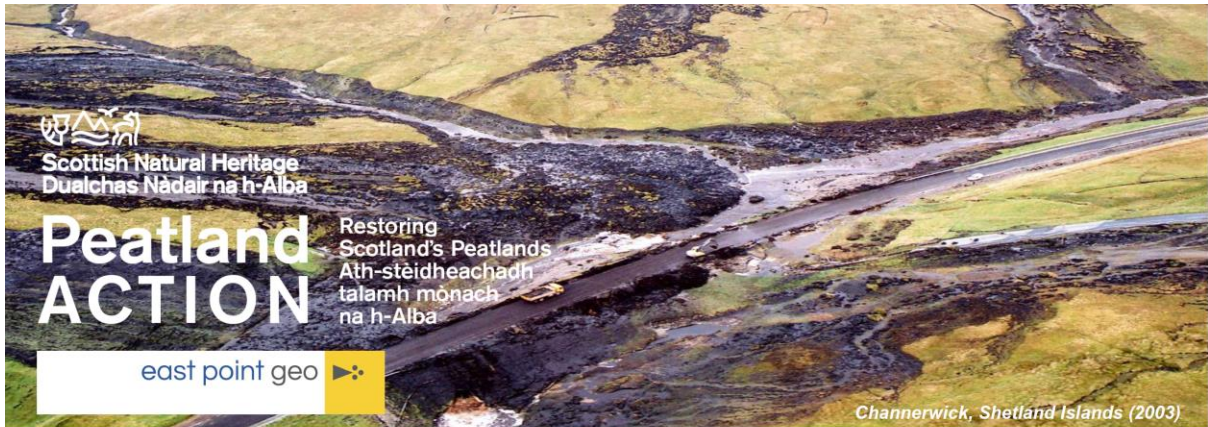


ANNEX 1: IUCN POSTER



Peatland restoration and peat stability in Scotland: developing a risk-based approach

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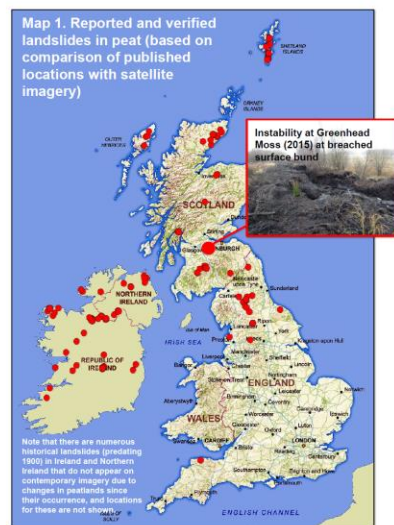
1. Introduction and Rationale

Peat instability is a well-documented but relatively rare phenomenon occurring in upland and lowland peatlands in the UK, Ireland (Map 1) and globally. Pressure to develop peatlands for renewable energy generated a range of guidance aimed at ensuring peat slide risk is minimised. To our knowledge, no study has generated specific guidance on peat slide risk to inform peatland restoration projects.

Restoration activities share some similarities with construction work, but require consideration of additional potential 'trigger' factors for mass movement such as:

- re-wetting (increasing soil moisture tends to reduce stability); and
- reversing structural damage caused by drainage or afforestation (changes in peat properties affecting shear strength).

In order to minimise the likelihood of adverse effects in association with peat restoration, Peatland ACTION has commissioned an assessment of the potential for restoration activities to cause peat instability.



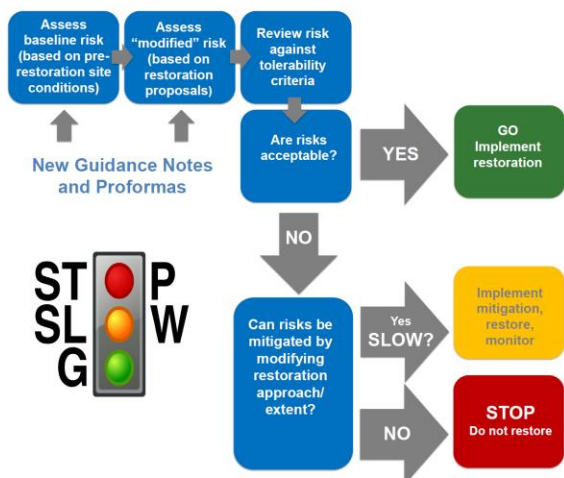
2. Project Scope

Key tasks are summarised below:



3. Project outputs: risk protocol and guidance

Guidance, proformas and a decision making protocol will assist Peatland ACTION Project Officers in determining suitable restoration techniques according to site characteristics.



ANNEX 2: THE VON POST CLASSIFICATION

The von Post scale classification is a qualitative system used to classify peat according to its degree of decomposition (humification), moisture content and elasticity. Peat soils are assigned an 'H' value of between 1 (least humified) and 10 (most humified). The most humified peats are described as 'amorphous' (structureless) and have no apparent fibrous material. Amorphous peat is most often cited in association with peat instability (though it is not necessarily always present within a peat profile).

The von Post classification is shown below:

Degree of humification	Decomposition	Plant Structure	Content of amorphous material	Material extruded on squeezing (passing between fingers)	Nature of residue
<i>H₁</i>	None	Easily identified	None	Clear, colourless water	
<i>H₂</i>	Insignificant	Easily identified	None	Yellowish water	
<i>H₃</i>	Very slight	Still identifiable	Slight	Brown, muddy water, no peat	Not pasty
<i>H₄</i>	Slight	Not easily identified	Some	Dark brown, muddy water, no peat	Somewhat pasty
<i>H₅</i>	Moderate	Recognisable, but vague	Considerable	Muddy water and some peat	Strongly pasty
<i>H₆</i>	Moderately strong	Indistinct (more distinct after squeezing)	Considerable	About one third of peat squeezed out; water dark brown	Fibres and roots more resistant to decomposition
<i>H₇</i>	Strong	Faintly recognizable	High	About one half of peat squeezed out; any water very dark brown	
<i>H₈</i>	Very strong	Very indistinct	High	About two thirds of peat squeezed out; also some pasty water	
<i>H₉</i>	Nearly complete	Almost unrecognisable		Nearly all the peat squeezed out as a fairly uniform paste	
<i>H₁₀</i>	Complete	Not discernible		All the peat passes between the fingers; no free water visible	

More detail can be found within Hobbs (1986).

A helpful summary of the von Post classification is provided in RSK's (2018) 'Engineer's quick reference guide', a modified version of which is provided below (with indicative H values).

Type of Peat	von Post	Description
Fibrous	H3 - H5	Plant remains clearly recognisable and retain some tensile strength. Water and no solids on squeezing.
Pseudo-fibrous	H6 - H8	Mixture of fibres and amorphous paste. Turbid water and <50% solids on squeezing.
Amorphous	H9 - H10	No recognisable plant remains, mushy consistency. Paste and >50% solids on squeezing.

While use of the von Post classification becomes easier with experience, it is recommended that the abbreviated version above is used by Peatland ACTION officers. The H value boundaries correspond to data inputs in Step 1 of the Blanket Bog protocol.

ANNEX 3: PROTOCOL GUIDANCE

The risk-based protocols are accessible as embedded Microsoft Excel Workbooks. The workbooks have also been supplied separately to the Peatland ACTION project management team.

Opening the protocols

The Blanket Bog protocol and the Raised Bog protocol can be downloaded from the [NatureScot website](#).

If the site is an Intermediate Bog, read Section 5.4.6 and then click on the appropriate workbook above.

Once the appropriate protocol is open, go to the first worksheet to read an overview of how to work through the workbook. Each protocol comprises three worksheets which should be worked through in sequence, as per the descriptions in Sections 5.4.1 to 5.4.5.

Assigning a filename to the protocol

The protocol should be saved with an appropriate filename. It is recommended that the filename should be in the format below:

NS Blanket Bog Landslide Risk Protocol v1 *Laggan Moor Phase 1 200914*.xlsx

Working through the protocols

The Blanket Bog and Raised Bog protocols should be worked through in sequence, as follows:

Step 1 Pre-Restoration Likelihood

The first worksheet provides a series of questions, the answers to which are used to determine the baseline natural likelihood of a peat landslide and the most likely mode of instability. Answers are selected from drop down menus in the coloured boxes to the right of each question. Guidance on how to answer the questions is provided in a section on the right of the protocol sheet called 'How to answer the question'. If further detail is required, references to the relevant sections of the supporting technical report are provided. In some cases, hyperlinks are provided to useful online resources (such as online imagery or geology viewers).

The user should answer all questions using the drop down options and the best data available for the site.

Step 2 Post-Restoration Likelihood

The second worksheet provides a series of questions about the proposed restoration techniques to be used at the site in question, and uses the answers to determine the 'modified' landslide likelihood based on anticipated stabilising or destabilising effects of restoration groundworks.

The user should select all the restoration techniques proposed for the site from the coloured boxes to the right of each technique.

Once the user has completed this step, the protocol states the modified landslide likelihood based on the inputs from Step 1 and Step 2. A short statement is generated either indicating that no further inputs are required (and restoration can proceed as proposed) or that consequence assessment must be undertaken in Step 3.

Step 3 Consequence and Risk

The third worksheet provides a series of questions about the receptors within and in proximity to the site. Receptors are natural and human aspects of the landscape that may be adversely impacted if a peat landslide were to occur.

The user should select all the receptors for the site (or nearby, depending on the question) using the coloured boxes to the right of each receptor type.

Once the user has completed this step, the protocol states the calculated risk-based on the modified landslide likelihood and identified receptors. Where this risk is Low or Negligible, restoration may proceed as proposed. Where this risk is Medium or High, further assessment is required.

What to do if risks are Low or Negligible and restoration can proceed

The outcome of the protocol should be recorded on the Summary Sheet. This sheet provides a simple A4 printable summary of the data inputs and results and provides space to record contextual site information (such as the project name). The lower part of the protocol does not need to be completed if no consequence assessment has been required. Some elements of the Summary Form autopopulate with information from the preceding sheets.

What to do if risks are Medium or High and further assessment is required

The outcome of the protocol should be recorded on the Summary Sheet, as above. This provides a record of the initial assessment of the site and the reasons why further assessment is required. The next steps are to review the data inputs to determine whether any answers are overly conservative, whether the severity of impacts for receptors is overstated or whether modifying the chosen restoration techniques provides any reduction in risk.

Further guidance is provided in Section 5.4.5 of the report.

If the above steps fail to reduce risks to Low or Negligible, consideration should be given to subdividing the site into two or more smaller areas which may better reflect the variability in site conditions, and potentially, risk (e.g. Figure 5.4). For example, a restoration project proposed on both sides of a ridge may have a valuable receptor on one side of the ridge (e.g. a watercourse or railway) but a low value receptor on the other side. Splitting the site at the ridge crest and considering both ridge sides separately may result in lower calculated risks for the side of the ridge without the valuable receptor.

Where sites are to be split, the original filename should be appended with PartA and PartB (or South, North, etc) so that protocols can be saved for each subarea of the site.

ANNEX 5: CHANGE LOG

In the event that the protocols require further updating, there may be requirements to update the report text as well as the protocols. The change record below provides a basis for recording iterations to the report and protocols.

How to log changes

If an iteration is required to the protocols, the following details should be noted:

- The new name of protocol(s) being updated (e.g. NS Blanket Bog Landslide Risk Protocol v1.3 – noting the first version was titled NS Blanket Bog Landslide Risk Protocol v1.2).
- The steps updated and the details of changes within each step (e.g. Step 1, modified scores associated with question ix) relating to drains).
- The sections of the report updated (e.g. Section 4.2.1.6 on drainage)
- The reasons for the updates (e.g. site experience suggested that drainage categories were over conservative).

Background on possible reasons for iterating the protocols and report is provided in Section 6.4.

Change Log

The following table should be updated with the new protocol version number, an outline of changes made to the protocol and associated changes made to the report.

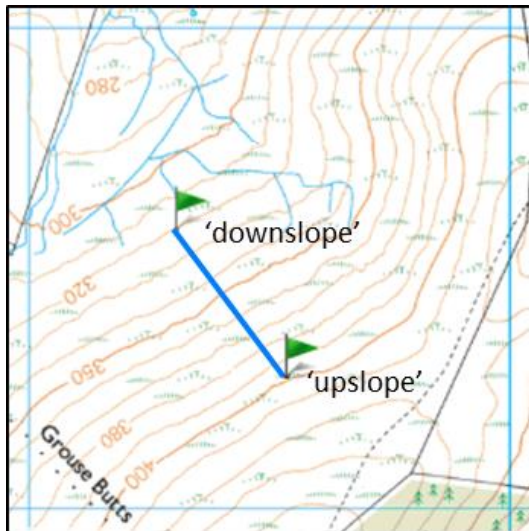
<u>New Protocol Version</u>	<u>Amendments</u>	<u>Updated report sections</u>
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ANNEX 6: GUIDE TO MAGICMAP AND GOOGLE EARTH

Both MagicMap and Google Earth Pro can be used to derive elevation and slope data without the need for purchase of data and without the need for GIS software. Simple guides on extracting data for use in the risk-based protocols are provided below. These guides are also accessible via hyperlink from within the protocols.

MagicMap

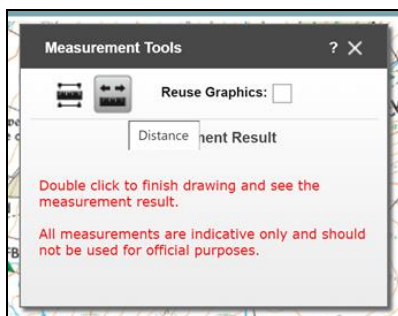
1. Open MagicMap using the link provided [here](#) or in the protocols.
2. Locate the proposed restoration site using the “County, Place or Postcode” search box in the top left or the navigation buttons in the map panel.
3. Select an 'upslope' contour location.
4. Select a 'downslope' contour location and note the difference in elevation value in m by counting the contours (each contour representing 10m).
5. Subtract the 'downslope' elevation value from the 'upslope' elevation value - this is the **RISE**.



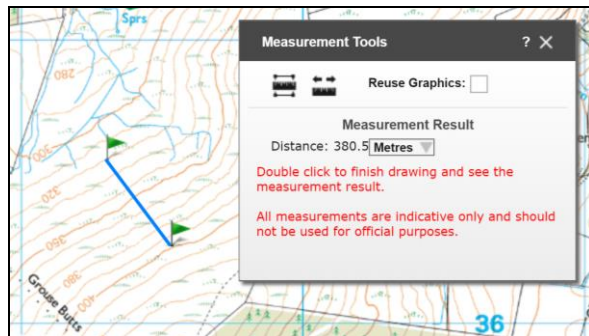
Select the 'ruler' icon in the toolbar (highlighted in red):



6. Ensure that the 'Distance' tool is selected:



7. Measure the distance from the 'upslope' contour location to the 'downslope' contour location - this is the **RUN**.



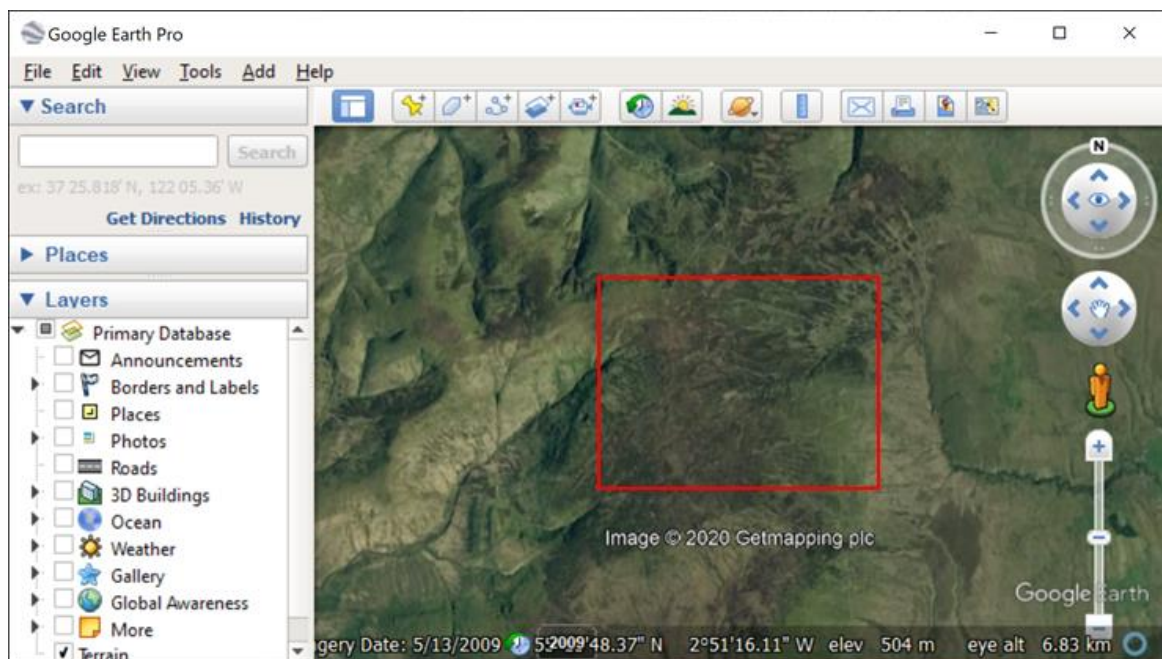
8. Enter the **RISE** and **RUN** into the appropriate protocol input boxes:

32
33 iii) What is the average slope angle for the hillside based on elevation data for the site?
34 Enter data for only one of the following:
35 Enter slope angle: Angle:
36 Enter the slope angle as a 'gradient' (in %), e.g. if using Google Earth's elevation profile tool: Gradient (%):
37 Enter the 'rise' (elevation change in m) and 'run' (distance in m over which elevation changes): Rise:
38 See how to answer for further guidance. Run:
39
40 Useful links:
41 <https://www.google.co.uk/earth/download/epo/agree.html> Google Earth Pro download
42 <https://magic.defra.gov.uk/MagicMap.aspx> MagicMap online viewer
43
44

In the example shown, the rise is 80m, the run is 380.5m.

Google Earth Pro

1. Open Google Earth Pro using the desktop application or by downloading and installing from [here](#).
2. Locate the proposed restoration site using the search panel or the navigation buttons.



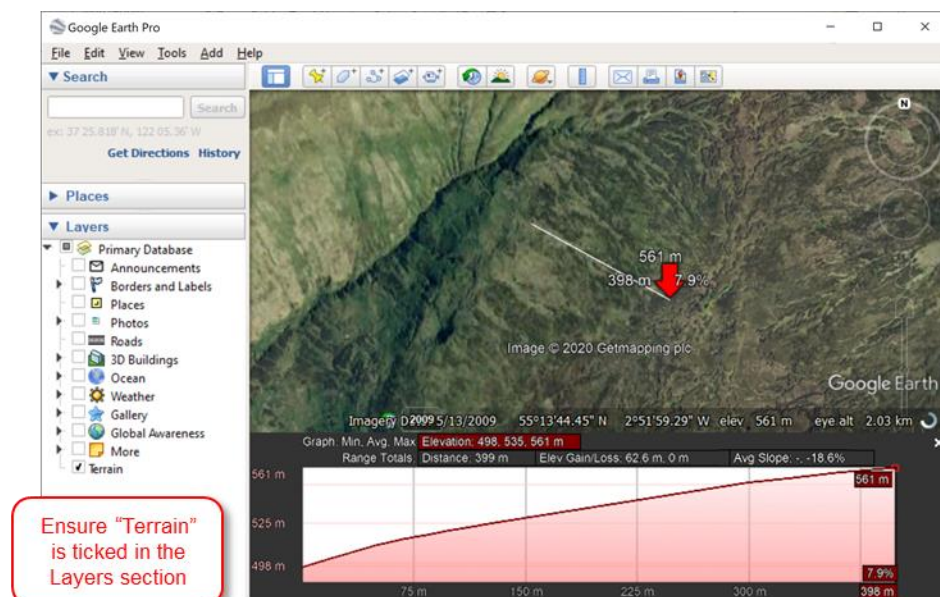
3. Click on the 'Add Path' tool (highlighted red):



4. Draw a profile on the restoration site by clicking once at the top of the slope (shown in green below) and once at the bottom of the slope (shown in red below):



5. Select "Show Elevation Profile" from EDIT menu. If the "Show Elevation Profile" option is greyed out, ensure that the Terrain layer is switched ON. If it is still greyed out, move the cursor over the line until a hand appears, and then click once (this will select the line again).



6. Read off the “Avg. Slope” value from the profile plot. Sometimes Google Earth Pro does not give an “Avg. Slope” value and only provides a “Max. Slope” value. If this is the case, use the elevation change and horizontal distance to derive **RISE** and **RUN** (as in the MagicMap example above).
7. Select either the gradient range from the drop down boxes in the “Gradient (%)” part of the protocol or enter the **RISE** and **RUN** (as in the MagicMap example).