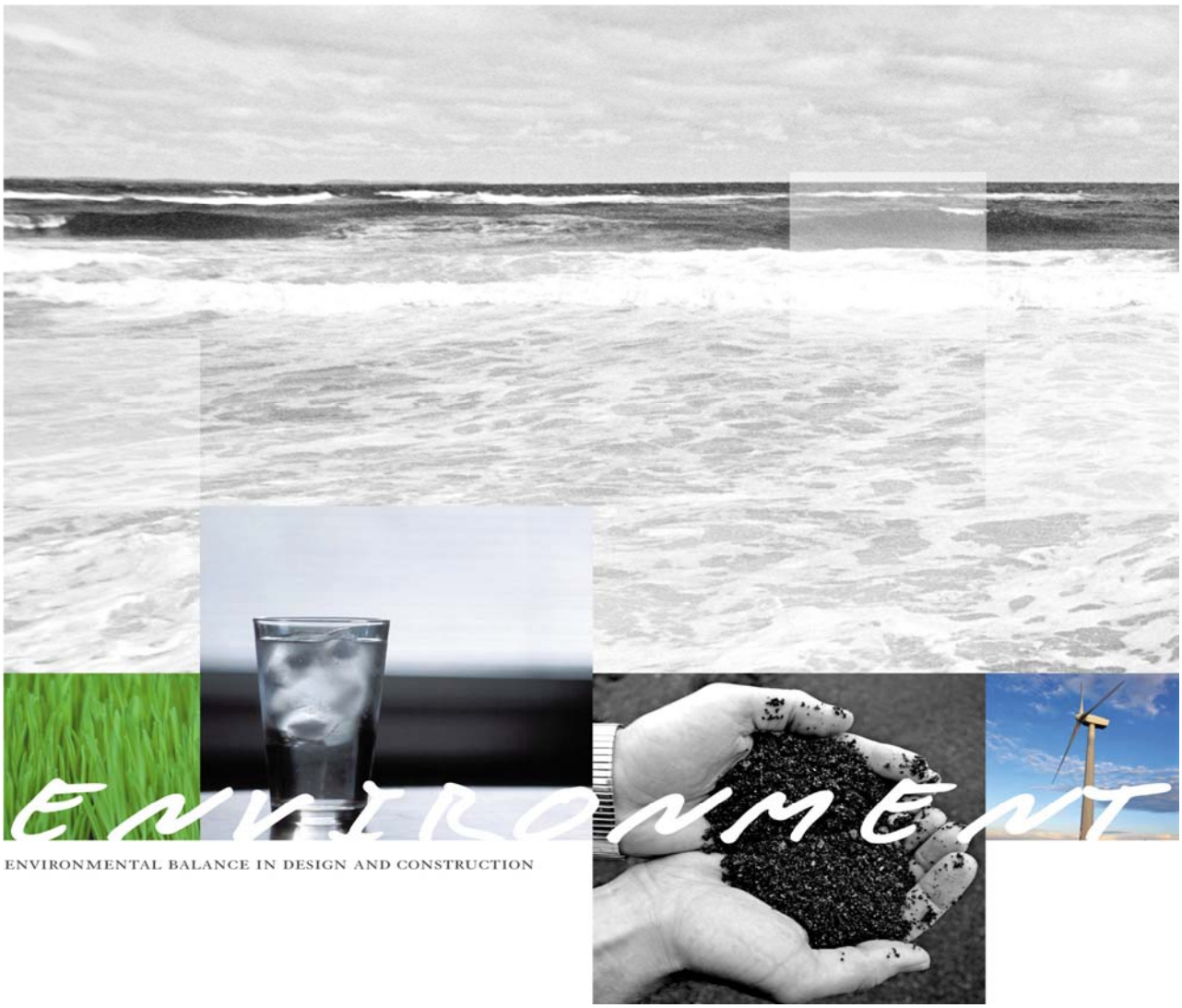
# APPENDIX 5

## *PEAT AND SPOIL MANAGEMENT PLAN*




# PEAT & SPOIL MANAGEMENT PLAN FOR

# CROAGH WIND FARM, COUNTY LEITRIM/SLIGO

## McCarthy Keville O'Sullivan

## JUNE 2020

MKO

FEHILY TIMONEY
30 YEARS

# Peat & Spoil Management Plan for Croagh Wind Farm, County Leitrim / Sligo

## McCarthy Keville O'Sullivan

**User is Responsible for Checking the Revision Status of This Document**

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**Abstract:** Fehily Timoney and Company (FT) were engaged in August 2018 by McCarthy Keville O'Sullivan to compile a Peat & Spoil Management Plan (PSMP) for Croagh wind farm in County Leitrim/Sligo. 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 and spoil which will be excavated from infrastructure locations such as turbine bases and roads and will be handled and placed/reinstated onsite. The report also provides construction details for the types of roads which will be put in place at the site and proposed peat and spoil placement/reinstatement areas which will be developed at the site. In addition, the report contains a cut and 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 and Experience

Fehily Timoney and Company (FT) formerly Applied Ground Engineering Consultants Ltd (AGEC) were engaged in August 2018 by McCarthy Keville O'Sullivan to compile a Peat & Spoil Management Plan (PSMP) for the proposed Croagh wind farm in County Leitrim/Sligo.

FT/AGEC 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 Croagh wind farm site is located on the boundary of County Sligo and County Leitrim, adjacent to the village of Drumkeeran.

The site is within the northwest part of the Lough Allen upland, which typically comprises plateaux and ridges with steep sides separated by valleys. The approximate development area for the site is 6.7km$^2$. A number of existing wind farm developments are located in the area of the site.

The proposed wind farm will comprise 10 no. turbines with a tip height of up to 170 metres and all associated foundations and hardstanding areas, access roads including upgrade of existing site roads and provision of new roads, 1 no. onsite electrical substation, excavation of 1 no. borrow pit, underground electrical and communications cabling connecting the turbines to the proposed onsite substation, underground cabling connecting the onsite substation to the existing Garvagh substation, 2 no. temporary construction compounds, 1 no. permanent anemometry mast, recreational car park, trails and signage, demolition of 1 no. derelict building, site drainage and all associated works.

The purpose of this report is to provide a Peat & Spoil Management Plan (PSMP) for the construction phase of the Croagh wind farm. The intention of the report is to describe how peat and spoil which will be excavated from infrastructure locations such as turbine bases and roads and will be handled and placed/reinstated onsite. The report also provides construction details for the types of roads which will be put in place at the site and proposed peat and spoil placement/reinstatement areas which will be developed at the site.

The PSMP contains some drainage guidelines for construction works and for management of peat and 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), Chapter 4 and Chapter 9.

This report also contains a cut and 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) 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 repository areas and borrow pit on site along with construction guidelines and drawings

(5) General recommendations for good working practice on site

(6) Monitoring instrumentation programme and guidelines

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

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

# 2 CONSTRUCTION ACTIVITIES COVERED BY PEAT & SPOIL MANAGEMENT PLAN

## 2.1 Construction Activities

For the construction phase of Croagh wind farm the activities that will generate peat and spoil are as follows:

(1) Upgrade of existing access tracks (excavate and replace and floating 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 and spoil

(5) Excavations in peat for turbine bases, hardstandings, met mast, substation, temporary construction compounds, repository areas and borrow pit

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

## 2.2 Road Construction Types

To provide access within the site and to connect the wind turbines and associated infrastructure existing tracks will need to be upgraded and new 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) Serviceability requirements for construction and wind turbine delivery and maintenance vehicles

(4) Minimise excavation arisings

(5) Requirement to minimise disruption to peat hydrology

The road construction types proposed for the Croagh wind farm site 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 Croagh 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 confirmatory ground investigation 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 | <3.0 | Varies | Upgrade existing excavated access track to the required width and finished with a layer of selected granular fill – Figure 2-1 |
| | Type B | >3.0 | Varies | Upgrade existing floated access track to the required width and finished with a layer of geogrid and stone fill – Figure 2-1 |
| Construction of new excavated roads through peat | Type C | Typically, <2.5, locally up to 4.5 | Varies | New access road construction technique envisaged for various locations on site – Figure 2-1 |
| Construction of floating road over peat | Type D | >1.5 | Typically, <5 | New access road construction technique envisaged for various locations on site – Figure 2-1 |

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

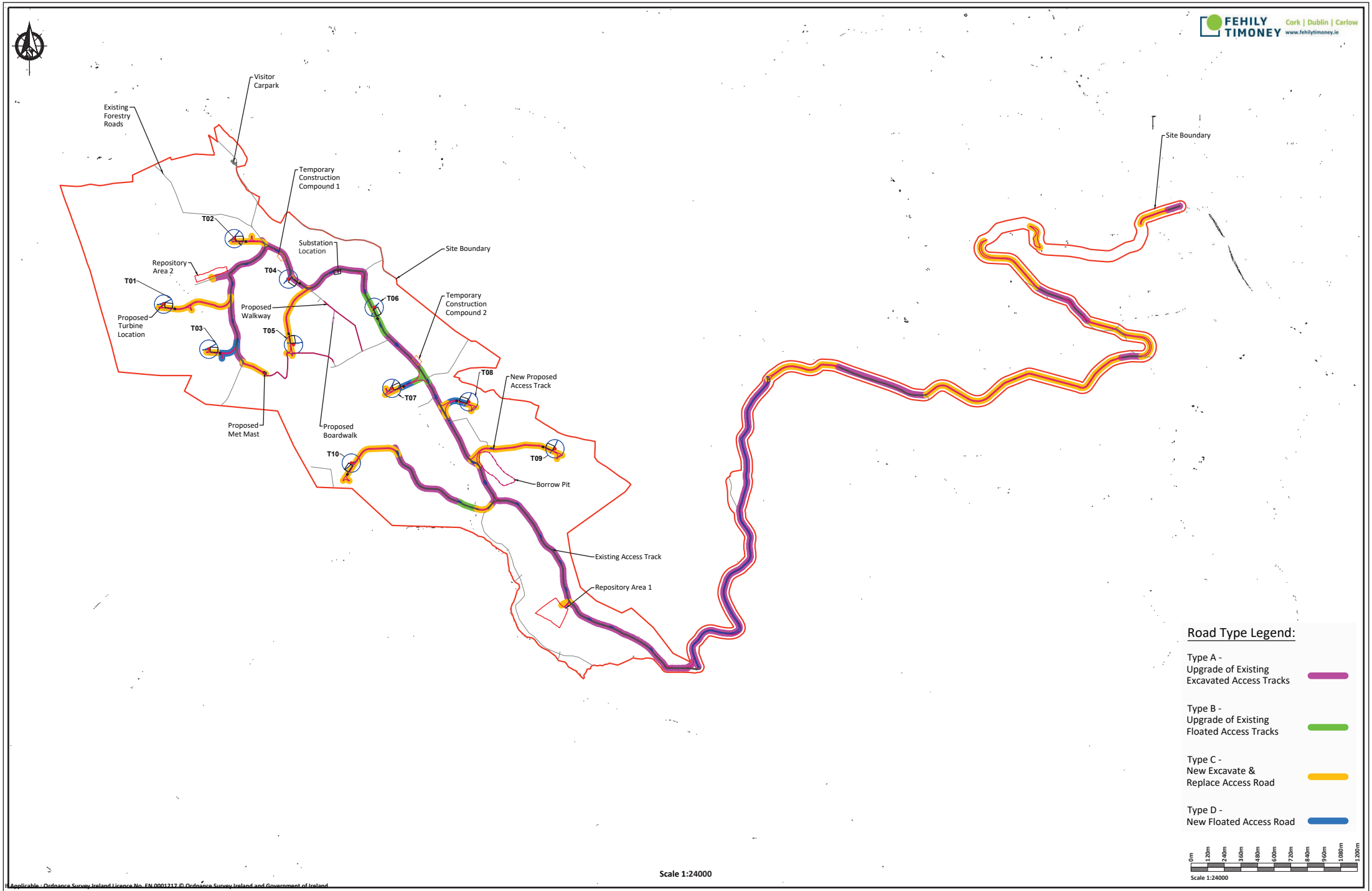




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**FIGURE 2-1 : PLAN DRAWING OF WIND FARM WITH ROAD CONSTRUCTION TYPE**

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# 3 UPGRADE OF EXISTING ACCESS TRACKS – TYPE A AND B

Up to 11.1km of existing access tracks requiring upgrade are present across the Croagh wind farm site and based on Coillte records have been in operation for a significant 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 been in relatively good condition. Upgrading works will 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 both excavate and replace and floated construction techniques (Appendix A – Photos 1 and 2). Upgrading for each is proposed as per details for type A and B respectively.

## 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 considerations, which are discussed in detail in Section 4.7 of the EIAR.

(1) For upgrading of existing excavated access tracks (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 and compacted in layers in accordance with the designer's specification.
- (c) The surface of the existing access track 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 road.
- (e) A layer of geogrid/geotextile may be required at the surface of the existing access road in areas where the existing track shows signs of excessive rutting, etc.
- (f) For excavations in peat and spoil, side slopes shall be not greater than 1 (v):3 (h). Where areas of weaker peat are encountered then slacker slopes will be required to ensure stability.

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

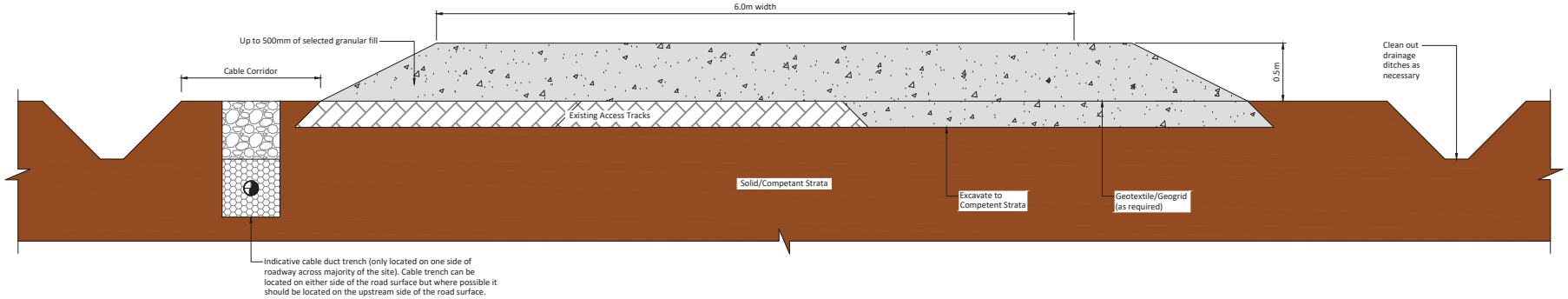
- (a) The make-up of the existing floating access roads on site is generally locally tree brash/trunks laid directly onto the peat surface and/or geotextile overlain by up to 500mm of coarse granular fill/till type (fine granular/cohesive) site won material. It should be noted that there are localised 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.

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

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

(5) At transitions between new 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, to provide a road profile and graded to accommodate wind turbine construction and delivery traffic.



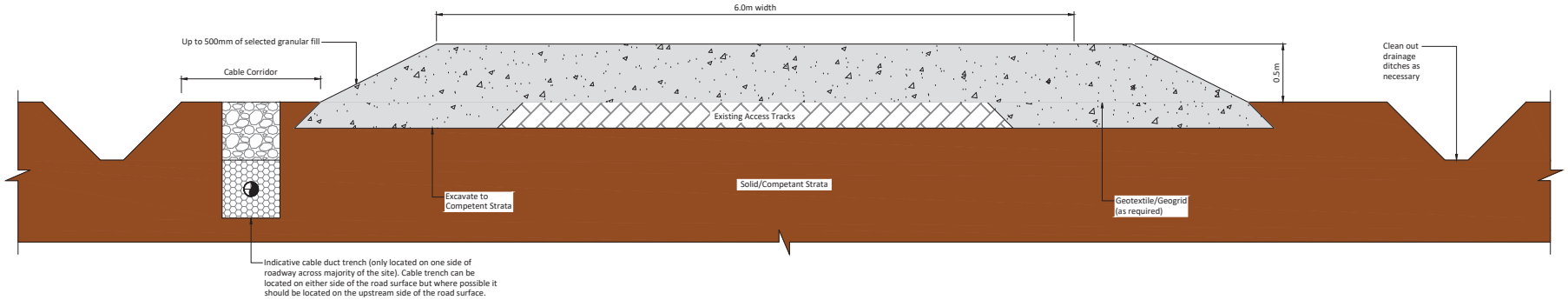




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**FIGURE 3-1 : TYPE A - UPGRADE OF EXISTING EXCAVATED ACCESS TRACKS**

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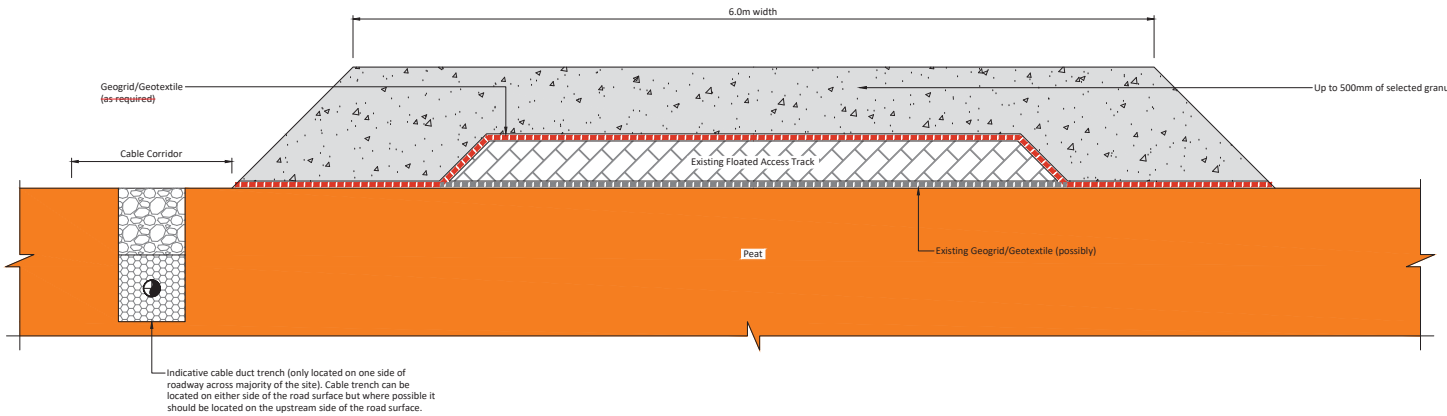


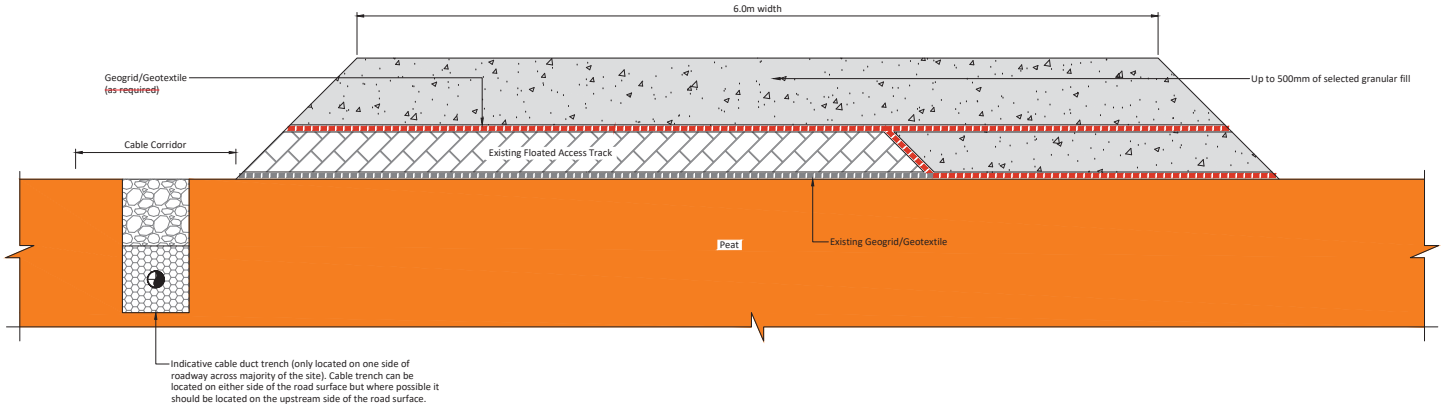


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**FIGURE 3-2 : TYPE B - UPGRADE OF EXISTING FLOATED ACCESS TRACKS**

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

The excavation of peat 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 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 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 considerations, which are discussed in Section 4.7 of the EIAR.

(1) Prior to commencing road construction movement monitoring posts will be installed in areas where the peat depth is greater than 2m.

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

(3) Excavation will take place to a competent stratum beneath the peat.

(4) Road construction will be carried out in sections of approximately 50m lengths i.e. no more than 50m of access road should be excavated without replacement 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 borrow pit or peat repositories.

(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 will be carried out as the excavation progresses.

(7) The excavated access road will be constructed of up to 1000mm of selected granular fill.

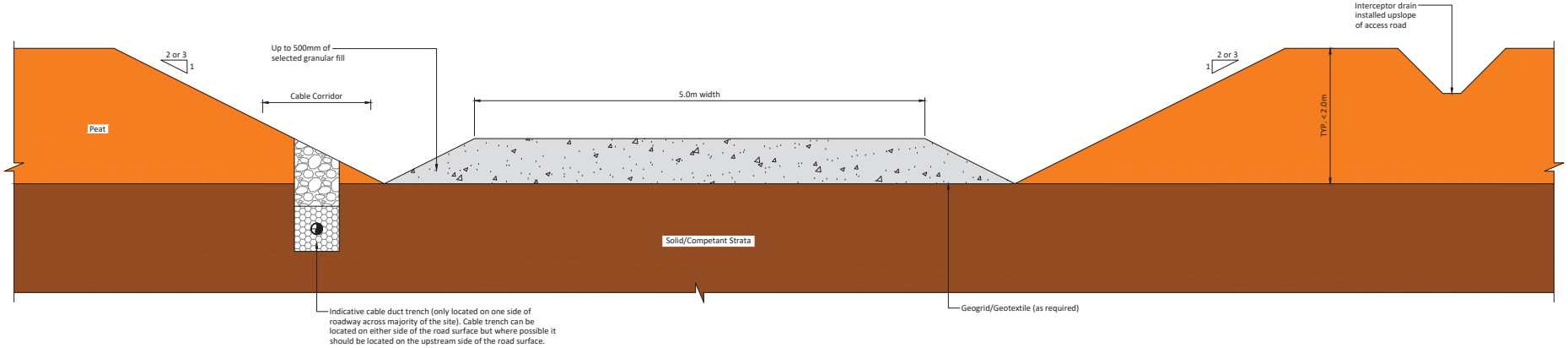
(8) Access roads to be finished with a layer of capping across the full width of the road.

(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.

(11) Where steeper 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 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

It will be necessary to construct floating roads over peat at various locations across the site. The use of new floated access tracks will be limited on site to areas of typically flatter terrain. The proposed locations for the new floating access roads on site are shown in Figure 2-1 and details are shown in Figure 5-1.

A confirmatory stability analysis to confirm the conditions predicted in this EIAR will be carried out 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. Also, 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 considerations, which are discussed in Section 4.7 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 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) The typical make-up of the new floated access road is a minimum of 1000mm 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).

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

(5) During construction of the floated access roads it may be necessary to include pressure berms either side of the access road in some of the deeper/weaker peat areas. The inclusion of a 2 to 5m wide pressure berm (typically 0.5m in height) either side of the access road at such locations will reduce the likelihood of potential bearing failures beneath the access road.

(6) The finished running width of the road will be 5m, with wider sections on bends and corners.

(7) 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.

(8) 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.

(9) Where it is not possible to end-tip over a 10m length of constructed floating road due to the presence of weak deep peat 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.

(10) 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.

(11) 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.

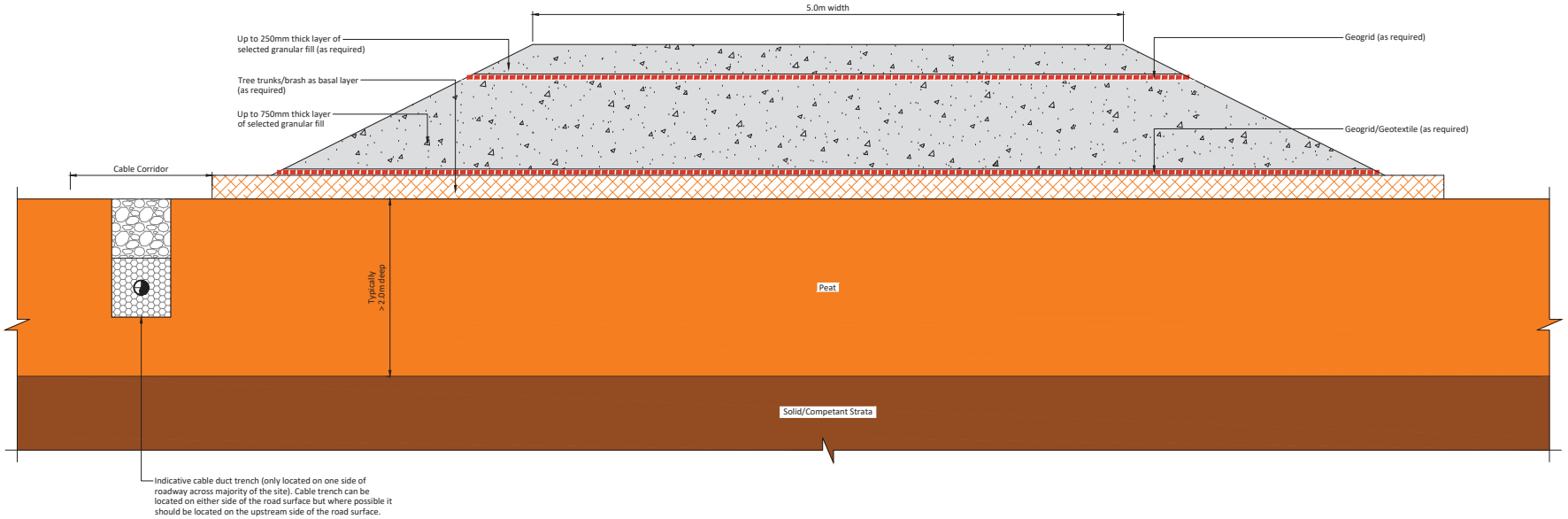


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**FIGURE 5-1 : TYPE D - NEW FLOATED ACCESS ROAD**

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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 will 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 a minimum 5m distance of a completed floated access road edge, or at a distance determined following site inspection by the Contractor. 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 3m). These survey points shall be surveyed on a weekly basis, and more frequently when construction activities are ongoing in the area.

(7) The construction and upgrading of access roads in areas of deep peat (greater than 3m) shall be 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 remedial measures will be required to ensure the stability of the road. These would 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 will 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 measures shall be taken to re-level the road, as necessary.

# 7 EXCAVATION AND PLACEMENT OF ARISINGS

## 7.1 Excavation and 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 considerations, which are discussed in Section 4.7 of the EIAR.

(1) All excavated peat and spoil shall be transported immediately on excavation to one of the 2 no. repository areas or borrow pit on site (see Figure 2-1).

(2) Further details on the construction and reinstatement of the borrow pit is given in Section 7.4.

(3) Further details on the placement of excavated material in the repository areas is 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 and Spoil Volumes on Site

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

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

| Infrastructure Element (1) | Typical Dimensions | Peat Volume ($m^3$) | Spoil (non-peat) Volume ($m^3$) (2) | Comment |
|---|---|---|---|---|
| 10 no. Turbines and Hardstands | 23m diameter excavation footprint for turbine foundation with 55 x 35m hardstand area | 65,925 | 48,635 | Hardstanding area and foundation footprint |
| Access Roads | 5m running surface with 6m wide development footprint | 103,500 | 93,550 | Excludes proposed floating sections of access road where no excavation of peat will take place (see Figure 2-1) |
| Substation | Hardstanding area of 65 x 40m | 2,810 | 17,095 | - |
| Meteorological Mast | Foundation footprint within 14 x 21m hardstanding area | 425 | | - |
| Temporary Construction Compounds | Hardstanding areas of 60 x 40m | 7,490 | | Hardstanding areas |
| Borrow Pit | 1 no. borrow pit | 14,820 | 34,580 | - |
| Repository Areas | 2 no. repository areas | 15,000 | 3,000 | Beneath footprint of perimeter buttresses |
| | | | | |
| | **Total =** | **209,970$m^3$** | **196,860$m^3$** | **Total = 406,830$m^3$ (peat and spoil volume) (3)** |

Note (1) The location of the infrastructure elements on site are shown on Figure 2-1.
Note (2) The excavated spoil volumes have been determined based on a cut-fill assessment carried out for the site, see section 13 of this report for further details.
Note (3) 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 13 of this report for further details.

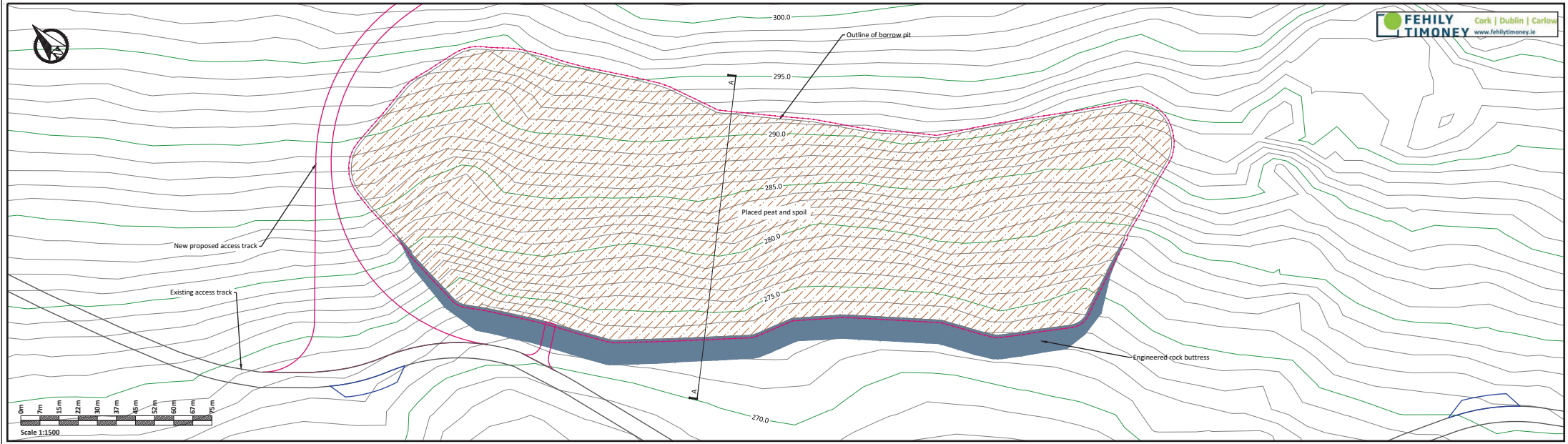
## 7.3 Summary of Peat and Spoil Placement/Reinstatement Areas on Site

A summary of the potential peat and spoil placement/reinstatement areas at the Croagh wind farm site are given in Table 7-2.

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

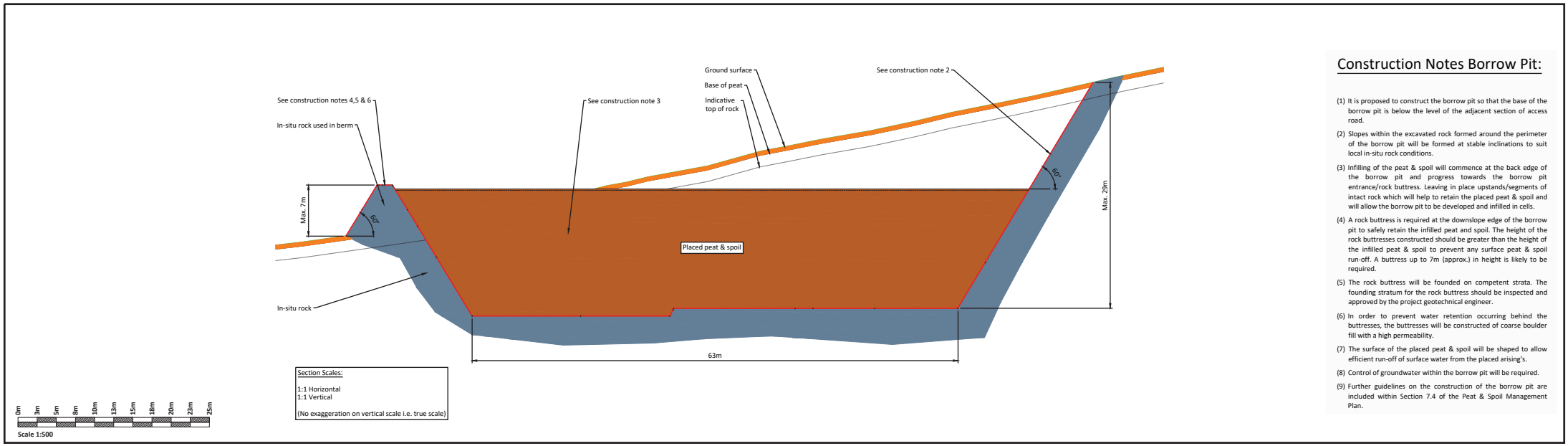
| Location (1) | Peat and Spoil Volume ($m^3$) | Comment |
|---|---|---|
| Borrow Pit | 298,000 | See Figure 7-1 for further details |
| Repository Area 1 | 82,000 | See Figure 7-2 for further details |
| Repository Area 2 | 18,000 | See Figure 7-3 for further details |
| Landscaping (2) | 10,000 | Approximately 1,000$m^3$ of peat will be required for landscaping purposes at each of the 10 no. turbine locations |
| | | |
| **Total =** | **408,000$m^3$** | |

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




**Plan**

**Scale 1:1500**




## 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.

(2) Slopes within the excavated rock formed around the perimeter of the borrow pit will be formed at stable inclinations to suit local in-situ rock conditions.

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

(5) The rock buttress will be founded on competent strata. The founding stratum for the rock buttress should be inspected and approved by the project geotechnical engineer.

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

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

(8) Control of groundwater within the borrow pit will be required.

(9) Further guidelines on the construction of the borrow pit are included within Section 7.4 of the Peat & Spoil Management Plan.

**Section**

**Scale 1:500**



Scale (@ A3 ) 1:1500

Date - 26.06.20

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

Drawn - POR

Checked - IH

Rev - C

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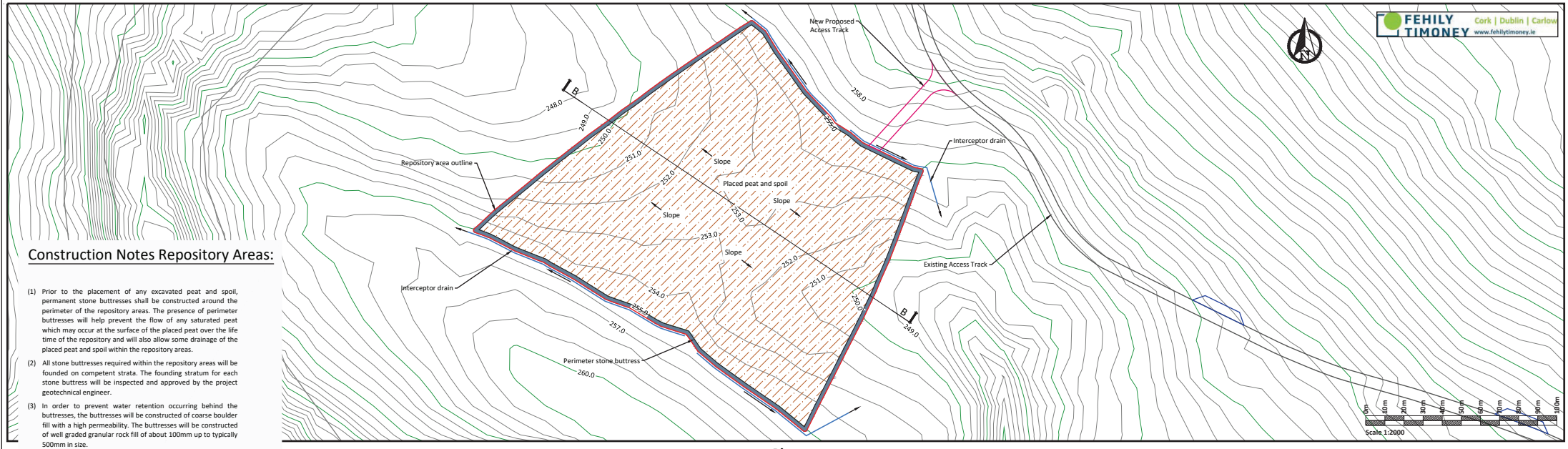
Friday 26 June 2020




## Plan

**Scale 1:2000**

## Construction Notes Repository Areas:

(1) Prior to the placement of any excavated peat and spoil, permanent stone buttresses shall be constructed around the perimeter of the repository areas. The presence of perimeter buttresses will help prevent the flow of any saturated peat which may occur at the surface of the placed peat over the life time of the repository and will also allow some drainage of the placed peat and spoil within the repository areas.

(2) All stone buttresses required within the repository areas will be founded on competent strata. The founding stratum for each stone buttress will be inspected and approved by the project geotechnical engineer.

(3) In order to prevent water retention occurring behind the buttresses, the buttresses will be constructed of coarse boulder fill with a high permeability. The buttresses will be constructed of well graded granular rock fill of about 100mm up to typically 500mm in size.

(4) The height of the stone buttresses constructed will be greater than the height of the stored peat and spoil to prevent any surface run-off.

(5) The side slopes of the stone buttresses will be constructed at typically 45 degrees. The stone buttresses will be widened to allow construction traffic access for tipping purposes during the placement of the excavated peat and spoil.

(6) An interceptor drain will also be installed upslope of the repository areas.

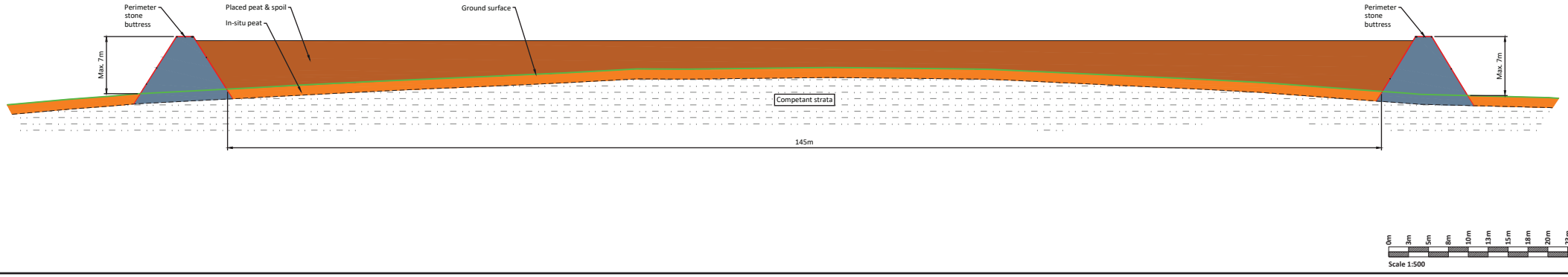
(7) A silting pond will be required at the lower side of the repository areas.

(8) The placement of the excavated spoil will commence at the downslope edge of the repository area against the stone buttress and placement will then continue upslope.

(9) It is important that the surface of the stored spoil be shaped to allow efficient run-off of water from the stored spoil.

(10) Supervision by the project geotechnical engineer or appropriately competent person is recommended for the construction of the repository area.

(11) Further guidelines on the construction of the repository area are included within Section 7.5 of the Peat & Spoil Management Plan.




## Section B - B

**Scale 1:500**



Scale (@ A3 ) 1:2000

Date - 26.06.20

**FIGURE 7-2 : REPOSITORY AREA 1 - PLAN & CROSS SECTION DETAILS**

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Rev - C

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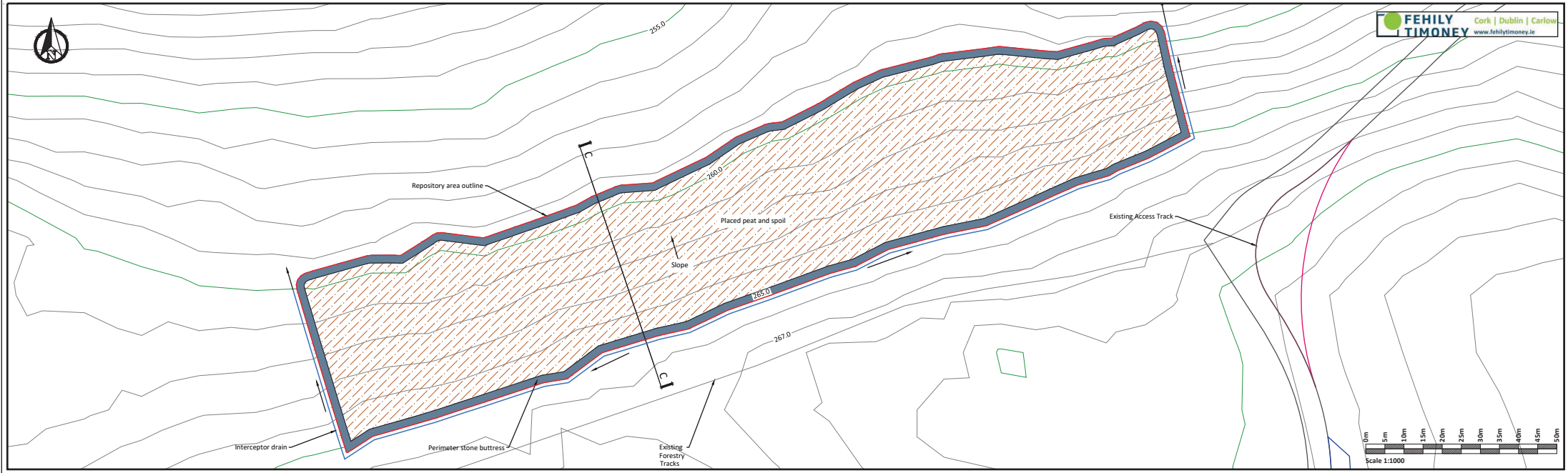
Friday 26 June 2020




## Plan

**Scale 1:1000**

## Construction Notes Repository Areas:

(1) Prior to the placement of any excavated peat and spoil, permanent stone buttresses shall be constructed around the perimeter of the repository areas. The presence of perimeter buttresses will help prevent the flow of any saturated peat which may occur at the surface of the placed peat over the life time of the repository and will also allow some drainage of the placed peat and spoil within the repository areas.

(2) All stone buttresses required within the repository areas will be founded on competent strata. The founding stratum for each stone buttress will be inspected and approved by the project geotechnical engineer.

(3) In order to prevent water retention occurring behind the buttresses, the buttresses will be constructed of coarse boulder fill with a high permeability. The buttresses will be constructed of well graded granular rock fill of about 100mm up to typically 500mm in size.

(4) The height of the stone buttresses constructed will be greater than the height of the stored peat and spoil to prevent any surface run-off.

(5) The side slopes of the stone buttresses will be constructed at typically 45 degrees. The stone buttresses will be widened to allow construction traffic access for tipping purposes during the placement of the excavated peat and spoil.

(6) An interceptor drain will also be installed upslope of the repository areas.

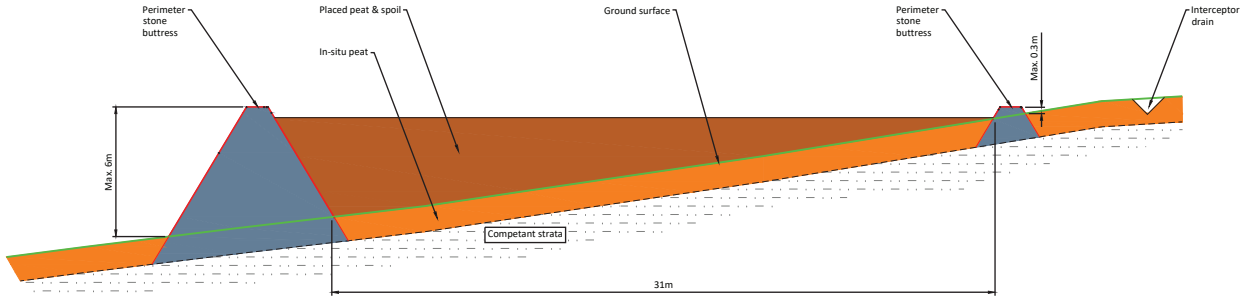
(7) A silting pond will be required at the lower side of the repository areas.

(8) The placement of the excavated spoil will commence at the downslope edge of the repository area against the stone buttress and placement will then continue upslope.

(9) It is important that the surface of the stored spoil be shaped to allow efficient run-off of water from the stored spoil.

(10) Supervision by the project geotechnical engineer or appropriately competent person is recommended for the construction of the repository area.

(11) Further guidelines on the construction of the repository area are included within Section 7.5 of the Peat & Spoil Management Plan.




## Section C - C

**Scale 1:250**



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Date - 03.07.20

**FIGURE 7-3 : REPOSITORY AREA 2 - PLAN & CROSS SECTION DETAILS**

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Checked - IH

Rev - D

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Friday 3 July 2020

## 7.4 Guidelines for the Construction and Reinstatement of Borrow Pit

A location has been identified as a borrow pit and is shown on Figure 2-1. Peat depths recorded within the footprint of the borrow pit range from 0.5 to 1.7m.

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 pit will be used in the construction of the infrastructure elements (turbine bases, roads, etc.) at the wind farm. It is proposed to construct cells within the borrow pit for the placement of the excavated peat and spoil. This is to allow for the safe placement and grading of the peat and spoil using dumper trucks and excavators.

It should be noted that there are significant excavations works required in order to develop this borrow pit at the site. Excavation works will be undertaken and supervised by an experienced contractor and suitably qualified personnel. The text below provides some design and construction guidelines for the borrow pit.

Figure 7-1 shows the 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 a combination of breaking and blasting, depending on its excavatability, which will be determined from confirmatory ground investigation carried out at the borrow pit.

(2) 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. Localised deepening of the borrow pit floor may be required depending on extraction operations.

(3) Depending on the condition of the 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 and spoil. The upstands/segments of intact rock will essentially act as engineered rock buttresses within the borrow pit.

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

(5) The stability of the rock faces within the borrow pit will 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, in line with best practice guidelines.

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

(7) 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 will be greater than the height of the infilled peat and spoil to prevent any surface peat and spoil run-off. A buttress up to 7m (approx.) in height will be required.

(8) The rock buttress will be founded on mineral soil or bedrock i.e. competent strata. The founding stratum for the rock buttress should be inspected and approved by the Project Geotechnical Engineer.

(9) In order to prevent water retention occurring behind the buttresses, the buttresses will be constructed of coarse boulder fill with a high permeability. The buttress will be constructed of well graded granular rock fill of about 100mm up to typically 500mm in size. Alternatively, drains will be placed through the buttresses to allow excess water to drain.

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

(11) The use of temporary access ramps and long reach excavators during the placement of the excavated peat and spoil will be required.

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

(13) A layer of geogrid to strengthen the surface of the placed peat and spoil within the borrow pit may be required.

(14) An interceptor drain will also be installed upslope of the borrow pit. This drain will divert any surface water away from the borrow pit and hence prevent run-off from ponding and lodging in the reinstated area.

(15) 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. Refer to EIAR Chapter 4 and 9 for drainage details.

(16) A settlement pond will be required at the lower side/outfall location of the borrow pit.

(17) Supervision by a geotechnical engineer or appropriately competent person is required for the development of the borrow pit.

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

## 7.5 Guidelines for the Construction of the Repository Areas

Two locations have been identified as repository areas and are shown on Figure 2-1. The peat depth within the footprint of the repository areas is generally less than 1.5m.

Both repository areas have a perimeter buttress which will contain and ensure the placed peat and spoil remains stable in the long-term. Prior to the placement of any excavated peat and spoil, the permanent stone buttresses shall be constructed around the perimeter of the repository areas. Construction details for each of the repository areas are shown on Figures 7-2 and 7-3.

The presence of perimeter buttresses will help prevent the flow of any saturated peat which may occur at the surface of the placed peat over the lifetime of the repository and will also allow some drainage of the placed peat and spoil within the repository areas.

The repository areas, in particular the stone buttresses, should be constructed as follows:

(1) All stone buttresses required within the repository areas will be founded on mineral soil or bedrock i.e. competent strata. The founding stratum for each stone buttress will be inspected and approved by a geotechnical engineer or competent person.

(2) In order to prevent water retention occurring behind the buttresses, the buttresses will be constructed of coarse boulder fill with a high permeability. The buttresses will be constructed of well graded granular rock fill of about 100mm up to typically 500mm in size. Alternatively, drains will be placed through the buttresses to allow excess water to drain.

(3) The height of the stone buttresses constructed will be greater than the height of the stored peat and spoil to prevent any surface run-off. The height of the stone buttresses will be a minimum of 0.5m above the height of the placed peat and spoil to prevent any potential for saturated peat to flow out of the repository area.

(4) The side slopes of the stone buttresses shall be constructed at 45 degrees. The stone buttresses will be widened to allow construction traffic access for tipping purposes during the placement of the excavated peat and spoil.

(5) An interceptor drain will also be installed upslope of the repository areas. The drain will divert any surface water away from the repository area and hence prevent water from ponding in the area.

(6) A settlement pond will be required at the lower side of the repository areas.

(7) A granular layer of material will be required at the base of the stored spoil immediately upslope of the stone buttresses to act as a drainage layer. This drainage layer will aid in preventing a build-up of pore water pressure behind the stone buttress.

(8) The placement of the excavated spoil will commence at the downslope edge of the repository area against the stone buttress and placement will then continue upslope.

(9) It is important that the surface of the stored spoil be shaped to allow efficient run-off of water from the stored spoil.

(10) Supervision by a geotechnical engineer or appropriately competent person is required for the construction of the repository area.

# 8 EXCAVATIONS IN PEAT AND SPOIL

The works require that most of the turbine bases are to be founded on competent founding strata which will require excavation through peat and spoil. Some turbine bases may require a piled solution following confirmatory ground investigations by the Contractor.

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

Excavations for the borrow pit and perimeter buttresses for the repository areas will also require the removal of peat and spoil overlying the rock.

## 8.1 Methodology

This methodology includes procedures that are to be included in the construction to minimise any adverse impact on peat stability. The methodology is not intended to cover all aspects of construction such as drainage and environmental considerations, which are covered in Chapter 4 and 9 of the EIAR.

(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 of 1 (v): 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 appropriately located outfall following suitable treatment, as noted in Section 4 and 9 of the EIAR.

# 9 EXCAVATIONS FOR UNDERGROUND CABLES

It is proposed to construct a 38kV substation within the site and to connect from here to the existing Garvagh substation, located approximately 730m east of the site. Connection will be via underground cabling located within existing forestry roads. The cabling route measures approximately 6.1km in total.

The proposed grid connection construction methodology, including proposals for water crossings on the underground cabling routes is described in Chapter 4 of the EIAR.

The cable trench route will encounter peat. It is proposed to excavate the trenches for the underground cable at a uniform depth in peat or non-peat overburden material. The trenches will be approximately 900mm wide and 1220mm 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, which are discussed in Chapter 4 and 9 of the EIAR.

(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 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): 3 (h). 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).

(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 transported to the borrow pit or peat repository.

# 10 GENERAL RECOMMENDATIONS FOR GOOD CONSTRUCTION PRACTICE ON SITE

To minimise the risk of construction activity causing potential peat instability the Construction Method Statements (CMS's) 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 from excavations during work shall be piped over areas specifically assessed as being unsuitable and hence directed into suitable drainage lines. See Chapter 4 and 9 of the EIAR.

(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 confirmed 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 and Project Geotechnical Engineer 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 roads 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 will 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 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. The posts shall be located along the road at 10m intervals in areas of deep peat (greater than 2m). 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

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 and 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) 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 the borrow pit on site, preferably the closest borrow pit, or where rock level is close to/at the ground surface.

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, 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.

# 13 CUT AND FILL EARTHWORKS ASSESSMENT

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

The outputs from the cut and 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)
- Cut and fill earthwork volumes (see Table 13-1 of this report)

A summary of the basis for the cut and fill earthworks assessment are included in Appendix B of this report.

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

## 13.1 Commentary on Earthwork Volumes

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:

1) The total net earthwork volume (cut minus fill) which includes peat, non-peat superficial deposits and rock for the scheme is estimated at 762,585m$^3$ (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 552,650m$^3$ (Cut).

3) The estimated quantity of available rock within the borrow pit is 372,600m$^3$, based on the information gathered from site investigations.

4) The total volume of non-peat superficial deposits only requiring placement/reinstatement on site is estimated at 196,860m$^3$. This material will be excavated and placed/reinstated to one of the 2 no. repository areas or the borrow pit.

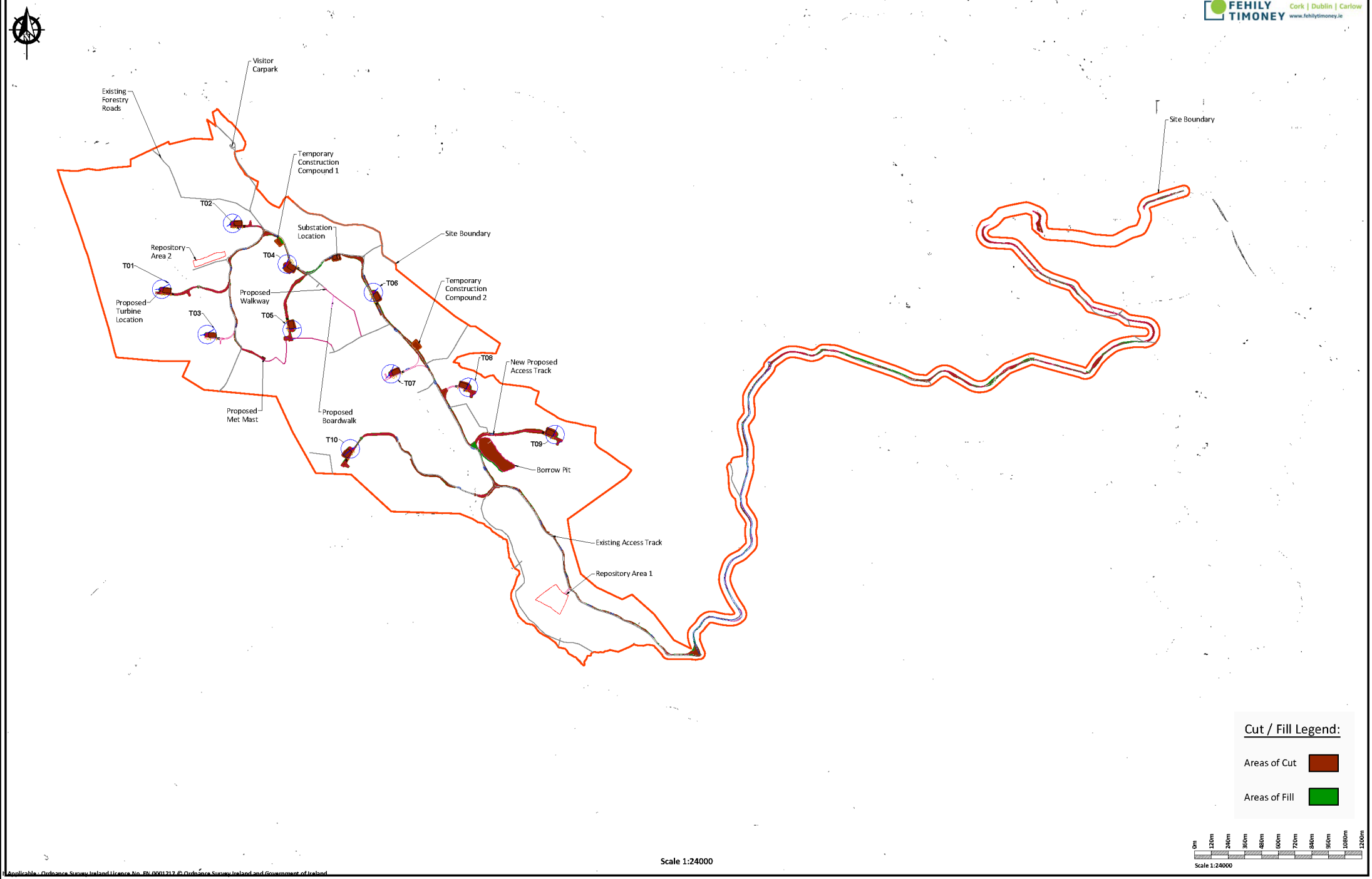
5) No bulking or contingency factors have been applied to the excavation volumes presented in Table 13-1.

## Table 13-1: Summary of Cut and Fill Earthwork Volumes

| Infrastructure Element | Description | Total Earthwork Volume (1) - Peat & non-peat overburden (spoil) & rock | | | Earthwork Volume (2) - Estimated non-peat material only (non-peat overburden and rock) | | | Earthwork Volume (3) - Estimated rock volume only | Comment |
|---|---|---|---|---|---|---|---|---|---|
| | | Cut ($m^3$) | Fill ($m^3$) | Net Volume ($m^3$) = Cut - Fill | Cut ($m^3$) (2) | Fill ($m^3$) | Net Volume ($m^3$) = Cut - Fill | Cut ($m^3$) | |
| 10 no. Turbines and Hardstands | 23.2m diameter excavation footprint for turbine foundation with 55 x 35m hardstand area | 114,580 | 20 | 114,560 (Cut) | 48,655 | 20 | 48,635 (Cut) | - | Hardstanding area and turbine foundation footprint |
| Access Roads | 5m running surface with 6m wide development footprint | 197,050 | 16,810 | 180,240 (Cut) | 93,550 | 16,810 | 76,740 (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 substation, 2 no. temporary construction compounds and met mast | 28,395 | 610 | 27,785 (Cut) | 17,705 | 610 | 17,095 (Cut) | - | - |
| Borrow Pit | Borrow pit footprint of 24,700$m^2$ | 422,000 | - | 422,000 (Cut) | 407,180 | - | 407,180 (Cut) | 372,600 (Cut) | Potential rock volume from the borrow pit is 372,600$m^3$. |
| Repository Areas | Repository Area 1 and 2 | 18,000 | - | 18,000 (Cut) | 3,000 | - | 3,000 (Cut) | - | |
| | **Total =** | **-** | - | **762,585 $m^3$ (Cut)** | **-** | - | **552,650 $m^3$ (Cut)** | **372,600 $m^3$ (Cut)** | |

**Notes**

Note (1) The total earthwork volumes includes peat, non-peat superficial deposits and rock from the borrow pit.
Note (2) The earthwork volumes quoted for the non-peat material were calculated based on the total earthwork volume (peat and non-peat material) minus the peat volumes calculated and presented in Table 7-1 within Section 7.2 of this report.
Note (3) The in-situ rock volume from the borrow pit was estimated based on the available ground investigation to define rockhead level.
Note (4) It should be noted that the earthwork volumes given in Table 13-1 are subject to confirmatory design.
Note (5) No bulking or contingency factors have been applied to the earthwork excavation volumes presented above.






Scale (@ A3 ) 1:24000

Date - 03.07.20

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

Drawn - POR

Checked - IH

Rev - F

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Friday 3 July 2020

# Appendix A

## Photos from Site Walkover

Photo 1 Example of an existing excavated access track on site

Photo 2 Example of an existing floating access track on site

# Appendix B

## Basis for Cut and Fill Earthworks Assessment

## Basis for Cut and Fill Earthwork Assessment

### Main Infrastructure Locations

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

Table B1 provides a summary of the dig depths adopted for the cut and fill assessment for the main infrastructure elements at Croagh wind farm.

The assumed excavation footprint for the turbine foundation is the turbine base diameter of 19m plus 2m working room all around the base i.e. 23m.

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

| Turbine | Easting | Northing | Average Peat Depth for Turbines (m) | Dig depth for Turbine Foundation (m) (1) | Average Peat Depth for Crane Hardstands (m) | Max Dig depth for Associated Crane Hardstand (m) (2) |
|---|---|---|---|---|---|---|
| **T1** | 583322 | 823639 | 2.0 | 3.0 | 2.1 | 2.4 |
| **T2** | 583831 | 824112 | 2.4 | 3.4 | 2.4 | 2.7 |
| **T3** | 583648 | 823314 | 2.2 | 3.2 | 1.2 | 1.5 |
| **T4** | 584223 | 823820 | 0.8 | 3.0 | 0.8 | 1.1 |
| **T5** | 584259 | 823347 | 0.8 | 3.0 | 1.1 | 1.4 |
| **T6** | 584841 | 823616 | 2.0 | 3.0 | 3.3 | 3.6 |
| **T7** | 584968 | 823032 | 2.4 | 3.4 | 3.0 | 3.3 |
| **T8** | 585523 | 822935 | 3.5 | 4.5 | 4.7 | 5.0 |
| **T9** | 586144 | 822595 | 3.2 | 4.2 | 3.9 | 4.2 |
| **T10** | 584676 | 822493 | 0.9 | 3.0 | 1.6 | 1.9 |
| | | | | | | |
| **Infrastructure Element** | **Easting** | **Northing** | **Average Peat Depth (m)** | **Max Dig depth for Infrastructure Element (m) (3) & (4)** | | |
| **Substation** | 584584 | 823867 | 1.2 | 1.5 | | |
| **Temporary Construction Compound 1** | 584170 | 823980 | 1.2 | 1.5 | | |
| **Temporary Construction Compound 2** | 585150 | 823232 | 1.6 | 1.9 | | |
| **Met Mast** | 548059 | 823136 | 1.2 | 2.2 | | |
| **Borrow Pit** | 585697 | 822449 | 0.5 | Varies | | |

**Notes**

(1) Based on ground investigation information, founding depths for the turbines were assumed to be the average peat depth + 1m to a competent stratum. 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. If piled foundations are required, then the calculated excavation volumes will be reduced.

(2) Founding depths for the crane hardstands were assessed to be the average peat depth + 0.3m to a competent stratum.

(3) For the temporary construction compounds and substation, the founding depth was assessed to be the average peat depth +0.3m to a competent stratum.

(4) For the met mast the founding depth was assumed to be the average peat depth +1.0m to a competent stratum.

(5) Note the maximum dig depths stated in Table B1 form the basis of this assessment and are subject to confirmation at detailed design stage following a ground investigation.

(6) It is not anticipated that the proposed amenity trails will generate any spoil.

## Access Roads

The following basis for the cut and fill assessment is given in relation to the access roads.

- Typical gradient requirements from turbine suppliers were assumed for the cut and fill assessment i.e. maximum gradients of 10 to 12%. A maximum gradient of 12% has been used for straight sections of access road on site.
- For the purpose of the assessment, the average width of the existing access tracks has been taken as 4m.
- 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 has been 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 (greater than 5% gradient), widening of existing tracks will take place on the upslope side of the road as per Figure 3.1. Estimated dig depth to competent strata for both cases is 0.3m below the base of the peat.

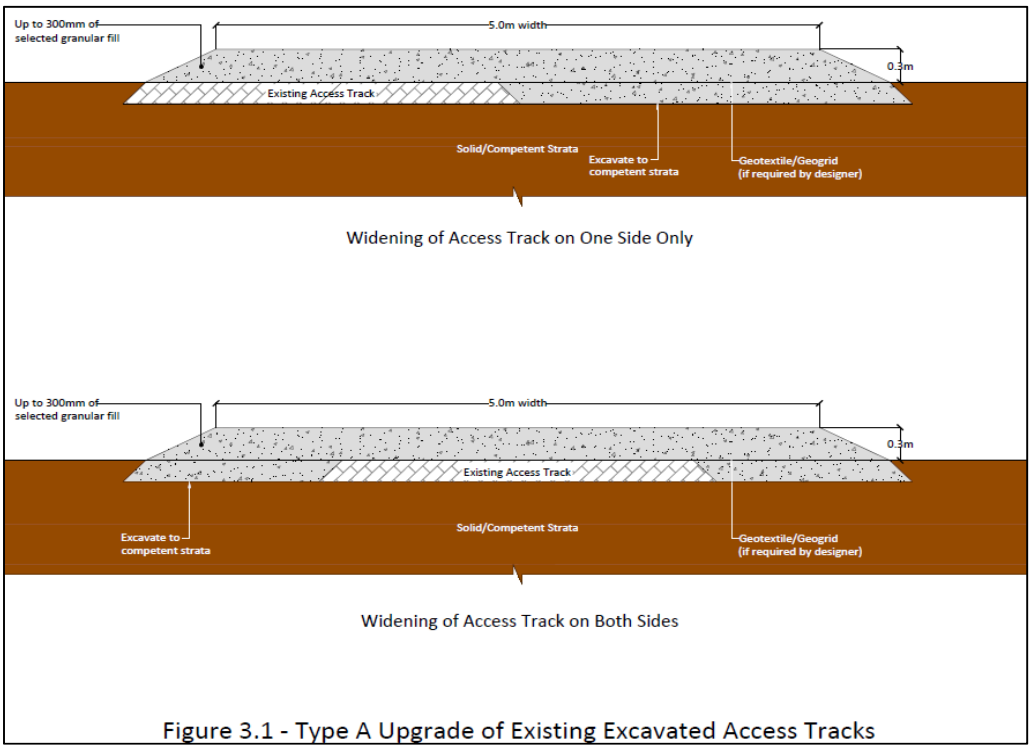


Figure 3.1 - Type A Upgrade of Existing Excavated Access Tracks

    - Existing floating type access tracks – minimal/no excavation will be required
    - New proposed floating access roads - no excavation will be required

- New proposed excavate and replace type access roads – excavation work will be required. Estimated dig depth to competent strata was 0.3m below the base of the peat

## Borrow Pit

The cut and fill assessment for the borrow pit is based on the cross-section drawing (Figures 7-1) included in this report. The borrow pit was sized to allow for the reinstatement of some of the excavated peat and spoil volume generated on site and to accommodate the estimated site-won stone fill requirements.

## General Assumptions

No spoil is anticipated from the proposed amenity facilities (walkways/trails).

A 1(v): 2(h) configuration for all excavation faces was used in the cut and fill earthworks assessment, except for excavations in rock at the borrow pit where a configuration of 1(v): 0.7(h) i.e. 60 degrees was used. These configurations are considered reasonable based on the ground conditions encountered on the site, and in line with best practice guidelines.