Luggie's Knowe Wind Energy Project

Technical Appendix 11.2 Outline Peat Management Plan

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1.0	2022-12-02	D Nisbet	J Hazzard	J Hazzard	Final for Issue
2.0	2023-05-16	D Nisbet	E Bathgate	E Bathgate	Revision to include battery storage area

Contents

1. Introduction

1.1 Background

This Stage 1 (Outline) Peat Management Plan (PMP) has been prepared by ITPEnergised on behalf of Shetland Aerogenerators Ltd (the Applicant) for the proposed Luggies Knowe Energy Project (the Proposed Development), located approximately 1.2 km north of Gremista, Lerwick on the Hill of Gremista, shown in shown in Drawing 1.

The Proposed Development will comprise one turbine and associated crane hardstanding access track and Battery Energy Storage System (BESS), shown in Drawing 2.

The PMP was led by David Nisbet, Head of Geology, Peat & Hydrology at ITPEnergised. David has a BSc in Earth Science and 10 years' experience in geology and environmental consultancy. David has led geology and peat assessments on many renewable energy and electrical transmission projects across the United Kingdom and Ireland, including PLHRA, Peat Management, Engineering Geological Assessment and Carbon Balance calculations.

1.2 Objectives

The aim of the Outline PMP, undertaken in accordance with generally accepted best practice guidance[1,2,3,4,5] is to ensure that there has been systematic consideration of peat management and a quantitative assessment takes place throughout the development process. The PMP is required to show:

- How, through site investigation and iterative design, the Proposed Development has been structured and designed to minimise, so far as reasonably practicable, the quantity of peat which will be extracted;
- That volumes of peat anticipated to be excavated by the Proposed Development have been considered; and
- How excavated peat will be managed.

[1] Scottish Renewables, SEPA (2012). Developments on Peatland: Guidance on the Assessment of Peat Volumes, Reuse of Excavated Peat and the Minimisation of Waste, Version 1.
[2] SEPA (May 2017). SEPA Regulatory Position Statement – Developments on Peat and Off-site Uses of Waste Peat) SEPA Guidance., WST-G-052. Version 1.
[3] Scottish Renewables, Scottish Natural Heritage, SEPA, Forestry Commission Scotland, Historic Environment Scotland, Marine Scotland Science, AECoW (2019). Good Practice During Wind Farm Construction, 4th Edition.
[4] Scottish Government, Scottish Natural Heritage, SEPA (2017). Guidance on Developments on Peatland: Site Surveys.
[5] Energy Consents Unit Scottish Government (2017). Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Developments.

2. Ground Conditions

2.1 Definitions of Peat

Peat is defined as an organic soil comprising the partly decomposed plant remains that have accumulated in-situ, rather than being deposited by sedimentation. When peat forming plants die, they do not decay completely as their remains become waterlogged due to regular rainfall. The effect of waterlogging is to exclude air and hence limit the degree of decomposition. Consequently, instead of decaying to carbon dioxide and water, the partially decomposed material is incorporated into the underlying material and the peat 'grows' in-situ.

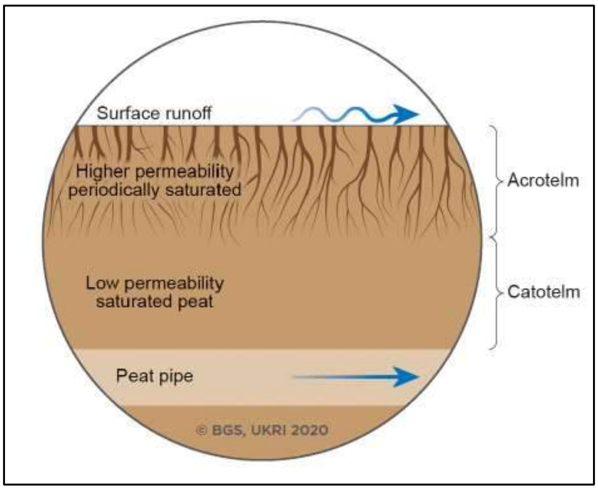
The Scottish Government Peat Landslide Hazard Best Practice Guide (2017) uses the following Joint Nature Conservation Committee (JNCC) report 455 'Towards an Assessment of the State of UK Peatlands' definition for classification of peat deposits:

- Peaty (or organo-mineral) soil: a soil with a surface organic layer less than 0.5 m deep;
- Peat: a soil with a surface organic layer greater than 0.5 m deep which has an organic matter content of more than 60 %; and
- Deep Peat: a peat soil with a surface organic layer greater than 1.0 m deep.

There are two principal types of peat:

- The upper (acrotelm) layer in which the water table fluctuates, which is fibrous and comprises plant roots etc. The acrotelm is relatively dry and has some tensile strength and its thickness typically ranges from 0.1 m to 0.6 m deep.
- The lower (catotelm) layer, which is saturated, sitting permanently below the water table. The catotelm layer is highly decomposed, generally becoming more amorphous/liquid in nature and losing structure with increasing depth. The structure of catotelmic peat tends to disrupt completely on excavation and handling.

Plate 2-1 Typical Peat Profile



2.2 Peat Depth Assessment

Peat probing was undertaken across several phases between October 2020 and February 2023 by ITPEnergised, in line with best practice guidance[4].

A summary of the peat depths encountered during probing is detailed in Table 2.1 below and within Drawing 3.

Table 2.1 Distribution of Peat Depth Recorded at the Site

Peat Depth Interval (m)	Number of Occurrences	% of Probes
Nil	0	0
0.01 to 0.49	41	7.1
0.50 to 1.00	118	20.3
1.01 to 1.50	145	25
1.51 – 2.0	158	27.2
2.01 – 3.0	110	19
3.01 – 4.0	7	1.2
4.01 – 5.0	1	0.2
>5.0	0	0

The results of the probing show that deep peat is present across much of the site, the majority of the peat probes identified peat ranging between 0.5 and 2.0 m thick, with some deposits up to 5m deep in the southern part of the site. Where possible, the deepest areas of peat have been avoided by design.

Table 2.2 Peat Depth at Infrastructure Locations

Infrastructure Element	Average Peat Depth (m)
Turbine	0.6
Hardstanding	1.1
New Access Track (Excavated)	0.95
New Access Track (Floated)	1.63
Battery Storage	1.21

2.3 Peat Condition

Much of the site comprises actively eroding peatland. There are a number of erosion features including haggs and pools where bare peat is exposed (see images 2-1 to 2-3).

Image 2-1 Peat Hag

Image 2-2 Multiple erosion channels within peat

Image 2-3 Water feature infilling bare peat haggs

3. Outline Peat Management Plan

This Outline PMP considers the excavation of peat and organic soils across the site resulting from construction of the Proposed Development. It considers the potential for minimising excavation and disturbance to avoid or reduce any unnecessary surplus of soil and peat.

3.1 Methodology

3.1.1 Design Principles

The Scottish Environmental Protection Agency (SEPA) has provided the following hierarchy of design principles to minimise the impacts associated with the excavation of peat.

- **Prevention**: The best management option for waste peat is to prevent or limit its production. This can be done through design, positioning infrastructure in shallower peat or through consideration of alternative construction methods or engineering solutions e.g., floated roads or piling solutions;
- **Reuse** (on site or offsite for peatland restoration): Using excavated peat in construction or reinstatement (where suitable) e.g., restoration of temporary hardstanding areas, verge reinstatement, screening bunds, peatland restoration etc;
- **Recycling/Recovery/Treatment**: Where peat cannot be reused on site or off site for restoration, it may be used for agricultural benefit or treated/blended with other materials to form a soil substitute or used in other relevant works. This use would require a waste management licence or registration as an exempt activity and compliance with the legal requirements;
- **Storage**: Temporary storage of peat on site (for example, during short periods in the construction phase) and then re-use. Should the peat become unsuitable for reuse during storage, it would be classed as a waste material;
- **Disposal (Waste)**: Only after all other options have been explored and discounted would this option be considered.

Three main stages within the development process are defined within the guidance and describe what data should be gathered and assessed to inform the site specific PMP:

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

This report has been prepared in accordance with the requirements for Stage 1. In line with the above guidance, a detailed PMP would be prepared post-consent, in advance of construction and would be informed by detailed ground investigation.

4. Potential Sources of Peat During Construction

Reasonable efforts to minimise impact on peat and requirement for excavation of peat – while taking account of other constraints – have been made in the design process, informed by desk study, walkover observations and targeted peat depth survey work.

The following activities are likely to generate excavation of peat during the construction process:

- Access Tracks;
- Wind Turbine Foundations;
- Crane Hardstandings
- BESS compound; and
- Cable Trenching;

4.1 Access Tracks

Access tracks across the site fall into two categories: new excavated track and new floated track. Areas of existing access track from the site entrance to the operational turbine are to be adopted but there is no upgrade required.

Floated tracks have been proposed on areas of peat greater than 1 m, where suitable. No excavation is required on floated tracks and therefore there is no associated peat excavation.

Appropriate drainage will be designed to mitigate disruption to natural hydrological drainage pathways.

Excavated access tracks in peat require complete excavation to a competent substrate. This peat would require storage ahead of reuse alongside the track in appropriate locations. Good practice in association with excavated tracks is as follows:

- Trackside ditches should capture surface water (within the acrotelm) before it reaches the road;
- Any additional interceptor drains associated with the track construction should be shallow and flat bottomed (and preferably entirely within the acrotelm to limit drawdown of the water table); and
- Any stripped peat turves should be placed back in the invert and sides of the ditch to stabilise the banks and assist regeneration.

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

4.2 Wind Turbine Foundations

Wind turbines in peatland would generally require full and permanent excavation of peat and soils to competent strata. Temporary excavation from a wider diameter would also likely be required to gain access to the base of the excavation.

Any peat excavated would be considered a loss, unless it can be re-used elsewhere on site. The proposed turbine is sited on an area of peat/soil averaging 0.6 m.

4.3 Crane Hardstandings

Similarly, crane hardstandings require excavation to a competent stratum, with any excavated peat considered a loss if it cannot be reused on site. The location of the hardstanding is influenced by the positioning of the turbine. The average depth of peat at the proposed hardstanding ranges from 0.38 m to 2.1 m, with an average of 1.15 m.

4.4 Battery Energy Storage System Compound

A substation and energy storage compound is proposed as part of the Proposed Development. Any peat excavated during the construction would be considered a loss unless it can be reused elsewhere on site.

4.5 Construction Compounds

A temporary construction compound would be required during the construction phase for storage of construction materials, turbine components and fuel, concrete batching plant and siting of welfare and office facilities. The hardstanding area of the operational turbine on site will be adopted and therefore no peat excavation is required.

4.6 Cable Trenching

Electric cabling would typically be buried/ducted in trenches alongside the proposed track network, where practicable. Should cables be buried within existing peat, excavated peat would generally be replaced at its point of origin and therefore not considered a loss.

4.7 Design Considerations for Reducing Peat Excavation

The Proposed Development was designed within the confines of a number of environmental constraints. From the outset, the design sought to avoid areas of known or potential peat, where possible. There have been several design iterations informed by multiple phases of peat probing, ensuring that the thickest areas of peat have been avoided wherever possible. Where it was not possible to site infrastructure (predominately short stretches of access track) outside areas of deep peat due to other factors, efforts have been made to minimise the footprint of the site infrastructure, as far as is practicable, and floated construction has been proposed on stretches of track overlying deep peat.

5. Proposed Mitigation During Construction

There are four main types of impact on peat which can occur during construction. These are:

- Loss of structural integrity and peat strength, due to stripping off or damaging the surface vegetation turf, excavation, handling and transporting peat (particularly wet, subsurface peat);
- Erosion and gullying, caused by exposure and desiccation of bare peat surfaces primarily caused by water erosion, due to surface runoff after rainfall;
- Contamination, caused by leaks, spillages or inappropriate laydown of materials; and
- Peat slide, caused by laying wet peat on top of wet peat, laying other heavy materials (including excavated mineral soil or other construction materials) on top of wet peat or by inappropriate stockpiling, such as attempting to create stockpiles of peat that are too high, without bunding, engineering or geotechnical support.

A range of methods and control measures are described below which are designed to prevent these impacts from occurring. This best practice guidance should be adhered to throughout the construction phase.

5.1 Peat Protection Ahead of Soil Stripping

The layout of the Proposed Development has already taken into account constraints relating to sensitive areas. The Proposed Development layout, including access track routes, will be marked on an Access Plan and will be demarcated on the ground by temporary fencing. Off-road tracking of heavy plant will not be permitted outside the demarcated area.

The Access Plan and the route of the access tracks will provide a designated controlled route and a permissible corridor within which service vehicles and plant can operate prior to peat and topsoil stripping. The purpose of the Access Plan will be to protect in situ peat in areas that are not affected by the Development and to prevent unnecessary vehicle and plant tracking across these areas. The following rules will apply to the Access Plan:

- There will be no vehicle access to areas of the site outside the area marked on the Access Plan (the Development layout marked on the plan);
- There will be no stopping of vehicles outside the area marked on the Access Plan;
- Servicing or refuelling activities will only take place within clearly designated areas within the Access Plan, identified in the CEMP; and
- Laydown of materials (either construction materials or waste materials) will take place only within designated areas within the Access Plan. There will be no laydown, unless identified in the construction drawings, of any type of materials either within the access route corridors or anywhere outside of designated areas. All laydown areas not already considered will be subject to a peat slide risk assessment prior to their designation.

Access routes and working areas will be clearly delimited throughout the construction phase to ensure that peat compaction and damage in areas not directly involved in the works are avoided. The construction works will be phased to ensure that peat is stripped in each part of the Site ahead of mineral subsoil.

5.2 Peat Excavation and Handling

As described previously there are two distinct layers of peat; the acrotelm (including the vegetated turves) and the catotelm. These distinct layers should be recognised during peat excavation and reuse activities.

5.3 Excavation

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

- Peat should be excavated as turves, including the acrotelm (surface vegetation) and a layer of adjoining catotelm (more humified peat) or as blocks of catotelmic peat;
- The acrotelm should not be separated from its underlying peat, if possible, the full depth of acrotelm layers from the top surface of the peat deposit should be excavated together;
- Turves should be as large as possible to minimise desiccation during storage;
- Mineral soils should be transported and stored separately to reduce the risk of contamination of excavated peat;
- The timing of excavation of peat should avoid periods of very wet weather and multiple handling of peat should be avoided to reduce the risk of peat losing its structural integrity

5.4 Temporary Storage

Peat storage will only be required where reinstatement is not immediately possible, and all stored peat will be reinstated at the end of the construction phase. To ensure that the storage locations are suitable in terms of environment, construction practicality and safety, the precise location of temporary peat stockpiles should be determined at a site level following consideration and assessment of suitable areas by the Environmental Clerk of Works (ECoW), Geotechnical Engineer and contractor using the guiding principles below:

- Peat turves should be stored in wet conditions or irrigated to prevent desiccation (once dry, peat will not rewet);
- Stockpiling of peat should be in large volumes to minimise exposure to wind and sun but with due consideration for slope stability;
- Excavated peat and topsoil should be stored to a maximum of 1m thickness (unless otherwise agreed by the Geotechnical Engineer);
- Stockpiles of peat should be isolated from any surface drains and a minimum of 50 m from watercourses, and stockpiles should not be located on areas of deep peat, in order to avoid increasing peat slide risks associated with additional loading;
- Stockpiles should include appropriate bunding to minimise any pollution risks where required. Excavated topsoils would be stored on geotextile matting to a maximum of 1 m thickness;
- Stores of non-turf (catotelm) peat should be bladed off to reduce the surface area and desiccation of the stored peat; and
- Monitor areas of steep peat/storage during period of wet weather, or during snow melt, to identify early signs of peat instability.

5.5 Temporary Storage around Infrastructure

Where peat cannot be transferred immediately to an appropriate restoration area, short term storage will be required. The following good practice applies:

- Peat should be stored around the perimeter at sufficient distance from the cut face to prevent overburden induced failure;
- Local gullies, drainage lines, wet ground and steep slopes should be avoided;
- Stored upper turves (incorporating vegetation) should be organised and identified according to National Vegetation Classification (NVC) community (assisted by 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).

Where longer term storage is required (>2months) the following good practice applies:

- Peat generated should be transported directly to its allocated restoration area to minimise the volume being stockpiled, with the possibility of drying out;
- Stores of catotelmic peat should be bladed off to reduce surface area and minimise desiccation; and
- Monitoring of large areas after wet weather or snow melt.

5.6 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 time of excavation.

If HGVs are used for transporting non-peat material and excavated peat, measures should be taken to minimise the risk of cross-contamination.

5.7 Handling

A detailed storage and handling plan will be prepared by the Principal Contractor as part of the construction phase PMP, including:

- Best estimate excavation volume at each infrastructure location (including peat volume split into acrotelm or 'turf' and catotelm);
- Volume to be stored locally and volume to be transferred directly on excavation to restoration areas elsewhere to minimise handling;
- Location and size of storage area relative to natural peat morphology and drainage features; and
- Irrigation requirements and methods to minimise desiccation of excavated peat during short term storage.

These parameters will be determined by the contractor prior to construction and are best determined post-consent in light of detailed ground investigation with the micro-siting for each element of infrastructure.

5.8 Reinstatement and Restoration of Construction Disturbed Areas

- Undertake reinstatement/relocation and revegetation works as soon as possible;
- Where required, consider exclusion of livestock from areas of site undergoing restoration, to minimise the impacts on revegetation;
- As far as is reasonably practicable, restoration should be carried out concurrently with construction rather than at its conclusion; and
- To ensure safe reuse, all peatland restoration works should be subject to assessment by a geotechnical specialist, ensuring that emplacement of peat will not increase the likelihood of peat instability.

6. Site Based Excavation and Management Assessment

This outline PMP has been undertaken as part of the Environmental Impact Assessment for the Proposed Development. The PMP aims to ensure that:

- there is a clear understanding of any peat on site;
- the total volume of peat that may be excavated is known;
- the design avoids areas of deep peat where possible; and
- the reuse of excavated materials is certain and minimised where possible, in line with industry good practice and guidance.

6.1 Estimated Peat Excavation and Reuse Volumes

Encompassing all data gathered from peat probing, aerial photography reviews and site walkovers, the total predicted volume of excavated materials has been calculated, with estimates of reuse (see Table 6-1).

The total peaty soil/peat volumes are based on a series of assumptions for the Proposed Development and peat depth data averaged across discrete areas of the development. Such parameters can still vary over small scale and therefore topographic changes in the bedrock profile, historical ground disturbance etc. may impact the total accuracy of the volume calculations.

6.1.1 Reuse

This section of the PMP includes methods for dealing with peat which could potentially be classified as waste (only if the material cannot be reused).

Excavated peat from the construction process will be reused in the following ways:

- Reinstatement of temporary infrastructure;
- Appropriate landscaping of new infrastructure e.g., track sides, hardstanding etc; and
- Restoration of degraded peatland habitat on site.

Table 6-1 Excavation Materials Management Plan

Infrastructure Location	Average Peat Depth (m)	Estimated Volume of Excavated Peat (m^3)	Estimated Volume of Potential Peat Reuse (m^3)	Hierarchy Adherence	Assumptions
Excavated Track (New) Approximately 330 m of excavated track	0.95	Acrotelm: 660.00 (330 x 5 x 0.40) Catotelm 907.50 (330 x 5 x 0.55) Total: **1,567.50**	Acrotelm: 660.00 (330 x 2.5 x 0.4) x 2 Catotelm: 1,320.00 (330 x 2.5 x 0.80) x 2 Total: **1,980.00**	Avoidance was the first level of screening, to avoid areas of thick peat. Routing has been planned on thinner peat or peaty soils where possible.	Sections of the route may require cut and fill and these slopes would require restoration to minimise visual impact. Verge restoration either side of tracks. Assumes 2.5 m wide verge with an average height of 1.2 m. Acrotelm and turves should be used for the upper 0.4 m. Subject to detailed post-consent ground investigation to fully characterise peat. Detailed assessment may identify further lengths of floating access tracks, which would further reduce requirement for excavation.
Floated Track (New) Approximately 264 m of floated track	1.63	n/a	Acrotelm: 528.00 (264 x 2.5 x 0.4) x 2 Catotelm: 1056.00 (264 x 2.5 x 0.8) x 2	Avoidance was the first level of screening, to avoid areas of thick peat. Where thick areas of peat could not be avoided, floated tracks are proposed to avoid additional excavation.	Verge restoration either side of tracks. Assumes 2.5 m wide verge with an average height of 1.2 m. Acrotelm and turves should be used for the upper 0.4m, restoration must not impact existing, unexcavated peat.

Infrastructure Location	Average Peat Depth (m)	Estimated Volume of Excavated Peat (m^3)	Estimated Volume of Potential Peat Reuse (m^3)	Hierarchy Adherence	Assumptions
			Total: **1,584.00**		Subject to detailed post-consent ground investigation to fully characterise peat.
Turning Head (Floated) One turning head comprising an area of 820 m^2.	2.03	n/a	Acrotelm: 314.00 (314 x 2.5 x 0.4) Catotelm: 628.00 (314 x 2.5 x 0.8) Total: **942.00**	Avoidance was the first level of screening, to avoid areas of thick peat. Where thick areas of peat could not be avoided, floated track construction is proposed.	Assumes verge restoration along 314 m stretch of outer side of turning head (excludes sections already accounted for in track calculations). Acrotelm and turves should be used for the upper 0.4 m, restoration must not impact existing, unexcavated peat. Subject to detailed post-consent ground investigation to fully characterise peat.
Battery Storage Comprising an area of approximately 3,670 m^2 .	1.21	Acrotelm: 1,468.00 (3670 x 0.40) Catotelm: 2,972.70 (3670 x 0.81) Total: **4440.70**	Acrotelm: 180.00 (180 x 2.5 x 0.4) Catotelm: 360.00 (180 x 2.5 x 0.8) Total: **540.00**	Avoidance was the first level of screening, where design aimed to avoid areas of thick peat, however other environmental and operational constraints meant that the battery storage compound has been sited within an area of thick peat.	Assumes verge restoration along approximately 180 m stretch of outer side of battery storage compound (excludes sections facing existing track). Acrotelm and turves should be used for the upper 0.4 m, restoration must not impact existing, unexcavated peat.

Infrastructure Location	Average Peat Depth (m)	Estimated Volume of Excavated Peat (m^3)	Estimated Volume of Potential Peat Reuse (m^3)	Hierarchy Adherence	Assumptions
					Subject to detailed post-consent ground investigation to fully characterise peat.
Turbine Bases (Formation Only)	0.60	Acrotelm: 246.18 (14 x 14 x 3.14 x 0.40) Catotelm: 123.09 (14 x 14 x 3.14 x 0.20) Total: **369.26**	Acrotelm: 36.44 (91.106 x 1 x 0.4) Catotelm: 72.88 (91.106 x 1 x 0.8) Total: **109.33**	Avoidance was the first level of screening, to avoid areas of thick peat. The turbine is sited on shallow peat/peaty soils overlying glacial soils.	At the turbine foundation, 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. Assumes base circumference of 91.106 x 1.2m high (average) x 1m wide. Acrotelm (including turves) for upper 0.4m. Subject to detailed post-consent ground investigation to fully characterise peat.
Crane Hardstanding	1.1	Acrotelm: 753.60 (80 x 30 x 0.40) Catotelm: 1,318.80 (80 x 30 x 0.70) Total: **2,072.40**	Acrotelm: 105.00 (140 x 3 x 0.25) Catotelm: 231.00 (140 x 3 x 0.55) Total: **336.00**	The crane hardstanding location has been influenced by the turbine design iteration to avoid thicker peat and steep slopes. Orientation and location of crane hardstanding have been designed to avoid thick peat where possible.	Assumes restoration along 3 sides of hardstanding - 3m wide batter x 0.8m high (average). Subject to detailed post-consent ground investigation to fully characterise peat.

Infrastructure Location	Average Peat Depth (m)	Estimated Volume of Excavated Peat (m^3)	Estimated Volume of Potential Peat Reuse (m^3)	Hierarchy Adherence	Assumptions
-	-	-	**Acrotelm: 1304.33** **Catotelm: 1654.20** **Total: 2958.54**	Where surplus peat is generated, restoration options on site have been considered, reducing the requirement for material to be transported off-site (and potentially losing its structural integrity).	It is assumed that surplus peat generated from the excavation of infrastructure on site could be utilised to restore areas of degraded peatland on site. This includes using 'donor' peat to infill bare peat areas, alongside other restoration techniques including ditch blocking and hagg reprofiling.
TOTAL	-	Acrotelm: 3,1227.78 Catotelm: 5,322.09 **Total: 8,449.86**	Acrotelm: 3,1227.78 Catotelm: 5,322.09 **Total: 8,449.86**	-	-

Based on the values indicated, it is anticipated that all peat generated from infrastructure excavations can be reused within the site – see Annex 2. Where peat cannot be used in the reinstatement of infrastructure locations, it is assumed that any surplus could be used to undertake restoration of degraded peatland within the site boundary. The formation of peat deposits is reliant on a high water table, whether temporary or permanent. Without dead plant tissue being exposed to the anoxic conditions below the water table, they would decompose, and the carbon would be released to the atmosphere. Similarly, bare, dry peat degrades and releases carbon. Any restoration efforts would seek to encourage re-wetting by slowing drainage or reducing drying of peat (through exposure). Restoration techniques including hagg reprofiling, ditch blocking and targeted infilling/bunding would utilise excavated peat where suitable (subject to assessment by ECoW on excavation) and would comply with habitat management proposals.

Should further ground investigation information become available, the figures would need to be re-calculated. The figures calculated during this assessment are indicative only and will be subject to a detailed peat management assessment post-consent, informed by detailed ground investigation.

7. Monitoring and Inspection

The construction phase of the development would be supported by a Geotechnical Engineer and ECoW. There would be frequent, routine, and regular inspections of peat in all stockpiles and temporary storage areas as part of the PMP audit process. Inspections would assess in situ peat physical conditions, integrity of containment and temporary drainage conditions, and they would seek to confirm that stockpile design and management was adequate to prevent erosion and peat slide. These inspections would take place weekly (at a minimum) during stockpile creation and storage.

Should any problems be observed during regular visual inspections of peat stockpiles, this would invoke implementation of an appropriate corrective action which would be recorded and monitored for effectiveness. Types of corrective actions would include, but would not necessarily be limited to:

- modification of temporary drainage;
- additional or modified bunding;
- incorporating of sediment fencing if required; and
- light re-grading to correct any areas of surface erosion, etc.

Regular, frequent inspections of peat conditions during construction and restoration phases of work would be carried out by the Geotechnical Engineer and ECoW as follows:

- Peat surface, peat profile and peat consistency conditions would be carried out as part of ground investigations prior to the start of construction. This information would provide detailed information on the baseline conditions for each part of the infrastructure footprint.
- Restored peat conditions would be inspected immediately after restoration to ensure that the methods detailed in the PMP had been correctly implemented and to inform any corrective actions should they be required.
- The physical condition of peat would be retained as carefully as possible both at the peat storage and the peat restoration stages. This is particularly important for vegetation establishment.
- Within 3 months of completion of works in any area, the ECoW inspects the reinstatement efforts to determine satisfactory placement of sub-soil, topsoil and turves.
- The ECoW (or other qualified person) undertakes a final inspection of all reinstated areas at the end of the first growing season following completion of reinstatement.
- The ECoW should complete a daily diary of on-site activities which would be compiled within a monthly ECoW report which will include information relating to peat reinstatement, these reports will be available at the request of the Planning Authority.

8. Conclusion

The Outline PMP follows the guiding principles and has been created in adherence with best practice guidance.

The PMP addresses the following peat related issues:

- The depth of peaty soils/peat deposits at site;
- The volumes of peaty soils/peat that are predicted to be excavated and its suitability for reuse;
- The capacity to reuse the peat onsite; and
- Peat handling and temporary storage.

The figures detailed within this report are to be considered indicative at this stage. The total excavation volumes are based on a series of assumptions for the Proposed Development and peat depth data averaged across discrete areas of the development. Such parameters can still vary over small scale and therefore topographic changes in the bedrock profile, historical ground disturbance etc. may impact the total accuracy of the volume calculations.

A series of good practice standards detailed within this report relating to excavation, handling and storage of peat should be utilised to maintain the structural integrity of excavated peat and its suitability for reuse.

It has been concluded that all the materials to be excavated on site would fall into the non-waste classification as all of the peat soils would be re-used on site.

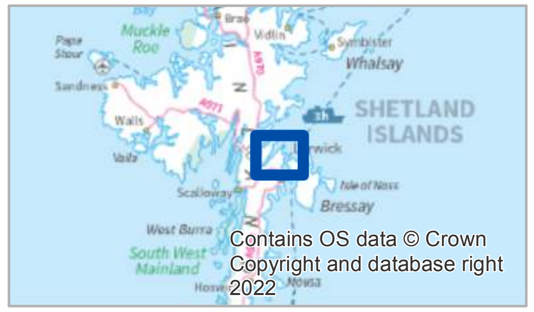
Although there is likely to be a surplus of peat generated from infrastructure excavations, it is anticipated that this material could be re-used through restoration of degraded peatland within the site boundary, without the need for any material to be taken off site.

Post consent, the Outline PMP and CEMP should be updated with information gathered during detailed ground investigation.

Annex 1 – Drawings

KEY

Site Boundary



Coordinate System: British National Grid
Projection: Transverse Mercator

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0 0.2 0.4 0.6 0.8 1 Kilometres

1:24,000

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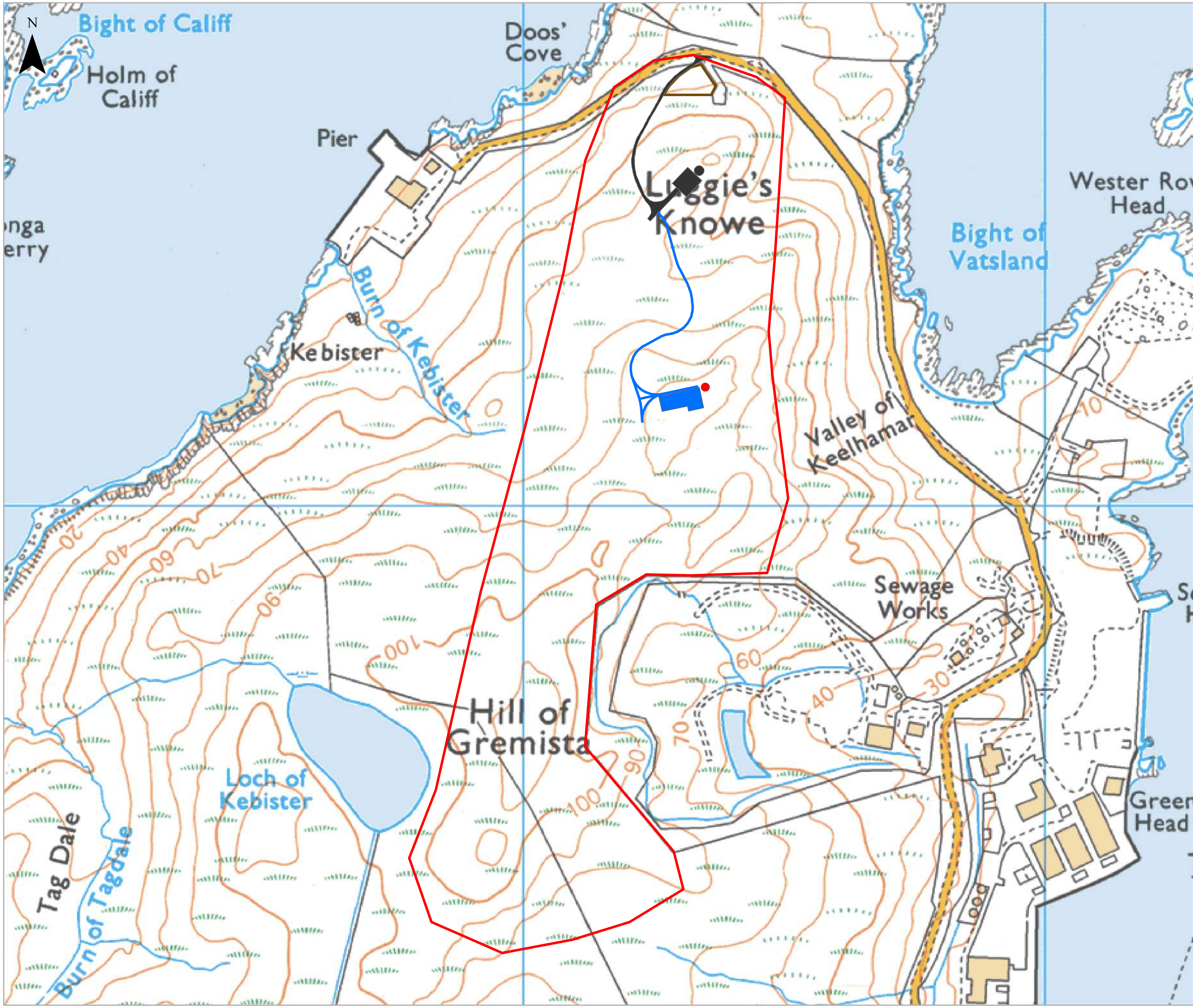
Luggies Knowe Wind Energy Project
Peat Management Plan

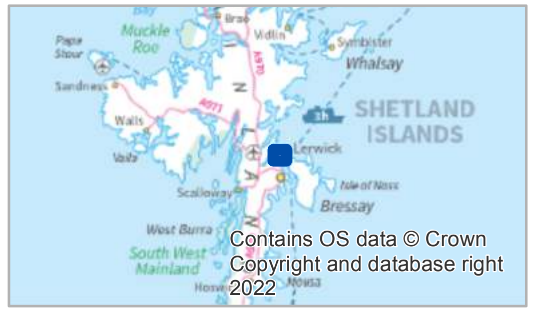
Drawing 1
Site Location

Date:	Lead:	Review:	Version:
18/05/2023	DN	EB	1.0



KEY

- Site Boundary
- Operational Turbine
- Proposed Turbine
- Proposed Access Track
- Operational Hardstanding & Access Track
- Proposed Hardstanding
- Proposed Battery Storage



Coordinate System: British National Grid
Projection: Transverse Mercator

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0 0.1 0.2 0.3 Kilometres

1:7,000

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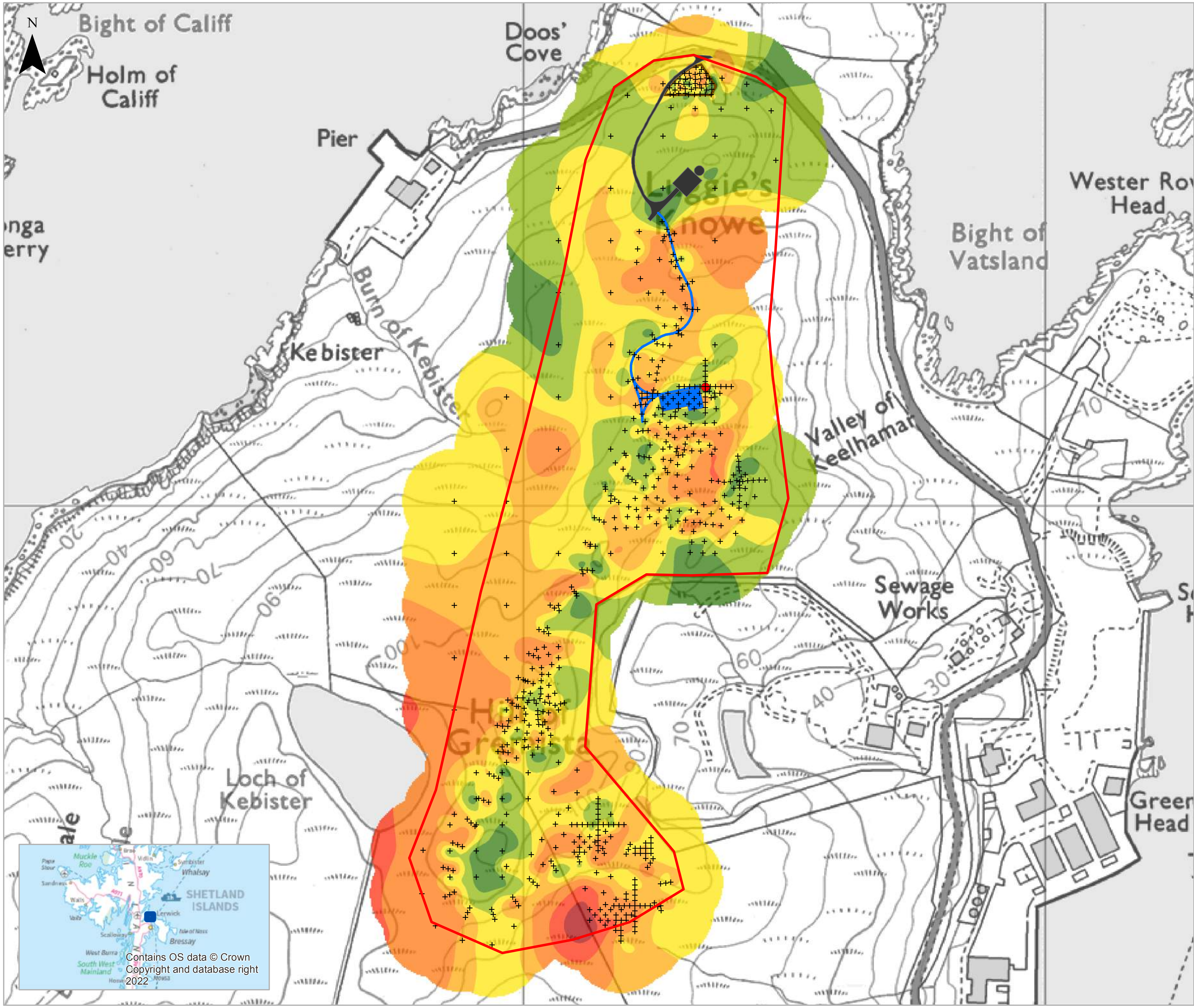
Luggies Knowe Wind Energy Project
Peat Management Plan

Drawing 2
Site Layout

Date:	Lead:	Review:	Version:
18/05/2023	ES	DN	1.0



KEY

- Site Boundary
- Operational Turbine
- Proposed Turbine
- Proposed Access Track
- Operational Hardstanding & Access Track
- Proposed Hardstanding
- Proposed Battery Storage
- + Probe Location

Peat Depth (m)

- 0 - 0.5
- 0.5 - 1.0
- 1.01 - 1.5
- 1.51 - 2.0
- 2.01 - 3.0
- 3.01 - 4.0
- 4.01 - 5.0

Coordinate System: British National Grid
Projection: Transverse Mercator

0 0.1 0.2 0.3 Kilometres

1:7,000

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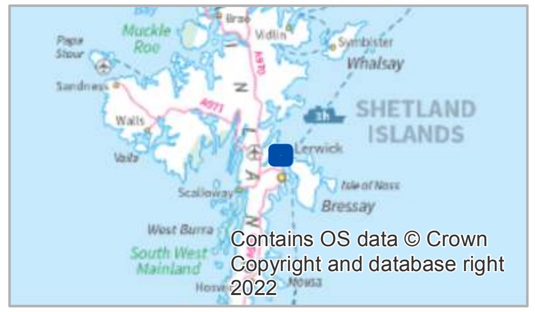
Luggies Knowe Wind Energy Project
Peat Management Plan

Drawing 3
Peat Depth

Date:	Lead:	Review:	Version:
18/05/2023	AD	DN	1.0

KEY

- Site Boundary
- Operational Turbine
- Proposed Turbine
- Proposed Access Track
- Operational Hardstanding & Access Track
- Proposed Hardstanding
- Proposed Battery Storage
- Break in Slope
- Haggs and pools
- Shallow rock



Coordinate System: British National Grid
Projection: Transverse Mercator

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0 0.1 0.2 0.3 Kilometres

1:7,000

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Luggies Knowe Wind Energy Project
Peat Management Plan

Drawing 4
Geomorphological Interpretation

Date:	Lead:	Review:	Version:
18/05/2023	ES	DN	1.0

Annex 2 – Excavated Materials Calculator

Infrastructure	Length (m)	Width (m)	Number	Area (m2)	Average Peat Depth (m)	Average Depth Acrotelm (m)	Average Depth Catotelm (m)	Total Volume Acrotelm Excavated (m3)	Total Volume Catotelm Excavated (m3)	Total Volume Excavated (m3)	Length (m)	Width (m)	Area (m2)	Average Depth (m)	Number	Depth of Acrotelm (m)	Max Depth of Catotelm (m)	Acrotelm Reuse Volume (m3)	Catotelm Reuse Volume (m3)	Total Re-use Volume (m3)	Notes
New Access Track (Excavated)	330	5	1	1650	0.95	0.40	0.55	660.00	907.50	1567.50	330	2.5	825	1.20	2	0.40	0.80	660.00	1320.00	1980.00	Verge restoration either side of tracks.
New Access Track (Floated)	264	5	0	0	1.63	0.40	1.23	0.00	0.00	0.00	264	2.5	660	1.20	2	0.40	0.80	528.00	1056.00	1584.00	Verge restoration either side of tracks.
Turning Heads	-	-	0	0	2.03	0.40	1.63	0.00	0.00	0.00	314	2.5	785	1.20	1	0.40	0.80	314.00	628.00	942.00	Assumes verge restoration on outer side of turning head (less what is accounted for in access track calculations).
Battery Storage	-	-	1	3670	1.21	0.40	0.81	1468.00	2972.70	4440.70	180	2.5	450	1.20	1	0.40	0.80	180.00	360.00	540.00	Assumes verge restoration on outer side of battery storage compound (less existing track section).
Turbine Bases (Formation Only)	28	28	1	615	0.60	0.40	0.20	246.18	123.09	369.26	91.106	1	91.106	1.20	1	0.40	0.80	36.44	72.88	109.33	Assumes base circumference of 91.11 x 1.2m high x 1m wide.
Hardstandings - Permanent	80	30	1	1884	1.10	0.40	0.70	753.60	1318.80	2072.40	140	3	420	0.80	1	0.25	0.55	105.00	231.00	336.00	Assumes restoration along 3 sides of hardstanding - 3m wide batter
Restoration of Degraded Peatland	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1304.33	1654.20	2958.54	Assumes excess peat excavated can be used to restore areas of degraded peatland on site.

	TOTAL	ACROTELM	CATOTELM
Total Excavated Volume (m3)	8449.86	3127.78	5322.09
Total Re-use Volume (m3)	8449.86	3127.78	5322.09
Net Balance (m3)	0.00	0.00	0.00

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