MEENBOG WIND FARM,

COUNTY DONEGAL

PEAT & SPOIL MANAGEMENT PLAN

Prepared for:

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1 INTRODUCTION

1.1 Background & Experience

Applied Ground Engineering Consultants Ltd (AGEC) was engaged in March 2017 by McCarthy Keville O'Sullivan to compile a peat and spoil management plan for the Meenbog wind farm site.

AGEC have been involved in over 125 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 Meenbog wind farm is at a site located approximately 8km southwest of Ballybofey, Co. Donegal.

The proposed wind farm comprises 19 no. wind turbines with associated infrastructure including access roads (new and upgrading of existing roads), substation, construction compounds, met mast, underground cables and borrow pits.

The purpose of this report is to provide a peat and spoil management plan for the construction phase of Meenbog wind farm. The intention of the report is to describe how peat which will be excavated from infrastructure locations such as turbine bases and roads and will be managed on site. 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 areas located within the borrow pits and alongside the excavated access roads on site.

The peat and spoil management plan 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 detail in the relevant chapter of Environmental Impact Assessment Report (EIAR).

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

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 of arisings

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

(5) Guidelines for the placement of peat & spoil alongside access roads

(6) General recommendations for good working practice on site

(7) Monitoring instrumentation programme & guidelines

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

2 CONSTRUCTION ACTIVITIES COVERED BY PEAT & SPOIL MANAGEMENT PLAN

2.1 Construction Activities

For the construction phase of the Meenbog Wind Farm the activities that are considered likely to generate peat and spoil are as follows:

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

(2) Construction of new excavated roads through peat & spoil

(3) Construction of floating roads over peat

(4) Excavation and placement of arisings

(5) Excavations in peat for turbine bases, hardstandings & substation

(6) Excavation in peat for cable trenches

Peat and 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 Meenbog wind farm site are summarised in Table 1.

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 detailed design will need to be carried out prior to construction on site.

Construction Method	Construction Type	Ground Conditions		Comment
		Typical Peat Depth (m)	Typical Slope Inclination (degs)	
Upgrade of existing access tracks	Type A	<1.5	Varies	Upgrade existing excavated access track with a layer of selected granular fill (to be confirmed by designer) – Figure 1
	Type B	>1.0	Varies	Upgrade existing floated access track with a layer of geogrid and stone fill (to be confirmed by designer) – Figure 1
Construction of new excavated roads through peat	Type C	<1.5	Varies	New access road construction technique envisaged particularly dominant in the east of the site (to be confirmed by designer) – Figure 1
Construction of floating road over peat	Type D	>1.5	<5	New access road construction technique envisaged particularly dominant in the west of the site (to be confirmed following detailed design from the designer) – Figure 1

Table 1 General Road Construction Techniques

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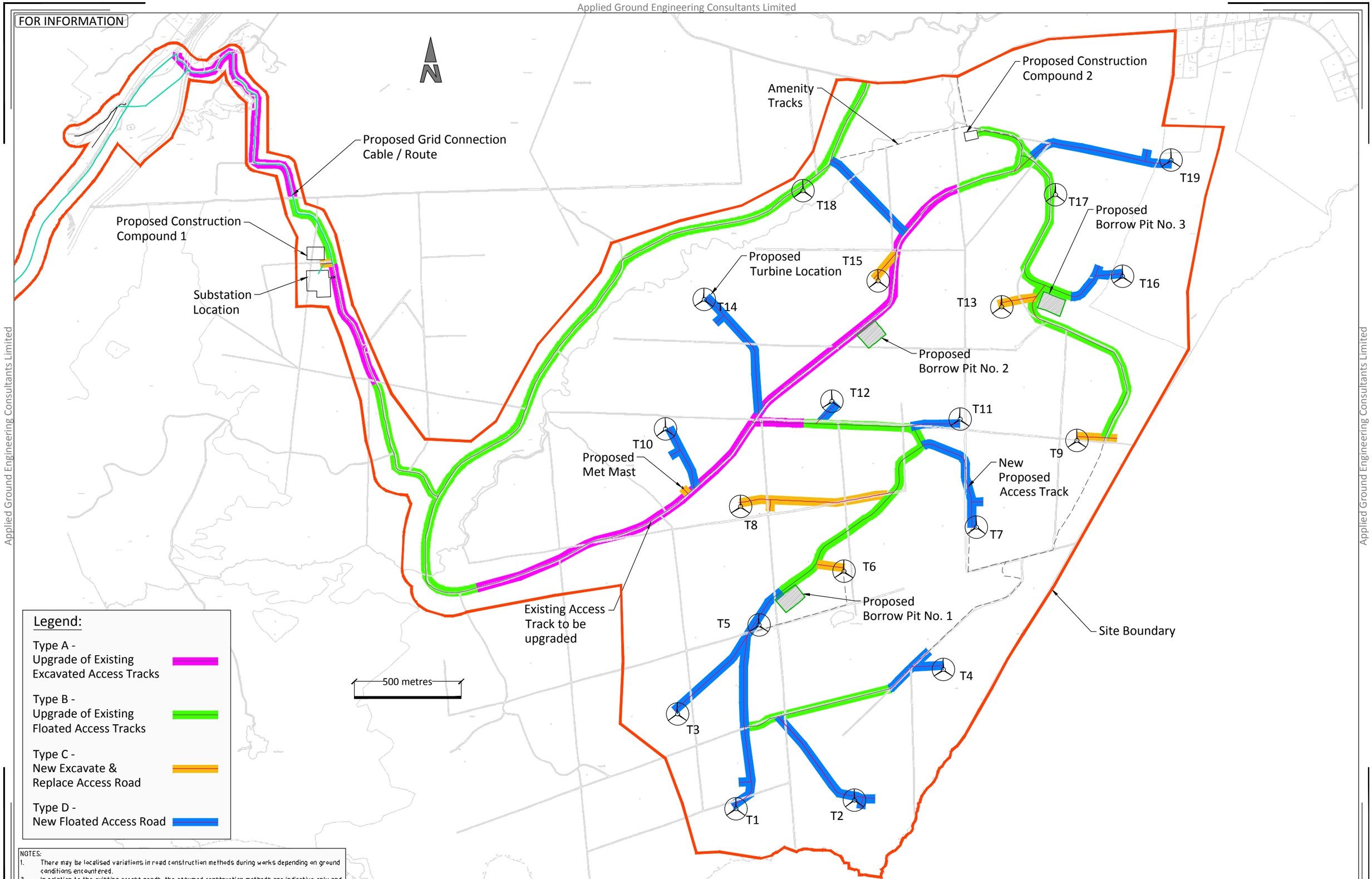

Legend:

- 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

NOTES:
1. There may be localised variations in road construction methods during works depending on ground conditions encountered.
2. In relation to the existing access roads, the assumed construction methods are indicative only and there may be localised variations on site.

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Figure 1 Plan Drawing of Wind Farm with Road Construction Type

3 UPGRADE OF EXISTING ACCESS TRACKS – TYPE A & B

Up to 15km of existing access tracks are present across the Meenbog wind farm site and have been in use 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 AGEC the existing access tracks were typically noted as being in relatively good condition. Upgrading works are likely to involve both widening and raising the level of the existing access track. The proposed locations for upgrading of the existing access tracks on site are shown in Figure 1 and details are shown in Figures 2 and 3.

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 & 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 and environmental considerations.

(1) Access road construction shall be to the line and level requirements as per design/planning conditions.

(2) For upgrading of existing excavated access tracks (Type A – Figure 2) the following guidelines apply:

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

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

   (c) 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.

(3) For upgrading of existing floated access tracks (Type B – Figure 3) 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 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 may be overlaid with up to 500mm of selected granular fill.

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

(4) The finished road width will be approximately 6m (to be confirmed by the designer).

(5) Any road widening works that are required where the existing road runs across a slope should be done on the upslope side of the existing access road, where possible.

(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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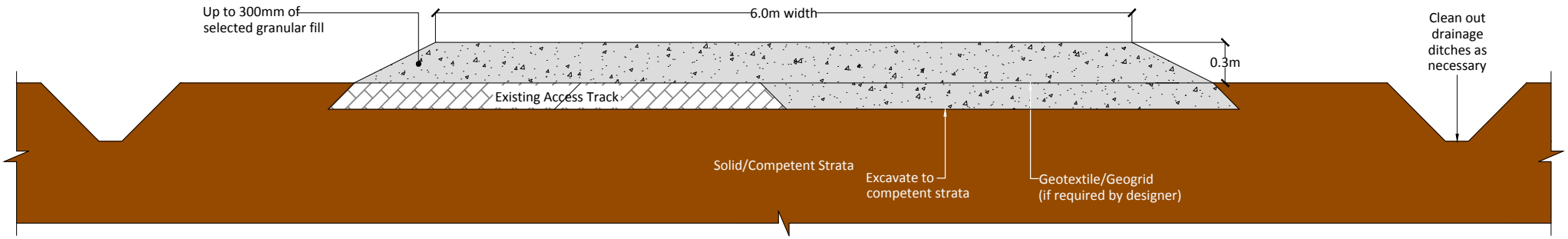
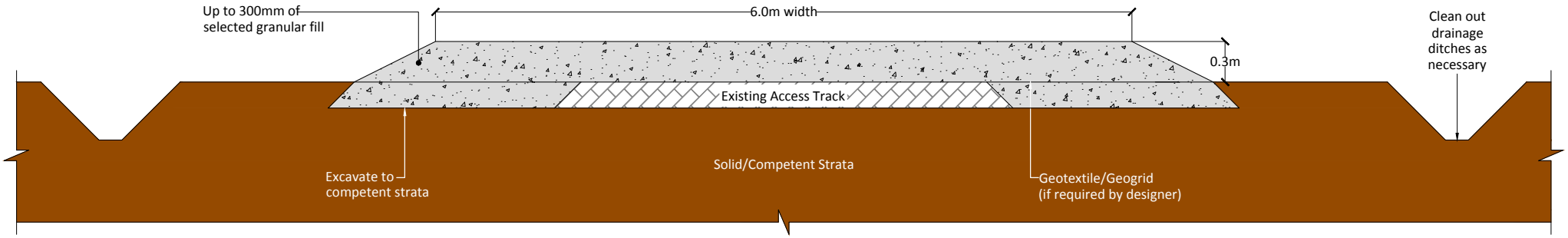


Widening of Access Track on One Side Only



Widening of Access Track on Both Sides

Figure 2 - Type A Upgrade of Existing Excavated Access Tracks

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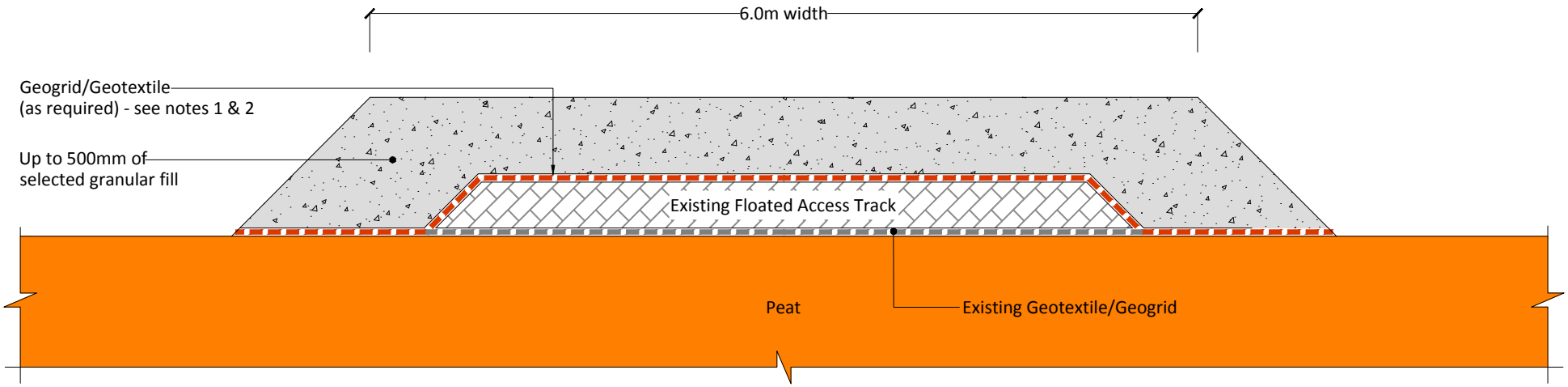
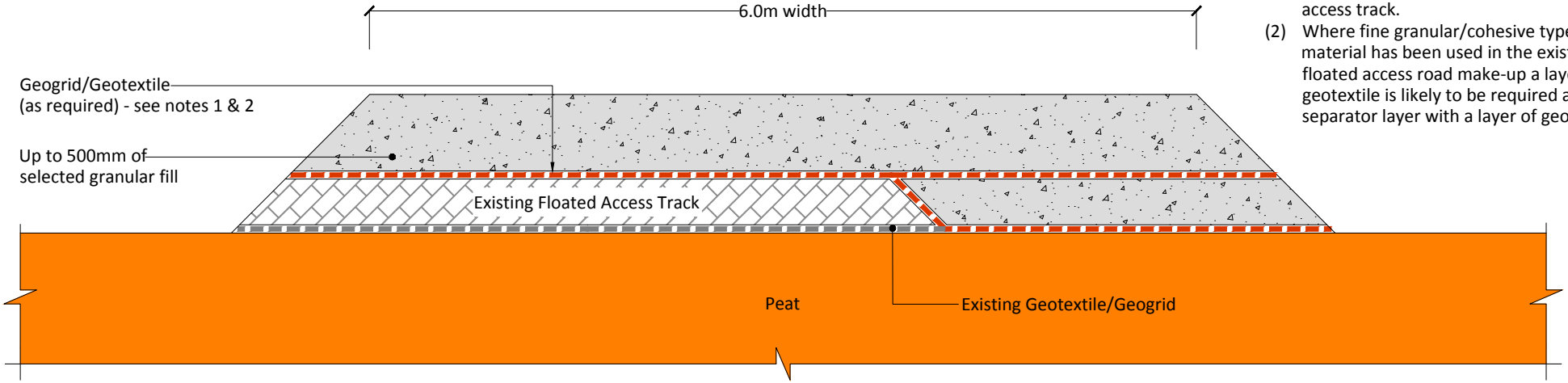


Widening of Access Track on Both Sides

(1) 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.

(2) Where fine granular/cohesive type material has been used in the existing floated access road make-up a layer of geotextile is likely to be required as a separator layer with a layer of geogrid.



Widening of Access Track on One Side Only

Figure 3 - 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 founding of access roads on competent stratum (below the peat) will be one of the types of new access road construction on site. The proposed locations for new excavated access roads on site are shown in Figure 1 and details are shown in Figure 4.

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 capacity is available on site for the placement of excavated peat and in areas where topographical conditions restrict the use of floated roads.

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 3m.

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

(3) Excavation of roads shall be to the line and level given in the design requirements. 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 removed on excavation and locally placed alongside access tracks.

   (d) Inappropriate side-casting of material is considered one of the main peat stability risks during the construction phase of a wind farm hence designated areas for the placement of excavated peat should be decided prior to construction on site and will only be placed in agreed locations alongside excavated access tracks.

(6) Where relatively steep peat slopes are encountered along with relatively deep peat (i.e. typically greater than 1.0m) 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.

(7) 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.

(8) The surface of the excavated access road should be overlaid typically with up to 750mm of selected granular fill.

(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) 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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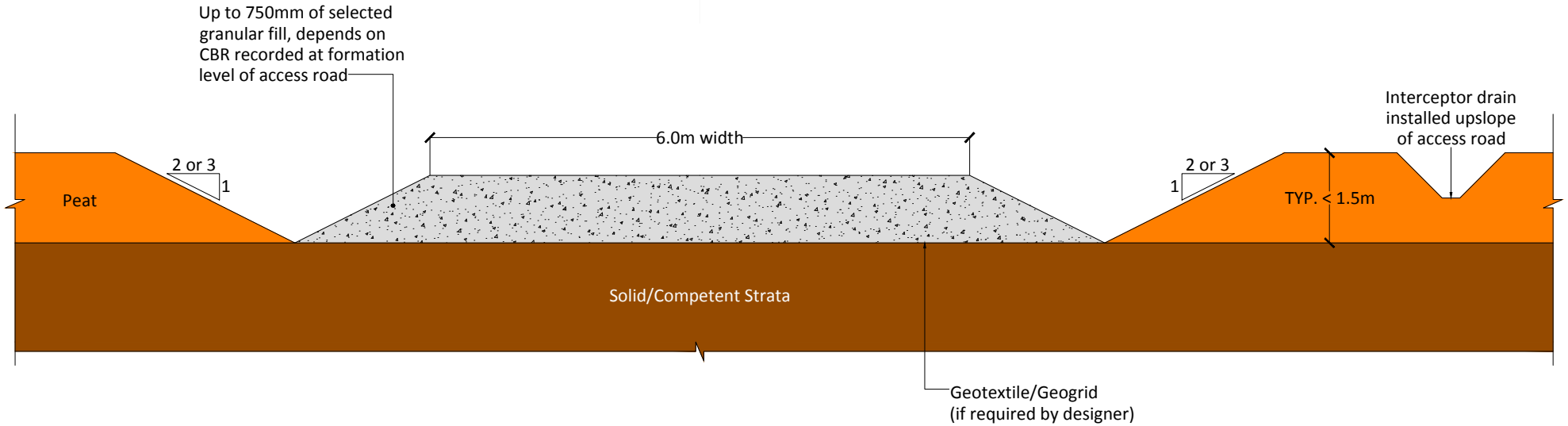

Figure 4 - Type C New Excavate & Replace Access Road

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5 CONSTRUCTION OF NEW FLOATING ROADS OVER PEAT – TYPE D

In a number of areas across the site it will be necessary to construct floating roads over peat. The proposed locations for the new floating access roads on site are shown in Figure 1 and details are shown in Figure 5. It should be noted that these locations should be confirmed by the designer.

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) Floating road construction shall be to the line and level requirements as per design/planning conditions.

(3) Base geogrid to be laid directly onto the existing peat surface along the line of the road in accordance with geogrid provider's requirements.

(4) Construction of road to be in accordance with appropriate design from the designer.

(5) The typical make-up of the new floated access road is 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 – To be confirmed with the site designer).

(6) Following the detailed design of the floated access roads it may be deemed necessary to include pressure berms either side of the access road in some of the deeper peat areas. The inclusion of a 2 to 5m wide pressure berm (typically 0.5m in height) either side of the access road will reduce the likelihood of potential bearing failures beneath the access road.

(7) The finished road width will be approximately 6m (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 a suitable bulldozer shall be employed to spread and place the tipped stone over the base geogrid along the line of the road.

(12) A final surface layer shall be placed over the 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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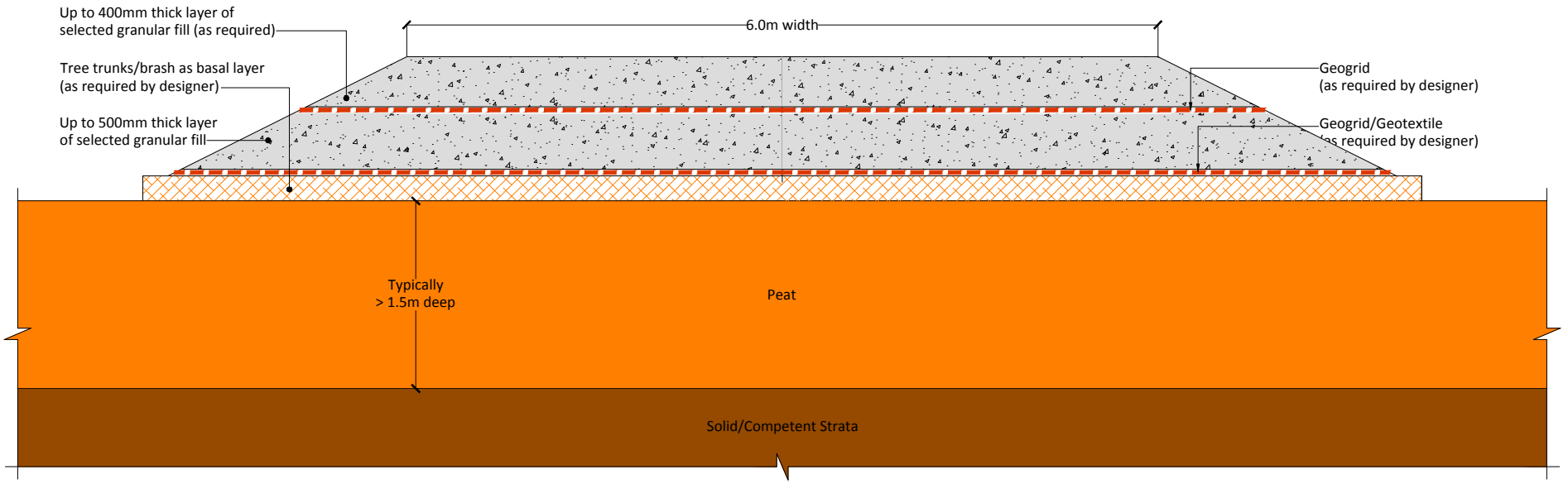

Figure 5 - Type D New Floated Access Road

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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 widening of existing access roads is required work should be done on the upslope side of the existing access road, where possible, to avoid any unnecessary loading of the adjacent peat downslope.

(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.

In relation to the floated access roads on site, the following recommendations are given:

(1) Where floating roads are proposed in this report, a detailed design will need to be carried out prior to construction on site.

(2) Additional ground investigation will be required along the route of the proposed floating access roads to assist in the detailed design.

(3) Where an open drainage ditch is present alongside an existing/proposed floating access track, the drainage ditch may need to be culverted and 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 drainage ditch shall be filled with suitable drainage stone. As applicable, a perforated pipe shall be laid into a drainage ditch prior to filling so as to maintain water flow within the ditch.

(4) No excavations (e.g. drainage, peat cuttings) shall be carried out within 10m 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.

(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; and 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

Inappropriate side-casting of material, notably as arisings from excavations, is considered one of the main peat stability risks during the construction phase of the wind farm. Control of general loading of the peat surface, such as placement of arisings, can greatly reduce the risk of peat instability.

7.1 Excavation & Placement of Arisings Methodology

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

(1) All excavated peat and spoil shall be permanently placed in the 3 no. borrow pits or appropriately placed alongside excavated access roads – See Figure 6.

(2) Further details on the placement of excavated arisings in the 3 no. borrow pits are given below.

(3) In addition, further details on the appropriate placement of excavated arisings alongside the excavated access roads are given below.

(4) Some of the acrotelm (upper layer of the peat) excavated during construction will be used for landscaping purposes. Temporary placement of acrotelm should only be undertaken in areas of low risk of peat instability. Material should not be placed in areas of deep peat or adjacent to floated access tracks.

7.2 Summary of Excavated Peat & Spoil Volumes

A summary of the excavated peat and spoil volumes calculated for the Meenbog site are given in Table 2.

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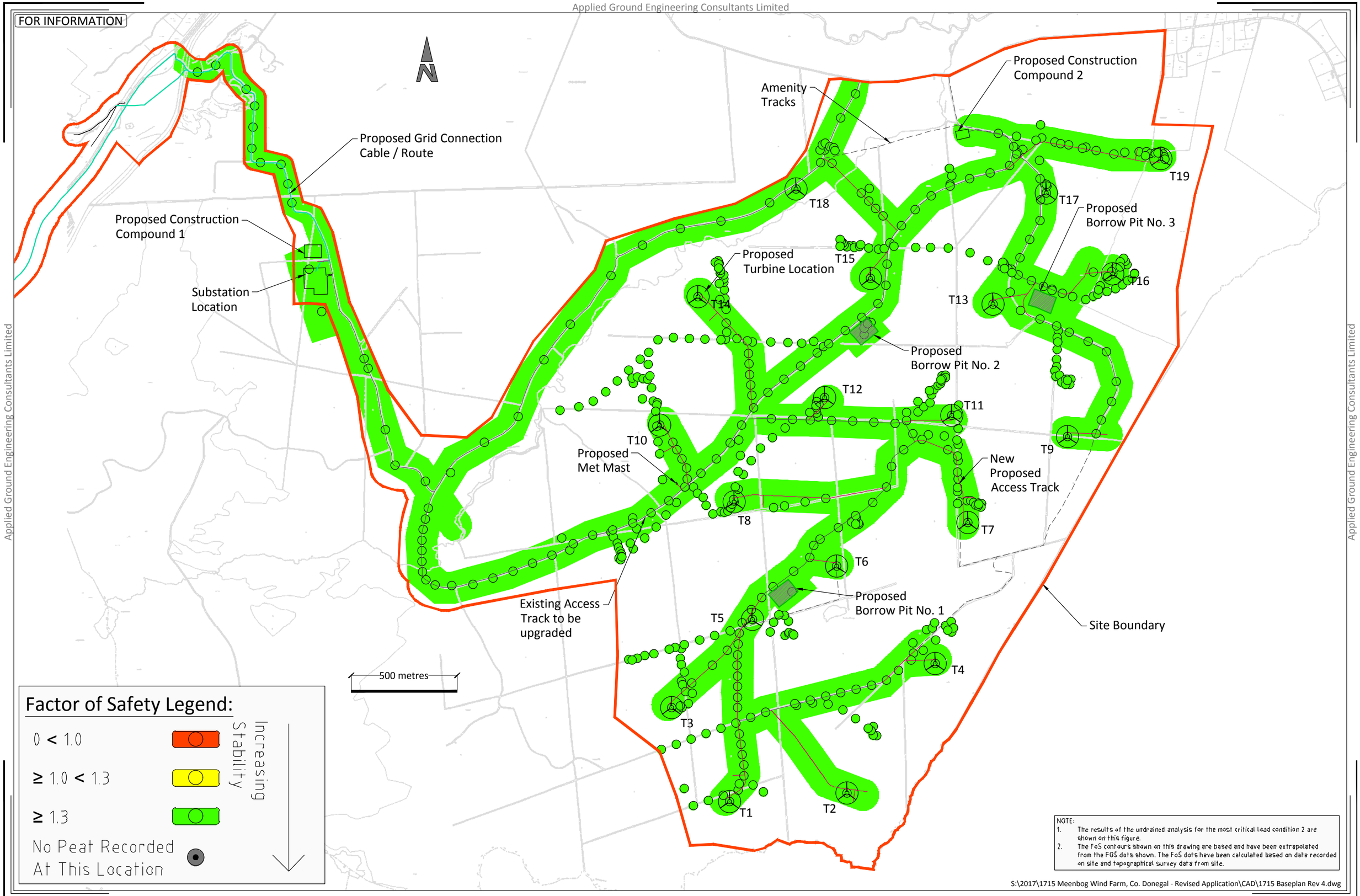

Figure 6 Factor of Safety Plan

Infrastructure Element [1]	Typical Dimensions	Peat Volume (m^3) [2]	Spoil (non-peat) Volume (m^3) [2] & [3]	Comment
19 no. Turbines & Hardstands	24m diameter excavation footprint for turbine foundation with hardstand areas	100,900	25,685	Hardstanding areas and foundation footprint
Access Roads (New & upgrading of existing tracks)	Assumed 6m running surface with 7m wide development footprint and 3m widening footprint to existing tracks	42,150	10,950	Excludes proposed floating sections of access road where no excavation of peat will take place (see Figure 1)
Substation	Hardstand area of 4,480m^2	31,350	6,275	-
Meteorological Mast	10 x 10m foundation footprint and 287m^2 hardstanding area	575	300	-
Construction Compounds	Hardstand areas	15,975	2,710	Hardstanding area
Cable Trench Works	Grid connection route	1,000	5,075	
Borrow Pits [3]	3 no. borrow pits	55,125	33,750	Borrow pit footprints
	Total =	**247,075m^3**	**84,745m^3**	**Total = 331,820m^3 (peat and spoil volume) [4]**

Note (1) The location of the infrastructure elements on site are shown on Figure 6.
Note (2) A factor of 25% (bulking factor of 15% and contingency factor of 10%) 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) It should be noted that the excavated rock volume for the borrow pits is not included in the total volume quoted above in Table 2. 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 have to be accommodated elsewhere on site.
Note (4) It should be noted that the peat and non-peat spoil volumes given in Table 2 are indicative and for information purposes only and subject to detailed design.

Table 2 Summary of Excavated Peat & Spoil Volumes on Site

7.3 Summary of Peat & Spoil Placement Areas

A summary of the potential peat and spoil placement areas at the Meenbog wind farm site are given in Table 3. The volume of peat and spoil provided in table 3 is a maximum value proposed for the borrow pits and will be tailored on site to match the volume of crushed rock required to construct the access roads and hardstand areas within the site.

Location [(1)]	**Peat & Spoil Placement Volume (m^3)**	**Comment**
Borrow Pit No. 1	108,000	See Figure 7 for further details
Borrow Pit No. 2	108,000	See Figure 8 for further details
Borrow Pit No. 3	99,000	See Figure 9 for further details
Placement of Arisings alongside Access Roads	31,500	Placement of arisings (3m wide and 1m depth) alongside existing excavated and new excavated access tracks with less than 10 degree slope
Landscaping [(2)]	9,500	It is estimated that approximately 500m^3 of peat will be required for landscaping purposes at each of the 19 no. turbine locations
Total =	**356,000m^3**	

Note (1) The location of the proposed borrow pits at the site are shown on Figure 6.
Note (2) Some of the acrotelm (upper layer of the peat) excavated during construction will be used for landscaping purposes.

Table 3 Summary of Peat & Spoil Placement Areas on Site

7.4 Guidelines for the Placement of Peat & Spoil in the Borrow Pits

A number of areas have been identified as potential borrow pits and are shown on Figure 6. The peat depth within the development footprint of the borrow pits is generally less than 3.0m.

Upon removal of the rock from the borrow pit, it is proposed to restore 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 contained 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. The text below provides design and construction guidelines for the borrow pits.

Figures 7 to 9 show typical construction details for each of the 3 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 placed safely.

(9) A number of rock buttresses to form cells within the borrow pits will be required to ensure access for trucks and excavators can be achieved. See Figures 7 to 9 for the location of the rock buttresses. The locations of the rock buttresses 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 placed peat & spoil to prevent any surface peat & spoil run-off. Buttresses up to 10m 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 borrow pit areas.

(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 on the re-instated borrow pit 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) Silting ponds 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 re-instated 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 Spoil Placement alongside Excavated 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.

(1) The potential spoil placement locations identified are alongside the new proposed and existing excavated access roads with cross slopes of less than 10 degrees.

(2) As a general guide, the peat & spoil placed adjacent to the proposed and existing excavated access roads should be restricted to a maximum height of 1.0m over a 3m wide corridor on both sides of the access roads. It should be noted that the designer should define/confirm the maximum restricted height for the placed peat & spoil.

(3) 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 such areas may require the use of long reach excavators, low ground pressure machinery and possibly bog mats in particular for drainage works.

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

(5) 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 area progresses. This will reduce the likelihood of debris run-off and ensure stability of the placed peat & spoil.

(6) 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.

(7) 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 areas.

(8) 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 prior to construction works commencing on site.

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

(10) 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.

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

8 EXCAVATIONS IN PEAT FOR TURBINE BASES, HARDSTANDINGS & SUBSTATION

The works require that turbine bases are to be founded on competent founding strata which will require excavation through peat and non-peat overburden. Similarly, hard standings for cranes and the substation platform are to be founded on competent mineral soil and/or rock which will also require excavation through peat and non-peat overburden.

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 and non-peat spoil are to be adequately supported or slopes are to be battered to a safe slope inclination typically of 1 (v): 2 or 3 (h) depending on the material encountered.

(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 IN PEAT FOR CABLE TRENCHES

It is intended that the proposed wind farm will connect to the national grid via the existing Clogher 110 kV Electricity Substation (Clogher Substation), located in the townland of Cullionboy, Co. Donegal. The Clogher Substation is located approximately 6.2km southwest of the proposed development at its closest point.

The route will originate from the proposed substation and run northwest along the proposed wind farm access track for approximately 1.65km before turning southwest off the track for approximately 300m and will then cross under the N15 corridor via a directionally-drilled duct. The cable will emerge on the existing forestry track northwest of the N15, where it will link into the Drumnahough cable approximately 300m south west of the N15 crossing point.

It is proposed to excavate the trenches for the underground cable at a uniform level in peat or other overburden material. The trenches will be 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 excavation the guidelines given in Section 7 are to be followed.

(2) 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.

(3) 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.

(4) Excavations shall be kept reasonably free from water at all times.

(5) Any material excavated from the cable trench which is deemed suitable for reinstatement of the trench will used for this purpose i.e. stockpiled locally to the works and reused for backfilling.

(6) Any material not deemed suitable for the reinstatement of the cable trench will be transported and placed in one of the three borrow pits proposed for the site.

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

10 GENERAL RECOMMENDATIONS FOR GOOD CONSTRUCTION PRACTISE 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 placing arisings from excavations and local concentrated loads on peat slopes without first establishing adequacy of the ground to support the load.

(2) 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.

(3) Avoidance of unstable excavations. All excavation shall be suitably supported or battered to a stable configuration to prevent collapse and development of tension cracks.

(4) Avoidance of placing fill and excavations in the vicinity of steeper peat slopes, that is at the crest or toe of the slope.

(5) Installation and regular monitoring of geotechnical instrumentation, as appropriate, during construction in areas of possible poor ground, such as deeper peat deposits (see section 10).

(6) 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.

(7) 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.

(8) 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 3.0m. 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 1.0m). Where there are relatively steeper slopes or softer ground a sighting line shall be placed down the slope, or at any location where monitoring would be deemed useful.

(3) Each line of sighting posts shall be uniquely referenced with each post in the line given a reference. The post reference shall be marked on each post (e.g. reference 1-1, 1-2, 1-3, 1-4, 1-5, 1-6 for posts in line 1).

(4) The sighting lines shall be monitored at the beginning of each working day, and during the day where considered appropriate (e.g. when working activity is concentrated at a specific location).

(5) Monitoring of the posts shall comprise sighting along the line and recording any relative movement of posts from the string line.

(6) Where increased movements are recorded the frequency of monitoring shall be increased.

(7) A monitoring record shall be kept of the date, time and relative movement of each post, if any. This record shall be updated and stored as a spreadsheet.

12 CONTINGENCY MEASURES

12.1 Excessive Movement

Where there is excessive movement or continuing peat movement recorded at a monitoring location or identified at any location within the site but no apparent signs of distress to the peat (e.g. cracking, surface rippling) then the following shall be carried out.

(1) All activities (if any) shall cease within the affected area.

(2) Increased monitoring at the location shall be carried out. The area will be monitored, as appropriate, until such time as movements have ceased.

(3) Re-commencement of activities shall only start following a cessation of movement and agreement with all parties.

12.2 Onset of Peat Slide

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 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.

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