Bloch Wind Farm

Technical Appendix 9.2: Stage 1 Peat Management Plan

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1. Introduction

This Stage 1 Peat Management Plan (PMP) provides information and guidance on the environmentally compliant re-use and management of excavated peat across the proposed development.

This document is a technical appendix to Chapter 9: Hydrology, Hydrogeology, Geology and Soil of the Environmental Impact Assessment Report (EIA Report) and should also be read in conjunction with Technical Appendix 9.3: Peat Slide Risk Assessment (PSRA).

The information presented in this PMP should be used to inform the wider assessments carried out for the proposed development. The study has drawn on information collected as part of a peat study, including desk-based study followed by a phase one and phase two peat depth surveying exercise. The PMP estimates the total volumes of excavated peat likely to be produced by the proposed development and outlines suitable reuse methods in line with regulatory requirements and industry good practice methods.

This strategy should be adopted to allow peat to be managed in a sustainable manner, minimising excavation via the adoption of appropriate construction methods. Targeted and appropriate re-use of peat as part of the reinstatement works shall also be a primary consideration.

1.1. Regulatory Requirements

This document addresses the following requirements in line with the Scottish Environment Protection Agency (SEPA) Regulatory Position Statement – Developments on Peatland (2017):

- Prevention – The best management option for waste peat is to prevent its production; and
- Re-use – Developers should attempt to re-use as much of the peat produced on site as possible.

In general, the following guidance has fed into the design assumptions and subsequent selection of appropriate construction methods based on the distribution of peat depths across the site:

- Developments on Peatland: Guidance on the assessment of peat volumes, re-use of excavated peat and the minimisation of waste (A joint publication by Scottish Renewables, NatureScot, SEPA, Forestry Commission Scotland, 2012);
- Guidance on Developments on Peatland – Peatland Survey 2017. Scottish Government, NatureScot, SEPA;
- Floating Roads on Peat (Forestry Civil Engineering & SNH, 2010); and
- Good Practice During Wind Farm Construction (A joint publication by Scottish Renewables, NatureScot, SEPA, Forestry Commission Scotland, 2019), Version 4.

2. Site Context

Information concerning the hydrology and hydrogeology of the site, including a summary of the distribution of mapped soil types are presented in Chapter 9 of the EIA Report, which this technical appendix supports.

The following figures presented as part of the EIA Report should be viewed in conjunction with this PMP:

- Figure 9.4: Carbon and Peatland Soils;
- Figure 9.5: Predominant Soils; and
- Figure 9.6: Peat Depth Interpolation.

3. Approach to Design

The applicant has sought to minimise the potential impacts on peat through an iterative design process, optimising the distribution and orientation of the proposed infrastructure following the completion of each phase of assessment and surveying. The approach to design is aligned with Scottish Planning Policy, following the hierarchy of deep peat (>1.0m) avoidance and where this isn't possible, minimisation of impacts through design and mitigation.

The avoidance of peat as part of the design evolution was identified as a key objective from the outset. An initial desk study was used to inform the layout by identifying areas potentially contain peat, such as the British Geology Survey (BGS) 1:50,000 scale Superficial Geology Map, Scotland Soils Map, and NatureScot Carbon and Peatland Soils Map (2016). Examples of where subsequent targeted peat surveys resulted in the repositioning of infrastructure to avoid peat are as follows:

- Complete avoidance of Bloch Flow and Collin Hags;
- Repositioning of proposed T2 to the west;
- Repositioning of T1 to the north; and
- Repositioning of T11 to the west.

Where the results of detailed design indicate that micro-siting within the allocated micro-siting distance could achieve a reduction in the requirement for peat excavation, this would be investigated by the appointed Principal Contractor and where possible, implemented following approval with the Environmental Clerk of Works (ECoW), Dumfries & Galloway Council (DGC) and SEPA.

4. Peat Survey Results

Surveys have been carried out to investigate peat depth and extent across the proposed development. Peat depth information has been collated to support the volumetric calculations provided in this document and has subsequently been used to consider and minimise any potential impact on the peatland environment.

Investigations were undertaken to ensure a high resolution and focussed assessment maximises the understanding of the impacts of the proposed development on the local peatland environment by improving the efficacy of the volumetric calculations provided in this PMP. The completion of a focussed assessment also provides the opportunity to micro-site infrastructure away from areas of deeper peat.

Peat deposits can exist in one of three forms:

- Fibrous – non-plastic with a firm structure and is only slightly altered by decomposition;
- Pseudo-fibrous – peat in this form still has a fibrous appearance but is much softer and more plastic than fibrous peat. The change is due to more prolonged sub-mergence in airless water rather than to decomposition; and
- Amorphous – decomposition has destroyed the original fibrous vegetation structure such that it has virtually become organic clay.

Peat deposits can also be characterised into two layers:

- The 'acrotelm' is the upper layer and has a relatively high hydraulic conductivity and therefore has variable water content. This layer comprises a thin surface layer of active vegetation; and
- The 'catotelm' is the lower layer, permanently below the water table, which has a small hydraulic conductivity and is often at a higher state of humification and lower tensile capacity.

In total, 2,568 locations were surveyed for peat depth across the proposed development. The surveys consisted of completing phase 1 peat depth investigations across a 100m grid of the site to inform the initial layout of infrastructure and was completed in March 2022. Follow up surveys took place during July and August 2022 and involved the collection and analysis of peat cores and detailed phase 2 peat depth surveys at infrastructure locations.

Table 4.1 provides a summary of the peat depths recorded during the peat surveys and an interpolated peat depth map (Volume 2a Figure 9.6 of the EIA Report) shows the distribution of peat depths in relation to infrastructure elements.

Table 4-1: Peat Depth Survey

Peat Depth Range	Results	% of Points
≤0.5	1,410	55
>0.5 - ≤1.0	579	22
>1.0 - ≤1.5	256	10
>1.5 - ≤2.0	131	5
>2.0 - ≤2.5	75	3
>2.5 - ≤3.0	42	2
>3	75	3
TOTAL	**2,568**	**100**

Source: Natural Power

Table 4.1 shows that the highest proportion (55%) of recorded depths fell within the ≤0.5m range with the next highest proportion (22%) within the >0.5 - ≤1.0m. Over 75% of locations surveyed encountered peat depths <1.0 m in thickness.

The deepest areas of peat (>3.0m) were located south of Bloch Farm and on Bloch Flow within the central section of site. These generally correspond with areas of mapped Class 1 and Class 2 peat as per Volume 2a Figure 9.5 of the EIA Report: Carbon Soils Map. It is highlighted that an extensive network of artificial drainage ditches is presented within the site (including areas of Class 1 and Class 2 peat) as indicated in Volume 2a Figure 9.12 Natural & Artificial Drainage of the EIA Report. The presence of these artificial ditches is likely to have modified the condition of peat through drainage and oxidation. Notwithstanding, the positioning of proposed development infrastructure has avoided areas of deep peat and priority peatland habitat.

5. Peat Extraction & Re-use

In order to quantify the volume of peat that may be excavated and re-used across the proposed development, the infrastructure layout has been spatially analysed using the peat depth dataset. The proposed 21 wind turbine layout has been appraised to obtain an estimate of the size and extent of the infrastructure footprint and then considered with the available peat depth data. Peat depth measurements of less than 0.5m have been categorised as peaty soils, with peat deposits being >0.5m in depth. Therefore, where depths are less than 0.5m, these will be excluded from final peat excavation calculations.

The estimation of peat extraction and re-use volumes relies on a series of design assumptions that may vary on a small scale according to discrete changes in ground conditions. Volumetric calculations should be re-evaluated when more detailed intrusive site investigation data becomes available. Design assumptions with regards to the likely access track construction methods have also been taken. The design of the detailed site layout should be confirmed with a comprehensive site investigation.

There are elements of proposed infrastructure which are to be located on areas of potentially Class 1 peatland. NatureScot defines Class 1 peatland as "*all vegetation cover indicates priority peatland habitat; all soils are carbon-rich soils and deep peat*". Micro-siting of infrastructure will therefore take into account vegetation cover, peat depth, hydrology, and peat quality. As highlighted in Section 4, there is an extensive network of artificial drainage ditches presented within the site as indicated in Volume 2a Figure 9.12 Natural & Artificial Drainage of the EIA Report. Many of these artificially drained areas overlaps with the mapped extent of Class 1 peat and is likely to have modified its condition. Areas most strongly displaying evidence of unmodified Class 1 peatland will be avoided as far as reasonably possible during micro-siting, considering all other constraints.

5.1. Peat Handling Prior to Construction

The principles of appropriate handling of acrotelmic and catotelmic peat so that it is suitable for reuse are presented below. Fundamentally, the intention is to minimise excavation volumes:

- Through the utilisation of all the data collected to date and ongoing throughout the construction process, the Principal Contractor will implement methods to minimise the volumes of excavated peat. Appropriate handling and storage of excavated materials will be undertaken such that their integrity and subsequent reuse is maintained;
- An ECoW will be employed and, prior to works commencing in each area, a walkover with engineers will be carried out to identify any areas of sensitive habitat or deep peat;
- The Principal Contractor will be required to ensure that excavated peat is reused on site in landscaping and re-profiling works, to minimise visual impacts and facilitate habitat and ecological restoration, improvement and enhancement;
- The results of the ground investigation, including groundwater level information, should be assessed with respect to refining the peat stability assessment at infrastructure at highest risk. All pertinent control measures and mitigation measures should be revised, and their implementation supervised following the results of the ground investigation and construction design phase of works. Current stability mitigation measures are set out in this PMP as well as in Technical Appendix 9.3: PSRA; and
- A programme of geotechnical inspections will be implemented during excavation works.

5.2. Excavation

Prior to construction of the proposed development, the Principal Contractor will produce a detailed method statement identifying where and how excavated peat will be used in reinstatement or landscaping works. Specific requirements for the excavation, handling, storage and reinstatement of peat will be outlined in the above method statement. The method statements will consider peat layering and the potential impacts on downstream hydrological receptors and also the potential for instability issues with the excavated material.

The principal requirements are outlined below:

- All excavations where required should be monitored and measures taken to prevent collapse and the destabilising of peat deposits adjacent to excavations;
- A system of daily reporting of excavations will be established during construction and utilised to monitor the geotechnical performance of slopes including peat, sub-soil and bedrock. This would be implemented and undertaken by a suitable, experienced and trained member of the site team;
- A system of daily reporting of excavations should be established during construction and utilised to monitor the geotechnical performance of slopes including peat, sub-soil and bedrock. This should be implemented and undertaken by a suitable, experienced and trained member of the site team;
- Where possible, areas of peat within the footprint of excavation will have the top layer of vegetation stripped off as turf prior to construction. When excavating areas of peat, excavated turves should remain as intact as possible. Peat turves will be stored to promote the retention of structure prior to use in reinstatement;
- Underlying catotelmic peat will then be removed and stored separately and kept damp;
- Excavated peat turves and catotelmic peat will be handled through careful excavation to reduce the risk of cross contamination between distinct horizons and to maximise the potential for reuse;

- Care will be taken when stripping and removing topsoil and peat turves and appropriate storage methods will be used on site, i.e. excavated material will be stored in separate horizons and turves will be placed on top of excavated peat to minimise desiccation and oxidation. They would be placed in a manner to maximise coverage in a "checkerboard" pattern; and
- Classification of excavated materials will depend on their identified re-use in reinstatement works. At this site it is anticipated that the material to be excavated will comprise peat (which may be sub-divided into amorphous peat (catotelmic), fibrous peat (acrotelmic)) and turf.

5.3. Design Assumptions

Detailed designs relating to proposed infrastructure (wind turbine foundations, access tracks, hardstands) are not considered within this Section. These details remain to be confirmed at the detailed design stage post-consent.

5.3.1. Access Tracks – Excavation & Replacement Construction

Excavate and replace ('cut') construction of access tracks, passing places and turning areas are proposed for the majority of the proposed access track. This is owing to the generally shallow nature of the peat and peat soils present within the site. Small lengths of access track are intended to be floated as shown in Figure 9.6 of the EIA Report.

The cut construction method requires the removal of soil deposits down to a suitable sub-grade layer within the superficial or bedrock geology. Excavated material is then reinstated carefully along cut access track landscaped verges on either side of the cut access track or utilised in appropriate landscaping across the proposed development infrastructure.

Cut access track construction sequences shall be designed in accordance with local ground conditions and following a detailed site investigation. A general good practice construction sequence has been provided below and has been adapted and informed by NatureScot (2017):

- The route of the cut access track shall be marked out on the ground well ahead of the construction activity. This will allow for advanced checks of any newly developed or unforeseen constraints;
- As part of this process, the most sensitive sections of the access track route shall be defined. This will include water crossings, flush zones, slopes and steep slopes. These defined zones shall become established management zones where specific mitigation measures and construction techniques shall be implemented to minimise impacts during the construction phase;
- Where possible, the construction of the cut access tracks shall avoid periods of wet weather (when soils and peat deposits are particularly susceptible to deformation and when there is an increased risk of run-off carrying unacceptable levels of sediment). Similarly, the construction of cut access tracks shall, where possible, avoid periods of very dry weather; when there is a high risk of excavated and exposed peat soils drying out;
- The cut access track construction shall typically proceed in an uphill direction, thus allowing drainage to be managed with a greater degree of control. The cut access track side and cut-off ditches shall generally be constructed first. It shall be ensured that these discharge to a suitable buffered watercourse in line with hydrological assessment and relevant drainage controls. It shall be important to ensure that surface water run-off is directed away from the cut access track formation layer. This will act to reduce disturbance by the prevention of waterlogging and erosion;
- A progressive construction method shall typically be adopted whereby the cut access track is excavated to a suitable formation and upfilled to the cut access track running surface. Following this, the newly constructed cut access track verges will be restored with peat and vegetation from the next advancing section of cut access track under construction. The sequence of excavation, up-fill and restoration will be managed to minimise the time between excavation and restoration as far as is practicable; and
- Plant machinery shall work where practicable from the section of cut access track most recently completed. The re-use of peat turves and peat from newly excavated sections onto the verges of the most recently completed

section of cut access track will act to reduce the overall disturbance of excavated peat. Excavators with long reach arms are also beneficial in reducing vehicle manoeuvres over peat deposits. Excavation, handling, storage and reinstatement of peat will follow the principles outlined in Sections detailed in this PMP.

5.3.2. Access Tracks - Floating Construction

The design of the access tracks has been made considering peat depths across the site and floating access track has been incorporated to minimise excavated peat.

An example construction sequence for floating access tracks adapted from the NatureScot publication is provided below. This sequence of construction may need to be adapted to localised ground conditions, which may only become fully evident following a detailed site investigation:

- Mark out the alignment of the access track and install cross drainage concomitant to construction where necessary;
- Clear the intended floating access track area of major protrusions such as rocks, trees, and scrub vegetation down to ground level leaving any residual stumps and roots in place;
- Leave the local surface vegetation and soils in place if possible. In many cases the existing vegetation and root system may be the strongest layer in the soil system providing increased tensile strength at surface, and care shall be taken to preserve the integrity of this layer;
- Any local hollows or depressions along the route alignment shall be infilled with a suitable lightweight fill such as tree brash, logs or a combination of lightweight fill and suitable materials. Similarly, a brash mat and fascines (bundles of brash material) may be adopted to form the initial surface across uneven ground surface;
- Broken vegetation surfaces and very wet areas with high fines content, may need to be covered with a separator grade geo-membrane to prevent contamination of the aggregate layers. This geotextile may be covered with a thin regulating layer of aggregate prior to installing the main geo-grid;
- Geo-grids are placed by hand along the alignment of the floating access track, directly onto the prepared area with a simple overlapping arrangement generally in accordance with the relevant manufacturer's specification. A minimum transverse overlap is normally set at 400 mm. However, this may need to be increased depending on the amount of displacement and transverse tension caused by un-even terrain. Again, this should be specified by the geo-grid manufacturer;
- Place the first layer of aggregate material onto the geo-grid, this shall be a suitable 'well graded material' that will be able to achieve a sound interlock with the geo-grid. The final specification of the aggregate grading shall be dictated by the chosen geo-grid mesh size. Care shall always be taken to avoid damage to the geo-grids; and
- The degree of compaction required will be dictated by the local ground conditions along the route alignment. Across exceptionally soft areas of peat there may be a requirement not to apply mechanical vibratory compaction and instead rely on compaction of aggregate through trafficking of wheels and tracks of the construction plant alone.

5.3.3. Access Tracks – Dimensions

There is approximately 12km of access track required to link infrastructure within the site. Proposed access tracks have been assumed to accommodate a 5m running width, drainage will add up an additional 2m, giving a total construction width of 7m respectively.

Turning areas and passing places have been omitted from excavation calculations as it is assumed that any peat excavated as part of their construction would be accommodated along the periphery of these infrastructure elements, used to form landscaped verges.

Electrical cabling is typically laid in trenches adjacent to the access track network, which requires excavation, laying and backfilling. Peat excavated from cable trenching is normally replaced at its point of origin and is therefore not considered as a peat excavation loss.

5.3.4. Wind Turbine Foundations

The excavation area has been assumed to be 28m diameter with a total excavation area of 615m^2.

It should be noted that although excavation areas for crane hardstands and wind turbine foundations will likely overlap, to provide a conservative assessment, peat volumes are calculated for both areas separately.

Excavation and handling methodologies as discussed above in the peat handling prior to construction and excavation sections will be employed particularly at turbines with deeper peat.

5.3.5. Crane Hardstands

The crane hardstands will be 55m in width and 35m in length. This equates to a permanent land take of 1925m^2 per crane hardstand and is the value which is used for excavation volume calculation. Additional excavation will be required for temporary crane hardstands, which are not included as part of this assessment as these areas will be reinstated following the completion of construction.

5.3.6. Additional & Ancillary Infrastructure

The proposed accessible ancillary infrastructure associated with the proposed development consists of three borrow pits, a substation compound, a battery energy storage system compound (BESS), and a temporary construction compound.

The estimations of the excavated peat volumes and any subsequent reinstatement have been calculated based on the design information available at the time of writing:

- 1 x substation compound: 78m x 83m (6,474m^2);
- 1 x BESS compound: 160m x 45m (7,200m^2) (area includes temporary compound); and
- 3 x borrow pits (BP north, BP centre & BP south) indicative working areas of 25,000m^2 each.

The temporary construction compound will be positioned within the footprint of the BESS compound. Therefore no additional excavation volumes are provided.

5.4. Excavation Volumes

The estimate of excavated peat volume has been completed following a desk-based appraisal of the proposed development layout supplemented by digital terrain analysis. There has been further refined spatial analysis of the peat depth data set using GIS software. According to latest statutory guidance, peat soil is an organic soil which contains more than 60% of organic matter and exceeds 0.5m in thickness. Therefore, for the purposes of these calculations, and as a result of the information collected on site, depths recorded to be less than 0.5m are considered to be peaty soils. Depths recorded to be greater than 0.5m are considered to be peat, with the upper 0.5m being acrotelmic peat and depths beyond 0.5m considered to be catotelmic peat.

The following sequence of tables (Table 5-1 to 5-4) provide a summary of the indicative peat extraction volume calculation for each infrastructure element. Table 5-5 provides a summary of total peat extractions from the proposed development. The relevant design assumptions are also confirmed within each table.

Table 5-1: Wind Turbine Foundations (excavation area = 615m²)

Wind Turbine No.	Mean Peat Depth (m)	Peat Excavation Volume (m³)		Total Peat Excavation Volume (m³)
		Acrotelmic Peat	Catotelmic Peat	
1	1.10	308	369	677
2	1.60	308	677	984
3	1.00	308	308	615
4	0.30	0	0	0
5	0.50	0	0	0
6	0.70	308	123	431
7	0.20	0	0	0
8	0.40	0	0	0
9	0.47	0	0	0
10	0.40	0	0	0
11	0.50	0	0	0
12	0.33	0	0	0
13	0.30	0	0	0
14	0.20	0	0	0
15	0.50	0	0	0
16	0.30	0	0	0
17	0.60	308	62	369
18	0.30	0	0	0
19	0.90	308	246	554
20	1.40	308	554	861
21	0.80	308	185	492
	Total	**2,464**	**2,524**	**4,983**

Table 5-2: Crane Hardstands (excavation area = 1,925m²)

Wind Turbine Location	Mean Peat Depth (m)	Peat Excavation Volume (m³)		Total Peat Excavation Volume (m³)
		Acrotelmic Peat	Catotelmic Peat	
1	1.10	963	1,155	2,118
2	1.60	963	2,118	3,080
3	1.00	963	963	1,925
4	0.30	0	0	0
5	0.50	0	0	0
6	0.70	963	385	1,348
7	0.20	0	0	0
8	0.40	0	0	0
9	0.47	0	0	0

Wind Turbine Location	Mean Peat Depth (m)	Peat Excavation Volume (m^3)		Total Peat Excavation Volume (m^3)
		Acrotelmic Peat	Catotelmic Peat	
10	0.40	0	0	0
11	0.50	0	0	0
12	0.33	0	0	0
13	0.30	0	0	0
14	0.20	0	0	0
15	0.50	0	0	0
16	0.30	0	0	0
17	0.60	963	193	1,155
18	0.30	0	0	0
19	0.90	963	770	1,733
20	1.40	963	1,733	2,695
21	0.80	963	578	1,540
	Total	**7,704**	**7,895**	**15,594**

Table 5-3: Access Tracks (excavation width = 7m)

Track Section	Description	Approx. Length (m)	Mean Peat Depth (m)	Peat Excavation Volume (m^3)		Total Peat Excavation Volume (m^3)
				Acrotelmic Peat	Catotelmic Peat	
1	T1 to Spur	545	0.70	1,908	763	2,671
2	T2 to Spur	311	0.76	1,089	566	1,655
3	Floating spur to T3	180	0.90	0	0	0
4	T3 to join	407	0.93	1,425	1,225	2,650
5	Track to T4	656	0.35	0	0	0
6	Track to T5	386	0.37	0	0	0
7	Track to T6	423	0.51	1,481	30	1,510
8	Floating track Section to T7	190	1.38	0	0	0
9	Track to T7	419	0.33	0	0	0
10	Floating track beyond T7	539	1.84	0	0	0
11	Track to T9	277	1.60	970	2,133	3,102
12	Track to T8	281	0.83	984	649	1,633
13	Track beyond T9	279	0.57	977	137	1,113
14	Track to T10	287	0.40	0	0	0
15	Floating segment beyond T9	111	1.93	0	0	0

Track Section	Description	Approx. Length (m)	Mean Peat Depth (m)	Peat Excavation Volume (m^3)		Total Peat Excavation Volume (m^3)
				Acrotelmic Peat	Catotelmic Peat	
16	Track to T11	460	0.78	1,610	902	2,512
17	Track to T12	598	0.45	0	0	0
18	Track to T13	452	0.72	1,582	696	2,278
19	Floating track segment beyond T12	91	1.08	0	0	0
20	Track to compounds	404	0.31	0	0	0
21	Track to T14	937	0.25	0	0	0
22	T15 Track	378	0.52	1,323	53	1,376
23	Floating track beyond T15	163	1.38	0	0	0
24	T17 track	563	0.76	1,971	1,025	2,995
25	Track to T18	641	0.41	0	0	0
26	Junction to T16	68	0.20	0	0	0
27	Floating T16 Segment	105	3.74	0	0	0
28	T16 track	299	0.76	1,047	544	1,591
29	T19 track	511	0.89	1,789	1,395	3,184
30	T20 track	92	1.92	0	0	0
31	T20	249	1.47	872	1,691	2,562
32	T21 Track	368	0.71	1,288	541	1,829
			Total	**20,316**	**12,350**	**32,661**

Table 5-4: Ancillary Infrastructure & Borrow Pits

WTG ID	Mean Peat Depth (m)	Peat Excavation Volume (m^3)		Total Peat Excavation Volume (m^3)
		Acrotelmic Peat	Catotelmic Peat	
Substation Compound	0.2	0	0	0
BESS Compound*	0.3	0	0	
Borrow Pit North	0.3	0	0	0
Borrow Pit Centre	0.3	0	0	0
Borrow Pit South	0.7	12,500	5,000	17,500
	Total	**12,500**	**5,000**	**17,500**

**Depth extrapolated from points immediately adjacent. Footprint could not be surveyed due to potential presence of buried utilities.*

Table 5-5: Summary of Likely Peat Extraction

Construction Element	Peat Excavation Volume (m^3)		Total Peat Excavation Volume (m^3)
	Acrotelmic Peat	Catotelmic Peat	
Wind Turbine Foundations	2,464	2,524	4,983
Crane Hardstands	7,704	7,895	15,594
Access Tracks	20,316	1,235	32,661
Ancillary Infrastructure	12,500	5,000	17,500
Total Peat Excavation (m^3)	**42,984**	**16,654**	**70,738**

5.4.1. Re-use Volumes of Excavated Peat

In order to estimate the volume of peat that could be re-used as part of construction and restoration, Natural Power has applied their experience from the construction management of wind farms across an array of upland peat sites. Table 5-6 below provides an approximate total volume of peat that could be accommodated across the site. The following additional design assumptions salient to the re-use of excavated peat are highlighted below:

- The uppermost 0.5m of excavated peat at all infrastructure locations will be accommodated in the finishing and landscaping of each infrastructure element;
- For the wind turbine foundations the peat re-use potential is considered to be within the excavation area around the protruding concrete foundation to a depth of 0.75 m;
- For crane hardstands, the battery energy storage compound and the substation compound it is assumed that peat can be used for reinstatement around the two peripheral edges to a height of 0.75m with a batter extending up to 3.5m;
- For borrow pits it is assumed that the average peat thickness to be reinstated would be reflective of the average depth encountered during surveying, down to a minimum of 0.5m of peat thickness to avoid peat placement reinstated too thinly;
- Batter slopes of reinstated cut access track verges must be considered in a manner that maintains slope stability, local topography and also maintains hydrological functionality of the peat. The final design of the reinstated verges and batter angles will be agreed with SEPA as part of the detailed design, with reuse volumes below based on batters with a depth of 0.75m and width of up to 3.5m. Ideally a batter slope of 1:4 would be required to maintain stability but the reinstatement values provided are indicative for the purposes of this assessment and will vary according to the prevailing ground conditions. Similar widths are considered for dressing the edges of floating access tracks to allow for visual continuity between the access track and surrounding peatland.
- The formulation of a detailed construction method statement shall incorporate detailed construction design and sequencing for the reinstatement purposes that will allow refinement of the excavation volumes presented in this document. These plans shall draw on detailed site investigation information gathered prior to the commencement of construction; and
- Appropriate signage shall also be considered to warn about potential soft ground hazards. The safety measures shall be maintained for as long as the hazard remains, which may be several years following construction. Typically, vegetation re-growth and natural stabilisation of the wetland areas would be anticipated within approximately two years following reinstatement. Ongoing periodic monitoring of the progress of restoration would be required to ensure fencing is maintained until the wetland is fully established.

During the excavation and re-use of peat deposits the two layered structure of the ‘acrotelm’ and underlying ‘catotelm’ shall be preserved as far as is practicable. This approach will aid in the successful re-vegetation and prevent drying and desiccation of the peat. Where the catotelmic peat becomes separated, appropriate measures shall be in place to ensure this material is stabilised prior to re-use. This will be verified by a suitably qualified geotechnical engineer.

It should be noted that this assessment has not accounted for excavation volumes of glacial sub-soils or weak bedrock material which may be deemed unsuitable for incorporation into foundations and hardstand elements.

5.4.2. Re-use Volume Estimate

Table 5-6: Estimate of Peat re-use volumes

Construction Element	Peat Excavation Volume (m^3)	Potential Peat Re-use Volume (m^3)	Surplus (+) or Capacity (-) (m^3)
Wind Turbine Foundations	4,983	6,458	-1,467
Crane Hardstands	15,594	2,481	13,112
Access Tracks	32,661	20,423	12,239
Ancillary Infrastructure	17,500	44,879	-27,379
Total	**70,738**	**74,241**	**-3,504**

Comparing the total capacity for peat re-use with total volume of excavated peat, it is indicated that the proposed development will have sufficient capacity to accommodate all excavated peat on site.

Where factors which contribute to the bulking of the peat deposit are mitigated the total volume of excavated peat may be reduced through:

- Reduction of peat handling with re-use of peat undertaken as close as possible to the excavation site;
- Maintaining the integrity of the excavated peat mass including preservation of the surface acrotelm layer as far as is practicable; and
- Prevent the drying and desiccation of excavated peat deposits through timely re-vegetation and preservation of the surface hydrology systems.

5.4.3. Temporary Storage

Consideration for the storage of peat has been undertaken with input gathered from the Scottish Renewables Guidance on the Assessment of Peat Volumes, Reuse of Excavated Peat and Minimisation of Waste.

The temporary storage of excavated peat shall seek to minimise disturbance of deposits by minimising haul distance between temporary peat storage sites and re-use areas. Stored peat would also be covered with turves in a manner to maximise coverage. In general, it shall be a priority to avoid a single site temporary peat storage area. A progressive construction method which re-cycles peat through excavation and timely re-instatement shall be adopted. However, some elements may require storage of peat prior to re-instatement at the end of the construction phase.

The areas and locations identified for temporary storage shall be identified only after site investigation, and a full topographic survey. Determining factors are associated with the peat stability, sensitive receptors, drainage and pollution prevention. Areas of deeper peat (>1.0m) and sensitive areas including Groundwater Dependent Ecosystems (GWDTE) shall be avoided for dedicated temporary storage areas. It will be a priority to ensure that a future detailed site investigation provides information on the suitability of these temporary peat storage areas including the topographic profile, groundwater regime, and geotechnical properties of deposits underlying the temporary storage sites. Furthermore, it may be necessary to undertake further peat stability calculations based on finalised placement of temporary peat storage areas.

Owing to the position of the site within an upland setting with consequentially high rainfall, it is anticipated that watering the stored peat through natural precipitation will be sufficient for the peat to remain damp, thus preventing drying out and desiccation and allowing the vegetation layer and seed bank to be sustained. This is an important element in the restoration of the landscape, providing continuity with surrounding local vegetation upon reinstatement. For the duration of the temporary storage it shall be necessary to periodically monitor the condition of the stored peat and ensure the stability is maintained should be undertaken by a suitably qualified geotechnical engineer. During prolonged dry spells artificial wetting could be undertaken, however, this will be done under the agreement and supervision of the ECoW and Principal Contractor with appropriate mitigation in place to ensure the protection of the stored peat, as well as any nearby receptors such as watercourses or GWDTE.

6. Reinstatement Methodologies

Prior to commencing the construction excavation works, consideration will be given to methods for handling and holding the excavated materials, particularly peat. Haulage distances for the excavated material will be kept to a minimum in order to reduce the potential impact on the peat structure. Peat has the potential to lose structural integrity upon excavation particularly when double handled or moved around the site. Peat handling can also increase the bulking factor of the material which has the overall effect of increasing the volume of peat which will need to be re-used across the site. The following paragraphs discuss the reinstatement measures that can be adopted for the main infrastructure components associated with the development.

6.1. Access Tracks

Where cut access tracks are required in areas of peaty soils, it is recommended that turves should be ‘rolled back’ to allow for the bank to be cut at an appropriate angle, then rolled back over to cover the exposed cut face. Reinstatement will be completed as soon as possible following construction to minimise the risk of turf drying. Restoration will be carried out as track construction progresses.

In order to obtain the best results, the previously stripped soils, vegetated layers or turves will be brought back over the verges of constructed access tracks within as short a time period as reasonably practicable, to give the seed bank and vegetation the best chance of an early regeneration. Where reasonably practicable, turves and topsoil will be matched to the adjacent habitat.

If storage is required, the soils will be correctly stored. This provides the seedbank and vegetation the best chance of early regeneration. If temporary storage of excavated materials is required, then material will be stored safely, and the method of storage will be reasonably minimised in order to reduce areas of additional disturbance. If soils are to be stored for any length of time, then these designated areas will be agreed with the ECoW prior to the storage of any material. Consideration will also be given to periodically wetting the vegetation layers during prolonged dry spells in order to prevent desiccation.

The soil and peat material that is utilised for the track edge reinstatement will not be spread too thinly. If the material is spread too thinly then there is a tendency for it to dry out and crack, particularly during prolonged dry periods. This subsequently means that the soil/peat material will be unstable because the root system has not had an opportunity to establish. This is very much dependent upon the time of year that the work is taking place and also the altitude. These factors affect the growing performance of the vegetated turf. Early reinstatement will be undertaken as this provides for the most beneficial results.

Care will also be taken to minimise excessive material being used during the re-profiling and reinstatement of the access track verges. In addition, excess peat will also not be used for reinstatement of access track edges where it can lead to additional loss of habitat by smothering the existing adjacent vegetation and preventing re-growth of the vegetation next to the tracks. The addition of excessive materials may cause instability at the track edges and increase the risk of the creation of sediment laden runoff.

During the construction works, in areas where the spreading of seed rich materials or natural re-growth are considered to be impractical, not plausible or ineffective, then consideration should be given to re-seeding methods. The seed type and mix will be agreed by NatureScot and the Local Planning Authority (the seed bank mix will be of local native species). If vegetation re-establishment is observed to be failing during the post-construction monitoring stage, the potential for using re-seeding methods will be considered and discussed in consultation with NatureScot and the local planning authority.

The fundamental aspects of access track reinstatement are summarised as follows:

- Consider haulage methods and specified storage locations in relation to areas being worked. Haulage distances to storage locations will be minimal;
- Vegetated turves and topsoil will be stripped with care and stored correctly i.e. separated in horizons and vegetation stored vegetation side up in a checkerboard pattern on top of stockpiled peat;
- For track reinstatement peat will be placed back in the correct horizon order and topsoil containing the seed bank will be on the top. If vegetated turves have been previously stripped, then these will be placed on top to maximise vegetation growth potential;
- Reinstatement of verges will be completed as soon as practical to minimise turf drying i.e. reinstatement can take place whilst track construction continues;
- Peat soil will not be spread too thinly during verge reinstatement in order to prevent cracking/drying out and excessive amounts of peat will also not be used as this can lead to unstable surfaces, effect drainage, loss of habitat via smothering of adjacent vegetation and create sediment laden runoff;
- Natural regeneration of vegetation is the preferred option for reinstatement and restoration, however, if required, following consultation with NatureScot, re-seeding using a native species mix may be considered; and
- Lateral water loss from track edge peat “cliffs” will be minimised. This can be achieved through appropriate re-profiling and reinstatement of the track verges at an angle that blends into the surrounding landscaping as well as placing vegetated turves onto the verges. Consideration will be given to the placement of turves in a checkerboard fashion should there be insufficient turves available. This will be considered in greater details as part of the detailed track design.

6.2. Cable Trenches

The reinstatement and storage of any excavated materials for the cable trenches will involve replacement of previously stripped soils, vegetated layers or turves. Timing of trench reinstatement works will also consider adjacent construction activities which may disturb any reinstatement works already carried out.

The amount of time between the excavation of the trench and subsequent reinstatement following cable laying will be minimised as much as practically possible. The reason for this is that the longer the stripped turves are stored for, the more they will degrade and become unsuitable for successful reinstatement. Reinstatement will take place as soon as possible, trenches which are left open for a long period of time have a tendency to act as conduits for surface water runoff, thus potentially leading to increased sediment loading due to erosion. This could potentially affect the sites watercourses and lead to the occurrence of a pollution event.

The type of vegetation used for reinstatement will not differ significantly from the adjacent area. The fundamental aspects of cable trench reinstatement are summarised as follows:

- Cable trenches will be constructed to the relevant detailed design specifications;
- Most cable trenches will be constructed adjacent to access tracks, i.e. reducing construction impacts on virgin ground;
- As a general principal, reinstated areas will not be re-disturbed. This will be avoided where practical although this is not always possible due to construction sequencing;
- Stripping, storage and reinstatement of excavated materials will be as per best practice;
- Time between trench excavations and reinstatement will be planned to reduce the potential for stored turf layers to dry out and decompose; and
- Natural regeneration of vegetation is the preferred option for reinstatement and restoration.

6.3. Wind Turbine Foundations

Where practical the peat turves and topsoil will be stored around the perimeter of the foundation excavation. A plan showing where the material is to be stored will also be created prior to the works commencing. In areas where storage of the peat turves or excavated material adjacent to the works is not possible, then the material will be taken to the nearest agreed storage areas as soon as possible.

The turbine foundations will be backfilled with the excavated material. Not all excavated material will be suitable for backfilling or reinstatement. The previously stripped and stored soils and vegetated layers or turves will likely be spread over the area disturbed by turbine foundation construction. Where turbine bases are constructed in peat, reinstatement will involve laying subsoil peat on the backfilled area and then placing the vegetated peat turves on top. Reinstatement will be carried out as soon as practically possible following completion of foundation construction to minimise the risk of turves/vegetated layers drying out.

The fundamental aspects of turbine foundation reinstatement are summarised as follows:

- Construction works will be carried out to the detailed specification of the turbine foundation design and to permit adequate temporary works. Excessive peat excavation will be minimised;
- Stripping, storage and reinstatement of excavated materials will be as per best practice;
- A detailed plan of where excavated material will be stored will be created;
- Subsoil/peat will be spread over the backfilled area during reinstatement. Peat turves will then be placed on top to encourage natural re-growth of the vegetation;
- Time between turbine foundation excavation and reinstatement will be planned to reduce the potential for stored turf layers to dry out and decompose; and
- Natural regeneration of vegetation is the preferred option for reinstatement and restoration.

6.4. Crane Hardstands

Reinstatement of the crane hardstands will not occur due to the following factors:

- Re-use of crane hardstands following construction is likely;
- In the past crane hardstands have been reinstated using a layer of peat following construction. On many sites this layer has been stripped back within 2-3 years of operation to allow maintenance works to take place; and
- When the peat has been stripped back, it mixes with the stone from the hardstanding, thus contaminating the peat layer and making it unsuitable for re-use for reinstatement.

Due to the requirement for hardstands to remain in place, and the use of crane hardstands during maintenance activities, levels of vegetation re-growth are liable to be low if crane hardstands are covered.

The area around the crane hardstand and any exposed batters will be reinstated with previously stripped soils, vegetated layers and turves, using the same methods to those described for track reinstatement.

6.5. Ancillary Infrastructure

With exception of the substation compound and BESS compound, all temporary construction areas will be removed and reinstated as quickly as possible following construction. Following removal of temporary site accommodation, storage, equipment and materials, all areas will then be reinstated. The temporary hardstanding surface will be lifted prior to re-soiling to aid with drainage and re-generation. Installation of a geo-grid base/geotextile during construction of the compound would help to facilitate removal of the hardstanding if this is required.

The reinstatement will involve reprofiling/landscaping to ensure that the reinstated area blends in with the surrounding area. Suitable materials i.e. topsoil and peat will then be replaced over the area in appropriate horizons i.e. in the correct order. The material used for the reinstatement works (often that which was excavated for the temporary construction area), will be stored and managed adjacent to the temporary construction areas but away from watercourses and other sensitive receptors.

It is highly probable that the temporary construction areas, such as the temporary compounds and/or batching plants, will be required for the full duration of the construction period. Therefore, it is unlikely that any stripped turves would be suitable for reinstatement as the vegetation is likely to decompose if stored for the duration of the construction programme in anticipation of reinstatement of the temporary construction areas. Therefore, it is likely that stripped turves would be used in suitable alternative locations as part of reinstatement elsewhere in the site rather than reused in situ.

As such, vegetation in the vicinity of the temporary construction areas will be allowed to regenerate naturally. Natural regeneration could take several years and is dependent upon the type of adjacent vegetation and the altitude of the location. Re-seeding will be considered if required. In the event that re-seeding is required, the seed type and mix will be agreed in consultation with NatureScot and the local planning authority. In addition, temporary fencing of the areas to prevent grazing by deer will also be considered in order to help accelerate the re-vegetation process.

The fundamental aspects of temporary construction reinstatement is summarised as follows:

- Areas will be re-profiled/landscaped to ensure they blend in with the surrounding area;
- Topsoil/peat will then be spread over the area in its appropriate horizons;
- Material used for the reinstatement will be stored appropriately where practical adjacent to the temporary construction area;
- Stripped turves may dry out due to the length of time they are stored (compound required for duration of construction period) therefore will be used in suitable locations elsewhere in the site; and
- Natural regeneration of vegetation is the preferred option for reinstatement and restoration. However, if required, following consultations with NatureScot, re-seeding using a native species mix will be considered.

6.6. Borrow Pits

Borrow pits will be reinstated with what was there before or to a minimum thickness of 0.5 m. Associated peat and soil handling, storage and general management details are presented within Technical Appendix 2.2: Outline Borrow Pit Management Plan.

7. Monitoring

The success of construction and the subsequent re-use of peat across the site will be monitored to ensure that effects on the peatland environment are appropriately understood and subsequently reduced via any remedial works that can be undertaken. The details of any required monitoring would be discussed and agreed with SEPA, NatureScot and the Local Planning Authority prior to commencement. Appropriate monitoring is important to:

- Provide reassurance that established in-place mitigation and reinstatement measures are effective and that the site is not having a significant adverse impact upon the local and/or wider environment;
- Indicate whether further investigation is required and, where pollution is identified or unsuccessful reinstatement, the need for additional mitigation measures to prevent, reduce or remove any impacts on the environment; and
- Understand the long-term effects of the site on the natural environment.

Due to the nature of the construction activities and the possibility that such works can increase the volume of dissolved and particulate matter from entering the natural drainage network a robust hydrological monitoring strategy will be implemented.

A reinstatement monitoring strategy can also be implemented, where surveys can be carried out to monitor the success of peat re-use and subsequent reinstatement. Complimentary to the hydrological monitoring highlighted above and best practise geotechnical monitoring, the success of vegetation reinstatement can provide an insight into the effects of the wind farm on the local environment. Full details of the environmental monitoring strategies will be finalised following consultation with SEPA, NatureScot and the Local Planning Authority.

8. Disclaimer

The information presented in this Stage 1 PMP is based on the results of peat surveys carried out by Natural Power in March, July and August 2022. There is no peat depth data for the construction compound (BESS) due to it overlying buried utilities, adjacent data has been used as a surrogate.

It is highlighted that whilst attempts have been made to collect peat depth and condition information, further investigations can be carried out as part of detailed site investigation (post consent). This process can provide further information across all infrastructure locations, which should be used to further refine the peat excavation and reuse volumes provided in this report.

The PMP should be considered a live document throughout the planning process and any future pre-construction phases of works. As such, additional information can be incorporated following the results of detailed site investigations carried out prior to construction, as well as from any discussions with SEPA or other engaged stakeholders throughout the development process.

The peat extraction and re-use volumes are intended as a preliminary indication. The total peat volumes are based on a series of assumptions for the infrastructure layout and peat depth data averaged across discrete areas of the proposed development. Such parameters can still vary over a small scale and therefore local topographic changes in the bedrock profile may impact the total accuracy of the volume calculation.

The accuracy of these predictions may be improved though further detailed site investigation (post consent). It is therefore important that the PMP remains a live document throughout pre-construction and construction phases and is encapsulated within a wider Construction Environmental Management Plan (CEMP). The PMP and volumetric assessments can be updated as more accurate information becomes available.

Further details on the best practice measures to re-use the excavated peat and peaty soils at the development are discussed in the following sections.

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