Appendix 9.3 Outline Peat Management Plan

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Appendix 9.3 Outline Peat Management Plan

Introduction

This Outline Peat Management Plan (PMP) document has been prepared by Fluid Environmental Consulting (Fluid) on behalf of the Applicant for the construction of the Proposed Development, located approximately 4.8 km south of Straiton, South Ayrshire, Scotland and covers an area of 540 ha. The site is located to the south of Straiton, south-west of Dalmellington and east of Girvan in South Ayrshire. Access to the site is from either the north or west along the mostly existing forestry access tracks. The majority of the main development area lies within a working farm with the open fells used for rough grazing of cattle and sheep. The western access track follows an existing commercial forestry track while the northern access runs through farmland and an existing commercial forestry road. The fells have been extensively cut with drains, although these are more apparent on aerial photography than on the ground, where they are generally overgrown. There is no evidence of cutting of peat, quarrying, or burning.

The infrastructure of the main development area comprises 240 m of new floated tracks and 4,031 m of new excavated tracks, nine turbine locations and associated crane hardstandings, a construction compound, a substation, an energy storage facility, a permanent meteorological mast and three borrow pits.

There are also two options for the site access, either: a western access comprised of 1,478 m of new tracks and 2,166 m of existing tracks that will be upgraded and widened, along with a gatehouse compound and a borrow pit, or; a northern access comprised of 1,977 m of new tracks and 2,776 m of existing tracks that will be upgraded and widened, along with a gatehouse compound and a borrow pit. Only one of these will be used, however both have been included in the peat calculations due to the very minor amounts of peat encountered along both routes.

All areas and volumes referred to in this assessment take account of both access route options, and associated borrow pits, given that a decision on which route to use has not yet been made. It is therefore noted that the areas and volumes are an overestimate, and the actual affected areas will be less in practice as only one of the two access routes will be selected, constructed and used. Only limited peat was identified at both of the two access route options, therefore this overestimate is not considered to be material to the assessment.

The total area of the Proposed Development footprint, including existing tracks, is 204,743m^2, and excluding existing tracks (but including the widened section) is 188,661m^2. An additional area of 3,223m^2 (see calculations section) is also considered as this is the area on peat outside of the infrastructure footprint that would either be excavated or covered by hardcore to build the infrastructure. The total area of the Proposed Development footprint (as noted, including both access route options) is therefore 207,966m^2, as this incorporates the drains and batters associated with the infrastructure, or 201,884m^2 when the existing access track sections are not included.

The design of the Proposed Development has been undertaken as an iterative process to avoid areas of deep peat as much as possible to limit peat excavation and to limit the potential for peat slide, as presented in Chapter 2.

The PMP will be further developed and implemented subsequent to the Proposed Development receiving consent from the Scottish Government. Further details and specific plans will be determined during the detailed design process and once further site investigations have been undertaken. These details will then be included in a detailed PMP as a part of the required Contractor's detailed Construction Environmental Management Plan (CEMP) to be approved by SAC in consultation with SEPA. The responsibility for the implementation of the PMP will be with the Principal Contractor (PC).

The PMP has been developed due to the presence of peatland and peat habitats on the Proposed Development site as although sporadic they do overlap with the infrastructure layout (Chapter 7, Ecology, of the EIA Report).

The potential volumes of peat extracted and re-used have been calculated based on an area specific or infrastructure specific basis using a modelled peat contour plan developed on a high-density probing grid where excavations will be undertaken (Scottish Government, Scottish Natural Heritage, SEPA (2017) Peatland Survey. Guidance on Developments on Peatland). This has allowed high levels of confidence in the estimation of the volumes of peat that will be excavated and that will then require appropriate re-use. This report should be read in conjunction with Chapter 9 and its associated figures and appendices.

The PMP addresses the management of peat during the construction period and the immediate restoration of the site once construction has been completed. In accordance with the SEPA Regulatory Position Statement (2010) Developments on Peat, as much peat as possible is reused on site.

Objectives

The PMP has been developed to demonstrate that peat has been afforded significant consideration and necessary protection during the construction phase of the Proposed Development, should consent be granted. It aims to propose mitigation measures that will minimise any impacts to peat, and present the long-term habitat restoration and management plans for key areas in order to enhance the site.

The PMP outlines the overall approach of minimisation of peatland disruption that has been adopted. It aims to ensure that all further opportunities to minimise peat disturbance and extraction will be taken.

The PMP seeks to identify that appropriate proposals to re-use the surplus peat can be accommodated within the site layout, without significant environmental or health and safety implications, to minimise risk in terms of carbon release and human health.

Structure

The structure of the PMP is as follows:

- legislation, policy and guidance;
- role of the PMP;
- definition of peat, details of peatland characteristics and peat conditions on site;
- avoidance and minimisation of peat disturbance;
- peat balance between excavation and reuse on site of surplus peat;
- peat excavation and handling methods/ controls and temporary peat storage; and
- reuse in infrastructure construction restoration.

Tables are included showing:

- a summary of depth of penetration probe data;
- a summary of interpreted peat depth at infrastructure areas;
- a summary of dimension and area details of the infrastructure;
- where excavated peat will be generated and the associated quantities;
- where excavated peat will be re-used and the associated quantities; and
- a summary of the peat extraction and re-use balance.

Legislation, Policy and Guidance for Peat Management

Legislation, Policy and Guidance

When considered as part of a carbon landscape, peat has the capacity to act as a carbon sink. The management of peat therefore has implications for carbon emissions and climate change. There is a substantial body of relevant legislation and guidance regarding climate change and carbon which is relevant to the management of peat including:

- The UK Climate Change Act (2008);
- Carbon Landscapes and Drainage, 2012 'The Carbon and Water Guidelines', www.clad.ac.uk;
- Forestry Commission, 2011, 'Forests and climate change: UK Forestry Standard Guidelines.

Other key documents relied upon to inform this draft PMP include:

- Scotland's National Peatland Plan Working for our future. Scottish Natural Heritage 2015;
- Best Practice Guidance to Planning Policy Statement 18 'Renewable Energy', August 2009;
- Good practice during windfarm construction (Scottish Renewables, SNH, SEPA & Forestry Commission Scotland, 4th Edition 2019);
- Scottish Government, Scottish Natural Heritage, SEPA (2017) Peatland Survey. Guidance on Developments on Peatland;
- SEPA Regulatory Position Statement – Developments on Peat. February 2010;
- Guidance on the Assessment of Peat Volumes, Reuse of Excavated Peat and the Minimisation of Waste Scottish Renewables, 17 January 2012;
- Forestry Civil Engineering and SNH (2010). Floating Roads on Peat: A Report into Good Practice in Design, Construction and Use of Floating Roads in Peat with particular reference to Wind Farm Developments in Scotland;
- Forestry Commission (2012). Forests & Water Guidelines. 5th Edition. HMSO;
- Scottish Executive (2017) Peat Landslide Hazard and Risk Assessments. Best Practice Guide for Proposed Electricity Generation Developments. Second Edition; and
- Towards an assessment of the state of UK Peatlands, JNCC 2010.

Role of the Peat Management Plan

The PMP is intended to be a working document to be used throughout the key stages of the design, construction, operation, decommissioning and re-instatement phases of the Proposed Development as part of an overall CEMP as follows:

Stage 1: Environmental Impact Assessment

It is necessary to show how, through site investigation and iterative design, the Proposed Development has been designed to minimise, so far as reasonably practicable, the quantity of peat which will be excavated; that volumes of peat anticipated to be excavated by the Proposed Development have been considered; and how excavated peat will be managed. The overall aim is to minimise the impacts associated with excavation of peat by using the following hierarchy of design principles: prevent excavation; reduce volumes of peat excavated; and reuse excavated peat in a manner to which it is suited. This hierarchical approach comprises:

1. calculation of estimated volumes of excavated peat and potential reuse volume requirements based upon the Proposed Development site design / layout;

2. determine whether there is likely to be adverse or beneficial overall peat balance, and whether the generation of excess material can be avoided, and, if not, where reductions in the volumes of excavated materials may be achieved;
3. site layout is refined to avoid areas of deeper peat and hence reduce carbon impacts of the project construction activities;
4. record specific examples of how overriding principles of prevention and minimisation of peat disturbance are to be taken into account in the design of the site;
5. the assessment is to be consistent with and feeds into the peat stability and carbon payback assessment; and
6. identify limitations and make recommendations for further site investigation (post-consent) in order to steer detailed design and micro siting such that opportunities for further reductions in excavated peat volumes can be implemented where possible.

Stage 2: Post Consent / Pre-Construction

As part of the EIA Report it has been demonstrated that, on the basis of the investigation and data gathered, it is likely that the excavated materials for the Proposed Development can be managed in an appropriate manner. The peat mass balance calculations may be further developed and refined post planning consent, and prior to the relevant works commencing, as a consequence of any further or more detailed ground investigation or survey works required to inform detailed design, or that may be required under planning consent conditions.

Stage 3: Construction Stage

Actual peat volumes excavated from site during construction will be recorded against predicted volumes provided in Table 5 of this PMP. Within micro-siting allowances, the alignment and design of tracks, hardstanding orientation and construction methods will be reviewed to avoid/minimise peat disturbance as much as possible in light of the more detailed information available once construction actually commences. A regular review and update of the peat mass balance table will be undertaken by the appointed PC and monitored by the Environmental Clerk of Works (ECoW) on site and made available to regulators as required.

Peat Conditions

Definitions of Peat

Organic material less than 0.5m depth is not defined as peat. This is in accordance with guidance from:

- Scottish Government, Scottish Natural Heritage, SEPA (2017) Peatland Survey. Guidance on Developments on Peatland states that *'Peat soil is an organic soil which contains more than 60 per cent of organic matter and exceeds 50 centimetres in thickness'*;
- The James Hutton Institute define shallow peat as having *'a prescribed depth of organic matter of 50 – 100 cm'* *(*https://www.hutton.ac.uk/learning/exploringscotland/soils/organicsoils); and
- The Forestry Commission, which uses 45 cm as the critical depth for peat to occur (Understanding the GHG implications of forestry on peat soils in Scotland, 2010).

Peat can therefore be classified as organic material over 0.5m in depth.

Peat can be separated into three main layers: acrotelmic (the upper living layer), catotelmic (the middle to lower layer) and occasionally amorphous (lower layer) peat:

- Acrotelmic peat is the living layer of the peat including the peat turf or turf being a thin, floating vegetation mat layer. The acrotelm is generally found within the top layer of peat

(often less than 0.5m) depending on the degree of decomposition and fibrous nature of the peat (approximately H1 to H6 on the von post classification scale). The acrotelm is generally of high permeability, decreasing with depth. The water table fluctuates in this layer and conditions vary from aerobic to anaerobic. Material may be fibrous or pseudofibrous (plant remains recognisable), spongy, and when excavated strength is lost but retains integral structure and can stand unsupported when stockpiled up to 1m.

- Catotelmic peat is the dead layer of peat found deeper than acrotelmic peat which has some remnant plant structures. Material has high water content and is permanently below the water table (saturated) therefore organic matter decomposes anaerobically. Some plant structures may be recognisable but are highly humified losing most of their characteristics (approximately H6 to H9 on the von post classification scale) and strength. Water flow through the catotelm is slow unless peat structures such as sink holes or peat pipes are present.
- Amorphous peat is highly decomposed organic material where all recognisable plant remains are absent (approximately H9 to H10 in the von post classification scale). These deposits are dark brown to black in colour, plastic, are low tensile strength and are unable to stand unsupported up to 1m when stockpiled.

Peat Conditions on Site

Desk Based Review

The site was assessed for peat vegetation through desktop review of maps and plans and a number of surveys by ecologists and hydrologists; and through intrusive site investigation in terms of peat depth probing and coring across the Proposed Development site and access track routes.

The land within the site boundary covers approximately 540 ha in area, includes both access route corridors. The main part of the site ranges from 120 m AOD in the western extreme to 313m AOD at Big Benyaw Summit towards the centre. The site generally slopes to the north becoming steeper in the north half.

The land cover for the site mainly consists of improved grassland pasture fields and open moorland with the access track to the west passing through forestry plantations with ridge and furrow drainage. The main land uses are rough grazing on the main body of the site, and forestry and deer stalking to the west and north.

Peat cover is sporadic, typically concentrated in valley floors between gentle ridges and spurs or in large flat areas on the summits. The site is not typical of blanket peatland environments and lacks geomorphological features associated with the best quality sites (such as bog pools and hummock and gully complexes). What peat there is appears to be in good condition with no signs of erosion and there is no evidence of peat cutting.

The EIA Report Ecology Chapter (Chapter 8) notes that the 'southern extent of the study area supports a more complex mix of plant communities and which is a reflection in topography, and underlying drainage. Any low-lying or flat areas in this area have allowed peat to form blanket bogs (E1.6.1) or wet modified bog (E1.7)'

The Ecology Chapter also notes that blanket bog and wet modified bogs occur over 48.88 ha or 9.36% of the site.

Peat Survey Methodology

To obtain a detailed understanding of the spatial and depth distribution of peat and its properties, a series of tasks have been completed which include:

- National vegetation classification (NVC) habitat mapping (detailed within Chapter 8 of the EIA Report);

- Depth penetration probing (see Peat Survey Report Appendix 9.2) at over 4,182 locations:
  - in a 100m grid over the whole of the site;
  - at turbines and crane hardstandings, construction compounds and the substation on a 10m grid along with 20m probing in the surrounding area up to 50m distance;
  - at borrow pit search areas on a 10m grid along with 20m probing in the surrounding area up to 50m distance;
  - at the construction compound, gatehouse compounds, the substation and the energy storage facility on a 10m grid along with 20m probing in the surrounding area up to 50m distance, and
  - along the track at 50m intervals and 10m offsets along the tracks.
- Peat coring at 41 locations to verify the probing is representative of peat depth and to assess the peat structure and properties;
- Development of a penetrable substrate depth map to indicate the maximum depth of probe penetration at all investigated points across the site;
- Development of an interpreted maximum depth of peat contour map to indicate the potential penetrable substrate or inferred peat depth based on the depth penetration probing results and verified by coring;
- Calculation of the maximum potential peat volumes that will be removed due to excavation for infrastructure based on the depth penetration probing results; and
- Examination of areas where peat will be reused to allow calculation of reuse volumes.

Peat Surveys

Two depth of penetration surveys have been completed, one in 2020 and one in 2021 as described below.

Phase 1

A first phase of peat depth probing was undertaken in August 2020 and comprised a 100 m grid across the part of the site that was considered for development. A total of 467 peat probes were undertaken and ten cores. These data were used as an input to the constraints map for development of the initial infrastructure layout.

Phase 2

Once the Proposed Development initial layout was determined, Fluid completed further detailed probing and coring in May 2021 at the following specification:

- at 50 m intervals with 10 m offset probes along all proposed and existing access tracks;
- at all nine turbine bases and hardstanding areas in a 10 m grid, along with probing in the 50 m micrositing area on a 20 m grid and one to two cores per turbine/hardstanding area;
- at the construction compound, the gatehouse compounds, the battery and the substation on a 10 m grid and one to two cores per infrastructure location; and
- at all five borrow pits on a 10 m grid and one to two cores per borrow pit.

This totalled 3,715 probes and 31 cores.

A total of 4,182 probes and 41 cores were completed across the two campaigns.

Peat Survey Results

A total of 4,182 probes were undertaken during the two campaigns between August 2020 and May 2021. Each probe recorded the depth of penetration and the potential substrate at the limit of penetration (Appendix 9.2).

Of the 4,182 locations probed a total of 3,677 probes (84.3%) recorded depths of 0.5m or less, 274 probes (10.2%) recorded depths of penetration between 0.5m and 1.0m indicating peat and 221 probes (5.5%) recorded depths of penetration >1.0m indicating deep peat (Table 1).

Table 1 – Depth of Penetration Distribution

Depth Range (m)	Number of Probes	Percentage of Probes
0 to 0.5 (no peat)	3,677	84.3%
>0. 5 – 1.0	274	10.2%
>1.0 – 1.5	77	1.84%
>1.5 – 2.0	77	1.84%
>2.0 – 3.0	53	1.27%
>3.0 – 4.0	15	0.36%
>4.0	9	0.22%
Total	**4,182**	**100%**

The depth of penetration at each probe location is presented on Figure 9.8 of ES Chapter 9.

Based on the data collected an interpreted peat depth map (Figure 9.9 of ES Chapter 9) was produced to demonstrate the variation in peat across the site and at the various infrastructure locations. A comparison of the peat depth with the infrastructure footprint is presented in Table 2:

Table 2 – Peat Depth Distribution across Infrastructure Footprint

Depth Range (m)	Area of infrastructure footprint (m^2)	Area of infrastructure footprint (%)
0 to 0.5 (no peat)	195,253	95.51%
>0. 5 – 1.0	7,723	3.78%
>1.0 – 1.5	1,501	0.73%
>1.5 – 2.0	266	0.13%
>2.0	0	0.00%
Total	204,743	100%

Note: The area of the infrastructure footprint is larger than the area of new infrastructure as the latter does not include the area of existing track. The area of infrastructure footprint does not include side slopes and drains although these are calculated and included in the peat excavation calculations.

These data indicate that deep peat (>1.0m depth) is present across 0.86% of the Proposed Development infrastructure and no peat (0 – 0.5m depth) is present across 95.8% of the Proposed Development infrastructure.

A total of 41 cores were completed with about half encountering peat with acrotelm and catotelm layers identifiable. The average acrotelm depth recorded is 0.12m and the peat depth minus the acrotelm depth can been used to calculate the potential catotelm thickness.

Peat Characteristics

The peat is low to moderately fibrous (mainly moderate content of fine fibres in cores and low content of coarse fibres) and moist in nature (Von Post B values) at the surface with a moderate acrotelmic layer up to 20cm in thickness. The catotelmic peat was up to a maximum of 4.2m in thickness but no clear basal layer of amorphous peat (H9/H10) was observed. Very little wood was observed within the cores.

These values have been used in calculations of volumes of peat across the site where the peat contour map indicates that peat is present (e.g. >0.5m probe depth). Catotelm and amorphous peat volumes were calculated together as a result of there being no clear basal layer of amorphous peat observed and only one core noted the presence of amorphous peat at >4m depth which has been avoided.

Avoidance and Minimisation of Peat Disturbance

Avoidance

The infrastructure layout has been designed to avoid or minimise impact on blanket bog habitats and deep peat and has been an iterative process to design around these constraints. The mapping of peat depth through probing has therefore allowed a peat depth contour map to be generated with a greater level of detail at proposed infrastructure locations to enable higher confidence in the avoidance of peat. Where this is unavoidable for any section of track, a floating road is proposed. The infrastructure has also been designed to avoid areas where peat slide risk is moderate or higher.

The impact on the blanket bog habitats is discussed within Chapter 8.

Further Minimisation

The disturbance of peat by the construction of the tracks, crane hardstandings, turbine foundations and other infrastructure will be minimised as much as practicably possible, taking into account the other constraints to the Proposed Development, in order to try and reduce any peat waste on site and reduce potential carbon losses from the peat excavation process.

Throughout the construction process, the appointed PC (and / or Designer) will aim to minimise the volumes of excavated peat. As far as possible, appropriate handling and storage of excavated materials will be undertaken such that their integrity and subsequent reuse is not jeopardised.

Although every effort has been made to map and identify sensitive habitats as thoroughly as possible, adjustment within the micrositing limits is likely to allow further improvements to avoid particularly sensitive pockets of habitat. Therefore, the ECoW will walk the site with engineers before construction commences, pointing out areas of sensitive habitat and identifying where impact can be reduced by minor movement of infrastructure within the micro-siting available. These areas will be clearly marked with post and tape. The ECoW will also ensure that any micro-siting does not lead to movements into more sensitive habitats.

Further measures to minimise peat disturbance will be incorporated in the development and construction process. The principles of the waste hierarchy (outlined above) will be adhered to in order to:

- avoid and/or minimise production of excavated peat;
- reuse, where possible, excavated peat on site to facilitate habitat, ecological and hydrogeological restoration, improvement and enhancement; and
- avoid waste peat being sent for disposal, recovery and/or reuse off site.

All contractors will be made aware of the sensitivity of peat and wetland habitats and the ECoW will clearly mark sensitive habitats near to construction areas. Contractors will be required to work within the narrowest practical construction corridor when working in or near areas of peat.

All plans and method statements will be accompanied by justification of the final design and/or construction methods identified by the PC, including reasons for discounting alternative methods. This is required in order to demonstrate that all avenues for avoiding hydrological disruption and reducing the disturbance and excavation of peat have been considered.

It is anticipated that an ECoW will be appointed for the construction of the Proposed Development that will:

- identify areas of sensitive habitat;
- clearly mark sensitive habitats near to construction areas and make the principal contractor aware of the sensitivity of peat habitats and inform all sub-contractors;
- walk the areas affected by the Proposed Development with engineers before construction commences;
- authorise minor movement of infrastructure within the micro-siting available where impact can be reduced; and
- monitor that any micro-siting does not result in movements into more sensitive habitats and deep peats unless unavoidable.

Excavation and Reuse Volume Estimates

Peat Excavation Assumptions

The Proposed Development infrastructure and dimensions used in the peat balance calculations are summarised in Table 3 and Table 4. The infrastructure areas and excavation calculations are based on the Proposed Development Final Layout GIS shape files provided, including for both access route options (and therefore acknowledged as an overestimate as only one access route will be selected), plus the following assumptions:

Excavated Tracks

- drains will be installed alongside the excavated tracks within the excavated section which will increase the width of the excavated base from 5m to 7m;
- slope batters will be installed along the 7m excavated width on a 2 in 1 gradient, extending the footprint to about 11m wide; and
- limited additional drains will be installed where required upgradient of the excavated tracks to protect the saturation state of the peat.

The peat volume excavated therefore includes all the peat within the 7m width over the total length of excavated track plus the amount of peat extracted from the slope batter and any additional drains.

Floated Tracks

- It is assumed that floated tracks will be elevated above ground level by up to 1m. Slopes will be installed either side of the 5m wide tracks on 2 in 1 slopes, therefore they will extend the floating track about 2m on either side (9m total track width).
- V drains will be installed either side of the track at 0.5m length of each V.

Construction Compound, Gatehouse, Substation, Energy Storage Facility

- All of these facilities will be excavated and will have slope batters installed along the perimeter on a 2 in 1 gradient to ground level with the base raised above the surrounding ground.
- V drains will be installed on three sides of the compound at 0.5m length of each V.

Turbine Foundations

- Turbine foundations will be backfilled with concrete. The areas outside of this footprint will have sloped sides for construction. Where these adjoin the crane hardstanding they will be

filled with hardcore. Where these adjoin the surrounding habitat they will be backfilled with the material removed.

- V drains will be installed on the side of the turbine foundations not connected to the crane hardstandings at 0.5m length of each V.

Crane Hardstandings

- The excavated crane hardstanding areas will have slope batters installed along the perimeter on a 2 in 1 gradient to ground level where the base is raised above the surrounding ground.
- V drains will be installed on all sides of the crane hardstandings at 0.5m length of each V.

Borrow Pits

- Borrow pits will be excavated with a perimeter diversion V ditch on all sides of the borrow pit at 0.5m length of each V.

Table 3 – Infrastructure Dimension Final Layout

Infrastructure	Dimensions	Area (m^2)
Turbines and crane hardstanding (total of 9)	Irregular shape	60,734
Gatehouse – compound (north)	Square 50m x 50m	2,500
Gatehouse – compound (south)	Square 50m x 50m	2,500
Compound	Rectangular 100m x 50m	5,000
Energy Storage Facility	Rectangular 200m x 50m	10,000
Substation	Rectangular 100m x 50m	5,000
Met mast	Irregular shape	1,023
Borrow Pit A – Northern Access Track	Irregular	10,639
Borrow Pit B	Irregular	6,627
Borrow Pit C	Irregular	12,726
Borrow Pit D	Irregular	3,920
Borrow Pit E – Western Access Track	Irregular	12,015
New Excavated Track – including main development area and both access route options	Width of 5m and approximate length of 7,506m which includes bellmouths, passing places and turning areas	42,879

Infrastructure	Dimensions	Area (m^2)
New Floated Track	Width of 5m and approximate length of 240m which includes bellmouths, passing places and turning areas	1,092
Existing track (widened) – including both access route options	2m wide strip on one side of 4,942m length of existing 3m wide track	12,006
Total		188,661

The following areas are also used for the peat calculations. The term 'free perimeter on peat' refers to the edge of the infrastructure where peat is present.

Table 4 – Infrastructure Additional Dimensions

Infrastructure	Dimensions	Area (m^2)
Turbines and crane hardstanding (9 in total) (excavated)	2 in 1 slope back to ground level around free perimeter on peat of between 0m and 185m, plus 0.5m V drains	1,031
Gatehouse – compound (north)	None as no peat	0
Gatehouse – compound (south)	2 in 1 slope back to ground level around free perimeter on peat of 52m, plus 0.5m V drains	98
Compound	None as no peat	0
Battery	2 in 1 slope back to ground level around free perimeter on peat of 31m, plus 0.5m V drains	61
Substation	None as no peat	0
Met Mast	2 in 1 slope back to ground level around free perimeter on peat of 33m, plus 0.5m V drains	59
Borrow Pit A	None as no peat	0
Borrow Pit B	None as no peat	0
Borrow Pit C	0.5m V drains along 32m free perimeter on peat	57
Borrow Pit D	None as no peat	0

Infrastructure	Dimensions	Area (m^2)
Borrow Pit E	None as no peat	0
New Excavated Track – including main development area and both access route options	1m wider than footprint on each side of track for drainage and 2 in 1 slope back to ground level along free perimeter of 557m, plus 0.5m V drains on upgradient side	1,116
New Floated Track	2 in 1 slope back to ground level along free perimeter of 198m, plus 0.5m V drains on upgradient side	537
Existing track (widened by 2m) – including both access route options	2 in 1 slope back to ground level along free perimeter of 140m, plus 0.5m V drains	264
Total		**3,223**

Excavated Volumes

Peat excavation volumes associated with the project have been calculated using the GIS package ArcGIS based on the data in Tables 3 and 4 and these further assumptions:

- A contour map of assumed peat depth based on interpolation of values from probing undertaken across the site (shown in Figure 9.9).
- Dimensions of the proposed areas for excavation for site infrastructure based on the Final Layout ArcGIS shapefiles provided (shown in Figure 9.9) and detailed in Table 3.
- An estimated acrotelm depth of 0.12m across infrastructure area where peat (>0.5m organic soil) is present based on the peat core data.
- An estimated catotelm thickness of the average depth of the peat minus the acrotelm (0.12m) across infrastructure area where peat is present and based on the peat core data.
- An assumption that the probe depth is representative of the actual depth of the peat (validated by the spatial coverage of 41 cores).
- Any peat excavated for cable trenches is stored adjacent to the trench while the track is laid and then replaced, therefore this volume is not applicable to the excavated volume.

Using the interpreted peat depth contour map (Figure 9.10, the volumes of peat that would be excavated during construction were calculated based on the Final Layout infrastructure dimensions (ArcGIS shapefiles) and associated excavation areas provided for the Proposed Development. These calculations produced the following volume estimates and are detailed in Table 5, Table 6 and Table 7:

- a total volume of peat to be excavated of 6,502m^3;
- a total volume of acrotelm to be excavated of 1,247m^3; and
- a total volume of catotem to be excavated of 5,255m^3.

It is again noted that the above volumes take account of both access route options, and associated borrow pits, given that a decision on which route to use has not yet been made. In practice only one of the two access routes will be selected, constructed and used. Only limited peat was identified at

both of the two access route options, therefore the overestimate resulting from including both options is not considered to be material to the assessment.

Table 5 – Excavated Peat Volumes based on Final Layout Actual Footprint

Infrastructure	Infrastructure area (m^2)	Average peat depth over infrastructure area (m)	Percentage of infrastructure with >0.5m depth of peat	Area of infrastructure with >0.5m depth of peat (m^2)	Average peat depth over area of infrastructure with >0.5m depth of peat (m)	Volume of peat excavated (m^3)	Volume of acrotelm peat excavated (m^3)	Volume of catotelm peat excavated (m^3)
Turbine 1 and associated hardstanding	6,695	0.38	34.4	2303	0.86	1,983	276	1,707
Turbine 2 and associated hardstanding	6,695	0.13	0.8	55	0.56	31	7	24
Turbine 3 and associated hardstanding	6,695	0.24	0.1	6	0.52	3	1	2
Turbine 4 and associated hardstanding	6,695	0.12	0.9	58	0.53	31	7	24
Turbine 5 and associated hardstanding	6,695	0.24	0.0	0	0.00	0	0	0
Turbine 6 and associated hardstanding	6,695	0.33	9.4	632	0.66	417	76	341

Infrastructure	Infrastructure area (m^2)	Average peat depth over infrastructure area (m)	Percentage of infrastructure with >0.5m depth of peat	Area of infrastructure with >0.5m depth of peat (m^2)	Average peat depth over area of infrastructure with >0.5m depth of peat (m)	Volume of peat excavated (m^3)	Volume of acrotelm peat excavated (m^3)	Volume of catotelm peat excavated (m^3)
Turbine 7 and associated hardstanding	6,693	0.20	1.1	74	0.55	41	9	32
Turbine 8 and associated hardstanding	7,176	0.36	8.0	572	0.77	440	69	372
Turbine 9 and associated hardstanding	6,695	0.36	7.2	481	0.56	269	58	212
Gatehouse – compound (north)	2,500	0.00	0.0	0	0.00	0	0	0
Gatehouse – compound (south)	2,500	0.41	29.2	729	0.59	430	87	343
Compound	5,000	0.07	0.0	0	0.00	0	0	0
Energy Storage	10,000	0.32	9.1	906	0.64	576	109	468
Substation	5,000	0.28	0.0	0	0.00	0	0	0
Met Mast	1,023	0.43	19.5	199	0.53	106	24	82

Infrastructure	Infrastructure area (m^2)	Average peat depth over infrastructure area (m)	Percentage of infrastructure with >0.5m depth of peat	Area of infrastructure with >0.5m depth of peat (m^2)	Average peat depth over area of infrastructure with >0.5m depth of peat (m)	Volume of peat excavated (m^3)	Volume of acrotelm peat excavated (m^3)	Volume of catotelm peat excavated (m^3)
Borrow Pit A	10,639	0.00	0.0	0	0.00	0	0	0
Borrow Pit B	6,627	0.08	0.0	0	0.00	0	0	0
Borrow Pit C	12,726	0.07	0.4	45	0.53	24	5	18
Borrow Pit D	3,920	0.13	0.0	0	0.00	0	0	0
Borrow Pit E	12,015	0.05	0.2	21	0.53	11	3	9
New Track Excavated (including main development area and both access route options)	42,879	0.14	3.4	1457	0.79	1,151	175	976
New Track Floating	1,092	0.61	43.6	476	0.98	0	0	0
Existing Track to be widened (including both access route options)	12,006	0.05	1.1	138	0.59	81	17	65
Total						5,596	921	4,675

Table 6 – Excavated Peat Volumes based on Excavated Slopes and Drains around Final Layout Infrastructure

Infrastructure	Additional Infrastructure area– slopes and drains (m^2)	Volume of peat excavated (m^3)	Volume of acrotelm peat excavated (m^3)	Volume of catotelm peat excavated (m^3)
Turbine 1 and associated crane hardstanding	450	160	48	112
Turbine 2 and associated crane hardstanding	53	13	6	7
Turbine 3 and associated crane hardstanding	0	0	0	0
Turbine 4 and associated crane hardstanding	0	0	0	0
Turbine 5 and associated crane hardstanding	0	0	0	0
Turbine 6 and associated crane hardstanding	166	46	18	28
Turbine 7 and associated crane hardstanding	94	22	10	12
Turbine 8 and associated crane hardstanding	128	41	14	27
Turbine 9 and associated crane hardstanding	139	33	15	19
Gatehouse – compound (north)	0	0	0	0
Gatehouse – compound (south)	98	25	10	14
Compound	0	0	0	0
Energy Storage	61	16	7	10
Substation	0	0	0	0
Met Mast	59	13	6	7
Borrow Pit A	0	0	0	0

Infrastructure	Additional Infrastructure area– slopes and drains (m^2)	Volume of peat excavated (m^3)	Volume of acrotelm peat excavated (m^3)	Volume of catotelm peat excavated (m^3)
Borrow Pit B	0	0	0	0
Borrow Pit C	57	13	6	7
Borrow Pit D	0	0	0	0
Borrow Pit E	0	0	0	0
New Track Excavated (including main development area and both access route options)	1,116	432	142	291
New Track Floating	537	25	17	8
Existing track to be widened (including both access route options)	264	66	28	38
Total	**3,223**	**906**	**326**	**580**

Note: Any minor differences in totals are due to rounding up/down

Table 7 – Total Peat Excavation Volumes of the Final Layout

	Total area of infrastructure, slopes and drains (m^2)	Volume of peat excavated (m^3)	Volume of acrotelm peat excavated (m^3)	Volume of catotelm peat excavated (m^3)
Total Infrastructure Footprint	188,661	5,596	4,675	921
Excavated slopes and drains around infrastructure	3,223	906	326	580
Total	**191,884**	**6,502**	**1,247**	**5,255**

In order to determine accurate peat volumes, probing and/ or other ground investigation techniques will be employed as necessary prior to and during the construction period in order to inform micro-siting requirements and to further update the PMP.

Allowance for Bulking of Peat

An allowance of an increase of 10% in the volume of the extracted peat has been included. This increases the total volume of peat to be reused to:

Total volume of peat	7,152m^3
Total volume of acrotelm	1,372m^3
Total volume of catotelm	5,781m^3

Peat Reuse Volumes

The excavated peat will be reused around the site in the following areas:

- In Borrow Pits C and D as these are located adjacent to peat habitat and offer the potential for peat placed in the base of the borrow pit to extend the existing peat habitat (see Plates 1 and 2 below). The peat in each borrow pit would be 1m in depth; and
- along the 2 in 1 sloped verges along all tracks (both cut and floated) and around all infrastructure where it is adjacent to peat in a 0.5m thickness. In practice this will involve peeling back the top 0.5m of peat in these areas and relaying it over the slope along with controlling water runoff from the track and flows from adjacent peat. This is described further below.

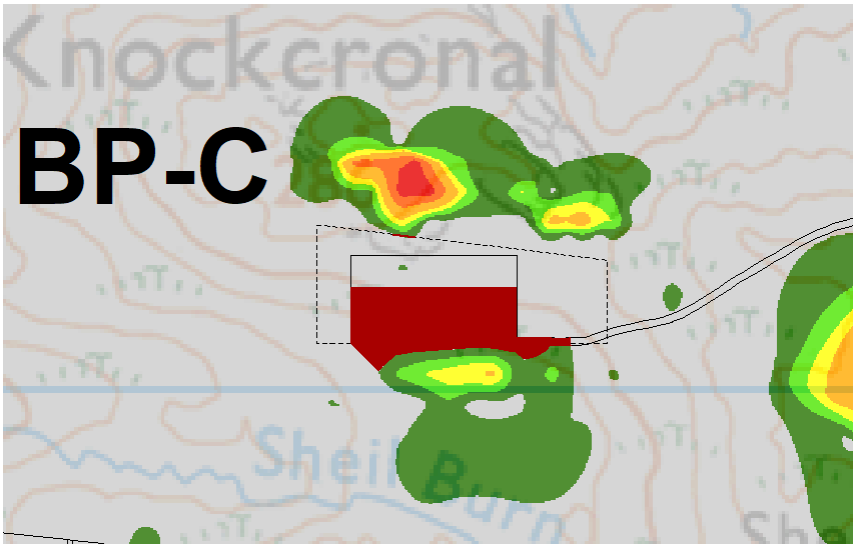

Plate 1 Borrow Pit C will be excavated into the slope to the north however peat placed in the base after excavations are complete can link to the existing peat habitat to the south

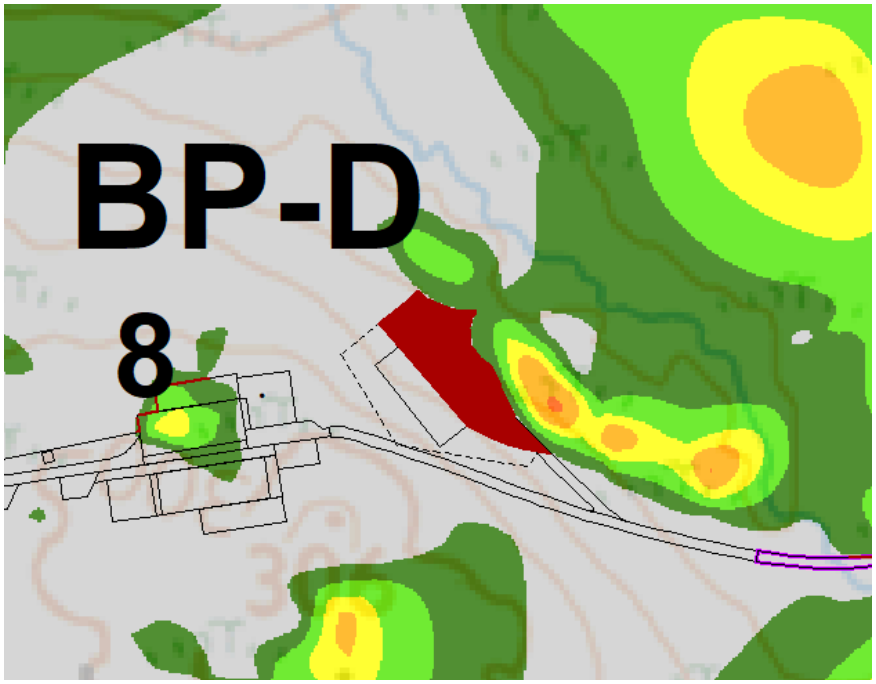

Plate 2 Borrow Pit D will be excavated into the slope to the south west however peat placed in the base after excavations are complete can link to the existing peat habitat to the north-east

The thickness of peat in each area are shown on Figure 9.12 and the associated volumes are presented in Table 8. Further discussion on the methodology for reuse is discussed below.

Table 8 – Estimated Reuse Volumes

Reuse Type	Reuse Summary	Area (m^2)	Acrotelm volume (m^3)	Catotelm volume (m^3)	Total Volume (m^3)
Peat reinstatement around free perimeter adjacent to peat of turbines and crane hardstandings	Placement of 0.3m thickness of peat along length of between 0m to 185m per turbine and crane hardstanding with a 2 in 1 slope.	690	83	124	207
Peat reinstatement around free perimeter of Gatehouse – compound (south)	Area of 61m^2 of side slope around 52m perimeter to be reinstated with 0.3m of peat	61	7	11	18
Peat reinstatement around free perimeter of	Area of 39m^2 of side slope around 31m perimeter to be	39	5	7	12

Reuse Type	Reuse Summary	Area (m^2)	Acrotelm volume (m^3)	Catotelm volume (m^3)	Total Volume (m^3)
energy storage facility	reinstated with 0.3m of peat				
Peat reinstatement around free perimeter of Met Mast	Area of 35m^2 of side slope around 33m perimeter to be reinstated with 0.3m of peat	35	4	6	11
Peat reinstatement in part of borrow pit C	Peat placed at a thickness of 1m on the lowest part of borrow pit C where it connects to peat habitat	5,120	614	4,506	5,120
Peat reinstatement in part of borrow pit D	Peat placed at a thickness of 1m on the lowest part of borrow pit D where it connects to peat habitat	2,370	284	2,086	2,370
Peat reinstatement along verges of new excavated tracks (including main development area and both access route options where peat is present)	Peat placed in a 0.3m thickness along 5770m of excavated track verges where peat is present	912	109	164	273
Peat reinstatement along verges of new floated tracks	Peat placed in a 0.3m thickness along 198m of floated track verges where peat is present	396	48	71	119
Peat reinstatement along verge of widened existing cut track (including both access route options where peat is present)	Peat placed in a 0.3m thickness along 140m of excavated track verges where peat is present	445	38	56	94

Reuse Type	Reuse Summary	Area (m^2)	Acrotelm volume (m^3)	Catotelm volume (m^3)	Total Volume (m^3)
Total		**10,068**	**1,192**	**7,032**	**8,224**

It is assumed that the cable trenches will have no impact on peat as the removed volume will be rapidly used to backfill the same trench once the cables have been laid shortly after the trench is opened up and clay will be used at regular intervals to prevent preferential pathways developing in the sand/cable layer at the base of the trench.

Final implementation of peat reuse and classification will be subject to geotechnical on-site tests e.g. shear vane testing, to determine peat stability and type and use potential.

Net Peat Balance

The volume of peat predicted to be excavated does not exceed the potential re-use volume so no disposal of excess peat off-site is expected for the final layout of the Proposed Development. The excavated peat volumes and volumes of peat to be re-used are summarised in Table 9 below.

Table 9 – Net Peat Balance

	Acrotelm volume (m^3)	Catotelm volume (m^3)	Total Volume (m^3)
Excavated Peat (plus 10% for bulking)	1,374	5,748	7,121
Potential Peat Reuse	1,192	7,032	8,224
Total Balance	-182	1,284	1,103

Based on the figures and reuse strategy presented it is expected that over the lifetime of the Proposed Development there will be a potential for more peat to be reused on the site than the volume excavated. This is as a result of the peatland habitat being directly lost to tracks, turbines and crane hardstandings generating a total amount of excavated peat of around 7,120m^3 and there is a capacity for the reuse of over 8,200m^3 of peat onsite. These numbers show that all of the catotelmic peat can be used in the planned areas and where there is additional acrotelmic peat this is easily used to further extend any of these restoration areas.

The calculations for the re-use of excavated peat are based on accepted best practice so that any peat reuse is focused on areas where it will remain saturated and connect with existing peat habitats.

Handling Excavated Materials

Excavation

The following methodologies for excavation of peat are recommended:

- Areas of peat within the footprint of any excavation will have the top layer of vegetation stripped off as a turf, prior to construction by an experienced specialist contractor, when

excavating areas of peat. Often it is easiest to achieve this by removing large turfs up to 500mm in order to keep the peat intact, however a 300mm thickness has been used for calculations on this site due to the shallow nature of the peat and to be conservative.

- These turfs should be stored adjacent to the construction area in a way that ensures they remain moist and viable (see temporary storage below). Excavated turfs should be as intact as possible so as to minimise carbon losses. Stacking of vegetated turfs will be avoided in order to best preserve the viability of the vegetation layer.
- Peat will then be removed, stored separately and kept damp (Carbon and Water Guidelines 2012).
- Excavated soils and turfs will be handled so as to avoid cross contamination between distinct horizons and ensure reuse potential is maximised.
- Mineral soil and aggregate will be kept separate from peat or peaty soils in order to avoid contamination (which could result in a change in chemical or hydrological properties in the peat, reducing the likelihood of successful reinstatement on placement).
- Prior to any excavations, the PC will produce a detailed Method Statement identifying where and how excavated peat will be used in reinstatement works. Specific requirements for the excavation, handling, storage and reinstatement of peat will be outlined in this Method Statement. The PC will consider potential impacts on downstream hydrological receptors and also the potential for instability issues with the excavated material.
- Care will be taken when stripping and removing topsoil and peat turfs and appropriate storage methods used on site, i.e. excavated material will be stored in separate horizons and vegetation rich top layers will be stored vegetation side up.
- Classification of excavated materials will depend on their identified re-use in reinstatement works. At this site it is anticipated that the material to be excavated will comprise peat (which may be sub-divided into turf, acrotelm and catotelm/amorphous), peaty soils and mineral soils (subsoil and topsoil).

Temporary Storage

Following excavation, peat will be required to be temporarily stored before reuse, although peat restoration will commence in locations as soon as feasible e.g. in borrow pits as they are completed. Excavated peat should be stored in stockpiles to minimise carbon losses while being stored.

Where possible, excavated turfs will be stored adjacent to the construction area such that they remain moist and viable.

Areas for temporary storage required for peat will be identified in the PC's Method Statement taking into account constraints and mitigation requirements identified in further pre-construction investigations. This will describe any intended drainage, pollution prevention and material stability mitigation measures that may be required. The following general guidelines will apply:

- The appropriate temporary storage areas for excavated peat will also be as close to the excavation as practicable.
- A number of areas for temporary peat storage have been identified alongside the proposed tracks (Figure 9.11). These have been determined to be suitable area for temporary excavated peat storage as the ground conditions are suitable for some loading, the peat slide risk is low, they are outside of the main watercourse buffers and the gradients are low (Figure 9.11). This would be supplemented by smaller peat storage areas near to each section of infrastructure where the peat is extracted and to be re-used to minimise the handling and transportation requirements.

- The design and location of stockpiles, including incorporated drainage elements, will be agreed with the ECoW and Geotechnical Consultant / Geotechnical Clerk of Works prior to excavation works commencing.
- Temporary peat storage areas should be located so that erosion and run off is limited, leachate from the material is controlled, and stability of the existing peatland in the vicinity is not affected.
- Excavated material is to be stockpiled at least 50m away from watercourses. This will ensure that any wetting required on stored peat does not runoff and discharge into adjacent watercourses.
- Any edges of cut peat that may remain exposed, or areas of peat excavation on steep slopes, will be covered with geotextile or similar approved. This will allow re-turfing and re-vegetation and reduce erosion risks.
- Suitable storage areas are more appropriately sited in areas with lower ecological value and low slopes. Cleared areas of forestry are preferred to areas of higher ecological value or areas close to watercourses.
- Temporary peat storage should be in locations where the water table can be kept artificially high.
- An up-gradient cut off ditch should be installed around the edge of the storage bund in order to collect up-gradient surface water runoff and divert water runoff from eroding the toe of the bund.
- It is desirable to keep haul distances of excavated peat as short as possible and as close to intended re-use destinations to minimise plant movements in relation to any earthworks activity including peat management in order to minimise the potential impact on the peat structure. It is important that temporary storage is safe and keeps the material suitable for its planned reuse.
- The handling and storage of peat will seek to ensure that excavated peat does not lose either its structure or moisture content. Peat turfs require careful storage and wetting and to be maintained to prevent drying out and subsequent oxidisation to ensure that they remain fit for re-use.
- Stockpiling of peat should be in large volumes, taking due regard to potential loading effects. Piles should be bladed off at the side to minimise the available drying surface area.
- Higher piles are more likely to become dewatered, while smaller piles expose a greater area to evaporation, therefore a balance is required to achieve optimum saturation. Reducing mound size may also increase likelihood of erosional losses as particulate organic carbon (POC).
- Stockpiles should be battered so as to limit instability and erosion and should be bunded or covered using impermeable material. The bunds should extend to a level above the toe of the stockpiled material to provide restraint to surface runoff.
- When planning the temporary storage areas any additional disturbance areas should be minimised.
- Transport of peat to temporary storage areas, restoration areas or designated spoil areas will be by low ground pressure vehicles to avoid excessive compaction of the peat.

Reuse of Peat in Infrastructure and Borrow Pit Restoration

Bare Peat

There are a number of important methodologies regarding the exposure of bare peat including:

- The amount of time any bare peat will be exposed will be minimised to preserve its integrity.
- The phasing of work should be carried out to minimise the total amount of exposed ground at any one time. By stripping turf and replacing as soon as possible after peat has been re-distributed there will be minimal areas of bare peat.
- Any peat areas on steep ground or that remains partially bare will be covered using geotextile or a similar method to stop erosion.
- Any areas of bare peat, where vegetation is not re-growing, will be seeded with a seed mixture obtained from the existing habitat. Stock exclusion in these areas will continue until vegetation is properly established.
- The re-vegetated areas will be monitored.
- Areas where full recovery is complete will have fences removed.

This approach has been shown to be effective on other peat sites and the turfs re-grow quickly both establishing vegetation and consolidating the peat.

Infrastructure Re-use

Peat re-use around and within infrastructure areas is an important aspect of the Proposed Development as it allows an opportunity to maintain the integrity of the excavated peat, enhance habitats and create new habitats. This will be undertaken through the following actions:

- The PC will be required to provide appropriate plant for undertaking all reinstatement works such that no unnecessary disturbance of the ground surface occurs. In order to minimise disturbance and damage to the ground surface, any mobile plant required for reinstatement works will be positioned on constructed access tracks, hard standing areas or existing disturbed areas wherever possible. The use of a long reach excavator for excavations and reinstatement works is preferable as it enables sufficient room to allow initial side casting and subsequent pulling back of turfs over reinstated peat or soil.
- Excavated catotelm or amorphous peat will only be used in restoration works where the topography allows straight forward deposition with no pre-treatment or containment measures and without risk to the environment. Suitable scenarios may be present in those disturbed areas where natural topography profile allows such use. A fibrous layer of acrotelm and turf will be placed above any catotelm or amorphous peat reinstated.
- Reinstatement of vegetation will be focused on natural regeneration utilising peat vegetated turfs. To encourage stabilisation and early establishment of vegetation cover, where available, peat turfs (acrotelmic material) or other topsoil and vegetation turfs in keeping with the surrounding vegetation type will be used to provide a dressing for the final surface.
- Any reinstatement and re-profiling proposals will consider, and mitigate against, identified significant risks to environmental receptors. In particular, in areas of replaced peat, water management will be considered in the PC's Construction Method Statements to ensure that as far as possible an appropriate hydrological regime is re-established within areas of disturbance. Particular attention will be paid to maintaining hydrological continuity and preventing the creation of preferential subsurface flow paths (for instance within backfilled cable trenches).

- When cutting the track the vegetation layer (approx. 500mm thick) will be undercut and rolled back. A geotextile layer will then be installed on the side slopes of the track immediately after track construction to prevent erosion. The undercut vegetation layer will then be rolled back over the verge of the installed track. Through careful management of upgradient water and track cambers to shed water to the peat on the verges the level of saturation can be maintained.
- Peat placed on track verges should gently taper in to the adjacent land form, with the peat blocks placed snugly together and the edge of the peat placed furthest from the track should be firmed in to the adjacent ground to form a seal, in order to minimise water loss through evaporation.
- Track edges and passing places would be reinstated post construction through the removal of capping material and the reuse of peat turfs. Where peat turfs are used to reinstate track edges this will be done in a manner to ensure works tie in with the surrounding topography, landscape and ground conditions.
- The design and construction of tracks on peat shall be done in such a way so as to reduce impacts on the existing peat hydrology at the site. The built track should allow for the transmittance of water, so natural drainage can be maintained as far as possible.
- Where possible drains will be blocked as soon as they are no longer required to reduce impacts on adjacent peat habitat and allow recovery of the drains to peat habitat.

Summary

A high-density grid of 4,182 peat probes and associated cores has been completed at all site infrastructure in 2020 and 2021 to obtain a detailed understanding of peat variability, depth and characteristics at the site.

The infrastructure has generally avoided peat with Deep peat (>1.0m depth) is present across only 0.46% of the Proposed Development infrastructure and any peat (>0.5m depth) is present at 4.2% of the Proposed Development infrastructure. This compares favourably with the peat occurrence of 14.6% across the site (Appendix 9.2).

The total volume of excavated peat associated with the infrastructure footprint, associated excavated slopes and drains has been calculated at about 7,150m^3 with about 1,370m^3 of acrotelmic peat and about 5,780m^3 of catotelmic peat when adjusted with a 10% bulking factor.

The potential reuse of excavated peat has been calculated based on SEPA guidance and totals over 8,200m^3, comprised of almost 1,200m^3 of acrotelmic peat and over 7,000m^3 of catotelmic peat.

The above volumes take account of both access route options, and associated borrow pits, given that a decision on which route to use has not yet been made. In practice only one of the two access routes will be selected, constructed and used. Only limited peat was identified at both of the two access route options, therefore the overestimate resulting from including both options is not considered to be material to the assessment.

Based on the peat depth, characteristics and distribution investigations undertaken across the development area and the final layout, a surplus of peat is not expected to be generated by the Proposed Development. All estimated excavated peat is planned for re-use for restoration work during the construction and post-construction phases of the Proposed Development.

Further investigations will be undertaken prior to works commencing to confirm peat depth, distribution and characterisation. The additional survey data will be used to inform any micro-siting, and potentially further minimise the volume of peat extracted. The peat management plan will be further updated using the additional survey data and detailed infrastructure design. The detailed PMP will be approved by South Ayrshire Council in consultation with SEPA as part of the CEMP pursuant to the imposition of a planning condition.

The PC will maintain a record of actual peat volumes excavated and the subsequent peat re-use to compare the predicted and actual peat volumes. This record during the construction, operation, decommissioning and restoration phases of the Proposed Development will be made available for review by regulators as and when required.

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