Guidance on Developments on Peatland

PEATLAND SURVEY (2017)

For further information on this guidance please consult:
http://www.snh.gov.uk/planning-and-development/planning-renewable-guidance/

This guidance should be quoted as:
Scottish Government, Scottish Natural Heritage, SEPA (2017) Peatland Survey. *Guidance on Developments on Peatland*, on-line version only.

Contents

1. Introduction

1.1. This guidance defines a consistent sampling methodology to quantify and qualify the peat material on site and advice on how to publish peat surveys as part of wider site investigations for development management applications, with a particular focus on win farm developments. It updates the 2014 Guidance on Developments on Peatland - Site Surveys published on the Scotland Government renewable website.

1.2. It will also consider how peat surveys interact with other elements of site investigation.

2. Why are peat surveys needed?

2.1. Peat surveys will provide information on peat depth and peat quality and will inform:

- Site design and layout to minimise disruption to peatlands
- Peat and Habitat Management Plans
- Carbon savings & losses evaluation, including informing carbon calculator assessments
- Drainage planning and hydrological assessment
- Peat landslide hazard and risk assessments
- Post-construction habitat management / site reinstatement and restoration.

3. Undertaking peat surveys

3.1 Site investigations should be carried out through a combination of desk study, site walk-over surveys, and more “intrusive” methods often termed “ground investigations”. Field survey should be carried out using appropriate methods for the site and the type of data required.

3.2 Peat is defined as the partially decomposed remains of plants and soil organisms which have accumulated at the surface of the soil profile. Peat accumulates where the rate of input of organic material from the surface exceeds the rate of decomposition and ‘turn-over’ of this new material. A peat layer does not include a mineral fraction (hence being differentiated from topsoil).

3.3 Peat soil is an organic soil which contains more than 60 per cent of organic matter and exceeds 50 centimetres in thickness.

Key information
Peat survey will consider the distribution and quality of peat soil. A peat depth survey should assess the presence of any peat layer even when less than 50cm thickness.

PEAT SURVEY FLOWCHART – WHEN /WHY / HOW

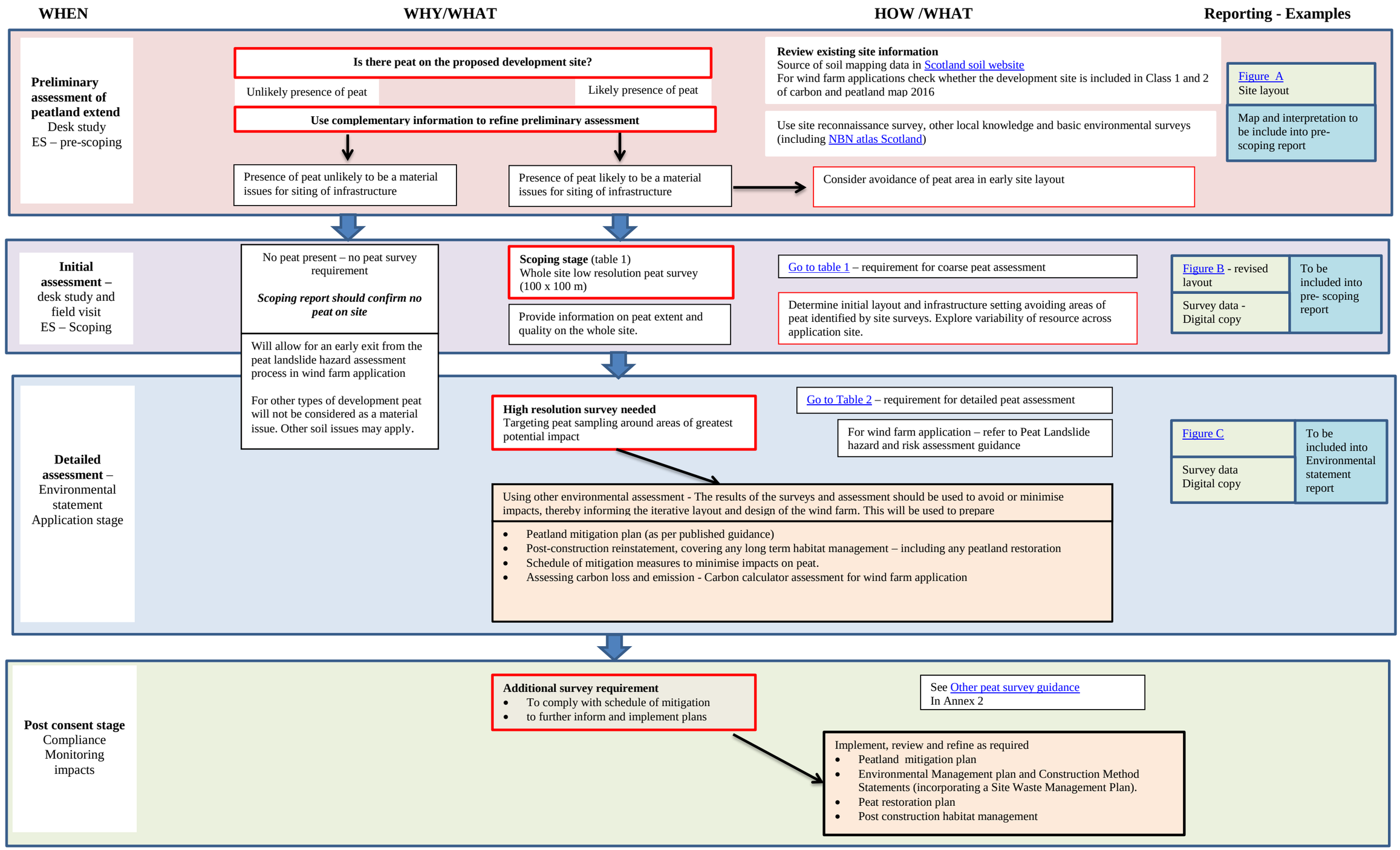


TABLE 1 – PRELIMARY ASSESSMENT OF PEATLAND EXTENT AND CONDITIONS

A field evaluation at low resolution will determine the presence of peat across the whole site. This is usually undertaken at an early stage in the EIA process.

<table>
<tr><td>Area coverage</td><td colspan="4">Whole proposed development site</td></tr>
<tr><td>Peat depth survey resolution</td><td colspan="4">Low resolution - Usually 100 m X 100 m on a regular grid pattern across the whole area proposed for development. Greater intensity surveys will not be required for areas that are unlikely to be developed.</td></tr>
<tr><td>A- Information to be sampled and gathered during peat depth survey</td><td>B- Other ancillary information to be recorded during field visit</td><td>C- Other information collected as part of Environment statement</td><td>D- Methodology for peat depth survey</td><td>E-Data interpolation</td></tr>
<tr><td>1- Location of each individual sampling point - Grid reference of each sampling point (at least precision to 100 cm) – use of GPS device is essential.</td><td rowspan="2">1- Contextual information, including surface drainage conditions</td><td rowspan="5">1- Detailed Phase 1 Habitat Survey whole site and National Vegetation Classification (NVC) Survey in locations where infrastructure is proposed which provide identification of Annex I habitats and Ground Water Dependent Terrestrial Ecosystems.</td><td>1- Peat depth surveys are usually conducted using peat probes (sometimes referred to as depthing rods). Probes should be long enough to cover the whole peat depth.</td><td rowspan="2">1- Detail on the geo-statistical procedure used to generate the estimated peat distribution map from the scattered set of peat depth values (i.e. interpolation using natural neighbor, IDW, Spline function, Kriging using QGIS, ARCGIS or other software)</td></tr>
<tr><td>2- Depth of the peat deposit – all occurrence of peat deposit (even if less than 50cm) should be recorded with at least a 10 cm precision. When no peat deposit is present a value of zero should be entered.</td><td>2- More information can be collected using a gouge auger – such as information on peat stratification and localized surface hydrological conditions. (See A-3)</td></tr>
<tr><td>3- Composition of the soil column / type of peat (fibrous, semi-fibrous or amorphous) / moisture within the soil column where a auger is used instead of peat rods (see additional information in Annex 1)</td><td rowspan="2">2- Photography at selected viewpoints to provide a visual context of the spatial data</td><td colspan="2">E- Information presentation (see section 4, figure A)</td></tr>
<tr><td>4- Slope and other pertinent features such as active, incipient or relict instability should be recorded to inform the Peat Landslide Hazard & Risk[1] Assessment that will inform whether these areas should also be avoided.</td><td colspan="2">• Geo-referenced peat depth data provided in a table
• Peat distribution map
• Peat depth data and interpolated distribution map provided as GIS shape file
• Habitat Maps – Phase 1 and NVC</td></tr>
</table>

[1] http://www.gov.scot/Publications/2006/12/21162303/1

TABLE 2 - FURTHER ASSESSMENT OF PEATLAND EXTENT AND CONDITIONS

For areas potentially to be developed to determine where peat is and how deep it is. This is so that developments can be designed to avoid the areas of deepest peat and minimise the impacts on peat and peatland environment, as much as possible.

Area coverage & resolution	Targeted sampling regime tailored to potential development areas within the proposal boundary. Sampling should focus on areas of greatest potential impact from development including:
	• full targeted probing along all tracks, at all turbines/hard standings, turning points and passing places, site compounds, substation, borrow pits and met mast locations
	• detailed survey on a 10m by 10m grid basis around the centre of each proposed turbine base or other infrastructure including borrow pits and proposed temporary storage sites. Need to take account of potential micro-siting limits.
	• Detailed survey at 10 to 50m intervals along proposed track/road locations using 10m right angled offsets. Need to take account of potential micro-siting limits.

A - Information to be sampled and gathered during peat survey	**B- Other ancillary information to be recorded during field visit**	**C- Methodology for peat depth survey**	**D- Data interpolation and analysis**
1- Grid reference of each sampling point (precision at least 50 cm) – use of GPS device is essential.	1- Photography of areas of proposed infrastructure	1- Survey should use hand held GPS device with at least 50 cm resolution. This is used to record and locate sampling points and markers to identify the grid pattern being applied across the site.	1- Detail on the method used to calculate the depth and volume of peat that will be excavated at different locations.
2- Total depth of the peat deposit at each sample point (accurate measurement with at least 5 cm precision – including in areas where peat is less than 50cm, or is absent.)	2- Contextual information and other information that is collected as part of the Environment statement	2- Conduct surveys using an auger to identify the thickness of peat deposits, as well as providing an indication of peat stratification and localised surface hydrological conditions. Peat probes are not sufficient for collecting samples at depth.	2- Detail of any geo-statistical procedure used to generate the estimated peat distribution map from the scattered set of peat depth values (i.e. interpolation using natural neighbor, IDW, Spline function, Kriging using QGIS, ARCGIS or other software)
3- Description of the soil core column including texture, depth and moisture content. These should be provided using recognised field assessment protocols (see additional info below about *Soil survey of Scotland Peat survey methods*)	3- Results of detailed habitat and vegetation surveys including Phase 1 Habitat Survey across the whole site and National Vegetation Classification (NVC) Survey in locations where infrastructure is proposed, which will provide identification of Annex I habitats and Ground Water Dependent Terrestrial Ecosystems	3- Soil augers or Russian peat samplers/corers, capable of extracting peat samples for carbon analysis, bulk density measurements and the degree of decomposition are required. Surveys should be undertaken by suitably skilled surveyors. This should be capable of reaching total core depth, and extension rods should be used where required. The minimum number of samples should reflect the diversity of habitats (4 samples in most cases). Selected samples should be representative of peat in areas where development is planned. The results can be checked against nationally derived estimates of bulk density and total carbon content to ensure accuracy.	
4- Peat bulk density samples for laboratory analysis		4- Samples collected should be carried back for laboratory assessment in labeled, air and water tight containers (or polypropylene bags) prior to analysis.	**Information presentation (see section 4, figures B and C)**
5- Details of peatland characteristics such as surface vegetation cover density, vegetation type, artificial drainage features, signs of historic and current erosion (gullies, rills or hags) and peat stability on slopes. Note some of this may have been undertaken as part of any habitat survey.		5- Additional habitat survey sampling protocol based on quadrats to describe the vegetation. Phase 1 and NVC guidance[6,10] should be used to provide a representative survey across the site. This should be undertaken by suitably qualified ecologists.	• Tabulated survey results - Geo-referenced and including all information collected at each sampling / survey points • All map of peat distribution map should include an overlay all proposed infrastructure locations • Interpolated map should include location and depth of surveyed points as an overlay. • Peat depth data point and interpolated distribution map provided as GIS shape file • Average peat depth and maximum peat as required in the Carbon Calculator assessment • Volume of excavated peat to inform the Peat Management Plan • Drawings and tables demonstrating how and where peat will be re-used • Calculations relevant to peat hazard and risk assessment

4. How to visualise survey results

General principle

The purpose of a peat depth survey is to help identify areas where the presence of peat may be an issue during site design and construction. The plans of the proposed development should then be superimposed over any maps of peat depth to show the link between the intended locations of infrastructure and how impacts on peat and peatland habitats have been minimised or avoided (See examples below)

We request that the applicant submit maps of peat surveys considering:

- the location of all peat probe locations at an appropriate scale covering the *whole* site with overlay of site boundary and all proposed infrastructure, including temporary works;
- detail of peat survey at an appropriate scale, focusing on sensitive areas with overlay of site boundary and all proposed infrastructure, including temporary works. The maximum peat depth from across the area surveyed should be provided;
- a contour map of peat depth estimating the extent of the resource between sampling points should be provided with detail of the spatial interpolation methodology used and with overlay of site boundary and all proposed infrastructure, including temporary works.

We request that the applicant submit peat survey data considering:

- Geo-referenced data on peat depth, the carbon content and bulk density of peat, dominant vegetation cover plus some measure of the variability of peat depth across the site. This should be presented in a suitable format such as separate digital spreadsheet or GIS layer. A pdf table only will not be acceptable.
- For wind farm applications - The peat landslide hazard and risk assessments guidance (2006) section 5.6 requires detailed appendices listing all samples taken during investigations with reference numbers, dates and test undertaken for each samples.

We request that the applicant include the following:

- a key to all the field attributes should be provided in a separate table and where appropriate cross referenced in the main report.
- A key to content classification, value range and symbols used in tables should be fully explained with a link provided to the standard and protocol used.

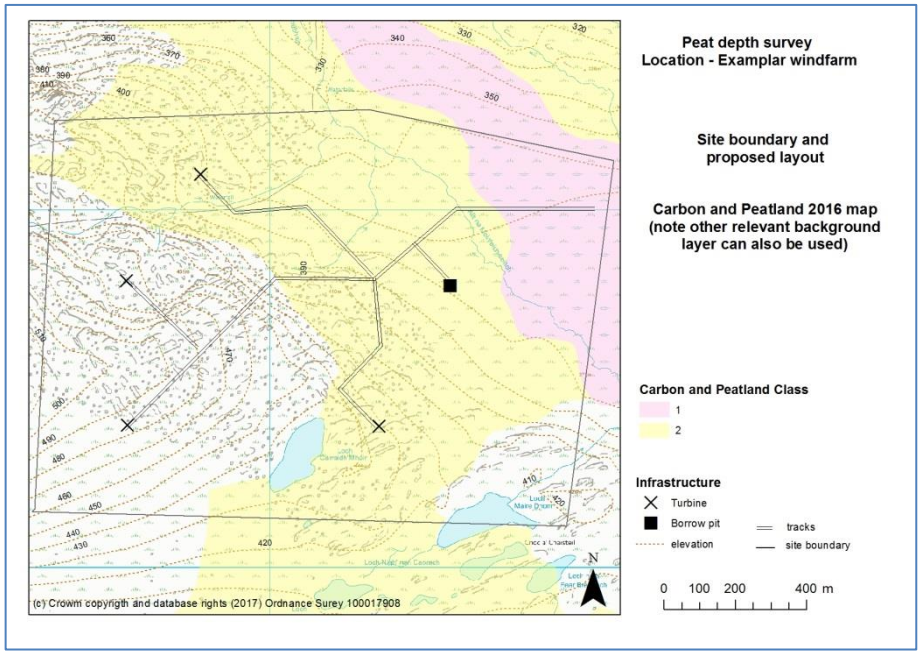
The applicant will be asked to confirm if they are willing to make data submitted available within the proposed Peatland Action database (or other similar database), by agreeing to the following statement:

EIA environment statements are recognized as an underused resource by academic research communities and policy makers. Information on peatland is being collected to populate a new Peatland Action database to provide a robust understanding of the state of our nation peatland and facilitate access to detail information on good practices on peatland management and restoration. This is development under CAMERAS initiative. By allowing us to share and re-use the appropriate information more widely we will have a greater opportunity for collective understanding of peatlands and their public benefit. I must stress that personal information will not be shared. To ensure that you have access to all the information we are requesting that the collected information and data is shared more widely and displayed or linked to Scotland's Environment website http://www.environment.scotland.gov.uk/ to give as wide access to the information as possible.

Pre-scoping Desk Study – reporting examples as per table 1

MAP outputs – for used in planning application and to support preliminary discussion

Figure A - Exemplar wind farm – Location map and Carbon and peatland map 2016 overlay



The map should display

- Site boundary
- Layout and infrastructure- Modification to layout may be highlighted if relevant
- Topographic background – OS backdrop, contour line, grid reference
- Carbon and Peatland map 2016 (transparency level >50%) other relevant background may be used as well.

The figure should contain

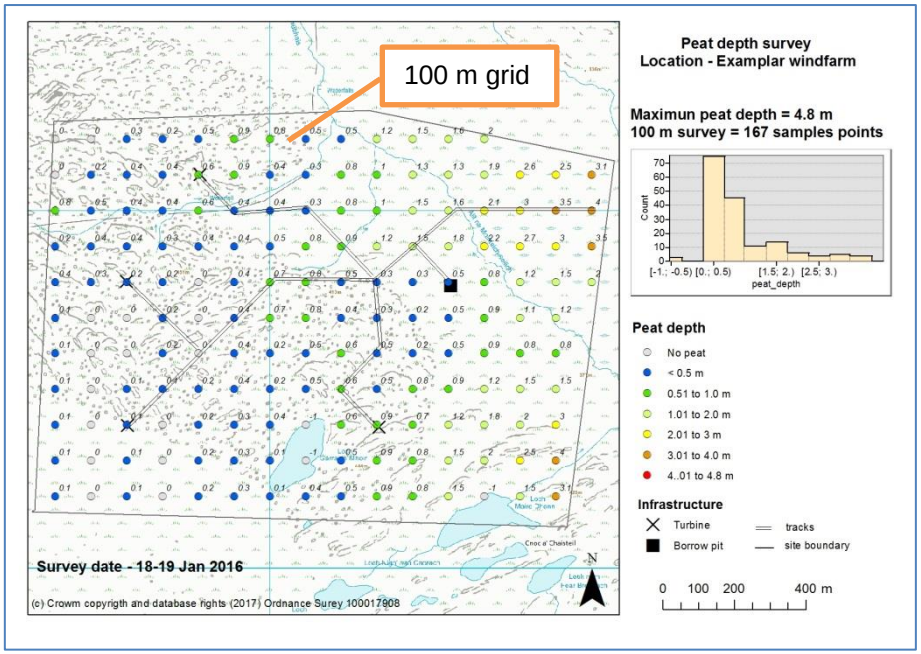
- Title
- Legend for all display items
- Scale
- Orientation
- Copyright

Tabulated and digital outputs – to support application

- GIS Shapefile for proposed site boundary
- GIS Shapefile of location of site infrastructure (track, turbine, borrow pit and others)

Scoping - Initial assessment – reporting examples as per table 2

Figure B1 - Exemplar wind farm – Whole site peat depth survey map – no interpolation – purpose of the map is to provide an overview of the site peat depth using a condensed peat depth classification with contrasted colour.



Full page at least A4 size, pdf format with relevant layers visible

The map should display

- Site boundary
- Layout and infrastructure
- Topographic background – OS backdrop, contour line, grid reference
- Whole site peat depth survey data
- Point label showing recorded depth

The figure should contain

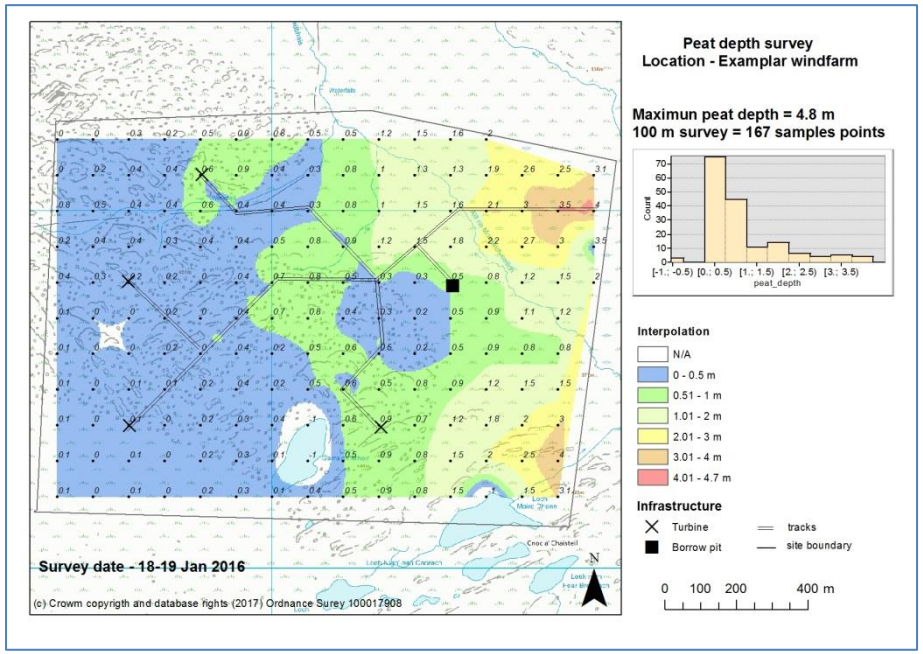
- Title
- Legend for all display items
- Scale
- Orientation
- Copyright
- Survey date
- Total number of sample points and maximum depth of peat

The figure may also contain a peat depth histogram (interval class 0.5m)

Tabulated and digital outputs – to support application

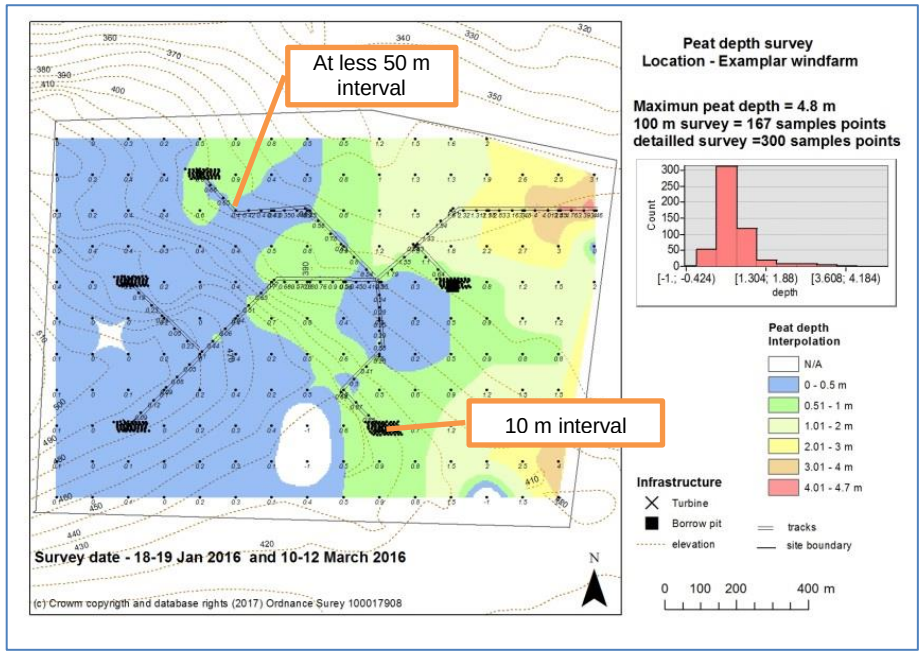
- Georeference or GIS Shapefile of peat survey data – to include for each sample point X,Y coordinates, peat depth as measured (provide unit of measurement and precision), other relevant observations.

Figure B2 - Exemplar wind farm – **Alternative representations**
As above (for B1) – with interpolation – detail on interpolation technique used should be provided



Environmental Assessment – detail survey

Figure C - Exemplar wind farm – Whole site peat depth survey map + peat depth with interpolation underlain.



Full page at least A4 size, pdf format with relevant layers visibility
The map should display

- Site boundary
- Layout and infrastructure
- Topographic background – OS backdrop, contour line, grid reference
- Whole site Peat depth survey data (using simplified legend)

The figure should contain

- Title
- Legend for all display items
- Scale
- Orientation
- Copyright
- Survey date
- Total number of samples points and maximum depth of peat

The figure may also contain a peat depth histogram (interval class 0.5m)

Tabulated and digital outputs – to support application

- Georeference or GIS Shapefile of peat survey data – to include for each sample point X,Y coordinates, peat depth as measured (provide unit of measurement and precision), other relevant observations.

Annex 1 - Additional information – extract of Soil survey of Scotland Scottish Peat survey methods

Relevant sections of the 1964 Soil Survey of Scotland Scottish Peat Survey methods[2] methodology shown below will inform the conduct of an appropriate site survey to determine peat stock and condition on site. Note S.I unit must be used.

Soil survey of Scotland Scottish Peat survey methods

Section 1 to 2 no included

Section 3 - FIELD WORK

a) to c) not included

d) Surface firmness estimation

It is necessary to make some estimate of the bearing capacity of the bog surface as this will influence the type of machines recommended for initial and subsequent exploitation. Modem bog tractors have a ground pressure of less than 2 lb. per square inch but the total pressure applied is also affected by the character and density of the vegetation and whether the tractor carries or pulls its loads. A miller or rotavator for instance imparts a forward push to a tractor.

An average man standing on one foot applies a pressure to the ground of between 5 and 6 lbs. p.s.i. and this fact is used to estimate the bearing capacity. The following symbols are used to denote the pressure the ground will stand.

Firmness of surface (P)

PO = Surface too soft to walk on

P1 = Surface just passable

P2 = Surface fairly firm

P3 = Surface firm

As an example, Table 1 shows data from White Moss, Mainland, Orkney.

P0		P1		P2		P3		Total number of observations
No	Percent	No	Percent	No	Percent	No	Percent	
0	-	1	16.7	3	50.0	2	33.3	6

In practice these data mean that some 83 per cent of the bog could be developed with mechanical equipment without much difficulty. On 17 per cent of the area some care would be required but this softer part would be expected to become firmer as drainage began to have a consolidating effect.

Table 2 shows to some extent the relationship between the surface moisture content (for the stratum 0-20 in. (0-0.5 m)) and the estimated bearing capacity.

P-value / Moisture content (%)	P1	P2	P3
Average (range)	93.8 (92.4-94.7)	92.2 (86.5 -94.5)	89.0 (79.4-92.2)

(No data for areas rated P0)

[2] Soil Survey of Scotland Scottish Peat Surveys, 1964. http://www.gov.scot/Topics/Business-Industry/Energy/Energy-sources/19185/17852-1/CSavings/PS1964

Although the differences in terms of percentage water in the peat appear small, it is important to note that a 1 per cent increase in water content at or near the figure of 90 per cent which is common for peat, results in a decrease in solids content of 10 per cent and the peat becomes appreciably more fluid and less able to bear applied pressure without collapse.

e) Observations on the vegetation

The plants growing within a radius of 49 to 66 ft (15-20 m) round each bore hole are recorded, as are the boundaries between well-defined plant communities which are noted during traverses across the bog.

f) Observations on the peat

i. *Botanical* origin

The range of vegetable remains easily identifiable in the field is strictly limited and laboratory analyses of the many hundreds of samples taken in anyone season would be vastly time-consuming. However, it is usually possible to ascertain the main peat-forming species in the field and this is done for all samples examined.

The universal peat formers found in both Blanket and Raised Basin Bogs are species of *Sphagnum.* Also found in most bogs are the remains of *Eriophorum vaginatum,* the leaf-sheaths of which contain fine fibres which are extraordinarily resistant to the processes of decomposition, and small twigs of *Callana vulgaris* which are generally found in the upper strata. The usual type of peat found in the lower horizons of Basin Bogs is a mixture of the remains of *Carex* species with smaller amounts of *Phragmites, Typha, Equisetum* and *Menyanthes,* all or some of which are usually present. Wood remains are frequent, even in areas which are now treeless such as Shetland. The commonest wood is *Betula* but *Pinus* is not uncommon and it is probable that *Salix, Alnus* and Cory*lus* occur more often than they are recognised. Field identification of wood fragments is somewhat uncertain.

ii. Degree *of humification* - von POST SCALE

The degree of humification of peat samples is estimated in the field according to the method devised by the Swedish botanist L. von Post.

A small amount of peat is squeezed in the hand and the water and! or peat exuded indicates, by its colour and consistency, the degree to which the peat has undergone humification or, more correctly, a type of decomposition which includes breakdown under anaerobic conditions. This is one of the most important observations to be made on the peat and, because it is entirely subjective, one of the most difficult to make with a minimum of error. As far as possible, the same person makes all such observations and experience counts for a great deal. It is necessary to make allowance for moisture content, oxidation of the surface horizons and for the botanical origin of the peat. Obviously for example, pieces of wood do not squeeze between the fingers and yet the matrix in which the wood fragments are embedded may be very highly humified. A very dry peat may appear to be less well humified than it actually is and vice versa. Attempts have been made by various workers to develop an objective method for the estimation of degree of humification but without conspicuous success. The von Post scale ranges from 1 to 10, the higher the number the higher the degree of humification. The full scale is as follows:

DEGREE OF HUMIFICATION - von POST SCALE

H1	Completely undecomposed peat free of amorphous material. On squeezing, clear colourless water is pressed out.
H2	Nearly undecomposed peat, free of amorphous material, yielding only yellowish brown water on pressing.
H3	Very slightly decomposed peat, containing a little amorphous material. On squeezing, muddy brown water but no peat passes between the fingers. Residue is not pasty.
H4	Slightly decomposed peat containing some amorphous material. Strongly muddy brown water but no peat passes between the fingers. Residue is somewhat pasty.
H5	Moderately decomposed peat containing a fair amount of amorphous material. Plant structure recognisable though somewhat vague. On squeezing, some peat but mainly muddy water issues. Residue is strongly pasty.
H6	Moderately decomposed peat with a fair amount of amorphous material and indistinct plant structure. On pressing, about one third of the peat passes between the fingers. Residue is strongly pasty, but shows the plant structure more distinctly than in unsqueezed peat.
H7	H7 Strongly decomposed peat with much amorphous material and faintly recognisable plant structure. On squeezing, about one half of the peat is extruded. The water is very dark in colour.
H8	Strongly decomposed peat with much amorphous material and very indistinct plant structure. On squeezing, two thirds of the peat and some water passes between the fingers. Residue consists of plant tissues capable of resisting decomposition (roots, fibres, wood, etc.).
H9	Practically fully decomposed peat with almost no recognisable plant structure. Nearly all the peat squeezed between the fingers as a uniform paste.
H10	Completely decomposed peat with no discernible plant structure. On squeezing, all the peat, without water, passes between the fingers.

Mean H-values are calculated for each bog and its sub-areas if required and also for each 20 in. (0.5 m.) layer from the surface to the bottom. The variation with depth is shown graphically in the Bog Reports. The usual pattern is for the H-value to increase more or less steadily with increasing depth unless the origin of the peat changes drastically. When *Carex* peat occurs near the bottom of a deposit, the degree of humification generally falls to a value similar to that found in the upper layers of the bog.

Peats of low degrees of humification are those commonly described as "light" or "brown" and are used as moss litter and in horticulture. The highly humified "black" or "blue" peats comprise good fuel types. In recent years horticulturalists have been less insistent on having the very light peats since rather darker qualities have been found equally useful for many purposes.

Inspection of humification data from the surveys shows that the extremes of the von Post scale are rarely encountered (i.e. H1 and H10). The majority of samples lie about the centre of the scale with small shifts of the average towards the lower or higher values depending upon whether the peat in the bog is of a fuel or a moss litter type.

iii. Fibre

The fibre content of each peat sample is estimated visually and the amounts of the two types (classified 'fine' or 'coarse') are noted on a scale ranging from 0 to 3 as shown below. Accurate quantitative determinations are made later on bulk samples in the laboratory as described in section 4(f).

Fine fibres, mainly derived from *Eriophorum spp*. (F)
- F0 = Nil
- Fl = Low content
- F2 = Moderate content
- F3 = High content

Coarse fibres, mainly rootlets (R)
- R0 = Nil
- Rl = Low content
- R2 = Moderate content
- R3 = High content

iv. Wood

Wood remains, especially if they are large and resistant, may conceivably cause a certain amount of difficulty during the exploitation of a bog. An attempt is therefore made when sampling to assess the extent of wood. It is estimated on a scale ranging from 0 to 3 as detailed below.

Wood remains (W)
- W0= Nil
- Wl = Low content
- W2 = Moderate content
- W3 = High content

Extensive wood remains of a type that might prove a serious obstacle to exploitation are not frequent but bogs with this feature have been surveyed in Sutherland and Aberdeenshire.
In Blanket Bogs, impenetrable wood is found mainly in sheltered valleys; in Raised Basin Bogs it tends to occur at the margins of the deposits.

v. Other *observations*

When peat is freshly sampled and before it darkens by oxidation, note is taken of its colour, stratification, the presence of visible mineral matter and any other features of interest.

Section 4 - OFFICE AND LABORATORY WORK

a) not included

b) Calculation of the volume of raw peat

This calculation is based on the area of deep peat and the average depth in that area. If the bog is divided into sub-areas, the volume of peat in each sub-area is calculated separately. The accuracy of the calculation depends largely upon the accuracy of the calculation depends largely upon the accuracy of the calculated average depth. In this connection the Scottish Statistical Office has carried out Standard Error calculations on the depth measurements for some bogs and, for example, in the Moss of Cree, Wigtownshire survey, found the S.E. to be ± 0.0971. There is a high degree of probability that the true average depth lies within the limits: calculated average depth plus or minus twice the S.E. In this case therefore the true average depth is probably within the range 10.64-11.92 ft. (3.246- 3.634 m.) and the true volume of peat will lie between 17.8 and 19.9 million cu. yd. (13.6-15.2 million cu. m.). (Survey results indicate an average depth of 11.3 ft. (3.44 m.) and a volume of 18.8 million cu. yd. (14.4 million cu. m.)).

The calculation of the exact volume of peat is not the most important task in a bog survey. It must be established which part or parts of a deposit may be most economically developed and for what purposes. The data should also indicate which of the several possible methods would be the choice in particular circumstances. It should also be noted that, although the total amount of peat present in a bog may be fairly accurately estimated, it is usually the case that not all this material could be exploited because of various factors, the most important of which is the variation in depth due to changes in level of the bog floor. In practice not more than approximately 70 per cent of the total volume could be utilised in the majority of deposits.

An example of data from one of the surveys is given in Table 3.

Sub-area	Area of deep peat (over 20 in. (0.5m)		Average depth		Volume of raw peat	Solids	
	acres	hectares	Feet	meter	Millions of cubic metres	Percent	Millions of tons
I	**2,342**	**948**	**13.5**	**4.1**	**37.38**	**8.1**	**3.03**
IA	**215**	**87**	**9.8**	**3.0**	**3.15**	**7.2**	**0.23**
II	**917**	**371**	**9.2**	**2.8**	**10.21**	**9.3**	**0.95**
III	**1,275**	**516**	**7.5**	**2.3**	**14.69**	**8.7**	**1.28**
IV	**1,883**	**762**	**8.2**	**2.5**	**16.45**	**9.3**	**1.58**
total	**6,632**	**2,684**	**-**	**-**	**81.86**	**-**	**7.07**

(1 cu. m = 1.308 cu. yd)

c) Moisture and solids contents

Earlier surveys of many Scottish bogs by the International Survey Company, a British Company which worked in conjunction with Peco Ltd., were not sufficiently detailed to allow an accurate estimation of the moisture content to be made. The current series of surveys has shown that these early estimates of moisture content tended to be rather low.

The estimation of moisture content entails considerable work which must be done within a short time of the samples being collected in order to avoid error by evaporation and mechanical loss. The number of samples to be taken is a matter of judgment, bearing in mind the degree of accuracy required, the time available for field work and the capacity of the laboratory. No rigid routine is followed.

d) Bulk density

The bulk density of the peat solids, including ash, is determined in the laboratory as follows:-

i. the sample is completely dried and ground to pass a 1 mm. screen.
ii. the ground sample is put into a graduated container and exposed to a standard number of controlled taps on a tapping machine.
iii. the volume after compaction is noted and, related to the weight, gives the bulk density in g. per cc.

A certain degree of correlation can sometimes be demonstrated between the degree of humification, the bulk density and the calorific value but comparisons are subject to the probable error introduced by the subjective estimation of the degree of humification.

e) Ash content

The content of ash in peat is an extremely variable factor and is in no sense diagnostic.

It is useful to know the ash content of any particular peat in that it may have some bearing on the suggested utilisation of the bog but it can be so greatly affected by numerous outside agencies that its value as a factor in classification is virtually nil. For example, coastal bogs exposed to on-shore winds tend to be high in ash due to the long-continued deposition of wind-borne sand and spray; valley bogs also tend to have high ash contents because of the continual inflow of ron-off from the surrounding slopes carrying mineral particles eroded from these slopes. Peat areas subject to flooding

are frequently grossly contaminated with mineral matter deposited by flood water, often in distinct strata visible to the eye.

f) Fibre content

Large samples are taken for laboratory estimation of fibre content, each being a mixture of peat from all levels of one bore hole. Each sample is washed through sieves to remove the finely divided material and the fibrous residues are dried and weighed. The results are expressed as a percentage of the total solids content which is separately estimated on another similar sample.
The data shown in Table 4 are collected from a number of bog reports.

Table 4 – Fibre content

Name of deposit and location	Classification of bog peat	Fibre (per cent of total solids)		
		Fine	Coarse	Total
Achaim, Caithness	Blanket	7.3	8.6	15.9
Altnabreac, Caithness	Blanket	11.75	2.6	14.35
Kame, Shetland	Blanket	4.5	12.2	16.7
Garror, Perthshire	Raised Basin	3.7	12.9	16.6
Mindork, Wigtownshire	Raised Basin	4.9	13.2	18.1
Cranley, Lanarkshire	Raised Basin	5.9	8.8	14.7

It should be mentioned that the fibre content varies considerably from place to place even within one bog area. The data obtained are, therefore, only a guide to the amount of fibre present.

Section 5 ASSESSMENT OF DATA

a) drainage

All data relevant to the drainage possibilities of a bog are collected during the survey and include information on water levels, outfalls, catchment areas and any deep basins or "pockets" in the floor of the bog which might pose special problems in the drainage of the bottom should the peat be removed.
Existing ditches are examined and are mapped if in reasonable condition and capable of future use. Non-functioning ditches are noted but not recorded in detail.
Tentative drainage schemes suggested for a particular bog usually include a layout of at least the main ditches for the bog itself and an assessment of the work that would be required to carry run-off to the nearest convenient outlet.

Subsequent sections not included

Annex 2 - Peat survey and peat guidance as used by other activities sectors

Peatland Action – restoration grants

- Peat Depth Survey Guidance http://www.snh.gov.uk/docs/A2210297.pdf
- Peatland Condition Assessment - http://www.snh.gov.uk/docs/A1916874.pdf

Forestry Commission Scotland

- Guidance on undertaking a soil survey (including peat depth) http://soils.environment.gov.scot/resources/forests-and-woodlands/

UK woodland code

- Soil Carbon and the Woodland Carbon Code - https://www.forestry.gov.uk/pdf/SoilCarbonandtheWoodlandCarbonCode_FINAL_14July2011.pdf/$FILE/SoilCarbonandtheWoodlandCarbonCode_FINAL_14July2011.pdf

Peatland code

- Assessing the Condition of your Project Site Guidance and Procedures (start page 172) http://randd.defra.gov.uk/Document.aspx?Document=13239_PeatlandCodemetricsFinalReportforpublication.pdf

National Soil Inventory of Scotland

- Profile description and soil sampling protocols for the National Soil Inventory of Scotland (2007-2009) - http://www.hutton.ac.uk/sites/default/files/files/soils/NSIS%202007-2009%20Field%20Protocols.pdf

Peat Landslide Hazard & Risk Assessment (second edition, April 2017)

- Guidance on the required scope of any preliminary site investigations for proposed electricity generation developments http://www.gov.scot/Publications/2017/04/8868