FEHILY TIMONEY

CONSULTANTS IN ENGINEERING,
ENVIRONMENTAL SCIENCE & PLANNING

PEAT & SPOIL MANAGEMENT PLAN

SHESKIN SOUTH WIND FARM

Prepared for: **MKO Ltd**

Date: January 2023

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PEAT AND SPOIL MANAGEMENT PLAN
SHESKIN SOUTH WIND FARM

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Abstract: Fehily Timoney and Company (FT) were engaged by McCarthy Keville O'Sullivan (MKO) to compile a Peat and Spoil Management Plan (PSMP) for Sheskin South wind farm. The purpose of this report is to provide a Peat and Spoil Management Plan for the construction phase of the wind farm. The report describes how peat and spoil which will be excavated from infrastructure locations such as turbine bases and roads and will be handled and placed/reinstated onsite. The report also provides construction details for the types of roads which will be put in place at the site and proposed peat and spoil placement/reinstatement areas which will be developed at the site.

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1. INTRODUCTION

1.1 Fehily Timoney and Company

Fehily Timoney and Company (FT) is an Irish engineering, environmental science and planning consultancy with offices in Cork, Dublin and Carlow. The practice was established in 1990 and currently has c.90 members of staff, including engineers, scientists, planners and technical support staff. We deliver projects in Ireland and internationally in our core competency areas of Waste Management, Environment and Energy, Civils Infrastructure, Planning and GIS and Data Management.

This Report was written by Ian Higgins (FT Principal Geotechnical Engineer, MSc in Geotechnical Engineering) and Alan Whelan (FT Project Engineer, BEng (Hons) Civil Engineering). Ian is a Principal Geotechnical Engineer with Fehily Timoney and has over 20 years' experience in geotechnical engineering. Alan is a Project Engineer with Fehily Timoney and has two years' experience in geotechnical engineering.

1.2 Project Description

Fehily Timoney and Company (FT) was engaged in February 2021 by MKO (on behalf of Sheskin South Renewables Power DAC) to compile a Peat and Spoil Management Plan for the proposed Sheskin South wind farm site (the 'Proposed Development').

The Proposed Development will be located at a site located approximately 5km northwest of Bellacorrick, Co. Mayo.

The Proposed Development site comprises predominantly commercial forestry underlain by blanket peat. The surrounding landscape to the east and north is predominately flat with land-use comprising forestry, cutover bog, agriculture, wind energy and blanket peatland.

1.3 Purpose

The purpose of this report is to provide a peat and spoil management plan with particular reference to peat stability for the construction phase of the project. The report describes how peat and spoil which will be excavated from infrastructure locations such as turbine bases and roads 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.

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

As for all construction projects, a detailed engineering construction design must be carried out by the appointed construction stage designer prior to any construction work commencing on site. This must take account of the consented project details and any conditions imposed by that consent. This must include a detailed peat stability assessment to account for any changes in the environment which may have occurred in the time leading up to the commencement of construction and a peat and spoil management plan to allow for the most appropriate geotechnical and environmental led solutions to be developed for the management of peat and spoil.

As work is carried out on site the contents of the peat and spoil management plan and peat stability monitoring programme will be implemented in full and updated (if required) in the Construction & Environmental Management Plan (CEMP) for the construction phase.

This peat and spoil management plan contains some drainage guidelines for construction works and for management of peat on site. It should be noted that the control of water quality and drainage measures for site is outlined in detail in Chapter 9 of the Environmental Impact Assessment Report (EIAR).

1.4 Peat Instability Definition

Peat instability in this report is defined as a mass movement of a body of peat that would have a significant adverse impact on the surrounding environment. Peat instability excludes localised movement of peat that would occur below a floating access road (not proposed as part of this development), creep movement or localised erosion type events.

Adherence to the peat and spoil management plan should reasonably minimise the potential for all such peat movements. However, it is noted that due to the soft ground nature of the peat terrain it is not possible to completely avoid such localised peat movement as described above.

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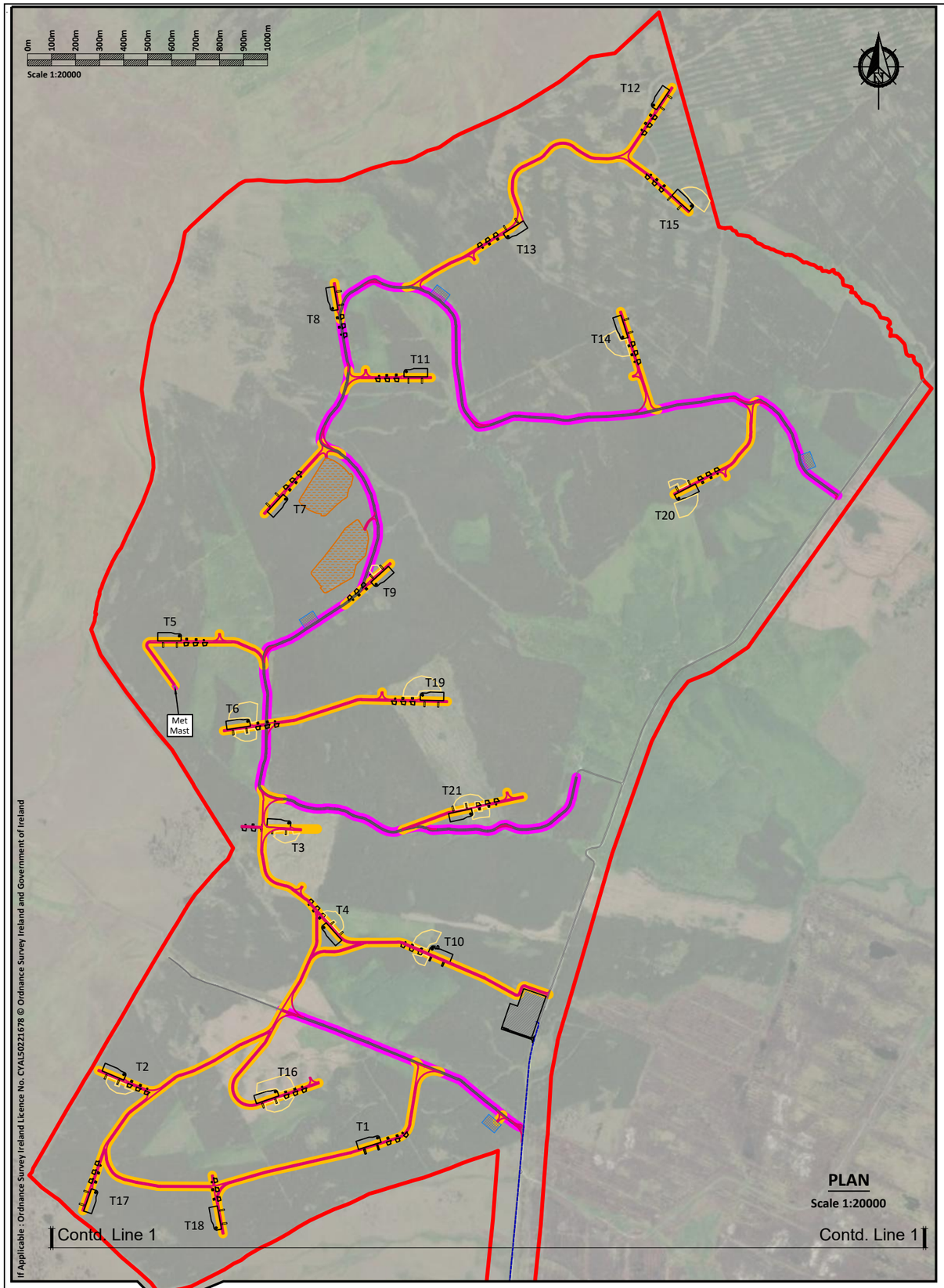

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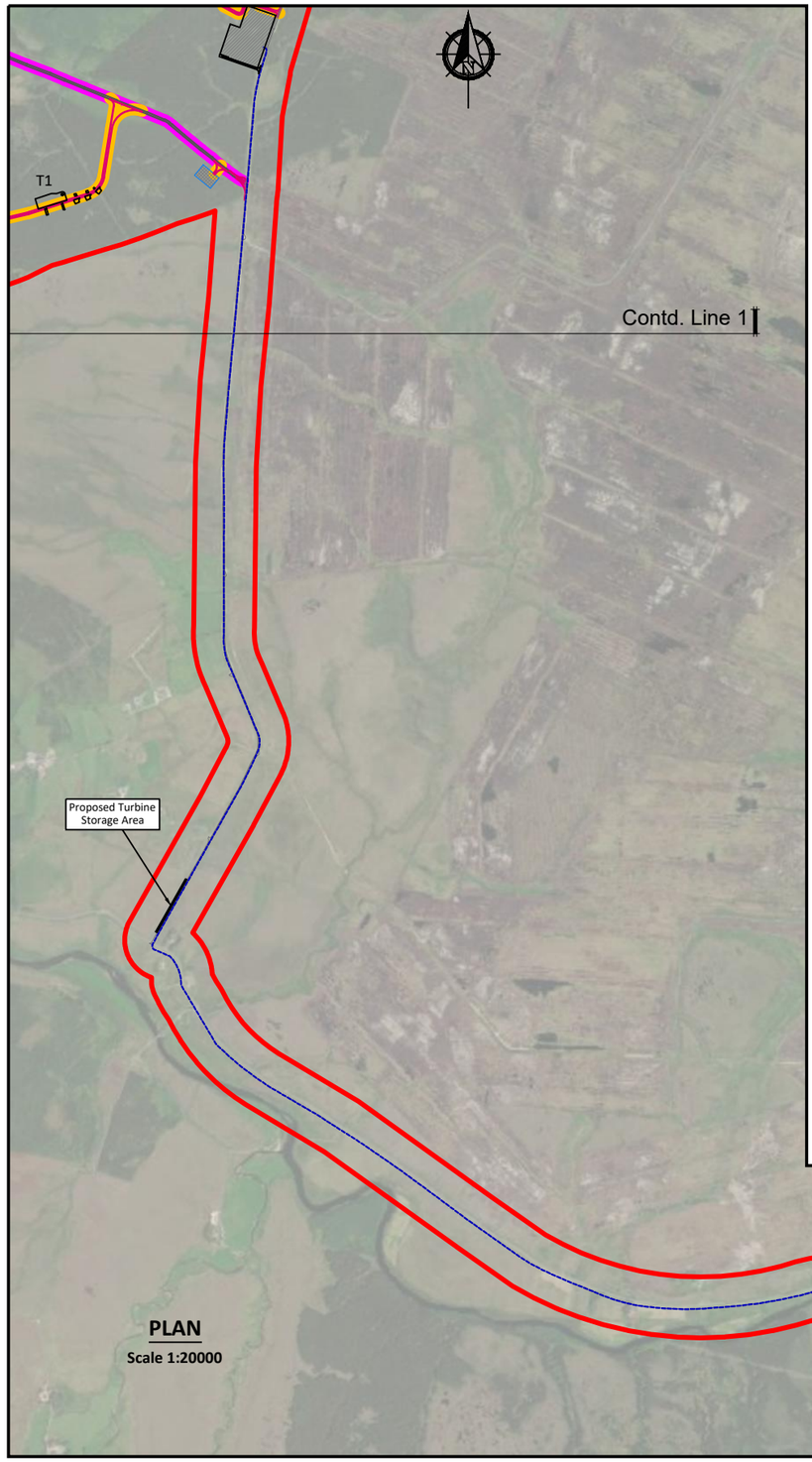

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Legend:

- EIAR Site Boundary
- Proposed Access Track
- Existing Access Track To Be Upgraded
- Existing Access Track
- Proposed Grid Connection Route
- Proposed Turbine
- Proposed Construction Compound
- Proposed Substation
- Proposed Met Mast
- Proposed Borrow Pit
- Proposed Peat Placement

Road Type Legend:

Type A - Upgrade of Existing Excavated Access Tracks

Type B - New Excavate & Replace Access Road

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FIGURE 1.1 - ROAD CONSTRUCTION TYPES PLAN

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2. CONSTRUCTION ACTIVITIES COVERED BY PEAT AND SPOIL MANAGEMENT PLAN

2.1 Construction Activities

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

(1) Upgrade of existing access tracks (as excavate and replace tracks)
(2) Construction of new excavated roads through peat
(3) Excavation and placement of arisings
(4) Excavations in peat and overburden for borrow pits
(5) Excavations in peat for turbine bases, hardstands and other infrastructure foundations
(6) Excavations for underground cables

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) Minimising excavation arisings
(4) Serviceability requirements for construction and wind turbine delivery and maintenance vehicles
(5) Requirement to minimise disruption to peat hydrology

Whilst the above key factors are used to determine the road design the actual construction technique employed for a particular length of road will be determined by the prevailing ground conditions encountered along that length of road.

The general road construction techniques to be considered are given in Table 2-1.

This report describes the most suitable type of road construction for each section of access road based on the ground/site conditions recorded during the site walkovers. It should be noted that this report does not include a detailed design for the access roads on the Proposed Development site.

Table 2.1: General Road Construction Techniques

Construction Method	Typical Site Conditions			Comment
	Construction Type	Typical Peat Depth (m)	Typical Slope Inclination (degs)	
Upgrade of existing access roads	Type A	<2.0	Varies	Upgrade existing excavated access roads to the required width and finished with a layer of selected granular fill – Figure 1-1
Construction of new excavated roads through peat	Type B	Typically, less than 1.5m, locally up to 4.0m	Varies	New access road construction technique envisaged for various locations on site – Figure 1-1

Further details on access road construction types A and B are given in Sections 3 and 4 of the report.

3. UPGRADE OF EXISTING ACCESS ROADS – TYPE A

Up to 7.8km of existing access road requiring upgrade is present across the Sheskin South wind farm site and have been in operation for a significant number of years. The existing access roads appear to have been constructed using an excavate and replace construction technique. Based on the site walkover carried out by FT the existing access roads were typically noted as being in relatively good condition. Upgrade works will involve both widening and resurfacing of the existing access road. The proposed locations for upgrade of the existing access roads on site are shown in Figure 1-1 and details are shown in Figure 3-1.

3.1 Upgrading Existing Access Tracks Construction Methodology

This methodology includes procedures that will 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 separately in Chapter 4 of the EIAR .

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

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

(a) Excavation of the widened section of access road will take place to a competent stratum beneath the peat, removing all peat and soft clay (as agreed with the designer) and backfilled with suitable granular fill.

(b) Benching of the excavation will be required between the existing section of access road and the widened section of access road where the depth of excavation exceeds 500mm.

(c) The surface of the existing access road will be overlaid with up to 500mm of selected granular fill.

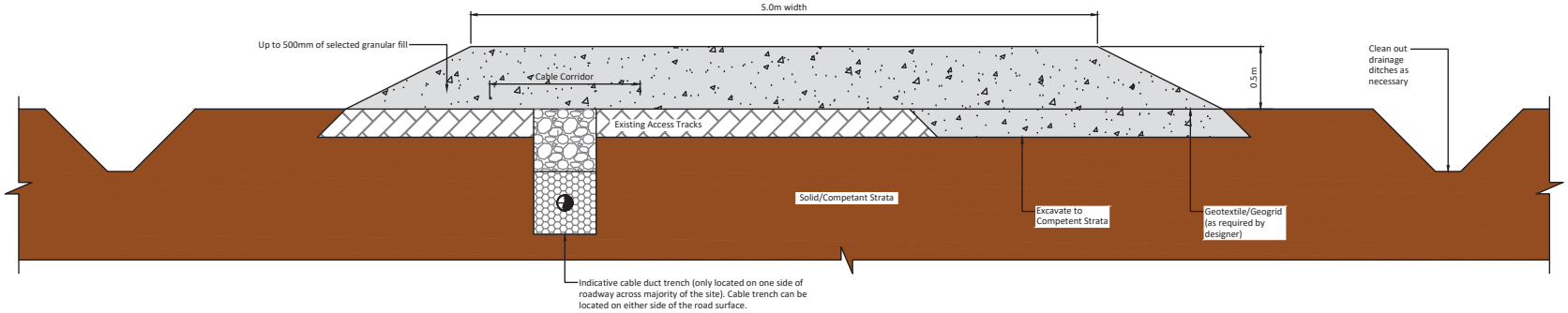
(d) Access roads will be finished with a layer of capping across the full width of the track

(e) A layer of geogrid/geotextile may be required at the surface of the existing access road where the existing tracks shows signs of rutting, etc.

(f) For excavations in peat, side slopes shall be not greater than 1 (v): 3 (h). This slope inclination will be reviewed during construction, as appropriate. Where areas of weaker peat are encountered then slacker slopes will be required to ensure stability.

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

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



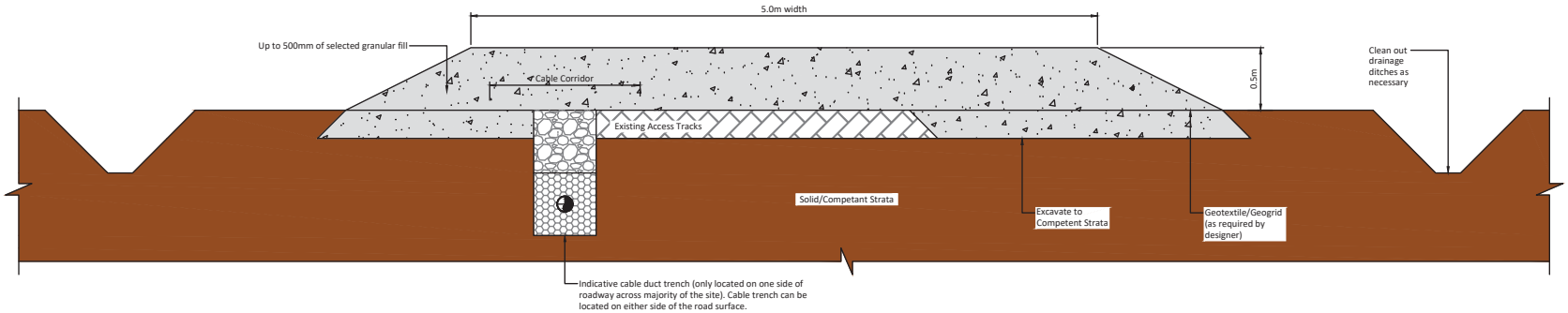


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FIGURE 3.1 - TYPE A - UPGRADE OF EXISTING EXCAVATED ACCESS TRACKS

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

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

Excavate and replace type access roads are the conventional method for construction of access roads on peatland sites and the preferred construction technique for this site provided sufficient placement/reinstatement capacity is available on site for the excavated peat. This construction method will also be used to replace existing floating roads within the site.

4.1 New Excavated Road Construction Methodology

This methodology includes procedures that will be adopted 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) Prior to commencing the construction of the excavated roads, movement monitoring posts will be installed in areas where the peat depth is greater than 2.0m.

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

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

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

(5) Once excavated, peat will be temporarily stored in localised areas adjacent to excavations for roads and hardstands before being placed into the permanent peat storage areas within the borrow pits. All peat placement areas will be upslope of founded roads/hardstands and will be inspected by the Project Geotechnical Engineer before material is stored in the area.

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

  (a) Acrotelm (to about 0.3 to 0.4m of peat) will be required for landscaping and will be stripped and temporarily stockpiled for re-use as required. Acrotelm stripping will be undertaken prior to main excavations.

  (b) Where possible, the acrotelm shall be placed with the vegetation part of the sod facing the right way up to encourage growth of plants and vegetation.

  (c) All catotelm peat (peat below about 0.3 to 0.4m depth) will be transported immediately on excavation to the designated placement areas.

(7) Excavation side slopes in peat shall be not greater than 1 (v): 3 (h). This slope inclination will be reviewed during construction, as appropriate. Should areas of weaker peat be encountered then slacker slopes will be required. Battering of the side slopes of the excavations will be carried out as the excavation progresses.

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

(9) The excavated access road will be constructed with a minimum of 800mm of selected granular fill. Granular fill to be placed and compacted in layers in accordance with the TII Specification for Road Works.

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

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

(12) Where slopes of greater than 5 degrees are encountered along with relatively deep peat (i.e. greater than 1.5m) and where it is proposed to construct the access road perpendicular to the slope contours it is best practice to start construction at the bottom of the slope and work towards the top, where possible. This method avoids any unnecessary loading to the adjacent peat and greatly reduces any risk of peat instability.

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

(14) The construction and upgrading of access roads in areas of deep peat (greater than 2m) will be inspected on a routine basis (by the Site manager/Ecological Clerk of Works/Project Geotechnical Engineer) during the works, particularly before/following trafficking by heavy vehicular loads.

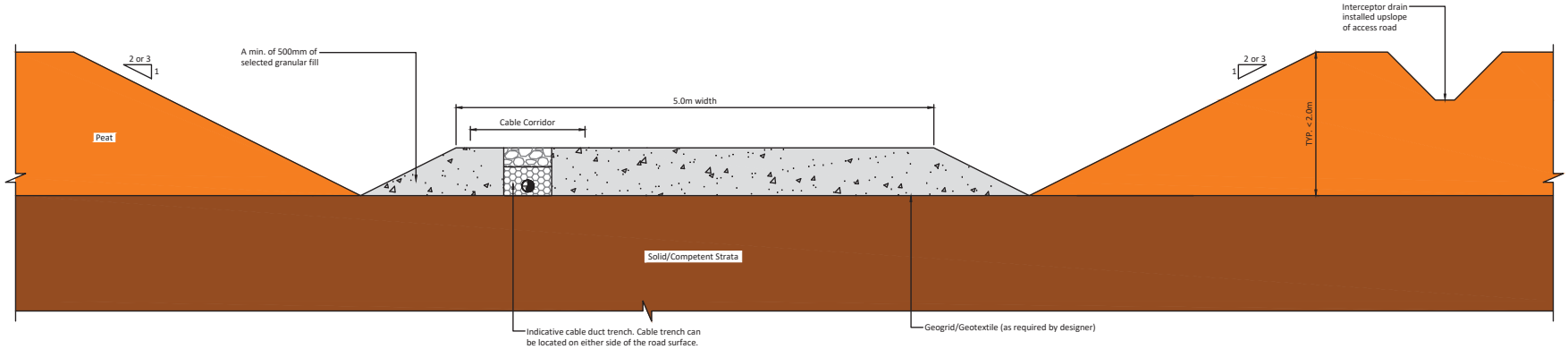

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FIGURE 4.1 - TYPE B - NEW EXCAVATE AND REPLACE ACCESS ROAD

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5. EXCAVATION AND STORAGE OF PEAT AND SPOIL

5.1 Excavation and Storage of Arisings Methodology

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

(1) All excavated peat and spoil will be either temporarily stockpiled locally at turbine hardstands, or transported immediately on excavation to one of the 2 no. borrow pits (see Figure 1-1) or to one of the designated peat placement areas around the turbine locations.

(2) Further details on the construction and reinstatement of the 2 no. borrow pits are given in Section 6.4.

(3) Further details on the placement of excavated material to designated peat placement areas close to turbines are given in Section 7.5.

(4) Some of the peat, in particular the acrotelm (upper layer of the peat), excavated during construction will be used for landscaping purposes.

5.2 Summary of Peat and Spoil Volumes on Site

A summary of the excavated peat and spoil volumes calculated for the proposed Sheskin South wind farm site are given in Table 5-1.

Table 5.1: Summary of Excvated Peat and Spoil Volumes on Site

Infrastructure Element [1]	Proposed Dimensions	Peat Volume (m^3) [2]	Spoil (non-peat) Volume (m^3) [2] and [3]	Comment
21 no. Turbines and Hardstands	25m diameter excavation footprint for turbine foundation with 75 x 35m hardstand area.	315,000	70,000	
Access Roads	Assumed 5m running surface with 6m wide development footprint.	335,000	45,500	
Temporary Construction Compounds	Hardstanding area of 45 x 70m.	7,500	3,000	
Substation	Hardstanding area of 180 x 130m.	36,200	4,550	
Met Mast	Hardstanding area of 30 x 30m	1,800	450	
Borrow Pits	2 no. borrow pits.	100,000	41,000	
	Total =	**795,500m^3**	**164,500m^3**	**Total = 960,000m^3 (peat and spoil volume) [4]**

Note (1) The location of the infrastructure elements on site are shown on Figure 1-1.

Note (2) A factor of 10% (bulking factor of 10%) has been applied to the excavated peat and spoil volumes to allow for expected increase in volume upon excavation and to allow for a variation in ground conditions across the site.

Note (3) The excavated spoil volumes have been determined based on a cut-fill assessment carried out for the site, see Section 12 of this report for further details.

Note (4) It should be noted that the excavated rock volume is not included in the total volume quoted above in Table 6-1, see the cut-fill assessment in Section 12 of this report for further details. It is assumed that the excavated rock volume will be re-used on site as part of the construction works for the development and hence will not require reinstatement on site.

5.3 Summary of Peat and Spoil Placement/Reinstatement Areas on Site

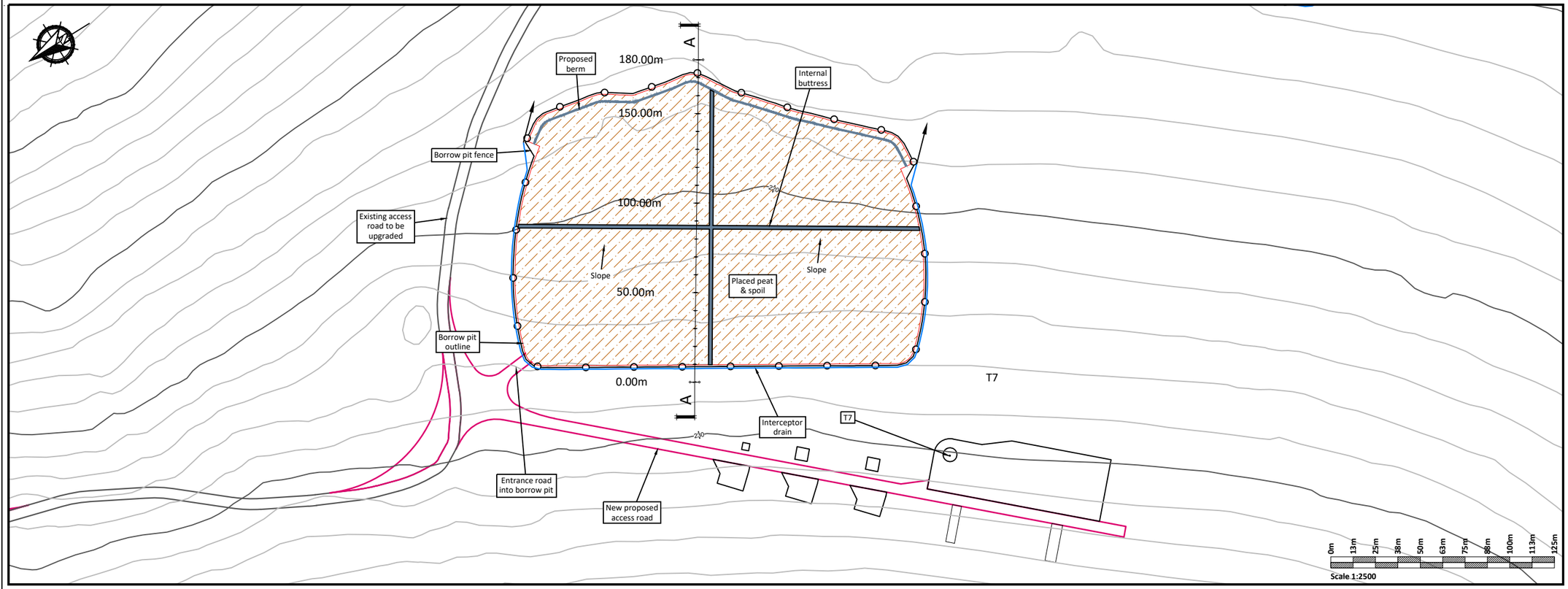
A summary of the proposed peat and spoil placement/reinstatement areas at the Proposed Development site are given in Table 5-2.

Table 5.2: Summary of Peat and Spoil Placement/Reinstatement Areas on Site

Location (1)	Peat and Spoil Volume (m^3)	Comment
Borrow Pits	870,000	See Figures 5-1 and 5-2 for further details
Peat placement around clear fell areas around turbines	76,000	1m in height across clear fell areas around turbine, where slopes are relatively shallow (<5 degrees) (Figure 6-3)
Landscaping (2)	21,000	It is estimated that approximately 1,000m^3 of peat will be required for landscaping purposes at each of the 21 no. turbine locations.
Total =	**967,000m^3**	

Note (1) The location of the proposed borrow pits at the site are shown on Figure 1-1.

Note (2) Some of the acrotelm (upper layer of the peat) excavated during construction will be used for landscaping purposes.



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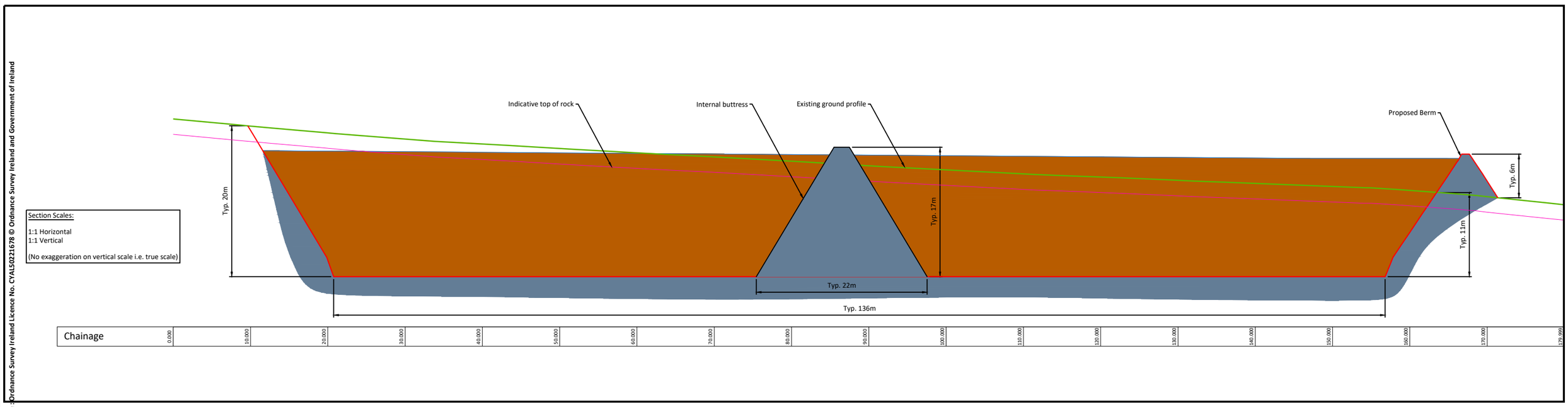

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Borrow Pit Construction Notes:

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

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

(3) Infilling of the peat & spoil will commence at the back edge of the borrow pit and progress towards the borrow pit entrance/rock buttress. 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 will be greater than the height of the infilled peat & spoil to prevent any surface peat & spoil run-off. A buttress up to 8m (max.) in height is likely to be required.

(5) The rock buttress will be founded on competent strata. The founding stratum for the rock buttress will 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 5.4 of the Peat & Spoil Management Plan

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FIGURE 5.1 - PROPOSED BORROW PIT 1

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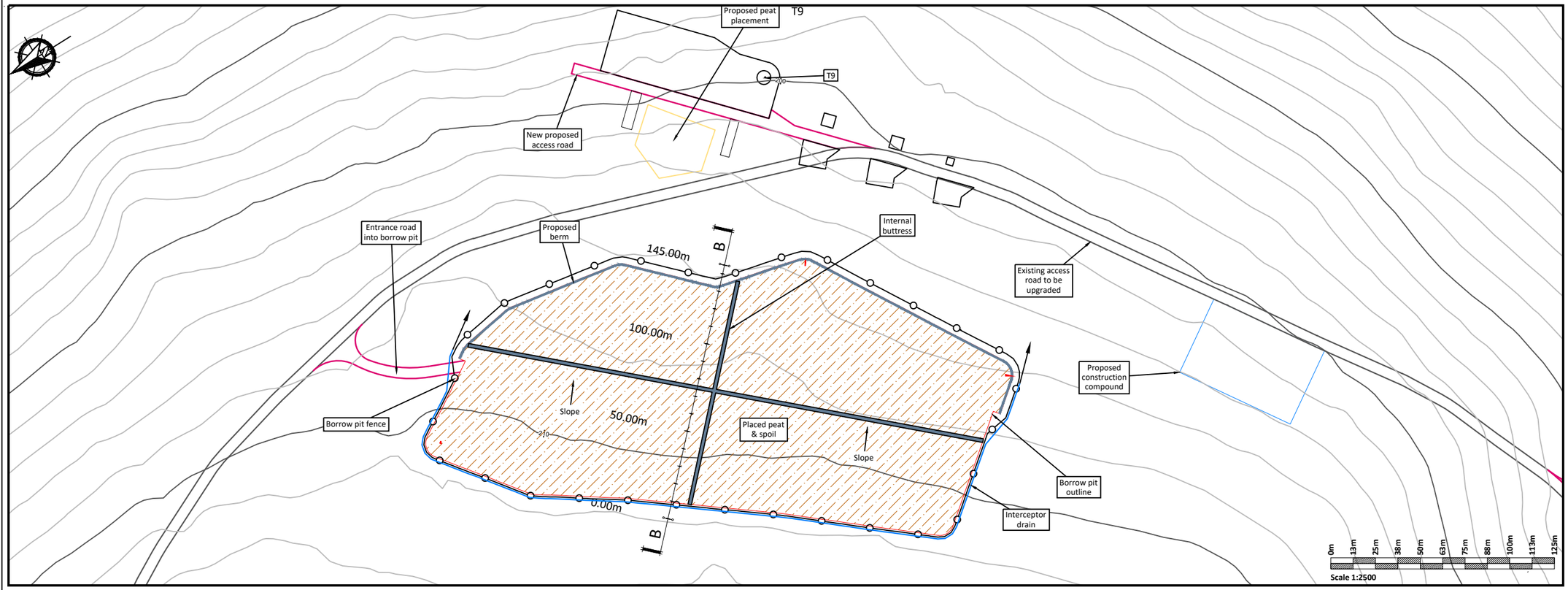

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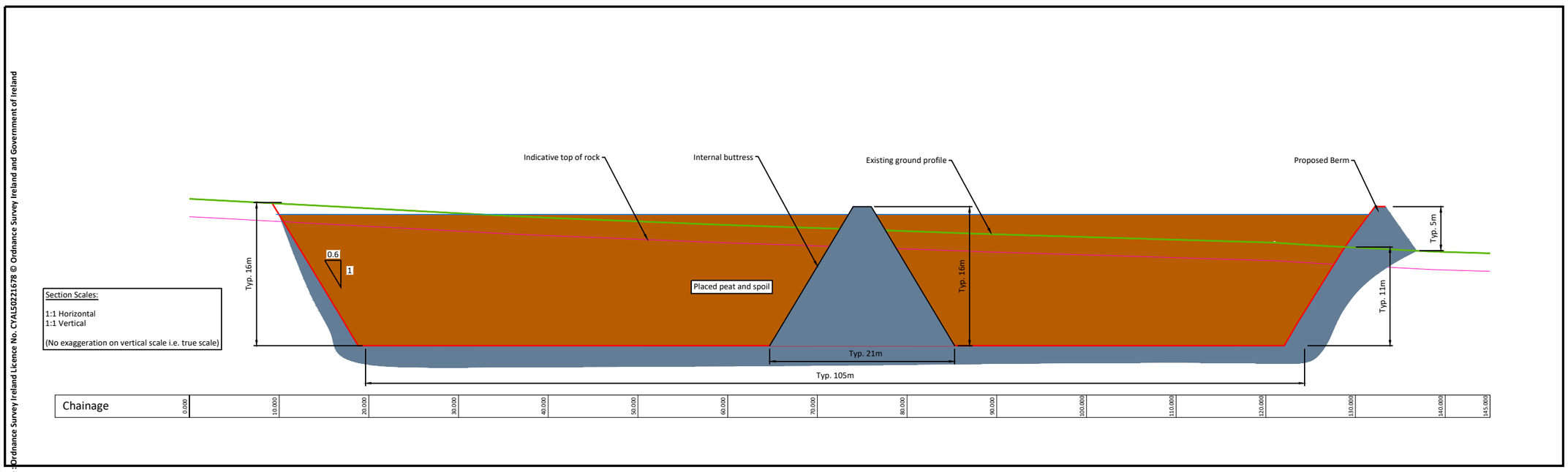

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Borrow Pit Construction Notes:

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

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

(3) Infilling of the peat & spoil will commence at the back edge of the borrow pit and progress towards the borrow pit entrance/rock buttress. 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 will be greater than the height of the infilled peat & spoil to prevent any surface peat & spoil run-off. A buttress up to 8m (max.) in height is likely to be required.

(5) The rock buttress will be founded on competent strata. The founding stratum for the rock buttress will 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 5.4 of the Peat & Spoil Management Plan

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FIGURE 5.2 - PROPOSED BORROW PIT 2

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Construction Notes Peat Placement Areas:

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

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

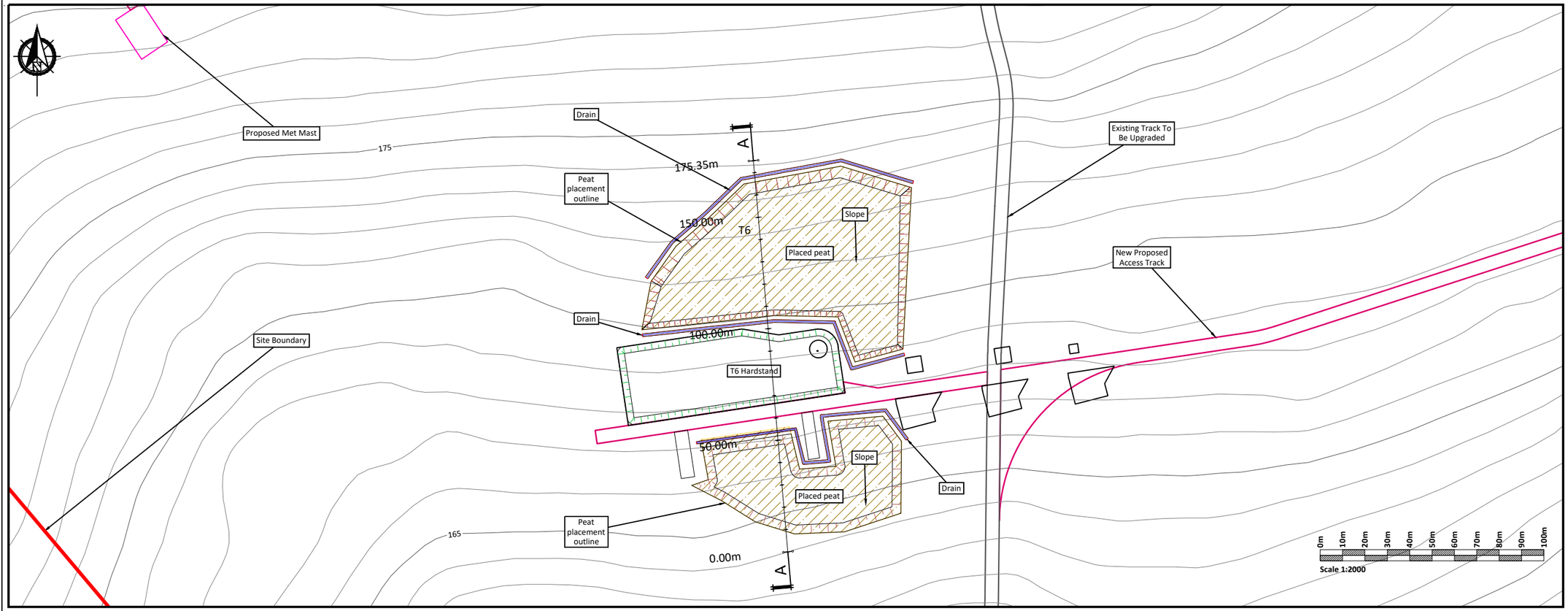
(3) It is important that the surface of the stored spoil be shaped to allow efficient run-off of water from the stored spoil.

(4) The thickness of the stored peat will decrease towards the edge of the placement area.

(5) Supervision by a geotechnical engineer or appropriately competent person is recommended for the construction of the peat placement.

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

(7) Further guidelines on the construction of the peat placement are included within Section 5.5 of the Peat & Spoil Management Plan.



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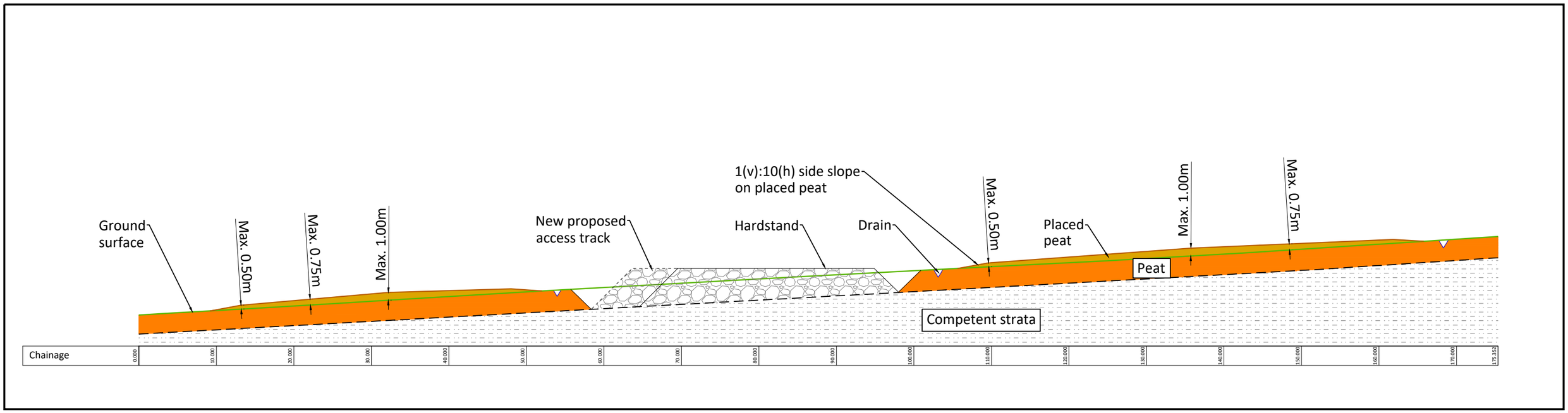

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FIGURE 5.3 - PEAT PEAT PLACEMENT AREA - TYPICAL PLAN AND CROSS SECTION DETAILS

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5.4 Construction and Reinstatement of Borrow Pits

Two locations have been identified as borrow pits and are shown on Figure 1-1. The peat depth within the development footprint of the borrow pits is less than 1.0m. The borrow pit locations were selected based on the shallow depth of peat and overburden and accessibility from the existing forestry tracks.

Upon removal of the rock from the individual cells within the borrow pits, it is proposed to reinstate the borrow pits using excavated peat and spoil. 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 and spoil to be placed safely. It is proposed to construct cells within the borrow pits for the placement of the excavated peat and spoil. This is to allow for the safe placement and grading of the peat and spoil using dumper trucks and excavators. It also eliminates the need to construct above ground retaining structures which may have an unnecessary visual impact and increase the development footprint of the proposed wind farm. The text below provides design and construction commitments for the borrow pits.

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

Figures 6-1 to 6-2 show typical construction details for the borrow pits.

The borrow pits shall be constructed as follows:

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

(2) It is proposed to construct the borrow pits so that the base of the borrow pits are below the level of the adjacent section of access road. As excavation progresses into the back edge of the borrow pits, localised deepening of the borrow pit floors may be required depending on extraction operations.

(3) It may be possible to excavate the rock from the borrow pits 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 pits, forming a series of cells (4 no.). The cells will be opened in sequence and filled as needed.

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

(5) The stability of the rock faces within the borrow pits will be inspected by the project Geotechnical Engineer upon excavation to ensure stability during construction works and in the long term. This inspection will allow unfavourable rock conditions to be identified and suitable mitigation measures to be applied such as removal of loose rock, in line with best practice guidelines.

(6) Where it is not possible to leave upstands/segments of intact rock in place it will 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) The rock buttresses will be constructed in stages to allow infilling of peat and spoil within cells. The buttress will be constructed of selected rock fill and placed and compacted in suitable layers to form a buttress of sufficient stability to retain the placed peat and spoil.

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

(9) A number of rock buttresses to form cells with the borrow pits may be required to ensure access for trucks and excavators can be achieved. See Figures 6-1 to 6-2 for the location of the rock buttresses. The locations of the rock buttresses shown on Figures 6-1 to 6-2 for the borrow pit are indicative only and may change subject to local conditions encountered on site during construction and as a result of the confirmatory ground investigation.

(10) The rock buttresses should be wide enough to allow construction traffic access for tipping and grading during the placement of the excavated peat and spoil. The permanent side slopes of the rock buttress should be constructed between 40 to 60 degrees.

(11) A rock buttress will be required on the downslope side of the borrow pits to safely retain the infilled peat and spoil. The height of the berm constructed will be greater than the height of the reinstated peat and spoil to prevent any surface peat and spoil run-off. A berm up to 6m (approx..) in height will be required.

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

(13) A level surface in the underlying granular Glacial Till or Weathered Bedrock will be prepared before placing and compacting the rock fill used to construct the berms.

(14) In order to prevent water retention occurring behind the buttresses, the 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. In addition, drains will be placed through the buttresses to allow surface water to drain from the surface of the placed peat.

(15) The rock buttress will be wide enough (up to 4m) during construction 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 40 to 60 degrees.

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

(17) The surface of the placed peat and spoil should be shaped to allow efficient run-off of surface water from the placed arisings.

(18) As the berms are slightly higher than the retained peat, drains will be provided at regular intervals through the berms, at the same level as the top of the peat surface, to prevent ponding of water around the edges of the repositories. These drains will be 150mm diameter flexible plastic drainage pipe or equivalent.

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

(20) An interceptor drain should also be installed upslope of the borrow pit, where necessary. This drain will divert any surface water away from the borrow pit and hence prevent water from ponding and lodging during construction and also when reinstated.

(21) Temporary control of groundwater within the borrow pits may be required and measures will be determined as part of the ground investigation programme. A temporary pump and suitable outfall locations will be required during construction.

(22) Settlement ponds have been designed at the lower side/outfall location of the borrow pits.

(23) The acrotelm shall be placed with the vegetation part of the sod facing the right way up to encourage growth of plants and vegetation at the surface of the peat and spoil within the borrow pits.

(24) Supervision by the Project Geotechnical Engineer is required for the development of the borrow pits.

(25) All the above-mentioned general guidelines and requirements will be implemented by the Contractor during construction.

5.5 Designated Peat Placement Areas within Turbine Clearfell Areas

The following commitments for the placement of peat within permanent clearfell areas around 12 no. turbines will be implemented during construction. These areas have been selected based on the depth of peat and the slope angle.

(1) Excavated peat will be placed/spread across the clearfell areas around 12 no. of the proposed turbines. These locations are shown in Figure 1-1.

(2) The peat placed within the areas shown on Figure 1-1 will be restricted to a maximum height of 1m. Weak/liquified peat must be placed within the proposed borrow pits and not stored within these areas.

(3) The placement of excavated peat will be avoided without first establishing the adequacy of the ground to support the load. The placement of peat and spoil within the placement areas will require the use of long reach excavators, low ground pressure machinery and possibly bog mats in particular for drainage works.

(4) Where there is any doubt as to the stability of the peat surface then no material shall be placed on to the peat surface. The risk of peat instability is reduced by not placing any loading onto the peat surface.

(5) It should be ensured that the surface of the placed peat is shaped to allow efficient run-off of surface water. Shaping of the surface of the peat will be carried out as placement of peat within the placement area progresses. This will reduce the likelihood of debris run-off and reduce the risk of instability in the placed peat.

(6) Finished/shaped side slopes in the placed peat shall be not greater than 1 (v): 4 (h). This slope inclination will be reviewed during construction, as appropriate.

(7) The acrotelm will be placed on the finished surface with the vegetation part of the sod facing the right way up to encourage growth of plants and vegetation at the surface of the placed peat within the placement areas.

(8) Movement monitoring instrumentation will be placed around the areas where peat has been placed. The locations where monitoring is required will be identified by the Project Geotechnical Engineer on site.

(9) Supervision by the Project Geotechnical Engineer is required for the works.

(10) An interceptor drain will 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 will be undertaken by the Contractor during construction.

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

The turbine bases will be founded on competent founding strata which will require excavation through peat and any soft overburden. Some turbine bases may require a piled solution following confirmatory ground investigations by the Contractor.

Similarly, crane hardstandings, construction compound, substation platforms and met mast foundations are to be founded on competent mineral soil and/or rock which will also require excavation through peat and spoil. Excavations for the borrow pits will also require the removal of peat and non-peat spoil overlying the rock.

6.1 Methodology

This methodology includes procedures that will 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 of the EIAR.

(1) With respect to placement of arisings from excavations the commitments given in Section 6 are to be followed.

(2) All excavations within peat will be adequately supported or peat slopes will be battered to a safe slope inclination typically of 1(v): 3(h). This slope inclination will be reviewed during construction, as appropriate. Where areas of weaker peat are encountered then slacker slopes will be required.

(3) Excavations shall be kept reasonably free from water at all times. Water will 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 will be fed into an established watercourse or drainage ditch following suitable treatment, as described in Chapter 4 of the EIAR.

7. EXCAVATIONS FOR UNDERGROUND CABLES

A 110kV connection between the Sheskin South Wind Farm and the national electricity grid will be necessary to export electricity. It is proposed that the Sheskin South Wind Farm will connect to the national grid via an existing substation located in at Bellacorick to the southeast of the Proposed Development. The proposed grid connection is approximately 6.9km in length and will follow existing roads and the public road corridor.

The proposed grid connection construction methodology, including proposals for water crossings on the underground cabling routes is described in Appendix 4-6 of the EIAR.

It is proposed to install the underground cable at a uniform level within the footprint of the access roads and TDR. The grid connection route will encounter peat and till derived from Devonian and Carboniferous sandstones and will be constructed on solid ground to Eirgird specifications.

7.1 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 described in Chapter 4 of the EIAR.

(1) With respect to placement of arisings from excavations the guidelines given in Section 6 will be followed.

(2) All excavations within peat will be adequately supported or peat slopes will be battered to a safe slope inclination typically of 1(v): 3(h). This slope inclination will be reviewed during construction, as appropriate. Where areas of weaker peat are encountered then slacker slopes will be required.

(3) Similarly, all excavations within non-peat overburden for the cable trench will 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 overburden excavated from the cable trench will be transported to the borrow pits for storage. Any pavement materials containing tar will be transported to an authorised waste facility.

8. GENERAL COMMITMENTS FOR GOOD CONSTRUCTION PRACTICE

To minimise the risk of construction activity causing potential peat instability the Construction Method Statements (CMS) for the project will also implement, but not be limited to, the general measures below together with the specific measures.

(1) Uncontrolled concentrated water discharge onto peat slopes identified as being unsuitable for such discharge will be avoided. All water discharged from excavations during work will be piped over areas specifically assessed as being unsuitable and hence directly into suitable drainage lines.

(2) All excavations will be suitably supported to prevent collapse and development of tension cracks.

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

(4) Installation and regular monitoring of geotechnical instrumentation during construction in areas of possible poor ground, such as deeper peat deposits (see Section 9).

(5) Site reporting procedures will be implemented to ensure that working practices are suitable for the encountered ground conditions. Ground conditions to be assessed by suitably experienced geotechnical engineer.

(6) Regular briefing of all site staff (e.g. toolbox talks) to provide feedback on construction and ground performance and to promote reporting of any observed change in ground conditions.

(7) Routine inspection of wind farm site by the Contractor and Project Geotechnical Engineer will be undertaken and will include an assessment of ground stability conditions (e.g. cracking, excessive floating road settlement, disrupted surface, closed-up drains) and drainage conditions (e.g. blocked drains, absence of water in previously flowing drains, springs, etc).

9. INSTRUMENTATION

9.1 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 2.0m. Additional monitoring locations will be required at infrastructure locations with deeper peat deposits, as determined by the Designer or Project Geotechnical Engineer. Details of sighting posts are given below.

(1) A line of sighting posts shall comprise:

(a) A line of wooden stakes (typically 1 to 1.5m long) placed vertically into the peat to form a straight line.

(b) The sighting line shall comprise 6 no. posts at 5m centres that is a line some 25m long.

(c) A string line shall be attached to the first and last posts and all intervening posts shall be adjusted so they are just touching the string line.

(2) Lines of sighting posts shall be placed across the existing slope about 5m away from the area to be worked. The posts will be located along the road at 10m intervals in areas of deep peat (say greater than 2.0m). Where there are relatively steeper slopes or softer ground a sighting line shall be placed down the slope, or at any location where monitoring is deemed necessary by the Designer or the Project Geotechnical Engineer.

(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.

10. CONTINGENCY MEASURES

10.1 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 until such time as movements have ceased.

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

10.2 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 will cease and all available resources will be diverted to assist in the required mitigation procedures.

(2) Action will be taken to prevent a peat slide reaching any watercourse. This will take the form of the construction of check barrages on land. Due to the terrain and the inability to predict locations it may not be possible to implement any on-land prevention measures, in this case a watercourse check barrage will be implemented.

(3) All relevant authorities will be notified if a peat slide event occurs on site.

(4) For localised peat slides that do not represent a risk to a watercourse and have essentially come to rest the area will be stabilised initially by rock infill, if required. The failed area and surrounding area will then be assessed by the engineering staff and stabilisation procedures implemented. The area will be monitored, as appropriate, until such time as movements have ceased.

10.3 Check Barrages

Whilst it is not anticipated based on 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 pits on site.

The size of the barrage will vary depending on the scale of the peat debris to be contained and the geometry of the watercourse at the barrage location. In general, due to the low speed of a peat slide there is generally little impact force and most of the lateral load is due to fluid pressure on the upslope face of the barrage.

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 will be inducted by means of a briefing by on-site supervisors as to the proposed location of the check barrage.

(3) The check barrage provides containment for peat debris in the highly unlikely event of a major peat slide. Further remedial measures, should they be required, will be assessed by the Contractor and the Project Geotechnical Engineer, and carried out as soon as physically possible when the location and extent of the failure is established.

(4) Where a barrage was constructed as a precaution and no peat debris reached the watercourse then the barrage should be removed as soon as any measures to prevent further peat sliding is agreed with all parties (Contractor/Engineer/Designer).

11. CUT & 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 & fill assessment is graphically presented in Figure 11-1.

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

- Plan drawings of the entire site showing an outline of cut & fill earthworks at all infrastructure elements (Figure 11-1)
- Estimated cut & fill earthwork volumes (see Table 11-1 of this report)

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

A summary of the cut & fill earthwork volumes is given in Table 11-1.

11.1 Commentary on Earthworks Volumes

It should be noted that the earthwork volumes given in Table 11-1 are indicative and for information purposes only and subject to detailed design. This section of the report should be read in conjunction with Sections 6.2 and 6.3 of the report which summarise the peat and spoil volumes for site and the placement/reinstatement areas on site.

In summary the following points are given,

1) The total volume of spoil (peat and non-peat superficial deposits) requiring placement/reinstatement on site is estimated at 960,000m^3. This material will be excavated and placed/reinstated to the borrow pit, with 76,000m^3 placed across clearfell areas near turbines and 21,000m^3 used for landscaping around turbines.

2) The estimated quantity of available rock within the borrow pit is 640,000m^3. Note that limited ground investigation is available at the borrow pits to define rockhead level. Conservative assumptions were made in estimating the quantity of rock available in the borrow pits.

3) Note a number of assumptions were made during the cut & fill assessment, see Appendix A. A 10% bulking factor has been applied to the excavation volumes.

Table 11.1: Summary of Cut & Fill Earthworks Volumes

Infrastructure Element	Description	Total Earthwork Volume (1) & (2) – Peat	Earthwork Volume (3) – Estimated non-peat overburden material	Earthwork Volume (4) - Estimated rock volume only	Earthworks Stone Requirements	Comment
		Cut (m^3)	Cut (m^3) (3)	Cut (m^3)	Stone (m^3)	
21 no. Turbines and Hardstands	25m diameter excavation footprint for turbine foundation with 55 x 35m hardstand area	315,000	70,000	-	206,000	Hardstanding area and turbine foundation footprint
Access Roads	Assumed 5m running surface with 6m wide development footprint	335,000	45,500	-	310,000	Excludes proposed and existing floating sections of access road where no excavation of peat will take place (see Figure 1-1).
Various Infrastructure Locations	Includes substation, 4 no. construction compounds and met mast	45,500	8,000	-	104,000	-
Borrow Pit	Borrow Pit	100,000	41,000	640,000	10,000	Estimated and indicative only potential rock volume from borrow pit is **640,000m^3**. Note limited ground investigation in area of borrow pit to define rockhead level.
	Total =	**795,500**	**164,500**	**640,000**	**630,000**	

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 & 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 pits was estimated based on available ground investigation data to define rockhead level.
Note (4) It should be noted that the earthwork volumes given in Table 11-1 are subject to confirmatory design.

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0m 100m 200m 300m 400m 500m 600m 700m 800m 900m 1000m

Scale 1:20000

T12
T15
T13
T8
T14
T11
T7
T20
T9
T5
T19
T6
Met Mast
T21
T3
T4
T10
T2
T16
T1
T17
T18

Contd. Line 1

Contd. Line 1

PLAN

Scale 1:20000

T1

Contd. Line 1

Proposed Turbine Storage Area

PLAN

Scale 1:20000

Legend:

- EIAR Site Boundary
- Proposed Access Track
- Existing Access Track To Be Upgraded
- Existing Access Track
- Proposed Grid Connection Route
- Proposed Turbine
- Proposed Construction Compound
- Proposed Substation
- Proposed Met Mast
- Proposed Borrow Pit
- Proposed Peat Placement

Cut / Fill Legend:

- Areas of Cut
- Areas of Fill

Scale (@ A3) 1:20000

Date - 16.02.23

FIGURE 11-1 : PLAN DRAWING OF CUT FILL EARTHWORKS FOR SITE

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Checked - IH

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Thursday 16 February 2023

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CONSULTANTS IN ENGINEERING,
ENVIRONMENTAL SCIENCE & PLANNING

APPENDIX A

Assumptions for Cut & Fill Earthworks Assessment

Assumptions for Cut/Fill Earthwork Assessment

Main Infrastructure Locations

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

Table A1 provides a summary of the assumptions regarding the dig depths adopted for the cut/fill assessment for the main infrastructure elements at Sheskin South wind farm.

The assumed excavation footprint for the turbine foundation is the turbine base diameter of 23m plus 1m working room all around the base i.e. 25m.

Table A1: 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	493541	824049	2.8	4.0	2.8	3.1
T2	492484	824313	1.7	3.0	1.7	2.0
T3	493171	825359	1.3	3.0	1.3	1.6
T4	493318	824924	3.0	4.5	3.0	3.3
T5	492715	826139	2.6	4.0	2.6	2.9
T6	493000	825783	1.0	3.0	1.0	1.3
T7	493158	826709	2.1	3.5	2.1	2.4
T8	493355	827503	1.5	2.5	1.5	1.8
T9	493535	826353	1.0	3.0	1.0	1.3
T10	493769	824835	2.4	3.5	2.4	2.7
T11	493661	827239	1.3	3.0	1.3	1.6
T12	494691	828349	2.6	4.5	2.6	2.9
T13	494085	827802	2.4	4.0	2.4	2.7
T14	494563	827383	2.1	3.5	2.1	2.4
T15	494848	827929	2.0	3.5	2.0	2.3
T16	493115	824241	2.6	4.0	2.6	2.9
T17	492366	823822	2.2	3.5	2.2	2.5
T18	492870	823674	2.8	4.0	2.8	3.1
T19	493729	825892	1.4	3.0	1.4	1.7
T20	494796	826712	2.4	4.0	2.4	2.7

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]
T21	493929	825397	0.6	3.0	0.6	0.9
Infrastructure Element	**Easting**	**Northing**	**Average Peat Depth (m)**	**Max Dig depth for Infrastructure Element (m) [3] & [4]**		
Substation	494111	824433	2.4	2.7		
Construction Compound 1	494058	824104	2.5	2.8		
Construction Compound 2	493275	826243	1.2	1.5		
Construction Compound 3	493790	827608	1.2	1.5		
Construction Compound 4	495340	826865	0.8	1.1		
Met Mast	492700	825934	1.2	3.0		

Notes

(1) Founding depths for the turbines was assumed to be the average peat depth + 1m to a competent strata. To be confirmed at detailed design stage following confirmatory ground investigation. A minimum dig depth of 3m is assumed for each turbine foundation. For the purpose of this assessment it is assumed that all turbine foundations will be gravity type founded bases i.e. no piled foundations.

(2) Founding depths for the crane hardstands was assumed to be the average peat depth + 0.3m to a competent stratum. To be confirmed at detailed design stage following confirmatory ground investigation. In areas of steeper terrain (say greater than 10% gradient), for the crane hardstandings and for the purpose of this assessment, it was endeavoured to balance the earthworks for the footprint of the hardstands, where possible.

(3) For the construction compounds and substation the founding depth was assumed to be the average peat depth +0.3m to a competent stratum. To be confirmed at detailed design stage following confirmatory ground investigation. In areas of steeper terrain (say greater than 10% gradient), for the compounds and substation platform and for the purpose of this assessment, it was endeavoured to balance the earthworks for the footprint of the platforms, where possible.

(4) For the met mast the founding depth was assumed to be the average peat depth +1.0m to a competent stratum. To be confirmed at detailed design stage following confirmatory ground investigation.

(5) Note the maximum dig depths stated in the Table above are indicative and for information purposes only and are subject to confirmation at detailed design stage following a confirmatory ground investigation.

Access Roads

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

- Typical gradient requirements from turbine suppliers were assumed for the cut & fill assessment i.e. maximum gradients of 10 to 12%. A maximum gradient of 12% has been assumed for straight sections of access road on site.
- For the purpose of the assessment, it is assumed that the existing access tracks on site are 4m in width.
- There are 2 types of access tracks/roads proposed/present on site, which include:
    - Existing excavated and replace type access tracks - some excavation works as a result of localised widening will be required. It is assumed that widening will typically take place on both sides of the road. In areas of side long ground/steeper terrain (say greater than 5% gradient), widening of

existing tracks will take place on the upslope side of the road. Assumed dig depth to competent strata for both cases is 0.3m below the base of the peat.

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

Borrow Pits

The cut/fill assessment for the borrow pits is based on the cross-section drawings (Figure 5-1 and 5-2) included in this report. The borrow pits were sized to allow for the reinstatement of the excavated peat volume generated on site and to accommodate the estimated site-won stone fill requirements.

General Assumptions

A 1(v): 1(h) configuration for all excavation faces was assumed for the cut & 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 assumed.

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