

Technical Appendix 4.1: Peat Management Plan for the T39 Layout

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Strathy South Wind Farm

Peat Management Plan – T39 Layout

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1 Introduction

This appendix provides updated supporting information to the Further Information Report (2014 FIR) for the T39 Layout. It provides details of the predicted volumes of peat that would be excavated on the site, the characteristics of the peat that would be excavated, and how and where this excavated peat would be stored, reused and managed. This report also details of what quantities and thicknesses of catotelmic and acrotelmic peat would be excavated and reused. A description of the proposed T39 Layout is provided in Section 4: Development Description of the 2014 FIR and the layout is shown on Figure 1.2 of the 2014 FIR.

This report has been compiled in accordance with the following best practice guidance:

- Guidance on Developments on Peatland: Guidance on the Assessment of Peat Volumes, Reuse of Excavated Peat and Minimisation of Waste (SEPA & Scottish Renewables (2012));
- Developments on Peatland: Site Surveys & Best Practice (Scottish Natural Heritage, SEPA, Scottish Government, The James Hutton Institute (2011));
- Floating Roads on Peat Guidance (Scottish Natural Heritage & Forestry Commission (2010));
- Good Practice During Wind Farm Construction (Scottish Renewables, Scottish Natural Heritage, SEPA, Forestry Commission Scotland, (2nd Edition, 2013)); and
- SEPA Regulatory Position Statement – Developments on Peat (SEPA, (2010)).

The following sections of this report provide:

- a description of the peat conditions on site, with reference to the Peat Landslide and Hazard Risk Assessment (Strathy South ES Addendum, Volume 4: Technical Appendices, TA A14.1, prepared by SLR, 2013);
- detail of the construction activities that would generate peat and of the estimated volumes that would be generated as well as the estimated re-use volumes;
- detail of the physical nature of the peat and confirmation of its suitability for the reuses proposed;
- methods and procedures for handling excavated soils and turves; and
- details of temporary storage.

2 Site Context

2.1 Background

The site is located within the Strathy South Forest block, approximately 15 km south of Strathy village, and 30-35 km west of Thurso. Strathy South Forest extends 12 – 17 km inland from the north coast and the proposed wind farm occupies most of the forest between Loch nam Breac Mór and the River Strathy, an area of approximately 1,600 hectares (ha).

The site varies in altitude between approximately 130 m and 200 m. The topography undulates throughout most of the forest with the lower ground towards the central boggy inner boundary of the U-shaped forest area, which follows the River Strathy valley. The area is open and gently undulating in character, with extensive blanket bog, lochs and pools. Strathy South Forest is a commercial conifer plantation and occupies most of the forest between Loch nam Breac Mór and the River Strathy. The proposed turbines would be located within the U-shaped area of Strathy South Forest (Figure 1.2 of the 2014 FIR).

Peaty soil and peat deposits cover most of the site and variously overly glacially derived soils such as glacial till comprising, sand and gravels and in places bedrock. There are exposures of bedrock and where exposed these are seen to be metasedimentary rocks over the entire site.

2.2 Habitats

The site is dominated by commercial plantation coniferous woodland on areas of varying peat depths; dominant species within the forest canopy include lodgepole pine (*Pinus contorta*) and Sitka spruce (*Picea sitchensis*). Rides and glades throughout the plantation areas are a mixture of blanket mire, wet and dry heath, with scattered areas of acid grassland on areas of shallow mineral soil. Areas of marshy grassland and acidic flush habitat surround watercourses and waterbodies across the site. The site is adjacent to the Caithness and Sutherland Peatlands SAC and the Strathy Bogs SSSI, which comprise wet heath and blanket mire habitats for which the areas are designated.

Whilst extensive areas within Strathy South Forest are mapped as having potential for groundwater dependence, in general, given the flat or gentle sloping nature of these areas, the majority of these habitats will be largely ombrotrophic (rain fed). In addition, the majority of these habitats relate to NVC M15 wet heaths, however, there is a strong likelihood that these habitats are the result of changes in vegetation composition over a period of time due to the influence of forestry and drainage. Prior to afforestation, these habitats are likely to have been M17 or similar non-groundwater dependant habitat types, particularly in areas of peat >0.5 m.

2.3 Peat Conditions

A peat probing, walkover survey and peat slide risk assessment was undertaken by SLR, in June and September 2012, with some additional survey work completed in May 2013. The results of the survey work are presented in Volume 4: Technical Appendices, TA A14.1 of the Strathy South ES Addendum. A total of 2,462 locations were probed across the site to determine the thickness of peat, including 700 probe locations undertaken in 2007. The extent of peat coverage and depth of peat on the site is shown on Figure 5 in Technical Appendix A14.1 of the Strathy South ES Addendum.

In general, the peat is mapped as being developed over the whole of the site where the peat is extensively draped over existing glacial till and bedrock. The peat has been subject to limited erosion from fluvial activity and localised erosion, causing minor haggling and ponding on the peat. The peat within the site is generally a blanket type peat overlying the underlying strata, dissected by distinct watercourses, with thicker peat (deeper isolated peat) at the stream head of the River Strathy to the south of the site.

Peat was found to vary across the site in terms of thickness, surface slopes and apparent characteristics. Peat thickness varies from zero to 5.0 m within the site, as shown in Table 2.1. Accumulations of peat less than 0.50 m thick are considered to be too thin to be classified as true peat deposits and are often classified as organic soils or peaty soils.

Number of Probes	Peat Thickness
163	>3.0 m
720	1.5 – 3.0 m
1068	0.5 – 1.5 m
511	<0.5 m

Details of the specific ground conditions at each of the turbine locations are included in Table 6.5 in Technical Appendix A14.1 of the Strathy South ES Addendum and are therefore not repeated in this report.

3 General Excavation Principles

The Modified 2013 Scheme was designed within the confines of a number of environmental constraints. From the outset, the design of the Modified 2013 Scheme sought to avoid areas of deep peat on site (Chapter A4: Development Description of the ES Addendum). To this extent, it was considered that the Modified 2013 Scheme provided an optimal solution to the competing environmental constraints. The subsequent removal of turbines for the T39 Layout would further reduce the amount of peat requiring excavation.

During the construction of the Modified 2013 Scheme, all reasonable measures would be taken to avoid or minimise excavations and minimise disturbance to peat and peatland habitats. Further mitigation could include maximising batter angles in cuttings and the use of floating track.

Ground disturbance areas around excavations would be kept to a minimum and would be clearly defined on site. Access to working areas during construction would be restricted to specified routes, comprising constructed tracks.

Cable routes would in general follow access tracks. Any disturbance relating to the cable route to Dalangwell, not via access tracks, would only be temporary for a short duration of time, in accordance with approved method statements. Any peat excavated would be replaced. Therefore this has not been included within the excavation volumes; however it would still need to be managed on site, as set out in Section 4 below.

Peat and topsoil originally excavated at the temporary laydown areas, concrete batching plant, temporary construction compounds and borrow pits would be stored and also reinstated. Therefore, peat generated from these areas have not been included within the excavation volumes; however, it would still need to be managed on site, as set out in Section 4 below.

Appropriate plant such as low pressure models would be used to avoid unnecessary disturbance to the ground surface.

Bog mats could also be used if required for cable ploughing proposals through the designated areas.

4 Estimation of Excavation and Re-instatement Peat Volumes

The construction period for the T39 Layout would be approximately 24 months on-site. The programme and nature of construction activities projected are described in Chapter 4: Development Description of the 2007 Strathy South ES. Those activities which would generate volumes of peat areas are as follows:

- establishment of the temporary construction compounds, which would include stripping of topsoil, peat and remaining sub-soil and stockpiling of the material for later reinstatement in accordance with the Construction Environmental Management Plan (CEMP) requirements;
- establishment of four borrow pit areas, which would require that superficial soils (“overburden”) are stripped off and stockpiled in designated areas, in accordance with the requirements of the CEMP;
- formation of cut track and upgrades to existing track, which would involve: the removal and temporary storage of turves, as appropriate, followed by excavation down to formation level;
- construction of the turbine foundations and crane hardstandings, which would require the excavation of peat and subsoil to expose underlying bedrock. The depth of the excavation would be dependent on the depth to bedrock, but is likely to be up to approximately 4 m;
- excavation of trenches for underground cabling between the turbines and the substation, which would be approximately 0.5 m wide by 0.8 m (minimum) deep;
- development of the laydown areas and concrete batching plant; and
- construction of the switching station and welfare buildings, and construction compound; and ploughing of the cable alongside the access track (when leaving the Strathy South boundary to the north) where existing bunds adjacent to existing track could need to be removed to provide an even surface for ploughing.

Details of the estimated peat volumes associated with each of the tracks, foundations, hardstanding and switching station are provided in the following sub-sections. The detailed calculations of peat excavation and re-use are presented in Annex A of this report.

4.1 Track and Drainage Excavation

For the construction of access tracks, it is proposed to float tracks where peat is greater than 1 m in depth and to cut/excavate tracks where peat is less than 1 m in depth.

Table 4.1 provides the indicative dimensions of the proposed tracks and peat excavated as a result.

Table 4.1: Peat Excavation for Cut and Floated Tracks	
Description	Dimension
New Track width (m) ¹	7
Length of cut track (m) ²	21,929
Depth of excavation (m) ³	0.65
Volume of peat excavated (m ³)	99,778
Volume of peat excavated from drainage ditches on cut tracks (assuming 0.7 m width and 0.5 m depth) (m ³) ⁴	3,838
Allowance for 1:1 batters (m ³)	14,254
Volume of peat excavated from cut off ditches on floating tracks (assuming 0.7 m width and 0.5 m depth) (m ³) ⁵	878
Total Peat Generated from tracks and ditches (m³)	118,748

4.2 Foundations and Hardstanding Excavation

Turbine foundation and crane pad construction would be undertaken in line with best practice. At this stage it is assumed that gravity foundations would be used for all turbines.

Table 4.2 provides the indicative dimensions for foundations and hardstanding and the peat excavated as a result.

Table 4.2: Peat Excavation for Foundation and Hardstanding areas	
Description	Dimension
Turbine Foundations	
Diameter of excavation at top (m)	50
Depth of excavated peat (average) (m)	1.40
Cut slope angle	3.50
Diameter of excavation at base of peat (m)	41
Volume of peat excavated per base (m ³)	2,283
Total Peat Generated from Turbine Bases (m³)	89,023
Hardstandings	
Area of hardstanding (m ²)	833

¹ Average of widths taken for upgrade to existing track and new track.

² Length of track for Preferred Option; includes new access track, (including preferred bridge crossing of the River Strathy, and upgrades to existing track)

³ Average peat excavation depth along length of access track

⁴ Assumes V-shaped drainage ditch

⁵ Assumes V-shaped drainage ditch

Table 4.2: Peat Excavation for Foundation and Hardstanding areas	
Description	Dimension
Depth of excavation (m)	1.40
Volume of peat per base (m ³)	1167
Total Peat Generated from Hardstandings (m³)⁶	29,589

4.3 Other Infrastructure Excavation

Construction of temporary infrastructure on-site, including laydown areas, and concrete batching plant, would be undertaken in line with best practice. Any peat removed would be stored temporarily before reinstatement. Table 4.3 provides the indicative dimensions of the Switching Station and Control Room, and the peat excavated as a result.

Table 4.3: Peat Excavation for Switching Station	
Description	Dimension
Control Room/Switching Station: volume of peat excavated (m ³)	5,000
Total Peat Generated from Excavations (m³)	5,000

4.4 Reinstatement Volumes

Table 4.4 sets out the volumes of peat required for specific restoration activities and areas on the site including the reinstatement and landscaping of site infrastructure and borrow pits.

Table 4.4: Peat required for Restoration and Reinstatement Activities	
Description	Dimension
Total peat re-used on cut and floating tracks (m ³) based on 1:4 profile	26,574
Total peat re-used for borrow pit restoration (m ³) (to depth of 1.32 m)	141,577
Reinstatement volume for area around turbines (m ³)	74,208
Total Volume of Peat Re-used (m³)	242,359

⁶ 35% of the hardstanding area has already been accounted for in the turbine excavation values.

5 Classification of Excavated Material

There are two distinct layers within a peat bog, the upper acrotelm and the lower catotelm. The acrotelm is the fibrous surface to the peat bog, typically less than 0.5 m thick; which exists between the growing bog surface and the lowest position of the water table in dry summers. The majority of the peat found on the site is classified as upper acrotelm, very slightly to slightly decomposed with some fibrous content and moderate water content up to 1.5 m in depth. This material would be suitable for reuse without the need for any engineering measures.

The deeper peat generally in excess of 1.5 m is classified as the catotelm, moderately decomposed with a high fibrous content and moderate water content. There are various stages of decomposition of the vegetation as it slowly becomes assimilated into the body of the peat. Generally, the catotelm is not considered to be reusable. The design process has ensured that the layout would avoid the requirement for excavation of the catotelm⁷.

The peat is generally flat lying with very little erosion or haggling associated with it. Where the peat was found to be deeper (>1.5 m) the level of decomposition was far more evident with increased humification and higher moisture content.

Further detail is provided in Section 5 of the peat slide risk assessment, which is included as Technical Appendix A14.1 of the Strathy South ES Addendum.

⁷ Peat Landslide and Hazard Risk Assessment (SLR, 2013; Technical Appendix TA A14.1): Drawing No. 2: Geomorphology and Drawing No. 5: Interpreted Peat Depths

6 Handling of Excavated Material

As detailed within the CEMP, which is included as Technical Appendix A4.1 of the ES Addendum, the excavation of soils would be undertaken in such a manner as to avoid cross contamination between distinct horizons, where possible. The different soil horizons would be kept and stored separately for use at a later date.

During and after excavation, storage, haulage and reuse of excavated material would be planned to minimise material movement around the site. Where possible, immediate reuse would be preferred to temporary storage.

Turves would be stripped and handled with care and kept vegetation side up such that damage to the living vegetation mat would be prevented or minimised as far as possible.

7 Temporary Storage

As detailed within Technical Appendix A4.1: CEMP of the Strathy South ES Addendum, temporary storage could be required where material is not required for immediate reinstatement. To minimise handling and haulage distances, where possible excavated material would be stored local to the site of excavation and/or local to the end-use site where it would be required for re-profiling, landscaping or structural purposes. Stockpiles of peat would be located on site, if possible located adjacent to the borrow pits and construction compound. The exact storage location(s) would be agreed with the ECoW prior to commencement of main phase of works and provided on a plan to accompany the Peat Management Plan and relevant Method Statements.

Temporary storage locations would be appropriately located and designed to minimise impact to sensitive habitats and species, prevent risks from material instability (particularly in peatland areas) and runoff into watercourses.

Stripped materials would be carefully separated to keep peat and other soils apart, and stored in appropriately designed and clearly defined separate piles. Excavated peat would be excavated as turves which should be as large as possible and kept wet in order to minimise desiccation during storage.

Stockpiles would be isolated from any surface drains and a minimum of 70 m away from watercourses, unless otherwise agreed with the ECoW. Stockpiles would include appropriate bunding to minimise any pollution risks where required. Excavated topsoils would be stored on geotextile matting to a maximum of 1 m thickness.

Peat would not be stockpiled or deposited permanently higher than 1 m, and turf would be stockpiled separately. Peat would not be stockpiled for more than 6 months, unless otherwise agreed with SEPA.

Turves would be stored turf side up and would not be allowed to dry out. The condition of stored turves would be monitored by the Contractor and the ECoW.

7.1 Temporary Borrow Pit Storage

Where the excavated material is identified to be required elsewhere in restoration works, although re-use is not imminent, specified areas within the working borrow pit could provide suitable temporary storage locations. However, the handling of the stored material would be kept to a minimum and appropriate drainage, pollution prevention and material stability measures would be designed prior to the temporary deposition of the material to ensure material would be maintained in a suitable condition for future use.

Annex A: Calculation of Peat Excavation and Reuse

Calculation of Peat Excavation and Re-Use

Generated	
Access Tracks	
Length of Access Track Cut	21929.20 m
Width of Access Track	7.00 m
Depth of Excavation	0.65 m
Volume Peat Excavated	99777.86 m ³
Further Allowance for 1:1 batters	14253.98 m ³
Total Peat Generated from Cut Tracks	114031.84 m³
Drainage Ditches on cut tracks	
Length	21929.20 m
Width	0.70 m
Depth	0.50 m
Volume	3837.61 m³
Cut off ditches for Floating Tracks	
Length	10037.90 m
Percentage cut off ditches	50.00%
Applied Length	5018.95
Width	0.7 m
Depth	0.5 m
Volume	878.32 m³
Foundation Excavation	
Diameter of Excavation at top of Peat	50.00 m
Depth of Excavated Peat (Average)	1.40 m
Cut Slope Angle	3.50
Diameter of Excavation at base of peat	40.59
Volume of Peat per base	2282.63 m ³
Total Volume of Peat from Bases	89022.55 m³
Hardstandings	
Area	832.50 m ²
Depth of Excavation	1.40 m
Volume of Peat per base	1167.21 m ³
Percentage of Area counted in Foundation	35.00 %
Total Volume of Peat from Hardstandings	29588.72 m³
Switching Station Compound	
Length	100 m
Width	100 m
Depth	0.5 m
Total Volume of Peat from Bases	5000 m³
Total Volume Excavated	242359.03 m³

Re-Used	
Access Tracks	
Length of Access Track Floated	10037.90 m
Height of floated track	0.80 m
Gradient of peat profile 1:	4.00
Length of profile	3.20 m
Length of Track Cut	21929.20 m
Height of cut track	0.10 m
Gradient of peat profile 1:	4.00
Length of profile	0.40 m
Total Peat Re-used on Floating Tracks	26574.19 m³
Borrow Pits	
Borrow Pit A	
Width	242.88 m
Length	242.88 m
Area	58990.69 m ²
Borrow Pit B	
Width	124.54 m
Length	124.54 m
Area	15510.21 m ²
Borrow Pit C	
Width	157.64 m
Length	157.64 m
Area	24850.37 m ²
Borrow Pit D	
Width	90.83 m
Length	90.83 m
Area	8250.09 m ²
Depth of peat to reinstate	1.316 m
Total Volume of Peat used to Reinstate Borrc	141577.24 m³
(peat/topsoil originally excavated at borrow pits will be stored and also reinstated)	
Reinstatement to Foundations	
Diameter for foundation Excavation	50.00 m
Area	1962.50 m ²
Diameter for Tower and Access Track around T	20.00 m
Area	314.00 m ²
Area for Reinstatement	1648.50 m ²
Hardstanding area affected*	291.38 m ²
Area for Reinstatement	1357.13 m ²
Depth of Peat	1.40 m ³
Total Volume for all 39 turbines	74207.60 m³
Total Volume of Material to Re-Use	242359.03 m³
Difference	0.00 m³

Turbine Number	Peat Depth (m)
1	0.25
2	0.73
4	0.59
6	0.38
8	0.48
9	2.96
10	1.54
11	0.75
13	0.6
15	0.73
17	1.4
18	2.47
19	2.77
20	0.94
22	1.13
24	0.41
26	0.48
28	0.72
29	2.24
30	0.79
33	3.29
35	1.09
36	1.52
39	1.37
41	0.95
42	2.08
43	1.66
45	1.38
46	1.61
49	2.24
47	0.9
50	1.06
52	3.41
57	2.45
56	1.5
61	0.31
69	2.09
70	0.6
72	2.81
39	1.40