.07.25

PROJECT: LEMANAGHAN WIND FARM, CO. OFFALY	CLIENT: MKO
SHEET: PEAT DEPOSITION AREA 2	Date: 22.07.25
	Drawn by: POR
	Checked by: AC
	Project number: P20-216
	Scale (@ A1): As Shown
	Drawing Number: P20-216-0600-0022 (Sheet set subset 0600)
	Rev: D

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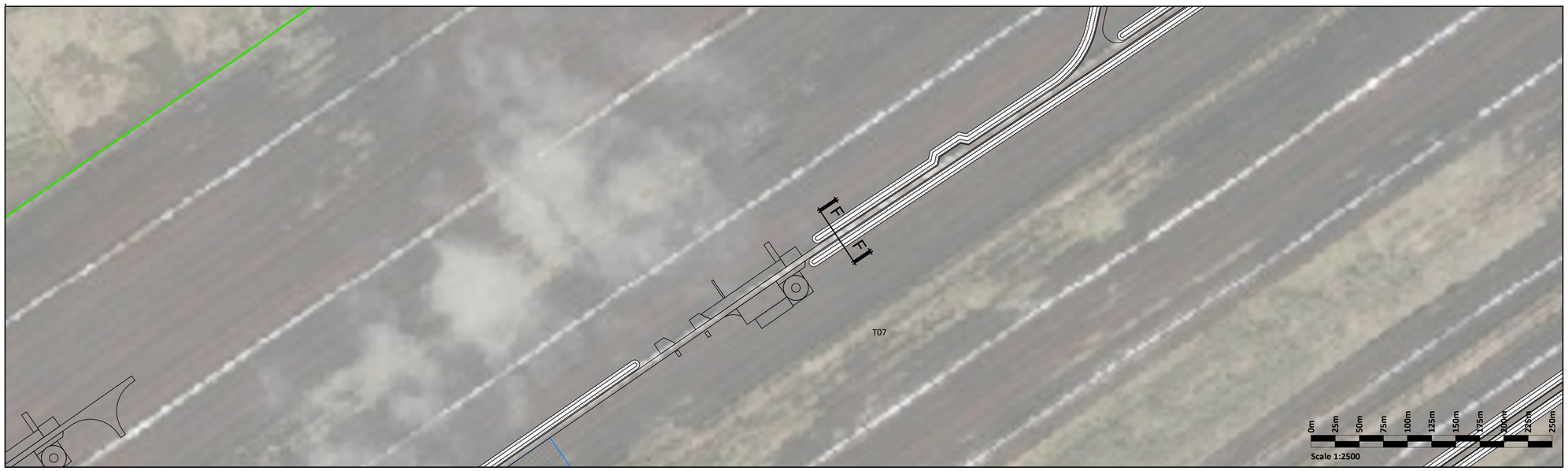
9 March 2026

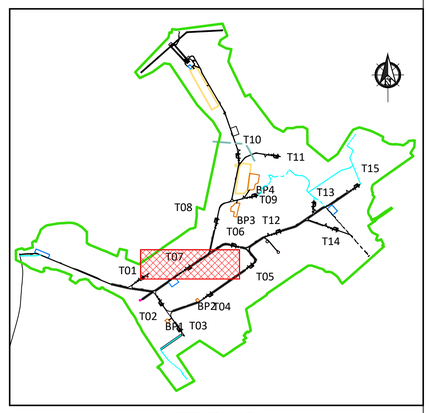


PLAN

Scale 1:2500

Legend:

- EIAR Site Boundary
- Proposed Turbine & Hardstanding
- Proposed Internal Track
- Proposed Upgrade to Existing Internal Track
- Proposed New Amenity Track
- Existing Amenity Track
- Proposed Construction Compound
- Proposed Substation
- Proposed Met Mast
- Existing Pump Station
- Proposed Borrow Pit
- Proposed Peat Deposition Area
- Proposed Peat / Spoil Side Casting Berms
- Tougher (Archaeological Feature)

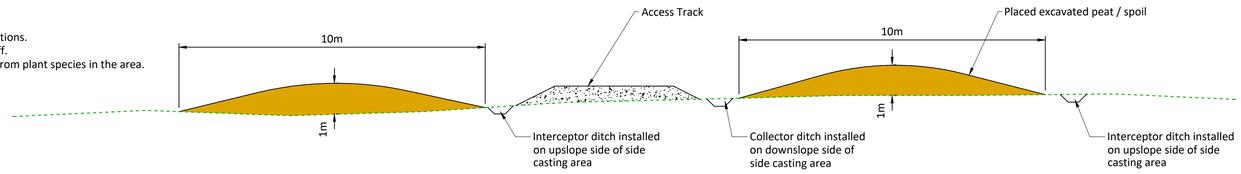


KEYPLAN

Scale 1:50000

Construction Notes:

1) Spoil heap may consist of peat and overburden from local excavations.
2) Stored material should be shaped to allow suface water to run-off.
3) Placed / spread spoil should be allowed to re-vegetate naturally from plant species in the area.
4) Supervision by suitably qualified is required during the works.



TYPICAL SECTION F - F

Scale 1:100

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Rev.	Description	App By	Date
A	FOR INFORMATION	BDH	27.06.25
B	FOR INFORMATION	BDH	22.07.25

PROJECT: LEMANAGHAN WIND FARM, CO. OFFALY	CLIENT: MKO		
SHEET: DETAIL OF SIDE CASTING	Date: 22.07.25	Project number: P20-216	Scale (@ A1): As Shown
	Drawn by: POR	Drawing Number: P20-216-0600-0023 (Sheet set subset 0600)	Rev: B
	Checked by: AC		

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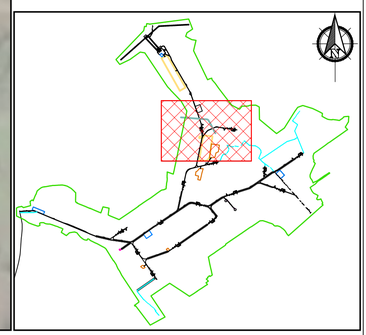
9 March 2026

PLAN

Scale 1:2500



KEYPLAN

Scale 1:60000

Legend:

- EIAR Site Boundary
- Proposed Turbine & Hardstanding
- Proposed Internal Track
- Proposed Upgrade to Existing Internal Track
- Proposed New Amenity Track
- Existing Amenity Track
- Proposed Construction Compound
- Proposed Substation
- Proposed Met Mast
- Existing Pump Station
- Proposed Borrow Pit
- Proposed Peat Deposition Area
- Proposed Peat / Spoil Side Casting Berms
- Togher (Archeological Feature)

Road Type Legend:

Type A -
New Excavate &
Replace Internal Track

Type B -
New Floated Internal Track

Type C -
Upgrade of Existing
Excavated Internal Track

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Rev.	Description	App By	Date
A	FOR INFORMATION	BDH	09.03.26

PROJECT	LEMANAGHAN WIND FARM, CO. OFFALY
CLIENT	MKO
SHEET	TOGHER TYPICAL DETAIL SECTION LOCATIONS
Date	09.03.26
Project number	P20-216
Scale (@ A1)	As Shown
Drawn by	POR
Checked by	AC
Drawing Number	P20-216-0600-0024 (Sheet set subset 0600)
Rev	A

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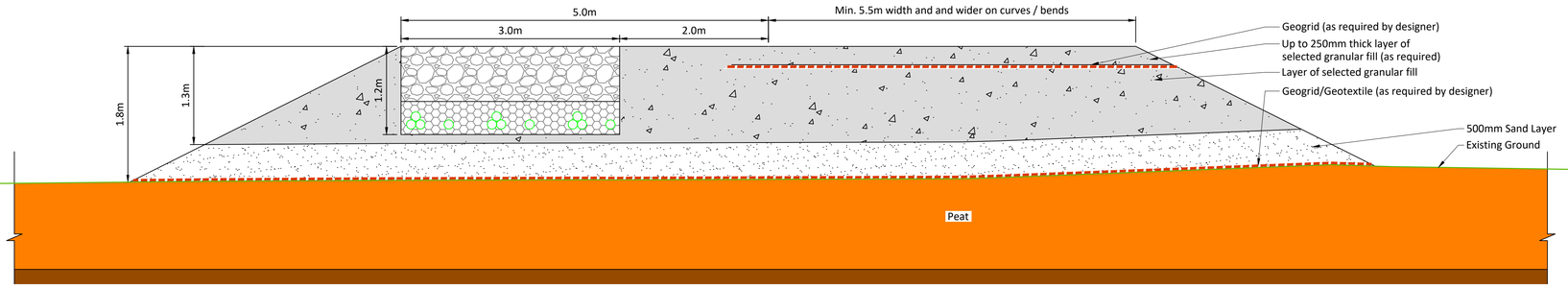
9 March 2026

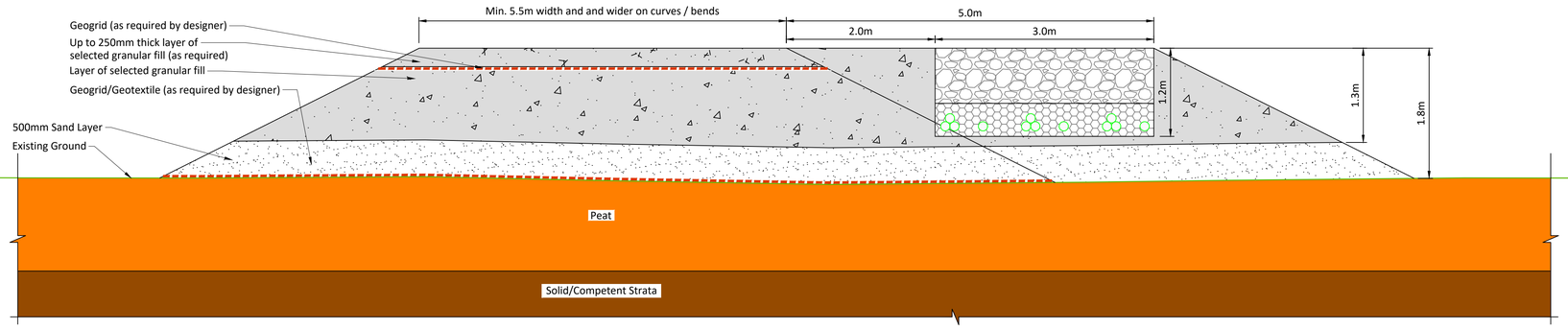
Legend:

Note - See Drawing P20-216-0600-0024 for plan location of typical sections I - I, G - G and H - H.



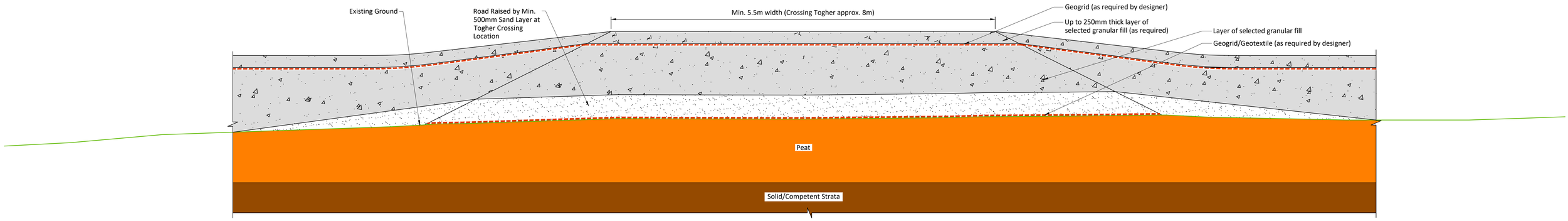
TYPICAL SECTION G - G

Scale 1:40



TYPICAL SECTION H - H

Scale 1:40



TYPICAL LONG SECTION I - I

Scale 1:40

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Rev.	Description	App By	Date
A	FOR INFORMATION	BDH	09.03.26

PROJECT: LEMANAGHAN WIND FARM, CO. OFFALY	CLIENT: MKO		
SHEET: TOGHER TYPICAL DETAIL SECTIONS	Date: 09.03.26	Project number: P20-216	Scale (@ A1): As Shown
	Drawn by: POR	Drawing Number: P20-216-0600-0025 (Sheet set subset 0600)	Rev: A
	Checked by: AC		

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