Gordonbush Extension Wind Farm

Appendix 9.3

Peat Management Plan

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CONTENTS

TABLES

FIGURES

APPENDIX

1.0 NON TECHNICAL SUMMARY

This Stage 1 Peat Management Plan (PMP) has been prepared by SLR Consulting Ltd and its purpose is to ensure that there has been systematic consideration of peat management and a quantitative assessment throughout the development process.

Detailed peat depth probing and peat characterisation has been undertaken across the site (as outlined in Chapter 9 of the ES and Appendix 9.1). This was used to aid the design of the Development in order to avoid areas of deeper peat or areas of peat instability.

Using site specific peat depth probing data, the potential volume of peat and soils that might be excavated as a consequence of constructing the Development has been estimated. Excavated peat associated with development on peat is not classed as a waste provided it is suitable (from an engineering as well as environmental perspective) for a required and predetermined use as part of construction works and reinstatement on site[1] (SR, SEPA, January 2012).

It has been shown using best practice guidelines that as a result of the site design, the volume of peat and soils that would be excavated is low and can be readily reused on site as part of the site construction and restoration. As a result, no surplus peat would be generated.

This document provides initial volume estimates for peat excavation and reuse and outlines recommendations for the handling and storage of peat during construction and restoration of the site, in line with current best practice guidelines.

[1] Guidance on the Assessment of Peat Volumes, Reuse of Excavated Peat and the Minimisation of Waste (SR, SEPA, January 2012)

2.0 INTRODUCTION

This Stage 1 Peat Management Plan (PMP) considers the excavation of peat and soil across the site as a result of construction of the proposed Development. It considers the potential for minimising excavation and disturbance in order to reduce any unnecessary surplus of soils and peat.

The best management option to minimise potential surplus peat is to prevent its production. Therefore, the design of the Development has aimed to minimise peat excavation where possible. Discussion of design considerations to avoid deeper areas of peat is included in Chapter 9: Hydrology, Hydrogeology and Geology, Appendix 9.1: Peat Slide Hazard Risk Assessment and Chapter 3: Site Selection, Design Evolution and Consideration of Alternatives of this ES.

SEPA has provided a hierarchy of management approaches through which the effectiveness of the approach to peat management is optimised at development sites as summarised below (SEPA 2010[2], SEPA 2012[3]):

- **prevention:** avoiding generating excess peat during construction (e.g. by avoiding peat areas or by using construction methods that do not require excavation such as floating tracks);
- **re-use:** use peat produced on site in restoration of hardstandings or landscaping, provided that its use is fully justified and suitable;
- **recycling/recovery/treatment:** modify peat produced on site for use as fuel, or as a compost/soil conditioner, or dewater peat to improve its mechanical properties in support of re-use; and
- **storage:** temporarily store peat on-site (for example, during short periods in the construction phase) and then re-use.

The guidance identifies three main stages in the development process and describes what data should be gathered and assessed at each to inform a site-specific PMP:

- **Stage 1**: Environmental Impact Assessment (EIA);
- **Stage 2:** Post-consent / pre-construction; and
- **Stage 3:** Construction.

This PMP has been prepared in accordance with the principles in the guidance for Stage 1 and proposes that **prevention** and **re-use** are the most appropriate means of managing peat excavated during construction at this site.

This report details the methodologies required to assess all potential surplus materials and presents preliminary estimates of the expected volume of excavated materials and required reuse volumes for reinstatement and restoration purposes.

[2] SEPA Regulatory Position Statement – Developments on Peat (SEPA, February 2010)

[3] Guidance on the Assessment of Peat Volumes, Reuse of Excavated Peat and the Minimisation of Waste (SR, SEPA, January 2012)

In particular, this report considers the construction of access tracks, site compounds, turbine foundations and all other associated infrastructure which result in the excavation of peat and sub-soils potentially resulting in surplus materials.

Many of the issues associated with peat on a wind farm site can be accommodated by modifying the Development layout to avoid potentially difficult or sensitive areas. Such areas would include:

- areas of deep peat, requiring potentially large volumes of excavation;
- areas of very wet peat (such as flushes, pool and hummock complexes and gullied peatland);
- areas of moderate to steep slopes (where site infrastructure might increase the chance of peat instability); and
- areas of sensitive habitat.

This report estimates the extent of materials generated during the construction phase and identifies potential areas where peat can be reused through the following:

- the avoidance of creating surplus materials, and
- the reuse of materials on site.

The assessment is based on the description of the proposed Development provided in Chapter 4 (Description of Development) of this ES.

2.1 Guidance

There are a number of guidance documents appropriate to the activities planned on site which have been used to guide this assessment, as follows:

- Guidance on the assessment of peat volumes, reuse of excavated peat and the minimisation of waste (SR, SEPA, January 2012);
- SEPA Regulatory Position Statement – Developments on Peat (SEPA, February 2010);
- Good practice during wind farm construction (SR, SNH, SEPA, FCS; October 2010);
- Floating roads on peat (SNH, FCS; August 2010); and
- Constructed tracks in the Scottish Uplands (SNH, March 2005).

3.0 METHODOLOGY

To determine the extent of excavated material across the site as a result of the Development, the following have been considered:

- the amount of excavated materials arising from construction activities on site; and
- the extent of excavated materials derived from any excavations, which if not stored correctly (on a temporary basis), or used appropriately in restoration, is at risk of releasing CO_2 emissions.

This PMP assesses the volumes of excavated material sourced from the site, to calculate site specific volumes based on factors including:

- excavations around turbines – what materials would be re-used and how;
- length of access tracks – would peat be removed and where it would be used in landscaping/reinstatement in an appropriate fashion;
- borrow pits - whether peat, or any other material, would be used appropriately to restore borrow pits; and
- other infrastructure - can materials from site be used during reinstatement works.

An assessment of the soils balance has been undertaken to determine the materials available on site for use in reinstatement.

4.0 POTENTIAL IMPACTS ON PEAT FROM CONSTRUCTION SITE ACTIVITIES

4.1 Wind Turbines

Wind turbine foundations in peatlands would normally require full and permanent excavation of peat to competent strata, with temporary excavation of peat from a wider diameter to enable safe access to the base of the excavation.

The resulting peat generated could be considered as a permanent loss, unless satisfactory re-use could be achieved within the development site. The peat would normally be used to reinstate track shoulders, around crane hardstandings and turbine bases.

4.2 Crane Hardstanding

In order to assemble the wind turbine and enable servicing during operation, crane pads are constructed adjacent to each wind turbine. These must be sufficient to take the weight of both the crane and turbine components, and therefore excavation to underlying competent strata is required. Without adequate drainage controls, permanent excavation may disrupt natural hydrological pathways.

Crane pads must remain in place for the life of the wind farm to enable routine inspection and maintenance. Peat generated from these excavations would be considered a permanent loss, unless satisfactory re-use could be achieved within the development site.

4.3 Construction Compounds

Temporary compounds are provided during the construction phase to enable storage of construction materials, turbine components and fuel, concrete batching plant, siting of welfare facilities and site offices.

Because of their temporary nature, peat excavated for compounds would normally be stored and reinstated, and therefore re-use is required.

4.4 Borrow Pits

Where access track and hardstanding construction materials are required, it is intended to source the material from borrow pits within the development site boundary.

Peat overlying Glacial Till and bedrock is normally excavated and temporarily stored for the duration of construction, and then re-used for borrow pit restoration and landscaping post construction, and therefore re-use is required.

4.5 Access Tracks

Access tracks are required to enable passage of construction and servicing traffic around the wind farm site. Over peatlands, the choice of access track design normally reflects the peat depths along the route, with shallow peat / organic soils <1m deep excavated to competent strata (cut and fill tracks), and deeper peats) overlain by floating tracks (with no excavation).

Access tracks are permanent infrastructure, peat excavated for cut and fill would be considered a permanent loss, unless the peat can be re-used elsewhere on site.

No excavations are undertaken for floating tracks, and therefore there is no associated peat excavation. In excavated tracks, the surface vegetation (i.e. habitat) would be lost unless stored and reinstated elsewhere, however the intention will be to re-use excavated turves and peat on verges and shoulders of track shoulders (including along the verges of floated track sections) and hardstandings for landscaping and restoration purposes.

Both types of access track have the potential to disrupt natural hydrological drainage pathways, appropriate drainage will be designed to mitigate this and this is detailed in the draft Construction Environmental Management Plan (CEMP), included in Appendix 4.1 of this ES.

4.6 Cable Trenching

Electrical cabling is typically buried or ducted adjacent to the access track network (cable trenching), either into existing peat (requires excavation, laying and backfilling) or wherever possible ducts are laid within reinstated material at the sides of floated tracks (no excavation of in-situ peat required). Where excavation is required, peat generated from cable trenching is normally replaced at its point of origin, and therefore is not considered a volume loss and re-use is a certainty.

5.0 PROPOSED MITIGATION DURING CONSTRUCTION

There are a number of ways in which detailed design and construction activities can be specified to minimise impacts on peatlands. The detailed construction environmental mitigation is outlined in detail in the draft CEMP (see Appendix 4.1 of this ES); the following section outlines briefly the likely mitigation based on the reuse of peat specific to key elements of the wind farm development.

5.1 Wind Turbine Foundations

Wind turbine foundations represent permanent excavation and the primary mitigation measure is to locate the wind turbines to avoid the areas of deepest peat, thereby reducing excavated volumes.

All turbine locations for the proposed Development are located on peat with an average peat depth of 0.75m, ranging from 0.2m to 1.9m.

5.2 Crane Hardstanding's and Temporary Compounds

In relation to crane hardstanding, guidance is to avoid their full reinstatement post-construction, given the likelihood of re-use for maintenance activities associated with the wind turbines.

In relation to temporary compounds, the following good practice guidance applies:

- peat stripped from compound and hard standing areas will require particularly careful storage due to its volume, and the relatively long residence times for stored peat;
- Stripped turves are generally used for final restoration, however where turves are insufficient or vegetation regeneration requires reseeding and temporary fencing may be considered around compound areas undergoing restoration in order to prevent grazing; and
- the choice of seed mix for reseeding should be appropriate to the ecological and hydrological conditions of the restored compound location and surrounding habitats.

5.3 Borrow Pits

Peat may be reused within borrow pits for the purpose of their restoration provided the method of reuse is consistent with the environmental reinstatement objectives of the site and presents no residual risks from pollution of the environment or harm to human health (SEPA, 2012).

Key issues for borrow pit restoration are:

- Prevention of desiccation and carbon losses from peat used in the restoration;
- Development of complete vegetation cover through emplacement of peat turves or seeding with an appropriate species; and
- Fencing where required to exclude grazing stock and encourage vegetation establishment.

It is proposed to open and extend the existing borrow pits that were used for the construction of Gordonbush Wind Farm, and as a result limited in-situ peat should be encountered. A significant volume of reinstated materials used on original scheme. will be excavated to allow re-opening of the borrow pits. This material will be reused for restoration on completion of the construction phase.

5.4 Access Tracks

In comparison to infrastructure specific to wind turbines, there is considerably more guidance available to support access track design in peatlands. Guidance is generally focused on floating tracks and excavated tracks, and is summarised below.

5.4.1 Floating AccessTracks

Over deeper peat (typically >1.0m), floating tracks are used to remove the requirement for peat excavation and limit disruption of hydrological pathways. The success of construction requires careful planning to take account of the unique characteristics of peat soils. Specific guidance[4] is available on design, the duration and timing of construction, the sequence of construction and the re-use of peat on the shoulders of the floating access track.

5.4.2 Design of Floating Access Tracks

The following issues should be considered during detailed design of floating access tracks:

- adopting conservative values for peat geotechnical properties during detailed design (post-consent);
- applying a maximum depth rule whereby an individual layer of geogrid and aggregate should not normally exceed 450mm without another layer of geogrid being added;
- on gently sloping ground and where the access track runs transverse to the prevailing slope, accommodating natural hydrological pathways such as flushes and peat pipes through installation of a permanent conduit within or underneath the track and allowing for as much diffuse discharge (while minimising disturbance to existing peatland) on the downslope as possible;
- ensuring transitions between floating tracks and excavated tracks (or other forms of track not subject to long term settlement) are staged in order to minimise likelihood of track failure at the boundary between construction types;
- scheduling access track construction to accommodate for, and reduce, peat settlement characteristics; and
- Re-use of existing roads (with upgrading if required), where possible.

[4] Floating roads on peat (SNH, FCS; August 2010);

5.4.3 Duration and Timing of Construction of Floating Access Tracks

The critical factor in successful construction of floating access tracks is the timescale of construction, and the following good practice guidance is provided:

- the settlement characteristics of peat; should be accommodated by appropriate scheduling of access track construction, as follows:
  - prior to construction works, the setting out the centreline of the proposed access track to identify any ground instability concerns or particularly wet zones;
  - identifying ‘stop’ rules, i.e. weather dependent criteria for cessation of access track construction based on local meteorological data; and
  - maximising the interval between material deliveries over newly constructed access tracks that are still observed to be within the primary consolidation phase.

5.4.4 Sequence of Construction

The sequence of construction is normally stipulated in guidance provided by the supplier of the geotextile or geogrid layer, and suppliers are often involved in the detailed access track design. Good practice in relation to the sequence of access track construction is as follows:

- retaining rather than stripping the vegetation layer (i.e. the acrotelm, providing tensile strength), and laying the first geotextile/geogrid directly on the peat surface;
- adding the first rock layer;
- adding the second geotextile/geogrid, and add overlying graded rockfill as a running surface;
- heavy plant and Heavy Goods Vehicles (HGV) using the access tracks during the construction period should be trafficked slowly in the centre of the track to minimise dynamic loading from cornering, breaking and accelerating;
- ensuring wheel loads should remain at least 0.5m from the edge of the geogrid, markers should be laid out, monitored and maintained on the access track surface to clearly emphasise these boundaries; and
- initial ‘toolbox’ talks and subsequent feedback to construction and maintenance workers and drivers to emphasise the importance of the implementing the above measures.

5.4.5 Use of peat as trackside shoulders

A key opportunity to re-use peat is to employ it in landscaping of constructed access tracks. Wedge-shaped reinstatement at the margins of a floating access track (which is elevated above the peat surface) is termed shoulders, and good practice guidance is as follows:

- re-using peat excavated from elsewhere on site as shoulders adjacent to the floating track;

- peat shoulders should taper from just below the track sides (thereby preventing over high shoulders from causing ponding on the track surface) to join the surrounding peat surface, keeping as natural a profile as possible to tie in with existing slope profiles; and
- limiting the width of peat shoulders to avoid unnecessary smothering of intact vegetation adjacent to the floating track.

5.5 Excavated Access Tracks

Excavated tracks require complete excavation of peat to a competent substrate. Excavated tracks are generally undertaken where peat depths are less than 1m. This peat would require storage ahead of re-use elsewhere on site. Good practice guidance relates mainly to drainage in association with excavated tracks:

- trackside ditches should capture surface water (within the acrotelm) before it reaches the road;
- interceptor drains should be shallow and flat bottomed (and preferably entirely within the acrotelm to limit drawdown of the water table);
- any stripped peat turves should be placed back in the invert and sides of the ditch to assist regeneration; and
- culverts and cross drains should be installed under excavated tracks to maintain subsurface drainage pathways (such as natural soil pipes or flushes). Discharge from constructed drainage should allow for as much diffuse dispersion of clean (silt free) water as possible while minimising disturbance to existing peatland as far as possible. Silt mitigation measures will be incorporated into all constructed drainage as per the requirements of the CEMP.

Although excavation is normally undertaken in peat of minor thickness (< 1.0m), there is a possibility of minor slippage from the cut face of the peat mass. Accordingly:

- free faces should be inspected for evidence of instability (cracking, bulging, excessive discharge of water or sudden cessation in discharge); and
- where significant depths of peat are to be stored adjacent to an excavation, stability analysis should be conducted to determine Factor of Safety (FoS) and an acceptable FoS adopted for loaded areas.

As with floating tracks, monitoring should be scheduled post-construction to ensure that hydrological pathways and track integrity have been suitably maintained.

5.6 Cable Trenches

Cable trenches either require peat excavation specifically for this purpose, or they can be constructed within landscaping of shoulders adjacent to floating tracks. Guidance is as follows:

- utilise peat shoulders for cable lays where possible to minimise peat excavations specifically for this purpose, in this case, peat shoulders should be 1.0m to 1.5m thick;

- where cable trenching is constructed adjacent to a floating road, ensure the trench is backfilled to prevent void filling by material migration;
- minimise time between excavation of the cable trench and peat reinstatement, preferably avoiding excavation until the electrical contractor has cables on-site ready for installation; and
- avoid incorporating substrate materials in the excavation, to minimise contamination of the peat to be reinstated. Replace excavated materials sequentially.

5.7 Peat Excavation, Storage and Transport

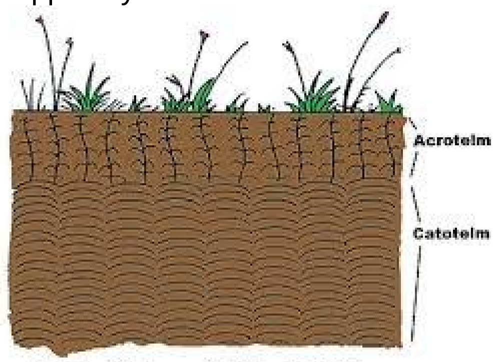
If peat is to be re-used or reinstated with the intention that its supported habitat continues to be viable, the following good practice applies:

5.7.1 Excavation

Excavated peat should be excavated as turves, including the acrotelm (surface vegetation) and a layer of adjoining catotelm (more humified peat) typically up to 500mm thick in total, or as blocks of catotelm; the acrotelm should not be separated from its underlying peat;

- the turves should be as large as possible to minimise desiccation during storage;
- contamination of excavated peat with substrate materials should be avoided; and
- consider timing of excavation activities to avoid very wet weather and multiple handling to minimise the likelihood of excavated peat losing structural integrity.

If possible, extract intact full depth acrotelm layers from the top surface of the peat deposit. This technique will maintain connectivity between the surface vegetation and the partially decomposed upper layers of the catotelm.



Hydrological Layers in Bogland Habitat

5.7.2 Storage

- peat turves should be stored in wet conditions or irrigated in order to prevent desiccation (once dried, peat will not rewet);
- stockpiling of peat should be in large volumes to minimise exposure to wind and sun (and desiccation), but with due consideration for slope stability;
- excavated peat and topsoils should be stored to a maximum of 1m thickness;

- stores of non-turf (catotelm) peat should be bladed off to reduce the surface area and desiccation of the stored peat; and
- monitor areas of steep peat and peat storage areas during periods of very wet weather, or during snowmelt, to identify early signs of peat instability.

5.7.3 Temporary Storage

Initial excavation volumes for construction of turbine foundations range between 1600m^3 and 2100m^3. Based on the volume of peaty soils/peat encountered at site, volumes ranging from as little as 150m^3 to 1500m^3 of peat will require excavation from the turbine bases. As an example, for the average volume (~600m^3), this would require a temporary storage area near to the construction works of approximately 25m x 25m to a height of 1.0m. Where peat cannot be transferred immediately to an appropriate restoration area, short term storage will be required. In this case, the following good practice applies:

- peat should be stored around the turbine perimeter at sufficient distance from the cut face to prevent overburden induced failure;
- local gullies, diffuse drainage lines (or very wet ground) and locally steep slopes should be avoided for peat storage;
- stored upper turves (incorporating vegetation) should be organised and identified according to NVC community (assisted by the Environmental Clerk of Works, ECoW) for reinstatement adjacent to like communities in the intact surrounding peat blanket; and
- drying of stored peat should be avoided by irrigation (although this is unlikely to be significant for peat materials stored less than 2 months).

For crane pads, borrow pits and compounds (with longer term storage requirements), the following good practice applies:

- peat generated from crane pad locations should be transported directly to its allocated restoration location, to minimise the volume being stockpiled with the possibility of drying out;
- stores of catotelmic peat should be bladed off to reduce their surface area and minimise desiccation;
- where transport cannot be undertaken immediately, stored peat should be irrigated to limit drying and stored on a geotextile mat to promote stability; and
- monitoring of large areas of peat storage during wet weather or snowmelt should be undertaken to identify any early signs of peat instability.

5.7.4 Transport

- movement of turves should be kept to a minimum once excavated, and therefore it is preferable to transport peat planned for translocation and reinstatement to its destination at the time of excavation; and

- if HGVs that are used for transporting non-peat material are also to be used for peat materials, measures should be taken to minimise cross-contamination of peat soils with other materials.

5.7.5 Handling

Following refinement of the wind farm peat model, a detailed storage and handling plan should be prepared as a detailed PMP forming part of the detailed CEMP:

- best estimate excavation volume at each infrastructure location (including peat volumes split into area / volume of ‘actrotelm’ or ‘turf’, and volume of catotelm);
- volume to be stored locally and volume to be transferred directly on excavation to restoration areas elsewhere (e.g. disused quarries, borrow pits or forest drains) in order to minimise handling;
- location and size of storage area relative to turbine foundation, crane hardstanding and natural peat morphology / drainage features; and
- Irrigation requirements and methods to minimise dessication of excavated peat during short term storage.

These parameters are best determined post-consent in light of detailed ground investigation with the micro-siting areas for each element of infrastructure.

5.8 Restoration

- carefully evaluate potential restoration sites, such as borrow pits for their suitability, and agree that these sites are appropriate with the ECoW, landowners and relevant consultees;
- undertake restoration and revegetation work as soon as possible;
- where required, consider exclusion of livestock from areas of the site undergoing restoration, to minimise impacts on revegetation; and
- as far as reasonably practicable, restoration should be carried out concurrently with construction rather than at its conclusion.

6.0 SITE BASED PEAT EXCAVATION AND REUSE ASSESSMENT

The Stage 1 PMP has been requested by SEPA[5] as part of the planning process to ensure there is an understanding of the extent of peat on site, the total amount of peat that might be excavated, a demonstration that the current design avoids areas of deep peat where possible and that the re-use of the excavated materials is certain and minimised where possible.

The Development layout comprises 16 wind turbines and associated crane hardstandings, a single access point for construction traffic to the south of the site, on-site access tracks of both floating and cut construction, a temporary construction compound and permanent operations building, cabling and one permanent meteorological mast.

Existing infrastructure from the operational Gordonbush Wind Farm would be utilised for the proposed Development where possible, including existing access tracks, borrow pits and the substation.

6.1.1 Peat Probing

A series of peat probing exercises were undertaken in March and November 2014 by experienced geotechnical and hydrogeological engineers, which fed into the iterative design process of the Development. Initially peat probing was undertaken across the whole of the development on a notional 100m square grid. Areas of particular interest, including access track routes and wind turbine positions were probed on a 50m grid or less resulting in 1,170 peat probes within the site boundary[6].

The overall conclusion regarding peat stability is that there is a negligible to low risk of peat instability over most of the site although some limited areas of medium risk have been identified.

The site is generally covered in peaty soils and peat, therefore avoidance of deeper peat areas (generally greater than 1m) has been avoided where possible. No evidence of significant peat instability was noted on the site, primarily as it is generally flat lying. The area is open moorland, with quite extensive organic peaty soil and peat coverage. The layout has been carefully designed to minimise excavating or disturbing thick peat, where possible, and where this cannot be avoided, mitigated by the use of floating roads.

Figure 1 illustrates the extent of peat / peaty soils (<0.5m) and Figure 2 presents the extent of 'true' peat (>0.5m) across the site.

Based on the original 100m grid undertaken on the site, the average peat depth is recorded as ~1.00m. By utilising this data to modify the layout, the design process has reduced the potential impact on future peat disturbance. By undertaking detailed probing along the finalised layout, the average peat depth at each turbine is now <0.75m and along the roads to an average of ~0.53m. The detailed peat assessment has allowed modification of layout to reduce overall impact to peat on site, by

[5] SEPA, Response to Scoping Reference PCS/129202, October 2013

[6] Appendix 9.1: Peat Slide Hazard Risk Assessment

avoiding deep peat areas. The average peat thickness across the site of the 1,170 data points is ~0.80m, based on the additional detailed data.

6.1.2 Excavated Peat Volume Estimates

Based on the Development details, a total volume of excavated peat, sub-soil and topsoil has been calculated (see Table 6.1). It also includes an estimate of the extent of acrotelmic peat (fibrous) vs catotelmic peat (amorphous) which will be excavated. Reuse estimates are discussed in Section 7 (Table 7.1).

The figures used in the following table, are derived from the excavated materials worksheet included as Appendix A.

Table 6-1
Excavation Materials Management Plan

Method	Volume of Excavated material m^3	How much of this can be reused on site %	Opportunity for Avoidance or minimisation of Excavated material	Re-use Requirements	Heirarchy Adherance	Limitations and Constraints
Excavated Access Tracks Total length of the access tracks would be 18.9km and would consist of the following: • 6.437km of new access tracks (excavated); • 1.522km of new access tracks (floated); • 10.93km of upgraded existing access tracks. Of the total 18.9km, ~6.437km would be excavated access tracks and these would be located on peaty soil (<0.5m) and thin peat between 0.5 and 1.0m. Average peat thickness along excavated access	**18764 m^3** (6437m x 0.53m x 5.5m)	100%	The access track route has been subject to a number of design iterations to avoid thicker peat and steep slopes. Where possible track width would be minimised. The peat along the proposed excavated access tracks on the site is very fibrous and does not exhibit thick catotelmic peat. Visually the peat is coarse fibrous peat which is fairly dry and reasonably well drained. There are some areas of thick catotelmic peat on the route of the site access tracks; however these areas would utilise floated access tracks to minimise disturbance of the peat.	Verge Restoration and visual screening, particularly along access track. Sections of the route may require cut and fill and these slopes would require restoration to minimise visual impact **~15448m^3** of excavated peat and peaty soil would be used along access tracks. Further restoration materials would be required to upgrade existing access track and additional peat would be required to restore cut and fill sections of the track. Hence a further ~5000m^3 may be required giving ~**20,448m^3.**	Avoidance was first level of screening to avoid areas of thicker peat. Routing has been planned on thinner peat or peaty soils where possible. The layout design has been guided by constraints which highlight ecological, hydrogeological and geomorphological considerations, all of which identify the peat areas to avoid. As the southern and eastern portion of the site is almost entirely underlain by peat, access track route selection has also been guided by extensive peat probing to establish areas of shallow peat.	Requires detailed ground investigation to fully characterise peat. Detailed assessment may identify further lengths of floating access tracks, which would further reduce requirement for excavation.

Method	Volume of Excavated material m^3	How much of this can be reused on site %	Opportunity for Avoidance or minimisation of Excavated material	Re-use Requirements	Heirarchy Adherance	Limitations and Constraints
track is 0.53m. The access track would be a minimum of 4.5 wide, with 0.5m verges. This volume includes ~30% of peaty soils, which are very fibrous and technically a soil rather than peat. The material would all be excavated and as such should be considered as peat. All of this fibrous material can be reused and has an inherent strength.						
Floating Access Tracks It is anticipated that 1.522km of floating tracks would be required, which would generate no surplus peat.	0	Not applicable	No excavated material except where cable trenches are proposed (see below).	Verge restoration along access tracks ~ **3652 m^3**	Looked at different cut off depths for floating access track. Based on > 1m depth.	Verge restoration must avoid impacting existing unexcavated peat.
Borrow Pits There is a limited amount of top soil which can be reused for restoration on site. Based on the area for the 2 No. existing borrow	**6534 m^3** Plus up to **63,000m^3** from existing restoration of borrow pits	100	There is no peat overlying the selected borrow pits, which are extensions to existing borrow pit sites. The existing restoration material will be excavated and reused on	Limited peaty topsoil can be stockpiled and used for restoration. **21780 m^3** can be re-used to restore borrow pits	Site selection avoided areas of peat for borrow pits, identified sites on bedrock or close to minimise removal of excessive materials.	None

Method	Volume of Excavated material m^3	How much of this can be reused on site %	Opportunity for Avoidance or minimisation of Excavated material	Re-use Requirements	Heirarchy Adherance	Limitations and Constraints
pits; BP1 and BP2, ~21,200m^2 (Assuming a thin (average) soil cover of 0.30m). In addition a total of 63,000m^3 requires excavation as the borrow pits are being reopened. This volume of material will be reused on completion of this phase of works.			site	Up to **63,000m^3** restoration material will be reused on completion of pits		
Turbine Foundations 16 No. turbines With average excavation of 28m diameter x 0.75m (average peat thickness at turbines)	**~7385m^3**	100%	Turbine locations have been subject to a number of design iterations to avoid thicker peat and steep slopes. Average thickness of peat at turbine sites is~0.75m	At turbine foundations topsoil would be stripped keeping top 200mm of turf intact. This would be stored adjacent to the base working area and would be limited to 1m height. To reinstate following construction the hardstanding area around the turbine, crane hardstanding and access track an area of ~ 168 m^3 would be required per turbine, hence a total of **2688m^3** could be reused.	Avoided areas of thick peat for turbine bases, identified sites on bedrock or close to bedrock to minimise removal of excessive materials. Two sites (Turbine 2 and 10) are located on thicker peat (up to 2m), which could not be avoided.	Requires detailed ground investigation to fully characterise peat.

Method	Volume of Excavated material m^3	How much of this can be reused on site %	Opportunity for Avoidance or minimisation of Excavated material	Re-use Requirements	Heirarchy Adherance	Limitations and Constraints
Crane Pads 16 No. crane hard standings With average excavation of 65m x 28m x 0.75m with additional small areas for cranes and blades (3m x 12m)	**22,272 m^3**	100%	Crane hardstanding locations have been influenced by the turbine design iterations to avoid thicker peat and steep slopes. Average thickness of peat at turbine sites is~0.75m; hence crane hard standings would be similar.	At crane hardstandings topsoil would be stripped keeping top 200mm of turf intact. This would be stored adjacent to the base working area and would be limited to 1m height. To restore the hardstanding area around the turbine, crane hardstanding an area of ~ 360 m^3 would be required per turbine, hence a total of **5760m^3** could be reused.	See issues for turbine bases. Orientation of crane hardstandings to be designed following detailed site investigation (SI), to avoid constraints and minimise requirement for peat excavation.	Requires detailed ground investigation to fully characterise peat.
Cable Routes Total distance of cabling ~18.95km 18950m of cables would be located on Peaty Soils and peat over Glacial Till. Using an average for roads at 0.53m peat depth, however in reality, trench depth is unlikely to exceed 1.0m.	Total Road Length 18950 x 1.55 x 0.53= 15567 m^3 **Total = 15567m^3**	100%	Minimised disturbance to drainage by taking cable route along existing access track and around the turbines adjacent to new access tracks. Much of the cable routes are over shallow peaty soils and Glacial Till where complete re-use of the materials on site is envisaged.	Suitable excavated materials would be reused to backfill trenches **15567 m^3**	Re-use and backfill excavated materials.	Ground conditions along route which may require further investigation.

Method	Volume of Excavated material m^3	How much of this can be reused on site %	Opportunity for Avoidance or minimisation of Excavated material	Re-use Requirements	Heirarchy Adherance	Limitations and Constraints
			In areas where the cable route is on rock, the site may require excavation of rock or laying cable in upfilled sections to minimise excavation of rock.			
Temporary Construction Compound 1 No. 150m x 50m the majority of the compound would be located on Glacial Till with a thin average peat thickness of 0.5.m.	150 x 50x 0.5 = **3975 m^3**	100%	The construction compounds would largely be located on Glacial Till alongside the existing access track. Small area of thicker peaty soils/peat (<1m) also occurs, but this was difficult to avoid.	Materials would be re-used on site to restore working areas and for appropriate landscaping. **3975 m^3**	Avoided siting temporary compounds on thick peat areas where possible.	None
Batching Plant 1 No 50m x 50m	50 x 50x 0.7 = **1750 m^3**	100%	The batching plant would largely be located on Glacial Till alongside the existing access track. Small area of thicker peaty soils/peat (<1m) also occurs, but this was difficult to avoid.	Materials would be re-used on site to restore working areas and for appropriate landscaping. **1750 m^3**	Avoided siting temporary compounds on thick peat areas where possible.	None

Method	Volume of Excavated material m^3	How much of this can be reused on site %	Opportunity for Avoidance or minimisation of Excavated material	Re-use Requirements	Heirarchy Adherance	Limitations and Constraints
Total Excavated	**139,247 m^3**	100%		**139,582 m^3**		

Based on the values indicated there is a balance of materials with no surplus peat anticipated to be generated on site.

7.0 PEAT EXCAVATION CONSIDERATIONS

This section of the PMP includes the method for dealing with peat which could potentially be classified as waste (only if the above volumes estimate significant quantities of catotelmic peat, which cannot be re-used).

Table 7.1: Excavated Materials – Assessment of Suitability, outlines where the materials likely to be generated on site fall within the Waste Licensing Regulations.

It has been concluded that all of the materials to be excavated on site would fall within the non-waste classification as most of the top soil and peaty soils would be re-used on site. Similarly the peat is predominantly fibrous peat which would be re-used on site and is classified based on the von Post classification as ranging from an H_3 to H_4 peat ranging from very slightly decomposed to slightly decomposed[7]. The majority of the excavated peat is therefore entirely re-useable as it is predominantly fibrous and easily re-used on site.

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[7] Technical Appendix - Peat Landslide Hazard and Risk Assessment 9.1

Table 7-1
Excavated Materials – Assessment of Suitability

Excavated Material	Indicative Volume on Site by % of total excavated soils[8]	Is there a suitable use for Material[9]	Is the Material required for Use on Site	Material Classified as a Waste	Re-use Potential	Re-use on site
Mineral Soil	10	Yes	Yes	Not classified as a waste	Yes	Will be reused in reinstatement of floated access track verges, cut and fill verges, road verges, side slopes and check drains. Peripheral embankments of turbine bases, crane hardstandings and restoration of borrow pits
Turf (Surface layer of vegetation and fibrous matt)	15	Yes	Yes	Not classified as a waste	Yes	
Acrotelmic Peat and catotelmic peat with H_3 to H_4 classification (very slightly decomposed to slightly decomposed[10] semi-fibrous with low moisture content) Likely to have suitable structural	65	Yes	Yes[11]	Not classified as a waste	Yes	Will be reused in reinstatement of floated access track verges, cut and fill verges, road verges, side slopes and check drains. Peripheral embankments of turbine bases, crane hardstandings and restoration of borrow pits Method statements to identify how peat is excavated, stored and used will be detailed and agreed through the detailed CEMP.

8 Based on a total excavated volume for the site of 139,427 m^3.

9 Is there a suitable use for the material without need for treatment and without risk to the environment or human health

10 Technical Appendix 9.1 - Peat Landslide Hazard and Risk Assessment

11 The material must be required in it's excavated state, the use must not require any form treatment, specialist containment or engineering at the site of use

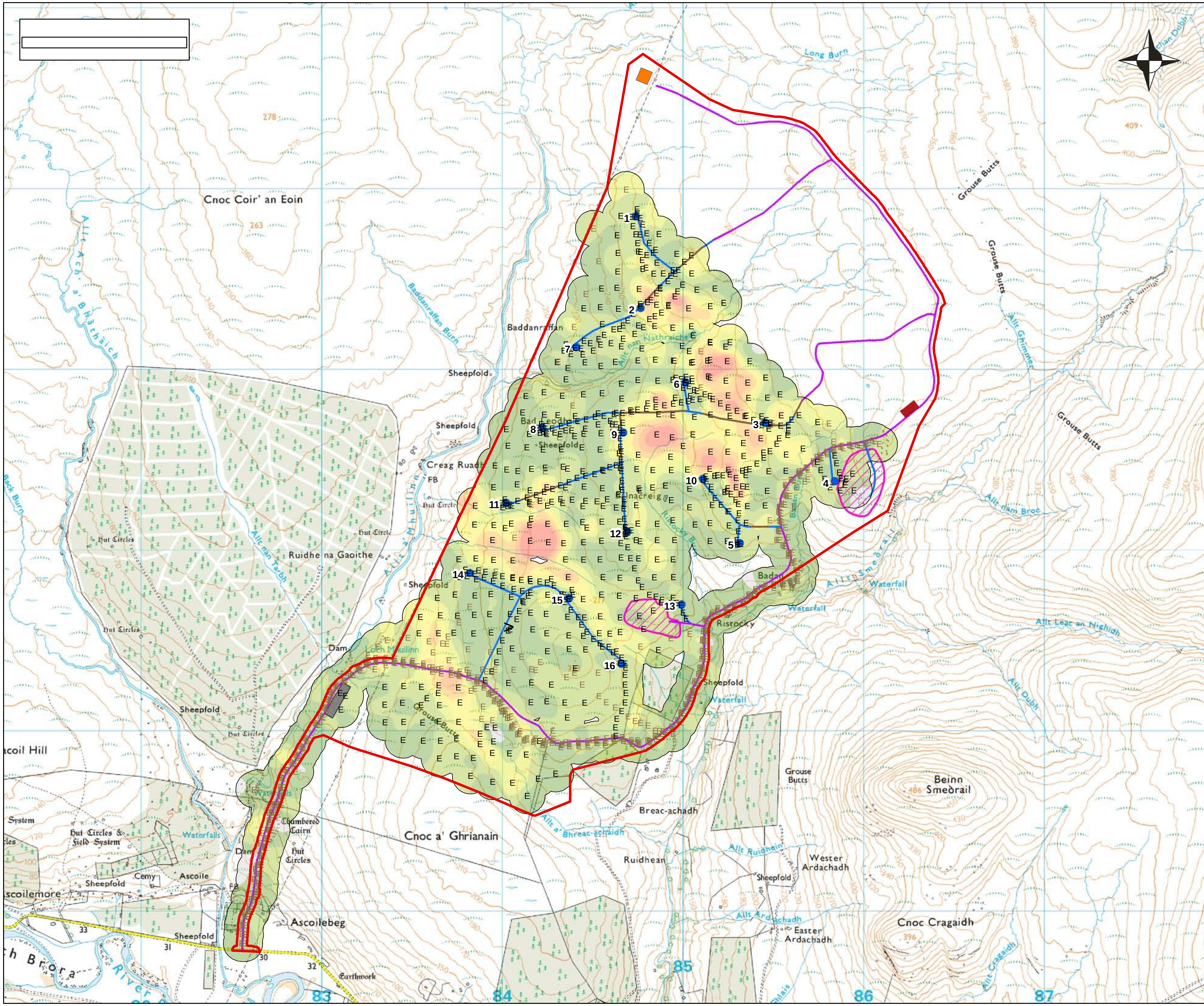
Excavated Material	Indicative Volume on Site by % of total excavated soils[8]	Is there a suitable use for Material[9]	Is the Material required for Use on Site	Material Classified as a Waste	Re-use Potential	Re-use on site
integrity for reuse on site (fibrous material retains integral structure and can stand unsupported when stockpiled >1m)						
Catotelmic Peat (amorphous material unable to stand unsupported when stockpiled >1m)	10 Very limited around site development due to avoidance by design	Potentially	Potentially[12]	Potentially if not required as part of justifiable restoration or habitat improvement works	No?	If peat does not require treatment prior to re-use it can be used on site providing adequate justification and method statements are provided and approved by SEPA If it is unsuitable for use without treatment then it may be regarded as a waste. However every attempt to avoid this type of peat has been incorporated into the design.

[12] Such uses for this type of material are limited, although there may be justification for use in the base of borrow pits to maintain water logged conditions and prevent desiccation of restored area and in some habitat improvement works such as, gully or ditch blocking where saturated peat is required to mimic mire type habitats and encourage establishment of sphagnum

8.0 CONCLUSION

The figures shown in the tables are indicative and suggest that the volumes of peat excavated on site would be re-used without creating surplus materials which would require to be classified as waste. Post consent, the Stage 1 PMP and the draft CEMP (see Appendix 4.1 of this ES) would be updated with information obtained during detailed ground investigations and design stage.

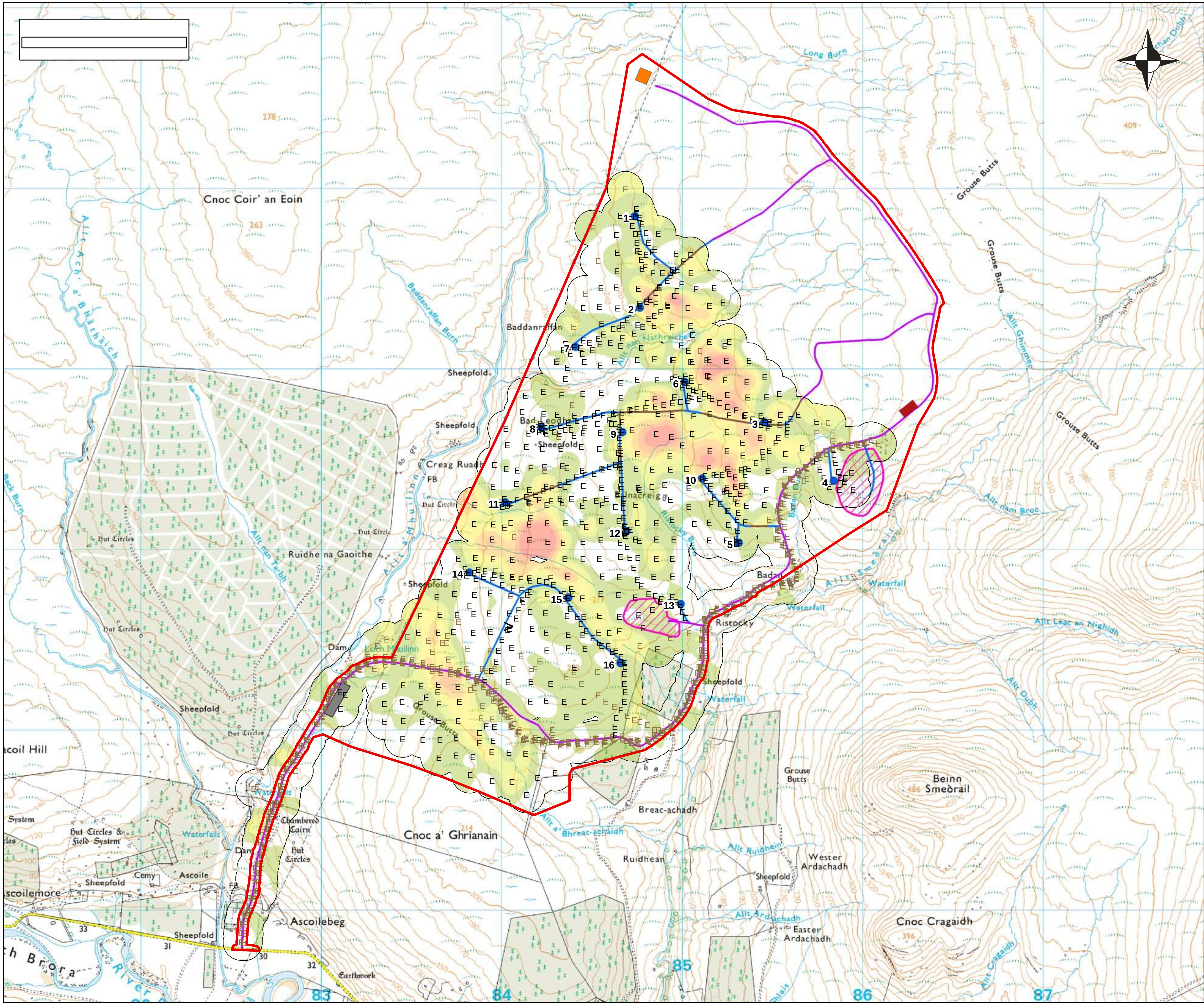
These plans would be developed to update the CEMP, with detailed post construction restoration plans. This would be reviewed and monitored along with the updated PMP and CEMP to ensure compliance with method statements and to keep track of volumes.



PEAT DEPTH (m)

INTERPRETED PEAT THICKNESS
- FULL THICKNESS

1



PEAT DEPTH (m)

INTERPRETED PEAT THICKNESS - PEAT ONLY (>0.5M)

2

Gordonbush Excavated Materials Worksheet

	Excavated					Reused				
	Length	Width	Average Depth	No	Total Volume Excavated m^3	Length	Width	Average depth	No	Total Volume Reused m^3
Excavated Tracks (New)	6437	5.5	0.53		**18763.86**	6437	3	0.4	2	**15448.80**
Excavated Tracks (Cut and Fill)										**5000.00**
Excavated Tracks (Upgraded)	10930				**0.00**	10930				**0.00**
Floating Tracks	1522	7			**0.00**	1522	3	0.4	2	**3652.80**
Borrow Pit 1	66	110	0.3		**2178.00**	66	110	1		**7260.00**
Borrow Pit 1 (existing restoration material)					**27000.00**					**27000.00**
Borrow Pit 2	88	165	0.3		**4356.00**	88	165	1		**14520.00**
Borrow Pit 2 (existing restoration material)					**36000.00**					**36000.00**
Turbine Foundations	28	28	0.75	16	**7385.28**	84	2	1	16	**2688.00**
Crane Pads	65	28	0.75	16	**21840.00**	160	2	1	16	**5120.00**
Crane Pads Ancillary	3	12	0.75	16	**432.00**	50	2	1	16	**1600.00**
Cable Routes	18950	1.55	0.53		**15567.43**	18950	1.55	0.53		**15567.43**
Temp Construction Compound	150	50	0.53		**3975.00**	150	50	0.53		**3975.00**
Batching Plant	50	50	0.7		**1750.00**	50	50	0.7		**1750.00**
Operations Building										
TOTAL EXCAVATED VOLUME					**139247.56**					**139582.03**
TOTAL REUSED VOLUME					139582.03					
NET BALANCE					-334.46					

Assume 3m wide shoulder. road height 0.8m
Estimate to reinstate cut slopes

Assume 3m wide shoulder, road height 0.8m
Includes top soil and peat to restore borrow pits

Assumes all re-used on site

Assumes all re-used on site
Based on circular base. Average peat depth at turbines 0.75m Assumes 2m^3 per linear metre around base
Average peat depth at turbines 0.75m Assumes 2m3 per linear metre around base

Average peat depth along roads is 0.53m

Use for landscaping bunds and screening
Full reinstatement

global environmental solutions

ABERDEEN
214 Union Street,
Aberdeen AB10 1TL
T: +44 (0)1224 517405

AYLESBURY
7 Wornal Park, Menmarsh Road,
Worminghall, Aylesbury,
Buckinghamshire HP18 9PH
T: +44 (0)1844 337380

BELFAST
Suite 1 Potters Quay, 5 Ravenhill Road,
Belfast BT6 8DN
T: +44 (0)28 9073 2493

BRADFORD-ON-AVON
Treenwood House, Rowden Lane,
Bradford-on-Avon, Wiltshire BA15 2AU
T: +44 (0)1225 309400

BRISTOL
Langford Lodge, 109 Pembroke Road,
Clifton, Bristol BS8 3EU
T: +44 (0)117 9064280

CAMBRIDGE
8 Stow Court, Stow-cum-Quy,
Cambridge CB25 9AS
T: + 44 (0)1223 813805

CARDIFF
Fulmar House, Beignon Close, Ocean
Way, Cardiff CF24 5PB
T: +44 (0)29 20491010

CHELMSFORD
Unit 77, Waterhouse Business Centre,
2 Cromar Way, Chelmsford, Essex
CM1 2QE
T: +44 (0)1245 392170

DUBLIN
7 Dundrum Business Park, Windy
Arbour, Dundrum, Dublin 14 Ireland
T: + 353 (0)1 2964667

EDINBURGH
No. 4 The Roundal, Roddinglaw
Business Park, Gogar, Edinburgh
EH12 9DB
T: +44 (0)131 3356830

EXETER
69 Polsloe Road, Exeter EX1 2NF
T: + 44 (0)1392 490152

GLASGOW
4 Woodside Place, Charing Cross,
Glasgow G3 7QF
T: +44 (0)141 3535037

GUILDFORD
65 Woodbridge Road, Guildford
Surrey GU1 4RD
T: +44 (0)1483 889 800

LEEDS
Suite 1, Jason House, Kerry Hill,
Horsforth, Leeds LS18 4JR
T: +44 (0)113 2580650

LONDON
83 Victoria Street,
London, SW1H 0HW
T: +44 (0)203 691 5810

MAIDSTONE
19 Hollingworth Court, Turkey Mill,
Maidstone, Kent ME14 5PP
T: +44 (0)1622 609242

MANCHESTER
Digital World Centre, 1 Lowry Plaza,
The Quays, Salford, Manchester
M50 3UB
T: +44 (0)161 216 4064

NEWCASTLE UPON TYNE
Sailors Bethel, Horatio Street,
Newcastle-upon-Tyne NE1 2PE
T: +44 (0)191 2611966

NOTTINGHAM
Aspect House, Aspect Business Park,
Bennerley Road, Nottingham NG6 8WR
T: +44 (0)115 9647280

SHEFFIELD
Unit 2 Newton Business Centre,
Thorncliffe Park Estate, Newton
Chambers Road, Chapeltown,
Sheffield S35 2PW
T: +44 (0)114 2455153

SHREWSBURY
2nd Floor, Hermes House, Oxon
Business Park, Shrewsbury SY3 5HJ
T: +44 (0)1743 239250

STAFFORD
8 Parker Court, Staffordshire Technology
Park, Beaconside, Stafford ST18 0WP
T: +44 (0)1785 241755

WORCESTER
Suite 5, Brindley Court, Gresley Road,
Shire Business Park, Worcester
WR4 9FD
T: +44 (0)1905 751310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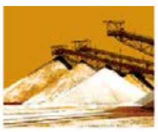
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