Luggie's Knowe Wind Energy Project

Technical Appendix 11.2 Peat Landslide Hazard and Risk Assessment

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Contents

1. Introduction

1.1 Background

ITPEnergised were commissioned by Shetland Aero Ltd (the Applicant) to undertake a Peat Landslide Hazard and Risk Assessment (PLHRA) at the proposed Luggie's Knowe Wind Energy Project (the Proposed Development), located approximately 1.2 km north of Gremista, Lerwick on the Hill of Gremista, shown in **Drawing 1**.

The Proposed Development will comprise one turbine and associated crane hardstanding and access track, shown in **Drawing 2**.

The PLHRA was led by David Nisbet, Head of Geology & Peat 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.

The assessment has been undertaken in line with best practice guidance [1, 2] issued by the Scottish Government for investigation, assessment, and reporting for wind farms in peat areas. Where relevant, reference is also made to guidance published by, the Scottish Environmental Protection Agency (SEPA) and wind farm constriction good practice guidance[3].

Although peat slides are naturally occurring, in the wake of high-profile peat slides arising during construction of Derrybrien Wind Farm in 2003 (and more recently at Meenbog in 2020) further consideration of the impact on peat instability of siting developments on peatlands is required.

Blanket bog is the most common peat habitat in the UK and is associated with thick peat deposits. Renewable energy developments, including wind farms, and transmission projects are commonly located on upland moorland terrain comprising blanket bog (though raised bogs, intermediate bogs and fens may also be impacted).

Within these settings, peat instability can occur, particularly where thick peat deposits (> 1 m) are present. Peat instability is impacted by numerous factors, including but not limited to:

- Peat thickness;
- Gradient;
- Climate (and rainfall);
- Underlying geology; and
- Subsurface hydrology.

Other anthropogenic factors may also increase the likelihood of peat instability events occurring, which are explored further within this report.

[1] Energy Consents Unit Scottish Government., (April 2017) Peat Landslide Hazard and Risk Assessment: Best Practice Guide for Proposed Electricity Generation Developments, Second Edition.
[2] Scottish Government, SNH, SEPA., (2017) Peatland Survey. Guidance on Developments on Peatland, online version only.
[3] Scottish Renewables, SNH, SEPA, Forestry Commission Scotland, Historic Environment Scotland, Marine Scotland Science, AEECoW (2019), Good Practice During Wind Farm Construction, Fourth Edition.

1.2 Objectives

The PLHRA aims to assess the influence of peat on the Proposed Development and the potential for instability. The objectives have been achieved by completion of the following:

- Geomorphological mapping of the site to identify the prevailing conditions;
- Reporting on evidence of any active, incipient or relict peat instability and the potential risk of future instability, describing the likely causes and contributary factors;
- Identification of potential mitigation and controls to be imposed on the contractors for the works to minimise the risk of peat instability occurring at the site;
- Peat Probing to full depth across the Proposed Development site;
- Recommendation for further work or specific construction methodologies to suit the ground conditions at the site to mitigate any unacceptable risk of potential peat instability.

This report summarises the findings of the desk study and peat surveys and provides an assessment of the prevailing ground conditions at the site and how they relate to peat stability issues.

The results of this assessment have been used through the iterative design process to avoid areas of increased likelihood of a peat slide and avoid areas of thicker peat.

1.3 Development Description

The Proposed Development comprises the following:

- One turbine with internal transformers and related switchgear;
- Associated turbine foundations and hardstanding area;
- A battery storage compound;
- A total of approximately 0.6 km of newly constructed track; and
- Underground electrical cabling.

A full description of the Proposed Development is provided in Chapter 4 of the EIA Report.

2. Peat Instability

2.1 Background Information on Peat

Peat is found in extensive areas in the upland and lowland regions of the UK and is defined as 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.

Lindsay[4] defined two main types of peat bog, raised bog and blanket bog, which are prevalent on the west coast of Europe along the Atlantic seaboard. In Britain, the dominant peatland is blanket bog which occurs on the gentle slopes of upland plateaux, ridges and benches and is predominately supplied with water and nutrients via precipitation. Blanket peat is generally considered to be hydrologically disconnected from the underlying mineral layer.

[4] Lindsay, R.A, (1995), Bogs: The ecology, classification and conservation of ombrotrophic mires. Scottish Natural Heritage. Perth.

There are two distinct layers within a peat bog, the upper acrotelm layer and the lower catotelm. The acrotelm is the fibrous surface to the peat bog, typically less than 0.5 m thick; which exists between the growing bog surface and the lowest position of the water table in dry summers. Below this are various stages of decomposition of the vegetation as it slowly becomes assimilated into the body of the peat.

The degree of humification (decomposition) can be measured in the field via the von Post scale of humification[5, 6]. The 'squeezing test' undertaken in the field provides humification values ranging from H1 (minimal decomposition) to H10 (highly decomposed).

The relative position of the water table within the peat controls the balance between accumulation and decomposition, and therefore its stability, hence artificial adjustment of the water table by drainage can have significant impacts.

2.2 Peat Shear Strength

In geotechnical terms, the shear strength of a soil is the maximum stress that a soil can sustain without experiencing failure. The physical characteristic of a soil impacts on the overall shear strength. For mineral soils such as clay or sands, such strength is variously given by an interparticle friction value and cohesion. Whether the mineral soil is predominately cohesive (clay) or non-cohesive (sand & gravels) governs which of the component strengths control the behaviour of the soil.

In the case of peat soils, where the major constituent is organic, there is likely to be little or no mineral component, the geotechnical definition of shear strength therefore does not strictly apply. At present, there is no real alternative to defining shear strength of peat, therefore the geotechnical definition is usually adopted, in the knowledge that it should be used with caution.

As noted, the acrotelm or near surface peat comprises a tangle of fresh and slightly rotted roots and plant fibres. These roots and fibres impart a significant tensile strength capacity to the material which provides it with a significant load carrying capacity. The acrotelm is in effect, a fibre reinforced soil.

In the more decomposed catotelm, the tensile shear strength is reduced as the roots and fibres become increasingly rotted. However, the loss of strength is offset to a limited degree, by a gain in strength due to the overburden pressure. In geotechnical engineering there is an established relationship for recently deposited soils, between the shear strength of a sample and thickness of overburden above it.

Consequently, it is almost impossible to predict a shear strength profile in peat and attempts to measure the shear strength using normal geotechnical methods can be misleading (Evans & Warburton 2007[7]; Gosling and Keeton 2008[8], Winter et al 2005[9]). Typical values of shear strength from hand shear vanes would be in the range 10-60 kilopascal (kPa) although values of over 100 kPa have been recorded in peat elsewhere. The higher strengths are almost certainly influenced by the roots or other non-decomposed material. It is believed that the strength of peat should be quoted as a cohesion value as there are few, if any, discrete particles to give the material a significant frictional resistance. It should be noted that any quotation of shear strength for peat should be treated with extreme caution.

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[5] Von Post, L and Grunland, E., (1926) Sodra Sveriges torvillganger 1, Sverges Geol. Unders. Avh., C335, 1-127.

[6] Hobbs, N.B. (1986) Mire morphology and the properties and behaviour of some British and foreign peats. Quarterly Journal of Engineering Geology, London, 19, 7-80).

[7] Evans, E. and Warburton, J (2007). *Geomorphology of Upland Peat: Erosion, Form and Landscape Change*. John Wiley & Sons.

[8] Gosling, D., and Keeton, P. (2008). *Problems with Testing Peat for Stability Analysis.* Paper presented at Reinforced Water, Geological Society Conference;

[9] Winter, M.G., MacGregor, F. and Shackman, L. (2005) *Scottish Road Network Landslides Study*, ISBN 0 7559 4649 9.

2.3 Peat Failure Characteristics/Mechanisms

This section reviews the nature of peat and how current and past activities can influence stability.

The PLHRA Best Practice Guide for Proposed Electricity Generation Developments, published by the then Scottish Executive (2006, updated by the Scottish Government April 2017[1]) determines peat landslide (instability) in two categories, 'peat slides' and 'bog bursts'. It is indicated that peat slides have a greater risk of occurrence in areas where peat depth is shallow (up to 2 m), and slope gradients are steep (5 to 15°). Bog bursts, however, are indicated to have a greater risk of occurrence in areas where peat depth is deep and slope gradients are shallow. As recorded in the Best Practice Guide[1], bog burst events have generally only been reported in Irish and Northern Irish peat bogs. They are uncommon in Scotland and therefore are not considered to attribute significant risk in relation to this assessment. It is noted that peat instability events (including bog bursts), although extremely uncommon, may occur outside the limits mentioned above.

Further to the definition above, a number of natural factors are considered to interact and create the potential for peat instability to occur. These natural factors would typically include:

- Slope Gradient: As noted in the Best Practice Guide[1], peat slides have a greater likelihood of occurrence where slope angles range from 5 to 15°. Deposits with shallower slope gradients are less susceptible to failure due to the reduced influence of gravity. Deposits with steeper slope gradients are less susceptible to failure due to the general lack of peat presence (although peaty debris slide may occur).
- Peat Depth: Boylan et al. (2008)[10] describes three common types of peat, controlled to an extent by rainfall and elevation:

  - Upland Blanket Bog: blanket bogs are typically about 3 m thick, however, they can be up to 5 m thick, generally thinning at higher elevations.

  - Lowland Blanket Bog: similar to the upland blanket bog, however, they form around sea level in areas of very high rainfall.

  - Raised Bog: generally 3-12 m thick, averaging 7 m, with growth occurring above the water table.

Peat depth can give an indication of peat strength and the potential magnitude of a slide, where the generalisation can be made that the potential for peat instability increases with peat depth provided gradients exist to allow movement. However, when combined with other instability indicators, any depth of peat can fail. Factors that influence the potential include:

- Peat Strength: the shear strength of peat is an important aspect in assessing the risk of landslip in blanket peat areas, with areas of lower shear strength likely to be the cause of any peat slide. However, due to the influence of fibres within the deposits and of stratification with depth, reliable values of shear strength are difficult to near impossible to obtain, using common place in situ and laboratory soil strength tests. Where data is available, it can be used, with extreme caution, to assist in assessing likely risk.
- Relief: the combination of slope gradient and variation in elevation can result in confined and unconfined zones i.e., where undulating or hummocky terrain (confined) exists, the natural relief has the potential to mitigate the occurrence of a peat slide. However, convex sloping hillsides (unconfined) can increase the slide potential.
- Evident and/or Potential Areas of Instability: the presence of certain geomorphological characteristics may signify an increased risk of peat instability. However, peat instability events may occur in areas where no such geomorphological characteristics are present, if the general characteristics match those mentioned above.

[10] Boylan, N., Jennings, P., Long, M. (2008). *Peat Slope Failure in Ireland*. Quarterly Journal of Engineering Geology and Hydrogeology.

- Vegetation Cover: the vegetation cover of an area of bog/mire gives an indication as to its hydrological setting and therefore physical characteristics, as noted in the Best Practice Guide[1] and detailed by Hobbs, 1986[6].
- Peat Stratification: the peat formation process causes peat to show natural anisotropic strength. The interface between the three distinct layers (indicating three hydroseral stages) within a peat mass is defined by hydrology. The three layers are:

  - Top Mat: living vegetation of herbaceous plants, grasses and mosses;

  - Acrotelm: decomposing peat which is saturated periodically and is of relatively high permeability; and

  - Catotelm: permanently saturated dense peat of relatively low permeability.

  Peat stratification is linked to peat depth (Dykes, 2006[11]), with thinner peat deposits having a thinner or no catotelm layer. A minimal or absent catotelm layer leads to peat mass having a higher shear strength, as the overlying top mat and acrotelm layers are more fibrous in nature compared to the underlying catotelm layer.
- Hydrology (Surface and Subsurface): surface (seeps and springs, wet flushes, watercourses, concentration of drainage networks etc.) and subsurface (pipe systems, underground channels etc.) drainage pathways can provide areas of peat with a water supply which may be absorbed by and potentially increase the mass of the peat. This can cause pooling/piping within the peat mass, or an increase in water at the base of the peat mass, each of which increases the susceptibility of the peat mass to failure.

The presence of a number of the above natural factors may create the potential for peat instability to occur, however, the actual instability is generally the result of a combination of further contributing factors. These factors have been grouped into two categories within the Best Practice Guide[1] described as preparatory and triggering factors.

Preparatory factors, which affect the stability of peat slopes in the medium to long-term (tens to hundreds of years), are:

- increase in mass of the peat through peat formation;
- increase in mass of the peat through increase in water content;
- increase in mass of the peat through afforestation;
- reduction in shear strength from changes in the physical structure of the peat due to creep, weathering or vertical tension cracks of the material;
- loss of surface vegetation and associated tensile strength (e.g. deforestation);
- changes in the subsurface hydrology (water filled pools and/or pipes etc.); and
- afforestation reducing the water held in the peat body, increasing the potential for formation of desiccation cracks which can be exploited by rainfall on forest harvesting.

Triggering factors, which can have an immediate effect on peat stability and act on susceptible slopes, include:

- intensive rainfall or snow melt causing development of high porewater pressures within the peat;
- alterations to drainage patterns generating high porewater pressures within the peat;

[11] Dykes, A.P. and Kirk, K.J. (2006) *Slope Instability and Mass Movements in Peat Deposits*. In Martini, I.P., Martinez Cortizas, A. and Chesworth, W. (Eds.) Peatlands: Evolution and Records of Environmental and Climatic Changes. Elsevier, Amsterdam.

- peat extraction at the toe of the slope i.e. fluvial incision, cut slopes etc. reducing the support of the upslope material;
- peat loading commonly due to stockpiling or plant during construction (or natural causes i.e. landslide) causing an increase in shear stress;
- changes to the vegetation cover i.e. by stripping the surface cover or afforestation; and
- earthquakes or man-made rapid ground accelerations, such as blasting or mechanical vibrations, causing an increase in shear stress.

Evidence of the potential for peat instability within an area may be observed through the recording of the geomorphological conditions of the area. These existing geomorphological characteristics may indicate the presence of existing or historical failures or areas of future potential instability. The characteristics of particular interest include the presence of the following:

- historical failure scars and debris;
- tension cracking and tearing;
- compression ridges/thrusts or extrusion;
- peat creep;
- subsurface drainage (pools and/or piping);
- seeps and springs;
- cracking related to drying;
- concentration of surface drainage networks; and
- the presence of organic clays at the peat and bedrock interface.

2.4 Types of Failures

The result of peat instability is the down-slope mass movement of the peat material. There are several definitions of peat instability which are used to characterise the type of failure, briefly mentioned above but detailed below.

2.4.1 Bog Bursts (or Bog Flows)

Particularly fluid (amorphous) failures involving rupture of the peat blanket surface or margin due to subsurface creep or swelling, with liquefied basal material expelled through surface tears followed by settlement of the overlying peat mass, in-situ (Hemingway and Sledge, 1941-46[12], Bowes, 1960[13]).

Accounts of bog bursts are generally associated with very wet climates or areas which have received storm rainfall events. Bog bursts can be associated with particularly wet peat landscapes; therefore, it is possible to identify broad regions of a higher susceptibility to these failures. The constraints used to identify the areas of higher susceptibility to bog burst failures are given below:

- peat thicknesses >1.5 m;
- shallow gradients, ranging from 2 - 10^{o} (peat thicknesses associated with bog bursts are generally not observed on slopes steeper than 10^{o}, where moisture content is reduced due to natural drainage;

[12] Hemingway, J.E. and Sledge, W.A. (1941-46) *A Bog Burst near Danby in Cleveland*. Proceedings of the Leeds Philosophical and Literature Society, Science 4, pp276 – 288.
[13] Bowes, D.R. (1960) *A bog burst in the Isle of Lewis*. Scottish Geographical Magazine, 76, pp21-23

- ground which is annually waterlogged to within the upper 1 m below ground level (the groundwater level may rise but rarely falls below this level (Crisp et al, 1964[14]));
- greater humification of the lower catotelm within the waterlogged ground; and
- lower surface tensile strength of the fibrous peat and vegetation.

The humified mass can be considered as analogous to a heavy liquid and the stability of this mass is maintained by the strength of the surface or acrotelm peat. Should the surface become weakened through erosion or desiccation or the construction of a surface drainage ditch for agricultural or forestry reasons or through turbary (peat cutting), failure is made more likely.

2.4.2 Peat Slides

Peat slides tend to be translational failures with a defined shear surface at or close to the interface with the substrate. The factors generally considered to influence susceptibility to peat slide failures are listed below:

- Peat depth up to 2 m;
- Slope gradients between 5 and 15^{o};
- Natural or artificial drainage cut into the surrounding peat landscape;
- Greater humification of the lower catotelm within the waterlogged ground; and
- Lower surface tensile strength of the fibrous peat and vegetation.

It is noted that some of the factors causing instability are common to both bog bursts and peat slides. The peat – substrate interface is the primary zone of failure and is enhanced by elevated water content at this boundary and softening or weathering of the lower mineral surface. For this reason, any investigation or probing should try to distinguish the nature of the lower mineral substrate.

2.4.3 Bog Slides

A bog slide is a variation on a peat slide where part of the peat mass is subject to movement, usually on an internal layer of material, which may be more prone to movement, such as an interface between the acrotelmic and catotelmic layer.

2.5 Natural Instability

The stability of a peat mass is controlled by a complex interrelationship of factors. Key factors include sloping rock head, and proximity to water bodies. Rainfall often acts as a trigger after the slope has been conditioned to fail by natural processes.

It should also be remembered that peat bogs are growing environments and that there would come a time, on sloping ground, where the forces causing instability, the weight of the bog, can no longer be resisted by the internal strength of the peat and its interface with the underlying mineral surface. At this point, failure would occur.

The weight of the peat bog or any soils mantling steep hill slopes would be increased during periods of very heavy rain and it is common to see landslips occurring following extreme rain events. This may be a concern for future developments where one of the predicted effects of global warming is greater frequency of extreme weather, including intense storm events.

[14] Crisp, D.T., Dawes, M. & Welch, D. (1964), *'A Pennine Peat Slide'*, The Geographical Journal, Vol 130, No4, pp519-524.

3. Desk Based Assessment

A desk-based review of the site and its condition has been conducted by the use of the following sources of information:

- British Geological Survey (BGS) mapping and data;
- Scottish Natural Heritage (SNH) (now NatureScot) Carbon and Peatland Map, 2016;
- Hydrogeological Map of Scotland, BGS, 1988;
- Soil Survey of Scotland Maps, James Hutton Institute;
- Habitat and botanical survey data (refer to Chapter 6: Ecology);
- Aerial photography;
- Ordnance Survey and topographic maps; and
- Historical mapping.

3.1 Baseline Conditions

3.1.1 Geological Setting

3.1.1.1 Superficial Geology

Published geological mapping from the BGS at 1:50,000 scale indicates that the entire site is blanketed in peat, as shown in **Drawing 3**.

3.1.1.2 Soils

The SNH (now NatureScot) Carbon and Peatland Map[15] characterises the site to be almost entirely underlain by Class 1 Peatland (nationally important carbon-rich soils, deep peat and priority peatland habitat, likely to be of high conservation value). There are limited areas of Class 3 and Class 5 Peatland in the north and south of the site.

Several phases of peat surveys were undertaken to gather site specific information on the presence and condition of peat soils and/or peat and is described further in Section 4.

3.1.1.3 Bedrock Geology

BGS 1:50k mapping indicates that the bedrock geology underlying the site comprises metamorphic and sedimentary rock units, ranging in age from Neoproterozoic to Devonian. There is a strong regional fabric to the rocks on Shetland, with the rocks on site trending roughly southwest – northeast, creating distinct linear boundaries between geological units. The majority of the site, where all proposed infrastructure is sited, is directly underlain by semipelite of the Clift Hills Phyllitic Formation. To the east, separated by a thrust fault are a series of shear-bounded metamorphic rocks, of the Quarff Succession, beyond which, sit the younger Devonian age conglomerate rocks of the Rova Head Conglomerate Member (Lerwick Sandstone Formation).

The bedrock geology at the site and adjacent area, are detailed within **Table 3.1** and **Drawing 4**.

[15] Scottish Natural Heritage (NatureScot) (2016). *Carbon and Peatland Map.* Available at https://soils.environment.gov.scot/maps/thematic-maps/carbon-and-peatland-2016-map/

Table 3.1 Summary of Bedrock Geology

Stratigraphy				Description
Age	Group	Formation	Member	
Devonian	Sumburgh Group (Old Red Sandstone)	Bressay Flagstone Formation	-	Sandstone and Agrillaceous Rocks, Interbedded
		Lerwick Sandstone Formation	-	Breccia
				Sandstone
				Siltstone and Mudstone, Interbedded
			Rova Head Conglomerate Member	Conglomerate
Neoproterozoic	Clift Hills 'Division' (Dalradian Supergroup)	Clift Hills Phyllitic Formation	-	Semipelite
			-	Semipelite and Pelite
			Dales Voe Grit Member	Quartzite
	Clift Hills 'Division'	-	-	Basaltic metalava and basaltic tuff
	Quarff Succession and Melange (Dalradian Supergroup)	-	-	Shear-bounded Metamorphic Rock Slices Forming Tectonic Melange, Quarff type
				Metalimestone
				Quartzite
	Whiteness 'Division' (Dalradian Supergroup)	-	-	Metalimestone
				Quartzite
	Neeans "Group" (Walls Division)	-	-	Semipelite and Psammite
	Neoproterozoic Metamorphosed Mafic and Ultramafic Minor Intrusion Suite of Shetland	-	-	Schist, Hornblende

3.1.1.4 Mining and Quarrying

The site is not located within a historical mining area, small scale excavations have taken place to construct the operational turbine and access track, but there is no reason to expect any larger-scale excavation has taken place.

3.1.2 Hydrology and Climate

3.1.2.1 Hydrology

The site is located within the Shetland Coastal catchment, with on-site and adjacent watercourses and waterbodies including the Burn of Kebister, Loch of Kebister and its tributaries and drains in the surrounding area. The nearest watercourse classified by SEPA is Burn of Dale which is considered to be of 'Good' quality. There are no recorded watercourses within 250 m of any proposed infrastructure.

3.1.2.2 Hydrogeology

The superficial geology on site is characterised by low permeability peat, with localised perched groundwater. Deeper, catotelmic peat deposits typically exhibit very low permeability, with extremely slow transmission

of groundwater. This is considered to have minimal connectivity to the underlying class 2C 'low productivity' bedrock aquifer where flow is largely in fractures and discontinuities. An inferred thrust fault is located 180 m southeast of the proposed turbine.

3.1.2.3 Rainfall

Periods of intense, heavy rainfall are often seen as triggers for instability events. The nearest Met Office weather station to the Proposed Development site is approximately 5.5 km south, at Lerwick (S.Screen) (National Grid Reference 445480 1139667). The average annual rainfall is 1252.34 mm, which is 36% less than the Scotland North regional average, and 26% less than the Scotland-wide average.

3.1.3 Land Use and Topography

The topography rises gently inland to a high point on the Hill of Gremista, in the south of the site.

The existing land use of the site includes an operational turbine and access track. Otherwise, the primary land use is occasional rough grazing by sheep. There is industrial infrastructure in the surrounding vicinity, including the port facility at Dales Voe to the west and a waste recycling facility to the east.

The site has been characterised into slope classes based on 5m Digital Terrain Model (DTM) and is shown in **Drawing 6**.

3.1.4 Aerial Photography and site History

3.1.4.1 Aerial Photography Interpretation

The aerial photography was interpreted, and it was possible to identify changes in vegetation and drainage patterns. The aerial photographs were used in conjunction with the site DTM data to identify the major geomorphological features, mainly as breaks of slope, significant watercourses etc. The site was further assessed during site visits when more detailed mapping was undertaken.

Interpretation of available aerial photographs was undertaken to assess and identify (where present) evidence of historic peat instability. The photographs were examined to highlight features of interest, where present, including:

- Possible extension and/or compression features;
- Areas of historic failure scars and debris;
- Evidence of soil or peat creep;
- Areas with apparent poor drainage;
- Areas with concentrations of surface drainage networks; and
- Steeply incised stream cuttings within peat deposits.

The aerial photography, DTM and data gathered on site have been used in conjunction to create a geomorphological interpretation of the site, presented in **Drawing 8**.

There was no evidence visible in the historic photographs of any extension or compression features in the peat. It was not possible to identify evidence of any significant historic peat failures or slides from the aerial photographs. There was no evidence from aerial photographs however some collapsed peat pipes were recorded within the ecology survey in the west of the site, outwith influencing distanced of the Proposed Development.

3.1.4.2 Historic Mapping

Freely available historic OS mapping has been reviewed, there was no evidence of historic instability identified.

3.1.4.3 Local Knowledge

No anecdotal background from landowners or past site users or construction users has been provided to suggest there has been a history of peat instability on the site.

3.2 Surface Water and Sensitive Receptors

The effects of peat failures are felt locally, both in the long and short term, but they can also have wider off-site implications.

A key part of the risk assessment process is to identify the potential scale of peat failure, should it occur, and identify the potential environmental effects as well as the receptors of such an event.

Peat failure associated with the Proposed Development could affect the following key receptors:

- The Proposed Development itself including associated infrastructure;
- Property and infrastructure, for example roads or utilities;
- Land based ecological effects (damage to habitats);
- On-site and downstream watercourses;
- Archaeological assets; and
- Visual amenity (scarring of the landscape).

4. Site Work

4.1 Peat Depth Survey

Peat probing was undertaken across several phases between October 2020 and October 2021 by ITPEnergised. Additional probing was undertaken in March 2023 to address changes to the design.

4.1.1 Methodology

The surveys were carried out followed best practice guidance for development on peatland[2].

The thickness of the peat/soils was assessed using a graduated fibre glass peat probe (with a maximum depth of 5m). This was pushed vertically into the peat/soil to refusal and the depth recorded using a handheld Trimble Global Positioning System instrument (GPS), reaching an accuracy of <1.5 m.

Alongside desk-based information, the 'feel' on refusal was used to interpret the underlying substrate. The following criteria was used in the field:

- Solid and abrupt refusal – Rock
- Solid but less abrupt refusal with grinding or crunching sound – Granular (sands, gravel, weathered rock)
- Gentle refusal – Cohesive (Clay/Silt)

4.1.2 Peat Depth Analysis

A summary of the peat depths encountered during probing is detailed in **Table 4.1** below and within **Drawing 5**.

Table 4.1 Distribution of Peat Depth Recorded at the Site

Peat Depth Interval (m)	Number of Occurrences	% of Probes
Nil	1	<1
0.01 to 0.49	51	8.1
0.50 to 1.00	126	20
1.01 to 1.50	159	25.3
1.51 – 2.0	173	27.5
2.01 – 3.0	111	17.6
3.01 – 4.0	7	1.1
4.01 – 5.0	1	<1
Total	629	-

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.

5. Peat Landslide Hazard and Risk Assessment

The Best Practice Guide[1] acknowledges that there is no universal agreed definition of hazard and risk that can be applied in the context of peat landslides.

The guidance describes the calculation of risk from the following formula:

Risk = Likelihood of a Peat Landslide x Adverse Consequence

The guidance provides examples of assessment methodology to be used. ITPEnergised have reviewed the guidance and the approach of other leading experts and has undertaken the assessment using the following methodology.

Firstly, it is important to note that the Proposed Development layout, including siting of turbines (noting that the initial layout comprised two turbines) and other infrastructure, resulted from an iterative process which took into account the findings from peat survey work. Deeper peat was avoided wherever possible, in order to minimise the requirement to disturb and/or excavate peat, and to minimise peat slide risk associated with construction across and within peat.

The first phase of assessment is to identify the susceptibility or likelihood of a peat landslide occurring based on existing conditions and parameters that influence peat landslide occurrence (prior to influence of construction).

Once areas of increased likelihood of a peat slide occurring have been identified, an assessment of adverse consequence (impact) and risk assessment would be undertaken on these areas, assessing the impact of a potential peat slide on identified receptors. For this further assessment, impact coefficient scores are determined, combined with an assessment of the vulnerability of receptors to establish a final risk score.

5.1 Likelihood Assessment

The susceptibility or likelihood of a peat slide occurring is controlled by a number of natural controlling and trigger factors. These are typically:

- Slope gradient;
- Peat depth;
- Peat strength;
- Nature of the substrate beneath peat deposits;
- Relief;
- Evidence of historical failures/potential instability (e.g. tension cracks, creep, compression ridges);
- Vegetation cover;
- Land use; and
- Hydrology.

The most important of the above controlling factors are considered by the assessor to be peat depth, slope gradient, underlying substrate and evidence of potential instability (which is controlled by the former). Without peat and slope, the risk of a peat slide would be unlikely to exist.

These key parameters influencing peat stability have been scored and provided a coefficient value.

The Best Practice Guide[1] relates the likelihood of a peat landslide to a scale of 1 to 5, with 1 being negligible (very low likelihood) and 5 being almost certain (very high likelihood). This scale relates to the likelihood of instability for all the controlling factors under consideration.

It is important to note that this study only focuses on peat soils and the criteria used is specifically tailored to the key factors affecting peat stability. As such it does not account for the stability of other mineral soils or rock.

Peat strength has not been included as a factor in the likelihood scoring process. Site-specific peat strength data was not collated for the site given the difficulty in obtaining reliable values of shear strength using common place in situ and laboratory soil strength tests (as described in Section 2.2). The shear strength is also linked to peat depth as strength is considered to decrease with thickness. As such this parameter is considered to be factored into the risk scoring for peat depth.

5.1.1 Input Data

The input data sets used for the analysis were as follows:

- Slope gradient: Terrain 5 DTM with a 5 m grid size;
- Peat depth: Site survey information for peat depth and site observations;
- Nature of substrate: Surveyor observations of substrate “feel” at the refusal point during probing, together with BGS geological mapping and surveyor observations of exposed substrate at the site;
- Emerging Instability: Where there is evidence of instability or factors which may increase the likelihood of a slide event occurring e.g. soil creep, slumping, possible extension/compression features, poor drainage etc.

The assessment firstly considers the likelihood of instability occurring, based on a series of input factors. These factors were attributed coefficient scores based on their influence on peat stability.

There is no guidance available on how to combine the likelihood scoring for each of the factors used in the assessment. The assessment team have used the methodology set out below.

For each of the factors noted, a score/coefficient of zero to three has been assigned. A zero score reflects no contribution to peat slide likelihood, with a score of three indicating a high peat slide likelihood associated with that particular factor.

The total likelihood ranking is the product of the four individual factor scores.

5.1.1.1 Slope Angle

The limiting factor governing the formation of thick peat deposits is topography. In the case of blanket peat, it tends to be deepest in closed depressions, and typically thin as the slope angle increases (Boylan et al. 2008[10]). The Best Practice Guide[1] details that a PLHRA is not needed for blanket bog sites with slopes less than 2° and as such, a score of zero has been assigned for slopes less than 2°. For slopes greater than 2°, scores have been assigned based on the type and nature of peat slides reported for different slope conditions.

A slope angle GIS layer was generated from the DTM at a 5 m cell resolution. The source DTM is also at a 5 m resolution. The slope angle details are illustrated in **Drawing 6**.

This slope, calculated in degrees, was identified at each probe location and scored as shown in **Table 5.1**.

Table 5.1 – Coefficient for Slope

Slope (degrees)	Slope Coefficient	Notes
2.0 or less	0	Failure unlikely due to flat ground
2.1 – 5.0	2	Failure in blanket bog areas would typically occur as peat slides and peaty debris slides, due to low slope angle.
5.1 – 15.0	3	Failure in blanket bog areas would typically occur as peat slides, bog slides or peaty-debris slides. This is the key slope range for reported peat failures.
15.1 – 20.0	2	Failure would typically occur as peaty debris slides due to low thickness of peat on steeper slopes.
>20.0	1	Failure would typically occur as peaty debris slides due to low thickness of peat on steeper slopes.

5.1.1.2 Peat Depth

Peat thickness is seen as one of the key factors associated with peat stability. Typically, the deeper the peat the more humified, and therefore potentially weaker and unstable it is. Peat depth surveys have been completed on the site and these data were then interpolated using the Spline interpolation function within the Spatial Analyst Tools of ArcMap 10.3 (see **Drawing 5**).

The highest hazard scores have been assigned to peat depth ranges most frequently associated with peat slides on upland sites (Evans and Warburton, 2007[7]).

The peat depth was identified at each probe location and scored as shown in **Table 5.2**.

Table 5.2 – Coefficient for Peat Depth

Peat Depth (m)	Depth Coefficient	Notes
Nil	0	No peat/organic soil therefore no potential for peat slide
<0.5	1	Peaty/organic soil rather than peat, therefore failures would be peaty-debris slides
0.5 – 1.5	3	Sufficient peat thickness for peaty debris or peat slide
>1.5	2	Sufficient peat thickness for peat slide however less often recorded at this thickness, due to thicker peat generally occurring in areas of shallow gradients

5.1.1.3 Substrate

The nature of the substrate beneath peat deposits can have a bearing on the likelihood of instability arising, with failure often occurring at the interface between the base of the peat mass and the top of the substrate.

Where granular soils (sand/gravel derived from glacial till) or weathered rock form the substrate, the effective strength of the interface can be considered to be good, with comparatively high friction values. Under these conditions, failure of likely to occur in a zone within the peat, just above the interface. Further factors are necessary to cause a failure of this nature (increased pore pressures within the peat) and occurrence of such events is rare.

Where cohesive soils (clay) form the interface, there is likely to be a significant zone of softening in the clay (due to saturation at low normal stresses, poor or non-existent vertical drainage and the effect of organic acids), resulting in either very low undrained shear strength or low effective shear stress parameters. The result is that potential shearing could occur either in the peat, or in the interface or in the clay; all three possibilities have been documented in peat slides.

A rock substrate provides a high strength stratum; however, the rock surface can be smooth, with a relatively impermeable surface which can result in a 'slippery' interface. This can allow accumulation of groundwater and/or low shear strength at the interface, resulting in a higher susceptibility for the overlying peat mass to fail.

The nature of the substrate was inferred at each probe location, based on surveyor observations and BGS geological mapping, and scored as shown in **Table 5.3**.

Table 5.3 – Coefficient for Substrate

Substrate	Substrate Coefficient	Notes
Granular – Sands/Gravels/Weathered rock	1	Peat failures sometimes associated with bedrock or granular till substrate
Cohesive (clay)	2	Peat failures often associated with cohesive till substrate
Rock (smooth interface)	2	Peat failures often associated with impermeable 'smooth' bedrock surface.
Not proven	3	If the overall thickness of the peat had not been proven, the risk associated with the significant thickness and the unknown substrate would be given a high rating to accommodate unknown factors.

5.1.1.4 Evidence of Existing or Emerging Instability

Geomorphological considerations such as peat erosion, hagging, peat pipes, pools, and evidence of existing instability, can contribute to the potential for instability to arise.

Where evidence of existing or emerging instability was identified by surveyor observations or through mapping and aerial photography a coefficient score has been assigned, as shown in **Table 5.4**.

Table 5.4 – Coefficient for Existing or Emerging Instability

Evidence of Existing/Emerging Instability	Existing or Emerging Instability Coefficient	Notes
Yes	2	Failures likely to occur where evidence of emerging/ developing instability is observed (peat pipes/collapsed pipes, areas of diffuse surface drainage such as flushes and pools, tension cracks, compression ridges, bulging, quaking bog) or in areas in close proximity to previous failure events.
No	1	No impact on likelihood of peat slide

5.1.2 Likelihood Rating

The coefficient scores assigned for each of the above factors were multiplied to give a likelihood rating.

Identification of the likelihood of a peat landslide occurring is the first step of the assessment, allowing areas of potential concern to be identified.

Table 5.5 sets out the ranking system employed in this assessment.

Table 5.5 – Likelihood of a Peat Landslide Occurring

Likelihood Rating Coefficient	Likelihood of Instability	Action
0	None	No mitigation required; good construction practices should be followed.
1 - 5	Negligible	No mitigation required; good construction practices should be followed.
>5 - 15	Low	Further investigation to refine assessment and mitigate hazard through relocation or re-design at these locations.
>15 - 30	Medium	Should not proceed unless risk can be avoided or mitigated at these locations, without significant environmental impact, in order to reduce likelihood score to low or negligible.
>30 - 36	High	Avoid project development at these locations
>36 - 54	Very High	Area should be avoided due to very high level of risk and almost certain likelihood of a peat slide occurring.

The assessment of all probe locations is included in Annex 2. The results show that of the 629 probe locations within the extent of the DTM, the following likelihood ratings were identified:

- No or Negligible likelihood at 183 locations; and
- Low likelihood at 446 locations.

No medium, high or very high likelihood locations. **Drawing 7** provides the interpreted likelihood of peat stability based on the rating calculated from the above factors. A summary of the likelihood of peat instability at infrastructure locations is shown in **Table 5.6** below.

Table 5.6 – Likelihood or Peat Instability Rating at Infrastructure Locations

Infrastructure Element	Instability Rating	Average Peat Depth (m)	Slope (degrees)	Suitability of Location
Turbine	Low	0.6	3.5	Suitable
Hardstanding	Low	1.1	7.9	Suitable
New Access Track	Low	1.49	-	Suitable
Battery Storage	Low	1.21	8.46	Suitable

As can be seen from **Table 5.6**, all infrastructure elements have been assigned likelihood rankings of low. The low rankings accord with gentle gradients across the site with limited peat at the proposed turbine and battery storage location.

5.2 Results

The likelihood assessment has determined that the majority of the site lies within an area of negligible or low likelihood of a peat landslide occurring (**Drawing 7**). Although there are significant thickness of peat deposits on the site, they are generally located on gentle slopes.

5.3 Impact Assessment

As part of the PLHRA, any medium or higher likelihood locations would be subject to an impact assessment. As no medium risk or higher locations have been identified, the impact assessment is not required, however the proposed methodology is included in the sections below.

Had areas with medium or higher likelihood of instability been identified, further assessment would have been undertaken to identify the overall risk by considering the impact (adverse consequence) should a peat landslide occur.

The assessment would follow the methodology outlined below, and consider the sensitivity of the receptor, the distance between the potential source of instability and the receptor, and the relative elevation of the source compared to the receptor. This is considered to be a more realistic and suitable analysis than considering distance alone, given that a receptor which is close to a source area but is up-gradient from it, would not be affected by run-out from the resultant failure.

The impact rating is derived by multiplying the receptor sensitivity coefficient by the receptor proximity coefficient and the relative elevation coefficient. The following sections detail the methodology for assigning coefficient scores.

For example, a highly sensitive watercourse (6) at 250 m from the source of potential peat slide (2) at a relative elevation of <10 m (1) would be scored an impact rating of 12 (low), as detailed in **Table 5.10**.

5.3.1 Receptor Sensitivity Ranking

Should a peat landslide occur, nearby structures or features may be impacted. Generally, only features down-gradient should be considered, therefore a review of topography and geomorphological features need to be identified prior to identifying receptors. However, it should be noted that instability occurring on steep slopes do risk the back scarp of instability migrating up-slope, affecting areas not previously considered to be at risk. The receptors detailed in **Table 5.7** have been ranked according to their size and sensitivity with corresponding coefficients assigned.

Table 5.7 Coefficients for Receptor Sensitivity

Receptor	Receptor Sensitivity Coefficient
Minor infrastructure e.g. private roads/tracks, including Proposed Development track	1
Watercourses, and critical infrastructure (roads/ services, individual dwellings and business properties)	3
High-sensitivity watercourses (e.g. national/international designations)	6
Communities (over approximately 10 dwellings)	8

5.3.2 Receptor Proximity

The proximity of a receptor should be considered to assess the likely level of disruption should a peat landslide occur. Predicting the size of a failure and the distance it may travel is very difficult. The high

moisture content of peat makes it especially mobile once it fails and the structure of the peat breaks down. If a peat slide enters a watercourse this can mobilise the slide further and have impacts many kilometres beyond the bounds of the site. In many instances, minor slumps are localised and have little or no impact. Other failures may travel at 100 – 200 m and those entering watercourses, many miles, as was the case of the Derrybrien failure in Co. Galway, Ireland in 2003 (Lindsay & Bragg 2005[Error! Bookmark not defined.]).

The distance from the source and the relative elevation of the receptor have been assigned coefficients as detailed in **Table 5.8** and **5.9**.

Table 5.8 Coefficient for Receptor Proximity

Distance from Coefficient Feature	Distance Coefficient
More than 1 km	1
100 m to 1 km	2
10 m to 100 m	3
Less than 10 m	4

Table 5.9 Coefficient for Relative Elevation

Relative Elevation of Receptor	Relative Elevation Coefficient
Less than 10 m	1
10 m to 50 m	2
50 m to 100 m	3
More than 100m	4

The results of the likelihood and impact assessment would be normalised into a numerical score, detailed in **Table 5.10**. The overall risk ranking (detailed in **Table 5.11**) is determined from the product of the likelihood rating coefficient (normalised) and the Impact rating coefficient (normalised).

Where a risk ranking is greater than negligible, qualitative assessment would then be undertaken to determine if the ranking can be revised to an acceptable level through appropriate mitigation or re-design.

Table 5.10 Rating Normalisation

Likelihood		Impact	
Current Scale	Normalised Scale	Current Scale	Normalised Scale
Negligible (≤5)	1	Very Low (<10)	1
Low (>5 – 15)	2	Low (11 – 20)	2
Medium (>15 – 30)	3	Moderate (21 – 30)	3
High (>30 – 36)	4	High (31 – 50)	4
Very High (>36)	5	Extremely High (>51)	5

Table 5.11 Risk Ranking

Risk Ranking	Risk Ranking Level	Action
1-4	Negligible	No mitigation required; good construction practices should be followed.
5-10	Low	Further investigation to refine assessment and mitigate hazard through relocation or re-design at these locations.
11-16	Medium	Should not proceed unless risk can be avoided or mitigated at these locations, without significant environmental impact, in order to reduce risk score to low or negligible.
17-25	High	Avoid project development at these locations

5.4 Assessment of Increased Likelihood Locations

Where the likelihood assessment identified areas of negligible and low likelihood of instability, no specific mitigation measures are considered necessary. However, best practice construction methodology should be adopted with ongoing monitoring of ground conditions.

6. Proposed Development Design and Mitigation

6.1 Detailed Design and Site Investigation

A detailed site investigation would be required to assist detailed design, comprising intrusive ground investigations at infrastructure locations prior to construction commencing, to ascertain depth to bedrock and suitable founding conditions.

A detailed stability analysis can then be completed at all infrastructure locations using the increased confidence in the shear strength/peat depth data and site-specific topographical survey data, to provide added robustness to the stability assessment.

6.1.1 Turbines, Hardstandings and BESS

6.1.1.1 Design

This PLHRA has identified that the proposed turbine, hardstandings and battery energy storage system (BESS) are in an area where there is a low likelihood of a peat slide occurring.

6.1.1.2 Mitigation

The infrastructure would not be constructed on peat, rather peat would be excavated to allow founding onto a suitable stratum i.e. bedrock.

It is anticipated that extraction of rock will be required in at least some areas to create suitable levels for founding turbines and hardstandings and the BESS element of the Proposed Development.

Prior to construction, a specific construction method statement would be produced which would draw on the findings of intrusive investigations. The method statement would detail the exact construction methodology to be used, in line with the Peat Management Plan and taking into account:

- Opportunities for micro-siting the turbine and hardstanding to further minimise risk where possible;
- A geotechnical analysis for the turbine base;
- The method of excavation and the location for placing and storing excavated material to ensure that these operations do not give rise to slope or site instability;
- Methodology for storing and watering surface vegetated turves, for re-sodding bare areas;
- Details of how excavated spoil would be stored;
- Avoidance of construction (if possible) on wet areas, flushes and easily eroded soils;
- Adequate drainage design to cater for expected heavy rainfall events; and
- Monitoring of ground movement and water levels.

The Construction Method Statement would also detail how pumped water from the excavated base would be controlled and monitored to ensure it is appropriately managed and if directed into or conveyed to existing drains/watercourses, to ensure that all have adequate treatment beforehand and capacity to deal with the volumes of water encountered.

6.1.2 Access Tracks

6.1.2.1 Design

The thickest areas of peat have been avoided where possible, though based on other constraints there are still sections which cross over deep peat (>1 m).

6.1.2.2 Mitigation

Where track construction is required over peat areas in excess of 1.0 m thick, this would be undertaken with a floating track construction, where the integrity of the peat allows, and cross gradients are appropriate to allow floating roads. Cut and fill should be avoided in peat greater than 1.0 m thick if possible.

Where excavated tracks are proposed, mitigation measures are set out below, to ensure suitable construction of tracks and minimising risk of instability:

- Road alignments would be micro-sited to further reduce risk where possible and appropriate, based on detailed site investigation findings;
- Roads would be constructed to take the required vehicular loadings, having due regard to overall site stability;
- Machinery and vehicles used in track construction would be operated from the already constructed sections of the road as it progresses;
- Good quality rock would be used to construct roads where applicable;
- Ground movement and water level monitoring would be carried out at all times;
- All machinery and construction methods on-site would be selected with a view to minimising impact on the surrounding habitat; and
- All roads would have sufficiently sized culverts (where required), permeable fill or cross drains at the location of the water crossings (limited to minor field drains), flush or other hydrological features to allow the natural flow of water across the area and prevent ponding and the generation of pore pressures which may initiate instability.

6.1.2.3 Peat Storage

The principles of temporary peat storage are discussed in Appendix 12.3 Outline Peat Management Plan. Detailed requirements for any appropriate mitigation measures would be set out in the Construction Environmental Management Plan (CEMP).

Best practice measures for temporary and permanent peat storage during construction would be followed, in accordance with guidance including Developments on Peatland: Guidance on the Assessment of Peat Volumes, Reuse of Excavated Peat and the Minimisation of Waste (Scottish Renewables and SEPA, 2012). This includes:

- selecting suitable temporary storage areas with relatively low ecological value, and low stability risk i.e. not at the crest of a slope or in areas identified as being at higher risk of instability;
- reuse of temporarily stored peat as soon as possible after excavation;
- dressing and reinstating peat used for road verges and infrastructure batters (as part of site landscaping works) as soon as practicable after construction; and
- suitably limiting the angle of reinstated slopes to reduce run-off and erosion.

6.1.2.4 Drainage Areas

Design and construction of a suitable drainage system for the proposed Development would follow Sustainable Drainage Systems (SuDS) principles and would ensure natural drainage without significant alteration of the hydrological regime of the site area.

Any construction activity relating to or undertaken in the vicinity of watercourses would be carried out in general accordance with relevant guidelines and legislation.

6.1.3 Monitoring and Management

A line of surveyed and levelled pegs and visual monitoring is an acceptable method of monitoring movement adjacent to roads, excavations and stockpile areas.

Thus, as construction activities commence, the appearance of the area and surrounding land would be monitored visually by installing a line of levelled pegs adjacent to the activity location. Specifically, the following signs would be looked for:

- An increased rate of sinking or tilting;
- The rising of adjacent peat/peaty soils;
- Cracking and lateral movement of the soil surface; and
- A rise in water levels.

The Principal Contractor would ensure that suitably qualified and experienced construction staff are engaged on the project, including a senior geotechnical engineer with extensive practical knowledge and experience of similar conditions to those at the site. The senior geotechnical engineer would have responsibility for maintaining and actively monitoring a geotechnical risk register for the construction works.

Additionally, all staff would undergo a site induction and suitable training relating to construction on peatland sites. This would raise awareness of ground instability indicators, best practice construction techniques, mitigation and emergency procedures. All staff should be responsible for observational monitoring and reporting.

7. Conclusion

The Proposed Development has been assessed for potential peat instability through consideration of the likelihood of a peat slide occurring based on existing site conditions, the potential impact on identified receptors and the overall risk associated.

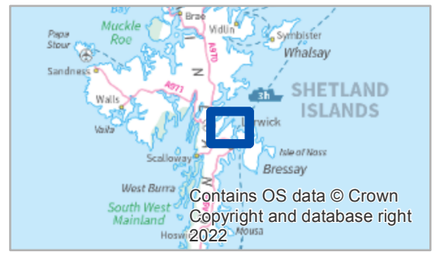
The overall conclusions show that there is a **negligible to low** likelihood of peat instability over most of the site.

Although the identified likelihood is recorded to be negligible to low, good construction practices and appropriate mitigation should be followed, with construction works supervised by a suitably qualified geotechnical specialist.

Annex 1 – Drawings

KEY

Site Boundary



Coordinate System: British National Grid
Projection: Transverse Mercator

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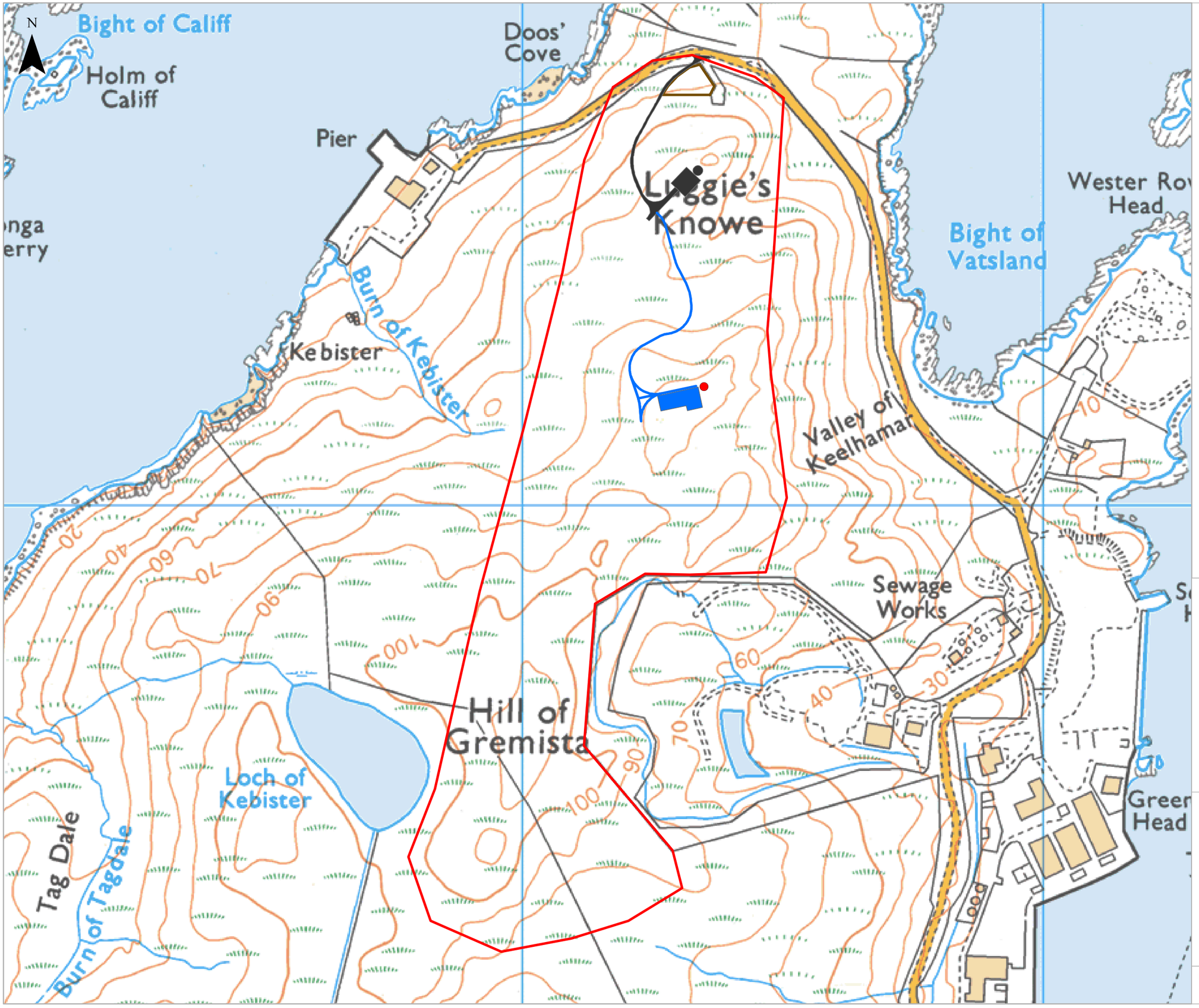
Luggies Knowe Wind Energy Project
Peat Landslide Hazard and Risk Assessment

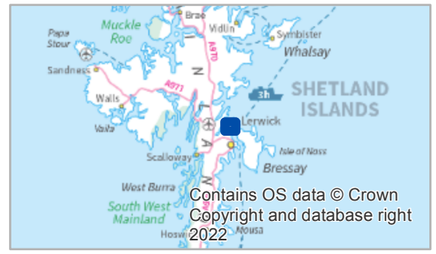
Drawing 1
Site Location

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



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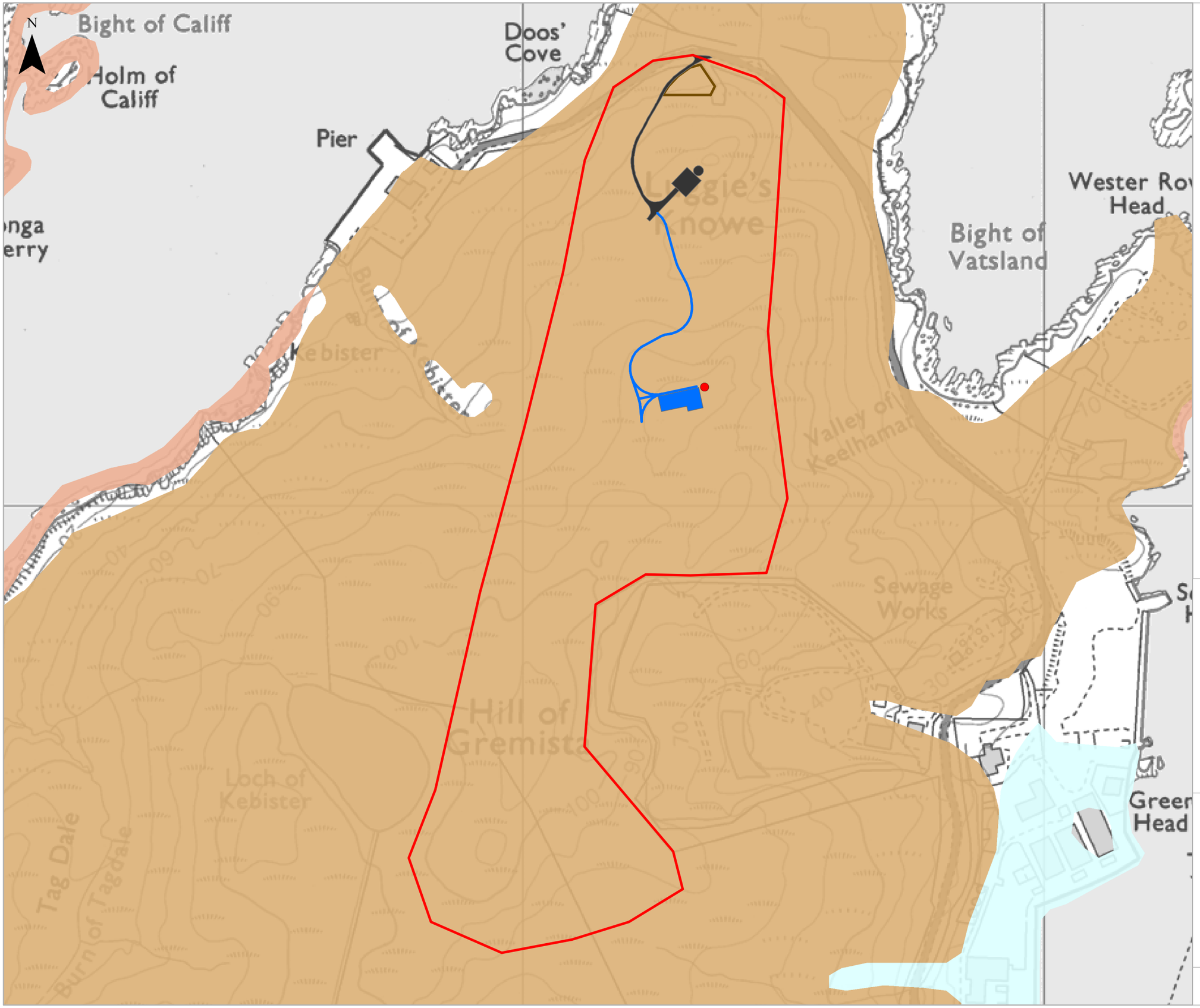
Peat Landslide Hazard and Risk Assessment

Drawing 2
Site Layout

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

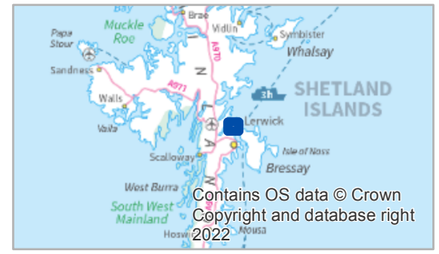


KEY

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

BGS 1:50k Superficial Deposits

- TILL, DEVENSIAN - DIAMICTON
- MARINE BEACH DEPOSITS - GRAVEL, SAND AND SILT
- PEAT - PEAT



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Peat Landslide Hazard and Risk Assessment

Drawing 3
Superficial Geology

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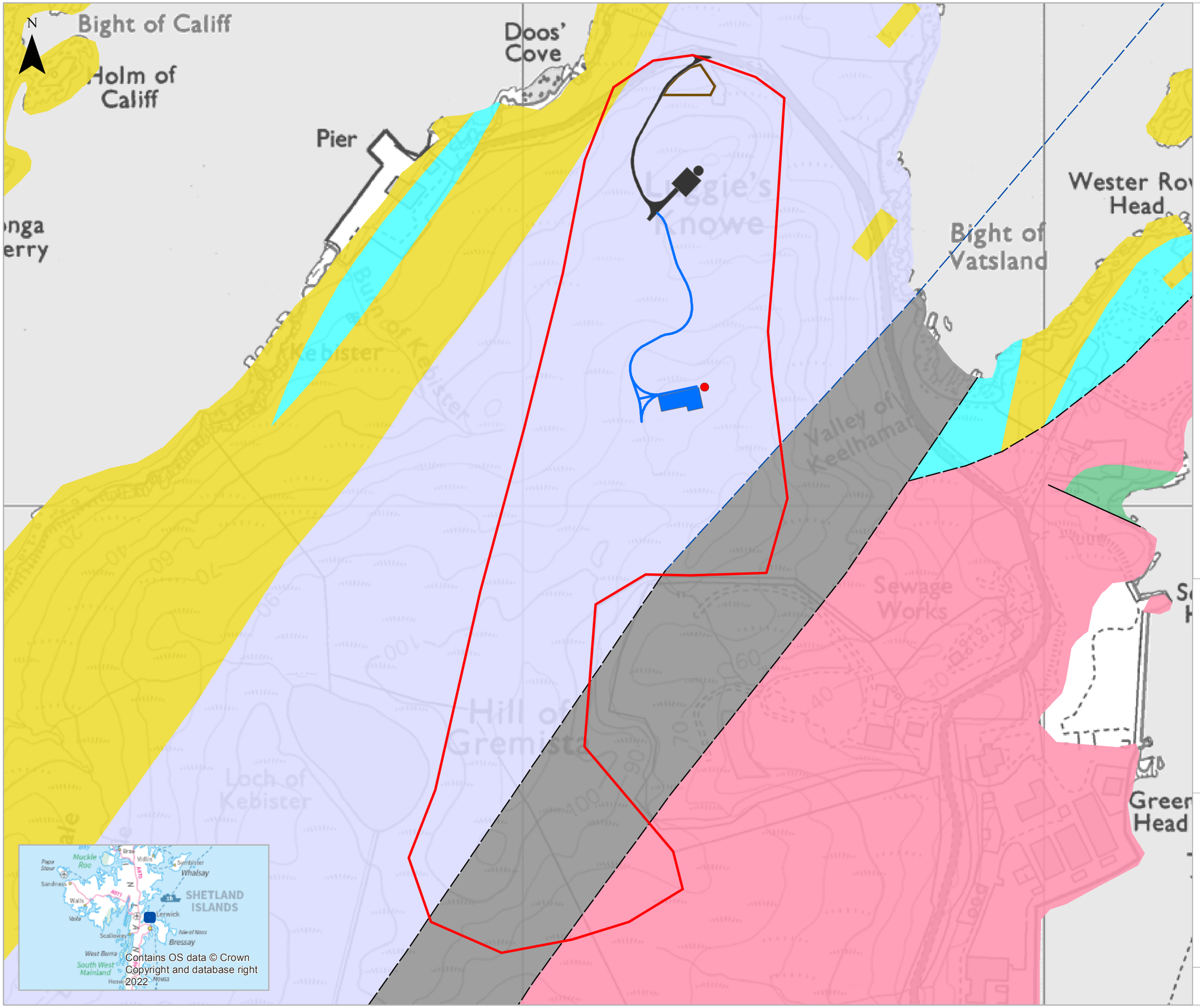
18/05/2023	ES	DN	1.0



KEY

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

BGS 1:50k Bedrock Geology

- LERWICK SANDSTONE FORMATION - BRECCIA
- LERWICK SANDSTONE FORMATION - SANDSTONE
- LERWICK SANDSTONE FORMATION - SILTSTONE AND MUDSTONE, INTERBEDDED
- ROVA HEAD CONGLOMERATE MEMBER - CONGLOMERATE
- CLIFT HILLS PHYLLITIC FORMATION - SEMIPELITE
- DALES VOE GRIT MEMBER - QUARTZITE
- QUARFF SUCCESSION AND MELANGE - SHEAR-BOUNDED METAMORPHIC ROCK SLICES FORMING TECTONIC MELANGE; QUARFF TYPE
- QUARFF SUCCESSION AND MELANGE - METALIMESTONE
- QUARFF SUCCESSION AND MELANGE - QUARTZITE
- WHITENESS 'DIVISION' - METALIMESTONE
- WHITENESS 'DIVISION' - QUARTZITE

BGS 1:50k Linear Features

- Fault, inferred, displacement unknown
- Fault, observed, displacement unknown
- Reverse or thrust fault, inferred

Coordinate System: British National Grid
Projection: Transverse Mercator

0 0.1 0.2 0.3 Kilometres

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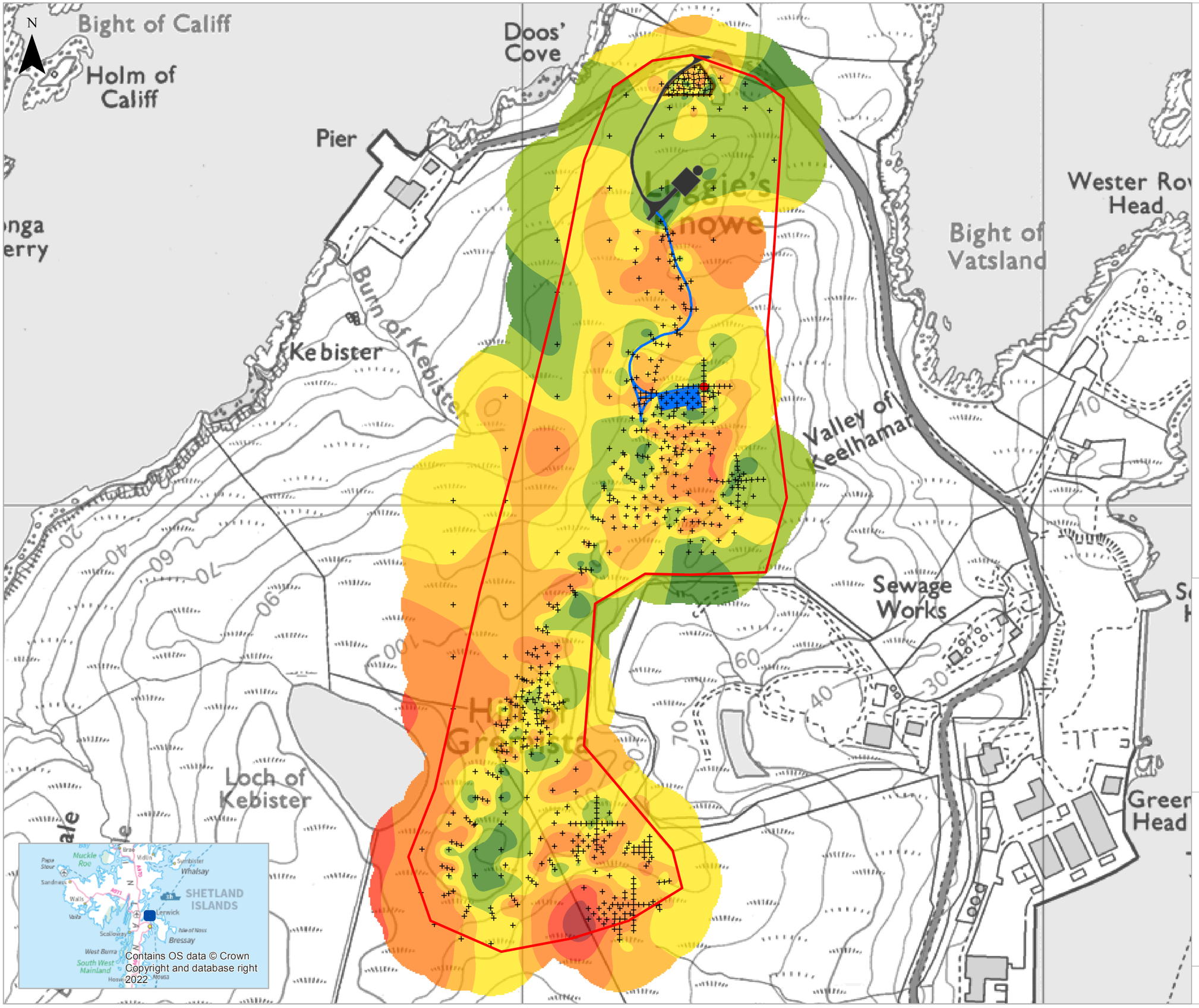
Luggies Knowe Wind Energy Project
Peat Landslide Hazard and Risk Assessment

Drawing 4
Bedrock Geology

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



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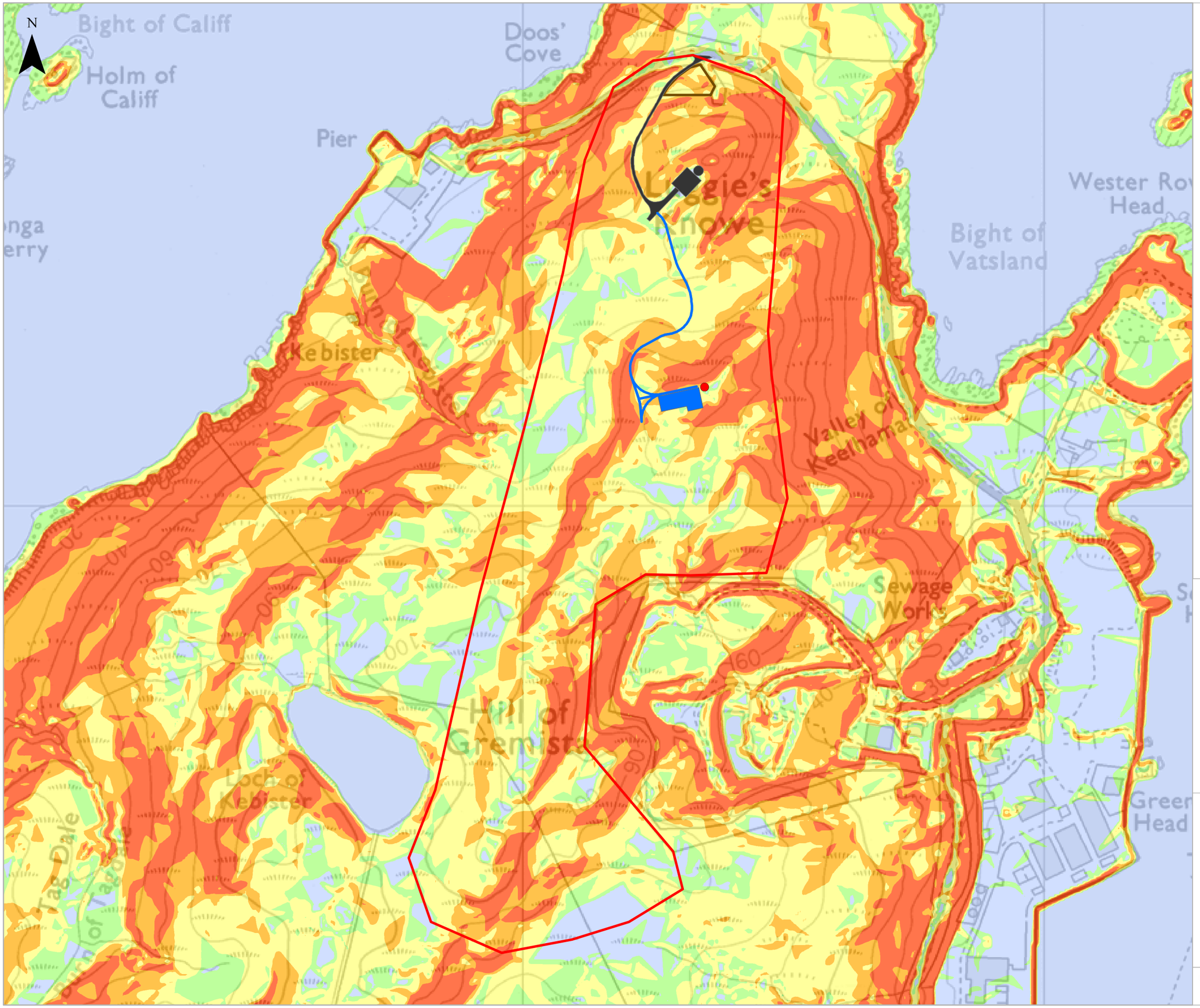
Peat Landslide Hazard and Risk Assessment

Drawing 5
Peat Depth

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



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Projection: Transverse Mercator

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0 0.1 0.2 0.3 Kilometres

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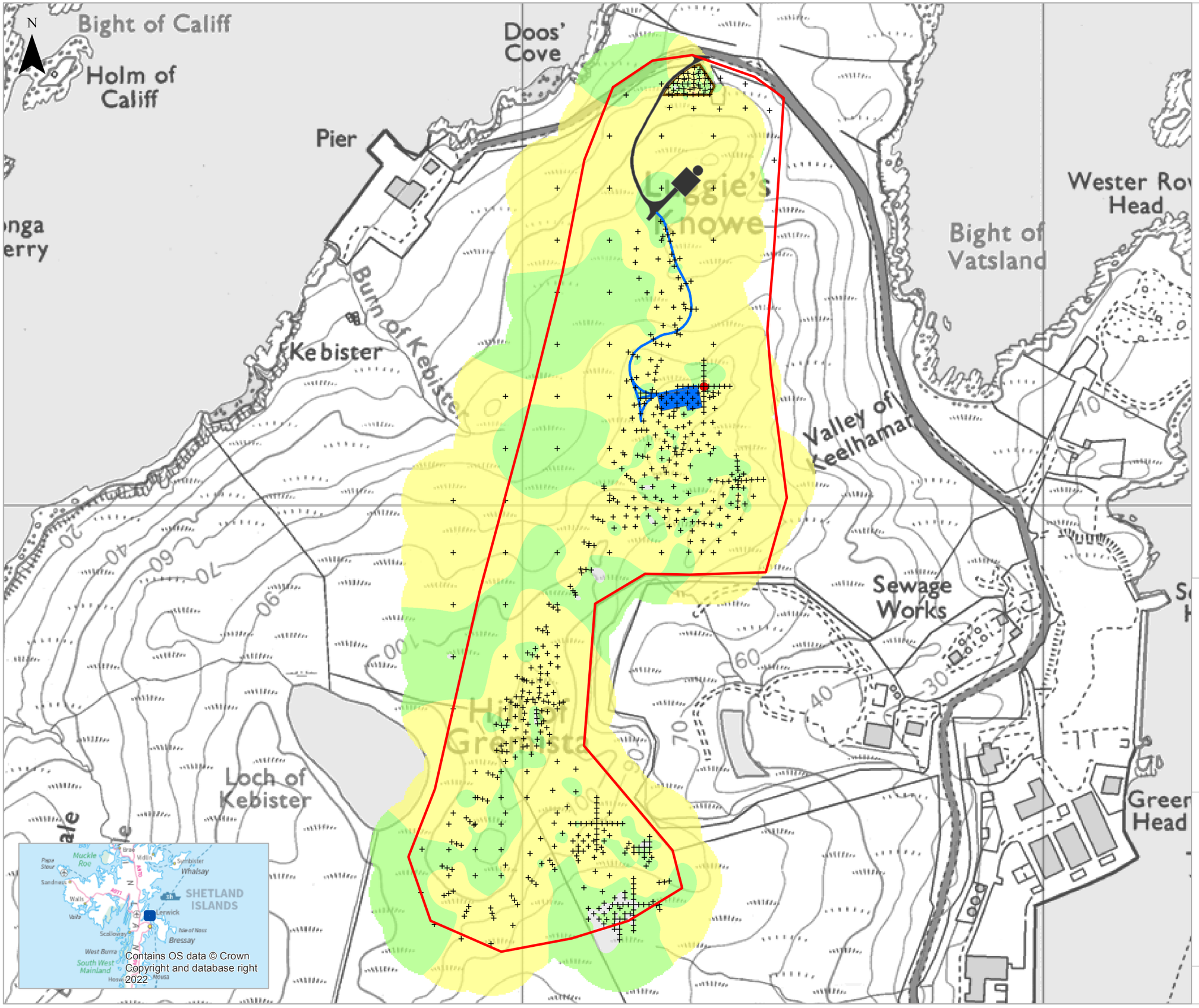
Peat Landslide Hazard and Risk Assessment

Drawing 6
Slope

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 Slide Likelihood Rating

- None
- Negligible
- Low
- Medium

Coordinate System: British National Grid
Projection: Transverse Mercator

0 0.1 0.2 0.3 Kilometres

1:7,000

ITPENERGISED

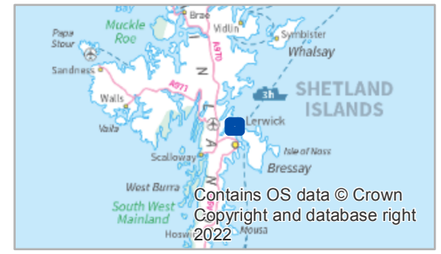
Luggies Knowe Wind Energy Project
Peat Landslide Hazard and Risk Assessment

Drawing 7
Likelihood of Peat Landslide

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

KEY

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



Coordinate System: British National Grid
Projection: Transverse Mercator

0 0.1 0.2 0.3 Kilometres

1:7,000

ITPENERGISED

Luggies Knowe Wind Energy Project
Peat Landslide Hazard and Risk Assessment

Drawing 8
Geomorphological Interpretation

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

Annex 2 – Peat Slide Likelihood Data

ID	Easting	Northing	Peat Depth (m)	Substrate	Evidence of Instability	Slope (Degrees)	Ground Condition Coefficient	Existing Instability Coefficient	Peat Depth Coefficient	Slope Coefficient	Substrate Coefficient	Likelihood Coefficient	Likelihood of Peat Landslide
0	445859	1144290	0.95	Granular	No	7.47	Thin Peat	1	3	3	1	9	Low
1	445909	1144290	0.40	Granular	No	6.35	Peaty Soil	1	1	3	1	3	Negligible
2	445959	1144290	0.50	Granular	No	11.76	Peaty Soil	1	1	3	1	3	Negligible
3	445859	1144340	0.50	Granular	No	7.35	Peaty Soil	1	1	3	1	3	Negligible
4	445909	1144340	0.25	Granular	No	6.10	Peaty Soil	1	1	3	1	3	Negligible
5	445959	1144340	0.20	Granular	No	13.85	Peaty Soil	1	1	3	1	3	Negligible
6	445859	1144390	1.50	Granular	No	6.22	Thin Peat	1	3	3	1	9	Low
7	445909	1144390	0.90	Granular	No	8.54	Thin Peat	1	3	3	1	9	Low
8	445959	1144390	0.50	Granular	No	2.27	Peaty Soil	1	1	2	1	2	Negligible
9	445909	1144440	0.30	Granular	No	7.13	Peaty Soil	1	1	3	1	3	Negligible
10	445959	1144440	0.30	Granular	No	4.64	Peaty Soil	1	1	2	1	2	Negligible
11	446009	1144440	1.10	Granular	No	11.13	Thin Peat	1	3	3	1	9	Low
12	445909	1144490	1.25	Granular	No	9.04	Thin Peat	1	3	3	1	9	Low
13	445959	1144490	0.10	Granular	No	5.85	Peaty Soil	1	1	3	1	3	Negligible
14	446009	1144490	1.05	Granular	No	3.70	Thin Peat	1	3	2	1	6	Low
15	445959	1144540	2.00	Granular	No	8.49	Thick Peat	1	2	3	1	6	Low
16	446009	1144540	1.50	Granular	No	7.47	Thin Peat	1	3	3	1	9	Low
17	446204	1145296	0.75	Granular	No	11.96	Thin Peat	1	3	3	1	9	Low
18	445951	1144531	1.45	Granular	No	10.16	Thin Peat	1	3	3	1	9	Low
19	446221	1145097	0.40	Granular	No	6.71	Peaty Soil	1	1	3	1	3	Negligible
20	446247	1145329	0.40	Granular	No	10.68	Peaty Soil	1	1	3	1	3	Negligible
21	445914	1144441	1.40	Granular	No	9.51	Thin Peat	1	3	3	1	9	Low
22	446306	1145423	1.90	Granular	No	9.06	Thick Peat	1	2	3	1	6	Low
23	445970	1144629	2.10	Granular	No	7.03	Thick Peat	1	2	3	1	6	Low
24	445990	1144235	1.90	Granular	No	10.33	Thick Peat	1	2	3	1	6	Low
25	445945	1144209	1.25	Granular	No	13.59	Thin Peat	1	3	3	1	9	Low
26	446270	1145518	2.30	Granular	No	4.18	Thick Peat	1	2	2	1	4	Negligible
27	446197	1144334	1.55	Granular	No	3.08	Thick Peat	1	2	2	1	4	Negligible
28	446155	1144335	2.50	Granular	No	6.96	Thick Peat	1	2	3	1	6	Low
29	446314	1145379	2.25	Granular	No	6.01	Thick Peat	1	2	3	1	6	Low
30	446051	1144811	1.95	Granular	No	7.81	Thick Peat	1	2	3	1	6	Low
31	446293	1145347	1.35	Granular	No	7.52	Thin Peat	1	3	3	1	9	Low
32	445892	1144401	1.70	Granular	No	7.31	Thick Peat	1	2	3	1	6	Low
33	446062	1144302	0.50	Granular	No	11.70	Peaty Soil	1	1	3	1	3	Negligible
34	445850	1144252	2.15	Granular	No	5.71	Thick Peat	1	2	3	1	6	Low
35	446215	1145194	1.80	Granular	No	12.12	Thick Peat	1	2	3	1	6	Low
36	446010	1144718	2.50	Granular	No	3.44	Thick Peat	1	2	2	1	4	Negligible
37	446119	1144931	1.50	Granular	No	9.90	Thin Peat	1	3	3	1	9	Low
38	445950	1144581	2.05	Granular	No	3.62	Thick Peat	1	2	2	1	4	Negligible
39	446168	1145021	0.95	Granular	No	7.09	Thin Peat	1	3	3	1	9	Low
40	446026	1144273	1.50	Granular	No	10.06	Thin Peat	1	3	3	1	9	Low
41	445889	1144213	1.95	Granular	No	9.66	Thick Peat	1	2	3	1	6	Low
42	446238	1144308	2.40	Granular	No	4.70	Thick Peat	1	2	2	1	4	Negligible
43	446201	1145240	0.65	Granular	No	15.86	Thin Peat	1	3	2	1	6	Low
44	446092	1144846	2.80	Granular	No	6.69	Thick Peat	1	2	3	1	6	Low
45	445990	1144672	1.85	Granular	No	7.26	Thick Peat	1	2	3	1	6	Low
46	446283	1145469	1.85	Granular	No	9.47	Thick Peat	1	2	3	1	6	Low
47	445846	1144308	2.25	Granular	No	2.72	Thick Peat	1	2	2	1	4	Negligible
48	446108	1144319	1.00	Granular	No	17.33	Thin Peat	1	3	2	1	6	Low
49	446201	1145059	0.70	Granular	No	3.09	Thin Peat	1	3	2	1	6	Low
50	446251	1144240	1.60	Granular	No	4.23	Thick Peat	1	2	2	1	4	Negligible
51	445934	1144488	1.50	Granular	No	8.00	Thin Peat	1	3	3	1	9	Low
52	446030	1144764	1.50	Granular	No	6.43	Thin Peat	1	3	3	1	9	Low
53	446136	1144979	1.00	Granular	No	7.77	Thin Peat	1	3	3	1	9	Low
54	446113	1144879	0.60	Granular	No	7.67	Thin Peat	1	3	3	1	9	Low

ID	Easting	Northing	Peat Depth (m)	Substrate	Evidence of Instability	Slope (Degrees)	Ground Condition Coefficient	Existing Instability Coefficient	Peat Depth Coefficient	Slope Coefficient	Substrate Coefficient	Likelihood Coefficient	Likelihood of Peat Landslide
55	445865	1144356	2.20	Granular	No	6.04	Thick Peat	1	2	3	1	6	Low
56	446219	1145145	1.40	Granular	No	11.69	Thin Peat	1	3	3	1	9	Low
57	446263	1144277	1.45	Granular	No	3.27	Thin Peat	1	3	2	1	6	Low
58	446256	1145312	1.25	Granular	No	8.14	Thin Peat	1	3	3	1	9	Low
59	445971	1144528	2.00	Granular	No	6.02	Thick Peat	1	2	3	1	6	Low
60	446220	1145246	2.05	Granular	No	5.77	Thick Peat	1	2	3	1	6	Low
61	446221	1145286	1.90	Granular	No	15.18	Thick Peat	1	2	2	1	4	Negligible
62	446048	1144756	1.40	Granular	No	9.24	Thin Peat	1	3	3	1	9	Low
63	446241	1145094	0.95	Granular	No	5.69	Thin Peat	1	3	3	1	9	Low
64	445907	1144387	1.95	Granular	No	8.54	Thick Peat	1	2	3	1	6	Low
65	445933	1144434	1.80	Granular	No	6.92	Thick Peat	1	2	3	1	6	Low
66	446264	1144226	1.40	Granular	No	4.32	Thin Peat	1	3	2	1	6	Low
67	445970	1144579	2.00	Granular	No	3.76	Thick Peat	1	2	2	1	4	Negligible
68	446133	1144878	0.25	Granular	No	1.18	Peaty Soil	1	1	0	1	0	None
69	446102	1144829	0.35	Granular	No	1.99	Peaty Soil	1	1	0	1	0	None
70	446324	1145431	1.70	Granular	No	7.46	Thick Peat	1	2	3	1	6	Low
71	446216	1145046	1.30	Granular	No	2.14	Thin Peat	1	3	2	1	6	Low
72	445897	1144231	1.15	Granular	No	10.79	Thin Peat	1	3	3	1	9	Low
73	446053	1144320	1.45	Granular	No	5.01	Thin Peat	1	3	3	1	9	Low
74	446068	1144801	1.05	Granular	No	7.82	Thin Peat	1	3	3	1	9	Low
75	446205	1144352	1.45	Granular	No	4.02	Thin Peat	1	3	2	1	6	Low
76	446235	1145197	2.25	Granular	No	8.86	Thick Peat	1	2	3	1	6	Low
77	445979	1144252	1.15	Granular	No	9.19	Thin Peat	1	3	3	1	9	Low
78	446029	1144710	2.65	Granular	No	7.03	Thick Peat	1	2	3	1	6	Low
79	446303	1145329	1.70	Granular	No	7.69	Thick Peat	1	2	3	1	6	Low
80	445883	1144348	1.90	Granular	No	7.12	Thick Peat	1	2	3	1	6	Low
81	445868	1144261	2.05	Granular	No	7.79	Thick Peat	1	2	3	1	6	Low
82	446334	1145378	1.90	Granular	No	5.95	Thick Peat	1	2	3	1	6	Low
83	446138	1144925	0.90	Granular	No	6.39	Thin Peat	1	3	3	1	9	Low
84	446154	1144971	1.70	Granular	No	8.35	Thick Peat	1	2	3	1	6	Low
85	446239	1145146	1.95	Granular	No	8.25	Thick Peat	1	2	3	1	6	Low
86	446283	1144280	1.55	Granular	No	4.88	Thick Peat	1	2	2	1	4	Negligible
87	446249	1144325	1.40	Granular	No	2.88	Thin Peat	1	3	2	1	6	Low
88	446303	1145475	0.90	Granular	No	2.84	Thin Peat	1	3	2	1	6	Low
89	445865	1144302	2.30	Granular	No	6.97	Thick Peat	1	2	3	1	6	Low
90	446011	1144287	1.20	Granular	No	13.95	Thin Peat	1	3	3	1	9	Low
91	445939	1144228	1.00	Granular	No	17.07	Thin Peat	1	3	2	1	6	Low
92	445952	1144479	1.60	Granular	No	5.88	Thick Peat	1	2	3	1	6	Low
93	445987	1144617	1.95	Granular	No	6.82	Thick Peat	1	2	3	1	6	Low
94	446009	1144664	2.00	Granular	No	5.46	Thick Peat	1	2	3	1	6	Low
95	446289	1145523	2.70	Granular	No	6.24	Thick Peat	1	2	3	1	6	Low
96	446183	1145008	1.45	Granular	No	5.39	Thin Peat	1	3	3	1	9	Low
97	446280	1145520	1.90	Granular	No	5.78	Thick Peat	1	2	3	1	6	Low
98	446293	1145472	1.15	Granular	No	4.36	Thin Peat	1	3	2	1	6	Low
99	446315	1145427	1.60	Granular	No	9.48	Thick Peat	1	2	3	1	6	Low
100	446324	1145379	2.30	Granular	No	6.01	Thick Peat	1	2	3	1	6	Low
101	446298	1145338	1.80	Granular	No	7.54	Thick Peat	1	2	3	1	6	Low
102	446252	1145321	1.00	Granular	No	10.14	Thin Peat	1	3	3	1	9	Low
103	446212	1145291	1.20	Granular	No	11.55	Thin Peat	1	3	3	1	9	Low
104	446210	1145243	1.55	Granular	No	9.38	Thick Peat	1	2	3	1	6	Low
105	446225	1145195	2.20	Granular	No	7.40	Thick Peat	1	2	3	1	6	Low
106	446229	1145145	0.85	Granular	No	9.54	Thin Peat	1	3	3	1	9	Low
107	446231	1145096	0.25	Granular	No	6.12	Peaty Soil	1	1	3	1	3	Negligible
108	446208	1145052	0.60	Granular	No	2.34	Thin Peat	1	3	2	1	6	Low
109	446175	1145015	1.40	Granular	No	5.58	Thin Peat	1	3	3	1	9	Low

ID	Easting	Northing	Peat Depth (m)	Substrate	Evidence of Instability	Slope (Degrees)	Ground Condition Coefficient	Existing Instability Coefficient	Peat Depth Coefficient	Slope Coefficient	Substrate Coefficient	Likelihood Coefficient	Likelihood of Peat Landslide
110	446145	1144975	1.05	Granular	No	10.61	Thin Peat	1	3	3	1	9	Low
111	446128	1144928	1.60	Granular	No	7.82	Thick Peat	1	2	3	1	6	Low
112	446123	1144878	1.50	Granular	No	4.29	Thin Peat	1	3	2	1	6	Low
113	446097	1144837	2.35	Granular	No	4.84	Thick Peat	1	2	2	1	4	Negligible
114	446060	1144806	1.85	Granular	No	8.57	Thick Peat	1	2	3	1	6	Low
115	446039	1144760	1.45	Granular	No	3.50	Thin Peat	1	3	2	1	6	Low
116	446019	1144714	2.90	Granular	No	3.23	Thick Peat	1	2	2	1	4	Negligible
117	446000	1144668	1.55	Granular	No	8.60	Thick Peat	1	2	3	1	6	Low
118	445978	1144623	2.20	Granular	No	8.30	Thick Peat	1	2	3	1	6	Low
119	445960	1144580	2.30	Granular	No	4.99	Thick Peat	1	2	2	1	4	Negligible
120	445961	1144530	2.20	Granular	No	9.74	Thick Peat	1	2	3	1	6	Low
121	445943	1144483	1.10	Granular	No	7.57	Thin Peat	1	3	3	1	9	Low
122	445924	1144437	1.85	Granular	No	10.02	Thick Peat	1	2	3	1	6	Low
123	445900	1144394	1.60	Granular	No	7.34	Thick Peat	1	2	3	1	6	Low
124	445874	1144352	1.90	Granular	No	6.12	Thick Peat	1	2	3	1	6	Low
125	445856	1144305	2.30	Granular	No	4.29	Thick Peat	1	2	2	1	4	Negligible
126	445859	1144256	2.00	Granular	No	6.94	Thick Peat	1	2	3	1	6	Low
127	445893	1144222	1.75	Granular	No	6.93	Thick Peat	1	2	3	1	6	Low
128	445942	1144218	1.00	Granular	No	13.55	Thin Peat	1	3	3	1	9	Low
129	445985	1144244	2.50	Granular	No	8.10	Thick Peat	1	2	3	1	6	Low
130	446019	1144280	1.00	Granular	No	14.26	Thin Peat	1	3	3	1	9	Low
131	446058	1144311	1.25	Granular	No	9.54	Thin Peat	1	3	3	1	9	Low
132	446104	1144329	1.60	Granular	No	6.57	Thick Peat	1	2	3	1	6	Low
133	446152	1144345	2.95	Granular	No	6.50	Thick Peat	1	2	3	1	6	Low
134	446201	1144343	1.20	Granular	No	4.58	Thin Peat	1	3	2	1	6	Low
135	446243	1144317	1.75	Granular	No	1.38	Thick Peat	1	2	0	1	0	None
136	446273	1144278	1.10	Granular	No	5.06	Thin Peat	1	3	3	1	9	Low
137	446258	1144233	1.60	Granular	No	4.32	Thick Peat	1	2	2	1	4	Negligible
138	446162	1144206	3.15	Granular	No	1.76	Thick Peat	1	2	0	1	0	None
139	446213	1144185	1.95	Granular	No	2.36	Thick Peat	1	2	2	1	4	Negligible
140	446213	1144195	1.95	Granular	No	1.89	Thick Peat	1	2	0	1	0	None
141	446213	1144205	2.25	Granular	No	0.83	Thick Peat	1	2	0	1	0	None
142	446213	1144215	2.30	Granular	No	0.81	Thick Peat	1	2	0	1	0	None
143	446213	1144225	2.30	Granular	No	0.71	Thick Peat	1	2	0	1	0	None
144	446173	1144235	2.20	Granular	No	0.67	Thick Peat	1	2	0	1	0	None
145	446183	1144235	2.45	Granular	No	0.68	Thick Peat	1	2	0	1	0	None
146	446193	1144235	2.45	Granular	No	0.67	Thick Peat	1	2	0	1	0	None
147	446203	1144235	2.25	Granular	No	0.68	Thick Peat	1	2	0	1	0	None
148	446213	1144235	2.05	Granular	No	0.70	Thick Peat	1	2	0	1	0	None
149	446223	1144235	2.00	Granular	No	0.78	Thick Peat	1	2	0	1	0	None
150	446233	1144235	2.00	Granular	No	2.52	Thick Peat	1	2	2	1	4	Negligible
151	446243	1144235	1.80	Granular	No	4.36	Thick Peat	1	2	2	1	4	Negligible
152	446263	1144235	1.90	Granular	No	4.32	Thick Peat	1	2	2	1	4	Negligible
153	446213	1144245	2.00	Granular	No	0.66	Thick Peat	1	2	0	1	0	None
154	446213	1144255	1.50	Granular	No	2.90	Thin Peat	1	3	2	1	6	Low
155	446213	1144265	1.65	Granular	No	5.26	Thick Peat	1	2	3	1	6	Low
156	446213	1144275	1.05	Granular	No	4.73	Thin Peat	1	3	2	1	6	Low
157	446213	1144285	1.25	Granular	No	2.66	Thin Peat	1	3	2	1	6	Low
158	446143	1144340	2.95	Granular	No	6.98	Thick Peat	1	2	3	1	6	Low
159	446143	1144350	2.90	Granular	No	5.57	Thick Peat	1	2	3	1	6	Low
160	446143	1144360	2.10	Granular	No	7.53	Thick Peat	1	2	3	1	6	Low
161	446143	1144370	1.60	Granular	No	9.18	Thick Peat	1	2	3	1	6	Low
162	446143	1144380	1.25	Granular	No	9.07	Thin Peat	1	3	3	1	9	Low
163	446093	1144390	1.50	Granular	No	9.53	Thin Peat	1	3	3	1	9	Low
164	446103	1144390	1.55	Granular	No	15.29	Thick Peat	1	2	2	1	4	Negligible

ID	Easting	Northing	Peat Depth (m)	Substrate	Evidence of Instability	Slope (Degrees)	Ground Condition Coefficient	Existing Instability Coefficient	Peat Depth Coefficient	Slope Coefficient	Substrate Coefficient	Likelihood Coefficient	Likelihood of Peat Landslide
165	446113	1144390	1.15	Granular	No	15.93	Thin Peat	1	3	2	1	6	Low
166	446123	1144390	1.00	Granular	No	13.92	Thin Peat	1	3	3	1	9	Low
167	446133	1144390	0.75	Granular	No	12.58	Thin Peat	1	3	3	1	9	Low
168	446143	1144390	0.95	Granular	No	12.56	Thin Peat	1	3	3	1	9	Low
169	446153	1144390	1.30	Granular	No	11.66	Thin Peat	1	3	3	1	9	Low
170	446163	1144390	1.00	Granular	No	11.31	Thin Peat	1	3	3	1	9	Low
171	446173	1144390	0.90	Granular	No	12.21	Thin Peat	1	3	3	1	9	Low
172	446183	1144390	1.80	Granular	No	7.79	Thick Peat	1	2	3	1	6	Low
173	446193	1144390	2.00	Granular	No	4.69	Thick Peat	1	2	2	1	4	Negligible
174	446143	1144400	0.80	Granular	No	11.15	Thin Peat	1	3	3	1	9	Low
175	446143	1144410	0.70	Granular	No	13.06	Thin Peat	1	3	3	1	9	Low
176	446143	1144420	0.60	Granular	No	18.00	Thin Peat	1	3	2	1	6	Low
177	446143	1144430	0.55	Granular	No	13.81	Thin Peat	1	3	3	1	9	Low
178	446143	1144440	1.15	Granular	No	8.24	Thin Peat	1	3	3	1	9	Low
179	446349	1145180	0.65	Granular	No	12.88	Thin Peat	1	3	3	1	9	Low
180	446349	1145190	1.20	Granular	No	12.71	Thin Peat	1	3	3	1	9	Low
181	446349	1145200	2.00	Granular	No	10.50	Thick Peat	1	2	3	1	6	Low
182	446349	1145210	2.00	Granular	No	5.79	Thick Peat	1	2	3	1	6	Low
183	446349	1145220	0.55	Granular	No	3.70	Thin Peat	1	3	2	1	6	Low
184	446299	1145230	0.90	Granular	No	12.21	Thin Peat	1	3	3	1	9	Low
185	446309	1145230	1.30	Granular	No	10.96	Thin Peat	1	3	3	1	9	Low
186	446319	1145230	0.80	Granular	No	10.32	Thin Peat	1	3	3	1	9	Low
187	446329	1145230	0.50	Granular	No	9.89	Peaty Soil	1	1	3	1	3	Negligible
188	446339	1145230	0.40	Granular	No	7.08	Peaty Soil	1	1	3	1	3	Negligible
189	446349	1145230	0.60	Granular	No	3.51	Thin Peat	1	3	2	1	6	Low
190	446359	1145230	1.15	Granular	No	3.40	Thin Peat	1	3	2	1	6	Low
191	446369	1145230	1.35	Granular	No	1.31	Thin Peat	1	3	0	1	0	None
192	446379	1145230	1.75	Granular	No	6.76	Thick Peat	1	2	3	1	6	Low
193	446389	1145230	1.55	Granular	No	11.51	Thick Peat	1	2	3	1	6	Low
194	446399	1145230	1.65	Granular	No	10.32	Thick Peat	1	2	3	1	6	Low
195	446349	1145240	0.90	Granular	No	14.38	Thin Peat	1	3	3	1	9	Low
196	446349	1145250	0.85	Granular	No	20.22	Thin Peat	1	3	1	1	3	Negligible
197	446349	1145260	1.00	Granular	No	20.09	Thin Peat	1	3	1	1	3	Negligible
198	446349	1145270	0.35	Granular	No	25.16	Peaty Soil	1	1	1	1	1	Negligible
199	446349	1145280	1.35	Granular	No	13.94	Thin Peat	1	3	3	1	9	Low
200	446127	1144207	5.00	Granular	No	0.72	Thick Peat	1	2	0	1	0	None
201	446147	1144207	3.15	Granular	No	1.16	Thick Peat	1	2	0	1	0	None
202	446177	1144207	2.95	Granular	No	0.98	Thick Peat	1	2	0	1	0	None
203	446187	1144207	2.90	Granular	No	0.67	Thick Peat	1	2	0	1	0	None
204	446197	1144207	2.85	Granular	No	0.70	Thick Peat	1	2	0	1	0	None
205	446137	1144217	3.50	Granular	No	0.88	Thick Peat	1	2	0	1	0	None
206	446157	1144217	2.80	Granular	No	1.27	Thick Peat	1	2	0	1	0	None
207	446177	1144217	2.70	Granular	No	0.68	Thick Peat	1	2	0	1	0	None
208	446197	1144217	2.80	Granular	No	0.68	Thick Peat	1	2	0	1	0	None
209	446207	1144217	2.50	Granular	No	0.59	Thick Peat	1	2	0	1	0	None
210	446127	1144227	3.95	Granular	No	0.65	Thick Peat	1	2	0	1	0	None
211	446147	1144227	2.90	Granular	No	0.85	Thick Peat	1	2	0	1	0	None
212	446167	1144227	2.40	Granular	No	0.67	Thick Peat	1	2	0	1	0	None
213	446187	1144227	2.50	Granular	No	0.67	Thick Peat	1	2	0	1	0	None
214	446157	1144237	2.45	Granular	No	0.68	Thick Peat	1	2	0	1	0	None
215	446177	1144247	2.05	Granular	No	1.18	Thick Peat	1	2	0	1	0	None
216	446197	1144247	1.95	Granular	No	0.86	Thick Peat	1	2	0	1	0	None
217	446197	1144257	1.70	Granular	No	1.73	Thick Peat	1	2	0	1	0	None
218	446234	1144325	1.70	Granular	No	2.46	Thick Peat	1	2	2	1	4	Negligible
219	446097	1144337	1.90	Granular	No	5.24	Thick Peat	1	2	3	1	6	Low

ID	Easting	Northing	Peat Depth (m)	Substrate	Evidence of Instability	Slope (Degrees)	Ground Condition Coefficient	Existing Instability Coefficient	Peat Depth Coefficient	Slope Coefficient	Substrate Coefficient	Likelihood Coefficient	Likelihood of Peat Landslide
220	446107	1144337	1.15	Granular	No	5.78	Thin Peat	1	3	3	1	9	Low
221	446117	1144337	1.50	Granular	No	10.12	Thin Peat	1	3	3	1	9	Low
222	446214	1144335	1.70	Granular	No	5.17	Thick Peat	1	2	3	1	6	Low
223	446224	1144335	1.55	Granular	No	3.41	Thick Peat	1	2	2	1	4	Negligible
224	446234	1144335	1.80	Granular	No	1.33	Thick Peat	1	2	0	1	0	None
225	446244	1144335	1.25	Granular	No	2.07	Thin Peat	1	3	2	1	6	Low
226	446107	1144347	2.00	Granular	No	8.84	Thick Peat	1	2	3	1	6	Low
227	446127	1144347	1.55	Granular	No	5.37	Thick Peat	1	2	3	1	6	Low
228	446214	1144345	1.40	Granular	No	3.34	Thin Peat	1	3	2	1	6	Low
229	446224	1144345	1.50	Granular	No	1.24	Thin Peat	1	3	0	1	0	None
230	446234	1144345	1.55	Granular	No	1.21	Thick Peat	1	2	0	1	0	None
231	446244	1144345	1.40	Granular	No	1.49	Thin Peat	1	3	0	1	0	None
232	446097	1144357	2.40	Granular	No	6.58	Thick Peat	1	2	3	1	6	Low
233	446117	1144357	2.00	Granular	No	8.36	Thick Peat	1	2	3	1	6	Low
234	446137	1144357	2.10	Granular	No	6.32	Thick Peat	1	2	3	1	6	Low
235	446157	1144357	2.90	Granular	No	4.61	Thick Peat	1	2	2	1	4	Negligible
236	446234	1144355	1.45	Granular	No	1.30	Thin Peat	1	3	0	1	0	None
237	446244	1144355	1.45	Granular	No	0.63	Thin Peat	1	3	0	1	0	None
238	446107	1144367	1.95	Granular	No	9.79	Thick Peat	1	2	3	1	6	Low
239	446127	1144367	1.20	Granular	No	9.34	Thin Peat	1	3	3	1	9	Low
240	446167	1144367	2.45	Granular	No	5.79	Thick Peat	1	2	3	1	6	Low
241	446244	1144365	1.30	Granular	No	6.65	Thin Peat	1	3	3	1	9	Low
242	446157	1144377	1.00	Granular	No	11.29	Thin Peat	1	3	3	1	9	Low
243	446227	1145177	1.70	Granular	No	9.97	Thick Peat	1	2	3	1	6	Low
244	446267	1145187	0.95	Granular	No	7.98	Thin Peat	1	3	3	1	9	Low
245	446327	1145187	0.40	Granular	No	9.51	Peaty Soil	1	1	3	1	3	Negligible
246	446277	1145197	0.55	Granular	No	10.00	Thin Peat	1	3	3	1	9	Low
247	446297	1145197	1.85	Granular	No	6.61	Thick Peat	1	2	3	1	6	Low
248	446317	1145197	1.90	Granular	No	5.45	Thick Peat	1	2	3	1	6	Low
249	446337	1145197	1.85	Granular	No	6.21	Thick Peat	1	2	3	1	6	Low
250	446227	1145207	2.05	Granular	No	4.61	Thick Peat	1	2	2	1	4	Negligible
251	446237	1145207	2.20	Granular	No	8.61	Thick Peat	1	2	3	1	6	Low
252	446247	1145207	1.65	Granular	No	10.45	Thick Peat	1	2	3	1	6	Low
253	446267	1145207	1.10	Granular	No	10.61	Thin Peat	1	3	3	1	9	Low
254	446287	1145207	0.85	Granular	No	10.81	Thin Peat	1	3	3	1	9	Low
255	446307	1145207	1.50	Granular	No	6.10	Thin Peat	1	3	3	1	9	Low
256	446327	1145207	1.85	Granular	No	5.72	Thick Peat	1	2	3	1	6	Low
257	446227	1145217	1.95	Granular	No	4.01	Thick Peat	1	2	2	1	4	Negligible
258	446237	1145217	2.10	Granular	No	4.25	Thick Peat	1	2	2	1	4	Negligible
259	446247	1145217	2.30	Granular	No	7.54	Thick Peat	1	2	3	1	6	Low
260	446257	1145217	1.45	Granular	No	10.37	Thin Peat	1	3	3	1	9	Low
261	446277	1145217	0.80	Granular	No	11.84	Thin Peat	1	3	3	1	9	Low
262	446297	1145217	1.05	Granular	No	11.04	Thin Peat	1	3	3	1	9	Low
263	446317	1145217	0.60	Granular	No	7.75	Thin Peat	1	3	3	1	9	Low
264	446337	1145217	0.60	Granular	No	5.17	Thin Peat	1	3	3	1	9	Low
265	446217	1145227	2.20	Granular	No	5.13	Thick Peat	1	2	3	1	6	Low
266	446177	1144187	2.50	Granular	No	1.83	Thick Peat	1	2	0	1	0	None
267	446187	1144167	1.50	Granular	No	1.86	Thin Peat	1	3	0	1	0	None
268	446187	1144197	2.25	Granular	No	1.37	Thick Peat	1	2	0	1	0	None
269	446187	1144177	1.95	Granular	No	1.82	Thick Peat	1	2	0	1	0	None
270	446187	1144187	2.30	Granular	No	1.82	Thick Peat	1	2	0	1	0	None
271	446177	1144197	2.95	Granular	No	1.81	Thick Peat	1	2	0	1	0	None
272	446157	1144197	3.40	Granular	No	1.54	Thick Peat	1	2	0	1	0	None
273	446367	1145218	0.95	Granular	No	6.76	Thin Peat	1	3	3	1	9	Low
274	446376	1145217	1.60	Granular	No	9.74	Thick Peat	1	2	3	1	6	Low

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275	446360	1145209	1.30	Granular	No	7.42	Thin Peat	1	3	3	1	9	Low
276	446356	1145221	0.20	Granular	No	3.65	Peaty Soil	1	1	2	1	2	Negligible
277	446103	1144495	2.20	Granular	No	7.81	Thick Peat	1	2	3	1	6	Low
278	446103	1144451	1.90	Granular	No	2.51	Thick Peat	1	2	2	1	4	Negligible
279	446058	1144454	2.20	Granular	No	5.92	Thick Peat	1	2	3	1	6	Low
280	446086	1144422	1.30	Granular	No	9.28	Thin Peat	1	3	3	1	9	Low
281	446138	1144325	2.90	Granular	No	8.19	Thick Peat	1	2	3	1	6	Low
282	446140	1144299	1.15	Granular	No	5.40	Thin Peat	1	3	3	1	9	Low
283	446167	1144290	1.50	Granular	No	5.37	Thin Peat	1	3	3	1	9	Low
284	446154	1144260	2.70	Granular	No	3.09	Thick Peat	1	2	2	1	4	Negligible
285	446118	1144267	3.45	Granular	No	3.33	Thick Peat	1	2	2	1	4	Negligible
286	446077	1144371	2.10	Granular	No	4.45	Thick Peat	1	2	2	1	4	Negligible
287	446061	1144391	1.45	Granular	No	9.92	Thin Peat	1	3	3	1	9	Low
288	446035	1144362	1.65	Granular	No	7.25	Thick Peat	1	2	3	1	6	Low
289	446015	1144333	1.05	Granular	No	10.47	Thin Peat	1	3	3	1	9	Low
290	446038	1144314	2.95	Granular	No	2.99	Thick Peat	1	2	2	1	4	Negligible
291	446062	1144346	2.60	Granular	No	5.77	Thick Peat	1	2	3	1	6	Low
292	445982	1144195	1.15	Granular	No	10.04	Thin Peat	1	3	3	1	9	Low
293	445940	1144160	1.30	Granular	No	8.34	Thin Peat	1	3	3	1	9	Low
294	445883	1144168	1.75	Granular	No	13.11	Thick Peat	1	2	3	1	6	Low
295	445831	1144196	2.70	Granular	No	2.54	Thick Peat	1	2	2	1	4	Negligible
296	445805	1144258	2.40	Granular	No	3.39	Thick Peat	1	2	2	1	4	Negligible
297	445808	1144341	2.60	Granular	No	3.95	Thick Peat	1	2	2	1	4	Negligible
298	445987	1144518	1.95	Granular	No	4.03	Thick Peat	1	2	2	1	4	Negligible
299	446048	1144605	1.95	Granular	No	11.22	Thick Peat	1	2	3	1	6	Low
300	446060	1144642	1.10	Granular	No	14.84	Thin Peat	1	3	3	1	9	Low
301	446048	1144679	1.25	Granular	No	9.71	Thin Peat	1	3	3	1	9	Low
302	446069	1144692	0.95	Granular	No	11.93	Thin Peat	1	3	3	1	9	Low
303	446054	1144697	2.00	Granular	No	7.77	Thick Peat	1	2	3	1	6	Low
304	446035	1144691	1.95	Granular	No	5.91	Thick Peat	1	2	3	1	6	Low
305	446048	1144717	2.05	Granular	No	6.94	Thick Peat	1	2	3	1	6	Low
306	446067	1144732	2.15	Granular	No	8.83	Thick Peat	1	2	3	1	6	Low
307	446040	1144730	2.25	Granular	No	7.67	Thick Peat	1	2	3	1	6	Low
308	446255	1144967	1.85	Granular	No	0.80	Thick Peat	1	2	0	1	0	None
309	446296	1144972	0.80	Granular	No	2.87	Thin Peat	1	3	2	1	6	Low
310	446333	1144988	1.60	Granular	No	4.88	Thick Peat	1	2	2	1	4	Negligible
311	446319	1145024	2.25	Granular	No	4.95	Thick Peat	1	2	2	1	4	Negligible
312	446291	1145037	2.10	Granular	No	2.24	Thick Peat	1	2	2	1	4	Negligible
313	446315	1145053	2.35	Granular	No	5.65	Thick Peat	1	2	3	1	6	Low
314	446323	1145077	1.95	Granular	No	3.95	Thick Peat	1	2	2	1	4	Negligible
315	446295	1145081	1.20	Granular	No	7.59	Thin Peat	1	3	3	1	9	Low
316	446295	1145060	2.00	Granular	No	5.49	Thick Peat	1	2	3	1	6	Low
317	446277	1145066	1.80	Granular	No	6.41	Thick Peat	1	2	3	1	6	Low
318	446249	1145072	0.80	Granular	No	3.77	Thin Peat	1	3	2	1	6	Low
319	446268	1145091	1.75	Granular	No	1.51	Thick Peat	1	2	0	1	0	None
320	446282	1145089	1.95	Granular	No	5.54	Thick Peat	1	2	3	1	6	Low
321	446297	1145098	2.00	Granular	No	5.67	Thick Peat	1	2	3	1	6	Low
322	446295	1145111	2.10	Granular	No	4.74	Thick Peat	1	2	2	1	4	Negligible
323	446309	1145109	2.05	Granular	No	5.61	Thick Peat	1	2	3	1	6	Low
324	446340	1145106	1.80	Granular	No	8.67	Thick Peat	1	2	3	1	6	Low
325	446361	1145101	2.95	Granular	No	3.48	Thick Peat	1	2	2	1	4	Negligible
326	446378	1145140	2.60	Granular	No	6.11	Thick Peat	1	2	3	1	6	Low
327	446366	1145161	0.95	Granular	No	14.26	Thin Peat	1	3	3	1	9	Low
328	446370	1145188	0.95	Granular	No	12.27	Thin Peat	1	3	3	1	9	Low
329	446348	1145160	0.90	Granular	No	13.71	Thin Peat	1	3	3	1	9	Low

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330	446347	1145137	2.60	Granular	No	8.49	Thick Peat	1	2	3	1	6	Low
331	446326	1145140	2.30	Granular	No	9.93	Thick Peat	1	2	3	1	6	Low
332	446322	1145159	0.90	Granular	No	10.19	Thin Peat	1	3	3	1	9	Low
333	446310	1145176	0.40	Granular	No	7.30	Peaty Soil	1	1	3	1	3	Negligible
334	446291	1145172	1.00	Granular	No	5.81	Thin Peat	1	3	3	1	9	Low
335	446298	1145150	1.95	Granular	No	5.82	Thick Peat	1	2	3	1	6	Low
336	446256	1145137	2.00	Granular	No	7.69	Thick Peat	1	2	3	1	6	Low
337	446243	1145118	0.50	Granular	No	5.70	Peaty Soil	1	1	3	1	3	Negligible
338	446211	1145169	0.90	Granular	No	15.66	Thin Peat	1	3	2	1	6	Low
339	446195	1145146	0.75	Granular	No	15.05	Thin Peat	1	3	2	1	6	Low
340	446194	1145102	0.55	Granular	No	12.47	Thin Peat	1	3	3	1	9	Low
341	446197	1145098	1.40	Granular	No	6.70	Thin Peat	1	3	3	1	9	Low
342	446176	1145084	0.90	Granular	No	8.19	Thin Peat	1	3	3	1	9	Low
343	446191	1145072	1.60	Granular	No	4.68	Thick Peat	1	2	2	1	4	Negligible
344	446157	1145038	0.45	Granular	No	6.11	Peaty Soil	1	1	3	1	3	Negligible
345	446157	1145033	0.95	Granular	No	6.55	Thin Peat	1	3	3	1	9	Low
346	446215	1145016	1.20	Granular	No	6.34	Thin Peat	1	3	3	1	9	Low
347	446230	1145036	0.70	Granular	No	1.72	Thin Peat	1	3	0	1	0	None
348	446236	1145017	1.70	Granular	No	4.62	Thick Peat	1	2	2	1	4	Negligible
349	446256	1145017	1.90	Granular	No	2.11	Thick Peat	1	2	2	1	4	Negligible
350	446237	1144997	1.90	Granular	No	5.15	Thick Peat	1	2	3	1	6	Low
351	446261	1144994	1.65	Granular	No	5.62	Thick Peat	1	2	3	1	6	Low
352	446242	1144981	1.00	Granular	No	1.43	Thin Peat	1	3	0	1	0	None
353	446273	1144978	0.95	Granular	No	4.97	Thin Peat	1	3	2	1	6	Low
354	446283	1144960	0.90	Granular	No	4.57	Thin Peat	1	3	2	1	6	Low
355	446304	1144954	1.95	Granular	No	3.66	Thick Peat	1	2	2	1	4	Negligible
356	446326	1144952	1.95	Granular	No	8.73	Thick Peat	1	2	3	1	6	Low
357	446311	1144974	1.95	Granular	No	2.82	Thick Peat	1	2	2	1	4	Negligible
358	446327	1144970	2.25	Granular	No	3.23	Thick Peat	1	2	2	1	4	Negligible
359	446322	1144994	1.00	Granular	No	5.56	Thin Peat	1	3	3	1	9	Low
360	446339	1144969	2.30	Granular	No	6.90	Thick Peat	1	2	3	1	6	Low
361	446349	1144966	1.60	Granular	No	8.16	Thick Peat	1	2	3	1	6	Low
362	446364	1144966	1.95	Granular	No	5.34	Thick Peat	1	2	3	1	6	Low
363	446379	1144964	2.05	Granular	No	2.67	Thick Peat	1	2	2	1	4	Negligible
364	446322	1144932	0.60	Granular	No	8.76	Thin Peat	1	3	3	1	9	Low
365	446320	1144912	0.05	Granular	No	12.33	Peaty Soil	1	1	3	1	3	Negligible
366	446344	1144911	0.55	Granular	No	11.74	Thin Peat	1	3	3	1	9	Low
367	446347	1144933	0.60	Granular	No	9.59	Thin Peat	1	3	3	1	9	Low
368	446377	1144933	1.45	Granular	No	9.30	Thin Peat	1	3	3	1	9	Low
369	446407	1144949	1.05	Granular	No	8.53	Thin Peat	1	3	3	1	9	Low
370	446419	1144974	1.60	Granular	No	6.75	Thick Peat	1	2	3	1	6	Low
371	446395	1144980	1.40	Granular	No	5.66	Thin Peat	1	3	3	1	9	Low
372	446401	1145005	0.90	Granular	No	1.73	Thin Peat	1	3	0	1	0	None
373	446428	1145004	0.50	Granular	No	8.38	Peaty Soil	1	1	3	1	3	Negligible
374	446425	1145035	0.50	Granular	No	6.87	Peaty Soil	1	1	3	1	3	Negligible
375	446426	1145061	0.40	Granular	No	6.99	Peaty Soil	1	1	3	1	3	Negligible
376	446403	1145061	0.50	Granular	No	13.50	Peaty Soil	1	1	3	1	3	Negligible
377	446404	1145035	0.40	Granular	No	9.07	Peaty Soil	1	1	3	1	3	Negligible
378	446409	1145050	0.45	Granular	No	11.03	Peaty Soil	1	1	3	1	3	Negligible
379	446417	1145057	0.50	Granular	No	6.83	Peaty Soil	1	1	3	1	3	Negligible
380	446413	1145076	0.30	Granular	No	13.83	Peaty Soil	1	1	3	1	3	Negligible
381	446421	1145048	0.55	Granular	No	6.77	Thin Peat	1	3	3	1	9	Low
382	446441	1145050	0.55	Granular	No	11.97	Thin Peat	1	3	3	1	9	Low
383	446414	1145041	0.65	Granular	No	6.81	Thin Peat	1	3	3	1	9	Low
384	446385	1145047	1.85	Granular	No	5.43	Thick Peat	1	2	3	1	6	Low

ID	Easting	Northing	Peat Depth (m)	Substrate	Evidence of Instability	Slope (Degrees)	Ground Condition Coefficient	Existing Instability Coefficient	Peat Depth Coefficient	Slope Coefficient	Substrate Coefficient	Likelihood Coefficient	Likelihood of Peat Landslide
385	446415	1145021	0.95	Granular	No	2.96	Thin Peat	1	3	2	1	6	Low
386	446444	1145019	0.70	Granular	No	9.91	Thin Peat	1	3	3	1	9	Low
387	446463	1145051	0.65	Granular	No	15.70	Thin Peat	1	3	2	1	6	Low
388	446452	1145051	0.70	Granular	No	12.72	Thin Peat	1	3	3	1	9	Low
389	446430	1145050	0.85	Granular	No	6.31	Thin Peat	1	3	3	1	9	Low
390	446415	1145048	0.40	Granular	No	7.00	Peaty Soil	1	1	3	1	3	Negligible
391	446414	1145068	0.45	Granular	No	9.57	Peaty Soil	1	1	3	1	3	Negligible
392	446413	1145087	0.50	Granular	No	13.87	Peaty Soil	1	1	3	1	3	Negligible
393	446411	1145097	1.15	Granular	No	7.66	Thin Peat	1	3	3	1	9	Low
394	446397	1145048	0.65	Granular	No	14.66	Thin Peat	1	3	3	1	9	Low
395	446374	1145049	3.10	Granular	No	5.25	Thick Peat	1	2	3	1	6	Low
396	446361	1145050	2.90	Granular	No	3.12	Thick Peat	1	2	2	1	4	Negligible
397	446415	1145036	0.75	Granular	No	4.27	Thin Peat	1	3	2	1	6	Low
398	446414	1145010	0.60	Granular	No	2.13	Thin Peat	1	3	2	1	6	Low
399	446414	1144997	1.10	Granular	No	3.40	Thin Peat	1	3	2	1	6	Low
400	446385	1145022	0.55	Granular	No	12.87	Thin Peat	1	3	3	1	9	Low
401	446380	1144996	1.50	Granular	No	5.43	Thin Peat	1	3	3	1	9	Low
402	446360	1144986	1.45	Granular	No	7.81	Thin Peat	1	3	3	1	9	Low
403	446346	1145004	2.30	Granular	No	6.24	Thick Peat	1	2	3	1	6	Low
404	446299	1144991	0.60	Granular	No	4.47	Thin Peat	1	3	2	1	6	Low
405	446295	1145017	2.10	Granular	No	1.06	Thick Peat	1	2	0	1	0	None
406	446280	1144993	1.05	Granular	No	5.79	Thin Peat	1	3	3	1	9	Low
407	446221	1144980	1.70	Granular	No	7.87	Thick Peat	1	2	3	1	6	Low
408	446217	1144960	1.45	Granular	No	7.48	Thin Peat	1	3	3	1	9	Low
409	446197	1144959	1.65	Granular	No	6.09	Thick Peat	1	2	3	1	6	Low
410	446199	1144981	1.00	Granular	No	6.08	Thin Peat	1	3	3	1	9	Low
411	446175	1144979	1.90	Granular	No	6.87	Thick Peat	1	2	3	1	6	Low
412	446202	1145000	1.25	Granular	No	6.28	Thin Peat	1	3	3	1	9	Low
413	446259	1145054	1.60	Granular	No	5.73	Thick Peat	1	2	3	1	6	Low
414	446235	1145060	0.90	Granular	No	3.27	Thin Peat	1	3	2	1	6	Low
415	446262	1145162	1.50	Granular	No	6.99	Thin Peat	1	3	3	1	9	Low
416	446233	1145163	0.60	Granular	No	11.17	Thin Peat	1	3	3	1	9	Low
417	446241	1145253	1.40	Granular	No	9.11	Thin Peat	1	3	3	1	9	Low
418	446247	1145281	1.45	Granular	No	10.09	Thin Peat	1	3	3	1	9	Low
419	446291	1145381	1.85	Granular	No	6.01	Thick Peat	1	2	3	1	6	Low
420	446261	1145474	2.75	Granular	No	7.57	Thick Peat	1	2	3	1	6	Low
421	445967	1144310	1.46	Granular	No	11.87	Thin Peat	1	3	3	1	9	Low
422	445867	1144410	2.10	Granular	No	5.28	Thick Peat	1	2	3	1	6	Low
423	445967	1144410	1.00	Granular	No	0.94	Thin Peat	1	3	0	1	0	None
424	446067	1144410	1.15	Granular	No	8.67	Thin Peat	1	3	3	1	9	Low
425	446167	1144410	0.95	Granular	No	13.38	Thin Peat	1	3	3	1	9	Low
426	445967	1144510	1.43	Granular	No	6.56	Thin Peat	1	3	3	1	9	Low
427	446067	1144510	0.78	Granular	No	19.82	Thin Peat	1	3	2	1	6	Low
428	445867	1144610	2.80	Granular	No	5.21	Thick Peat	1	2	3	1	6	Low
429	445967	1144610	0.76	Granular	No	4.05	Thin Peat	1	3	2	1	6	Low
430	446067	1144610	1.07	Granular	No	15.90	Thin Peat	1	3	2	1	6	Low
431	445867	1144710	2.30	Granular	No	1.11	Thick Peat	1	2	0	1	0	None
432	445967	1144710	1.79	Granular	No	11.03	Thick Peat	1	2	3	1	6	Low
433	446067	1144710	1.77	Granular	No	8.64	Thick Peat	1	2	3	1	6	Low
434	445867	1144810	1.87	Granular	No	5.79	Thick Peat	1	2	3	1	6	Low
435	445967	1144810	1.86	Granular	No	3.27	Thick Peat	1	2	2	1	4	Negligible
436	446067	1144810	1.56	Granular	No	4.45	Thick Peat	1	2	2	1	4	Negligible
437	445867	1144910	1.37	Granular	No	5.64	Thin Peat	1	3	3	1	9	Low
438	445967	1144910	1.75	Granular	No	10.04	Thick Peat	1	2	3	1	6	Low
439	446067	1144910	1.15	Granular	No	21.12	Thin Peat	1	3	1	1	3	Negligible

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440	446167	1144910	1.88	Granular	No	5.31	Thick Peat	1	2	3	1	6	Low
441	446267	1144910	1.16	Granular	No	4.79	Thin Peat	1	3	2	1	6	Low
442	446367	1144910	0.53	Granular	No	11.87	Thin Peat	1	3	3	1	9	Low
443	445867	1145010	1.10	Granular	No	5.62	Thin Peat	1	3	3	1	9	Low
444	445967	1145010	1.47	Granular	No	4.29	Thin Peat	1	3	2	1	6	Low
445	446167	1145010	1.22	Granular	No	7.00	Thin Peat	1	3	3	1	9	Low
446	446267	1145010	1.84	Granular	No	2.67	Thick Peat	1	2	2	1	4	Negligible
447	446367	1145010	1.98	Granular	No	8.36	Thick Peat	1	2	3	1	6	Low
448	445967	1145110	1.58	Granular	No	3.56	Thick Peat	1	2	2	1	4	Negligible
449	446067	1145110	2.50	Granular	No	0.67	Thick Peat	1	2	0	1	0	None
450	446167	1145110	0.54	Granular	No	15.09	Thin Peat	1	3	2	1	6	Low
451	446267	1145110	1.06	Granular	No	2.14	Thin Peat	1	3	2	1	6	Low
452	446367	1145110	2.63	Granular	No	3.44	Thick Peat	1	2	2	1	4	Negligible
453	445967	1145210	1.62	Granular	No	8.24	Thick Peat	1	2	3	1	6	Low
454	446067	1145210	0.90	Granular	No	4.12	Thin Peat	1	3	2	1	6	Low
455	446167	1145210	1.78	Granular	No	6.75	Thick Peat	1	2	3	1	6	Low
456	446267	1145210	0.70	Granular	No	10.86	Thin Peat	1	3	3	1	9	Low
457	446367	1145210	0.65	Granular	No	5.65	Thin Peat	1	3	3	1	9	Low
458	446067	1145310	0.44	Granular	No	3.77	Peaty Soil	1	1	2	1	2	Negligible
459	446167	1145310	1.78	Granular	No	7.48	Thick Peat	1	2	3	1	6	Low
460	446267	1145310	1.05	Granular	No	7.32	Thin Peat	1	3	3	1	9	Low
461	446367	1145310	0.78	Granular	No	14.47	Thin Peat	1	3	3	1	9	Low
462	446067	1145410	0.48	Granular	No	2.62	Peaty Soil	1	1	2	1	2	Negligible
463	446167	1145410	1.66	Granular	No	2.51	Thick Peat	1	2	2	1	4	Negligible
464	446267	1145410	1.95	Granular	No	5.53	Thick Peat	1	2	3	1	6	Low
465	446067	1145510	0.97	Granular	No	7.76	Thin Peat	1	3	3	1	9	Low
466	446167	1145510	1.68	Granular	No	2.62	Thick Peat	1	2	2	1	4	Negligible
467	446267	1145510	2.47	Granular	No	3.72	Thick Peat	1	2	2	1	4	Negligible
468	446367	1145510	3.00	Granular	No	8.62	Thick Peat	1	2	3	1	6	Low
469	446067	1145610	1.03	Granular	No	8.58	Thin Peat	1	3	3	1	9	Low
470	446167	1145610	1.49	Granular	No	11.59	Thin Peat	1	3	3	1	9	Low
471	446267	1145610	0.49	Granular	No	10.21	Peaty Soil	1	1	3	1	3	Negligible
472	446367	1145610	0.62	Granular	No	13.55	Thin Peat	1	3	3	1	9	Low
473	446167	1145710	0.86	Granular	No	13.12	Thin Peat	1	3	3	1	9	Low
474	446267	1145710	0.95	Granular	No	9.70	Thin Peat	1	3	3	1	9	Low
475	446367	1145710	0.75	Granular	No	8.37	Thin Peat	1	3	3	1	9	Low
476	446267	1145810	1.83	Granular	No	2.45	Thick Peat	1	2	2	1	4	Negligible
477	446025	1144623	0.70	Granular	No	5.83	Thin Peat	1	3	3	1	9	Low
478	446028	1144609	0.75	Granular	No	0.63	Thin Peat	1	3	0	1	0	None
479	446027	1144601	1.40	Granular	No	0.49	Thin Peat	1	3	0	1	0	None
480	446028	1144592	1.40	Granular	No	0.72	Thin Peat	1	3	0	1	0	None
481	446029	1144582	1.20	Granular	No	1.25	Thin Peat	1	3	0	1	0	None
482	446021	1144629	0.70	Granular	No	5.62	Thin Peat	1	3	3	1	9	Low
483	446010	1144628	0.60	Granular	No	6.32	Thin Peat	1	3	3	1	9	Low
484	445999	1144633	1.00	Granular	No	7.59	Thin Peat	1	3	3	1	9	Low
485	445988	1144633	1.40	Granular	No	8.69	Thin Peat	1	3	3	1	9	Low
486	446032	1144632	1.00	Granular	No	4.60	Thin Peat	1	3	2	1	6	Low
487	446034	1144641	1.00	Granular	No	5.04	Thin Peat	1	3	3	1	9	Low
488	446033	1144651	0.90	Granular	No	6.71	Thin Peat	1	3	3	1	9	Low
489	446034	1144666	1.25	Granular	No	7.69	Thin Peat	1	3	3	1	9	Low
490	446035	1144678	1.75	Granular	No	11.81	Thick Peat	1	2	3	1	6	Low
491	446041	1144625	1.40	Granular	No	6.80	Thin Peat	1	3	3	1	9	Low
492	446050	1144623	1.30	Granular	No	12.12	Thin Peat	1	3	3	1	9	Low
493	446061	1144619	0.92	Granular	No	15.42	Thin Peat	1	3	2	1	6	Low
494	446071	1144622	1.23	Granular	No	15.21	Thin Peat	1	3	2	1	6	Low

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495	446079	1144624	0.94	Granular	No	15.55	Thin Peat	1	3	2	1	6	Low
496	446008	1144624	0.73	Granular	No	6.31	Thin Peat	1	3	3	1	9	Low
497	446001	1144614	1.35	Granular	No	6.01	Thin Peat	1	3	3	1	9	Low
498	446005	1144602	1.30	Granular	No	5.31	Thin Peat	1	3	3	1	9	Low
499	446002	1144590	1.50	Granular	No	5.17	Thin Peat	1	3	3	1	9	Low
500	446011	1144581	1.40	Granular	No	4.74	Thin Peat	1	3	2	1	6	Low
501	446007	1144566	1.20	Granular	No	5.53	Thin Peat	1	3	3	1	9	Low
502	446003	1144553	1.16	Granular	No	6.08	Thin Peat	1	3	3	1	9	Low
503	446001	1144538	1.08	Granular	No	2.51	Thin Peat	1	3	2	1	6	Low
504	446028	1144539	1.05	Granular	No	3.40	Thin Peat	1	3	2	1	6	Low
505	446017	1144524	0.39	Granular	No	5.72	Peaty Soil	1	1	3	1	3	Negligible
506	446029	1144552	2.18	Granular	No	1.20	Thick Peat	1	2	0	1	0	None
507	446035	1144566	1.50	Granular	No	3.89	Thin Peat	1	3	2	1	6	Low
508	446037	1144582	1.35	Granular	No	8.06	Thin Peat	1	3	3	1	9	Low
509	446052	1144545	1.05	Granular	No	15.73	Thin Peat	1	3	2	1	6	Low
510	446052	1144561	1.35	Granular	No	12.00	Thin Peat	1	3	3	1	9	Low
511	446047	1144574	1.58	Granular	No	11.01	Thick Peat	1	2	3	1	6	Low
512	445972	1144589	1.90	Granular	No	5.03	Thick Peat	1	2	3	1	6	Low
513	445964	1144569	1.43	Granular	No	4.47	Thin Peat	1	3	2	1	6	Low
514	445969	1144544	1.29	Granular	No	5.33	Thin Peat	1	3	3	1	9	Low
515	445987	1144548	1.08	Granular	No	5.24	Thin Peat	1	3	3	1	9	Low
516	445988	1144573	0.92	Granular	No	4.36	Thin Peat	1	3	2	1	6	Low
517	445987	1144596	1.85	Granular	No	5.69	Thick Peat	1	2	3	1	6	Low
518	445990	1144616	1.70	Granular	No	6.82	Thick Peat	1	2	3	1	6	Low
519	446199	1145789	0.73	Granular	No	20.27	Thin Peat	1	3	1	1	3	Negligible
520	446310	1145152	1.80	Granular	No	6.67	Thick Peat	1	2	3	1	6	Low
521	446282	1145173	0.84	Granular	No	5.78	Thin Peat	1	3	3	1	9	Low
522	446291	1145181	0.74	Granular	No	5.46	Thin Peat	1	3	3	1	9	Low
523	446297	1145188	1.05	Granular	No	4.66	Thin Peat	1	3	2	1	6	Low
524	446274	1145152	1.30	Granular	No	4.23	Thin Peat	1	3	2	1	6	Low
525	446267	1145178	0.72	Granular	No	8.15	Thin Peat	1	3	3	1	9	Low
526	446259	1145190	0.86	Granular	No	7.26	Thin Peat	1	3	3	1	9	Low
527	446281	1145115	1.16	Granular	No	3.72	Thin Peat	1	3	2	1	6	Low
528	446293	1145105	1.43	Granular	No	2.76	Thin Peat	1	3	2	1	6	Low
529	446305	1145099	1.27	Granular	No	9.71	Thin Peat	1	3	3	1	9	Low
530	446310	1145120	1.38	Granular	No	5.75	Thin Peat	1	3	3	1	9	Low
531	446274	1145124	1.33	Granular	No	5.24	Thin Peat	1	3	3	1	9	Low
532	446290	1145133	2.20	Granular	No	4.31	Thick Peat	1	2	2	1	4	Negligible
533	446314	1145133	2.01	Granular	No	6.49	Thick Peat	1	2	3	1	6	Low
534	446278	1145139	2.10	Granular	No	4.83	Thick Peat	1	2	2	1	4	Negligible
535	446222	1145527	1.60	Granular	No	9.51	Thick Peat	1	2	3	1	6	Low
536	446219	1145494	1.10	Granular	No	4.35	Thin Peat	1	3	2	1	6	Low
537	446217	1145468	1.70	Granular	No	6.61	Thick Peat	1	2	3	1	6	Low
538	446224	1145437	2.90	Granular	No	4.81	Thick Peat	1	2	2	1	4	Negligible
539	446240	1145410	1.80	Granular	No	4.97	Thick Peat	1	2	2	1	4	Negligible
540	446258	1145381	1.80	Granular	No	6.15	Thick Peat	1	2	3	1	6	Low
541	446271	1145346	1.35	Granular	No	11.88	Thin Peat	1	3	3	1	9	Low
542	446259	1145268	1.80	Granular	No	7.41	Thick Peat	1	2	3	1	6	Low
543	446250	1145224	2.15	Granular	No	4.89	Thick Peat	1	2	2	1	4	Negligible
544	446252	1145176	0.90	Granular	No	7.40	Thin Peat	1	3	3	1	9	Low
545	446336	1145124	1.40	Granular	No	8.52	Thin Peat	1	3	3	1	9	Low
546	446357	1145117	1.45	Granular	No	5.02	Thin Peat	1	3	3	1	9	Low
547	446323	1145107	1.60	Granular	No	7.78	Thick Peat	1	2	3	1	6	Low
548	446272	1145073	1.50	Granular	No	6.30	Thin Peat	1	3	3	1	9	Low
549	446250	1145037	1.45	Granular	No	0.83	Thin Peat	1	3	0	1	0	None

ID	Easting	Northing	Peat Depth (m)	Substrate	Evidence of Instability	Slope (Degrees)	Ground Condition Coefficient	Existing Instability Coefficient	Peat Depth Coefficient	Slope Coefficient	Substrate Coefficient	Likelihood Coefficient	Likelihood of Peat Landslide
550	446217	1144995	1.10	Granular	No	5.71	Thin Peat	1	3	3	1	9	Low
551	446176	1144957	1.70	Granular	No	2.60	Thick Peat	1	2	2	1	4	Negligible
552	446128	1144924	1.70	Granular	No	7.14	Thick Peat	1	2	3	1	6	Low
553	446114	1144872	2.00	Granular	No	7.52	Thick Peat	1	2	3	1	6	Low
554	446101	1144833	0.30	Granular	No	2.95	Peaty Soil	1	1	2	1	2	Negligible
555	446046	1144768	0.70	Granular	No	3.76	Thin Peat	1	3	2	1	6	Low
556	446025	1144726	2.45	Granular	No	4.41	Thick Peat	1	2	2	1	4	Negligible
557	446017	1144690	1.75	Granular	No	9.47	Thick Peat	1	2	3	1	6	Low
558	446003	1144667	1.85	Granular	No	6.95	Thick Peat	1	2	3	1	6	Low
559	446001	1144645	1.40	Granular	No	7.53	Thin Peat	1	3	3	1	9	Low
560	446013	1144642	0.95	Granular	No	8.49	Thin Peat	1	3	3	1	9	Low
561	446018	1144660	1.70	Granular	No	6.84	Thick Peat	1	2	3	1	6	Low
562	446049	1144658	1.25	Granular	No	13.08	Thin Peat	1	3	3	1	9	Low
563	446048	1144637	1.70	Granular	No	11.82	Thick Peat	1	2	3	1	6	Low
564	446037	1144607	0.70	Granular	No	6.37	Thin Peat	1	3	3	1	9	Low
565	446041	1144588	1.90	Granular	No	10.56	Thick Peat	1	2	3	1	6	Low
566	446254	1145242	2.00	Granular	No	8.91	Thick Peat	1	2	3	1	6	Low
567	446256	1145256	1.95	Granular	No	8.91	Thick Peat	1	2	3	1	6	Low
568	446267	1145280	1.70	Granular	No	8.73	Thick Peat	1	2	3	1	6	Low
569	446281	1145308	1.65	Granular	No	7.91	Thick Peat	1	2	3	1	6	Low
570	446296	1145331	2.00	Granular	No	7.94	Thick Peat	1	2	3	1	6	Low
571	446303	1145360	1.75	Granular	No	7.29	Thick Peat	1	2	3	1	6	Low
572	446310	1145388	2.20	Granular	No	6.01	Thick Peat	1	2	3	1	6	Low
573	446304	1145417	2.25	Granular	No	5.86	Thick Peat	1	2	3	1	6	Low
574	446300	1145439	2.10	Granular	No	6.53	Thick Peat	1	2	3	1	6	Low
575	446292	1145460	1.55	Granular	No	4.65	Thick Peat	1	2	2	1	4	Negligible
576	446287	1145483	1.45	Granular	No	4.65	Thin Peat	1	3	2	1	6	Low
577	446284	1145508	2.30	Granular	No	6.02	Thick Peat	1	2	3	1	6	Low
578	446275	1145531	1.00	Granular	No	2.05	Thin Peat	1	3	2	1	6	Low
579	446266	1145546	0.05	Granular	No	5.71	Peaty Soil	1	1	3	1	3	Negligible
580	446283	1145765	0.70	Granular	No	14.22	Thin Peat	1	3	3	1	9	Low
581	446329	1145763	1.60	Granular	No	9.41	Thick Peat	1	2	3	1	6	Low
582	446379	1145762	0.60	Granular	No	9.71	Thin Peat	1	3	3	1	9	Low
583	446428	1145764	0.70	Granular	No	14.10	Thin Peat	1	3	3	1	9	Low
584	446484	1145664	0.50	Granular	No	11.97	Peaty Soil	1	1	3	1	3	Negligible
585	446475	1145759	0.90	Granular	No	16.25	Thin Peat	1	3	2	1	6	Low
586	446428	1145810	0.10	Granular	No	9.38	Peaty Soil	1	1	3	1	3	Negligible
587	446381	1145821	1.90	Granular	No	5.44	Thick Peat	1	2	3	1	6	Low
588	446360	1145790	1.10	Granular	No	5.81	Thin Peat	1	3	3	1	9	Low
589	446349	1145791	0.40	Granular	No	6.18	Peaty Soil	1	1	3	1	3	Negligible
590	446339	1145791	0.90	Granular	No	9.79	Thin Peat	1	3	3	1	9	Low
591	446328	1145790	1.10	Granular	No	10.00	Thin Peat	1	3	3	1	9	Low
592	446317	1145790	0.50	Granular	No	6.65	Peaty Soil	1	1	3	1	3	Negligible
593	446310	1145792	0.50	Granular	No	6.60	Peaty Soil	1	1	3	1	3	Negligible
594	446298	1145792	1.10	Granular	No	6.52	Thin Peat	1	3	3	1	9	Low
595	446288	1145789	1.10	Granular	No	6.17	Thin Peat	1	3	3	1	9	Low
596	446281	1145791	1.10	Granular	No	5.97	Thin Peat	1	3	3	1	9	Low
597	446280	1145803	1.10	Granular	No	9.10	Thin Peat	1	3	3	1	9	Low
598	446291	1145799	1.10	Granular	No	6.38	Thin Peat	1	3	3	1	9	Low
599	446301	1145802	2.20	Granular	No	6.63	Thick Peat	1	2	3	1	6	Low
600	446310	1145801	1.70	Granular	No	7.13	Thick Peat	1	2	3	1	6	Low
601	446322	1145800	1.10	Granular	No	8.34	Thin Peat	1	3	3	1	9	Low
602	446330	1145803	1.40	Granular	No	8.59	Thin Peat	1	3	3	1	9	Low
603	446341	1145802	1.60	Granular	No	12.10	Thick Peat	1	2	3	1	6	Low
604	446351	1145799	0.10	Granular	No	7.16	Peaty Soil	1	1	3	1	3	Negligible

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605	446361	1145800	0.20	Granular	No	8.77	Peaty Soil	1	1	3	1	3	Negligible
606	446361	1145811	0.10	Granular	No	10.16	Peaty Soil	1	1	3	1	3	Negligible
607	446350	1145810	2.00	Granular	No	12.34	Thick Peat	1	2	3	1	6	Low
608	446338	1145809	2.00	Granular	No	9.22	Thick Peat	1	2	3	1	6	Low
609	446329	1145811	1.90	Granular	No	9.92	Thick Peat	1	2	3	1	6	Low
610	446318	1145810	0.00	Granular	No	8.79	No Peat	1	0	3	1	0	None
611	446308	1145810	0.50	Granular	No	9.03	Peaty Soil	1	1	3	1	3	Negligible
612	446298	1145811	1.90	Granular	No	7.05	Thick Peat	1	2	3	1	6	Low
613	446291	1145811	0.90	Granular	No	8.73	Thin Peat	1	3	3	1	9	Low
614	446300	1145820	0.90	Granular	No	11.00	Thin Peat	1	3	3	1	9	Low
615	446311	1145820	1.20	Granular	No	12.19	Thin Peat	1	3	3	1	9	Low
616	446311	1145819	1.20	Granular	No	12.19	Thin Peat	1	3	3	1	9	Low
617	446320	1145821	1.90	Granular	No	9.08	Thick Peat	1	2	3	1	6	Low
618	446330	1145819	1.90	Granular	No	8.12	Thick Peat	1	2	3	1	6	Low
619	446340	1145820	1.90	Granular	No	8.30	Thick Peat	1	2	3	1	6	Low
620	446351	1145822	2.00	Granular	No	9.77	Thick Peat	1	2	3	1	6	Low
621	446357	1145820	0.10	Granular	No	10.07	Peaty Soil	1	1	3	1	3	Negligible
622	446350	1145831	2.00	Granular	No	6.14	Thick Peat	1	2	3	1	6	Low
623	446338	1145831	1.50	Granular	No	5.96	Thin Peat	1	3	3	1	9	Low
624	446329	1145829	1.90	Granular	No	7.18	Thick Peat	1	2	3	1	6	Low
625	446318	1145831	1.70	Granular	No	9.27	Thick Peat	1	2	3	1	6	Low
626	446309	1145831	1.50	Granular	No	9.56	Thin Peat	1	3	3	1	9	Low
627	446331	1145842	1.50	Granular	No	9.44	Thin Peat	1	3	3	1	9	Low
628	446341	1145838	1.00	Granular	No	5.59	Thin Peat	1	3	3	1	9	Low

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