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Appendix 11.4

Peat and Spoil Management plan

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PEAT & SPOIL MANAGEMENT PLAN

SHANCLOON WIND FARM

Prepared for:
RWE Renewables Ireland Limited

RWE

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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.100 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 Doireann Tarrant (FT Senior Project Engineer, MSc in Geotechnical Engineering) Senior Project Engineer with Fehily Timoney and has two years' professional experience in geotechnical engineering, and Aaron Clarke (BSc, MSc, MCSM, PGeo, EurGeol) FT Principal Geologist who has over 20 years' professional experience.

This report should be read in conjunction with the following EIAR appendices (Volume III):

- Appendix 11.1 - Geotechnical & Peat Stability Assessment
- Appendix 11.2 – Karst Assessment report
- Appendix 11.3 - Review of Stabilising techniques for floating road on peat
- Appendix 2.1 – Construction Environmental Management Plan (CEMP)

1.2 Project Description

The proposed Shancloon wind farm is located approximately 3.5 km east of the village of Shrule and approximately 8 km west of Tuam, Co. Galway.

The description of the Proposed Development is included in Chapter 2 – Development Description and is summarised as:

- The wind farm site (referred to in this EIAR as the 'Site') which includes the turbine array and associated civil and electrical infrastructure and the on-site 110 kV substation and loop-in connection to the existing Cashla-Dalton overhead line;
- The turbine delivery route (referred to in this EIAR as the 'TDR').

The Shancloon wind farm site comprises peat and agricultural land. The surrounding landscape is predominately flat with land-use comprising forestry, agricultural land and cutaway peatland.

The peat depth data was recorded by FT during the site walkovers carried out December 2021 and has been used in the assessment of peat stability for the proposed wind farm site.

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 intention of the report is to describe how peat and spoil which will be excavated from infrastructure locations such as turbine bases and roads and will be handled and placed/reinstated onsite in an appropriate manner.

The report also provides construction details for the types of roads which will be put in place at the site and associated 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 (noting however that risk at the site is classified as Low as per Appendix 11.1).

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 12 - Hydrology of Environmental Impact Assessment Report (EIAR) and associated surface water management plan (Appendix 12.2).

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 for example a floating access road, creep movement or localised erosion type events. Adherence to the peat and spoil management plan will minimise the potential for all such peat movements. However, it is noted that due to the soft ground nature of the peat terrain it is not possible to completely avoid localised peat movement.

2. CONSTRUCTION PACTIVITIES COVERED BY PEAT AND SPOIL MANAGEMENT PLAN

2.1 Construction Activities

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

1. Upgrade of existing access tracks (excavate and replace, and floating tracks)
2. Construction of new excavated roads through peat
3. Excavation and placement of arisings
4. Excavations in peat for turbine bases, hardstands and other infrastructure foundations
5. Excavations in peat 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 and are shown in accompanying Planning Drawings.

It should be noted that this report does not include a detailed design for the access roads on the Shancloon wind farm site. This report includes the most suitable type of road construction envisaged for each section of access road based on the ground/site conditions recorded during the site walkovers. Where floating roads are proposed in this report, a typical methodology is presented however a detailed design will be carried out prior to construction commencing on site. These recommendations are based on available guidance, such as 'Constructed Tracks in the Scottish Uplands (Scottish Natural Heritage, 2nd Edition ,2015), Floating Roads on Peat (Scottish Natural Heritage/Forestry Commission Scotland, 2010) and 'Dealing with Bearing Capacity Problems on Low Volume Roads Constructed on Peat (ROADEX II, 2004).

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	-	Varies	Upgrade existing excavated access roads to the required width and finished with a layer of selected granular fill – see Planning Drawing P20-306-0300-0016.
Construction of new excavated roads through peat	Type B	Typically, less than 1.5m, locally up to 3.0m	Varies	New access road construction technique envisaged for various locations on site – see Planning Drawing P20-306-0300-0016.
Construction of new floating roads over peat	Type C	>2.0	<5	New access road construction technique envisaged for various locations on site – see Planning Drawing P20-306-0300-0016.

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

3. UPGRADE OF EXISTING ACCESS ROADS – TYPE A

Minimal, localised sections of existing access tracks are present on the site. Upgrading works are likely to involve both widening and resurfacing of the existing access tracks. The proposed locations for upgrade of the existing access roads on site are shown in Site Layout Drawings P20-306-0100-0011 to P20-306-0100-0072.

3.1 Upgrading Existing Access Tracks Construction Methodology

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

1. (Access road construction shall be to the line and level requirements as per design/planning conditions.
2. For upgrading of existing excavated access roads (Type A) the following guidelines apply:
   a) Excavation of the widened section of access road should take place to a competent stratum beneath the peat (as agreed with the designer) and backfilled with suitable granular fill.
   b) Benching of the excavation may be required between the existing section of access road and the widened section of access road depending on the depth of excavation required.
   c) The surface of the existing access road should be overlaid with up to 500mm of selected granular fill.
   d) Access roads to be finished with a layer of capping across the full width of the track
   e) A layer of geogrid/geotextile may be required at the surface of the existing access road and at the base of the widened section of access road (to be confirmed by the designer).
   f) For excavations in peat, side slopes shall be not greater than 1 (v): 3 (h). This slope inclination should be reviewed during construction, as appropriate. Where areas of weaker peat are encountered then slacker slopes will be required to ensure stability.
3. The finished road width will have a running width of 5m, with wider sections on bends and corners.
4. On side long sloping ground any road widening works required will be done on the upslope side of the existing access road, where possible.
5. At transitions between new floating and existing excavated roads a length of about 10 to 20m shall have all peat excavated and replaced with suitable fill. The surface of this fill shall be graded to accommodate wind turbine construction and delivery traffic.
6. (For upgrading of existing access tracks constructed using a floated construction technique the following guidelines apply:
   a) The surface of the existing access track should be graded/tidied up prior to the placement any geogrid/geotextile, where necessary (to prevent damaging the geogrid/geotextile).
   b) Where granular fill has been used in the existing access track make-up, a layer of geogrid should be placed on top of the existing access track.
   c) (The geogrid may be overlaid with up to 500mm of selected granular fill.
   d) (Additional geogrid and granular fill may be required in certain sections of the works, such as where excessive rutting is noted in the existing track (to be confirmed by the designer).
7. On side long sloping ground any road widening works required will be done on the upslope side of the existing access road, where possible.

8. At transitions between new floating and existing excavated roads a length of about 10m shall have all peat excavated and replaced with suitable fill. The surface of this fill shall be graded to accommodate wind turbine construction and delivery traffic.
9. The finished road width will be 5.5m, including a running width of 5m, with wider sections on bends and corners.
10. 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.

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 Site Layout Drawings P20-306-0100-0011 to P20-306-0100-0072.

Excavate and replace type access roads are the conventional method for construction of access roads on peatland sites and the preferred construction technique in shallow peat provided sufficient placement/reinstatement capacity is available on site for the excavated peat.

4.1 Excavated Road Construction Methodology

This methodology includes procedures that are to be included in the construction to minimise any adverse impact on peat stability. The methodology is not intended to cover all aspects of construction such as drainage and environmental considerations, which are discussed in Chapter 11 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 swill 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. 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. Alternatively, peat will be side-cast local to the excavation or along adjacent access roads.
6. Excavation of materials with respect to control of peat stability:
    a) Acrotelm (to about 0.3 to 0.4m of peat) is generally required for landscaping and will be stripped and temporarily stockpiled for re-use as required. Acrotelm stripping will be undertaken prior to main excavations.
    b) Where possible, the acrotelm shall be placed with the vegetation part of the sod facing the right way up to encourage growth of plants and vegetation.
    c) All catotelm peat (peat below about 0.3 to 0.4m depth) shall be transported immediately on excavation to the designated placement areas.
7. Side slopes in peat shall be not greater than 1 (v): 3 (h). This slope inclination will be reviewed during construction, as appropriate. Where areas of weaker peat are encountered then slacker slopes will be required. Battering of the side slopes of the excavations will be carried out as the excavation progresses.
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 to 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. At transitions between floating and excavated roads a length of road of about 10m 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.
13. 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.
14. A final surface layer shall be placed over the excavated road and graded to accommodate wind turbine construction and delivery traffic.

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

Floating roads will be used in areas where the peat depth is in excess of 1.0m. The use of new floated access tracks will be limited on site to areas of flatter terrain, i.e., less than a 5 degree slope. The proposed locations for floating roads across the are shown in Site Layout Drawings P20-306-0100-0011 to P20-306-0100-0072.

A confirmatory stability analysis should be carried out by the designer where it is proposed to install floating access roads over the peat prior to any construction work commencing on site.

Floating roads minimise impact on the peat, particularly peat hydrology. As there is no excavation required no peat arisings are generated. However, where the underlying peat has insufficient bearing capacity or due to topographic restrictions an excavate and replace type access road may be more suitable (see Section 6), although this is not anticipated at the location of the floated roads.

5.1 Floating Road Construction Methodology

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

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

1. Prior to commencing floating road construction movement monitoring posts will be installed in areas where the peat depth is greater than 2.0m.
2. Base geogrid to be laid directly onto the existing peat surface along the line of the road in accordance with geogrid provider's requirements.
3. Construction of road to be in accordance with appropriate design from the designer.
4. The typical make-up of the new floated access road is up to 1,000mm of selected granular fill with 2 no. layers of geogrid with possibly the inclusion of a geotextile separator (see Planning Drawings for detail).
5. Granular fill to be placed and compacted in layers in accordance with the TII Specification for Road Works, Series 600 (2013).
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 5.5m (5.0m running width), with wider sections on bends and corners.
8. Stone delivered to the floating road construction shall be end-tipped onto the constructed floating road. Direct tipping of stone onto the peat shall not be carried out.
9. To avoid excessive impact loading on the peat due to concentrated end-tipping all stone delivered to the floating road shall be tipped over at least a 10m length of constructed floating road.
10. Where it is not possible to end-tip over a 10m length of constructed floating road then dumpers delivering stone to the floating road shall carry a reduced stone load (not greater than half full) until such time as end-tipping can be carried out over a 10m length of constructed floating road.
11. Following end-tipping a suitable bulldozer shall be employed to spread and place the tipped stone over the base geogrid along the line of the road.

12. A final surface layer shall be placed over the full width of the floating road, as per design requirements, to provide a road profile and graded to accommodate wind turbine construction and delivery traffic.

6. GENERAL CONSTRUCTION GUIDELINES FOR ACCESS ROADS

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

1. Where an open ditch is present alongside an existing/proposed floating access track, the ditch may need to be filled prior to upgrading/constructing the access track. The ditch shall be filled with suitable drainage stone. As applicable, a perforated pipe shall be laid into a ditch prior to filling so as to maintain water flow within the ditch.
2. Where existing drainage crosses the road then it will be necessary to ensure that this drainage is not affected by settlement of the upgraded access road. Cross drains comprising flexible perforated pipes within a permeable stone fill surround will be used to maintain the existing drainage.
3. No excavations (e.g. drainage, peat cuttings) shall be carried out within 5m distance of a completed floated access road edge, or at a distance determined following site inspection. The presence of excavations can destabilise the road. Temporary excavations should be excavated in short lengths and backfilled as soon as practicable.
4. Floating roads shall not be constructed on areas of sidelong ground.
5. No stockpiling of materials shall take place on or adjacent to floated access roads so as to avoid bearing failure of the underlying peat.
6. 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.
7. Due to the nature of floating road construction, it will be necessary to monitor the settlement/movement of the road. Survey points will be located along the road at 10m intervals in areas of deep peat (greater than 2m). These survey points shall be surveyed on a weekly basis, possibly more frequently when construction activities are ongoing in the area.
8. It is recommended that the construction and upgrading of access roads in areas of deep peat (greater than 2m) is inspected on a routine basis during the works, particularly before/following trafficking by heavy vehicular loads.
9. In the event of excessive vertical displacement of the road during/following construction then mitigation measures may be required to ensure the stability of the road. This may include:
    a) Introduction of pressure berms either side of the road (that are 2 to 5m wide by 0.5m deep stone layer).
    b) Where peat is relatively shallow then excavate peat and replace with suitable fill.
    c) Slowing the rate of construction.
10. Settlement of a floated access road is expected and will likely be in the order of several 100mm in the deeper peat areas; as such it may be necessary to re-level the road at convenient intervals during the works. The magnitude and extent of settlement is likely to be greater in areas of deeper peat with the rate of settlement reducing over time. Prior to completion of the works, it is recommended that measures are taken to re-level the road, as necessary.

7. EXCAVATION AND STORAGE OF PEAT AND SPOIL

The site has been extensively harvested by Bord na Móna using mechanical cutting resulting in well drained and extensively trafficked peat. Bord na Móna has considerable experience in the handling of peat in these circumstances, both during peat production operations and during the rehabilitation processes associated with its cutaway bogs. This experience has shown that when the handling and moving of such peat is appropriately managed, stability or environmental issues are not expected to arise.

7.1 Excavation and Storage 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, which are described in Chapter 4 of the EIAR.

1. All excavated peat and spoil will be placed on site as landscaping around the turbines, side casting of access roads and in designated peat storage areas. Haulage of excavated peat and spoil across the local road at Demesne Cottages will be kept to a minimum.
2. Further details on the placement of excavated material to designated spoil areas close to turbines are given in Section 7.5.
3. Some of the peat, in particular the acrotelm (upper layer of the peat), excavated during construction will be used for landscaping purposes.

7.2 Summary of Peat and Spoil Volumes on Site

A summary of the excavated peat and spoil volumes calculated for the proposed Shancloon wind farm site are given in Table 7.1, with the detailed calculations presented in Appendix A of this report.

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

Infrastructure Element (1)	Typical Dimensions	Peat Volume (m^3) (2)	Spoil (non-peat) Volume (m^3) (2) and (3)	Comment
11 no. Turbines and Hardstands	27m diameter excavation footprint for turbine foundation with hardstand area.	97,731	39,470	Hardstanding area and foundation footprint
Access Roads	Assumed 5m running surface with 6m wide development footprint.	2,443	19,726	
Temporary Construction Compound 1 (East)	1 no. Hardstanding areas (total area 12,400m^2).	0	13,640	

Infrastructure Element (1)	Typical Dimensions	Peat Volume (m^3) (2)	Spoil (non-peat) Volume (m^3) (2) and (3)	Comment
Temporary Construction Compound 2 (West)	1 no. Hardstanding areas (total area 3,600m^2).	0	3960	
Substation	Hardstanding area of (14,725m^2)	0	9,094	
Met Mast	Total area 900m^2	0	990	
Doline	Surface karst Feature approx. 4 no. 20m diameter	0	4,147	
	Total =	**100,174m^3**	**91,027m^3**	**Total = 191,201m^3 (peat and spoil volume) (4)**

Note (1) The location of the infrastructure elements on site are shown on 100-Series Planning Drawings.
Note (2) A factor of 15% (bulking factor of 10% and 5% contingency) has been applied to the excavated peat volumes and a factor of 10% (5% bulking factor and 5% contingency) has been added to spoil volumes to allow for expected increase in volume upon excavation and to allow for a variation in ground conditions across the site.
Note (4) It should be noted that the excavated rock volume is not included in the total volume quoted above in Table 7.1, see the cut-fill assessment in Section 13 of this report for further details. It is assumed that the excavated rock volume will be re-used on site as part of the construction works for the development and hence will not require reinstatement on site.

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

A summary of the potential peat and spoil placement/reinstatement areas at the Shancloon wind farm site are given in Table 7.2. Note in order to limit the requirement to cross the local road network for the purposes of peat and spoil movement, the Site has been delineated into a western and eastern parcel for spoil management.

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

Location (1)	Peat and Spoil Volume (m^3)	Comment
Peat placement alongside designated access roads	0	No Peat shall be placed along access roads.
Designated Peat storage area West (A)	11,625	See Drawing P20-306-0100-0011 to P20-306-0100-0073 for further details.
Designated Peat storage area West (B)	27,875	

Location [1]	Peat and Spoil Volume (m^3)	Comment
Designated Peat storage area West (C)	37,625	
Designated Peat storage area West (D)	16,750	
Designated Peat storage area West (E)	7,400	
Designated Peat storage area West (F)	6,875	
Designated Peat storage area East	50,000	
Designated Peat storage area near T11	3,150	
Landscaping [2]	22,000	It is estimated that approximately 2,000m^3 of peat will be required for landscaping purposes at each of the 11 no. turbine locations.
Total =	**192,550m^3**	

Note (1) The location of the proposed designated peat storage areas at the site are shown on Drawing P20-306-0600-XXXX-0009.
Note (2) Some of the acrotelm (upper layer of the peat) excavated during construction will be used for landscaping purposes.

7.4 Designated Peat Placement Areas alongside Infrastructure Elements

The following recommendations/best practice guidelines for the placement of peat alongside the proposed infrastructure elements will be considered and taken into account during construction.

1. The peat placed adjacent to the proposed turbine hardstandings as part of landscaping should be restricted to a maximum height of 1.5m. It should be noted that the designer should define/confirm the maximum restricted height for the placed peat.
2. The placement of excavated peat and spoil is to be avoided without first establishing the adequacy of the ground to support the load. The placement of peat within the placement areas will likely require the use of long reach excavators, low ground pressure machinery and possibly bog mats in particular for drainage works.
3. 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.
4. The surface of the placed peat will be shaped to allow efficient run-off of surface water. Where possible, shaping of the surface of the peat should be carried out as placement of peat within the placement area progresses. This will reduce the likelihood of debris run-off and ensure stability of the placed peat.
5. Finished/shaped side slopes in the placed peat shall be not greater than 1 (v): 3 (h). This slope inclination will be reviewed during construction, as appropriate. Where areas of weaker peat and spoil are encountered then slacker slopes will be required.
6. 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 within the placement areas.
7. Movement monitoring instrumentation may be required where peat has been placed. The locations where monitoring is required will be identified by the designer on site.
8. An interceptor drain will be installed upslope of the designated peat placement areas to divert any surface water away from these areas. This will reduce the likelihood of debris run-off.
9. All the above-mentioned general guidelines and requirements should be confirmed by the designer prior to construction.

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

Turbine foundations, crane hardstandings, construction compound, substation platforms and met mast foundations will require excavation through peat and spoil.

8.1 Methodology

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

1. (With respect to placement of arisings from excavations the commitments given in Section 7 are to be followed.
2. All excavations within peat are to be adequately supported or peat slopes are to be battered to a safe slope inclination typically of 1 (v): 3 (h). This slope inclination will be reviewed during construction, as appropriate. Where areas of weaker peat are encountered then slacker slopes will be required.
3. Excavations shall be kept reasonably free from water at all times. Water should be prevented from being impounded within excavations by either using drainage channels cut into the excavation face or by pumping.
4. Where water is channelled or pumped from an excavation then this water is to be managed as per the Surface Water Management Plan (Appendix 12.2, Volume III of the EIAR).

9. EXCAVATIONS FOR UNDERGROUND CABLES

A connection between the Shancloon Wind Farm and the national electricity grid will be necessary to export electricity. It is proposed that the Shancloon Wind Farm will connect to the national grid via a new substation located in the east of the proposed wind farm development. The new substation will be connected to existing overhead line via a loop-in connection.

The proposed grid connection construction methodology, including proposals for water crossings of the 33kV network, on the underground cabling route is described in the EIAR.

It is proposed to excavate the trenches for the underground cable at a uniform level in peat or other overburden material. The trenches will be 900mm wide and 1315mm deep.

The 33kV cable trench route is envisaged to encounter peat, the 110kV route is not envisaged to encounter peat.

9.1 Methodology

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

1. With respect to placement of arisings from excavations the guidelines given in Section 7 are to be followed.
2. It is proposed to excavate the trenches for the underground cable at a uniform depth in peat or other overburden material.
3. All excavations within peat are to be adequately supported or peat slopes are to be battered to a safe slope inclination typically of 1 (v): 3 (h). This slope inclination will be reviewed during construction, as appropriate. Where areas of weaker peat are encountered then slacker slopes will be required.
4. Similarly, all excavations within non-peat overburden for the cable trench are to be adequately supported or battered to a safe slope inclination typically of 1 (v): 1.5 or 2 (h). This slope inclination will be reviewed during construction, as appropriate.
5. Excavations shall be kept reasonably free from water at all times.
6. Any material excavated from the cable trench which is deemed suitable for reinstatement of the trench will be used for this purpose i.e. stockpiled locally to the works and reused for backfilling.
7. Any material not deemed suitable for the reinstatement of the cable trench will be landscaped locally to the trench, where possible.

10. GENERAL RECOMMENDATIONS FOR GOOD CONSTRUCTION PRACTICE

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

1. 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 in accordance with Appendix 12.2 – Surface Water management Plan.
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).

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 2.5m. Additional monitoring locations may be required at infrastructure locations with deeper peat deposits. Details of sighting posts are given below.

1. A line of sighting posts shall comprise:
   a) A line of wooden stakes (typically 1.0 to 1.5m long) placed vertically into the peat to form a straight line.
   b) The sighting line shall comprise 6 no. posts at 5m centres that is a line some 25m long.
   c) A string line shall be attached to the first and last posts and all intervening posts shall be adjusted so they are just touching the string line.
2. Lines of sighting posts shall be placed across the existing slope about 5m away from the area to be worked. It is recommended that the posts are located along the road at 10m intervals in areas of deep peat (say greater than 2.0m). Where there are relatively steeper slopes or softer ground a sighting line shall be placed down the slope, or at any location where monitoring would be deemed useful.
3. Each line of sighting posts shall be uniquely referenced with each post in the line given a reference. The post reference shall be marked on each post (e.g. reference 1-1, 1-2, 1-3, 1-4, 1-5, 1-6 for posts in line 1).
4. The sighting lines shall be monitored at the beginning of each working day, and during the day when working activity is concentrated at a specific location e.g. at Cloonbar Bog.
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 (Contractor/Engineer/Designer).

12.2 Onset of Peat Slide

In the unlikely event where there is the onset or actual detachment of peat (e.g. cracking, surface rippling) then the following shall be carried out.

1. On alert of a peat slide incident, all activities (if any) in the area should cease and all available resources will be diverted to assist in the required mitigation procedures.
2. Action will be taken to prevent a peat slide reaching any watercourse. This will take the form of the construction of check barrages on land. Due to the terrain and the inability to predict locations it may not be possible to implement any on-land prevention measures, in this case a watercourse check barrage will be implemented.
3. All relevant authorities (NPWS, Local Authority, IFI and EPA) should be notified if a peat slide event occurs on site.
4. For localised peat slides that do not represent a risk to a watercourse and have essentially come to rest the area will be stabilised initially by rock infill, if required. The failed area and surrounding area will then be assessed by the engineering staff and stabilisation procedures implemented. The area will be monitored, as appropriate, until such time as movements have ceased.

12.3 Check Barrages

Whilst it is not anticipated from the analysis undertaken that a peat slide will occur on site, as a contingency a check barrage procedure is included below.

The check barrage procedure deals with preventing a peat slide from moving downstream within a watercourse.

The most effective method of preventing excessive peat slide debris from travelling downstream in a watercourse is the use of a check barrage. A check barrage comprises the placement of rock fill across a watercourse. The check barrage is a highly permeable construction that will allow the passage of water but will prevent peat debris from passing through. Rock fill should comprise well-graded coarse rock pieces from about 300mm up to typically 1000mm.

The rock fill for the check barrage will be sourced locally from licensed quarries and the material stored with Temporary Construction Compound # 1.

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

Typically, the check barrage should fill the entire channel width of the watercourse up to a height of 3 to 4m with a crest width of typically 2m and side slopes of about 45 degrees depending on the geometry of the barrage location.

The check barrage procedure is as follows:

1. Access to the check barrage location shall be along the existing access roads on the wind farm site and/or along public roads, where possible. When it is necessary to form the barrage then rock fill will be placed across the watercourse to effectively block the passage of peat debris.
2. (Operatives employed to carry out the construction of the check barrage would need to be inducted by means of a briefing by on-site supervisors as to the proposed location of the check barrage.
3. The check barrage provides containment for peat debris in the highly unlikely event of a major peat slide. Further remedial measures, should they be required, will be assessed by the Contractor and the Project Geotechnical Engineer and carried out as soon as physically possible when the location and extent of the failure is established.
4. Where a barrage was constructed as a precaution and no peat debris reached the watercourse then the barrage should be removed as soon as any measures to prevent further peat sliding is agreed with all parties (Contractor/Engineer/Designer).

13. REFERENCES

Munro, R, 2004. Dealing with bearing capacity problems on low volume roads constructed on peat. Roadex II Northern Periphery.

Scottish Natural Heritage/Forestry Commission Scotland, 2010. Floating Roads on Peat.

Scottish Natural Heritage, 2015. Constructed Tracks in the Scottish Uplands. Scottish Natural Heritage.

FEHILY TIMONEY

DESIGNING AND DELIVERING
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APPENDIX A

Calculations for Estimates Peat and Spoil Volumes

Infrastructure Element	Typical Plan Area of Foundation (m^2)	Average Peat Depth (m)	Peat Volume (m^3) - Unfactored	Peat Volume (m^3) - Factored for Bulking & Contingency (15% - total)	Average Spoil Depth (m)	Spoil Volume (m^3) - Unfactored	Spoil Volume (m^3) - Factored for Bulking & Contingency (10% - total)	Comment
T1	452	3.00	1,356		0.00	0		Assumes min. excavation depth of 3m. Piled foundation
T2	452	0.40	181		2.60	1,176		Assumes min. excavation depth of 3m. Piled foundation
T3	452	0.00	0		3.00	1,356		Assumes min. excavation depth of 3m.Piled foundation
T4	452	0.00	0		3.00	1,356		Assumes min. excavation depth of 3m.Piled foundation
T5	452	1.70	769		1.30	588		Assumes min. excavation depth of 3m.Piled foundation
T6	452	0.00	0		3.00	1,356		Assumes min. excavation depth of 3m. Piled foundation
T7	452	3.00	1,356		0.00	0		Assumes min. excavation depth of 3m. Piled foundation
T8	452	0.00	0		3.00	1,356		Assumes min. excavation depth of 3m. Piled foundation
T9	452	0.00	0		3.00	1,356		Assumes min. excavation depth of 3m.Piled foundation
T10	452	2.80	1,266		0.50	226		Assumes min. excavation depth of 3m.Piled foundation
T11	452	3.00	1,356		0.50	226		Assumes min. excavation depth of 3m. Piled foundation
Hardstand at T1	4,480	5.07	27,238		0.00	0		Min. 1000mm stone thickness assumed at all hardstands or max peat depth whichever is greater
Hardstand at T2	4,480	0.10	448		0.90	4,032		Min. 1000mm stone thickness assumed at all hardstands or max peat depth whichever is greater
Hardstand at T3	4,480	0.00	0		1.00	4,480		Min. 1000mm stone thickness assumed at all hardstands or max peat depth whichever is greater
Hardstand at T4	4,480	0.00	0		1.00	4,480		Min. 1000mm stone thickness assumed at all hardstands or max peat depth whichever is greater
Hardstand at T5	4,480	1.70	7,616		0.00	0		Min. 1000mm stone thickness assumed at all hardstands or max peat depth whichever is greater
Hardstand at T6	4,480	0.00	0		1.00	4,480		Min. 1000mm stone thickness assumed at all hardstands or max peat depth whichever is greater
Hardstand at T7	4,480	4.60	24,730		0.00	0		Min. 1000mm stone thickness assumed at all hardstands or max peat depth whichever is greater
Hardstand at T8	4,480	0.00	0		1.00	4,480		Min. 1000mm stone thickness assumed at all hardstands or max peat depth whichever is greater
Hardstand at T9	4,480	0.00	0		1.00	4,480		Min. 1000mm stone thickness assumed at all hardstands or max peat depth whichever is greater
Hardstand at T10	4,480	2.80	12,544		0.00	0		Min. 1000mm stone thickness assumed at all hardstands or max peat depth whichever is greater
Hardstand at T11	4,480	3.30	14,784		0.00	0		Min. 1000mm stone thickness assumed at all hardstands or max peat depth whichever is greater
Turbine Sub-total			**93,645**	107,692		**35,430**	38,973	
Temp Construction Compound 2 (West)	3,600	0.00	0		0.00	0	0	Min. 1000mm stone thickness assumed at construction compound or max peat depth whichever is greater. Assume Floated construction
Temp Construction Compound 1 (East)	12,400	0.00	0		0.00	0	0	Min. 1000mm stone thickness assumed at construction compound or max peat depth whichever is greater Assume Floated construction
Met mast 1	900	0.00	0		1.00	900	990	Min. 1000mm stone thickness assumed at construction compound or max peat depth whichever is greater
Substation (Cut)	6832	0	0		0.00	4,321	4,753	Assumed no overdig required. Cut volume of 4321m^3 provided by Client.
Substation (Fill)	7893	0	0		0.50	3,947	4,341	min. 500mm topsoil to be removed before fill is placed
Dolines	1,257	0	0		3.00	3,770	4,147	20m diameter average and 3m to be excavated. Assumes 4 no. dolines
All access roads	-	-	2,124	2,443		17,933	19,726	See seperate tab for breakdown of volumes.
Total Excavated Peat Volume =			**95,769**	**110,134**		**66,300**	**72,930**	

Infrastructure Element	Typical Plan Area	Height of Placed Peat	Total Storage Volume (m^3)	Peat Storage Volume (m^3)	Spoil Storage Volume (m^3)
West Storage Area (A)	4,650	2.50	11,625	11,625	0
West Storage Area (B)	11,150	2.50	27,875	27,875	
West Storage Area (C)	15,050	2.50	37,625	37,625	
West Storage Area (D)	6,700	2.50	16,750	16,750	
West Storage Area (E)	7,400	1.00	7,400	0	7,400
West Storage Area (F)	2,750	2.50	6,875	4,125	2,750
West Storage Area (G)	3,700	2.50	9,250	0	9,250
East Storage Area	20,000	2.50	50,000	0	50,000
T11 Storage Area	3,150	1.00	3,150	3,150	
Landscaping	-	-	22,000	11,275	10,725
Available Peat & Spoil Storage on Site (m^3)			192,550		
Required Peat & Spoil Storage on Site (m^3)			183,064		
Total Off-Site Peat & Spoil Volume (m^3)			0	0	0
Total On-Site Peat & Spoil Storage Volume (m^3)			**183,064**	112,425	80,125

Infrastructure Element	Typical Plan Area of Foundation (m^2)	Average Peat Depth (m)	Peat Volume (m^3) - Unfactored	Peat Volume (m^3) - Factored for Bulking & Contingency (15% - total)	Comment
T1	452	3.00	1,356		Min 24m excavation footprint. Average peat depth 7.9m. Piled foundation
T2	452	0.40	181		Min 24m excavation footprint. Max peat depth used.Average peat depth 0.1m
T3	452	0.00	0		Min 24m excavation footprint. No peat
T4	452	0.00	0		Min 24m excavation footprint. No peat
T5	452	1.70	769		Min 24m excavation footprint. Max peat depth used.
T6	452	0.00	0		Min 24m excavation footprint. No peat
T7	452	3.00	1,356		Min 24m excavation footprint. Average peat depth 5.9m. Piled foundation
T8	452	0.00	0		Min 24m excavation footprint. No peat
T9	452	0.00	0		Min 24m excavation footprint. No peat
T10	452	2.80	1,266		Min 24m excavation footprint. Max peat depth used.
T11	452	3.00	1,356		Min 24m excavation footprint. Average peat depth 4.9m. Piled foundation
Hardstand at T1	4,480	5.1	27,238		Area advised by Project Team. Average peat depth over footprint used.
Hardstand at T2	4,480	0.10	448		Area advised by Project Team. Average peat depth over footprint used.
Hardstand at T3	4,480	0.00	0		Area advised by Project Team. Average peat depth over footprint used.
Hardstand at T4	4,480	0.00	0		Area advised by Project Team. Average peat depth over footprint used.
Hardstand at T5	4,480	1.70	7,616		Area advised by Project Team. Average peat depth over footprint used.
Hardstand at T6	4,480	0.00	0		Area advised by Project Team. Average peat depth over footprint used.
Hardstand at T7	4,480	4.60	24,730		Area advised by Project Team. Average peat depth over footprint used.
Hardstand at T8	4,480	0.00	0		Area advised by Project Team. Average peat depth over footprint used.
Hardstand at T9	4,480	0.00	0		Area advised by Project Team. Average peat depth over footprint used.
Hardstand at T10	4,480	2.80	12,544		Area advised by Project Team. Average peat depth over footprint used.
Hardstand at T11	4,480	3.30	14,784		Area advised by Project Team. Average peat depth over footprint used.
Turbine Sub-total			**93,645**	107,692	
Temp Construction Compound 2 (West)	3,600	0.00	0		No mapped peat. Assume floated construction
Temp Construction Compound 1 (East)	12,400	0.00	0		Peat depth assumed based on aerial photos. No peat probe data. Assume floated construction
Met mast 1	900	0.00	0		No mapped peat.
Substation (Cut)	6,832	0.00	0		No mapped peat.
Substation (Fill)	7,893	0.00	0		
Dolines	1,257	0.00	0		20m diameter average and 3m to be excavated
All access roads	-	-	2,124		See seperate tab for breakdown of volumes
Total Excavated Peat Volume =			**95,769**	**110,134**	
Infrastructure Element	**Typical Plan Area**	**Height of Placed Peat**	**Total Storage Volume (m^3)**	**Peat Storage Volume (m^3)**	
West Storage Area (A)	4650	2.5	11625	11625	**2.5 high storage area with 3.5m high bund**
West Storage Area (B)	11150	2.5	27875	27875	**3m high storage area with 3.5m high bund**
West Storage Area (C)	15050	2.5	37625	37625	**3m high storage area with 3.5m high bund**
West Storage Area (D)	6700	2.5	16750	16750	**3m high storage area with 3.5m high bund**
West Storage Area (E)	7400	1	7400	0	**Approximately 3.0m of insitu peat**
West Storage Area (F)	2750	2.5	6875	4125	
West Storage Area (G)	3700	2.5	9250	0	
T11 Storage Area	3150	1	3150	3150	
Landscaping	-	-	22,000	11,275	**2,000m^3** required at each of the 11 no. turbine locations
Total Peat Storage Volume =				**112,425**	

Infrastructure Element	Typical Plan Area of Foundation (m^2)	Average Peat Depth (m)	Peat Volume (m^3) - Unfactored	Peat Volume (m^3) - Factored for Bulking & Contingency (25% - total)	Average Stone Depth (m)	Stone Volume (m^3) - Unfactored	Stone Volume (m^3) - Factored for 25% Contingency	Comment
T1	452	3.00	1,356		0.50	226		500mm stone thickness assumed at all turbine bases
T2	452	0.40	181		0.50	226		
T3	452	0.00	0		0.50	226		
T4	452	0.00	0		0.50	226		
T5	452	1.70	769		0.50	226		
T6	452	0.00	0		0.50	226		
T7	452	3.00	1,356		0.50	226		
T8	452	0.00	0		0.50	226		
T9	452	0.00	0		0.50	226		
T10	452	2.80	1,266		0.50	226		
T11	452	3.00	1,356		0.50	226		
Hardstand at T1	4480	5.1	27238		5.07	22,699	28,373	Min. 1000mm stone thickness assumed at all hardstands or max peat depth whichever is greater
Hardstand at T2	4480	0.1	448		1.00	4,480	5,600	
Hardstand at T3	4480	0	0		1.00	4,480	5,600	
Hardstand at T4	4480	0	0		1.00	4,480	5,600	
Hardstand at T5	4480	1.7	7616		1.70	7,616	9,520	
Hardstand at T6	4480	0	0		1.00	4,480	5,600	
Hardstand at T7	4480	4.6	24729.6		4.60	20,608	25,760	
Hardstand at T8	4480	0	0		1.00	4,480	5,600	
Hardstand at T9	4480	0	0		1.00	4,480	5,600	
Hardstand at T10	4480	2.8	12544		2.80	12,544	15,680	
Hardstand at T11	4480	3.3	14784		3.30	14,784	18,480	
Turbine Sub-total			**93,645**			**107,618**		
Temp Construction Compound 2 (West)	3600	0	0		1.00	3,600	4,500	
Temp Construction Compound 1 (East)	12400	0	0		1.00	12,400	15,500	
Met mast 1	900	0	0		1.00	900	1,125	Min. 1000mm stone thickness assumed at construction compound or max peat depth whichever is greater
Substation (Cut)	6832	0	0		0.00	0	0	
Substation (Fill)	7893	0	0		1.00	7,893	9,866	
Dolines	1257	0	0		3.00	3,770	4,712	
All access roads	-	-	2,124		1.00	37,853	47,316	See seperate tab for breakdown of volumes
Total Excavated Peat & Stone Volume =			**95,769**	**119,711**		**174,033**	**217,541**	

Road Element	Length	Area (m2)	Average Stone depth (m)	FTC - Volume of Stone (m3)	Stone Volume (m^3) -Factored for 25% Contingency
New Roads					
existing (widening)	3565	17,825	0.5	8,913	
new track	8390	41950	0.5	20,975	
floating roads	1770	7080	0.75	7,965	
Total Access Roads				**37,853**	**47316**

Road Element	Length	Area (m2)	Average Peat depth (m)	Average Spoil depth (m)	FTC - Volume of Peat (m3)	FTC - Volume of Spoil (m3)
Roads						
existing (widening)	3565	17,825	0	0.30	0	5,348
new track	8390	41,950	0	0.30	0	12,585
floating roads	1770	7,080	0.3	-	2,124	-
Total Access Roads					**2,124**	**17,933**

Infrastructure Element	Typical Plan Area of Foundation (m^2)	Average Peat Depth (m)	Peat Volume (m^3) - Unfactored	Peat Volume (m^3) - Factored for Bulking & Contingency (15% - total)	Average Spoil Depth (m)	Spoil Volume (m^3) - Unfactored	Spoil Volume (m^3) - Factored for Bulking & Contingency (10% - total)	Comment
T1	452	3.00	1356		0.00	0		Assumes 0.5m D&R beneath peat and 6N upfill beneath pile mat and a min. excavation depth of 3m.
T2	452	0.40	181		2.60	1176		Assumes min. excavation depth of 3m.
T3	452	0.00	0		3.00	1356		Assumes min. excavation depth of 3m.
T4	452	0.00	0		3.00	1356		Assumes min. excavation depth of 3m.
					0.50			
Hardstand at T1	4,480	5.07	27238		0.00	0		Min. 1000mm stone thickness assumed at all hardstands or max peat depth whichever is greater
Hardstand at T2	4,480	0.10	448		0.90	4,032		Min. 1000mm stone thickness assumed at all hardstands or max peat depth whichever is greater
Hardstand at T3	4,480	0.00	0		1.00	4,480		Min. 1000mm stone thickness assumed at all hardstands or max peat depth whichever is greater
Hardstand at T4	4,480	0.00	0		1.00	4,480		Min. 1000mm stone thickness assumed at all hardstands or max peat depth whichever is greater
Turbine Sub-total			**29,224**			**16,881**		
Temp Construction Compound 2 (West)	3,600	0.00	0.00		0.00	0		Min. 1000mm stone thickness assumed at construction compound or max peat depth whichever is greater
Met mast 1	900	0.00	0.00		1.00	900		Min. 1000mm stone thickness assumed at construction compound or max peat depth whichever is greater
Substation (Cut)	6832	0	0		-	4321		Assumed no overdig required. Cut volume of 4321m3 provided by Client.
Substation (Fill)	7893	0	0		0.50	3947		min. 500mm topsoil to be removed before fill is placed
All access roads	-	-	850			7173		See seperate tab for breakdown of volumes.
Total Excavated Peat Volume =			**30,073**	**34,584**		**33,221**	**36,543**	

Infrastructure Element	Typical Plan Area	Height of Placed Peat	Total Storage Volume (m^3)	Peat Storage Volume (m^3)	Spoil Storage Volume (m^3)
West Storage Area (A)	4650	2.5	11625	11625	0
West Storage Area (B)	11150	2.5	27875	27875	0
West Storage Area (C)	15050	2.5	37625	37625	0
West Storage Area (D)	6700	2.5	16750	16750	0
West Storage Area (E)	7400	1	7400	0	7400
West Storage Area (F)	2750	2.5	6875	4125	2750
West Storage Area (G)	3700	2.5	9250	0	9250
Landscaping	-	-	8,000	6,000	2,000
Total Storage Volume (m^3)			**125,400**	**71,128**	
Surplus Peat and Spoil Storage Volume (m^3)			-54,272		

Infrastructure Element	Typical Plan Area of Foundation (m^2)	Average Peat Depth (m)	Peat Volume (m^3) - Unfactored	Peat Volume (m^3) - Factored for Bulking & Contingency (15% - total)	Average Spoil Depth (m)	Spoil Volume (m^3) - Unfactored	Spoil Volume (m^3) - Factored for Bulking & Contingency (10% - total)	Comment
T5	452	1.70	769		1.30	588		Assumes min. excavation depth of 3m.
T6	452	0.00	0		3.00	1356		Assumes min. excavation depth of 3m.
T7	452	3.00	1356		0.00	0		Assumes 0.5m D&R beneath peat and 6N upfill beneath pile mat and a min. excavation depth of 3m.
T8	452	0.00	0		3.00	1356		Assumes min. excavation depth of 3m.
T9	452	0.00	1		3.00	1356		Assumes min. excavation depth of 3m.
T10	452	2.80	1266		0.50	226		Assumes min. excavation depth of 3m.
T11	452	3.00	1356		0.50	226		Assumes 0.5m D&R beneath peat and 6N upfill beneath pile mat and a min. excavation depth of 3m.
Hardstand at T5	4,480	1.70	7616		0.00	0		Min. 1000mm stone thickness assumed at all hardstands or max peat depth whichever is greater
Hardstand at T6	4,480	0.00	0		1.00	4480		Min. 1000mm stone thickness assumed at all hardstands or max peat depth whichever is greater
Hardstand at T7	4,480	4.60	24730		0.00	0		Min. 1000mm stone thickness assumed at all hardstands or max peat depth whichever is greater
Hardstand at T8	4,480	0.00	0		1.00	4480		Min. 1000mm stone thickness assumed at all hardstands or max peat depth whichever is greater
Hardstand at T9	4,480	0.00	0		1.00	4480		Min. 1000mm stone thickness assumed at all hardstands or max peat depth whichever is greater
Hardstand at T10	4,480	2.80	12544		0.00	0		Min. 1000mm stone thickness assumed at all hardstands or max peat depth whichever is greater
Hardstand at T11	4,480	3.30	14784		0.00	0		Min. 1000mm stone thickness assumed at all hardstands or max peat depth whichever is greater
Turbine Sub-total			**64,422**			**18,549**		
Temp Construction Compound 1 (East)	12,400	0.00	0		1.00	12,400		Min. 1000mm stone thickness assumed at construction compound or max peat depth whichever is greater
Dolines	1,257	0.00	0		3.00	3,770		20m diameter average and 3m to be excavated
All access roads	-	-	1,274			10,760		See seperate tab for breakdown of volumes.
Total Excavated Peat Volume =			**65,697**	**75,551**		**45,479**	**50,027**	

Infrastructure Element	Typical Plan Area	Height of Placed Peat	Total Storage Volume (m^3)	Peat Storage Volume (m^3)	Spoil Storage Volume (m^3)
T11 Storage Area	3150	1	3150	3150	#REF!
East Storage Area	20000	2.5	50000	0	50000
Landscaping	-	-	14,000	7,175	6,825
Total Storage Volume (m^3)			**67,150**	**125,578**	
Surplus Peat and Spoil Storage Volume (m^3)			58,428		

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