APPENDIX 4-2

PEAT AND SPOIL MANAGEMENT PLAN

FEHILY TIMONEY
30 YEARS

CONSULTANTS IN ENGINEERING,
ENVIRONMENTAL SCIENCE & PLANNING

PEAT & SPOIL MANAGEMENT PLAN

COOLE WIND FARM

Prepared for: **MKO**

Date: **February 2021**

Unit 6, Bagenalstown Industrial Park, Bagenalstown,
Co. Carlow, R21 XW81, Ireland
T: +353 59 9723800 E: info@ftco.ie

CORK | DUBLIN | CARLOW

www.fehilytimoney.ie

PEAT & SPOIL MANAGEMENT PLAN
COOLE WIND FARM

REVISION CONTROL TABLE, CLIENT, KEYWORDS AND ABSTRACT
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0	Draft for Comment	IH	PJ	BdeH	29.10.20
1	Update following layout alterations	IH	PJ	BdeH	17.12.20
2	Revisions to Peat & Spoil volumes	IH	PJ	BdeH	13.01.21
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Abstract: Fehily Timoney and Company (FT) were engaged by MKO to compile a Peat Management Plan (PMP) for Coole wind farm. The purpose of this report is to provide a Peat Management Plan for the construction phase of the wind farm. The report describes how peat 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 placement/reinstatement 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.70 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.

1.2 Project Description

Fehily Timoney and Company (FT) was engaged in August 2020 by McCarthy Keville O'Sullivan (MKO) on behalf of Coole Wind Farm Ltd. to compile a Peat Management Plan for the Coole wind farm site.

The proposed Coole wind farm is at a site located approximately 9km west of Castlepollard in Co. Westmeath.

The site, which is generally flat, consists predominantly of bare locally re-vegetated cut-away peat and intact shallow to deep peat with an extensive drainage network. The site has been extensively harvested using mechanical harvesting equipment resulting in a well-drained and extensively trafficked peat.

The development comprises of the following:

(1) up to 15 no. wind turbines with a tip height of up to 175 metres and all associated foundations and hardstanding areas,

(2) 1 no. onsite electrical substation including control building, associated electrical plant and equipment, welfare facilities and a wastewater holding tank,

(3) 1 no. temporary construction compound,

(4) provision of new site access roads, upgrading of existing access roads and hardstanding areas,

(5) excavation of 1 no. borrow pit,

(6) all associated underground electrical and communications cabling connecting the turbines to the proposed onsite substation,

(7) construction of 26 km of underground electricity cabling to facilitate the connection to the national grid from the proposed onsite substation located in the townland of Camagh to the existing 110kV Mullingar substation located in the townland of Irishtown,

(8) upgrade works to the existing 110kV Mullingar substation consisting of the construction of an additional dedicated bay to facilitate connection of the cable,

(9) construction of a link road between the R395 and R396 Regional Roads in the townland of Coole to facilitate turbine delivery,

(10) junction improvement works to facilitate turbine delivery, at the N4 junction with the L1927 in the townland of Joanstown, on land to the South East of railway line level crossing on the L1927 in the townland of Culvin, the L1927 and L5828 junction in the townland of Boherquill and the L5828 and R395 junction in the townland of Corralanna,

(11) drainage

(12) forestry felling

(13) signage, and

(14) all associated site development works.

1.3 Purpose

The purpose of this report is to provide a peat management plan with particular reference to peat stability for the construction phase of the project.

This peat management plan also includes a monitoring programme which will be implemented during the construction phase of the wind farm and a contingency plan should peat instability/failure occur at the site.

As work is carried out on site the contents of the peat management plan and peat stability monitoring programme will be updated, as appropriate.

This peat management plan 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 the relevant chapter of Environmental Impact Assessment Report (EIAR).

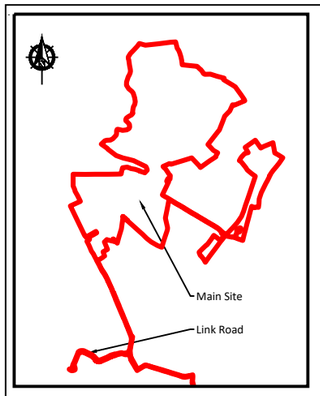
1.4 Proposed Construction Techniques for Site

With the exception of turbine T5 and T15 all turbines and their associated crane hardstands are likely to require a piled foundation as a result of the depth of peat and soft lacustrine deposits present. The substation platform and construction compound platform will likely be constructed using floating techniques. New proposed roads will be both floated and excavated techniques. Any existing access tracks will be upgraded as per Section 3 of this report.

1.5 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 access road, creep movement or localised erosion type events.

Adherence to the peat management plan 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.



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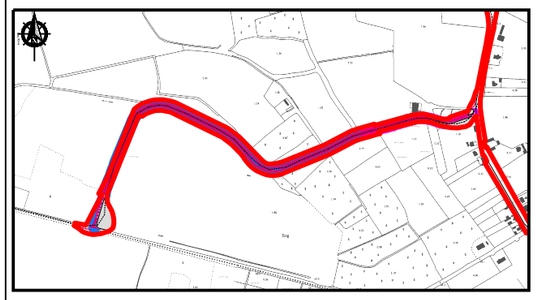

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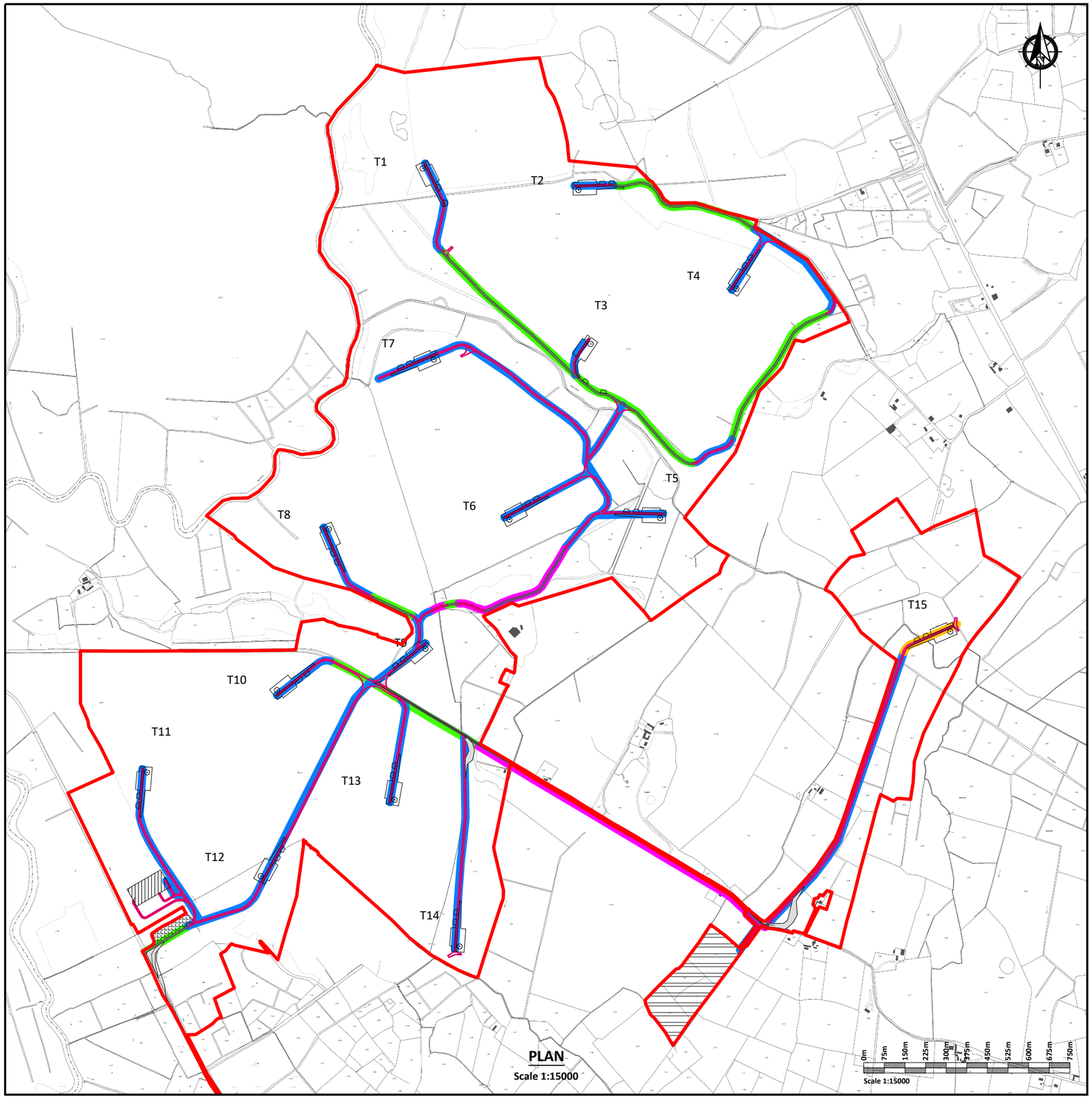

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Road Type Legend:

Type A - Upgrade of Existing Excavated Access Tracks

Type B - Upgrade of Existing Floated Access Tracks

Type C - New Excavated Access Road

Type D - New Floated Access Road

Legend:

Turbine and Hardstand

Construction Compound

Borrow Pit

Onsite Substation

Existing Internal Roads to Upgrade

New Internal Roads

Turbine Delivery Route

Site Boundary

Temporary Hardcore Surfacing

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FIGURE 1.1 - PLAN DRAWING OF WIND FARM WITH ROAD CONSTRUCTION TYPE

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2. CONSTRUCTION ACTIVITIES COVERED BY PEAT MANAGEMENT PLAN

For the construction phase of the Coole wind farm the activities that are considered to have issues in relation to peat stability are as follows:

(1) Upgrade of existing access tracks (floating tracks)

(2) Construction of new excavated roads through peat

(3) Construction of floating roads over peat (no peat will be excavated but the methodology for construction is included for completeness)

(4) Excavation and placement of arisings (given the ground conditions on site and the proposed construction techniques, the excavation and placement of arising's envisaged for the site is minimal)

(5) Excavations in peat for turbine bases, hardstands and other infrastructure foundations. Given the depth of peat and soft lacustrine deposits encountered on site, excavation works will be limited. It is proposed that some excavation works will be carried out at turbine T5 and T15 and the associated hardstands along with certain areas of existing access track upgrading.

(6) Excavations in peat for underground cables

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

2.1 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 access roads will need to be constructed. The road construction preliminary design has taken into account 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 access roads on the Coole wind farm site. This report includes the most suitable type of road construction envisaged for each section of access 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 on site.

Table 2.1: General Road Construction Techniques

Construction Method	Typical Site Conditions			Comment
	Construction Type	Typical Peat Depth (m)	Typical Slope Inclination (degs)	
Upgrade of existing access roads	Type A	Up to 5.5m (variable peat depths)	Typically, less than 2 degrees, locally up to 7 degrees (in shallower peat areas)	A number of localised existing access tracks sections are required to be upgraded – Figure 1-1
	Type B			
Construction of new excavated roads through peat	Type C	-	-	New excavated roads through peat is the proposed access road construction technique, where possible, for the site access tracks – Figure 1-1
Construction of new floating roads over peat	Type D	Typically, less than 4.5m, locally up to 6.5m	Typically, less than 3 degrees, locally up 5 degrees	Floating access roads across the peat is the new proposed access road construction technique for the majority of the site access tracks – Figure 1-1

It should be noted that Table 2.1 summarises the general road construction techniques only. Prior to the construction of any floating access roads on site a detailed design will need to be carried out.

Further details on access road construction types A to D are given in Sections 3, 4 and 5 of the report.

3. UPGRADE OF EXISTING ACCESS ROADS – TYPE A AND B

Upgrading of existing tracks is proposed for limited sections of access track, particularly in the north of the site and for a section of the turbine delivery route to the south of the wind farm site (Figure 1-1).

Upgrading works will include the upgrading of both floated and founded access tracks

3.1 Upgrading Existing Access 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) Access road construction shall be to the line and level requirements as per design/planning conditions.

(2) For upgrading of existing excavated access roads (Type A - Figure 3-1) the following guidelines apply:

- (a) Excavation of the widened section of access 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 access road and the widened section of access road depending on the depth of excavation required.
- (c) The surface of the existing access road should be overlaid with up to 500mm of selected granular fill.
- (d) Access 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 access road and at the base of the widened section of access 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) For upgrading of existing floated access tracks (Type B – Figure 3-2) the following guidelines apply:

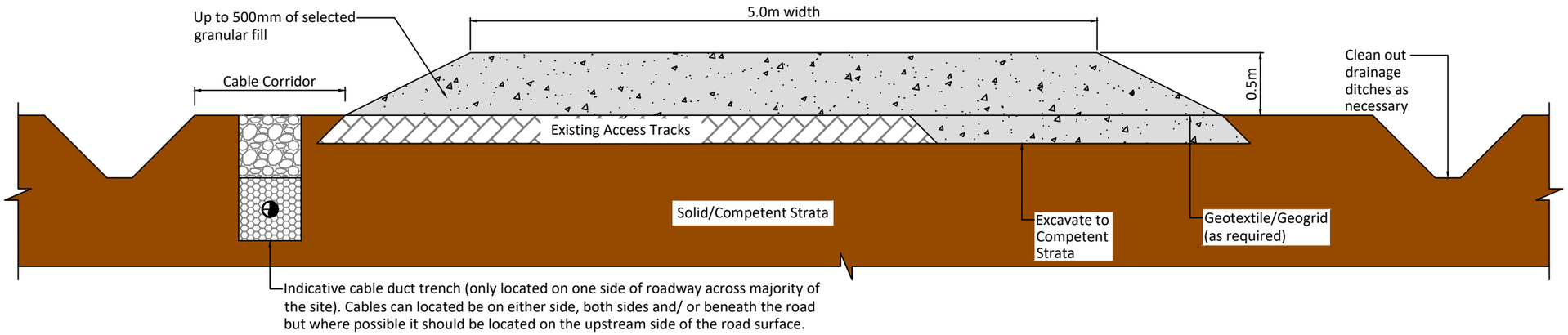
- (a) The make-up of the existing floating access roads on site is generally locally tree brash/trunks laid directly onto the peat surface and/or geotextile overlain by up to 500mm of coarse granular fill/till type (fine granular/cohesive) site won material. It should be noted that there are localised variations in the make-up of the existing floated access tracks on site, frequently no tree brash/trunks were used in the make-up and the presence of a geogrid was also noted in localised sections of the existing track.
- (b) The surface of the existing access track should be levelled prior the placement of any geogrid/geotextile, where necessary (to prevent damaging the geogrid/geotextile).
- (c) Where coarse granular fill has been used in the existing floated access road make-up, a layer of geogrid should be placed on top of the existing floated access track.
- (d) Where fine granular/cohesive type material has been used in the existing floated access road make-up (as is the case on some of the existing access roads in the southeast of the site), a layer of geotextile is likely to be required as a separator layer with a layer of geogrid.

(e) The geogrid will be overlaid with up to 500mm of selected granular fill. Granular fill to be placed and compacted in layers.

(4) The finished road width will have a running width of 5m, with wider sections on bends and corners.

(5) On side long sloping ground any road widening works required will be done on the upslope side of the existing access road, where possible.

(6) 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.



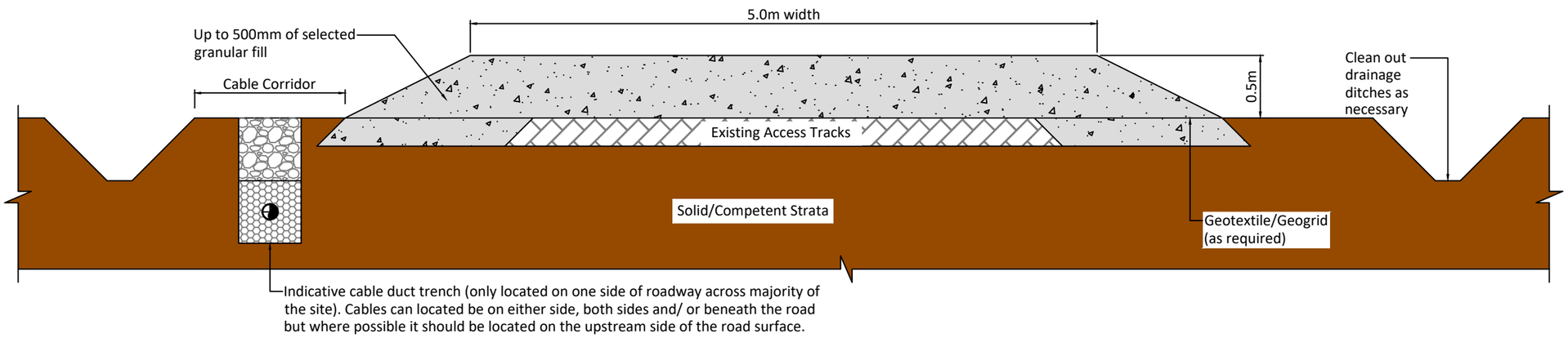


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FIGURE 3.1 - TYPE A - UPGRADE OF EXISTING EXCAVATED ACCESS TRACK

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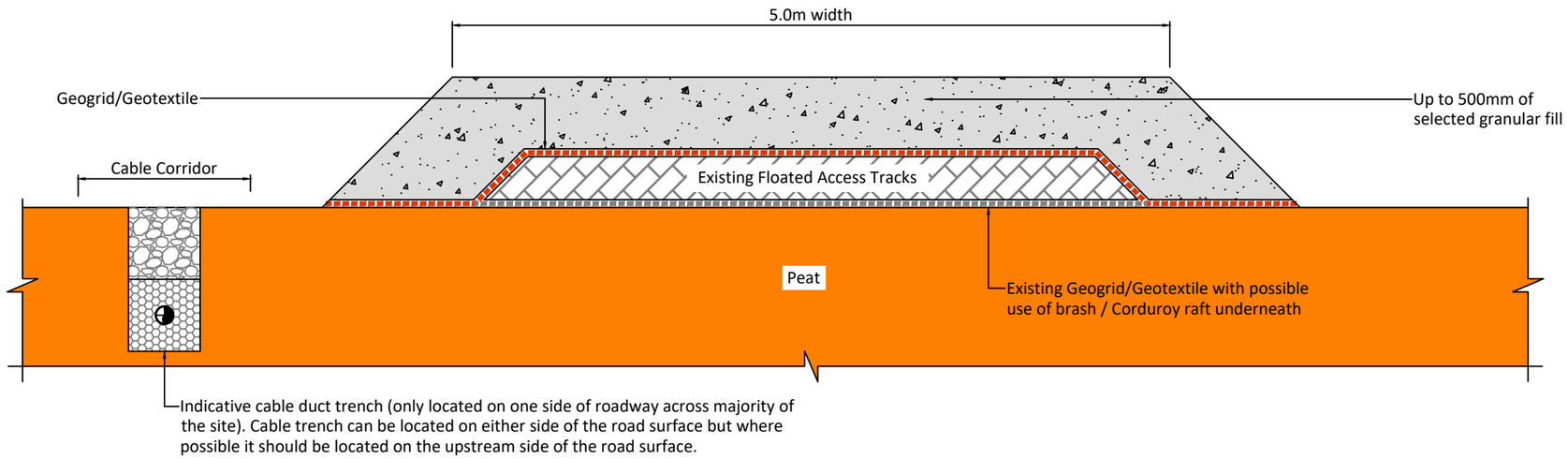
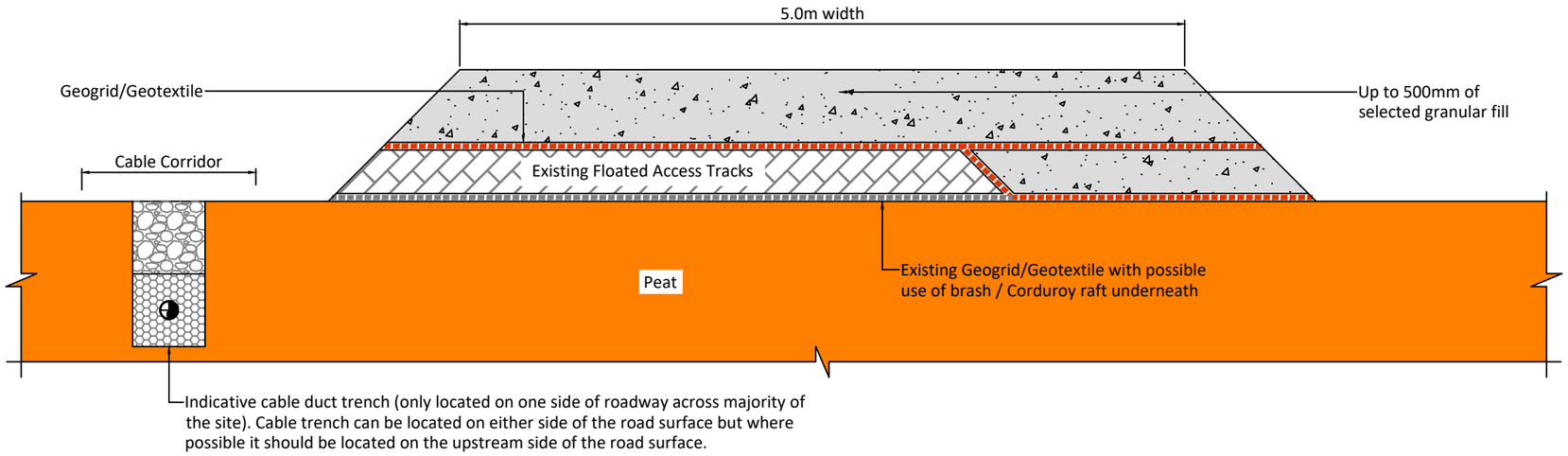


Upgrade of Existing Track on Flat Ground



Upgrade of Existing Track on Sidelong Ground

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FIGURE 3.2 - TYPE B - UPGRADE OF EXISTING FLOATED ACCESS TRACKS

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4. CONSTRUCTION OF NEW EXCAVATED ROADS THROUGH PEAT – TYPE C

The excavation of peat and spoil and founding of access roads on competent stratum (below the peat) for new access roads will be carried out at various locations on the site. The proposed locations for new excavated access roads on site are shown in Figure 1-1 and details are shown in Figure 4-1.

Excavate and replace type access roads are the conventional method for construction of access 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.

4.1 Excavated Road 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) 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 access road alignment to divert any surface water away from the construction area.

(3) Excavation of roads swill be to the line and level given in the design requirements. Excavation will take place to a competent stratum beneath the peat (as agreed with site designer).

(4) Road construction will be carried out in sections of approximately 50m lengths i.e. no more than 50m of access road should be excavated without re-placement with stone fill.

(5) Excavation of materials with respect to control of peat stability:

  (a) Acrotelm (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.

(6) 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.

(7) The excavated access road will be constructed with up to 1200mm of selected granular fill. Granular fill to be placed and compacted in layers in accordance with the TII Specification for Road Works.

(8) Access roads to be finished with a layer of capping across the full width of the road.

(9) A layer of geogrid/geotextile may be required at the surface of the competent stratum.

(10) At transitions between floating and excavated roads a length of road of about 10 to 20m 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 (Figure 5-2).

(11) 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 access 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.

(12) A final surface layer shall be placed over the excavated road and graded to accommodate wind turbine construction and delivery traffic.

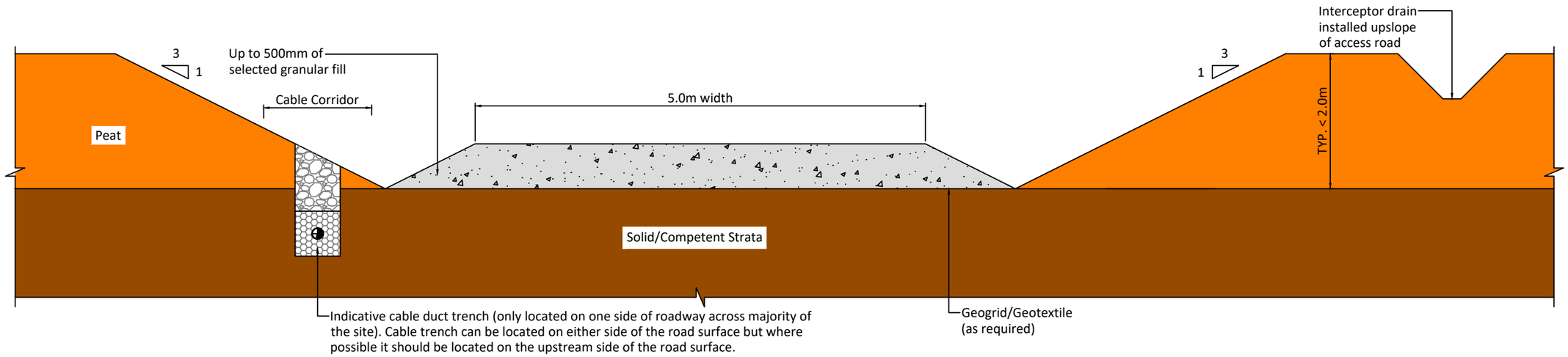

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FIGURE 4.1 - TYPE C - NEW EXCAVATED ACCESS ROAD

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5. CONSTRUCTION OF NEW FLOATED ROADS OVER PEAT – TYPE D

Floating roads across peat will be used for the construction of the majority of access roads. The use of new floated access tracks will be limited on site to areas of flatter terrain. The proposed locations for the new floating access roads on site are shown in Figure 1-1 and details are shown in Figure 5-1. It should be noted that these locations should be confirmed by the designer.

A confirmatory stability analysis should be carried out by the designer where it is proposed to install floating access 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 access road may be more suitable (see Section 6), although this is not anticipated at the location of the floated roads.

5.1 Floating Road 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, 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 access road is up to 1,000mm of selected granular fill with 2 no. layers of geogrid with possibly the inclusion of a geotextile separator (Figure 5-1).

(5) Granular fill to be placed and compacted in layers in accordance with the TII Specification for Road Works.

(6) Following the detailed design of the floated access roads it may be deemed necessary to include pressure berms either side of the access 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 access road will reduce the likelihood of potential bearing failures beneath the access road.

(7) The finished road width will be approximately 5m, 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.

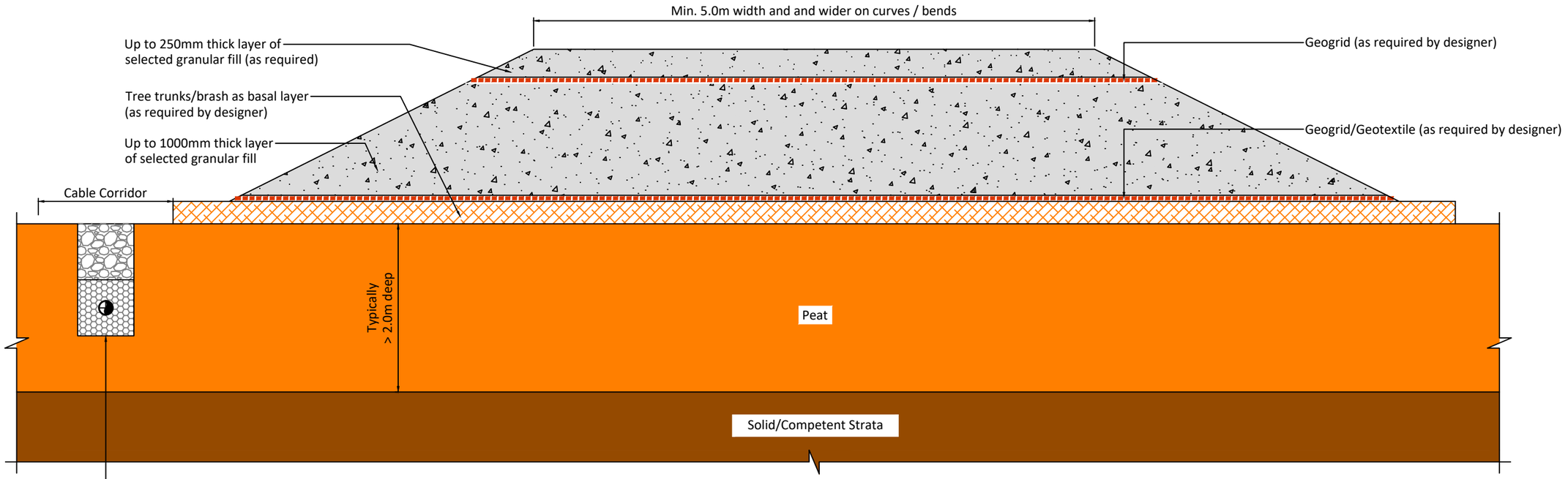

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FIGURE 5.1 - TYPE D - NEW FLOATED ACCESS ROAD

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Notes:

1) Floated access road detail may comprise 500 to 750mm stone fill, layer of geotextile & 1 to 2 layers of geogrid.
2) Excavated access road detail may comprise up to 500mm stone & layer of geotextile (depending on ground conditions encountered).

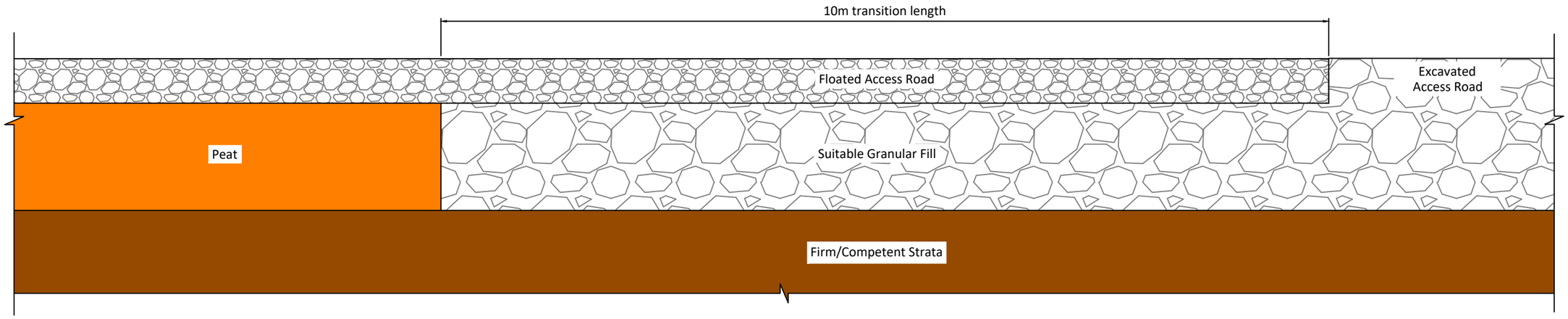

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FIGURE 5.2 - TRANSITION DETAIL FOR FLOATED & EXCAVATED ACCESS ROAD

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6. GENERAL CONSTRUCTION GUIDELINES FOR ACCESS ROADS

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

(1) Where an open ditch is present alongside an existing/proposed floating access track, the ditch may need to be filled prior to upgrading/constructing the access track. The ditch shall be filled with suitable drainage stone. As applicable, a perforated pipe shall be laid into a ditch 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 access 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 access 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) No stockpiling of materials shall take place on or adjacent to floated access roads so as to avoid bearing failure of the underlying peat.

(5) End-tipping of stone onto the road during the construction/upgrading of the access road should be carefully monitored to ensure that excessive impact loading, which may adversely affect the underlying peat, is limited.

(6) 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.

(7) It is recommended that the construction and upgrading of access 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.

(8) 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.

(9) Settlement of a floated access 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 ARISINGS

7.1 Excavation and Storage of Arisings 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.

Minimal excavation is likely to be required on site due the proposed construction techniques for site as a result of the deep nature of peat and underlying soft soil deposits encountered.

With the exception of turbine T5 and T15 all turbines and their associated crane hardstands are likely to require a piled foundation as a result of the depth of peat and soft lacustrine deposits present. In addition, it is likely that a piled foundation will be required for the substation building. The substation platform and construction compound platform will likely be constructed using floating techniques. The majority of new access roads will use a floated technique.

The peat and overburden that is excavated as part of the construction works will be placed/spread locally alongside the excavations for the infrastructure elements. As an example, Figure 7-1 shows a typical cross section with locally placed/spread spoil either side of an excavation. Further details are given in Section 7.5 of this report.

The proposed borrow pit is located on an existing pasture/grazing land area, approximately 700m to the south east of T14. A plan and cross section drawing of the borrow pit is included as Figure 7-2 to this report. In relation to the borrow pit, it is proposed to remove the overburden material and stockpile local to the borrow pit excavation. The rock will then be removed from the borrow pit and used in the construction of the access tracks, hardstandings, working platforms, etc, on the wind farm site. Upon removal of all required rock from the borrow pit it is proposed to reinstate the borrow pit with the locally stored overburden material from the borrow pit footprint.

A small volume of excavated non-peat spoil will be generated as a result of the upgrade works to a section of the turbine delivery route to the south of the site. The minimal amount of non-peat spoil generated would be landscaped into the existing terrain adjacent to the access tracks. See Figure 1-1 for the extent of the upgrade works required to this section of the turbine delivery route.

7.2 Summary of Peat and Spoil Volumes on Site

A summary of the excavated peat and spoil volumes calculated for the Coole wind farm site are given in Table 7-1.

Table 7.1: Summary of Excvated Peat and Spoil Volumes on Site

Infrastructure Element [1]	Typical Dimensions	Peat Volume (m^3) [2]	Spoil (non-peat) Volume (m^3)	Comment
2 no. Turbines	Assumed 22m diameter turbine foundation dig out for turbine T5 and T15 only	1,055	1,690	For calculation purposes, it is estimated that 13 of the 15 turbine bases will be piled hence no excavation of peat has being allowed for at these locations. This will be confirmed at detailed design stage. Excavated peat and spoil to be stored locally as per Section 7.5.
2 no. Crane Hardstands	Plan area of rectangular hardstand for T5 and T15 is 4,500m^2	11,880	3,240	For calculation purposes, it is assumed that 2 no. hardstands are constructed using a founded construction technique, the remaining are assumed to be piled. This will be confirmed at detailed design stage. Excavated peat and spoil to be stored locally as per Section 7.5.
1 no. Construction Compound Platform	Plan area of construction compound is 6,600m^2	-	-	Due to the depth of peat & soft soils at the proposed construction compound location, the platform will be constructed using a floated technique i.e. there will be no excavation of peat/spoil at this location. This will be confirmed at detailed design stage.
1 no. Substation Platform & Building	Plan area of substation platform is 10,000m^2	0		Due to the depth of peat & soft soils at the proposed substation location, the platform will be constructed using a floated technique i.e. there will be limited excavation of peat/spoil at this location. In addition, it is envisaged that the substation building will likely require a piled foundation. This will be confirmed at detailed design stage.
Upgraded access roads (on-site and link road)	Approximate plan area of upgraded access roads is 6,000m^2	3,575	2,140	It is envisaged that there will be some peat excavated as a result of the upgrading works carried out to the existing excavated assess tracks and excavation of new tracks on site. Excavated peat and spoil to be stored locally as per Section 7.5.
Borrow Pit	Plan area of borrow pit is 62,100m^2	-	74,400	Based on the trial pitting carried out, no peat is noted at the borrow pit location. Spoil generated from the stripping of overburden will be backfilled into the borrow pit.
	Total =	**16,510m^3**	**81,470m^3**	**Total = 97,980m^3 (peat and spoil volume)**

Note (1) A factor of 20% (bulking factor of 15% and contingency factor of 5%) 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 Stone Volumes Required on Site

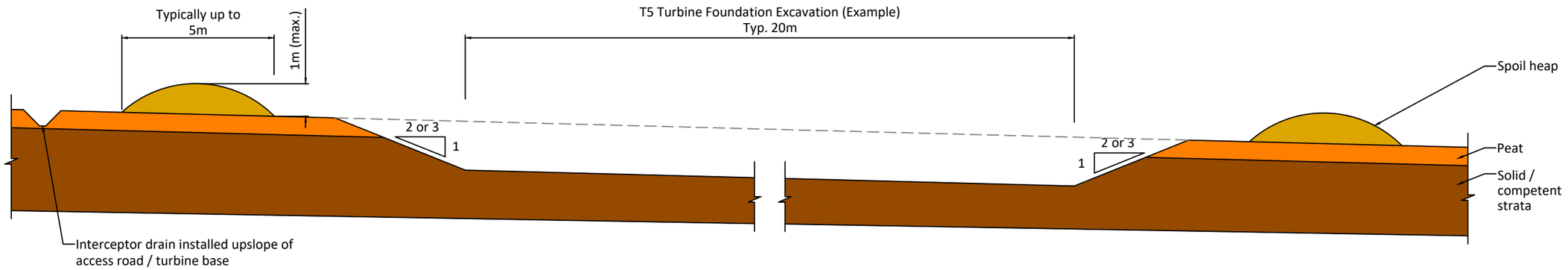
A summary of the estimated stone volumes required for the Coole wind farm site is given in Table 7-2.

Table 7.2: Summary of Stone Volumes Required

Infrastructure Element (1)	Typical Dimensions	Stone Volume (m^3) (2)	Comment
Turbine Fill and Crane Hardstands	15 turbines and hardstands	104,815	Stone thickness of 1.2m assumed for hardstand thickness.
Access Roads	Up to 5m in width, approximately 16km in length	121,900	Stone thickness of 1.2m along access roads assumed for calculation purposes
Substation Compound	Approximately 10,000m^2	15,000	Stone thickness of 1.2m assumed for calculation purposes
1 no. Construction Compound Platform	Approximately 6,800m^2	10,200	Stone thickness of 1.2m assumed for calculation purposes
	Total =	**251,915m^3**	

Note (1) A factor of 25% (bulking factor of 20% and contingency factor of 5%) has been applied to the estimated stone volumes to allow for expected increase in volume upon excavation and to allow for a variation in ground conditions across the site.

(2) These volumes do not include requirements for surfacing of hardstands/access roads with higher quality surface layer



Construction Notes:

1) Typical side excavation slope 1v:3h in peat, slope inclination to be reviewed during construction. Where areas of weaker peat are found to be present, slacker slope will be required. Typical side excavation slope 1v:2h in overburden, slacker slopes may be required.
2) Interceptor drain to be placed on the upslope side of excavation (as shown for the excavation above) to divert surface water away from excavation.
3) Spoil heap may consist of peat and overburden from local excavations.
4) Stored material should be shaped to allow suface water to run-off.
5) Placed / spread spoil should be allowed to re-vegetate naturally from plant species in the area.
6) Supervision by suitably qualified is required during the works.

Scale 1:150

Scale (@ A3) 1:150

Date - 23.02.21

FIGURE 7.1 - PLACED / STORED MATERIAL - TYPICAL CROSS SECTION

Drawn - POR

Checked - IH

Rev - B

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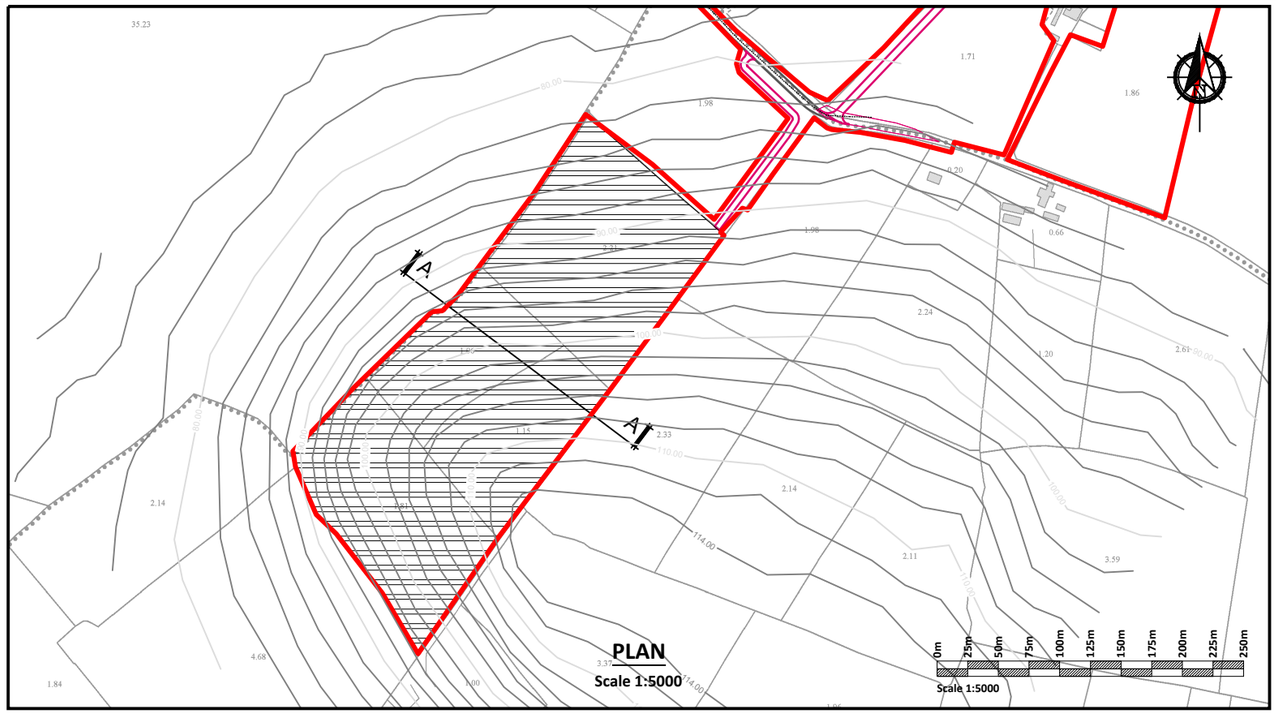


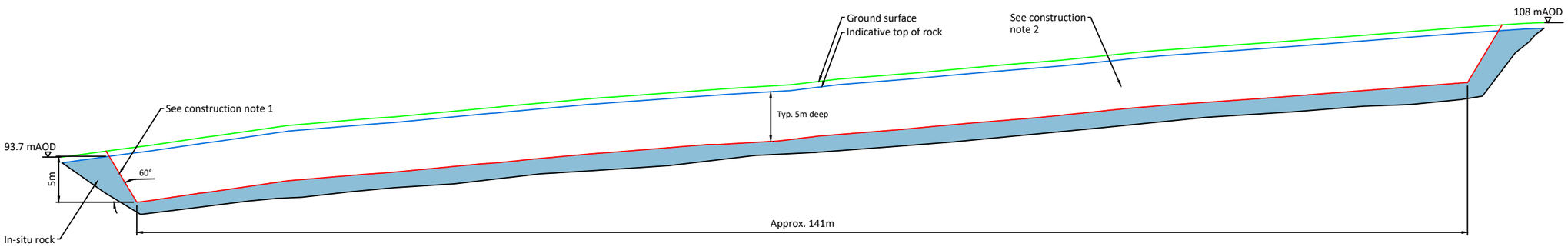
Legend:

- Turbine and Hardstand
- Construction Compound
- Borrow Pit
- Onsite Substation
- Existing Internal Roads to Upgrade
- New Internal Roads
- Turbine Delivery Route
- Site Boundary

Section Scales:

1:1 Horiz.
1:1 Vert.

(No Exaggeration on Vertical Scale i.e. True Scale)



CROSS SECTION A - A (NO VERTICAL EXAGGERATION TRUE SCALE 1:1)

Scale 1:500

Construction Notes:

(1) In-situ rock slope formed at stable inclinations to suit local rock conditions.

(2) Localised deepening of quarry floor to suit extraction operations, as required.

(3) The thickness of overburden was based on the trial pits carried out within the footprint of the borrow pit.

(4) Further guidelines on the construction of the borrow areas is included within the Peat Management Plan.

Scale (@ A3)
1:5000

Date - 23.02.21

FIGURE 7.2 - BORROW PIT NO 1 - PLAN AND CROSS SECTION DETAILS

Drawn - POR

Checked - IH

Rev - D

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Tuesday 23 February 2021

7.4 Guidelines for the Construction and Reinstatement of Borrow Pits

One location has been identified as a potential borrow pit and is shown on Figure 7-2. The overburden depth within the development footprint of the borrow pit is less than 1m.

Upon removal of the rock from the borrow pit, it is proposed to reinstate the borrow pit using excavated spoil comprising overburden material stripped during the excavation of the borrow pit. The excavated rock from the borrow pit will be used in the construction of the infrastructure elements (turbine bases, roads, etc.) at the wind farm. The contractor excavating the rock will be required to develop the 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 spoil using dumper trucks and excavators. It also eliminates the need to construct above ground retaining structures which may have an unnecessary visual impact and increase the development footprint of the proposed wind farm. The text below provides design and construction guidelines for the borrow pit.

Figure 7-2 shows typical construction details for the borrow pit.

The borrow pit shall be constructed as follows:

(1) The rock within the borrow pit footprint will be removed by breaking, following a confirmatory ground investigation carried out at the proposed borrow pit. The ground investigation shall comprise rotary core drilling with associated engineering logging including rock quality designation and strength testing, as required.

(2) Slopes within the excavated rock formed around the perimeter of the borrow pit should be formed at stable inclinations to suit local in-situ rock conditions. Exposed sections of the rock slopes should be left with irregular faces and declivities to promote re-vegetation and provide a naturalistic appearance.

(3) The stability of the rock faces within the borrow pit should be inspected by competent personnel upon excavation to ensure stability during construction works and in the long term. This inspection will allow unfavourable rock conditions to be identified and suitable mitigation measures to be applied such as removal of loose rock.

(4) Infilling of the spoil should commence at the back edge of the borrow pit and progress towards the borrow pit entrance. The contractor excavating the rock will be required to develop the borrow pit in a way which will allow the excavated spoil to be reinstated safely.

(5) The use of temporary access ramps and long reach excavators during the placement of the excavated spoil is likely to be required.

(6) Where possible, the surface of the placed spoil should be shaped to allow efficient run-off of surface water from the placed arisings.

(7) An interceptor drain should also be installed upslope of the borrow pit, where necessary. 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.

(8) Control of groundwater within the borrow pit may be required and measures will be determined as part of the confirmatory ground investigation programme. A temporary pump and suitable outfall locations are likely to be required during construction.

(9) A silting pond may be required at the lower side/outfall location of the borrow pit.

(10) Where possible, the topsoil 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 spoil within the borrow pits.

(11) Supervision by a geotechnical engineer or appropriately competent person is recommended for the works.

(12) All the above mentioned general guidelines and requirements should be confirmed by the designer prior to construction. A detailed construction methodology for the borrow pits should be compiled prior to construction.

7.5 Guidelines for the Placement/Spreading of Spoil alongside Excavations

The volume of materials to be placed adjacent to the excavation areas is considered minimal. The following recommendations and best practice guidelines for the placement/spreading of spoil alongside excavations should be considered and taken into account during construction.

(1) The peat and overburden that is excavated as part of the construction works will be locally placed/spread alongside the excavations for the infrastructure elements. As an example, Figure 7-1 shows a typical cross section with placed/spread spoil either side of an excavation. Given the flat topography/nature of the site, this approach for the placement of excavated spoil is deemed appropriate.

(2) During the construction process the spoil will be relayed locally to the side of the excavation by an excavator and spread on the bog on one or both sides of the excavations.

(3) The spoil will be spread to a depth not exceeding 1m in height over a typical width of 5m. The placed peat shall be tracked in to ensure it is adequately compacted and stable and graded to complement the topography and drainage system on the site.

(4) Where practical, it should be ensured that the surface of the placed material is shaped to allow efficient run-off of surface water. Where possible, shaping of the surface of the spread material should be carried out as placement of material progresses. This will reduce the likelihood of debris run-off and ensure stability of the spread material.

(5) The placement of excavated material is to be avoided without first establishing the adequacy of the ground to support the load. This may involve a visual inspection by competent personnel. The placement of material may require the use of long reach excavators and low ground pressure machinery in localised areas.

(6) Where there is any doubt as to the stability of the peat surface then no material shall be placed on to the peat surface.

(7) Finished/shaped side slopes in the placed material is likely to be in the region of 1 (v): 2 to 3 (h). This slope inclination should be reviewed during construction, as appropriate. Where areas of weaker material are encountered then slacker slopes may be required.

(8) All placed/spread material will be allowed to revegetate naturally from the extensive seed source of the plants that have already colonised in the area. Alternatively, and possibly in addition seeding of the placed material could be carried out which would aid in stabilising the placed material in the long term.

(9) Movement monitoring instrumentation may be required in deeper in-situ peat areas. The locations where monitoring is required will be identified prior to construction works commencing on site.

(10) Supervision by a geotechnical engineer or appropriately competent person is recommended for the works.

(11) An interceptor drain should be installed upslope of the placed material areas to divert any surface water away from these areas. This will help ensure stability of the placed material and reduce the likelihood of debris run-off.

(12) All the above mentioned general guidelines and requirements should be confirmed by the designer prior to construction.

8. EXCAVATIONS IN PEAT FOR TURBINE BASES, HARDSTANDINGS AND INFRASTRUCTURE FOUNDATIONS

With the exception of turbine T5 and T15 all turbines and their associated crane hardstands are likely to require a piled foundation as a result of the depth of peat and soft lacustrine deposits present. In addition, it is likely that a piled foundation will be required for the substation building. The substation platform and construction compound platform will likely be constructed using floating techniques. The majority of new access roads will use a floated technique.

Hence excavated spoil from the proposed construction works will be minimal. The following outlines the methodology to be used during construction/excavation in peat. The methodology is not intended to cover all aspects of construction such as drainage and environmental considerations.

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 guidelines given in Section 7 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.

9. EXCAVATIONS FOR UNDERGROUND CABLES

A connection between the Coole Wind Farm and the national electricity grid will be necessary to export electricity. It is proposed that the Coole Wind Farm will connect to the national grid via an existing substation located in Mullingar to the south of the proposed wind farm development. The proposed grid connection is approximately 26.4km in length and will follow existing and proposed tracks and the public road corridor.

The proposed grid connection construction methodology, including proposals for water crossings on the underground cabling routes is described in the EIAR.

It is proposed to excavate the trenches for the underground cable at a uniform level in peat or other overburden material. The trenches will be 900mm wide and 1200mm deep.

The cable trench route is envisaged to encounter peat and till derived from Limestone and Cherts.

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 CONSTRUCTION PRACTICE

To minimise the risk of construction activity causing potential peat instability it is recommended that the Construction Method Statements (CMS) for the project will also take into account, but not be limited, to the general recommendations below together with the specific recommendations above.

(1) Avoidance of uncontrolled concentrated water discharge onto peat slopes identified as being unsuitable for such discharge. All water discharged form excavations during work shall be piped over areas specifically assessed as being unsuitable and hence directly into suitable drainage lines.

(2) Avoidance of unstable excavations. All excavations shall 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, as appropriate, during construction in areas of possible poor ground, such as deeper peat deposits (see Section 11).

(5) Site reporting procedures 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 wind farm site by Contractor to 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 access road at staggered intervals at locations where the peat depth is greater than 4.0m. 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 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.

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 site 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.

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, i.e. the borrow pit to the southeast of the wind farm development.

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 access roads on the wind farm 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.

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Pouladuff Road,
Cork, T12 D773,
Ireland
+353 21 496 4133

Dublin Office
J5 Plaza,
North Park Business Park,
North Road, Dublin 11, D11 PXT0,
Ireland
+353 1 658 3500

Carlow Office
Unit 6
Bagenalstown Industrial Park,
Bagenalstown, Co. Carlow,
R21 XW81, Ireland
+353 59 972 3800