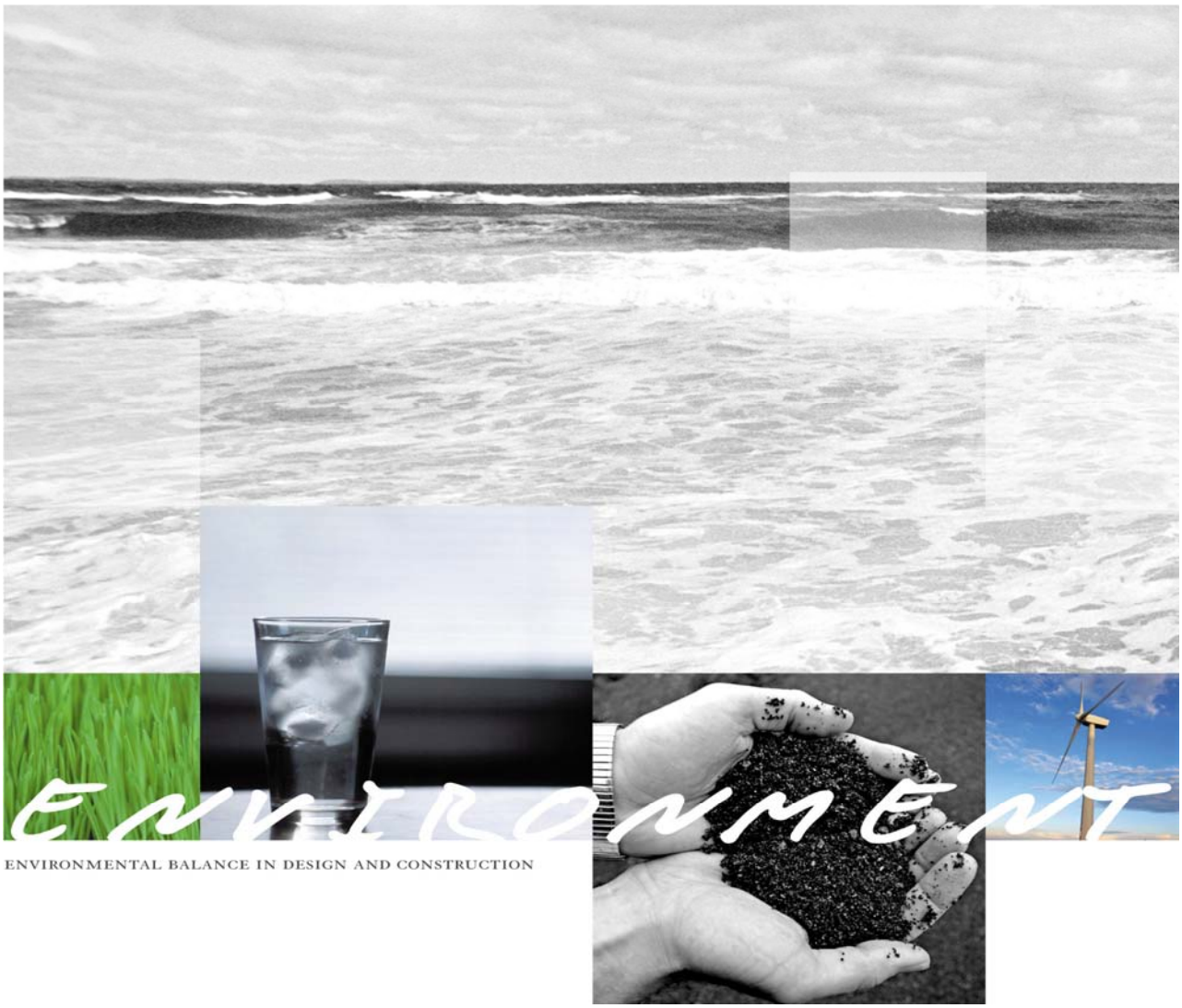
APPENDIX 4-2

FEHILY TIMONEY – PEAT & SPOIL MANAGEMENT PLAN CAHERMURPHY TWO WIND FARM, COUNTY CLARE



PEAT & SPOIL MANAGEMENT PLAN

CAHERMURPHY TWO WIND FARM, COUNTY CLARE

MAY 2020

MKO

FEHILY TIMONEY
30 YEARS

PEAT & SPOIL MANAGEMENT PLAN

CAHERMURPHY TWO WIND FARM, COUNTY CLARE

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1	Final following Client's comments	IH	IH	BdH	07.05.20

Client: McCarthy Keville O'Sullivan (MKO)

Keywords: Peat, Spoil, Cahermurphy Two Wind Farm

Abstract: Fehily Timoney and Company (FT) were engaged in July 2019 by McCarthy Keville O'Sullivan to compile a Peat & Spoil Management Plan (PSMP) for Cahermurphy Two wind farm in County Clare. The purpose of this report is to provide a Peat & Spoil Management Plan for the construction phase of the wind farm. The report describes how peat & 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 & spoil placement/reinstatement areas which will be developed at the site. In addition, the report contains a cut/fill assessment for the site which quantifies and graphically presents the total volume of cut and fill earthworks required for the construction of the development.

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1 INTRODUCTION

1.1 Background & Experience

Fehily Timoney and Company (FT) were engaged in July 2019 by McCarthy Keville O'Sullivan (MKO) to compile a Peat & Spoil Management Plan (PSMP) for the extension to Cahermurphy Two wind farm in County Clare.

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

The proposed Cahermurphy Two wind farm is located about 16km northeast of Kilrush within County Clare.

The site is adjacent to the already permitted Cahermurphy Wind Farm. The approximate development area for the site is 137.2 hectares. A number of existing wind farm developments are located to the north of the site.

The proposed wind farm development comprises 10 no turbines (T1 to T10) with associated infrastructure.

The purpose of this report is to provide a Peat & Spoil Management Plan for the construction phase of the Cahermurphy Two wind farm. The intention of the report is to describe how peat & 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 & spoil placement/reinstatement areas which will be developed at the site.

The PSMP contains some drainage guidelines for construction works and for management of peat & spoil on site. It should be noted that the control of water quality and drainage measures for site is outlined in the Environmental Impact Assessment Report (EIAR).

This report also contains a cut/fill assessment for the site which quantifies and graphically presents the total volume of cut and fill earthworks required for the construction of the development.

As work is carried out on site the contents of the PSMP and peat stability monitoring programme will be updated in the Construction & Environmental Management Plan (CEMP) for the construction phase.

1.2 Scope of Report

This report contains the following:

(1) Preliminary road construction types for site

(2) Methodology for the construction of each type of access road along with section drawings for each type of access road

(3) Methodology for the excavation and placement/reinstatement of peat and spoil arising's

(4) Summary of borrow pits on site along with construction guidelines and drawings

(5) General recommendations for good working practice on site

(6) Monitoring instrumentation programme & guidelines

(7) Contingency plan should peat instability/failure occur at the site

(8) Cut & fill assessment methodology and associated drawings & findings

2 CONSTRUCTION ACTIVITIES COVERED BY PEAT & SPOIL MANAGEMENT PLAN

2.1 Construction Activities

For the construction phase of the Cahermurphy Two wind farm the activities that are considered likely to generate peat & spoil are as follows:

(1) Upgrade of existing access tracks (excavate & replace and tracks)

(2) Construction of new excavated roads through peat

(3) Construction of floating roads over peat (will not generate peat & spoil but the methodology for construction is included for completeness)

(4) Excavation and placement/reinstatement areas for peat & spoil

(5) Excavations in peat for turbine bases, hardstandings, met mast, substation, construction compounds and spoil over the borrow pit footprints

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

2.2 Preliminary 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) Serviceability requirements for construction and wind turbine delivery and maintenance vehicles

(3) Minimise excavation arisings

(4) 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 on the prevailing ground conditions encountered along that length of road.

The preliminary road construction types proposed for the Cahermurphy Two wind farm are summarised in Table 2-1.

It should be noted that this report does not include a detailed design for the access roads on the Cahermurphy Two wind farm. 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	Construction Type	Ground Conditions		Comment
		Typical Peat Depth (m)	Typical Slope Inclination (degs)	
Upgrade of existing access tracks	Type A	<2.0	Varies	Upgrade existing excavated access track to the required width and finished with a layer of selected granular fill (to be confirmed by designer) – Figure 2-1
	Type B	>2.0	Varies	Upgrade existing floated access track to the required width and finished with a layer of geogrid and stone fill (to be confirmed by designer) – Figure 2-1
Construction of new excavated roads through peat	Type C	<2.0	Varies	New access road construction technique envisaged for various locations on site (to be confirmed by designer) – Figure 2-1
Construction of floating road over peat	Type D	>2.0	<5	New access road construction technique envisaged for various locations on site (to be confirmed following detailed design) – Figure 2-1

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

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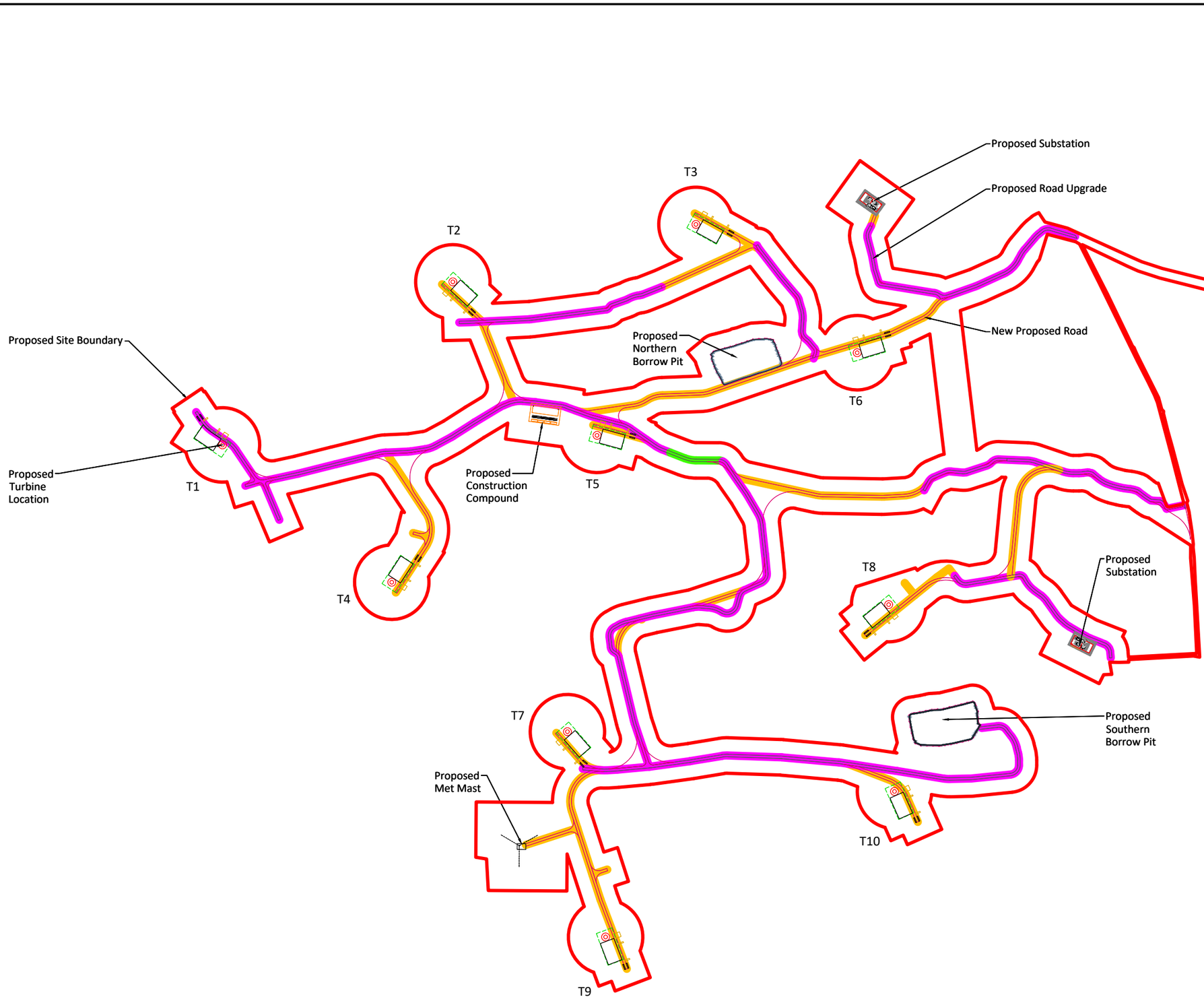

Road Type Legend:

Type A -
Upgrade of Existing
Excavated Access Tracks

Type B -
Upgrade of Existing
Floated Access Tracks

Type C -
New Excavate &
Replace Access Road

Type D -
New Floated Access Road

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

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FIGURE 2-1 : PLAN DRAWING OF WIND FARM ROAD CONSTRUCTION TYPE

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3 UPGRADE OF EXISTING ACCESS TRACKS – TYPE A & B

Up to 5km of existing access tracks requiring upgrade are present across the Cahermurphy Two wind farm site and based on site visits and desk top studies have been in operation for a number of years. The existing access tracks were constructed using both excavate and replace and floated construction techniques. Based on the site walkover carried out by FT the existing access tracks were typically noted as being in relatively good condition and were successfully ulitised for commercial forestry and agricultural activities. Upgrading works are likely to involve both widening and resurfacing of the existing access track. The proposed locations for upgrading of the existing access tracks on site are shown in Figure 2-1 and details are shown in Figures 3-1 and 3-2.

Two different types of existing access tracks are present on site which were constructed using excavate and replace and floating construction techniques (Appendix A – Photo 1). Upgrading of these existing tracks is proposed as per details for type A.

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

(a) Excavation will be required on one or both sides of the existing access track to a competent stratum.

(b) Granular fill to be placed in layers in accordance with the designer's specification.

(c) The surface of the existing access track should be overlaid with up to 300mm of selected granular fill.

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

(e) A layer of geogrid/geotextile may be required at the surface of the existing access road (to be confirmed by the designer).

(f) For excavations in peat & spoil, side slopes shall be not greater than 1 (v): 2 or 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.

(2) For upgrading of the limited area of existing floated access track (Type B – Figure 3-2) the following guidelines apply:

(a) The typical make-up of the existing floating access roads on site appears to be locally tree brash/trunks laid directly onto the peat surface and/or geotextile overlain by up to 300mm 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 graded/tidied up 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.

(g) The geogrid may be overlaid with up to 900mm of selected granular fill. Granular fill to be placed in layers in accordance with the designer's specification.

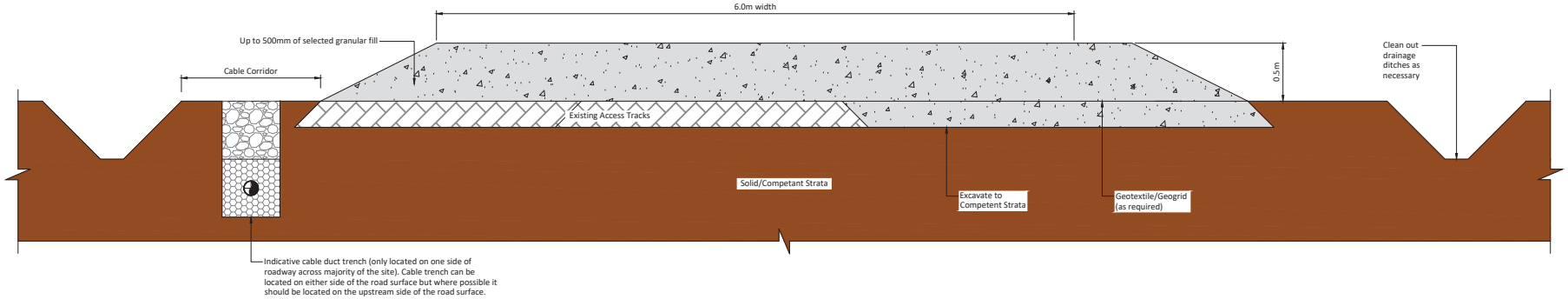
(e) Additional geogrid and granular fill may be required in certain sections of the works (to be confirmed by the designer).

(3) The finished road width will be approximately 5m (to be confirmed by the designer).

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

(5) At transitions between floating and existing 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.

(6) A final surface layer shall be placed over the existing access track, as per design requirements, to provide a road profile and graded to accommodate wind turbine construction and delivery traffic.



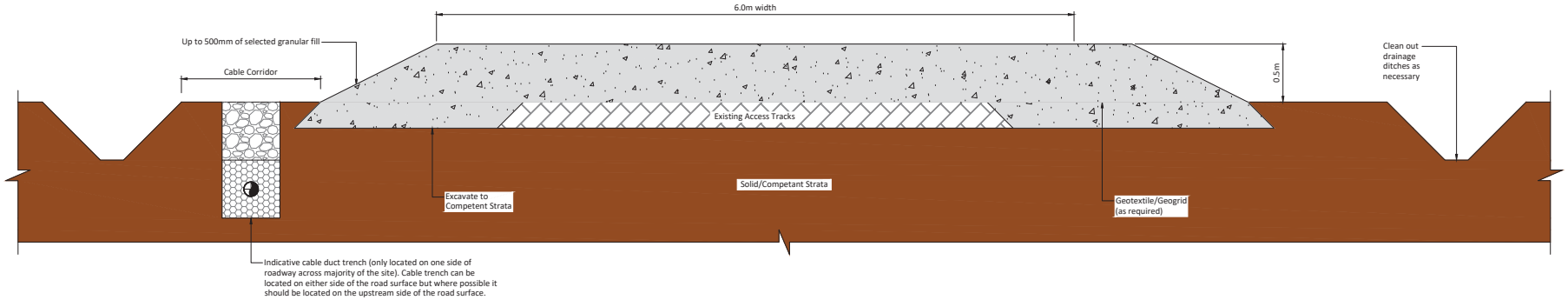


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FIGURE 3-1 : TYPE A - UPGRADE OF EXISTING EXCAVATED ACCESS TRACKS

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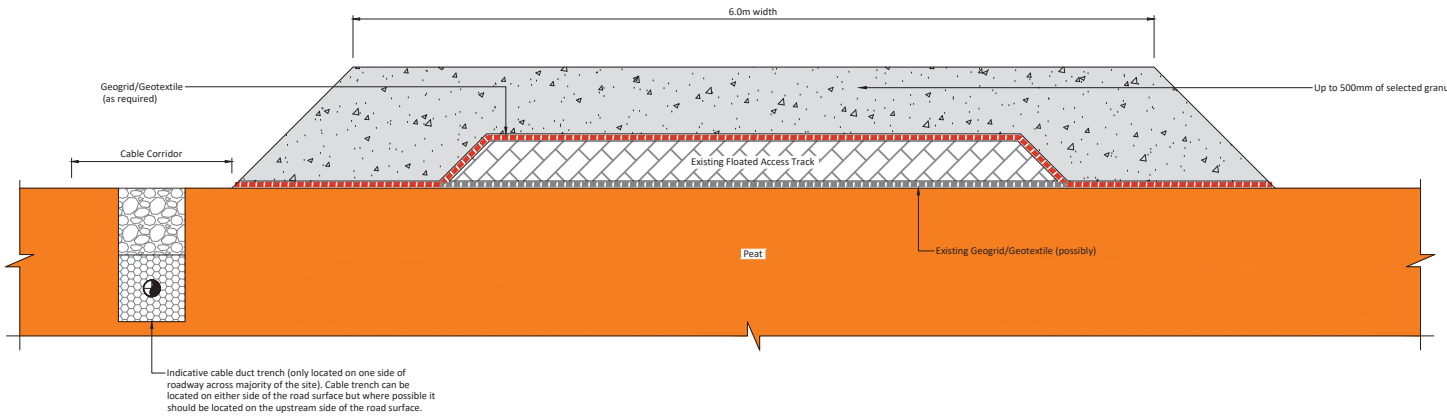

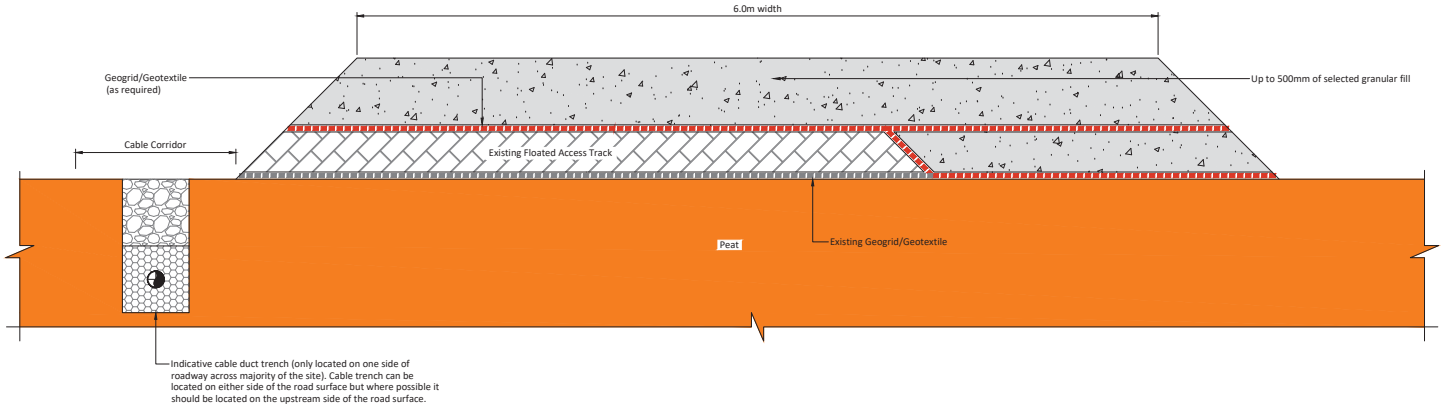

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FIGURE 3-2 : TYPE B - UPGRADE OF EXISTING FLOATED ACCESS TRACKS

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4 CONSTRUCTION OF NEW EXCAVATED ROADS THROUGH PEAT – TYPE C

The excavation of peat & 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 2-1 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. It is proposed to use the borrow pits to store the excavated materials.

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 road construction movement monitoring posts should be installed in areas where the peat depth is greater than 2m.

(2) Interceptor drains should be installed upslope of the access road alignment to divert any surface water away from the construction area.

(3) Excavation should take place to a competent stratum beneath the peat (as agreed with the site designer and resident engineer).

(4) Road construction should 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 (top about 0.3 to 0.4m of peat) is generally required for landscaping and shall be stripped and temporarily stockpiled for re-use as required. Acrotelm stripping shall 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 (peat below about 0.3 to 0.4m depth) shall be transported immediately on excavation to the designated areas.

(6) Side slopes in peat shall be not greater than 1 (v): 2 or 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 should be carried out as the excavation progresses.

(7) The surface of the excavated access road should be overlaid with up to 500mm of selected granular fill. Granular fill to be placed in layers in accordance with the designer's specification.

(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 (to be confirmed by the designer).

(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.

(11) Where relatively steep peat slopes are encountered along with relatively deep peat (i.e. typically greater than 1m) 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, as per design requirements, to provide a road profile and graded to accommodate wind turbine construction and delivery traffic.

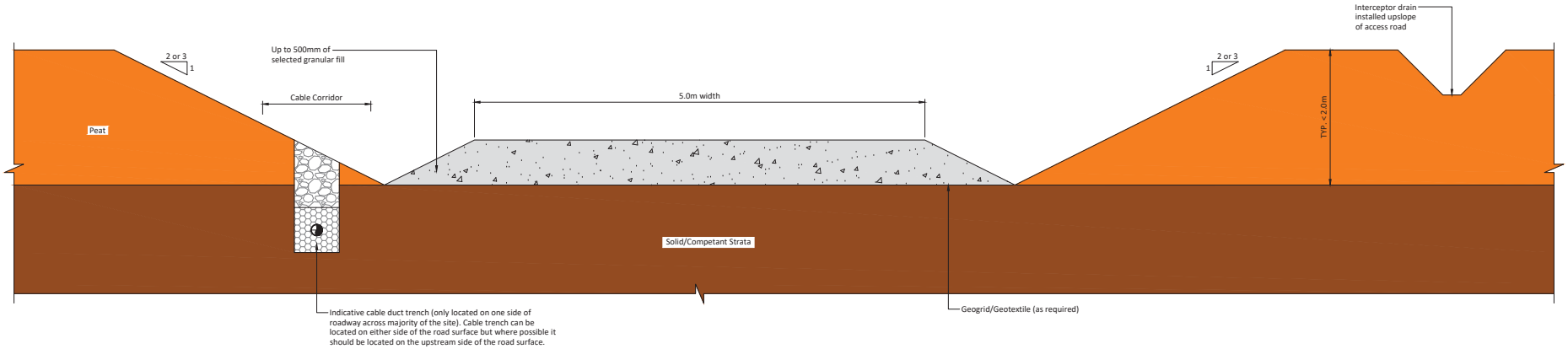

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FIGURE 4-1 : TYPE C - NEW EXCAVATE AND REPLACE ACCESS ROAD

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5 CONSTRUCTION OF NEW FLOATING ROADS OVER PEAT – TYPE D

Due to the relatively shallow peat recorded on the site and the relatively steep slope angles, floating roads have not been considered necessary for the site other that the upgrade of existing sections of floating roads. However, the methodology for the construction of floating roads has been included for information purposes.

A detailed 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 & replace type access road may be more suitable (see section 6).

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.

Note: Details of geogrid arrangement will be provided by the specialist geogrid provider/designer.

(1) Prior to commencing floating road construction movement monitoring posts should be installed in areas where the peat depth is greater than 3m.

(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 1000 to 1200mm of selected granular fill with 2 no. layers of geogrid with possibly the inclusion of a basal layer of tree trunks/brash (See Figure 5-1 – To be confirmed with the site designer).

(5) Granular fill to be placed in layers in accordance with the designer's specification.

(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 running width of the road will be approximately 5m (to be confirmed by the designer).

(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, suitable machinery shall be employed to spread and place the tipped stone over the base geogrid along the line of the road.

(12) A final surface capping 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.

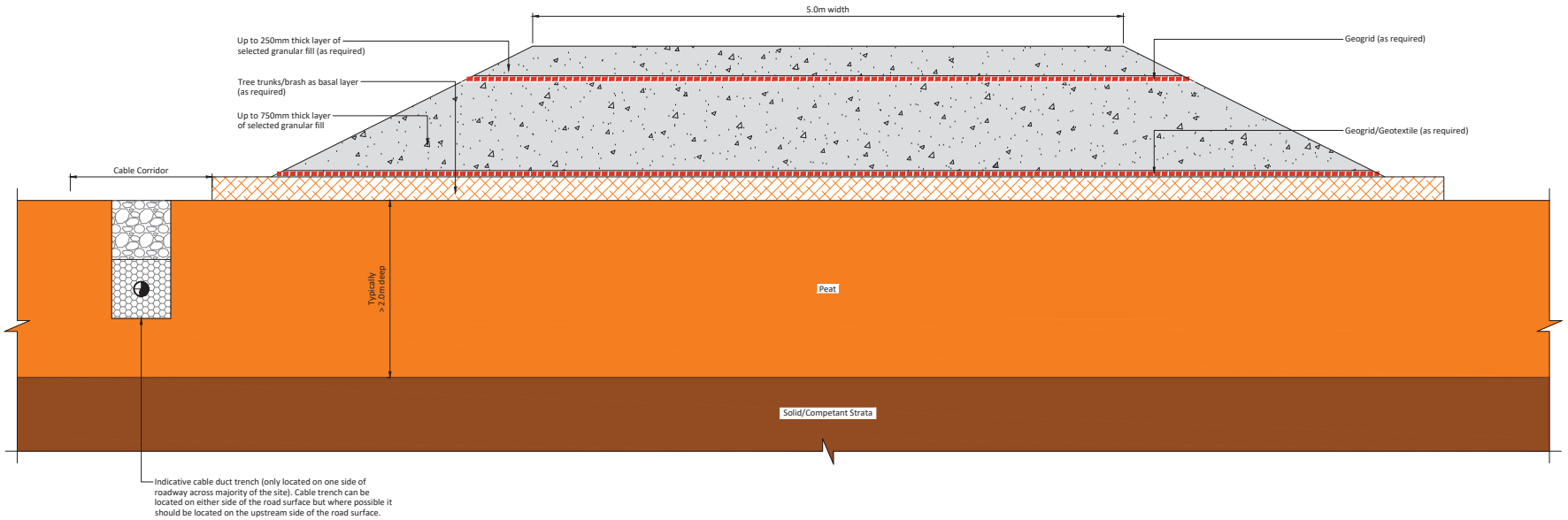

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FIGURE 5-1 : TYPE D - NEW FLOATED ACCESS ROAD

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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. It should be noted that the stability of a floating access road is notably reduced by the presence of adjacent ditches/excavations. 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. Recommended remedial works in this instance could include the placement (in the line of the existing drain crossing) of flexible perforated pipes within a permeable stone fill surround.

(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, where required, 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 is necessary to monitor the settlement/movement of the road. It is recommended that survey points are located along the road at 10m intervals in areas of deep peat (say greater than 3m). These survey points shall be surveyed on a weekly basis, possibly more frequently depending on construction activities in the area.

(7) It is recommended that the construction and upgrading of access roads in areas of deep peat (say greater than 3m) is inspected on a routine basis during the works, particularly before/following trafficking by heavy vehicular loads.

(8) Where there is 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 is 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 PLACEMENT OF ARISINGS

7.1 Excavation & Placement/Reinstatement 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) All excavated peat & spoil shall be transported immediately on excavation to one of the 2 no. borrow pits or to designated spoil areas alongside the access roads.

(2) Further details on the construction and reinstatement of the 2 no. borrow pits are given in Section 7.4.

(3) Further details on the placement of excavated material to designated spoil areas alongside the access roads are given in Section 7.5.

(4) 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 Excavated Peat & Spoil Volumes on Site

A summary of the excavated peat & spoil volumes calculated for the Cahermurphy Two wind farm are given in Table 7-1.

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

Infrastructure Element (1)	Typical Dimensions	Peat Volume (m^3) (2)	Spoil (non-peat) Volume (m^3) (2) & (3)	Comment
10 no. Turbines & Hardstands	22m diameter excavation footprint for turbine foundation with 55 x 35m hardstand area	26,415	16,757	Hardstanding area and foundation footprint
Access Roads	Assumed 5m running surface with 6m wide development footprint	45,322	103,320	
Substation 1	Assumed 140 x 85m footprint	648	4,195	-
Substation 2	Assumed 140 x 95m footprint	3,456		
Meteorological Mast	Foundation footprint within 21 x 14m hardstanding area	283		-
Temporary Construction Compound	Hardstanding area of 70 x 40m	1,968		Hardstanding areas
Borrow Pits	2 no. borrow pits	9,900	37,450	Borrow pit footprint
	Total =	**87,992m^3**	**161,722m^3**	**Total = 249,714m^3 (peat and spoil volume)** (4)

Note (1) The location of the infrastructure elements on site are shown on Figure 7-1.
Note (2) A factor of 20% (bulking factor of 15% and contingency factor of 5%) has been applied to the excavated peat & spoil volumes to allow for expected increase in volume upon excavation and to allow for a variation in ground conditions across the site.
Note (3) The excavated spoil volumes have been determined based on a cut-fill assessment carried out for the site, see Section 12 of this report for further details.
Note (4) It should be noted that the excavated rock volume is not included in the total volume quoted above in Table 7-1, see the cut-fill assessment in Section 12 of this report for further details. It is assumed that the excavated rock volume will be re-used on site as part of the construction works for the development and hence will not require reinstatement on site.

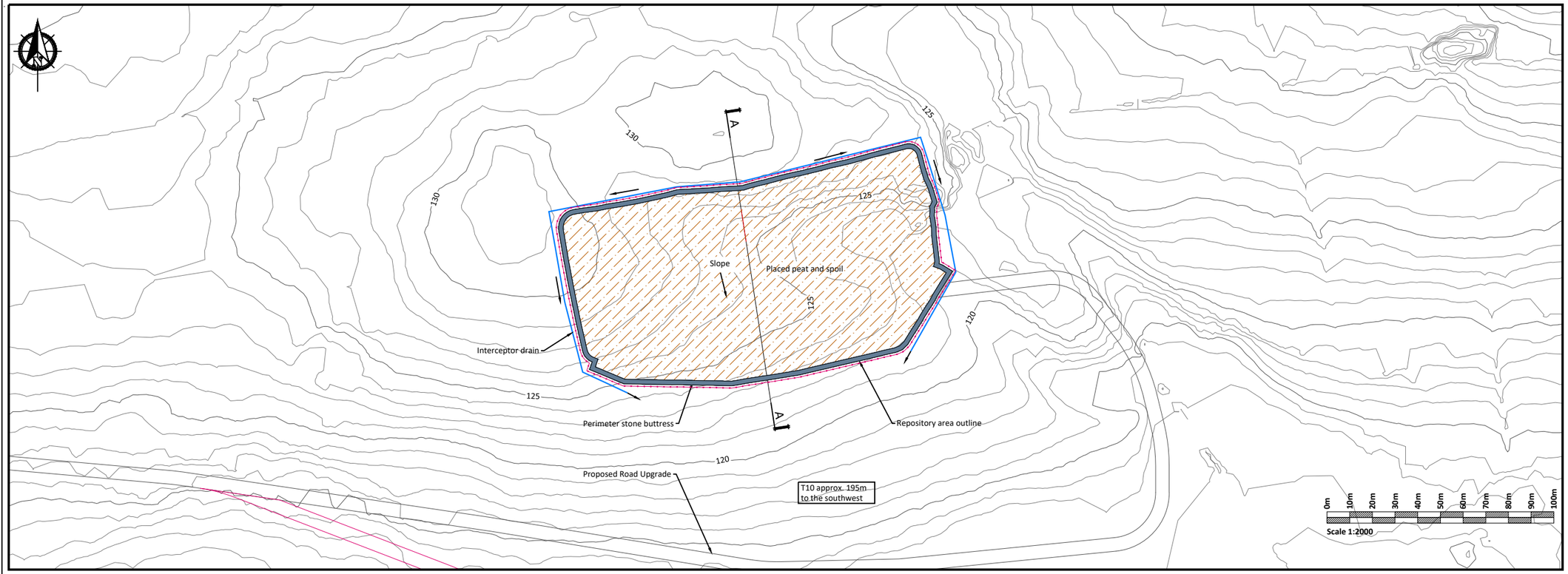
7.3 Summary of Peat & Spoil Placement/Reinstatement Areas on Site

A summary of the potential peat & spoil placement/reinstatement areas at the Cahermurphy Two wind farm are given in Table 7-2.

Table 7-2: Summary of Peat & Spoil Placement/Reinstatement Areas on Site

Location (1)	Peat & Spoil Volume (m^3)	Comment
Borrow Pit No. 1 (South)	134,000	See Figures 7-1 for further details
Borrow Pit No. 2 (North)	96,500	See Figures 7-2 for further details
Landscaping (2)	10,000	It is estimated that approximately 1,000m^3 of peat will be required for landscaping purposes at each of the 10 no. turbine locations
Peat & spoil placement alongside designated access roads	10,000	1m in height and 10m wide corridor on both sides of the access road, in the central part of the site only where topography is flat. See Section 7.5 of the report for further details
Total =	**250,500m^3**	

Note (1) The location of the proposed borrow pits at the site are shown on Figure 7-1.
Note (2) Some of the acrotelm (upper layer of the peat) excavated during construction will be used for landscaping purposes.



PLAN (SOUTHERN BORROW)

Scale 1:2000

FEHILY TIMONEY Cork | Dublin | Carlow www.fehilytimoney.ie

Construction Notes Borrow Pit:

(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. Depending on the type and condition of rock present in the borrow pit it may be possible to excavate the rock from the borrow pit whilst leaving in place upstands/segments of intact rock which will help to retain the placed peat & spoil. The upstands/segments of intact rock will essentially act as engineered rock buttresses within the borrow pit.

(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.

(3) Infilling of the peat & spoil should commence at the back edge of the borrow pit and progress towards the borrow pit entrance/rock buttress. Excavation and infilling of the borrow pit will need to be sequenced and programmed. Leaving in place upstands/segments of intact rock which will help to retain the placed peat & spoil and will allow the borrow pit to be developed and infilled in cells.

(4) The contractor excavating the rock will be required to develop the borrow pit in a way which will allow the excavated peat & spoil to be reinstated safely.

(5) A rock buttress is required at the downslope edge of the borrow pit to safely retain the infilled peat and spoil. The height of the rock buttresses constructed should be greater than the height of the infilled peat & spoil to prevent any surface peat & spoil run-off. A buttress up to 7m (approx.) in height is likely to be required.

(6) The rock buttress will be founded on competent strata. The founding stratum for the rock buttress should be inspected and approved by a competent person.

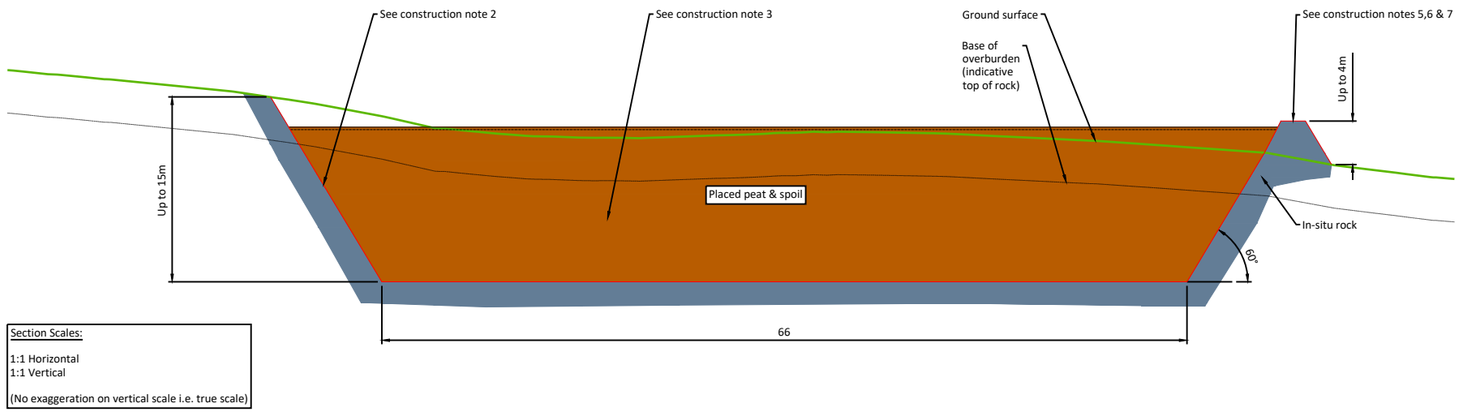
(7) In order to prevent water retention occurring behind the buttresses, the buttresses should be constructed of coarse boulder fill with a high permeability.

(8) Where possible, the surface of the placed peat & spoil should be shaped to allow efficient run-off of surface water from the placed arising's.

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

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

(11) Further guidelines on the construction of the borrow pit is included within Section 7.4 of the Peat & Spoil Management Plan



SECTION A - A

Scale 1:500

0m 3m 5m 8m 10m 13m 15m 18m 20m 23m 25m
Scale 1:500

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Scale (@ A3) 1:500

Date - 30.04.20

FIGURE 7-1 : SOUTHERN BORROW PIT - PLAN & CROSS SECTION DETAILS

Drawn - POR

Checked - IH

Rev - B

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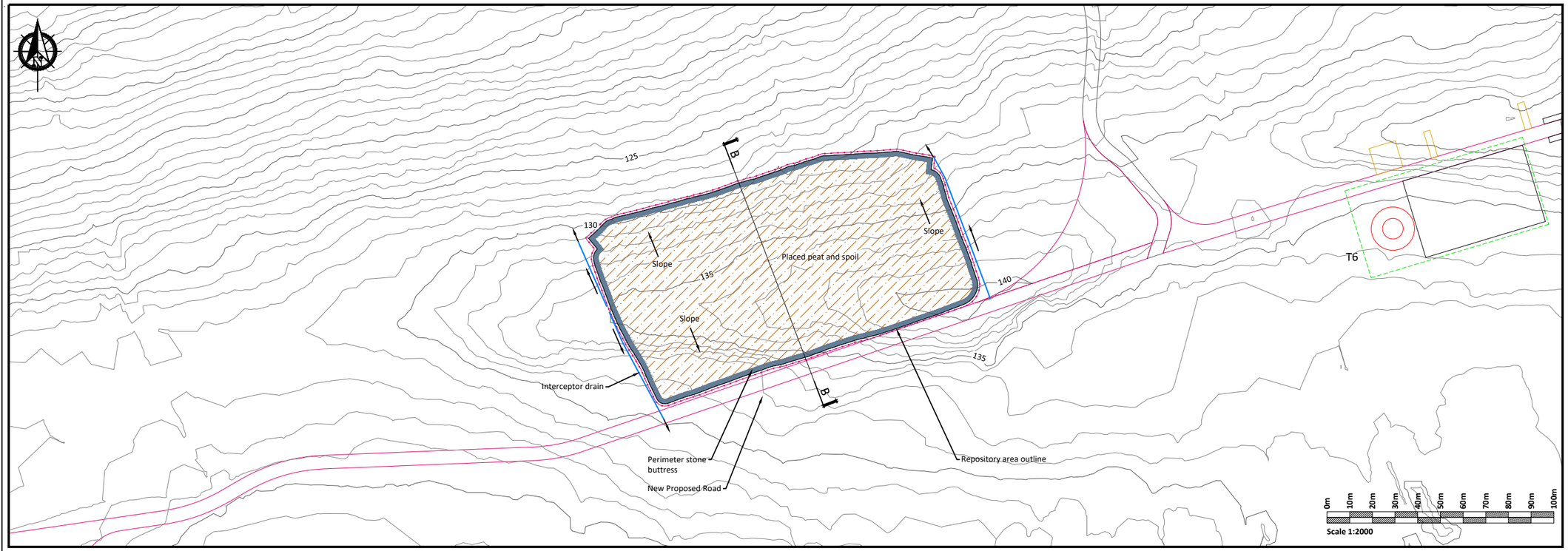
Thursday 30 April 2020



PLAN (NORTHERN BORROW)

Scale 1:2000

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Construction Notes Borrow Pit:

(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. Depending on the type and condition of rock present in the borrow pit it may be possible to excavate the rock from the borrow pit whilst leaving in place upstands/segments of intact rock which will help to retain the placed peat & spoil. The upstands/segments of intact rock will essentially act as engineered rock buttresses within the borrow pit.

(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.

(3) Infilling of the peat & spoil should commence at the back edge of the borrow pit and progress towards the borrow pit entrance/rock buttress. Excavation and infilling of the borrow pit will need to be sequenced and programmed. Leaving in place upstands/segments of intact rock which will help to retain the placed peat & spoil and will allow the borrow pit to be developed and infilled in cells.

(4) The contractor excavating the rock will be required to develop the borrow pit in a way which will allow the excavated peat & spoil to be reinstated safely.

(5) A rock buttress is required at the downslope edge of the borrow pit to safely retain the infilled peat and spoil. The height of the rock buttresses constructed should be greater than the height of the infilled peat & spoil to prevent any surface peat & spoil run-off. A buttress up to 7m (approx.) in height is likely to be required.

(6) The rock buttress will be founded on competent strata. The founding stratum for the rock buttress should be inspected and approved by a competent person.

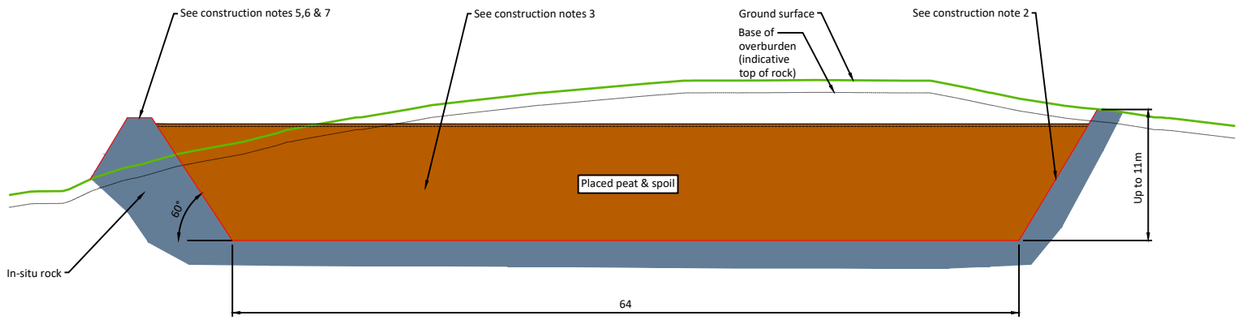
(7) In order to prevent water retention occurring behind the buttresses, the buttresses should be constructed of coarse boulder fill with a high permeability.

(8) Where possible, the surface of the placed peat & spoil should be shaped to allow efficient run-off of surface water from the placed arising's.

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

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

(11) Further guidelines on the construction of the borrow pit is included within Section 7.4 of the Peat & Spoil Management Plan



Section Scales:

1:1 Horizontal
1:1 Vertical

(No exaggeration on vertical scale i.e. true scale)

SECTION B - B

Scale 1:500

0m 3m 5m 8m 10m 13m 15m 18m 20m 23m 25m

Scale 1:500

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Scale (@ A3) 1:500

Date - 30.04.20

FIGURE 7-2 : NORTHERN BORROW PIT - PLAN & CROSS SECTION DETAILS

Drawn - POR

Checked - IH

Rev - B

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Thursday 30 April 2020

7.4 Guidelines for the Construction & Reinstatement of Borrow Pits

Two locations have been identified as potential borrow pits and are shown on Figure 7-1 and 7-2. The peat depth within the development footprint of the borrow pits is generally less than 1m.

Upon removal of the rock from the borrow pit, it is proposed to reinstate the borrow pit using excavated peat & spoil within cells located inside the borrow pit. The excavated rock from the borrow pits 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 pits in a way which will allow the excavated peat & spoil to be placed safely. It is proposed to construct cells within the borrow pits for the placement of the excavated peat & spoil. This is to allow for the safe placement and grading of the peat & 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 pits.

Figures 7-1 to 7-2 show typical construction details for each of the 2 no. borrow pits.

The borrow pits shall be typically constructed as follows:

(1) The rock within each proposed borrow pit footprint will be removed by either breaking or blasting depending on its excavatability, which will be determined from a ground investigation carried out at each of the proposed borrow pits. The ground investigation shall comprise rotary core drilling with associated engineering logging including rock quality designation and strength testing, as required.

(2) It is proposed to construct the borrow pits so that the base of the borrow pit is below the level of the adjacent section of access road. This may vary for each of the borrow pits and as excavation progresses into the back edge of the borrow pit, the base of the borrow pit may be raised to suit local conditions. Localised deepening of the borrow pit floor may be required depending on extraction operations.

(3) Depending on the depth and type of rock present in the borrow pits it may be possible to excavate the rock from the borrow pit whilst leaving in place upstands/segments of intact rock which will help to retain the placed peat & spoil. The upstands/segments of intact rock will essentially act as engineered rock buttresses.

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

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

(6) Where it is not possible to leave upstands/segments of intact rock in place it may be necessary to construct rock buttresses founded on in-situ rock within the borrow pits. The rock buttresses should be constructed of rock fill from the borrow pit excavation. The founding stratum for each rock buttress should be inspected and approved by a competent person.

(7) It may be necessary to construct the rock buttresses within the borrow pits in stages as infilling of peat & spoil behind the buttresses progress. The buttress should 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 & spoil, as necessary.

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

(9) A number of rock buttresses to form cells with the borrow pits will be required to ensure access for trucks and excavators can be achieved. See Figures 7-1 to 7-2 for the location of the rock buttresses. The locations of the rock buttresses shown on Figures 7-1 to 7-2 for the borrow pits are indicative only and may change subject to local conditions encountered on site during construction and as a result of the ground investigations.

(10) The rock buttresses should be wide enough to allow construction traffic access for tipping and grading during the placement of the excavated peat & spoil. The side slopes of the rock buttress should be constructed between 45 to 60 degrees.

(11) The height of the rock buttresses constructed should be greater than the height of the reinstated peat & spoil to prevent any surface peat & spoil run-off. Buttresses up to 8m in height are likely to be required.

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

(13) Where possible, the surface of the placed peat & spoil should be shaped to allow efficient run-off of surface water from the placed arising's.

(14) A layer of geogrid to strengthen the surface of the placed peat & spoil within the borrow pits may be required.

(15) 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 in the reinstated area.

(16) 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.

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

(18) 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 at the surface of the peat & spoil within the borrow pits.

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

(20) 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 Designated Spoil Placement Areas alongside the Access Roads

The following recommendations/best practice guidelines for the placement of peat & spoil alongside the access roads should be considered and taken into account during construction. Only limited sidecasting is currently proposed.

(1) The potential spoil placement area locations identified are alongside the proposed access roads in the central area of the site where the topography is flat. The placement of spoil alongside the access roads should be restricted to areas where the peat depth is less than 2m.

(2) Given the relatively flat topography present in the central part of the site, the placement of peat & spoil alongside the access roads is deemed appropriate.

(3) The peat & spoil placed adjacent to the new proposed access roads should be restricted to a maximum height of 1m over a 10m wide corridor on both sides of the access road. It should be noted that the designer should define/confirm the maximum restricted height for the placed peat & spoil.

(4) The placement of excavated peat & spoil is to be avoided without first establishing the adequacy of the ground to support the load. The placement of peat & spoil 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.

(5) 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.

(6) Where practical, it should be ensured that the surface of the placed peat & spoil is shaped to allow efficient run-off of surface water. Where possible, shaping of the surface of the peat & spoil should

be carried out as placement of peat & spoil within the placement area progresses. This will reduce the likelihood of debris run-off and ensure stability of the placed peat & spoil.

(7) Finished/shaped side slopes in the placed peat & spoil shall be not greater than 1(v): 2 or 3(h). This slope inclination will be reviewed during construction, as appropriate. Where areas of weaker peat & spoil are encountered then slacker slopes will be required.

(8) 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 at the surface of the placed peat & spoil within the placement areas.

(9) Movement monitoring instrumentation may be required adjacent to the access road where peat has been placed. The locations where monitoring is required will be identified by the designer 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 designated peat placement areas to divert any surface water away from these areas. This will help ensure stability of the placed peat 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 & NON-PEAT SPOIL

The works require that turbine bases are to be founded on competent founding strata which will require excavation through peat & spoil.

Similarly, crane hardstandings, construction compound & substation platforms and met mast foundations are to be founded on competent mineral soil and/or rock which will also require excavation through peat & spoil.

Excavations for the borrow pits will also require the removal of peat and non-peat 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 excavation 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): 2 or 3(h).

(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

It is proposed to construct a 38kV substation within the site and to connect from here to the existing Booltiagh substation, located approximately 7km southeast of the site. Connection via the Booltiagh route would comprise underground cabling, measuring approximately 12.1 km in total, located on existing forestry and agricultural land and within the public road corridor.

The proposed grid connection construction methodology for the underground cabling routes is described in the EIAR.

The cable trench route is envisaged to encounter peat. It is proposed to excavate the trenches for the underground cable at a uniform level in peat or non-peat overburden material. The trenches will be approximately 600mm wide and 1250mm deep.

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 level in peat or overburden material.

(3) All excavations within peat for the cable trench are to be adequately supported or peat slopes are to be battered to a safe slope inclination typically of 1 (v): 2 or 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.

(8) Backfill requirements for the cable trench will be decided as part of the detailed design/construction.

10 GENERAL RECOMMENDATIONS FOR GOOD CONSTRUCTION PRACTICE ON SITE

To minimise the risk of construction activity causing potential peat instability it is recommended that the Construction Method Statements (CMS's) for the project should also take into account, but not be limited, to the general recommendations below together with the specific recommendations above. Some of the general recommendations are already included in more detail within the specific recommendations.

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

(2) Avoidance of unstable excavations. All excavation 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 2m for excavated access roads and 3m for floated access roads. 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 nos. posts at (say) 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 1m). 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, and 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

Analysis of the site indicates that excessive movements are unlikely but 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 (Resident Engineer, Contractor & Client).

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) Where considered possible, 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) 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 Barrage

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 any of the borrow pits on site, preferably the closest borrow pit, or where rock level is close to/at the ground surface. Currently the rock within the proposed borrow pits is in situ and would need to be broken-out and possibly stockpiled as a contingency measure prior to construction work commencing.

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 unlikely event of a major peat slide. Further remedial measures may be required and would be assessed by all parties 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.

13 CUT & FILL EARTHWORKS ASSESSMENT

FT carried out a preliminary assessment for the site which quantifies the total volume of cut and fill earthworks required for the construction of the wind farm extension. The cut & fill assessment is graphically presented in Figure 13-1.

The outputs from the cut & fill earthworks assessment includes the following:

- Plan drawings of the entire site showing an outline of cut & fill earthworks at all infrastructure elements (Figure 13-1)
- Preliminary cut & fill earthwork volumes (see Table 13-1 of this report)

A summary of the assumptions made for the cut & fill earthworks assessment are included in Appendix B of this report.

A summary of the cut & fill earthwork volumes is given in Table 13-1.

13.1 Commentary on Earthwork Volumes

It should be noted that the earthwork volumes given in Table 13-1 are indicative and for information purposes only and subject to detailed design. This section of the report should be read in conjunction with Sections 7.2 and 7.3 of the report which summarise the peat and spoil volumes for site and the placement/reinstatement areas on site.

In summary the following points are given,

1) The total net earthwork volume (cut minus fill) which includes peat, non-peat superficial deposits and rock for the scheme is estimated at 466,521m^3 (Cut). Fill requirements for the scheme are relatively minor, see Table 13-1.

2) The total net earthwork volume (cut minus fill) excluding peat (i.e. non-peat overburden and rock) for the scheme is estimated at 405,896m^3 (Cut).

3) The estimated quantity of available rock within the 2 no. borrow pits is 228,500m^3. Trial pit and site visit records have been used to define rockhead level. Conservative assumptions were made in estimating the quantity of rock available in the borrow pits.

4) The total volume of non-peat superficial deposits only requiring placement/reinstatement on site is estimated at 162,722m^3. This material will be excavated and placed/reinstated to one of the 2 no. borrow pits or to designated spoil areas alongside the access roads.

5) A factor of 20% (bulking factor of 15% and contingency factor of 5%) has been applied to all excavation volumes to allow for expected bulking upon excavation and to allow for a variation in ground conditions.

6) Note a number of assumptions were made during the cut & fill assessment, see Appendix B. Volumes may change following additional ground investigation at the site and following detailed design.

Table 13-1: Summary of Cut & Fill Earthwork Volumes

Infrastructure Element	Description	Total Earthwork Volume (1) & (2) – Peat & non-peat overburden & rock			Earthwork Volume (3) – Estimated non-peat material only (non-peat overburden and rock)			Earthwork Volume (4) - Estimated rock volume only	Comment
		Cut (m^3)	Fill (m^3)	Net Volume (m^3) = Cut - Fill	Cut (m^3) (3)	Fill (m^3)	Net Volume (m^3) = Cut - Fill	Cut (m^3)	
10 no. Turbines & Hardstands	22m diameter excavation footprint for turbine foundation with 55 x 35m hardstand area	43,172	13,125	30,047 (Cut)	31,971	10,500	21,471 (Cut)	-	Hardstanding area and turbine foundation footprint
Access Roads	Assumed 5m running surface with 6m wide development footprint	148,624	700	147,924 (Cut)	103,320	700	102,600 (Cut)	-	Excludes proposed and existing floating sections of access road where no excavation of peat will take place (see Figure 2-1).
Various Infrastructure Locations	Includes substations, 1 no. temp. construction compound and met mast	6,335	5,520	815 (Cut)	4,195	5,520	1,325 (Fill)	-	-
Borrow Pits	Borrow pit 1	175,000	-	175,000 (Cut)	172,000	-	172,000 (Cut)	130,000 (Cut)	Estimated and indicative only potential rock volume from borrow pit 1 is **105,000m^3**. Note limited ground investigation in area of borrow pit to define rockhead level.
	Borrow pit 2	112,735	-	112,735 (Cut)	108,500	-	108,500 (Cut)	98,500 (Cut)	Estimated and indicative only potential in-situ rock volume from borrow pit 2 is **98,500m^3**. Note limited ground investigation in area of borrow pit to define rockhead level.
	Total =	**-**	-	**466,521 m^3 (Cut)**	**-**	-	**405,896 m^3 (Cut)**	**228,500 m^3 (Cut)**	

Note (1) The total earthwork volumes includes peat, non-peat superficial deposits and rock for the 2 no. borrow pits.
Note (2) A factor of 20% (bulking factor of 15% and contingency factor of 5%) 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 (3) The earthwork volumes quoted for the non-peat material were calculated based on the total earthwork volume (peat & non-peat material) minus the peat volumes calculated and presented in Table 7-1 within Section 7.2 of this report.
Note (4) The in-situ rock volume from the borrow pits was estimated based on limited ground investigation to define rockhead level and is considered indicative only.
Note (5) It should be noted that the earthwork volumes given in Table 13-1 are indicative and for information purposes only and subject to detailed design.

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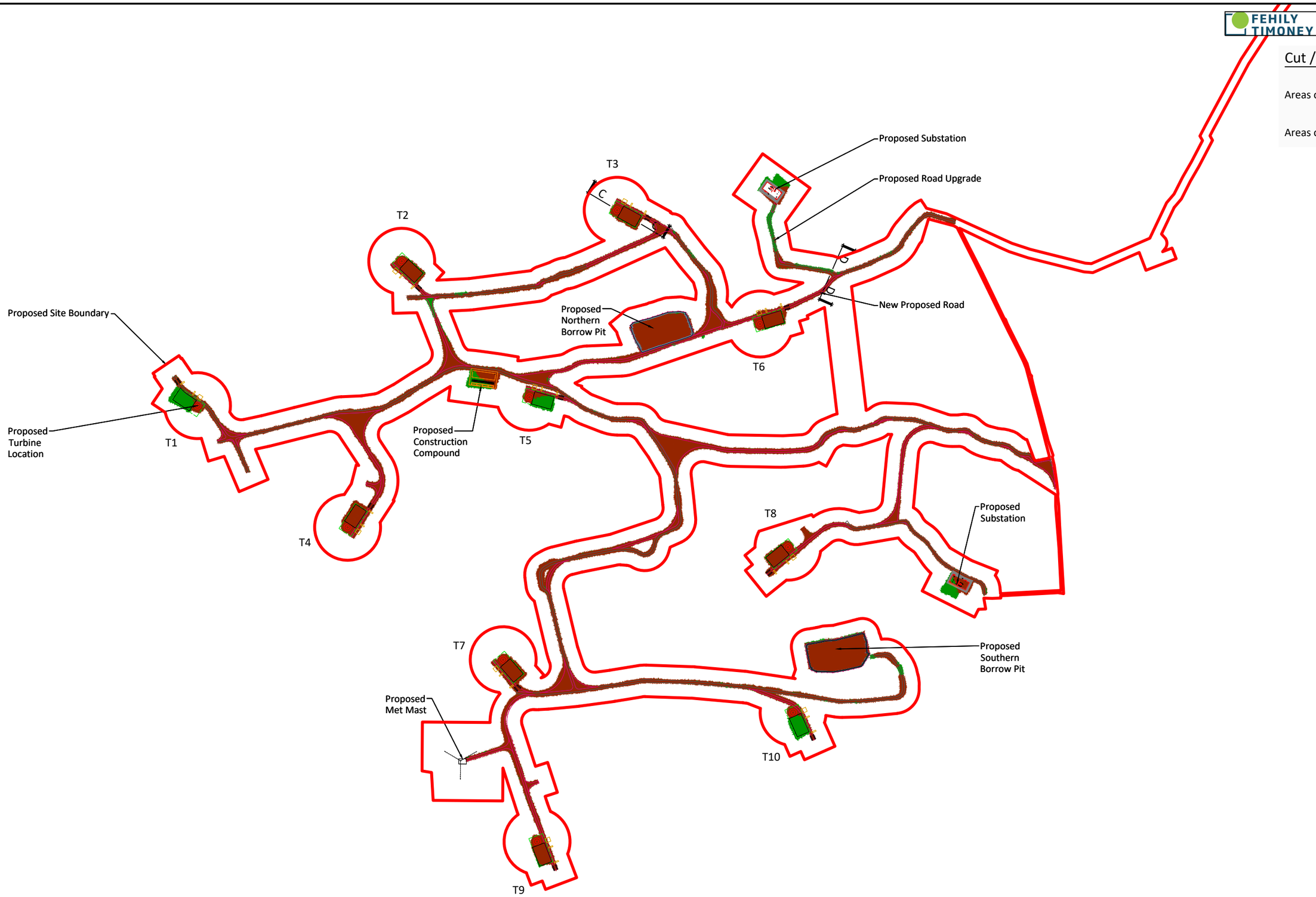
Cut / Fill Legend:

- Areas of Cut
- Areas of Fill



Scale 1:10000

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

Scale 1:10000

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Scale (@ A3) 1:10000

Date - 20.05.20

FIGURE 13-1 : PLAN DRAWING OF CUT FILL EARTHWORKS FOR SITE (1 OF 1)

Drawn - POR

Checked - IH

Rev - B

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Wednesday 20 May 2020

Appendix A

Photos from Site Walkover

Photo 1 Example of an existing excavated access track on site

Appendix B

Assumptions for Cut & Fill Earthworks Assessment

Assumptions for Cut/Fill Earthwork Assessment

Main Infrastructure Locations

Appendix B provides a summary of the main assumptions for the cut/fill earthworks assessment.

Table B1 provides a summary of the assumptions regarding the dig depths adopted for the cut/fill assessment for the main infrastructure elements at the Cahermurphy Two wind farm.

The assumed excavation footprint for the turbine foundation is the turbine base diameter of 19.2m plus 2m working room all around the base i.e. 23.2m.

Table B1: Summary of the dig depths at the main infrastructure locations

Turbine	Easting	Northing	Average Peat Depth (m)	Dig depth for Turbine Foundation (m) (1)	Max Dig depth for Associated Crane Hardstand (m) (2)
T1	507385	669377	0.3	3.0	0.4
T2	507942	669772	0.3	3.0	0.4
T3	508531	669911	0.5	3.0	0.6
T4	507833	669002	2.6	3.0	2.7
T5	508291	669400	0.2	3.0	0.3
T6	508921	669600	0.4	3.0	0.5
T7	508219	668683	1.7	3.0	1.8
T8	508965	668990	2.5	3.0	2.6
T9	508312	668187	0.7	3.0	0.8
T10	509012	668538	0.3	3.0	0.4
Infrastructure Element	**Easting**	**Northing**	**Average Peat Depth (m)**	**Max Dig depth for Infrastructure Element (m) (3)**	-
Substation 1	508888	669971	0.15	0.25	
Substation 2	509457	668893	0.80	1.0	
Construction Compound	508164	669452	0.15	0.25	
Met mast	508107	668404	0.80	1.80	
Borrow Pit 1	507398	669233	0.15	12.0	
Borrow Pit 2	508725	669570	0.3	12.0	

Notes

(1) Founding depths for the turbines was assumed to be the average peat depth + 1m to a competent strata. To be confirmed at detailed design stage following detailed ground investigation. A minimum dig depth of 3m is assumed for each turbine foundation. For the purpose of this assessment it is assumed that all turbine foundations will be gravity type founded bases i.e. no piled foundations.
(2) Founding depths for the crane hardstands was assumed to be the average peat depth + 0.1m to a competent strata. To be confirmed at detailed design stage following a ground investigation. In areas of steeper terrain (say greater than 10% gradient), for the crane hardstandings and for the purpose of this assessment, it was endeavoured to balance the earthworks for the footprint of the hardstands, where possible.
(3) For the temporary construction compounds and substation platforms the founding depth was assumed to be the average peat depth + 0.1m to a competent strata. To be confirmed at detailed design stage following ground investigation. In areas of steeper terrain (say greater than 10% gradient), for the compounds and substation platform and for the purpose of this assessment, it was endeavoured to balance the earthworks for the footprint.
(4) For the met mast the founding depth was assumed to be the average peat depth +1.0m to a competent stratum. To be confirmed at detailed design stage following ground investigation.
(5) Note the maximum dig depths stated in Table B1 are indicative and for information purposes only and are subject to confirmation at detailed design stage following a ground investigation.

Access Roads

The following assumptions for the cut/fill assessment are given in relation to the access roads.

- Typical gradient requirements from turbine suppliers were assumed for the cut & fill assessment i.e. maximum gradients of 10 to 12%. A maximum gradient of 12% has been assumed for straight sections of access road on site (in localised areas only). Where possible a 10% gradient for the access roads was used.
- For the purpose of the assessment, it is assumed that the existing access tracks on site are 3m in width. Existing access tracks are to be widened by 3m to give a final running width at the surface of the 5m.
- There are 4 types of access tracks/roads proposed/present on site, which include:
    - Existing excavated and replace type access tracks - some excavation works as a result of localised widening will be required. It is assumed that widening will typically take place on both sides of the road as per Figure 3.1. In areas of side long ground/steeper terrain (say greater than 5% gradient), widening of existing tracks will take place on the upslope side of the road as per Figure 3.1. Assumed dig depth to competent strata for both cases is 0.3m below the base of the peat.

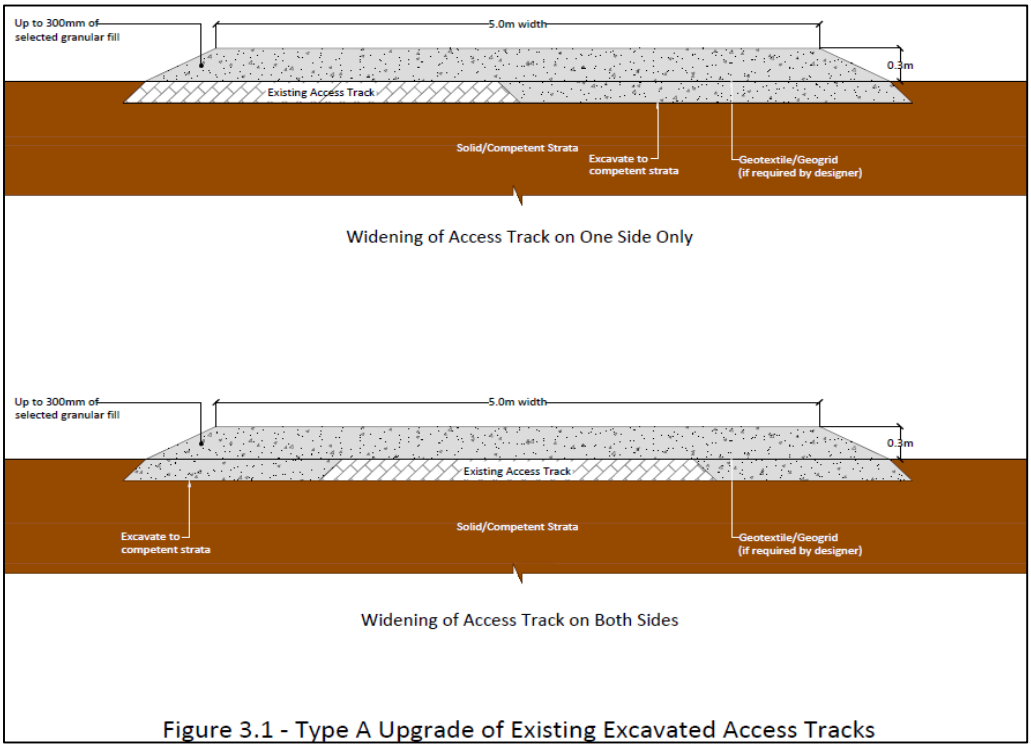

Figure 3.1 - Type A Upgrade of Existing Excavated Access Tracks

- Existing floating type access tracks – minimal/no excavation will be required
- New proposed floating access roads - no excavation will be required
- New proposed excavate & replace type access roads – excavation work will be required. Assumed dig depth to competent strata was 0.1m below the base of the peat

Borrow Pits

The cut/fill assessment for the borrow pits is based on the cross-section drawings (Figures 7-1 and 7-2) included in this report. The borrow pits were sized to allow for the reinstatement of the excavated peat and non-peat volume generated on site and to accommodate the estimated site-won stone fill requirements.

General Assumptions

A 1(v): 2(h) configuration for all excavation faces was assumed for the cut & fill earthworks assessment, except for excavations in rock at the borrow pits where a configuration of 1(v): 0.7(h) i.e. 60 degrees was assumed.