# SHEIRDRIM RENEWABLE ENERGY DEVELOPMENT

**Technical Appendix 10.2: Peat Management Plan**

Prepared for: ScottishPower Renewables UK Ltd

SLR

**SLR Ref: 405.00481.00051**
**Version: 1**
**October 2019**

# BASIS OF REPORT

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# 1.0 Introduction

SLR Consulting Ltd (SLR) was commissioned by ScottishPower Renewables UK Ltd (SPR) to undertake a Stage 1 Peat Management Plan (PMP) at the proposed Sheirdrim Renewable Energy Development. The proposed Development would be located approximately 11 km south of Tarbert, 2 km to the east of Clachan and 2.6 km south west of Whitehouse at the northern end of the Kintyre Peninsula. Details of the proposed Development can be found in **Chapter 3: Proposed Development**. The Site location is identified in **Figure 10.2.1**.

The proposed Development is likely to comprise 19 turbines (tip height of 149.9 m), a number of solar arrays and battery storage with associated infrastructure including:

- Turbine & Solar foundations;
- Crane hardstandings;
- Transformer/switchgear housings located adjacent to turbines;
- New and upgraded access tracks including watercourse crossings where necessary;
- Underground cabling;
- Substation compounds including control buildings, external equipment and ancillary grid service equipment/battery storage;
- Up to two temporary Power Performance Masts;
- Site signage;
- Search areas for up to five borrow pits; and
- construction and maintenance compound and laydown areas.

In addition, the following activities are required during the construction phase of the project:

- Potential establishment of on-site concrete batching plant; and
- Removal and management of material during foundation and track construction.

## 1.1 Scope of Assessment

A comprehensive programme of soils and peat probing has been completed at the Site. This document uses this information and provides indicative volumes for peat extraction and outlines recommendations for the handling, re-use and storage of peat during construction and operation of the Site. The results of the probing survey are detailed within **Figure 10.2.2** (Peat Depth). Areas of the Site where soils are less than 0.5 m thick are considered to be too thin to be classified as peat and are, therefore, classified as soils. **Figure 10.2.3** (Peat Depth >0.5m) shows the areas of the Site where soils/peat >0.5 m has been identified. Areas of the Site subject to the proposed Development and which have been proven to have soil depths of <0.5m, are not within the scope of the PMP.

The purpose of this report is to ensure that there has been a systematic consideration of peat management and a quantitative assessment throughout the development process.

## 1.2 Methodology

Scottish Planning Policy states that *"Where peat and other carbon rich soils are present, applicants should assess the likely effects of development on carbon dioxide ($CO_2$) emissions. Where peatland is drained or otherwise disturbed, there is liable to be release of $CO_2$ to the atmosphere. Developments should aim to minimise this release."*

The Stage 1 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.

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 in the following list (SEPA 2010[1], SR and SEPA 2012[2]):

- **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 of peat produced on site in restoration or landscaping, providing 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 to re-use; and
- Storage – storage of peat up to a depth of 2 m on a temporary basis for future re-use is not classified as a waste and does not require authorisation from SEPA; however, care must be taken to ensure that it does not cause environmental pollution, create an unnatural habitat or a safety risk.

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

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

This report presents site specific data and proposals to address the requirements of Stage 1 of SEPA's guidance and proposes that **prevention** and **re-use** are the most appropriate means of managing peat excavated during construction at the Site. It details the methodologies required to assess all potential surplus materials and presents preliminary estimates of the expected volume of excavated materials and required re-use volumes for reinstatement and restoration purposes. 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 the Site can be accommodated by modifying the proposed Development layout to avoid potentially difficult or sensitive areas. Such areas would include:

- Areas of deep peat, requiring potentially large volumes of excavation;

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

[2] Scottish Renewables, Scottish Environmental Protection Agency (2012) Developments on Peatland: Guidance on the Assessment of Peat Volumes, Reuse of Excavated Peat and the Minimisation of Waste, Version 1

- 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 re-used through the following:

- The avoidance of creating surplus materials, and
- Re-use of materials on site.

## 1.3 Guidance and Good Practice

Legislation relevant to the management of peat includes the following:

- The UK Climate Change Act 2008 (c27);
- Environmental Protection Act 1990 (as amended);
- Landfill (Scotland) Regulations 2003 (as amended);
- The Waste Management Licensing (Scotland) Regulations 2011; and
- Scottish Planning Policy (2014).

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

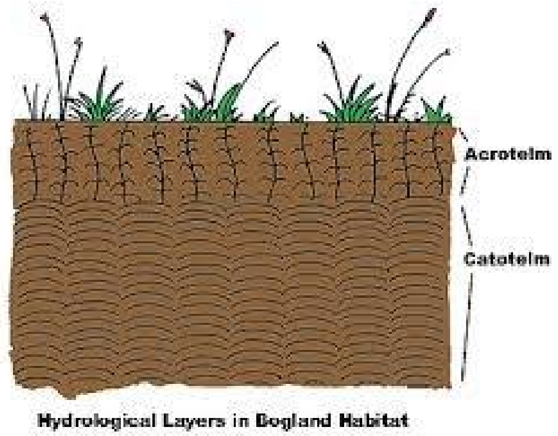
- Guidance on Developments on Peatland (SNH, SEPA 2017);
- Guidance on the assessment of peat volumes, reuse of excavated peat and the minimisation of waste (SR, SEPA, January 2012);
- SEPA Regulatory Position Statement – Developments on Peat (SEPA, February 2010);
- Good practice during wind farm construction (SR, SNH, SEPA, FCS, HES; September 2015);
- Floating roads on peat (SNH, FCS; August 2010);
- Constructed tracks in the Scottish Uplands (SNH, September 2015); and
- Restoration techniques using peat spoil from construction works (SEPA 2011).

## 1.4 Definitions of Peat

Peat is defined as a sedimentary material consisting of the partially decomposed remains of plant material and organic matter preserved over a period of time in a waterlogged environment resulting in anaerobic conditions, and is considered to be of depths > 0.5 m.

Peat can be classed as two principal types, the acrotelm layer, and the catotelm layer as shown on **Diagram 1-1** and described in the following paragraphs.

**Diagram 1-1**
**Hydrological Layers in Bogland Habitat**




The acrotelm layer is found in the upper layer of peat where conditions are relatively dry and comprises living vegetation and partially decomposed plant material. Hydraulic conductivity in this layer tends to be higher in relation to distance from the water table.

The thickness of the acrotelm layer varies depending on topography such as steepness of slope, peat hags, and hummocks. In particular, the acrotelm layer can be affected during periods of drought or as a consequence of drainage. Fibrous in texture, the acrotelm layer has some tensile strength and is generally considered to be stable for storage and re-use.

The catotelm layer is found under the acrotelm layer and comprises decayed plant material and organisms and is denser and with a very low hydraulic conductivity. The catotelm layer sits below the water table resulting in permanent anaerobic conditions. The catotelm layer is amorphous and has very low tensile strength making it less suitable for storage and re-use.

# 2.0 Occurrence of Peat

## 2.1 Peat Conditions

Peat surveys were undertaken to address the presence of peaty soils and/or peat. Peat is generally defined as an organic soil in excess of 0.5 m, if the soil is less than 0.5 m, then it is considered peaty soil. The peat was found to vary across the Site in terms of thickness and coverage.

Thin peat was classed as being 0.5 m to 1.5 m thick, with deposits in excess of this being classed as thick peat. The thickness ranges used were intended to reflect the probability of instability associated with both peat slides (in thin peat) and bog slides. Where the probing recorded less than 0.5 m thick, this has been considered to be an organic peaty soil rather than peat.

The results of the probing survey are detailed within **Figure 10.2.2**, with a summary of peat depths included within **Table 2-1**.

**Table 2-1**
**Peat Probing Data**

| Peat Thickness (m) | No. of Probes | Percentage (of total probes undertaken on site) |
|---|---|---|
| 0 (no peat) | 255 | 11.2 |
| 0 – 0.49 (peaty soil) | 966 | 42.4 |
| 0.50 – 1.49 (thin peat) | 663 | 29 |
| 1.50 – 1.99 (thick peat) | 143 | 6.3 |
| 2.00 – 2.49 (thick peat) | 80 | 3.5 |
| 2.50 – 2.99 (thick peat) | 70 | 3 |
| 3.00 – 3.99 (thick peat) | 63 | 2.8 |
| 4.00 – 4.99 (thick peat) | 26 | 1.1 |

In summary the peat depth probing has shown that:

- Approximately half of probes intersected no peat or peaty soils;
- Approximately 17% of peat probes undertaken across the entire site found peat in excess of 1.5 m thick; and
- Of the probes that intersected peat, approximately 71.9% was <1.5 m thick.

The assessment of the underlying substrate from the probing data was interpreted as predominately glacial soils and weathered bedrock. Bedrock was identified in outcrop and close to surface on many of the topographically high areas.

**Table 2-2**
**Ground Conditions at Proposed Turbine Locations**

| Turbine No. | Peat Thickness (m) | Peat Conditions | Slope (°) |
|---|---|---|---|
| 1 | 0.41 | Peaty Soil | 3.9 |
| 2 | 2.28 | Thick Peat | 2.1 |
| 3 | 0.17 | Peaty Soil | 0.8 |
| 4 | 0.39 | Peaty Soil | 1.5 |
| 5 | 0.30 | Peaty Soil | 5.9 |
| 6 | 1.51 | Thick Peat | 11.4 |
| 7 | 0.39 | Peaty Soil | 11.6 |
| 8 | 0.16 | Peaty Soil | 5.5 |
| 9 | 0.51 | Thin Peat | 4.8 |
| 10 | 0 | No Peat | 4.8 |
| 11 | 1.00 | Thin Peat | 4.0 |
| 12 | 0.58 | Thin Peat | 6.2 |
| 13 | 0.62 | Thin Peat | 4.4 |
| 14 | 0.90 | Thin Peat | 4.7 |
| 15 | 0.64 | Thin Peat | 5.5 |
| 16 | 0.42 | Peaty Soil | 6.5 |
| 17 | 1.05 | Thin Peat | 4.2 |
| 18 | 0.81 | Thin Peat | 1.6 |
| 19 | 0.44 | Peaty Soil | 9.2 |

# 3.0 Potential Impacts on Peat from Construction Activities

## 3.1 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 Site. The peat would normally be used to reinstate track shoulders, around crane hardstandings and turbine bases.

## 3.2 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 proposed Development 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 proposed Development site.

## 3.3 Construction and Maintenance Compound

The Construction and Maintenance Compound is 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.

Peat generated from these excavations would be considered a permanent loss, unless satisfactory re-use could be achieved within the proposed Development site.

## 3.4 Borrow Pits

Where access track and hardstanding construction materials are required, it is intended to source the material from borrow pits within the 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. Peat is not anticipated at any of the proposed borrow pit options for the proposed Development.

## 3.5 Access Tracks

Access tracks are required to enable passage of construction and servicing traffic around the proposed Development 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 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.

## 3.6 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.

## 3.7 Solar Arrays

Two areas (SA1 and SA2) identified for solar were selected based on topography and areas with no peat present.

## 3.8 Battery Storage/Substation/Control Building

The substation area will be excavated and some peat used for landscaping, the remainder will be used on access tracks close to this location.

# 4.0 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 following section outlines briefly the likely mitigation required to minimise impact, based on the reuse of peat specific to key elements of the proposed Development.

## 4.1 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/peaty soils, with an average peat/peaty soil depth of 0.66m, ranging from 0.0 m to 2.28 m.

## 4.2 Crane Hardstandings, Substation and 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.

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, temporary fencing may be considered around 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 locations and surrounding habitats.
- Where an excess of peat is generated on permanent structures such as the construction compound the material generated would be used for landscaping and for restoration around the compound area and on access tracks.

## 4.3 Borrow Pits

Peat may be re-used 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 to encourage vegetation establishment.

## 4.4 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.

### 4.4.1 Floating Access Tracks

Over deeper peat (typically >1.0 m), 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[3] 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.

**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 450 mm 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.

**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;
    - Maximising the interval between material deliveries over newly constructed access tracks that are still observed to be within the primary consolidation phase;

**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 rock fill 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 0.5 m 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.

**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.

### 4.4.2 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

[3] Floating Roads on Peat (SNH, FCS; August 2010)

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 (< 1.0 m), 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.

## 4.5 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 1.0 m to 1.5 m 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.

## 4.6 Peat Excavation, Storage and Transport

The construction process will both generate peat and use peat. Where possible, “restore-as-you-go” techniques will be used to place excavated peat material in its final destination rather than in temporary stockpiles. However there may, in some circumstances, be a time-delay between these actions. During the interim period, peat would be stored on-site. It is important both for the peat itself and for the surrounding environment that the peat is not allowed to substantially erode or become dry, while it is stored. Procedures to control the hydrology of stored peat are described in the Construction Environmental Management Plan (CEMP).

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:

### 4.6.1 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 500 mm 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.

### 4.6.2 Temporary Storage

Any peaty soils/peat to be removed during construction would require a temporary storage area near to the construction works. 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:

- Stockpiling of peat should be in large volumes to minimise exposure to wind and sun (and desiccation), but with due consideration for slope stability;
- Stockpiles should be isolated from watercourses or drains with appropriate bunding to minimise pollution risks;
- 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;
- 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;

- Monitoring of large areas of peat storage during wet weather or snowmelt should be undertaken to identify any early signs of peat instability. Prior to the excavation of relevant infrastructure, vegetation, peat and superficial geology will be removed and stored in overburden stockpiles (or used directly in restoration of other areas; see below);
- Care will be taken to segregate peat from other materials, to ensure that turves are kept reasonably intact, and to store turves right-side-up to form a protective layer on top of any deeper peat stockpiles;
- Overburden stockpiles will be located adjacent to the infrastructure at least 50 m from watercourses in order to reduce the potential for sediment to be transferred into the wider hydrological system;
- Run-off from overburden stockpiles will be directed through the infrastructure SUDS measures (as described in the CEMP), including silt fences and mats, drainage measures and settlement lagoons, as appropriate; and
- Peat will not be allowed to dry out in the overburden stockpiles.
- Storage areas and dimensions will remain largely unknown until the site work has commenced and the peat condition and requirements are better known.

#### 4.6.3 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/dump trucks 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.

#### 4.6.4 Handling

Following refinement of the windfarm peat model, a detailed storage and handling plan should be prepared, including:

- Best estimate excavation volume at each infrastructure location (including peat volumes split into area/volume of 'acrotelm' 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;
- Irrigation requirements and methods to minimise desiccation 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.

### 4.7 Restoration

During restoration, the following best practice should be followed:

- 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.

## 5.0 Site Based Peat Excavation and Management Assessment

The Stage 1 PMP has been undertaken as part of the Environmental Impact Assessment in support of the proposed Development, to ensure that 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 proposed Development layout comprises up to 19 wind turbines and associated crane hardstandings, solar arrays, an appropriate access point for construction traffic, on-site access tracks of both floating and cut construction, a construction and maintenance compound and permanent substation, battery storage and control building, cabling and two temporary meteorological mast(s). Existing access tracks will be utilised at the eastern entrance to the Site.

### 5.1 Peat Probing

Probing was undertaken in two phases, initially in May 2019 to an approximate 100 m grid and secondly as a detailed survey in August 2019 and peat characterisation in September 2019.

The results have been used to produce a peat isopach map (**Figure 10.2.2**). A total of 2280 probe locations were undertaken in areas of identified peaty soil/peat to determine the thickness thereof; and the overall conclusion regarding peat stability is that there is a low risk of peat instability over most of the site although some limited areas of medium and high risk have been identified.

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.

**Table 5-1: Excavation Materials Management Plan**

| Method | Volume of Excavated Material ($m^3$) | How much of this can be re-used on site (%) | Opportunity for Avoidance or Minimisation of Excavated Material | Re-use Requirements | Hierarchy Adherence | Limitations and Considerations |
|---|---|---|---|---|---|---|
| **Excavated Access Tracks**<br>Total Length of the access tracks would be 19.3 km and would consist of the following:<br>13.66 km of new access track (excavated);<br>1.4 km of new access track (floated);<br>4.4 km of existing upgraded tracks<br>The excavated access tracks would be located on an average peaty soil/peat depth of 0.64 m. | 48,192 $m^3$<br>(15060 m x 5 m x 0.64 m) | 100% | The access track route has been subject to a number of design iterations to avoid thicker peat and steep slopes.<br>Where possible track width would be minimised.<br>The peat along the proposed excavated tracks on the site is fibrous – pseudo fibrous and does not exhibit thick catotelmic peat. The peat is generally fairly dry and reasonably well drained.<br>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<br>45,180 $m^3$<br>(15060 m x 3m x 0.5 m x 2)<br>of excavated peat and peaty soil would be used along access tracks. | Avoidance was first level of screening to avoid areas of thicker peat. Routing has been planned on thinner peat or peaty soils where possible.<br>The layout design has been guided by constraints which highlight ecological, hydrogeological and geomorphological - all of which identify the peat areas to avoid | Requires detailed ground investigation to fully characterise peat.<br>Detailed assessment may identify further lengths of floating access tracks, which would further reduce requirement for excavation. |
| **Floating Access Tracks**<br>It is anticipated that 1.4 km of floating tracks would be required, which would generate no surplus peat. | Not applicable | Not applicable | No excavated material except where cable trenches are proposed (see below). | Verge restoration along access tracks ~ 4200 $m^3$<br>(1400 m x 3 m x 0.5 m x 2) | Looked at different cut off depths for floating access track. Based on > 1m depth. | Verge restoration must avoid impacting existing unexcavated peat. |
| **Turbine Foundations**<br>19 No. turbines<br>With average excavation of 28 m diameter x 0.66 m (average thickness of peat at turbines). | 9831 $m^3$<br>(28 x 28 x 0.66 X 19) | 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 ~0.63m | At turbine foundations topsoil would be stripped keeping top 200 mm of turf intact. This would be stored adjacent to the base working area and would be limited to 1m height.<br>1539 $m^3$<br>(54 m x 3 m x 0.5 m x 19) | Avoided areas of thick peat for turbine bases to minimise removal of excessive materials. | Requires detailed ground investigation to fully characterise peat. |
| **Turning Heads (13 No.) and Passing Places (11 No.)**<br>Turning Heads average excavation of 60 x 5 m x 13 No x 0.64 m (average thickness of peat). And Passing Places 70 x 5m x 11 x 0.64 | 4960$m^3$<br>(2496 $m^3$ + 2464 $m^3$)<br>(60 x 5 x 0.64 X 13) + (70 x 5 x 11 x 0.64) | 100% | Average thickness of peat at turning heads and passing places sites is ~0.64m | Verge Restoration at these areas.<br>2820$m^3$ could be re-used to dress the edges of the turning head area.<br>(125 m x 3 m x 0.5 m x 8) plus passing places (80 m x 3m x 0.5m x 11) | Avoided areas of constraint but limited by design. | Verge Restoration at these areas. |
| **Crane Pads**<br>19 No. crane hardstandings.<br>With average excavation of 70 m x 28 m x 0.8 m with additional areas for cranes and blades. | 23,089$m^3$<br>(based on 70 m x 28 m x 0.62 m) x 19 plus ancillary pads | 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 ~0.8m; 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.<br>5586 $m^3$ could be re-used to dress the edges of the hardstanding area. | Avoided areas of thick peat for turbine bases to minimise removal of excessive materials.<br>Orientation of crane hardstandings to be designed following detailed ground investigation, to avoid constraints and minimise requirement for peat excavation. | Requires detailed ground investigation to fully characterise peat. |

| Method | Volume of Excavated Material (m³) | How much of this can be re-used on site (%) | Opportunity for Avoidance or Minimisation of Excavated Material | Re-use Requirements | Hierarchy Adherence | Limitations and Considerations |
|---|---|---|---|---|---|---|
| | | | | (196 m x 3 m x 0.5 m x 19) plus ancillary pads | | |
| **Cable Routes Total Distance of Cabling ~ 22,492 m.** | 22,312 m³<br>(22,492 x 1.55 m x 0.64 m) | 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.<br><br>In areas where the cable route is on rock, the site may require excavation of rock or laying cable in up-filled sections to minimise excavation of rock. | Suitable excavated materials would be re-used to backfill trenches<br><br>22,312 m³<br>(22,492 m x 1.55 m x 0.64 m) | Re-use and backfill excavated materials. | Ground conditions along proposed route may require further investigation. |
| **Borrow Pits**<br>There are 5 borrow pit options, all of which have limited peat cover. (0.18 m) | 5886 m³ | Not applicable | There is limited peaty soils/peat overlying the selected borrow pits. | Limited peaty topsoil can be stockpiled and used for restoration.<br>Peat/peaty soils from elsewhere on site could be used to restore the proposed borrow pits with the following volumes:<br>Borrow Pit 1, 2,3 and 5: 39,567 m³<br>Assumes an average peat depth of 1m over restored borrow pits and on lower slopes, includes additional 10% disturbed area | Site selection avoided areas of peat for borrow pits, identified sites on bedrock or close to minimise removal of excessive materials. | Current calculations are based on conservative re-use and based on the use of all three borrow pits. Detailed design has yet to be undertaken on the proposed borrow pits. |
| **Construction and Maintenance Compound** | 1900 m³<br>(100 m x 50 m x 0.38 m) | 100% | The construction compound would largely be located on glacial till adjacent to the proposed access tracks. | Materials would be re-used on site to reinstate working areas and for appropriate landscaping.<br><br>1900 m³<br>(100 m x 50 m x 0.38 m) | Avoided siting compound on thick peat areas where possible | None |
| **Substation/Control Building (Including Battery Storage Facility)** | 5700 m³<br>(100 m x 75 m x 0.76 m) | 100% | The proposed substation locations would largely be located on glacial till adjacent to the proposed access tracks. | 175 m³ (350 m x 1 m x 0.5 m)<br><br>can be re-used dressing the area around the substation – the remainder can be re-used elsewhere on site. | Avoided siting substation on thick peat areas where possible | None |
| **Total Excavated** | 121,870 m³ | | | 123,279 m³ | | |

Based on the values indicated, there is a balance of materials with no significant surplus peat anticipated to be generated on site (refer to **Annex 1**).

Should further ground investigation information become available, the figures will need to be re-calculated, the figures in the table are indicative only.

# 6.0 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 6-1** outlines where those materials that are 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. Based on a detailed probing exercise and visual inspection of the peat, it is predominantly fibrous peat which would be suitable to be re-used on site. Typically, the peat was found to be fibrous and fairly dry within the top metre before becoming more amorphous with depth.

The majority of the excavated peat is therefore entirely re-useable as it is predominantly fibrous and easily re-used on site. Areas of deep peat have been avoided by design where possible.

**Table 6-1**
**Excavated Materials – Assessment of Suitability**

| Excavated Material | Indicative Volume on Site by % of total excavated soils | Is there a suitable use for material | Is the Material required for use on Site | Material Classified as Waste | Re-use Potential | Re-use on Site |
|---|---|---|---|---|---|---|
| Mineral Soil | 25 | Yes | Yes | Not classified as waste | Yes | Will be re-used 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) | 35 | Yes | Yes | Not classified as waste | Yes | |
| Acrotelmic peat | 25 | Yes | Yes | Not classified as waste | Yes | Will be re-used 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. |
| Catotelmic Peat (amorphous material unable to stand unsupported when stockpiled >1m) | 5<br>Very limited as it has been avoided by design. | Potentially | Potentially [4] | Potentially if not required as justifiable restoration of habitat management works | Limited | 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<br><br>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. |

[4] Such uses for this type of material are limited, however 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 management works such as gully or ditch blocking where saturated peat is required to mimic mire type habitats and encourage establishment of sphagnum.

# 7.0 Conclusion

The appendices detailed within this report are to be considered indicative at this stage and will require review following the results of detailed ground investigation. The figures shown in the tables 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 outline Construction Environmental Management Plan (CEMP) 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.