

APPENDIX 10 HYDROLOGY, HYDROGEOLOGY, GEOLOGY AND PEAT

Appendix 10-1: Peat Slide Risk Assessment

Executive Summary

This document describes the results of a peat slide risk assessment undertaken for Garn Fach wind farm. There are two broad groups of peat landslide that have been reported consisting of peat slides and bog bursts. The risk of peat instability has been assessed for 71 sub-areas within the proposed site boundary. A Phase 2 peat survey was undertaken at the site covering all locations of proposed infrastructure (including tracks and turbine foundations). 79% of the recorded peat depths were <0.5m thick, with only 1.5% recording peat depths exceeding 1.0m in thickness.

There are many different interconnected ground conditions which affect peat stability. The guidance in section 8 of this report has been developed in order to maintain the current interconnected relationships and ground conditions to prevent the destabilisation of peat slopes.

Following this assessment it was concluded with the adoption of appropriate construction best practices and mitigation measures as specified in in this report, 4 sub-areas are at low risk, and 67 sub-areas are at negligible risk. While it is not possible to completely rule out the possibility of a peat slide occurring on site, through the implementation of the measures and practices, the risk of peat instability occurring can be kept within acceptable levels

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1 Introduction

1.1 Scope

Wallingford HydroSolutions Ltd (WHS) has been commissioned by Dulas Ltd to complete a Peat Slide Risk Assessment (PSRA). This PSRA is an appendix to an Environmental Statement (ES) to accompany a planning application for a proposed 17 turbine windfarm to the south of Newtown, Powys NGR: SO 03413 81467 and covers an area of approximately 700ha.

This report provides a review and assessment of the peat landslide risk on the proposed development site and presents mitigation scenarios to minimise the risk of inducing peat instability. In summary this PSRA collates and analyses peat instability through:

- A desk-based review of, the presence of peat, historical and current evidence of instability, slope gradients, site hydrology and land-use.
- Site survey including peat depth probing, gouge auger samples including Von Post humification classification and any visual evidence of instability.

1.2 Sources of Information

This PSRA uses a range of data sources including:

- LiDAR data¹
- The British Geological Survey (BGS) GeoIndex dataset²
- Copernicus CORINE Land Cover 1990 to 2018 datasets³
- Proposed Electricity Generation Developments: Peat Landslide Hazard Best Practice Guide (Scottish Government, 2017)⁴
- Countryside Council for Wales (CCW) Guidance Note: Assessing the Impact of Windfarm Development on Peatlands in Wales (CCW, 2010)⁵
- Guidelines for the Risk Management of Peat Slips on the Construction of Low Volume/Low Cost Roads over Peat (Forestry Commission Scotland, 2006)⁶
- Site survey conducted by WHS between 18/05/2020 – 21/05/2020, 09/11/2020 – 13/11/2020 and 08/03/2021 – 10/03/2021
- Proposed development plans

1.3 Site Description

The proposed development site covers an area of approximately 700ha located approximately 10km south west of Newtown, Powys, (NGR: SO 03413 81467). The site area is characterised by peat land, rough grasslands, and isolated areas of coniferous forest. The site would include the following main components spread over three site areas (Northern, Central, and Southern) which are also shown in Appendix 5.

- 17 turbines with external transformers and related switchgear at each turbine.
- Associated turbine foundations and hardstanding areas.
- A site access route with any necessary road improvement works.
- A substation compound which will be used as a borrow pit initially.
- Two temporary site construction compounds, with the northern area used as a borrow pit initially.
- Two on-site borrow pit areas.
- A network of on-site buried electrical cables.
- An energy storage facility.
- Approximately 13.5 km of on-site tracks, including 9.79 km of new tracks and 3.66 km of upgraded existing tracks.

1.4 Objectives

The main objective of this report is to assess the potential stability of peat slopes on site, identifying any areas of concern and identifying mitigation methods to ensure peat stability before, during and after construction. All aspects of the construction will be planned as to ensure minimal disruption to peat areas on site.

The objectives have been achieved through the completion of.

- A desk study of geological, hydrological and topographical information.
- Geomorphological mapping of features identified that affect the risk of peat instability.
- Reporting on any evidence of instability identified in the desk study or walkover survey.
- Identification of any control measures needed for works to minimise the risk of peat instability.
- Peat probing undertaken between 18/05/2020 – 21/05/2020, 09/11/2020 – 13/11/2020 and 08/03/2021 – 10/03/2021.

The construction of a wind farm can increase the risk of peat instability if good geotechnical practice is ignored. It is required that wind farm developments follow a Construction Environmental Management Plan (CEMP), which incorporates the recommendations in the PSRA. The guidance contained within a Construction Method Statement of CEMP will outline how the construction of the wind farm can be conducted without increasing the risk of instability.

The risk assessment for this site has been developed through ground models using a Geographical Information System (GIS) for the site. A numerical analysis was undertaken in which coefficients were allocated for the factors determined to have the greatest influence on peat stability and the adverse consequences of peat slope failure.

The layout of the site infrastructure has been informed by findings from the peat probing to optimise the layout to avoid areas of deep peat.

The methodology for this assessment was developed in accordance with the guidelines on PSRA by the Scottish Government⁴ for the investigation, assessment, and reporting for wind farms in peat areas.

1.5 Background

In Wales peatlands are prevalent in upland areas above 300 mAOD⁵. Windfarms tend to be constructed in upland areas, which are associated with significant peat deposits. Following the peat slides during the construction of the Derrybrien Wind Farm in Ireland in 2003 there has been increasing focus on the impact of windfarms on peat stability⁴. There is potential for peat instability to occur at any location with significant peat deposits, particularly where they exceed 1m in thickness. Peat instability is influenced by a range of factors including but not limited to; peat thickness, slope gradient, underlying geology, and subsurface hydrology.

Peat deposits occur through the accumulation of partially decomposed plant remains. These deposits occur where plant remains become waterlogged and as such limit the degree of decomposition. As a result the partially decomposed material becomes part of the underlying material.

Characteristically peat generally has a low density, high moisture content, high compressibility, and low shear strength. All of these characteristics are related to the degree of decomposition of the peat material.

There are two main types of peat bog which are prevalent on the west coast of Europe, raised bog and blanket bog. In Wales the dominant peatland is blanket bog, which occurs on gentle slopes of upland plateaux, ridges, and benches⁵. These are predominantly supplied with water through precipitation. Blanket peat is generally considered to be hydrologically disconnected from the underlying mineral layer.

¹ NRW LiDAR Composite Dataset (2021), <https://lle.gov.wales/catalogue/item/LidarCompositeDataset/?lang=en>

² BGS GeoIndex WMS (2021), <https://www.bgs.ac.uk/technologies/web-map-services-wms/geoindex-wms-services/>

³ Copernicus CORINE Land Cover (2021), <https://land.copernicus.eu/pan-european/corine-land-cover>

⁴ Energy Consents Unit Scottish Government (April 2017) Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Developments. Second Edition.

⁵ Countryside Council for Wales (January 2010), CCW Guidance Note: Assessing the impact of windfarm developments on peatlands in Wales.

⁶ Frank MacCulloch (January 2006), Guidelines for the Risk Management of Peat Slips on the Construction of Low Volume/Low Cost Roads over Peat.

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

The degree of decomposition (humification) can be estimated in the field by the application of the 'squeezing test' proposed by Von Post and Gurnland⁷. The humification value ranges between H1 (no decomposition) and H10 (highly decomposed).

For mineral soils such as clays and sands the undrained shear strength is given by an inter-particle friction value and cohesion value. For peat soils where there is likely to be little or no mineral component these definitions of undrained shear strength do not strictly apply⁸. Since there is currently no agreed alternative method to define the undrained shear strength of peat, this method is generally adopted with the knowledge that it should be used with caution.

Within the acrotelm the roots and fibres of lowly decomposed material provide significant tensile shear strength to the material. In the catotelm this tensile shear strength is reduced by the increased level of decomposition of the material. Due to the lack of discrete particles to give significant frictional resistance the strength of peat should be quoted as a cohesion value.

There are two broad groups of peat landslide that have been reported consisting of peat slides and bog bursts⁴. A peat slide is generally described as a slab-like shallow translational failure occurring within a discrete shear plane at the peat-substrate interface, below this interface or more rarely within the peat body. These tend to occur in shallow peat (below 2.0m) and on moderate slopes (5° to 15°)⁹. Bog bursts describe fluid failures involving the rupture of the peat blanket surface, due to subsurface creep or swelling. They are characterised by pear shaped areas of disturbed blanket bog, with little substrate revealed and without necessarily a clear scarring to the surface. These tend to occur in deeper peat (above 1.5m) and on shallow slopes (2° to 10°)⁹.

2 Desk Study Review

2.1 Topography

A review of the NRW 2m DTM LiDAR data¹ found that the majority of the site is comprised of gently sloping terrain (flat to <5°), with isolated steep slopes (>15°) reaching a maximum of 26.4°. The elevations on site range between 370mAOD and 520mAOD. A topographical map of the site can be seen in Appendix 6.

Table 1 - Site Area Topography

Site Area	Average Slope (Degrees)	Maximum Slope (Degrees)	Minimum Elevation (mAOD)	Average Elevation (mAOD)	Minimum Elevation (mAOD)
Northern	5.7	18.5	414.7	487.8	519.7
Central	6.7	25.6	380.9	452.8	502.0
Southern	8.0	26.4	369.7	447.0	483.1

2.2 Superficial Deposits

A review of the BGS 1:50k Superficial deposit GeoIndex dataset² indicates that superficial deposits have not been recorded for the majority of the site area. The majority of deposits that have been recorded consist of Devensian till comprised of glacial tills, consisting of diamicton, an unsorted sediment with gravel in a fine mud matrix. There are smaller deposits of alluvium, a variable sediment of mud, sand and gravel with some

peat in places. Alluvium fan is present, which are, sedimentary deposits of fluvial origin consisting of sand and gravel and head, consisting of diamicton, a sedimentary deposit comprising of coarse to fine grained materials formed from solifluction and gelifluction processes. On the southern boundary of the southern area, superficial deposits of peat have been recorded. A review of the Soilscales online map viewer shows that the site is overlain by acidic soils, with the majority having a peaty surface.

The BGS mapping of the superficial geology indicates that the deposits on site are heterogenous in nature, with the majority of the known deposit being formed from glacial tills which are highly variable in nature, and can contain peat in places. This combined with the acidic soils found in the Soilscales dataset indicate that the presence of peat onsite is likely. A map of superficial deposits can be seen in Appendix 7.

2.3 Bedrock Geology

A review of BGS 1:50k Bedrock GeoIndex dataset² indicates that the site is underlain by sedimentary bedrocks comprising of sandstone, mudstone and siltstone. The BGS 1:50k Linear features GeoIndex dataset² has no recorded evidence of any faults onsite. The BGS 1:50k mass movement GeoIndex dataset² has no recorded landslide deposits. A map of the bedrock geology can be seen in Appendix 8.

2.4 Land Use

The Copernicus CLC2018 dataset³ indicates that the southern area of the site consists of natural grasslands. The majority of the central area consists of natural grasslands, with moors and heathland in the south west of the area, and pastures in the north. The majority of the northern area consists of moors and heathland in the west, pastures in the south east, and natural grasslands in the north east.

The Copernicus CHA datasets³ indicate that there has been little historic change in use within the site area, with only changes in the type of woodland seen at the borders of the site. The current and historical land use on site does not consist of land uses which have potentially detrimental effects on peat stability.

2.5 Hydrology

From a combination of aerial photography and OS mapping, the site has multiple small watercourses running through it. In the northern area these flow eastward into the Blue Lins brook. In the central area most of the watercourses drain eastward into the Custogion and Llaithddy brook, a small number of these watercourses drain westward into the Afon Marteg as do the watercourses found in the southern area. No evidence of artificial drainage features was found within the review of historical mapping, aerial photography or site walkover. A map of geomorphological features including watercourses is included in Appendix 9.

2.6 Hydrogeology

The BGS 1:625k Hydrogeology GeoIndex dataset² indicates that the site is underlain by low productivity aquifers, with limited groundwater. The bedrock has little potential for the storage and transport of water except within cracks and joints. From the walkover survey and peat depth probing, varying thicknesses of peat can be found on the site. These typically have a high-water content ranging between 500% and 2500% of the dry density of the peat.

The hydraulic conductivity of peat is highly variable, but generally conductivity is found to decrease with increasing levels of peat humification and depth. The conductivity is also known to decrease where the water table falls. In contrast to this, peat pipes where present, indicate significant concentrations of hydraulic flows within the peat deposit. Their collapse can lead to significant surface flows. No evidence of peat pipes were found within the review of aerial photography of the site or during the site surveys.

During the peat survey work, peat deposits were found to generally be underlain by clay deposits. This in combination with the low permeability of the bedrock layer, the lack of peat pipes, and high humification level of peat deposits found on-site suggest that the hydraulic conductivity of the peat on-site is low.

⁷ Von Post, L. (1924) Das Genetische System der Organogenen Bildungen Schwedens, *Comite internat. D. Pedologie IV. Communication*, 22.

⁸ Evans, M.G. and Warburton, J. (2007) *Geomorphology of Upland Peat: Erosion Form and Landscape Change*. Blackwell Publishers Limited, Oxford.

⁹ Dykes, A.P. and Warbuton, J. (2007) Mass movements in peat: a formal classification scheme. *Geomorphology*, 86, pp73-93.

3 Peat Survey

Peat depth surveys were undertaken by WHS in two phases. The phase 1 survey was undertaken between 18th May 2020 and 21st May 2020. 697 points were surveyed over the whole site boundary forming a 100m spaced points grid of peat depths. This included 477 peat depth probes and 220 auger samples, 86% (601) of the recorded peat depths were <0.5m thick, with only 2% (14) of the recorded peat depths exceeding 1.0m. It should be noted that 83% (182) of the auger samples found no peat, 9% (20) samples found completely decomposed peat (H10).

The phase 2 survey was undertaken in two site visits between the 9th November 2020 and 13th November 2020 and between the 8th March 2021 and 10th March 2021. 4,225 points were surveyed forming a 10m spaced points grid of peat depths within a 50m radius of the turbine locations, for the tracks, points were sampled every 50m at the track centreline and 10m either side of the centre line. This included 2,986 peat depth probes and 1,239 auger samples, 79% (3,354) of the recorded peat depths were <0.5m thick, with only 1.5% (62) recorded peat depths exceeding 1.0m in thickness. It should be noted that 80% (989) of the auger samples found no peat.

The peat depth results for the whole site can be seen in Appendix 10.

3.1 Methodology

The thickness of peat was measured using a combination of depth probes, performed with an avalanche probe and hand auger samples. For the depth probes, the avalanche probe was pushed vertically into the soil until refusal and the depth recorded, in combination with a unique location number. The location of these sample points was established with the use of a GPS enabled smartphone. For the auger samples, 10cm deep samples were taken until refusal. The depth of soil and general soil classification (i.e. peat, clay or non-peat) was recorded, where both peat and clay were present the depth of both was recorded. In addition to this where peat was present the degree of humification was recorded using the Von Post Scale.

3.2 Auger Sample Results

As shown in Table 2, where peat deposits are found on site they are generally moderately to completely humified or a mixture of peat and mineral soils. Where a mixture of peat and mineral soils are present there is likely to be an increase in the shear strength when compared to the highly humified peat deposits, which are likely to have a low shear strength with no fibres present to provide additional shear resistance.

Table 2 - Auger Sample Peat Classifications

Peat Classification	Number of Samples	Percentage (%)
H1	1	0.5
H3	6	2.8
H4	4	1.9
H5	37	17.2
H6	28	13.0
H7	35	16.3
H8	14	6.5
H9	12	5.6
H10	41	19.1
Peat mineral soil mixture	37	17.2

4 Peat Stability Risk Assessment

The stability of a slope is dependent on the ability of the soil to resist the forces acting on it. The force that the soil can resist is dependent on the undrained shear strength of the soil, whilst the disturbing forces are dependent on the weight of soil acting on it, the effects of groundwater and other disturbing forces.

The level of stability of a slope is normally ascertained by reference to the factor of safety (FoS), which provides a degree of confidence in the stability of the slope, for the given conditions against a particular failure mechanism occurring. It is normally expressed as a ratio of the load which would cause failure and the actual loading.

4.1 Factor of Safety Calculation

Peat landslides most frequently occur through a translational failure mechanism and as such the infinite slope model has been identified as providing the most informative results for the assessment of the FoS for peat slopes. The infinite slope model assumes a planar translational failure, with a shear surface parallel to the ground surface. A FoS greater than 1.0 would indicate that a slope should remain stable. BS6031:2009 states that for a 'first time failure' with a good standard of site investigation, the design factor of safety FoS should be 1.3 to 1.4¹⁰.

To assess the likelihood of slope failure occurring the FoS was analysed for each of the phase 1 peat depth survey points using the following equation¹¹:

$$F = \frac{Cu}{\gamma z \sin \beta \cos \beta}$$

Eq. 1

Where *F* is the FoS, *Cu* is the undrained shear strength of peat (kPa), *γ* is the bulk weight of peat (kN/m³), *z* is the depth of peat (m), and *β* is the angle of the sliding plane (deg). This equation conservatively assumes that the water table is at the surface, during these conditions the shear stress acting on the slope will be at its greatest and is likely to occur during periods of prolonged rainfall.

4.2 Peat Characteristic Properties

As discussed in section 1.5 the characteristic property values of peat are difficult to ascertain with certainty. In particular, deriving the shear strength parameters using conventional laboratory and in-situ testing methods has been identified as problematic. A review of relevant literature has indicated that undrained shear strength values typically range from¹² 3.0 kPa to 15.0 kPa, however back analysis of the peat at the Derrybrien

¹⁰ British Standards Institution (2009), Code of practice for earthworks, BS6031:2009, <https://geotechnicaldesign.info/download/bs6031-2009.pdf>

¹¹ Barnes, G. (2010) Soil Mechanics: Principles and Practice, Palgrave Macmillan.

¹² Kazemian, S. et al (April 2011), A state of art review of peat: Geotechnical engineering perspective, *International Journal of the Physical Sciences Vol. 6(8)*, pp1974 – 1981.

site calculated that the undrained shear strength of peat had a value of 2.5 kPa¹³. As such for this assessment the undrained shear strength of peat has been conservatively assumed to be 2.0 kPa. From the literature review typical values for the bulk weight of peat range from¹² 8.0 kN/m² to 12.0 kN/m², as such the bulk weight of peat has been conservatively assumed as 12.0 kN/m².

4.3 Slope Gradients

The slope gradients were assessed using the topographic data, which was used to create a gradient map of the site. From this the gradient at each probe location could be determined for the calculation of the FoS. The slope gradients for the probe locations ranged between 0.5° to 22.9°. The slope gradients found on site can be seen in Appendix 11.

4.4 Likelihood Rating

The likelihood of failure was assessed with the use of FoS calculated for each probe value, enabling areas of potential concern to be highlighted. In line with the guidance discussed in section 4.1 the likelihood ratings were applied as specified in Table 3. The table includes the number of locations in each category from the phase 1 probe locations.

The FoS calculation for each phase 1 probe location is included in Appendix 1 and map of likelihood can be seen in Appendix 12.

Table 3 - FoS Likelihood Ratings

Factor of Safety	Likelihood Rating	Number of Locations	Percentage (%)
$F \leq 1.0$	Almost Certain	0	0.0
$1.0 < F \leq 1.4$	Likely	4	0.6
$1.4 < F \leq 2.0$	Unlikely	20	2.9
$2.0 < F$	Negligible	489	70.2
No Peat	None	184	26.4

5 Peat Stability Hazard Assessment

In order to determine the risk ratings for the site, the degree of adverse consequence (hazard) as a result of a peat slope failure must be established. In order to assess the hazard allocated to potential receptors of a peat landslide the site was broken down into 71 sub-areas containing similar slope angles and slope direction. The following factors were identified to have the most influence on the potential hazard of a peat slope failure; peat depth, slope relief, potential receptors and distance to receptors. In order to consider the combined influence of all these factors they have been assigned numerical coefficients which are multiplied together to obtain a final hazard value. As no evidence of peat instability was found during the site visit, or desk study and as such all sub-areas were assigned a hazard coefficient of 1 for evidence of instability.

5.1 Peat Depth

In order to assess the potential scale of a peat slope failure, the average depth of peat for the sub-area was used. In order to obtain an average depth value for each area, the peat depths from the phase 1 survey were interpolated within QGIS using the inverse distance weighted method. The average peat depths for each sub-area were then obtained using the QGIS zonal analysis tool. The hazard coefficients assigned for peat depth are as specified in Table 4.

Table 4 - Peat Depth Hazard Coefficients

Description	Depth (m)	Hazard Coefficient
No Peat	$0.0 = Z$	1
Thin	$0.0 < Z < 0.5$	2
Moderately Thin	$0.5 \leq Z < 1.0$	3
Moderately Thick	$1.0 \leq Z < 1.5$	4
Thick	$1.5 \leq Z$	5

5.2 Relief

To further assess the potential scale of a failure, the “relief” of the terrain was analysed. The “relief” parameter is used to describe the change in gradient over the slope. Where there are changes in the gradient over the length of the slope, these can limit the scale of a failure, and the debris runout distance. The relief of the terrain was analysed using the DTM data for the site, with multiple cross sections taken in the direction of the slope for each sub-area using the QGIS terrain profile tool. The hazard coefficients assigned for the relief are as specified in Table 5.

Table 5 - Relief Hazard Coefficients

Relief	Hazard Coefficient
Undulating	1
Rolling	2
Long Uninterrupted	3

5.3 Potential Receptors

There are a number of potential receptors to a peat landslide from the development site, these include site construction works, site infrastructure, and environmentally sensitive areas. Some of the potential consequences of a peat slide damaging these areas include contamination of watercourses and private water supplies (PWS), disruption to construction, loss of site assets, injury to or death of site personal, and the loss of important habitat. The hazard coefficients assigned for potential receptors are as specified in Table 6.

Table 6 - Potential Receptor Hazard Coefficients

Potential Receptor	Hazard Coefficient
None	1
Footpaths	2
Non-critical Infrastructure, such as tracks and drainage features	3
Minor watercourses and critical infrastructure, such as substations and turbines	4
Residential properties, protected habitat and PWS	5

¹³ AGECE (2004) Reports on Derrybrien Windfarm: Final Report on Landslide of October 2003/ Final Report on Post-Landslide Site Appraisal.

5.4 Receptor Distance

The probability and degree of damage to a potential receptor on site from a peat slide decreases with distance. A receptor closer to the location of a landslide is both more likely to be damaged by debris run out from a slide, and likely to sustain more damage. The hazard coefficients assigned for receptor distance are as specified in Table 7.

Table 7 - Receptor Distance Hazard Coefficient

Distance to Receptor (m)	Hazard Coefficient
150 < D	1
100 < D ≤ 150	2
50 < D ≤ 100	3
D ≤ 50	4

5.5 Hazard Rating

In order to obtain a hazard rating for each sub-area the hazard coefficients for each of the factors listed above were multiplied to obtain a hazard value. The hazard rating was assigned for the hazard value as specified in Table 8, which also includes the number of sub-areas in each hazard category. The baseline hazard ratings calculations can be seen in Appendix 2.

Table 8 - Hazard Value Ratings

Hazard Value	Hazard Rating	Number of Sub-Areas	Percentage (%)
0 ≤ H < 19	Very Low	3	4.2
19 ≤ H < 55	Low	7	9.9
55 ≤ H < 85	Moderate	31	43.7
85 ≤ H < 110	High	23	32.4
110 ≤ H	Extremely High	7	9.9

6 Peat Landslide Hazard and Risk Assessment

In order to ascertain the risk rating for each sub-area, the likelihood and hazard ratings were assigned corrected values as specified in Table 9. These were then multiplied to obtain a final risk value which were assigned risk categories as specified in Table 10. The matrix of possible risk ratings is shown in Table 11, and the recommended actions for each risk rating from the Scottish Government best practice guide⁴ is shown in Table 12. For each sub-area the baseline risk rating, required action, and a short description can be seen in section 6.1. The baseline risk ratings for each sub-area can be seen in Appendix 2 and Appendix 13.

Table 9 - Likelihood and Hazard Corrected Values

Likelihood	Hazard	Corrected Value
Negligible/None	Very Low	1
Unlikely	Low	2
Likely	Moderate	3
-	High	4
Almost Certain	Extremely High	5

Table 10 - Risk Rating Categories

Risk Value	Risk Category	Number of Sub-Areas	Percentage (%)
0 ≤ R < 6	Negligible	44	62.0
6 ≤ R < 9	Low	19	26.8
9 ≤ R < 20	Moderate	8	11.3
20 ≤ R	High	0	0.0

Table 11 - Risk Score Matrix

Likelihood	Hazard				
	Very Low	Low	Moderate	High	Extremely High
Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Unlikely	Negligible	Negligible	Low	Low	Moderate
Likely	Negligible	Low	Moderate	Moderate	Moderate
Almost Certain	Low	Moderate	Moderate	High	High

Table 12 - Risk Rating and Recommended Actions

Risk Rating	Recommended Action
Negligible	Project should proceed with monitoring and mitigation of peat landslide hazards
Low	Project may proceed pending further investigation to refine assessment and mitigate hazard through relocation or re-design
Moderate	Project should not proceed unless risk can be avoided or mitigated at these locations in order to reduce risk ranking to low or negligible
High	Avoid Project development at these locations

6.1 Sub-Area Baseline Risk Ratings

Sub-Area	Description	Baseline Risk Rating	Action Required
N01	Infrastructure: Turbines 1 and 2, northern substation, energy storage facility, northern construction compound, tracks and turbine 4 crane hardstand. Topography: Gentle slopes Aspect: South easterly Geomorphology: Multiple watercourses with vegetation associated with peatland to the west. Peat depth range (m): 0.00 – 1.67 Slope gradient range (deg): 0.58 – 8.77	Negligible	None

Sub-Area	Description	Baseline Risk Rating	Action Required
N02	Infrastructure: Turbine 3 crane hardstand Topography: Gentle slopes Aspect: North westerly Geomorphology: Watercourse along the northern boundary and vegetation associated with peatlands found in the western half of the area. Peat depth range (m): 0.00 – 0.61 Slope gradient range (degs): 0.37 – 8.17	Negligible	None
N03	Infrastructure: Turbine 3 and tracks Topography: Gentle slopes Aspect: Easterly Geomorphology: One watercourse present and vegetation associated with peatlands found across the entire area. Peat depth range (m): 0.00 – 1.08 Slope gradient range (degs): 2.12 – 7.45	Moderate	Further analysis required
N04	Infrastructure: Tracks Topography: Moderate slopes Aspect: North easterly Geomorphology: Multiple watercourse and vegetation associated with peatlands found across the entire area. Peat depth range (m): 0.00 – 1.13 Slope gradient range (degs): 2.24 – 12.69	Low	Further analysis required
N05	Infrastructure: Tracks Topography: Steep Aspect: Easterly Geomorphology: Watercourse running along eastern boundary with vegetation associated with peatlands above slope crest. Peat depth range (m): 0.00 – 0.57 Slope gradient range (degs): 5.40 – 17.92	Negligible	None
N06	Infrastructure: Northern construction compound Topography: Moderately steep Aspect: South westerly Geomorphology: one watercourse running through the northern area and one watercourse running along the eastern boundary. Vegetation associated with peatlands found to the north of the area. Peat depth range (m): 0.04 – 0.85 Slope gradient range (degs): 3.47 – 18.46	Low	Further analysis required
N07	Infrastructure: Turbine 4 and crane hardstand, and tracks Topography: Moderately steep Aspect: Southerly Geomorphology: Multiple watercourses running through the area. Limited vegetation associated with peatlands found to the north east and south west of the area. Peat depth range (m): 0.00 – 0.65 Slope gradient range (degs): 1.82 – 16.75	Negligible	None

Sub-Area	Description	Baseline Risk Rating	Action Required
N08	Infrastructure: Turbine 5 and crane hardstand, and tracks Topography: Gentle slopes Aspect: Southerly Geomorphology: Watercourses running along the southern borders of the area, with vegetation associated with peatlands found across the entire area. Peat depth range (m): 0.14 – 0.71 Slope gradient range (degs): 0.72 – 7.64	Low	Further analysis required
N09	Infrastructure: Track Topography: Moderately steep Aspect: South easterly Geomorphology: Watercourse running along the southern borders of the area, with vegetation associated with peatlands found across most of the area. Peat depth range (m): 0.00 – 0.71 Slope gradient range (degs): 3.60 – 16.63	Negligible	None
N10	Infrastructure: None Topography: Moderately steep Aspect: North westerly Geomorphology: Watercourse running along the northern borders of the area, with vegetation associated with peatlands found across most of the area. Peat depth range (m): 0.12 – 0.40 Slope gradient range (degs): 0.99 – 12.83	Negligible	None
N11	Infrastructure: None Topography: Moderately steep Aspect: Easterly Geomorphology: Watercourses running along the northern border and a half of the eastern border. Vegetation associated with peatlands found in the western half of the area. Peat depth range (m): 0.13 – 0.66 Slope gradient range (degs): 2.16 – 13.65	Moderate	None
N12	Infrastructure: None Topography: Moderately steep Aspect: North easterly Geomorphology: Vegetation associated with peatlands found across the entire area Peat depth range (m): 0.00 – 0.67 Slope gradient range (degs): 5.25 – 12.79	Moderate	None
N13	Infrastructure: Track Topography: Moderate slopes Aspect: South easterly Geomorphology: Vegetation associated with peatlands found across the entire area. Peat depth range (m): 0.00 – 0.67 Slope gradient range (degs): 5.06 – 10.89	Negligible	None

Sub-Area	Description	Baseline Risk Rating	Action Required
N14	Infrastructure: Turbine 6 and crane hardstand and tracks Topography: Gentle slopes Aspect: North easterly Geomorphology: Watercourses run along the north western and eastern borders of the area, with vegetation associated with peatlands found to the south west of the area. Peat depth range (m): 0.23 – 0.41 Slope gradient range (degs): 0.72 – 7.97	Moderate	Further analysis required
N15	Infrastructure: Track Topography: Moderately steep Aspect: Northerly Geomorphology: Watercourses running along the northern border and through the west of the area, with grasslands found across the area. Peat depth range (m): 0.18 – 0.34 Slope gradient range (degs): 4.48 – 14.33	Moderate	Further analysis required
N16	Infrastructure: Track Topography: Moderately steep Aspect: North easterly Geomorphology: multiple watercourses running through the area, along the northern, eastern, and western borders of the area. Some vegetation associated with peatlands found to the east of the area. Peat depth range (m): 0.00 – 0.47 Slope gradient range (degs): 3.02 – 13.22	Low	Further analysis required
N17	Infrastructure: None Topography: Moderate slopes Aspect: Northerly Geomorphology: Multiple watercourses running through the centre of area, with vegetation associated with peatlands found to the north and west of the area. Peat depth range (m): 0.00 – 0.87 Slope gradient range (degs): 0.87 – 10.55	Low	None
N18	Infrastructure: None Topography: Moderately steep Aspect: Northerly Geomorphology: One watercourse running through the centre of the area and one watercourse running along the northern boundary of the area, with grasslands found across the area. Peat depth range (m): 0.00 – 0.56 Slope gradient range (degs): 6.76 – 11.71	Low	None
N19	Infrastructure: None Topography: Moderately gentle slopes Aspect: North easterly Geomorphology: No watercourses present and grasslands found across the area. Peat depth range (m): 0.00 – 0.40 Slope gradient range (degs): 4.76 – 6.51	Negligible	None

Sub-Area	Description	Baseline Risk Rating	Action Required
N20	Infrastructure: None Topography: Moderately gentle slopes Aspect: North easterly Geomorphology: No watercourses present and grasslands found across the area. Peat depth range (m): 0.00 – 0.21 Slope gradient range (degs): 2.93 – 7.11	Negligible	None
N21	Infrastructure: None Topography: Moderately gentle slopes Aspect: North easterly Geomorphology: No watercourses present and grasslands found across the area. Peat depth range (m): 0.00 – 0.76 Slope gradient range (degs): 3.79 – 7.43	Moderate	None
N22	Infrastructure: Turbine 8 crane hardstand Topography: Gentle slopes Aspect: Westerly Geomorphology: Multiple watercourses present to the west of the area and along the western boundary, with vegetation associated with peatland found across the area. Peat depth range (m): 0.00 – 2.20 Slope gradient range (degs): 0.11 – 6.98	Negligible	None
N23	Infrastructure: Turbine 7 and crane hardstand and track Topography: Gentle slopes Aspect: Easterly Geomorphology: No watercourses present, with vegetation associated with peatlands found across the entire area. Peat depth range (m): 0.00 – 0.66 Slope gradient range (degs): 2.08 – 7.89	Negligible	None
N24	Infrastructure: Turbine 8 and crane hardstand and track Topography: Moderately gentle slopes Aspect: Easterly Geomorphology: No watercourses present, with vegetation associated with peatlands found across the entire area. Peat depth range (m): 0.03 – 0.54 Slope gradient range (degs): 2.76 – 7.97	Negligible	None
C01	Infrastructure: Turbine 9 and crane hardstand and track Topography: Moderately steep Aspect: Westerly Geomorphology: One watercourse running along the western boundary, with small areas of vegetation associated with peatlands found to the north, south west, and west of the area. Peat depth range (m): 0.00 – 0.10 Slope gradient range (degs): 2.34 – 14.33	Negligible	None

Sub-Area	Description	Baseline Risk Rating	Action Required
C02	Infrastructure: Turbine 10 and crane hardstand and track Topography: Steep Aspect: South westerly Geomorphology: Multiple watercourses present at the southern boundary, with limited areas of vegetation associated with peatlands found above slope crest to the north and east of the area Peat depth range (m): 0.01 – 0.06 Slope gradient range (degs): 6.82 – 19.47	Negligible	None
C03	Infrastructure: None Topography: Gentle slopes Aspect: Easterly Geomorphology: No watercourses present, limited areas of vegetation associated with peatlands found to the south and east of the area. Peat depth range (m): 0.00 – 0.19 Slope gradient range (degs): 0.85 – 8.17	Negligible	None
C04	Infrastructure: Track Topography: Gentle slopes Aspect: Southerly Geomorphology: One watercourse running through the west of the area, with limited vegetation associated with peatlands found to the west of the area. Peat depth range (m): 0.01 – 0.06 Slope gradient range (degs): 3.10 – 8.59	Negligible	None
C05	Infrastructure: Turbine 10 and crane hardstand and track Topography: Moderate slopes Aspect: South easterly Geomorphology: No watercourses present, with vegetation associated with peatlands found across the majority of the area. Peat depth range (m): 0.01 – 0.40 Slope gradient range (degs): 3.05 – 8.99	Negligible	None
C06	Infrastructure: Track Topography: Gentle slopes Aspect: Easterly Geomorphology: No watercourses present, with grasslands found across the entire area. Peat depth range (m): 0.00 – 0.70 Slope gradient range (degs): 0.80 – 6.70	Negligible	None
C07	Infrastructure: Track Topography: Moderately gentle slopes Aspect: South easterly Geomorphology: No watercourses present, with grasslands found across the entire area. Peat depth range (m): 0.00 – 0.34 Slope gradient range (degs): 4.02 – 8.57	Negligible	None

Sub-Area	Description	Baseline Risk Rating	Action Required
C08	Infrastructure: None Topography: Gentle slopes Aspect: Easterly Geomorphology: One watercourse running through the centre of the area, with grasslands found across the entire area. Peat depth range (m): 0.00 – 0.49 Slope gradient range (degs): 3.19 – 6.19	Negligible	None
C09	Infrastructure: None Topography: Gentle slopes Aspect: South Easterly Geomorphology: One watercourse running through the north of the area, with grasslands found across the entire area. Peat depth range (m): 0.00 – 0.06 Slope gradient range (degs): 2.42 – 7.03	Negligible	None
C10	Infrastructure: Turbine 11 crane hardstand and tracks Topography: Moderate slopes Aspect: South easterly Geomorphology: Multiple watercourses present at the south eastern border, with grasslands found across the entire area. Peat depth range (m): 0.00 – 0.05 Slope gradient range (degs): 4.55 – 10.23	Negligible	None
C11	Infrastructure: Turbine 11 and crane hardstand and tracks Topography: Steep Aspect: Southerly Geomorphology: Watercourse running along the southern border, with grasslands found across the entire area. Peat depth range (m): 0.00 – 0.06 Slope gradient range (degs): 2.20 – 18.63	Negligible	None
C12	Infrastructure: Track Topography: Gentle slopes Aspect: Northerly Geomorphology: Watercourse running along the northern border, with vegetation associated with peatlands found to the west of the area. Peat depth range (m): 0.01 – 0.47 Slope gradient range (degs): 0.93 – 7.72	Low	Further analysis required
C13	Infrastructure: Northern borrow pit Topography: Steep Aspect: Northerly Geomorphology: No watercourses present, with vegetation associated with peatlands found at the toe of slope to the north. Peat depth range (m): 0.00 – 0.50 Slope gradient range (degs): 7.67 – 21.21	Low	Further analysis required
C14	Infrastructure: Northern borrow put and track Topography: Moderately steep Aspect: North easterly Geomorphology: No watercourses present, with grasslands found across the entire area. Peat depth range (m): 0.00 – 0.36 Slope gradient range (degs): 5.69 – 13.65	Negligible	None

Sub-Area	Description	Baseline Risk Rating	Action Required
C15	Infrastructure: None Topography: Moderately gentle slopes Aspect: Southerly Geomorphology: Multiple watercourses found to the south of the area, with vegetation associated with peatlands found across the entire area. Peat depth range (m): 0.00 – 0.95 Slope gradient range (degs): 1.23 – 8.25	Low	None
C16	Infrastructure: None Topography: Moderately steep Aspect: Westerly Geomorphology: No watercourses present, with a small area of vegetation associated with peatlands found at the south western border of the area. Peat depth range (m): 0.00 – 0.30 Slope gradient range (degs): 6.17 – 11.35	Negligible	None
C17	Infrastructure: None Topography: Steep Aspect: Westerly Geomorphology: one watercourse along the southern border of the area, with small areas of vegetation associated with peatlands found at the toe of the slope to the west of the area. Peat depth range (m): 0.00 – 0.64 Slope gradient range (degs): 6.22 – 19.40	Low	None
C18	Infrastructure: Turbine 12 crane hardstand Topography: Moderately gentle slopes Aspect: Westerly Geomorphology: No watercourses present and grasslands found across the entire area. Peat depth range (m): 0.01 – 0.22 Slope gradient range (degs): 2.41 – 10.11	Negligible	None
C19	Infrastructure: Turbine 12 crane hardstand Topography: Moderately gentle slopes Aspect: North easterly Geomorphology: No watercourse present, with limited vegetation associated with peatlands found in the centre of the area. Peat depth range (m): 0.00 – 0.55 Slope gradient range (degs): 1.34 – 9.11	Negligible	None
C20	Infrastructure: Turbines 12 and 13 and crane hardstands, southern temporary construction compound and tracks Topography: Gentle slopes Aspect: Easterly Geomorphology: No watercourses present, with limited vegetation associated with peatlands found in the centre of the area. Peat depth range (m): 0.00 – 0.17 Slope gradient range (degs): 0.72 – 7.84	Negligible	None

Sub-Area	Description	Baseline Risk Rating	Action Required
C21	Infrastructure: None Topography: Moderately gentle slopes Aspect: Easterly Geomorphology: No watercourses present, with grasslands found across the entire area. Peat depth range (m): 0.00 – 0.55 Slope gradient range (degs): 3.95 – 8.54	Negligible	None
C22	Infrastructure: None Topography: Moderate slopes Aspect: Easterly Geomorphology: one watercourse present at the south easter border of the area, with limited vegetation associated with peatlands found at the toe of the slope to the east of the area. Peat depth range (m): 0.00 – 0.48 Slope gradient range (degs): 2.38 – 10.47	Negligible	None
C23	Infrastructure: Tracks Topography: Moderate slopes Aspect: South easterly Geomorphology: One watercourse running along the southern border of the area, with vegetation associated with peatlands found to the south and west of the area. Peat depth range (m): 0.00 – 0.71 Slope gradient range (degs): 4.46 – 10.97	Negligible	None
C24	Infrastructure: None Topography: Moderately steep Aspect: South easterly Geomorphology: One watercourse found at the southern border of the area, with grasslands found across the entire area. Peat depth range (m): 0.01 – 0.14 Slope gradient range (degs): 8.04 – 12.41	Negligible	None
C25	Infrastructure: Turbines 14 and 16 and crane hardstands and track Topography: Gentle slopes Aspect: Easterly Geomorphology: One watercourse running along the northern border of the area, and two watercourses present at the eastern border of the area. Vegetation associated with peatlands can be found to the north, covering the majority of the area. Peat depth range (m): 0.00 – 1.12 Slope gradient range (degs): 1.39 – 7.14	Low	Further analysis required
C26	Infrastructure: None Topography: Moderately slopes Aspect: Easterly Geomorphology: Watercourses running along the norther and southern borders of the area, with vegetation associated with peatlands found across the entire area. Peat depth range (m): 0.13 – 0.33 Slope gradient range (degs): 3.84 – 10.36	Negligible	None

Sub-Area	Description	Baseline Risk Rating	Action Required
C27	Infrastructure: None Topography: Moderately gentle slopes Aspect: South westerly Geomorphology: Multiple watercourses present to the south of the area, with vegetation associated with peatlands found to the south covering the majority of the area. Peat depth range (m): 0.01 – 0.39 Slope gradient range (degs): 3.90 – 9.28	Negligible	None
C28	Infrastructure: None Topography: Steep Aspect: Westerly Geomorphology: Multiple watercourses present to the north of the area, with vegetation associated with peatlands covering the majority of the area. Peat depth range (m): 0.00 – 0.44 Slope gradient range (degs): 5.33 – 25.59	Low	None
C29	Infrastructure: None Topography: Moderately steep Aspect: Northerly Geomorphology: One watercourse present at the north western boundary of the area, with vegetation associated with peatlands found covering the majority of the site, with a small central section of grassland. Peat depth range (m): 0.00 – 0.39 Slope gradient range (degs): 0.00 – 12.78	Low	None
C30	Infrastructure: Turbine 15 and crane hardstand, and southern borrow pit Topography: Moderately gentle slopes Aspect: Easterly Geomorphology: No watercourses present, with vegetation associated with peatlands found to the west of the area. Peat depth range (m): 0.00 – 0.52 Slope gradient range (degs): 0.57 – 9.50	Low	Further analysis required
C31	Infrastructure: Turbine 16 and crane hardstand and tracks Topography: moderately gentle slopes Aspect: North easterly Geomorphology: No watercourses present, with a small area of vegetation associated with peatlands found running through the north of the area. Peat depth range (m): 0.00 – 0.50 Slope gradient range (degs): 1.91 – 7.20	Negligible	None
C32	Infrastructure: Turbine 17 and crane hardstands and track Topography: Gentle slopes Aspect: North easterly Geomorphology: One watercourse running through the centre of the area, with vegetation associated with peatland found surrounding it. Peat depth range (m): 0.00 – 0.36 Slope gradient range (degs): 1.35 – 5.71	Negligible	None

Sub-Area	Description	Baseline Risk Rating	Action Required
C33	Infrastructure: None Topography: Gentle slopes Aspect: Easterly Geomorphology: No watercourses present, with limited areas of vegetation associated with peatlands found to the south of the area. Peat depth range (m): 0.00 – 0.78 Slope gradient range (degs): 0.52 – 6.35	Low	None
C34	Infrastructure: Turbine 17 crane hardstand, and track Topography: Moderately gentle slopes Aspect: Easterly Geomorphology: No watercourses present, with limited areas of vegetation associated with peatlands found to the south of the area. Peat depth range (m): 0.00 – 1.40 Slope gradient range (degs): 4.13 – 7.56	Moderate	Further analysis required
C35	Infrastructure: None Topography: Moderate slopes Aspect: Easterly Geomorphology: Multiple watercourses present to the east of the area, with vegetation associated with peatlands to the east, covering the majority of the area. Peat depth range (m): 0.00 – 1.05 Slope gradient range (degs): 2.00 – 10.66	Negligible	None
C36	Infrastructure: None Topography: Gentle slopes Aspect: Easterly Geomorphology: Watercourse found at the north eastern and south eastern boundaries of the area, with vegetation associated with peatlands found to the south of the area. Peat depth range (m): 0.00 – 1.30 Slope gradient range (degs): 0.81 – 7.44	Low	Further analysis required
C37	Infrastructure: None Topography: Gentle slopes Aspect: Easterly Geomorphology: No watercourses present, with vegetation associated with peatlands found to the north of the area. Peat depth range (m): 0.02 – 1.39 Slope gradient range (degs): 1.90 – 9.21	Low	None
C38	Infrastructure: None Topography: Moderately steep Aspect: South easterly Geomorphology: One watercourse running along the south east of the area, with limited vegetation associated with peatlands found at the southern boundary at the slope toe. Peat depth range (m): 0.02 – 0.24 Slope gradient range (degs): 2.08 – 13.48	Negligible	None

Sub-Area	Description	Baseline Risk Rating	Action Required
S01	Infrastructure: None Topography: Steep Aspect: Westerly Geomorphology: No watercourses present, with vegetation associated with peatland found across the entire area. Peat depth range (m): 0.00 – 0.25 Slope gradient range (degs): 5.60 – 17.86	Negligible	None
S02	Infrastructure: None Topography: Moderately gentle slopes Aspect: South easterly Geomorphology: No watercourses present, with vegetation associated with peatlands found across the entire area. Peat depth range (m): 0.00 – 0.82 Slope gradient range (degs): 1.14 – 8.13	Low	None
S03	Infrastructure: None Topography: Moderately steep Aspect: Westerly Geomorphology: No watercourses present, with vegetation associated with peatlands found across the entire area. Peat depth range (m): 0.00 – 0.25 Slope gradient range (degs): 1.11 – 15.08	Negligible	None
S04	Infrastructure: None Topography: Gentle slopes Aspect: South easterly Geomorphology: No watercourses present, with vegetation associated with peatlands found across the entire area. Peat depth range (m): 0.00 – 0.62 Slope gradient range (degs): 0.31 – 7.94	Negligible	None
S05	Infrastructure: None Topography: Moderately steep Aspect: South easterly Geomorphology: One watercourse running along the southern edge of the area, with vegetation associated with peatland found to the east covering the majority of the area. Peat depth range (m): 0.00 – 0.96 Slope gradient range (degs): 0.49 – 14.66	Negligible	None
S06	Infrastructure: None Topography: Steep Aspect: Westerly Geomorphology: No watercourses present with grasslands found across the entire area. Peat depth range (m): 0.00 – 0.19 Slope gradient range (degs): 9.72 – 17.71	Negligible	None
S07	Infrastructure: None Topography: Gentle slopes Aspect: Westerly Geomorphology: No watercourses present with grasslands found across the entire area. Peat depth range (m): 0.05 – 0.21 Slope gradient range (degs): 0.29 – 10.83	Negligible	None

Sub-Area	Description	Baseline Risk Rating	Action Required
S08	Infrastructure: None Topography: Steep Aspect: Southerly Geomorphology: One watercourse running through the south of the area, with vegetation associated with peatlands found to the south at the toes of the slope. Peat depth range (m): 0.00 – 0.28 Slope gradient range (degs): 6.28 – 26.43	Negligible	None
S09	Infrastructure: None Topography: Moderately steep Aspect: North westerly Geomorphology: Watercourse running along the norther border of the area, with vegetation associated with peatlands found to the north covering the majority of the area. Peat depth range (m): 0.00 – 0.62 Slope gradient range (degs): 3.94 – 14.33	Moderate	None

7 Further Analysis

7.1 Refined Likelihood

Thirteen sub-areas were found that required further analysis to refine the assessment of risk at those locations. In order to obtain a refined assessment of the risk of the windfarm development inducing peat slope instability, the phase 2 peat depth samples were analysed at the locations of proposed infrastructure. For these points the FoS was calculated as specified in section 4.1. The maximum likelihood for the points at the locations of proposed infrastructure was then used to obtain the maximum refined likelihood value for that sub-area. The sub-areas N15 and N16 were analysed as one sub-area as the track ran along the border of these areas. For sub-area C13 there were no additional phase 2 peat depth samples, as such the maximum interpolated peat depth and maximum slope angle for the location of the borrow pit was used in the refined likelihood calculations. The FoS calculations for these sub-areas can be seen in Appendix 3.

Table 13 - Refined Likelihood Ratings

Sub-Area	Unmitigated Risk	Max Refined Likelihood	Action
N03	Moderate	Unlikely	Refine hazard rating
N04	Low	Negligible	No further analysis required
N06	Low	Unlikely	Refine hazard rating
N08	Low	Likely	Refine hazard rating
N14	Moderate	Likely	Refine hazard rating
N15 & N16	Moderate	Likely	Refine hazard rating
C12	Low	Negligible	No further analysis required
C13	Low	Negligible	No further analysis required
C25	Low	Unlikely	Refine hazard rating
C30	Low	Negligible	No further analysis required
C34	Moderate	Negligible	No further analysis required
C36	Low	Negligible	No further analysis required

7.2 Refined Hazard and Risk Rating

In order to refine the hazard rating a hazard value was calculated for each of the phase 2 points used in the analysis of refined likelihood. Since the relief variable is a description of the whole sub-area, the relief hazard coefficient used for the hazard rating of the sub-area was used for all the points in that area. Since the foundations for the windfarm infrastructure will be designed to provide appropriate support for the ground conditions at the infrastructure location only infrastructure down slope of the point was considered to be at risk e.g. for points at the location of turbine 4's foundations turbine 4 was not considered to be at risk of a peat slide from that location. The refined risk ratings for the sub-areas identified as requiring refined hazard ratings are shown in Table 14.

As shown in Table 14 six sub-areas were identified as requiring mitigating action in order to reduce the risk levels to tolerable levels. The details of this action and the mitigated risk ratings for these areas are shown in Table 15. The refined hazard and risk calculations for the points with a greater than negligible likelihood for these sub-areas are shown in Appendix 4, and the mitigated risk ratings for all sub-areas can be seen in Appendix 14.

Table 14 - Refined Hazard and Risk Ratings

Sub-Area	Unmitigated Risk	Max Refined Likelihood	Max Refined Risk	Mitigation Required
N03	Moderate	Unlikely	Negligible	No
N06	Low	Unlikely	Low	Yes
N08	Low	Likely	Moderate	Yes
N14	Moderate	Likely	Moderate	Yes
N15 & 16	Moderate	Likely	Moderate	Yes
C25	Low	Unlikely	Low	Yes

Table 15 - Mitigated Risk Ratings

Sub-Area	Max Refined Risk	Risk Locations	Mitigated Risk	Recommended Mitigating Actions
N06	Low	Low: 4 Negligible: 64	Negligible	Micro-siting of infrastructure to avoid localised areas of peat.
N08	Moderate	Moderate: 2 Low: 5 Negligible: 30	Low	Micro-siting of infrastructure to avoid localised areas of peat. Excavation spoil to be located in areas without peat.
N14	Moderate	Moderate: 2 Low: 1 Negligible: 53	Low	Micro-siting of infrastructure to avoid localised areas of peat. Excavation spoil to be located in areas without peat.
N15 & 16	Moderate	Moderate: 1 Low risk: 1 Negligible: 10	Low	Micro-siting of infrastructure to avoid localised areas of peat. Excavation spoil to be located in areas without peat.
C25	Low	Low risk: 1 Negligible: 122	Negligible	Micro-siting of infrastructure to avoid localised areas of peat.

8 Construction Good Practice and Mitigation Measures

All construction activities, in particular excavation and drainage works can have a detrimental effect on peat stability. The design and construction of the project would manage the susceptibility of peat to instability. While there is no extensive evidence for peat instability on the site, good practice measures and mitigation would be employed to minimise the risk of peat instability occurring. The following recommendations would be considered for all construction works in areas of peat:

- An appropriately experienced and qualified engineering geologist/geotechnical engineer would be appointed during the construction phase, to provide advice during the setting out, micro-siting and construction phases of work.
- A Geotechnical Risk Register is developed and maintained by the appointed geotechnical engineer.
- Minimise the "undercutting" of peat slopes, where this cannot be avoided a more detailed assessment of the area of concern by a geotechnical engineer would be required.
- Micro-siting of site infrastructure to minimise the effects on the prevailing hydrology.
- Produce a 'Peat Hazard Emergency Plan' to provide instructions to site staff in the event of a peat slide or discovery of peat instability indicators, which would be included in the site induction.
- For sections that require cuttings into peat, suitable support measures would be designed to maintain the stability of adjacent peat slopes.
- Develop methodologies to prevent the accelerated degradation and erosion of any exposed peat deposits.
- Refine the design through the pre-construction phase following the completion of a detailed ground investigation.

8.1 Drainage Design

In order to prevent detrimental impacts on peat stability the drainage design for the proposed development must maintain the current hydrological conditions. The following requirements would be met for the site drainage design:

- Drainage systems would not create areas of concentrated flow, oversaturation or undersaturation of peat habitats.
- Drainage systems would require minimal maintenance.
- The drainage systems and associated measures would be designed to minimise sedimentation into natural site watercourses. These would be maintained and silt build up removed on a regular basis.
- Method statements would be prepared to mitigate against a peat slide occurring, including the use of check dams and erosion protection to limit flows and prevent the contamination of watercourses.
- Construction areas with sensitive drainage or hydrology would be identified and demarked.

8.2 Access Tracks

The following measures would be considered to prevent the construction of access tracks having detrimental effects on peat stability:

- All existing drainage ditches would be maintained and where necessary channelled below the proposed track.
- Drainage ditches running along the tracks would be constructed with check dams and cross drains where necessary so; water can pass below the track at regular intervals, velocities are limited to prevent erosion and discharges of peat sediment.
- Identify and mark all existing drainage features within the track corridors, these features would be maintained (not enhanced) during the construction and operation of the development.
- Install cross drains at regular intervals to maintain groundwater flows through the peat mass below tracks, where track settlement could reduce the permeability of the peat mass.
- Installation of drainage up-slope of tracks to prevent ponding of water.
- Where track construction is required over peat in excess of 1.5m in depth, where the integrity of peat and gradients allow, floating construction would be used.
- For cut and fill construction, excavation would be to a sound stratum, construction surfaces would be essentially horizontal with a slight fall to aid drainage.

- Where the cut depth is deemed unstable, employ a stepped or benched surface to minimise the exposed surface of the up-slope cut face.
- Protect all exposed peat surfaces from erosion and degradation by ensuring the integrity and moisture content of peat is maintained.

9 Conclusion

This risk of peat instability has been assessed for 71 sub-areas within the proposed site boundary. The assessment has been based on:

- A walk-over survey
- Inspection and analysis of LiDAR mapping
- A review of historical and geological mapping and aerial photography
- Two phases of peat depth surveying

Initially, of the 71 sub-areas 44 were identified as having negligible risk, 19 low risk and 8 moderate risk. For the areas identified as having low or moderate risk, construction in that area has been avoided where possible. These areas have been assigned a mitigated risk rating of negligible as the risk of construction activities causing peat instability is being assessed. Through the adoption of the recommended best practices, the current stability of these slopes should be maintained. For the areas identified as having low or moderate risk with construction activities a more detailed assessment of risk was undertaken to assess the stability of the peat slopes at and around the location of infrastructure.

As discussed briefly in this report there are many different interconnected ground conditions which affect peat stability. The guidance in section 8 has been developed in order to maintain the current interconnected relationships and ground conditions to prevent the destabilisation of peat slopes.

Following this assessment it was concluded with the adoption of appropriate construction best practices and mitigation measures as specified in section 8 and Table 15, 4 sub-areas are at low risk, and 67 sub-areas are at negligible risk. While it is not possible to completely rule out the possibility of a peat slide occurring on site, through the implementation of the measures and practices specified, the risk of peat instability occurring can be kept within acceptable levels.

Appendix 1 Phase 1 Peat Survey Points Factor of Safety

Peat Depth (m)	Easting	Northing	Slope (deg)	Factor of Safety	Likelihood
0.33	303255	282348	3.90	7.44	Negligible
0.00	304255	282448	12.06		None
0.40	303055	282348	2.65	9.03	Negligible
0.00	304055	282448	15.01		None
0.00	304155	282448	12.50		None
0.54	303655	282548	5.41	3.29	Negligible
0.00	303755	282548	10.08		None
0.51	303455	282548	5.21	3.61	Negligible
1.08	303555	282548	6.62	1.35	Likely
0.15	303255	282548	2.45	26.03	Negligible
0.72	303355	282548	4.53	2.94	Negligible
0.61	303055	282548	3.67	4.28	Negligible
0.38	303155	282548	3.93	6.41	Negligible
0.39	303055	282448	1.87	13.13	Negligible
0.44	303155	282448	1.79	12.12	Negligible
0.00	304255	282548	8.96		None
0.02	304355	282548	8.32	58.20	Negligible
0.00	304055	282548	8.65		None
0.00	304155	282548	11.04		None
0.35	303855	282548	7.04	3.92	Negligible
0.06	303955	282548	12.93	12.74	Negligible
0.15	303455	282648	3.04	20.98	Negligible
0.18	303555	282648	3.62	14.71	Negligible
0.00	303255	282648	1.55		None
0.25	303355	282648	4.97	7.72	Negligible
0.75	304355	282748	4.73	2.70	Negligible
0.29	303155	282648	3.94	8.38	Negligible
0.00	304155	282748	3.78		None
0.00	304255	282748	3.22		None
0.00	304255	282648	4.37		None
0.01	304355	282648	4.79	200.27	Negligible
0.00	304055	282648	2.81		None
0.00	304155	282648	2.37		None
0.57	303855	282648	7.00	2.42	Negligible
0.04	303955	282648	12.79	19.30	Negligible
0.00	303655	282648	3.39		None
0.00	303755	282648	6.71		None
0.71	303055	281748	1.24	10.81	Negligible
0.50	303155	281748	4.20	4.56	Negligible
0.01	304655	281848	5.75	167.16	Negligible
0.02	304755	281848	5.37	89.40	Negligible
0.01	304455	281848	5.09	188.74	Negligible
0.02	304555	281848	4.94	97.20	Negligible
0.03	304255	281848	5.50	58.19	Negligible

Peat Depth (m)	Easting	Northing	Slope (deg)	Factor of Safety	Likelihood
0.01	304355	281848	5.85	164.26	Negligible
0.02	304555	281748	5.18	92.64	Negligible
0.01	304655	281748	6.47	148.90	Negligible
0.49	303655	281748	7.83	2.52	Negligible
0.40	303755	281748	2.70	8.87	Negligible
0.00	303455	281748	4.27		None
0.21	303555	281748	6.98	6.58	Negligible
0.61	303255	281748	5.45	2.89	Negligible
0.30	303355	281748	0.53	60.53	Negligible
0.00	304555	281948	5.96		None
0.40	304655	281948	5.47	4.39	Negligible
0.75	304355	281948	7.58	1.70	Unlikely
0.00	304455	281948	6.92		None
0.02	304155	281948	6.29	76.47	Negligible
0.00	304255	281948	6.33		None
0.00	303455	281948	10.74		None
0.61	303555	281948	9.13	1.74	Unlikely
0.67	303555	281848	11.37	1.29	Likely
0.26	303655	281848	7.71	4.82	Negligible
0.45	303355	281848	4.62	4.62	Negligible
0.00	303455	281848	7.13		None
0.60	303155	281848	4.41	3.62	Negligible
0.76	303255	281848	5.21	2.43	Negligible
0.00	304755	281948	4.80		None
0.00	304855	281948	4.51		None
0.51	304355	282048	8.27	2.30	Negligible
0.10	304455	282048	9.22	10.54	Negligible
0.27	304155	282048	7.20	4.96	Negligible
0.00	304255	282048	10.72		None
0.66	303555	282048	6.83	2.14	Negligible
0.04	304055	282048	6.32	38.10	Negligible
0.46	303355	282048	2.27	9.15	Negligible
0.13	303455	282048	8.87	8.42	Negligible
0.42	303255	281948	5.30	4.31	Negligible
0.60	303355	281948	4.95	3.23	Negligible
0.03	304955	282048	3.30	96.74	Negligible
0.54	303155	281948	3.19	5.56	Negligible
0.00	304755	282048	6.27		None
0.00	304855	282048	5.37		None
0.03	304555	282048	8.35	38.67	Negligible
0.00	304655	282048	7.47		None
0.27	304055	282148	10.45	3.46	Negligible
0.33	304155	282148	9.95	2.97	Negligible
0.12	303455	282148	5.88	13.64	Negligible
0.37	303555	282148	9.89	2.66	Negligible

Peat Depth (m)	Easting	Northing	Slope (deg)	Factor of Safety	Likelihood
0.45	303255	282148	1.32	16.11	Negligible
0.40	303355	282148	6.30	3.82	Negligible
0.23	304355	282248	6.92	6.06	Negligible
0.35	303155	282148	4.34	6.31	Negligible
0.29	304955	282148	6.92	4.81	Negligible
0.73	303255	282048	5.09	2.58	Negligible
0.02	304755	282148	9.99	48.79	Negligible
0.02	304855	282148	8.28	58.47	Negligible
0.83	304455	282148	7.12	1.63	Unlikely
0.56	304655	282148	10.79	1.62	Unlikely
0.20	304255	282148	9.72	5.01	Negligible
0.87	304355	282148	7.55	1.47	Unlikely
0.00	305055	281048	3.68		None
0.00	303955	280948	12.99		None
0.00	304955	281048	4.59		None
0.01	305055	281048	3.68	259.88	Negligible
0.02	304755	281048	3.77	127.11	Negligible
0.46	304855	281048	4.28	4.87	Negligible
0.01	304555	281048	4.43	216.40	Negligible
0.03	304655	281048	4.16	76.86	Negligible
0.70	304655	280948	5.34	2.57	Negligible
0.00	304755	280948	4.20		None
0.02	304455	280948	1.95	245.16	Negligible
0.01	304555	280948	3.41	280.81	Negligible
0.01	304255	280948	5.81	165.37	Negligible
0.22	304355	280948	5.55	7.87	Negligible
0.01	304055	280948	8.47	114.36	Negligible
0.02	304155	280948	0.98	487.81	Negligible
0.01	304255	281148	2.09	457.25	Negligible
0.02	304355	281148	6.13	78.52	Negligible
0.45	303155	281148	3.42	6.22	Negligible
0.12	303455	281148	5.64	14.21	Negligible
0.54	303555	281248	6.90	2.59	Negligible
1.55	303055	281148	0.55	11.20	Negligible
0.00	303455	281248	7.66		None
0.05	303455	281248	7.66	25.23	Negligible
0.05	304355	281048	5.65	34.00	Negligible
0.01	304455	281048	4.29	223.47	Negligible
0.02	304155	281048	3.66	130.73	Negligible
0.02	304255	281048	4.47	107.17	Negligible
0.00	303955	281048	12.25		None
0.02	304055	281048	6.74	71.50	Negligible

Peat Depth (m)	Easting	Northing	Slope (deg)	Factor of Safety	Likelihood
1.29	303055	281048	1.03	7.18	Negligible
0.82	303155	281048	2.77	4.21	Negligible
0.37	303055	281348	1.93	13.38	Negligible
1.90	303155	281348	1.06	4.76	Negligible
0.35	303455	281448	9.16	3.03	Negligible
0.28	303555	281448	7.45	4.63	Negligible
0.18	303255	281448	4.01	13.27	Negligible
0.37	303355	281448	2.27	11.38	Negligible
0.26	303155	281448	1.55	23.71	Negligible
0.26	303155	281448	1.55	23.71	Negligible
0.39	303255	281248	4.15	5.91	Negligible
0.40	303355	281248	2.61	9.15	Negligible
0.58	303055	281248	1.47	11.17	Negligible
0.49	303155	281248	3.43	5.70	Negligible
0.00	303455	281348	8.70		None
0.19	303555	281348	8.60	5.93	Negligible
0.70	303255	281348	4.23	3.24	Negligible
0.00	303355	281348	2.67		None
0.59	303555	281648	5.74	2.84	Negligible
0.30	303655	281648	8.15	3.96	Negligible
0.17	303355	281648	4.03	14.00	Negligible
0.30	303455	281648	4.03	7.92	Negligible
0.54	303155	281648	4.93	3.61	Negligible
0.15	303255	281648	4.70	13.62	Negligible
0.76	304755	281748	7.09	1.79	Unlikely
1.50	303055	281648	0.52	12.27	Negligible
0.18	303655	281548	7.14	7.51	Negligible
2.05	303055	281448	0.71	6.57	Negligible
0.66	303455	281548	5.81	2.51	Negligible
0.67	303555	281548	7.15	2.02	Negligible
0.20	303255	281548	4.45	10.77	Negligible
0.34	303355	281548	2.45	11.50	Negligible
2.20	303055	281548	0.52	8.40	Negligible
0.75	303155	281548	3.62	3.53	Negligible
0.00	304855	280448	7.77		None
0.00	304955	280448	8.87		None
0.00	304655	280448	8.64		None
0.00	304755	280448	7.60		None
0.01	304455	280448	6.18	155.61	Negligible
0.02	304555	280448	6.37	75.62	Negligible
0.02	305055	280548	6.58	73.21	Negligible
0.01	304355	280448	11.44	85.70	Negligible

Peat Depth (m)	Easting	Northing	Slope (deg)	Factor of Safety	Likelihood
0.01	304555	280248	13.39	73.97	Negligible
0.01	304655	280248	13.24	74.76	Negligible
0.00	304955	280348	11.92		None
0.01	305055	280348	7.50	128.85	Negligible
0.00	304755	280348	11.95		None
0.00	304855	280348	11.78		None
0.01	305055	280448	8.35	116.02	Negligible
0.00	304655	280348	13.75		None
0.00	304755	280648	7.16		None
0.05	304855	280648	7.16	26.97	Negligible
0.02	304555	280648	4.57	104.84	Negligible
0.00	304655	280648	6.94		None
0.01	304355	280648	5.71	168.40	Negligible
0.02	304455	280648	5.40	89.01	Negligible
0.01	304155	280648	11.70	83.92	Negligible
0.01	304255	280648	12.25	80.37	Negligible
0.00	304755	280548	7.86		None
0.05	304855	280548	6.39	30.15	Negligible
0.03	304555	280548	4.99	64.08	Negligible
0.00	304655	280548	6.31		None
0.01	305155	280648	4.23	226.53	Negligible
0.01	304455	280548	3.33	287.37	Negligible
0.05	304955	280648	4.40	43.54	Negligible
0.01	305055	280648	4.19	228.52	Negligible
0.01	304455	280748	3.68	260.50	Negligible
0.01	304555	280748	5.34	179.90	Negligible
0.01	304255	280748	8.21	117.95	Negligible
0.01	304355	280748	4.45	215.26	Negligible
0.01	304055	280748	13.35	74.17	Negligible
0.01	304155	280748	6.80	141.82	Negligible
0.02	305155	280848	2.77	172.63	Negligible
0.02	303955	280748	13.38	37.02	Negligible
0.02	303955	280648	15.64	32.10	Negligible
0.01	304055	280648	19.00	54.15	Negligible
0.02	305055	280748	3.44	139.00	Negligible
0.01	305155	280748	2.30	415.13	Negligible
0.00	304855	280748	7.54		None
0.00	304955	280748	4.89		None
0.00	304655	280748	5.81		None
0.00	304755	280748	7.07		None
0.00	304155	280848	2.65		None
0.00	304255	280848	7.76		None

Peat Depth (m)	Easting	Northing	Slope (deg)	Factor of Safety	Likelihood
0.00	303955	280848	11.59		None
0.00	304055	280848	8.92		None
0.00	305055	280948	4.11		None
0.03	305155	280948	3.39	94.22	Negligible
0.00	304855	280948	5.59		None
0.00	304955	280948	5.73		None
0.00	304955	280848	5.20		None
0.02	305055	280848	4.43	108.21	Negligible
0.00	304755	280848	5.37		None
0.00	304855	280848	7.36		None
0.00	304555	280848	4.09		None
0.00	304655	280848	6.07		None
0.40	304355	280848	3.38	7.08	Negligible
0.00	304455	280848	1.14		None
0.00	303855	279648	14.17		None
0.19	303955	279648	8.05	6.33	Negligible
0.00	303655	279648	6.53		None
0.00	303755	279648	7.20		None
0.02	304955	279748	6.47	74.39	Negligible
0.50	303555	279648	5.04	3.81	Negligible
0.00	304755	279748	11.57		None
0.02	304855	279748	9.45	51.45	Negligible
0.01	304655	279648	5.17	185.70	Negligible
0.00	304755	279648	6.09		None
0.00	304455	279648	6.70		None
0.02	304555	279648	5.95	80.80	Negligible
0.03	304255	279648	5.17	61.88	Negligible
0.22	304355	279648	5.77	7.58	Negligible
0.39	304055	279648	3.42	7.17	Negligible
0.00	304155	279648	5.64		None
0.25	303755	279748	4.42	8.68	Negligible
0.10	303855	279748	8.69	11.16	Negligible
0.42	303555	279748	3.84	5.93	Negligible
0.00	303655	279748	3.42		None
0.01	304855	279848	9.05	107.27	Negligible
0.01	304955	279848	8.80	110.21	Negligible
0.01	304655	279848	11.89	82.69	Negligible
0.00	304755	279848	11.04		None
0.02	304555	279748	8.82	54.99	Negligible
0.01	304655	279748	10.50	93.00	Negligible
0.35	304355	279748	4.41	6.21	Negligible
0.00	304455	279748	7.02		None

Peat Depth (m)	Easting	Northing	Slope (deg)	Factor of Safety	Likelihood
0.00	304155	279748	6.36		None
0.31	304255	279748	4.04	7.64	Negligible
0.15	303955	279748	6.73	9.55	Negligible
0.55	304055	279748	4.58	3.81	Negligible
0.03	304955	279948	5.71	56.08	Negligible
0.88	303555	279848	3.17	3.43	Negligible
0.20	304755	279948	5.74	8.37	Negligible
0.03	304855	279948	5.08	62.94	Negligible
0.00	304555	279948	11.69		None
0.00	304655	279948	8.52		None
0.01	304355	279948	16.85	60.09	Negligible
0.00	304455	279948	14.56		None
0.00	304455	279848	11.12		None
0.36	304555	279848	10.20	2.66	Negligible
0.10	304255	279848	9.06	10.71	Negligible
0.01	304355	279848	7.91	122.30	Negligible
0.00	303855	279848	5.44		None
0.00	304155	279848	12.14		None
0.95	303655	279848	2.32	4.33	Negligible
0.00	303755	279848	1.82		None
0.50	304255	280048	9.92	1.96	Unlikely
0.32	304355	280048	11.52	2.66	Negligible
0.01	304755	280148	1.18	811.19	Negligible
0.03	304855	280148	3.80	83.91	Negligible
0.01	304955	280248	2.46	387.88	Negligible
0.03	304655	280148	1.31	242.76	Negligible
0.01	304755	280248	11.33	86.53	Negligible
0.01	304855	280248	8.47	114.43	Negligible
0.00	304155	279948	19.45		None
0.10	304255	279948	18.18	5.62	Negligible
0.01	304855	280048	1.76	541.47	Negligible
0.00	304855	280048	1.76		None
0.03	304655	280048	5.21	61.40	Negligible
0.03	304755	280048	3.03	105.20	Negligible
0.03	304455	280048	9.33	34.72	Negligible
0.03	304555	280048	7.83	41.16	Negligible
0.65	304655	279248	3.56	4.13	Negligible
0.28	304755	279248	6.60	5.21	Negligible
0.00	304455	279248	2.53		None
0.38	304555	279248	4.07	6.20	Negligible
0.20	304255	279248	9.40	5.17	Negligible
1.12	304355	279248	2.49	3.42	Negligible

Peat Depth (m)	Easting	Northing	Slope (deg)	Factor of Safety	Likelihood
0.00	304155	279248	4.51		None
0.06	304155	279248	4.51	35.44	Negligible
0.40	304255	279148	7.29	3.31	Negligible
0.66	304355	279148	5.97	2.44	Negligible
0.27	304055	279148	11.09	3.27	Negligible
0.00	304155	279148	3.82		None
0.00	303855	279148	11.97		None
0.14	303955	279148	17.30	4.19	Negligible
0.13	304855	279248	7.87	9.46	Negligible
0.12	303755	279148	6.44	12.46	Negligible
0.05	304355	279348	6.59	29.24	Negligible
0.00	304455	279348	9.09		None
0.00	304155	279348	6.28		None
0.01	304255	279348	8.08	119.83	Negligible
0.15	303955	279348	13.72	4.82	Negligible
0.19	304055	279348	6.33	8.00	Negligible
0.22	303755	279348	4.11	10.61	Negligible
0.00	303855	279348	15.46		None
0.10	303955	279248	16.63	6.08	Negligible
0.13	304055	279248	8.87	8.42	Negligible
0.15	303755	279248	6.59	9.74	Negligible
0.00	303855	279248	13.70		None
0.00	304755	279348	6.76		None
0.15	304855	279348	4.57	13.98	Negligible
0.44	304555	279348	7.42	2.96	Negligible
0.01	304655	279348	6.74	142.99	Negligible
0.12	304055	279448	5.89	13.60	Negligible
0.00	304155	279448	5.80		None
0.00	303855	279448	15.84		None
0.23	303955	279448	12.44	3.44	Negligible
0.05	303655	279448	4.11	46.67	Negligible
0.17	303755	279448	7.57	7.51	Negligible
0.01	304955	279548	10.70	91.38	Negligible
0.14	303555	279448	6.45	10.66	Negligible
0.02	304855	279448	8.26	58.64	Negligible
0.03	304955	279448	9.19	35.24	Negligible
0.01	304655	279448	7.41	130.30	Negligible
0.00	304755	279448	7.69		None
0.00	304455	279448	5.74		None
0.02	304555	279448	5.23	91.82	Negligible
0.15	304255	279448	5.43	11.79	Negligible
0.05	304355	279448	3.32	57.68	Negligible

Peat Depth (m)	Easting	Northing	Slope (deg)	Factor of Safety	Likelihood
0.15	303955	279548	9.81	6.62	Negligible
0.06	304055	279548	4.34	36.78	Negligible
0.85	303755	279548	7.73	1.47	Unlikely
0.00	303855	279548	17.09		None
0.26	303555	279548	6.86	5.40	Negligible
0.54	303655	279548	7.80	2.30	Negligible
0.01	304855	279648	4.85	197.89	Negligible
0.01	304955	279648	6.62	145.51	Negligible
0.00	304755	279548	6.57		None
0.01	304855	279548	5.07	189.32	Negligible
0.01	304555	279548	3.08	310.15	Negligible
0.01	304655	279548	4.80	199.80	Negligible
0.17	304355	279548	2.91	19.36	Negligible
0.00	304455	279548	4.80		None
0.00	304155	279548	5.09		None
0.12	304255	279548	2.40	33.15	Negligible
0.05	304255	278648	7.28	26.51	Negligible
0.29	304355	278648	7.45	4.47	Negligible
0.15	304055	278648	13.76	4.81	Negligible
0.05	304155	278648	3.93	48.70	Negligible
0.44	303855	278648	13.35	1.69	Unlikely
0.24	303955	278648	22.87	1.94	Unlikely
0.32	304655	278748	5.24	5.72	Negligible
0.00	304755	278748	4.56		None
0.19	304055	278548	13.87	3.77	Negligible
0.18	304155	278548	3.73	14.25	Negligible
0.15	303855	278548	15.94	4.21	Negligible
0.20	303955	278548	15.55	3.23	Negligible
0.50	304655	278648	4.19	4.58	Negligible
0.00	304755	278648	5.12		None
0.00	304455	278648	2.85		None
0.38	304555	278648	3.36	7.50	Negligible
0.53	304655	278848	5.14	3.52	Negligible
0.00	304755	278848	5.61		None
0.08	304455	278848	6.53	18.44	Negligible
0.02	304555	278848	5.75	83.65	Negligible
0.02	304255	278848	5.11	93.99	Negligible
0.10	304355	278848	7.38	13.09	Negligible
0.10	304055	278848	11.02	8.88	Negligible
0.15	304155	278848	2.30	27.72	Negligible
0.00	304455	278748	5.00		None
0.02	304555	278748	3.76	127.39	Negligible

Peat Depth (m)	Easting	Northing	Slope (deg)	Factor of Safety	Likelihood
0.00	304255	278748	3.80		None
0.00	304355	278748	7.78		None
0.00	304055	278748	13.24		None
0.00	304155	278748	2.43		None
0.00	303855	278748	15.41		None
0.00	303955	278748	22.95		None
0.12	304155	278948	6.83	11.77	Negligible
0.15	304255	278948	7.87	8.19	Negligible
0.20	303955	278948	20.54	2.54	Negligible
0.15	304055	278948	12.02	5.45	Negligible
0.33	303755	278948	8.05	3.64	Negligible
0.00	303855	278948	16.91		None
0.00	304755	279048	3.84		None
0.42	304855	279048	6.34	3.61	Negligible
0.00	303855	278848	19.04		None
0.15	303955	278848	21.17	3.30	Negligible
0.00	304755	278948	4.38		None
0.43	304855	278948	4.85	4.60	Negligible
0.03	304555	278948	6.11	52.46	Negligible
0.49	304655	278948	4.35	4.50	Negligible
0.39	304355	278948	9.26	2.69	Negligible
0.97	304455	278948	5.97	1.66	Unlikely
0.39	303755	279048	5.82	4.24	Negligible
0.00	303855	279048	12.97		None
0.20	304755	279148	3.98	12.03	Negligible
0.33	304855	279148	7.35	3.98	Negligible
0.39	304655	279148	3.08	7.97	Negligible
0.00	304755	279148	3.98		None
0.00	304455	279148	3.33		None
0.70	304555	279148	3.90	3.51	Negligible
0.95	304555	279048	4.53	2.23	Negligible
0.59	304655	279048	3.69	4.40	Negligible
0.00	304355	279048	6.46		None
0.00	304455	279048	5.37		None
0.00	304155	279048	8.03		None
0.00	304255	279048	8.37		None
0.15	303955	279048	15.99	4.20	Negligible
0.35	304055	279048	10.91	2.56	Negligible
0.03	304655	278048	6.80	47.25	Negligible
0.84	304755	278048	3.89	2.93	Negligible
0.40	304455	278048	4.66	5.14	Negligible
0.00	304555	278048	6.13		None

Peat Depth (m)	Easting	Northing	Slope (deg)	Factor of Safety	Likelihood
0.05	305255	278148	6.81	28.31	Negligible
0.74	304355	278048	1.21	10.70	Negligible
0.00	305155	278148	6.59		None
0.10	305155	278148	6.59	14.63	Negligible
0.07	304655	277948	6.78	20.31	Negligible
0.02	304755	277948	4.92	97.45	Negligible
0.05	304455	277948	5.64	34.08	Negligible
0.00	304555	277948	6.23		None
0.36	305055	278048	5.98	4.47	Negligible
0.00	305155	278048	4.94		None
0.00	304855	278048	2.94		None
0.15	304955	278048	4.15	15.39	Negligible
0.21	305255	278248	7.15	6.43	Negligible
0.40	305355	278248	3.47	6.90	Negligible
0.07	305055	278248	5.64	24.34	Negligible
0.00	305155	278248	6.94		None
0.17	304855	278248	4.32	13.06	Negligible
0.17	304955	278248	5.52	10.23	Negligible
0.01	304655	278248	6.29	153.13	Negligible
0.01	304755	278248	5.33	180.23	Negligible
0.36	304955	278148	4.65	5.73	Negligible
0.32	305055	278148	4.31	6.95	Negligible
0.52	304755	278148	3.91	4.71	Negligible
1.05	304855	278148	2.96	3.08	Negligible
0.00	304555	278148	6.55		None
0.03	304655	278148	6.28	51.06	Negligible
0.09	304355	278148	3.17	33.51	Negligible
0.00	304455	278148	3.72		None
0.00	304755	278348	7.48		None
0.00	304855	278348	5.83		None
0.16	304555	278348	6.18	9.73	Negligible
0.01	304655	278348	6.47	148.76	Negligible
0.05	304355	278348	3.16	60.64	Negligible
0.08	304455	278348	1.88	63.63	Negligible
0.19	305255	278448	4.37	11.54	Negligible
0.18	304255	278348	4.92	10.84	Negligible
0.00	304455	278248	2.92		None
0.15	304555	278248	6.24	10.28	Negligible
0.00	305355	278348	2.88		None
0.08	304355	278248	3.92	30.54	Negligible
0.00	305155	278348	6.60		None
0.86	305255	278348	5.13	2.18	Negligible

Peat Depth (m)	Easting	Northing	Slope (deg)	Factor of Safety	Likelihood
0.00	304955	278348	4.90		None
0.00	305055	278348	5.68		None
0.14	304255	278448	4.84	14.17	Negligible
0.00	304355	278448	4.62		None
0.02	304655	278548	5.00	96.06	Negligible
0.00	304755	278548	7.01		None
0.00	304455	278548	3.80		None
0.14	304555	278548	4.25	16.10	Negligible
0.02	304255	278548	3.92	122.05	Negligible
0.36	304355	278548	5.14	5.19	Negligible
0.72	305055	278448	6.05	2.21	Negligible
0.41	305155	278448	6.30	3.73	Negligible
0.03	304855	278448	7.55	42.66	Negligible
0.40	304955	278448	4.50	5.33	Negligible
0.01	304655	278448	6.14	156.70	Negligible
0.00	304755	278448	8.14		None
0.00	304455	278448	3.76		None
0.20	304555	278448	4.42	10.84	Negligible
0.25	303955	276948	9.44	4.12	Negligible
0.00	304055	276948	6.29		None
0.00	304355	277048	3.93		None
0.15	304455	277048	6.88	9.35	Negligible
0.21	304155	277048	7.05	6.51	Negligible
0.14	304255	277048	5.31	12.93	Negligible
0.15	303955	277048	16.78	4.02	Negligible
0.13	304055	277048	12.56	6.04	Negligible
0.00	304055	276848	3.02		None
0.19	304155	276848	2.77	18.15	Negligible
0.20	303855	276848	9.14	5.31	Negligible
0.10	303955	276848	7.30	13.22	Negligible
0.12	304355	276948	4.50	17.74	Negligible
0.82	304455	276948	6.03	1.95	Unlikely
0.16	304155	276948	2.46	24.24	Negligible
0.16	304255	276948	0.96	62.48	Negligible
0.03	304955	277348	7.93	40.64	Negligible
0.02	304755	277248	8.77	55.29	Negligible
0.02	304755	277348	3.59	133.52	Negligible
0.03	304855	277348	5.28	60.65	Negligible
0.05	305055	277448	10.45	18.68	Negligible
0.10	304655	277348	3.28	29.19	Negligible
0.03	304855	277448	4.19	76.25	Negligible
0.03	304955	277448	6.00	53.43	Negligible

Peat Depth (m)	Easting	Northing	Slope (deg)	Factor of Safety	Likelihood
0.48	304855	277148	3.55	5.62	Negligible
0.00	304855	277148	3.55		None
0.22	304455	277148	5.60	7.80	Negligible
0.02	304755	277148	4.99	96.16	Negligible
0.06	304055	277148	11.61	14.09	Negligible
0.00	304355	277148	4.03		None
0.10	304855	277248	10.61	9.21	Negligible
0.03	304955	277248	5.81	55.19	Negligible
0.72	304455	277548	4.05	3.28	Negligible
1.40	304555	277548	5.02	1.37	Likely
0.10	304855	277648	3.38	28.28	Negligible
0.22	304955	277648	4.20	10.37	Negligible
1.31	304655	277648	4.91	1.49	Unlikely
0.25	304755	277648	3.14	12.18	Negligible
0.13	304455	277648	4.45	16.58	Negligible
0.00	304555	277648	7.17		None
0.07	304655	277448	3.95	34.69	Negligible
0.02	304755	277448	2.01	237.28	Negligible
0.05	305055	277548	8.74	22.20	Negligible
0.58	304555	277448	3.26	5.06	Negligible
0.28	304855	277548	4.93	6.95	Negligible
0.03	304955	277548	5.07	63.09	Negligible
0.13	304655	277548	4.18	17.64	Negligible
1.30	304755	277548	3.94	1.87	Unlikely
0.03	304755	277848	5.17	61.93	Negligible
0.00	304855	277848	2.20		None
0.00	304555	277848	5.34		None
0.03	304655	277848	6.45	49.80	Negligible
0.00	305055	277948	3.70		None
0.08	304455	277848	5.30	22.64	Negligible
0.20	304855	277948	2.35	20.37	Negligible
0.47	304955	277948	3.75	5.44	Negligible
0.00	304855	277748	3.14		None
0.09	304955	277748	5.43	19.65	Negligible
0.20	304655	277748	6.46	7.46	Negligible
0.57	304755	277748	4.15	4.05	Negligible
0.15	304455	277748	3.88	16.45	Negligible
0.00	304555	277748	6.56		None
0.02	304955	277848	3.22	148.80	Negligible
0.10	305055	277848	4.18	22.93	Negligible
0.62	303955	275748	12.57	1.27	Likely
0.00	304055	275748	8.06		None

Peat Depth (m)	Easting	Northing	Slope (deg)	Factor of Safety	Likelihood
0.10	304055	275848	9.67	10.06	Negligible
0.17	304155	275848	9.67	5.92	Negligible
0.55	304155	275948	7.02	2.50	Negligible
0.47	303955	275848	7.45	2.76	Negligible
0.39	303955	275948	8.91	2.79	Negligible
0.13	304055	275948	9.50	7.88	Negligible
0.40	304155	275748	4.11	5.82	Negligible
0.12	303755	276148	17.38	4.87	Negligible
0.06	303855	276148	16.40	10.25	Negligible
0.10	303555	276148	19.05	5.40	Negligible
0.00	303655	276148	19.23		None
0.47	304155	276248	4.49	4.55	Negligible
0.10	303455	276148	16.85	6.01	Negligible
0.14	303955	276248	8.30	8.34	Negligible
0.00	304055	276248	9.27		None
0.25	303955	276048	7.08	5.45	Negligible
0.12	304055	276048	8.01	10.06	Negligible
0.08	303755	276048	9.02	13.45	Negligible
0.10	303855	276048	6.61	14.57	Negligible
0.28	303555	276048	10.83	3.23	Negligible
0.00	303655	276048	12.58		None
0.08	303955	276148	18.94	6.78	Negligible
0.00	304055	276148	4.26		None
0.75	304155	276448	5.23	2.45	Negligible
0.96	304255	276448	2.84	3.51	Negligible
0.25	303955	276448	6.55	5.88	Negligible
0.00	304055	276448	8.59		None
0.07	304155	276548	7.51	18.38	Negligible
0.02	304255	276548	5.70	84.32	Negligible
0.12	303955	276548	1.10	72.33	Negligible
0.00	304055	276548	4.67		None
0.14	303755	276248	4.09	16.74	Negligible
0.05	303855	276248	3.19	59.97	Negligible
0.19	303555	276248	13.69	3.82	Negligible
0.00	303655	276248	9.91		None
0.23	304055	276348	6.77	6.19	Negligible
0.64	304155	276348	6.98	2.16	Negligible
0.21	303855	276348	0.93	48.77	Negligible
0.34	303955	276348	5.70	4.96	Negligible
0.00	304055	276748	5.19		None
0.10	304155	276748	5.64	17.04	Negligible
0.05	303855	276748	8.63	22.48	Negligible

Peat Depth (m)	Easting	Northing	Slope (deg)	Factor of Safety	Likelihood
0.12	303955	276748	6.44	12.46	Negligible
0.54	304455	276848	1.15	15.43	Negligible
0.19	303755	276748	7.95	6.40	Negligible
0.20	304255	276848	2.39	20.01	Negligible
0.20	304355	276848	4.44	10.80	Negligible
0.60	304255	276648	5.85	2.74	Negligible
0.17	304355	276648	3.42	16.48	Negligible
0.00	304055	276648	3.06		None
0.35	304155	276648	4.05	6.76	Negligible
0.62	304455	276748	2.92	5.28	Negligible
0.08	303955	276648	3.67	32.59	Negligible
0.03	304255	276748	5.78	55.41	Negligible
0.00	304355	276748	5.55		None
0.52	303155	282748	4.82	3.83	Negligible
0.49	303255	282748	4.15	4.71	Negligible
0.00	304255	282848	4.00		None
0.03	304355	282848	6.77	47.45	Negligible
0.00	304055	282848	1.08		None
0.00	304155	282848	4.20		None
1.13	303855	282848	5.70	1.49	Unlikely
0.49	303955	282848	4.54	4.31	Negligible
0.62	303955	282748	8.92	1.76	Unlikely
0.00	304055	282748	2.79		None
0.00	303755	282748	10.40		None
0.28	303855	282748	8.86	3.91	Negligible
0.51	303555	282748	5.10	3.69	Negligible
0.25	303655	282748	2.53	15.14	Negligible
0.34	303355	282748	3.44	8.19	Negligible
0.45	303455	282748	6.99	3.07	Negligible
0.75	304055	282948	1.67	7.61	Negligible
0.02	304155	282948	1.20	398.76	Negligible
0.14	303855	282948	3.79	18.05	Negligible
0.03	303955	282948	2.29	138.95	Negligible
0.55	303655	282948	7.09	2.48	Negligible
0.00	303755	282948	5.10		None
0.03	304155	283048	0.97	329.68	Negligible
0.87	303555	282948	5.52	2.00	Negligible
0.20	303655	282848	3.63	13.17	Negligible
0.00	303755	282848	1.66		None
0.55	303455	282848	5.56	3.14	Negligible
0.66	303555	282848	10.47	1.41	Unlikely
0.40	303255	282848	6.88	3.50	Negligible

Peat Depth (m)	Easting	Northing	Slope (deg)	Factor of Safety	Likelihood
0.41	303355	282848	7.37	3.19	Negligible
0.05	304255	282948	4.26	44.98	Negligible
0.03	304355	282948	6.24	51.45	Negligible
0.30	303755	283148	2.92	10.93	Negligible
0.40	303855	283148	2.60	9.21	Negligible
0.54	303555	283148	4.39	4.04	Negligible
0.59	303655	283148	3.85	4.22	Negligible
0.02	303955	283248	1.37	348.48	Negligible
0.00	304055	283248	3.40		None
0.00	303755	283248	1.75		None
0.28	303855	283248	2.93	11.66	Negligible
0.02	303955	283048	4.19	114.38	Negligible
0.00	304055	283048	0.99		None
0.15	303755	283048	5.07	12.61	Negligible
1.00	303855	283048	5.19	1.85	Unlikely
0.50	303555	283048	4.91	3.91	Negligible
0.45	303655	283048	3.80	5.60	Negligible
0.01	303955	283148	2.67	358.05	Negligible
0.00	304055	283148	5.42		None
0.03	303955	283448	1.83	174.51	Negligible
0.00	304055	283448	4.52		None
0.00	303755	283448	1.36		None
0.15	303855	283448	3.16	20.18	Negligible
0.67	303555	283448	3.62	3.95	Negligible
0.41	303655	283448	3.40	6.86	Negligible
1.67	303855	283548	2.45	2.33	Negligible
0.15	303955	283548	1.51	42.11	Negligible
0.25	303555	283248	2.01	18.97	Negligible
0.61	303655	283248	3.80	4.14	Negligible
0.02	303955	283348	2.72	175.83	Negligible
0.00	304055	283348	4.20		None
0.00	303755	283348	6.44		None
0.18	303855	283348	4.10	12.97	Negligible
0.60	303555	283348	3.81	4.19	Negligible
0.44	303655	283348	2.46	8.82	Negligible
0.65	304155	282348	7.26	2.05	Negligible
0.00	304255	282348	9.44		None
0.00	303955	282348	4.04		None
0.02	304055	282348	5.29	90.84	Negligible
0.21	303755	282348	6.32	7.25	Negligible
0.26	303855	282348	8.18	4.55	Negligible
0.25	303555	282348	9.25	4.20	Negligible

Peat Depth (m)	Easting	Northing	Slope (deg)	Factor of Safety	Likelihood
0.24	303655	282348	9.03	4.48	Negligible
0.47	304155	282248	10.22	2.03	Negligible
0.00	304255	282248	9.12		None
0.15	303455	282248	6.38	10.06	Negligible
0.25	303555	282248	9.68	4.02	Negligible
0.47	303255	282248	4.27	4.78	Negligible
0.56	303355	282248	4.19	4.08	Negligible
0.60	303055	282248	3.50	4.56	Negligible
0.71	303155	282248	3.96	3.41	Negligible
0.35	303855	282448	11.32	2.48	Negligible
0.07	303955	282448	15.31	9.35	Negligible

Peat Depth (m)	Easting	Northing	Slope (deg)	Factor of Safety	Likelihood
0.35	303655	282448	8.97	3.09	Negligible
0.11	303755	282448	6.78	12.92	Negligible
0.66	303455	282448	8.80	1.67	Unlikely
0.71	303555	282448	9.62	1.43	Unlikely
0.15	303255	282448	3.36	18.97	Negligible
0.60	303355	282448	4.87	3.28	Negligible
0.10	303355	282348	9.57	10.17	Negligible
0.00	303455	282348	4.54		None
0.35	303155	282348	3.76	7.28	Negligible

Appendix 2 Sub-Area Hazard and Risk Rating Analysis

Sub-Area	Average Peat	Average Relief	Relief Value	Receptor	Receptor Distance	Receptor	Hazard Value	Hazard	Max Likelihood	Av Hazard	Max	Risk Value	Unmitigated Risk Rating	Mitigated Risk Rating	
C01	0.05	2	Long uninterrupted	3	minor watercourses, critical infrastructure	4	< 50	4	9	High	Negligible	4	1	4	Negligible
C02	0.04	2	Long uninterrupted	3	minor watercourses, critical infrastructure	4	< 50	4	9	High	Negligible	4	1	4	Negligible
C03	0.05	2	Long uninterrupted	3	minor watercourses, critical infrastructure	4	< 50	4	9	High	Negligible	4	1	4	Negligible
C04	0.04	2	Rolling	2	minor watercourses, critical infrastructure	4	< 50	4	6	Moderate	Negligible	3	1	3	Negligible
C05	0.01	2	Long uninterrupted	3	minor watercourses, critical infrastructure	4	< 50	4	9	High	Negligible	4	1	4	Negligible
C06	0.08	2	Rolling	2	Non-critical Infrastructure	3	< 50	4	4	Low	Negligible	2	1	2	Negligible
C07	0.04	2	Long uninterrupted	3	Non-critical Infrastructure	3	< 50	4	7	Moderate	Negligible	3	1	3	Negligible
C08	0.01	2	Long uninterrupted	3	Residential properties, important habitat	5	< 50	4	12	Extremely High	Negligible	5	1	5	Low
C09	0.03	2	Rolling	2	Residential properties, important habitat	5	< 50	4	8	Moderate	Negligible	3	1	3	Negligible
C10	0.03	2	Rolling	2	minor watercourses, critical infrastructure	4	< 50	4	6	Moderate	Negligible	3	1	3	Negligible
C11	0.03	2	Rolling	2	minor watercourses, critical infrastructure	4	< 50	4	6	Moderate	Negligible	3	1	3	Negligible

Sub-Area	Average Peat	Average Relief	Relief Value	Receptor	Receptor Distance	Receptor	Hazard Value	Hazard	Max Likelihood	Av Hazard	Max	Risk Value	Unmitigated Risk Rating	Mitigated Risk Rating		
C12	0.07	2	Long uninterrupted	3	minor watercourses, critical infrastructure	4	< 50	4	9	High	Unlikely	4	2	8	Low	Negligible
C13	0.01	2	Rolling	2	minor watercourses, critical infrastructure	4	< 50	4	6	Moderate	Unlikely	3	2	6	Low	Negligible
C14	0.06	2	Rolling	2	Non-critical Infrastructure	3	< 50	4	4	Low	Negligible	2	1	2	Negligible	Negligible
C15	0.02	2	Rolling	2	Residential properties, important habitat	5	< 50	4	8	Moderate	Unlikely	3	2	6	Low	Negligible
C16	0.01	2	Rolling	2	minor watercourses, critical infrastructure	4	50 - 100	3	4	Low	Negligible	2	1	2	Negligible	Negligible
C17	0.04	2	Rolling	2	minor watercourses, critical infrastructure	4	< 50	4	6	Moderate	Unlikely	3	2	6	Low	Negligible
C18	0.03	2	Long uninterrupted	3	minor watercourses, critical infrastructure	4	< 50	4	9	High	Negligible	4	1	4	Negligible	Negligible
C19	0.01	2	Rolling	2	Non-critical Infrastructure	3	< 50	4	4	Low	Negligible	2	1	2	Negligible	Negligible
C20	0.09	2	Rolling	2	minor watercourses, critical infrastructure	4	< 50	4	6	Moderate	Negligible	3	1	3	Negligible	Negligible
C21	0.05	2	Long uninterrupted	3	minor watercourses, critical infrastructure	4	50 - 100	3	7	Moderate	Negligible	3	1	3	Negligible	Negligible
C22	0.06	2	Long uninterrupted	3	minor watercourses, critical infrastructure	4	< 50	4	9	High	Negligible	4	1	4	Negligible	Negligible

Sub-Area	Average Peat	Average Relief	Relief Value	Receptor	Receptor Distance	Receptor	Hazard Value	Hazard	Max Likelihood	Av Hazard	Max	Risk Value	Unmitigated Risk Rating	Mitigated Risk Rating		
C 2 3	0.16	2	Rolling	2	minor watercourses, critical infrastructure	4	< 50	4	6	Moderate	Negligible	3	1	3	Negligible	Negligible
C 2 4	0.20	2	Long uninterrupted	3	minor watercourses, critical infrastructure	4	< 50	4	9	High	Negligible	4	1	4	Negligible	Negligible
C 2 5	0.22	2	Rolling	2	minor watercourses, critical infrastructure	4	< 50	4	6	Moderate	Unlikely	3	2	6	Low	Low
C 2 6	0.22	2	Long uninterrupted	3	minor watercourses, critical infrastructure	4	< 50	4	9	High	Negligible	4	1	4	Negligible	Negligible
C 2 7	0.21	2	Rolling	2	minor watercourses, critical infrastructure	4	< 50	4	6	Moderate	Negligible	3	1	3	Negligible	Negligible
C 2 8	0.21	2	Long uninterrupted	3	Non-critical Infrastructure	3	< 50	4	7	Moderate	Unlikely	3	2	6	Low	Negligible
C 2 9	0.21	2	Rolling	2	minor watercourses, critical infrastructure	4	< 50	4	6	Moderate	Unlikely	3	2	6	Low	Negligible
C 3 0	0.21	2	Rolling	2	minor watercourses, critical infrastructure	4	< 50	4	6	Moderate	Unlikely	3	2	6	Low	Negligible
C 3 1	0.21	2	Long uninterrupted	3	Non-critical Infrastructure	3	< 50	4	7	Moderate	Negligible	3	1	3	Negligible	Negligible
C 3 2	0.22	2	Long uninterrupted	3	minor watercourses, critical infrastructure	4	< 50	4	9	High	Negligible	4	1	4	Negligible	Negligible
C 3 3	0.22	2	Long uninterrupted	3	Non-critical Infrastructure	3	50 - 100	3	5	Low	Likely	2	3	6	Low	Negligible

Sub-Area	Average Peat	Average Relief	Relief Value	Receptor	Receptor Distance	Receptor	Hazard Value	Hazard	Max Likelihood	Av Hazard	Max	Risk Value	Unmitigated Risk Rating	Mitigated Risk Rating	
C 3 4	0.17	2	Long uninterrupted	3	Non-critical Infrastructure	3	< 50	4	7	Moderate	Likely	3	3	9	Moderate
C 3 5	0.22	2	Long uninterrupted	3	Residential properties, important habitat	5	< 50	4	12	Extremely High	Negligible	5	1	5	Low
C 3 6	0.22	2	Rolling	2	minor watercourses, critical infrastructure	4	< 50	4	6	Moderate	Unlikely	3	2	6	Low
C 3 7	0.22	2	Rolling	2	minor watercourses, critical infrastructure	4	50 - 100	3	4	Low	Likely	2	3	6	Low
C 3 8	0.21	2	Long uninterrupted	3	minor watercourses, critical infrastructure	4	< 50	4	9	High	Negligible	4	1	4	Negligible
N 0 1	0.24	2	Undulating	1	minor watercourses, critical infrastructure	4	100 - 150	2	1	Very Low	Unlikely	1	2	2	Negligible
N 0 2	0.27	2	Long uninterrupted	3	minor watercourses, critical infrastructure	4	< 50	4	9	High	Negligible	4	1	4	Negligible
N 0 3	0.27	2	Rolling	2	minor watercourses, critical infrastructure	4	< 50	4	6	Moderate	Likely	3	3	9	Moderate
N 0 4	0.23	2	Rolling	2	minor watercourses, critical infrastructure	4	< 50	4	6	Moderate	Unlikely	3	2	6	Low
N 0 5	0.23	2	Rolling	2	minor watercourses, critical infrastructure	4	< 50	4	6	Moderate	Negligible	3	1	3	Negligible
N 0 6	0.23	2	Rolling	2	minor watercourses, critical infrastructure	4	< 50	4	6	Moderate	Unlikely	3	2	6	Low

Sub-Area	Average Peat	Average Relief	Relief Value	Receptor	Receptor Distance	Receptor Hazard Value	Hazard	Max Likelihood	Av Hazard	Max	Risk Value	Unmitigated Risk Rating	Mitigated Risk Rating
N 07	0.13	2	Long uninterrupted	3	minor watercourses, critical infrastructure	4 < 50 4 9 6	High	Negligible	4	1	4	Negligible	Negligible
N 08	0.42	2	Long uninterrupted	3	minor watercourses, critical infrastructure	4 < 50 4 9 6	High	Unlikely	4	2	8	Low	Low
N 09	0.33	2	Long uninterrupted	3	minor watercourses, critical infrastructure	4 < 50 4 9 6	High	Unlikely	4	2	8	Low	Negligible
N 10	0.28	2	Rolling	2	minor watercourses, critical infrastructure	4 < 50 4 6 4	Moderate	Negligible	3	1	3	Negligible	Negligible
N 12	0.59	3	Long uninterrupted	3	minor watercourses, critical infrastructure	4 < 50 4 1 4 4	Extremely High	Negligible	5	1	5	Low	Negligible
N 11	0.32	2	Long uninterrupted	3	minor watercourses, critical infrastructure	4 < 50 4 9 6	High	Likely	4	3	12	Moderate	Negligible
N 13	0.27	2	Long uninterrupted	3	minor watercourses, critical infrastructure	4 < 50 4 9 6	High	Negligible	4	1	4	Negligible	Negligible
N 12	0.36	2	Long uninterrupted	3	minor watercourses, critical infrastructure	4 < 50 4 9 6	High	Likely	4	3	12	Moderate	Negligible
N 13	0.31	2	Long uninterrupted	3	minor watercourses, critical infrastructure	4 < 50 4 9 6	High	Negligible	4	1	4	Negligible	Negligible
N 14	0.34	2	Rolling	2	minor watercourses, critical infrastructure	4 < 50 4 6 4	Moderate	Likely	3	3	9	Moderate	Low

Sub-Area	Average Peat	Average Relief	Relief Value	Receptor	Receptor Distance	Receptor Hazard Value	Hazard	Max Likelihood	Av Hazard	Max Risk Value	Unmitigated Risk Rating	Mitigated Risk Rating
N 24	0.24	2	Long uninterrupted	3	minor watercourses, critical infrastructure	4 < 50 4 9 6	High	Negligible	4 1 4	Negligible	Negligible	
N 15	0.25	2	Rolling	2	minor watercourses, critical infrastructure	4 < 50 4 6 4	Moderate	Likely	3 3 9	Moderate	Low	
N 16	0.26	2	Rolling	2	minor watercourses, critical infrastructure	4 < 50 4 6 4	Moderate	Unlikely	3 2 6	Low	Low	
N 17	0.37	2	Long uninterrupted	3	minor watercourses, critical infrastructure	4 < 50 4 9 6	High	Unlikely	4 2 8	Low	Negligible	
N 18	0.41	2	Long uninterrupted	3	minor watercourses, critical infrastructure	4 < 50 4 9 6	High	Unlikely	4 2 8	Low	Negligible	
N 19	0.19	2	Long uninterrupted	3	Residential properties, important habitat	5 < 50 4 1 2 0	Extremely High	Negligible	5 1 5	Low	Negligible	
N 20	0.28	2	Rolling	2	Residential properties, important habitat	5 < 50 4 8 0	Moderate	Negligible	3 1 3	Negligible	Negligible	
N 21	0.21	2	Long uninterrupted	3	Residential properties, important habitat	5 < 50 4 1 2 0	Extremely High	Unlikely	5 2 1 0	Moderate	Negligible	
S 01	0.15	2	Rolling	2	minor watercourses, critical infrastructure	4 100 - 2 3 2	Low	Negligible	2 1 2	Negligible	Negligible	
S 02	0.21	2	Rolling	2	minor watercourses, critical infrastructure	4 < 50 4 6 4	Moderate	Unlikely	3 2 6	Low	Negligible	
S 03	0.33	2	Long uninterrupted	3	None	1 > 150 1 6	Very Low	Negligible	1 1 1	Negligible	Negligible	

Sub-Area	Average Peat	Average Relief	Relief Value	Receptor	Receptor Distance	Receptor Hazard Value	Hazard	Max Likelihood	Av Hazard	Max Risk Value	Unmitigated Risk Rating	Mitigated Risk Rating			
S04	0.2	2	Long uninterrupted	3	minor watercourses, critical infrastructure	4 < 50	4	9	High	Negligible	4	1	4	Negligible	Negligible
S05	0.2	2	Rolling	2	minor watercourses, critical infrastructure	4 < 50	4	6	Moderate	Negligible	3	1	3	Negligible	Negligible
S06	0.1	2	Long uninterrupted	3	Residential properties, important habitat	5 < 50	4	1	Extremely High	Negligible	5	1	5	Low	Negligible
S07	0.1	2	Rolling	2	None	1 > 150	1	4	Very Low	Negligible	1	1	1	Negligible	Negligible
S08	0.1	2	Long uninterrupted	3	Residential properties, important habitat	5 < 50	4	1	Extremely High	Negligible	5	1	5	Low	Negligible
S09	0.2	2	Rolling	2	minor watercourses, critical infrastructure	4 < 50	4	6	Moderate	Likely	3	3	9	Moderate	Negligible

Appendix 3 Refined Likelihood Ratings

N03 Refined Likelihood Ratings	Peat Depth (m)	Easting	Northing	Slope (deg)	Factor of Safety	Likelihood Rating
	0.35	303449	282565	3.89	7.03	Negligible
	0.38	303370	282668	5.31	4.76	Negligible
	0.48	303360	282668	5.31	3.77	Negligible
	0.70	303350	282668	5.31	2.58	Negligible
	0.06	303757	282697	8.08	19.96	Negligible
	0.69	303340	282668	2.27	6.12	Negligible
	0.40	303317	282607	2.12	11.27	Negligible
	0.35	303400	282668	6.35	4.33	Negligible
	0.30	303511	282565	4.02	7.94	Negligible
	0.36	303390	282668	5.31	5.02	Negligible
	0.35	303342	282566	3.50	7.81	Negligible
	0.42	303599	282576	5.34	4.28	Negligible
	0.65	303380	282668	5.31	2.78	Negligible

N03 Refined Likelihood Ratings	Peat Depth (m)	Easting	Northing	Slope (deg)	Factor of Safety	Likelihood Rating
	0.40	303490	282561	3.25	7.35	Negligible
	0.51	303693	282584	4.41	4.26	Negligible
	0.39	303729	282612	3.59	6.83	Negligible
	0.26	303767	282697	8.08	4.61	Negligible
	0.34	303752	282651	8.08	3.52	Negligible
	0.76	303400	282566	4.64	2.72	Negligible
	0.25	303355	282648	5.20	7.38	Negligible
	0.74	303498	282569	3.25	3.97	Negligible
	0.44	303697	282575	4.41	4.94	Negligible
	0.48	303548	282573	4.02	4.96	Negligible
	0.26	303722	282618	3.59	10.24	Negligible
	0.32	303742	282654	2.35	12.69	Negligible
	0.00	303755	282648	5.64		None
	0.40	303330	282648	2.12	11.27	Negligible
	0.25	303761	282648	5.64	6.82	Negligible
	0.32	303320	282648	2.12	14.09	Negligible
	0.50	303547	282583	4.02	4.77	Negligible
	0.42	303310	282648	2.12	10.74	Negligible
	0.46	303600	282586	5.26	3.97	Negligible
	0.54	303300	282648	2.12	8.35	Negligible
	0.33	303599	282566	5.34	5.45	Negligible
	0.72	303688	282593	4.41	3.02	Negligible
	0.54	303652	282573	4.41	4.02	Negligible
	0.53	303448	282575	3.89	4.65	Negligible
	0.50	303449	282555	3.89	4.92	Negligible
	0.69	303497	282579	3.25	4.26	Negligible
	0.68	303499	282559	3.25	4.32	Negligible
	0.44	303350	282577	3.50	6.21	Negligible
	0.48	303370	282648	5.20	3.84	Negligible
	0.78	303349	282557	3.50	3.50	Negligible
	0.52	303360	282648	5.20	3.55	Negligible
	0.52	303400	282576	4.64	3.97	Negligible
	0.50	303350	282648	5.20	3.69	Negligible
	0.52	303399	282556	4.64	3.97	Negligible
	0.51	303455	282548	5.39	3.49	Negligible
	0.45	303340	282648	2.12	10.02	Negligible
	0.72	303355	282548	4.58	2.91	Negligible
	0.43	303653	282563	4.41	5.05	Negligible
	0.60	303310	282628	2.12	7.52	Negligible
	0.59	303330	282628	2.12	7.64	Negligible
	0.57	303320	282628	2.12	7.91	Negligible

N03 Refined Likelihood Ratings					
Peat Depth (m)	Easting	Northing	Slope (deg)	Factor of Safety	Likelihood Rating
0.47	303310	282608	2.12	9.59	Negligible
0.66	303455	282448	9.26	1.59	Unlikely
0.23	303618	282588	5.26	7.94	Negligible
0.55	303320	282608	2.12	8.20	Negligible
0.44	303370	282718	4.04	5.38	Negligible
0.43	303360	282718	4.04	5.51	Negligible
0.50	303350	282718	4.04	4.74	Negligible
0.00	303449	282500	5.20		None
0.57	303340	282718	0.75	22.43	Negligible
0.65	303380	282718	4.04	3.64	Negligible
0.37	303330	282698	2.27	11.40	Negligible
0.34	303370	282698	5.31	5.32	Negligible
0.44	303360	282698	5.31	4.11	Negligible
0.55	303350	282698	5.31	3.29	Negligible
0.39	303340	282698	2.27	10.82	Negligible
0.49	303410	282698	6.35	3.10	Negligible
0.50	303400	282698	6.35	3.03	Negligible
0.53	303390	282698	5.31	3.41	Negligible
0.26	303380	282698	5.31	6.96	Negligible
0.56	303625	282594	5.26	3.26	Negligible
0.22	303610	282583	5.26	8.30	Negligible
0.59	303320	282678	2.27	7.15	Negligible
0.30	303440	282559	3.89	8.21	Negligible
0.46	303439	282500	5.20	4.01	Negligible
0.25	303447	282450	6.34	6.08	Negligible
0.58	303459	282500	5.39	3.07	Negligible
0.59	303437	282451	6.34	2.58	Negligible
0.73	303457	282448	9.26	1.44	Unlikely
0.42	303360	282678	5.31	4.31	Negligible
0.44	303441	282549	5.20	4.20	Negligible
0.43	303350	282678	5.31	4.21	Negligible
0.72	303391	282547	4.58	2.91	Negligible
0.58	303340	282678	2.27	7.28	Negligible
0.40	303466	282546	5.39	4.45	Negligible
0.53	303330	282678	2.27	7.96	Negligible
0.57	303473	282539	5.39	3.12	Negligible
0.52	303400	282678	6.35	2.92	Negligible
0.50	303390	282557	4.64	4.13	Negligible
0.55	303390	282678	5.31	3.29	Negligible
0.30	303747	282696	2.35	13.54	Negligible
0.65	303336	282558	3.50	4.21	Negligible

N03 Refined Likelihood Ratings					
Peat Depth (m)	Easting	Northing	Slope (deg)	Factor of Safety	Likelihood Rating
0.44	303380	282678	5.31	4.11	Negligible
0.54	303458	282552	3.25	5.45	Negligible
0.46	303370	282678	5.31	3.93	Negligible
0.84	303491	282551	3.25	3.50	Negligible
0.73	303490	282571	3.25	4.03	Negligible
0.56	303441	282569	3.89	4.40	Negligible
0.30	303652	282583	4.41	7.24	Negligible
0.71	303391	282567	4.64	2.91	Negligible
0.50	303410	282678	6.35	3.03	Negligible
0.30	303549	282563	4.02	7.94	Negligible
0.36	303513	282555	4.02	6.62	Negligible
0.25	303737	282605	3.59	10.65	Negligible
0.56	303327	282607	2.12	8.05	Negligible
0.52	303307	282607	2.12	8.67	Negligible
0.42	303509	282575	4.02	5.67	Negligible
0.45	303349	282574	3.50	6.07	Negligible
0.59	303330	282668	2.27	7.15	Negligible
0.51	303320	282668	2.27	8.27	Negligible
0.45	303350	282567	3.50	6.07	Negligible

N04 Refined Likelihood Ratings					
Peat Depth (m)	Easting	Northing	Slope (deg)	Factor of Safety	Likelihood Rating
0.05	303648	282867	4.28	597.17	Negligible
0.05	303658	282867	6.50	259.78	Negligible
0.05	303668	282866	6.50	259.78	Negligible
0.54	303676	282811	4.46	51.07	Negligible
0.06	303684	282817	4.46	459.64	Negligible
0.23	303688	282923	7.43	43.24	Negligible
0.10	303692	282824	4.46	275.78	Negligible
0.02	303692	282913	7.43	497.31	Negligible
0.06	303696	282904	7.43	165.77	Negligible
0.39	303708	282772	6.91	29.43	Negligible
0.16	303716	282779	6.91	71.74	Negligible
0.03	303723	282785	6.91	382.61	Negligible
0.20	303736	282735	3.41	235.17	Negligible
0.24	303744	282740	3.41	195.98	Negligible
0.23	303753	282745	12.90	14.42	Negligible

N06 Refined Likelihood Ratings					
Peat Depth (m)	Easting	Northing	Slope (deg)	Factor of Safety	Likelihood Rating
0.60	303940	282778	6.38	2.51	Negligible
0.37	303950	282778	5.97	4.36	Negligible
0.50	303960	282778	5.97	3.22	Negligible
0.20	303970	282688	11.70	4.20	Negligible
0.20	303990	282688	11.70	4.20	Negligible
0.52	303940	282788	6.38	2.90	Negligible
0.24	304000	282688	5.46	7.34	Negligible
0.58	303950	282788	5.97	2.78	Negligible
0.45	303960	282788	5.97	3.58	Negligible
0.17	304010	282688	5.46	10.36	Negligible
0.47	303970	282788	5.97	3.43	Negligible
0.77	303980	282788	5.97	2.09	Negligible
0.27	303970	282698	11.70	3.11	Negligible
0.28	303980	282698	11.70	3.00	Negligible
0.20	303990	282698	11.70	4.20	Negligible
0.24	304000	282698	5.46	7.34	Negligible
0.18	304010	282698	5.46	9.78	Negligible
0.00	303980	282688	11.70		None
0.60	304000	282758	4.41	3.62	Negligible
0.20	303960	282758	5.97	8.06	Negligible
0.70	303950	282758	5.97	2.30	Negligible
0.20	303970	282758	5.97	8.06	Negligible
0.54	303980	282758	5.97	2.98	Negligible
0.25	303990	282758	5.97	6.45	Negligible
0.33	303980	282768	5.97	4.88	Negligible
0.33	303990	282768	5.97	4.88	Negligible
0.45	304000	282768	4.41	4.83	Negligible
0.45	303940	282768	6.38	3.35	Negligible
0.67	303950	282768	5.97	2.41	Negligible
1.13	303960	282768	5.97	1.43	Unlikely
0.52	303970	282768	5.97	3.10	Negligible
0.62	303950	282738	8.49	1.84	Unlikely
0.20	303960	282738	8.49	5.71	Negligible
0.26	303970	282738	8.49	4.39	Negligible
0.57	303980	282738	8.49	2.00	Negligible
0.50	303990	282738	8.49	2.28	Negligible
0.40	304000	282738	4.26	5.63	Negligible
0.39	304010	282738	4.26	5.77	Negligible
0.58	303950	282748	8.49	1.97	Unlikely

N06 Refined Likelihood Ratings					
Peat Depth (m)	Easting	Northing	Slope (deg)	Factor of Safety	Likelihood Rating
0.36	303960	282748	8.49	3.17	Negligible
0.25	303970	282748	8.49	4.57	Negligible
0.79	303980	282748	8.49	1.44	Unlikely
0.80	303990	282748	8.49	1.43	Unlikely
0.71	304000	282748	4.26	3.17	Negligible
0.21	303960	282708	8.49	5.44	Negligible
0.10	303970	282708	8.49	11.41	Negligible
0.22	303980	282708	8.49	5.19	Negligible
0.16	303990	282708	8.49	7.13	Negligible
0.34	303950	282798	5.97	4.74	Negligible
0.19	304000	282708	4.26	11.85	Negligible
0.60	303960	282798	5.97	2.69	Negligible
0.25	304010	282708	4.26	9.00	Negligible
0.60	303970	282798	5.97	2.69	Negligible
0.22	303980	282718	8.49	5.19	Negligible
0.28	303990	282718	8.49	4.08	Negligible
0.23	304000	282718	4.26	9.79	Negligible
0.35	304010	282718	4.26	6.43	Negligible
0.22	303960	282718	8.49	5.19	Negligible
0.29	303970	282718	8.49	3.94	Negligible
0.19	303960	282728	8.49	6.01	Negligible
0.26	303970	282728	8.49	4.39	Negligible
0.19	303980	282728	8.49	6.01	Negligible
0.37	303990	282728	8.49	3.09	Negligible
0.27	304000	282728	4.26	8.34	Negligible
0.38	304010	282728	4.26	5.92	Negligible
0.78	303970	282778	5.97	2.07	Negligible
0.35	303980	282778	5.97	4.60	Negligible
0.44	303990	282778	5.97	3.66	Negligible

N08 Refined Likelihood Ratings					
Peat Depth (m)	Easting	Northing	Slope (deg)	Factor of Safety	Likelihood Rating
0.88	303298	282216	4.65	2.35	Negligible
1.09	303318	282216	7.64	1.16	Likely
0.30	303288	282226	4.65	6.88	Negligible
0.51	303248	282226	4.21	4.46	Negligible
0.66	303248	282236	4.21	3.45	Negligible
0.26	303258	282226	4.65	7.94	Negligible
0.96	303258	282236	4.65	2.15	Negligible

N08 Refined Likelihood Ratings					
Peat Depth (m)	Easting	Northing	Slope (deg)	Factor of Safety	Likelihood Rating
1.05	303268	282226	4.65	1.97	Unlikely
0.49	303268	282236	4.65	4.21	Negligible
1.02	303278	282226	4.65	2.02	Negligible
0.81	303278	282236	4.65	2.55	Negligible
0.70	303308	282226	7.64	1.81	Unlikely
0.73	303288	282236	4.65	2.83	Negligible
0.86	303298	282236	4.65	2.40	Negligible
0.66	303258	282246	4.65	3.13	Negligible
0.69	303268	282246	4.65	2.99	Negligible
1.04	303278	282246	4.65	1.98	Unlikely
0.76	303288	282246	4.65	2.72	Negligible
0.85	303295	282249	4.65	2.43	Negligible
0.56	303305	282249	7.64	2.26	Negligible
0.88	303258	282196	4.90	2.23	Negligible
0.91	303312	282257	4.27	2.47	Negligible
0.59	303268	282196	4.90	3.32	Negligible
0.79	303275	282259	4.18	2.91	Negligible
0.56	303278	282196	4.90	3.50	Negligible
0.93	303285	282259	4.18	2.47	Negligible
0.68	303295	282259	4.18	3.38	Negligible
0.90	303305	282259	4.27	2.50	Negligible
0.58	303268	282206	4.65	3.56	Negligible
0.81	303278	282206	4.65	2.55	Negligible
0.42	303288	282206	4.65	4.91	Negligible
0.76	303298	282206	4.65	2.72	Negligible
0.64	303305	282239	7.64	1.98	Unlikely
0.66	303319	282239	7.64	1.92	Unlikely
0.60	303245	282249	4.21	3.79	Negligible
0.86	303315	282248	7.64	1.47	Unlikely
0.60	303258	282216	4.65	3.44	Negligible

N14 Refined Likelihood Ratings					
Peat Depth (m)	Easting	Northing	Slope (deg)	Factor of Safety	Likelihood Rating
1.12	303913	282018	5.48	1.57	Unlikely
0.24	303898	282031	5.98	6.70	Negligible
0.22	303879	281981	3.90	11.18	Negligible
0.60	303818	281901	0.85	18.69	Negligible
0.26	303864	281994	3.90	9.46	Negligible
0.22	303829	281951	3.31	13.13	Negligible

N14 Refined Likelihood Ratings					
Peat Depth (m)	Easting	Northing	Slope (deg)	Factor of Safety	Likelihood Rating
0.25	303827	281897	2.49	15.38	Negligible
0.50	303808	281905	0.85	22.43	Negligible
0.90	303807	281851	2.49	4.27	Negligible
0.25	303785	282089	3.75	10.23	Negligible
0.22	303765	282099	3.75	11.62	Negligible
0.19	303775	282099	3.75	13.46	Negligible
0.26	303785	282099	3.75	9.83	Negligible
0.65	303798	281855	0.80	18.41	Negligible
0.66	303980	282092	8.04	1.82	Unlikely
0.26	303965	282105	6.99	5.31	Negligible
0.36	303946	282055	4.31	6.18	Negligible
0.09	303931	282068	4.31	24.73	Negligible
0.12	303765	282079	3.75	21.31	Negligible
0.13	303775	282079	3.75	19.67	Negligible
0.23	303785	282079	3.75	11.12	Negligible
0.06	303735	282089	4.29	37.27	Negligible
0.20	303745	282089	4.29	11.18	Negligible
0.40	303905	282024	5.48	4.38	Negligible
0.19	303755	282089	3.75	13.46	Negligible
0.24	303765	282089	3.75	10.65	Negligible
0.17	303775	282089	3.75	15.04	Negligible
0.33	303765	282059	3.75	7.75	Negligible
0.40	303838	281947	0.85	28.03	Negligible
1.15	303972	282098	8.04	1.05	Likely
0.20	303773	281816	1.60	29.90	Negligible
0.24	303775	282059	3.75	10.65	Negligible
0.21	303785	282059	3.75	12.18	Negligible
0.15	303755	282069	3.75	17.05	Negligible
0.14	303765	282069	3.75	18.26	Negligible
0.36	303785	281986	0.80	32.99	Negligible
0.08	303775	282069	3.75	31.96	Negligible
0.24	303765	282039	2.01	19.80	Negligible
0.22	303785	282069	3.75	11.62	Negligible
0.23	303775	282039	2.01	20.66	Negligible
0.26	303755	282079	3.75	9.83	Negligible
0.21	303785	282039	2.01	22.63	Negligible
0.18	303755	282049	2.01	26.40	Negligible
0.20	303765	282049	2.01	23.76	Negligible
0.22	303775	282049	2.01	21.60	Negligible
0.11	303785	282049	2.01	43.20	Negligible
0.00	303939	282061	4.31		None

N14 Refined Likelihood Ratings					
Peat Depth (m)	Easting	Northing	Slope (deg)	Factor of Safety	Likelihood Rating
0.24	303814	281947	0.85	46.72	Negligible
0.00	303872	281987	3.90		None
0.10	303815	281956	3.31	28.90	Negligible
0.19	303817	281966	3.31	15.21	Negligible
0.28	303766	281980	0.80	42.42	Negligible
0.15	303775	281983	0.80	79.18	Negligible
0.58	303788	281859	0.80	20.64	Negligible
0.17	303780	281809	1.60	35.18	Negligible
0.35	303766	281823	1.60	17.09	Negligible

N15 & N16 Refined Likelihood Ratings					
Peat Depth (m)	Easting	Northing	Slope (deg)	Factor of Safety	Likelihood Rating
0.20	304041	282261	6.73	7.16	Negligible
0.22	304050	282265	4.82	9.05	Negligible
0.79	304035	282173	9.13	1.35	Likely
0.47	304032	282257	6.73	3.05	Negligible
0.63	304057	282216	9.25	1.67	Unlikely
0.26	304037	282218	9.85	3.80	Negligible
0.38	304044	282168	9.13	2.80	Negligible
0.10	304026	282177	9.13	10.64	Negligible
0.00	304007	282135	10.42		None
0.26	304014	282129	10.42	3.60	Negligible
0.06	303999	282142	6.99	23.01	Negligible
0.00	304047	282217	9.85		None

C12 Refined Likelihood Ratings					
Peat Depth (m)	Easting	Northing	Slope (deg)	Factor of Safety	Likelihood Rating
0.85	304656	280060	3.05	3.69	Negligible
0.16	304660	279961	6.56	9.18	Negligible
0.76	304670	280010	4.78	2.64	Negligible
0.13	304640	279965	8.95	8.35	Negligible
0.00	304669	280109	0.93		None
0.00	304666	280060	3.05		None
0.00	304660	280012	4.78		None
0.50	304679	280109	0.93	20.48	Negligible
0.00	304650	279963	8.95		None
0.05	304659	280110	0.93	204.82	Negligible

C12 Refined Likelihood Ratings					
Peat Depth (m)	Easting	Northing	Slope (deg)	Factor of Safety	Likelihood Rating
0.88	304676	280059	3.05	3.57	Negligible
0.05	304650	280014	4.78	40.18	Negligible

C13 Refined Likelihood Ratings					
Interpolated Peat Depth (m)		Slope (deg)		Factor of Safety	Likelihood Rating
Min	Max	Min	Max		
0.00	0.06	10.84	14.33	11.14	Negligible

C25 Refined Likelihood Ratings					
Peat Depth (m)	Easting	Northing	Slope (deg)	Factor of Safety	Likelihood Rating
0.40	304535	279119	3.32	7.20	Negligible
0.28	304545	279119	3.32	10.29	Negligible
0.25	304555	279119	4.11	9.33	Negligible
0.20	304565	279119	4.11	11.66	Negligible
0.45	304505	279129	3.32	6.40	Negligible
0.25	304515	279129	3.32	11.52	Negligible
0.35	304525	279129	3.32	8.23	Negligible
0.35	304535	279129	3.32	8.23	Negligible
0.29	304675	278819	5.12	6.47	Negligible
0.25	304685	278819	5.12	7.50	Negligible
0.28	304695	278819	5.12	6.70	Negligible
0.40	304705	278819	5.44	4.41	Negligible
0.31	304715	278819	5.44	5.70	Negligible
0.39	304725	278819	5.44	4.53	Negligible
0.29	304665	278829	5.12	6.47	Negligible
0.30	304675	278829	5.12	6.25	Negligible
0.27	304644	278785	6.19	5.76	Negligible
0.10	304634	278789	6.19	15.55	Negligible
0.36	304626	278793	6.19	4.32	Negligible
0.28	304675	278809	5.12	6.70	Negligible
0.28	304685	278809	5.12	6.70	Negligible
0.30	304488	279191	2.67	11.94	Negligible
0.30	304497	279195	2.67	11.94	Negligible
0.20	304454	279228	1.88	25.43	Negligible
0.15	304462	279233	1.88	33.91	Negligible
0.15	304471	279237	1.88	33.91	Negligible
0.70	304461	279280	5.48	2.51	Negligible

C25 Refined Likelihood Ratings					
Peat Depth (m)	Easting	Northing	Slope (deg)	Factor of Safety	Likelihood Rating
0.65	304451	279281	5.48	2.70	Negligible
0.60	304441	279283	6.83	2.35	Negligible
0.43	304665	278869	4.56	4.89	Negligible
0.36	304675	278869	4.56	5.84	Negligible
0.79	304685	278869	4.56	2.66	Negligible
0.57	304695	278869	4.56	3.69	Negligible
0.96	304705	278869	4.72	2.12	Negligible
0.00	304530	279104	3.32		None
0.23	304662	278874	4.56	9.14	Negligible
0.20	304671	278878	4.56	10.52	Negligible
0.22	304685	278879	4.56	9.56	Negligible
0.82	304715	278849	5.44	2.15	Negligible
0.40	304655	278859	4.56	5.26	Negligible
0.41	304665	278859	4.56	5.13	Negligible
0.47	304675	278859	4.56	4.47	Negligible
1.04	304685	278859	4.56	2.02	Negligible
0.79	304695	278859	4.56	2.66	Negligible
1.01	304705	278859	4.72	2.01	Negligible
1.30	304715	278859	4.72	1.56	Unlikely
0.89	304695	278839	5.12	2.11	Negligible
0.00	304526	279114	3.32		None
0.64	304705	278839	5.44	2.76	Negligible
0.77	304715	278839	5.44	2.29	Negligible
0.77	304665	278849	5.12	2.44	Negligible
0.79	304675	278849	5.12	2.37	Negligible
0.76	304685	278849	5.12	2.47	Negligible
0.78	304695	278849	5.12	2.40	Negligible
0.76	304705	278849	5.44	2.32	Negligible
0.23	304685	278829	5.12	8.15	Negligible
0.74	304695	278829	5.12	2.53	Negligible
0.76	304705	278829	5.44	2.32	Negligible
0.41	304715	278829	5.44	4.31	Negligible
0.20	304533	279095	3.95	12.13	Negligible
0.35	304725	278829	5.44	5.04	Negligible
0.33	304574	279123	4.11	7.07	Negligible
0.34	304665	278839	5.12	5.52	Negligible
0.59	304675	278839	5.12	3.18	Negligible
0.70	304685	278839	5.12	2.68	Negligible
0.20	304540	279105	3.32	14.40	Negligible
0.23	304515	279109	3.32	12.52	Negligible
0.20	304525	279109	3.32	14.40	Negligible

C25 Refined Likelihood Ratings					
Peat Depth (m)	Easting	Northing	Slope (deg)	Factor of Safety	Likelihood Rating
0.20	304535	279109	3.32	14.40	Negligible
0.30	304545	279109	3.32	9.60	Negligible
0.30	304549	279109	3.32	9.60	Negligible
0.35	304515	279119	3.32	8.23	Negligible
0.50	304525	279119	3.32	5.76	Negligible
0.25	304592	279019	4.60	8.34	Negligible
0.35	304600	279024	4.60	5.96	Negligible
0.30	304557	279058	4.12	7.74	Negligible
0.00	304567	279104	4.11		None
0.20	304566	279062	4.12	11.62	Negligible
0.18	304575	279067	4.12	12.91	Negligible
0.17	304525	279099	3.95	14.27	Negligible
0.18	304535	279099	3.95	13.48	Negligible
0.18	304531	279100	3.32	16.00	Negligible
0.35	304656	278925	4.43	6.19	Negligible
0.28	304633	278930	5.20	6.60	Negligible
0.25	304642	278933	5.20	7.39	Negligible
0.35	304652	278935	4.43	6.19	Negligible
0.25	304609	278971	4.20	9.13	Negligible
0.00	304571	279113	4.11		None
0.20	304617	278977	4.20	11.41	Negligible
0.20	304626	278981	4.20	11.41	Negligible
0.20	304583	279013	4.60	10.43	Negligible
0.36	304695	278879	4.56	5.84	Negligible
0.41	304705	278879	4.72	4.96	Negligible
0.23	304645	278882	6.20	6.75	Negligible
0.20	304680	278882	4.56	10.52	Negligible
0.25	304655	278885	4.56	8.41	Negligible
0.25	304665	278887	4.56	8.41	Negligible
0.45	304638	278918	5.20	4.10	Negligible
0.27	304647	278922	5.20	6.84	Negligible
0.45	304515	279159	3.08	6.90	Negligible
0.45	304525	279159	3.08	6.90	Negligible
0.45	304535	279159	3.08	6.90	Negligible
0.45	304545	279159	3.08	6.90	Negligible
0.30	304525	279169	3.08	10.35	Negligible
0.30	304535	279169	3.08	10.35	Negligible
0.26	304545	279169	3.08	11.95	Negligible
0.18	304479	279186	2.67	19.89	Negligible
0.30	304555	279139	4.11	7.77	Negligible
0.25	304495	279149	3.02	12.69	Negligible

C25 Refined Likelihood Ratings					
Peat Depth (m)	Easting	Northing	Slope (deg)	Factor of Safety	Likelihood Rating
0.40	304505	279149	3.32	7.20	Negligible
0.40	304515	279149	3.32	7.20	Negligible
0.40	304525	279149	3.32	7.20	Negligible
0.35	304535	279149	3.32	8.23	Negligible
0.40	304545	279149	3.32	7.20	Negligible
0.30	304505	279159	3.08	10.35	Negligible
0.40	304545	279129	3.32	7.20	Negligible
0.20	304555	279129	4.11	11.66	Negligible
0.30	304495	279139	3.02	10.57	Negligible
0.15	304505	279139	3.32	19.20	Negligible
0.20	304515	279139	3.32	14.40	Negligible
0.30	304525	279139	3.32	9.60	Negligible
0.32	304535	279139	3.32	9.00	Negligible
0.22	304545	279139	3.32	13.09	Negligible

C30 Refined Likelihood Ratings					
Peat Depth (m)	Easting	Northing	Slope (deg)	Factor of Safety	Likelihood Rating
0.00	304180	278808	2.05		None
0.00	304270	278808	5.74		None
0.00	304180	278618	3.89		None
0.00	304210	278618	4.18		None
0.25	304180	278708	1.80	21.26	Negligible
0.00	304250	278618	8.22		None
0.20	304180	278698	2.21	21.61	Negligible
0.00	304180	278668	2.21		None
0.20	304180	278688	2.21	21.61	Negligible
0.15	304230	278688	2.43	26.22	Negligible
0.18	304180	278678	2.21	24.01	Negligible
0.14	304230	278678	2.43	28.09	Negligible
0.00	304180	278658	2.21		None
0.15	304220	278668	2.43	26.22	Negligible
0.00	304260	278658	5.19		None
0.15	304210	278648	4.18	15.28	Negligible
0.00	304180	278648	3.89		None
0.10	304180	278788	3.50	27.33	Negligible
0.00	304260	278698	5.19		None
0.15	304250	278778	4.36	14.66	Negligible
0.15	304240	278758	0.57	111.12	Negligible
0.38	304180	278738	1.80	13.99	Negligible

C30 Refined Likelihood Ratings					
Peat Depth (m)	Easting	Northing	Slope (deg)	Factor of Safety	Likelihood Rating
0.18	304230	278728	1.18	44.99	Negligible
0.00	304260	278678	5.19		None
0.35	304180	278718	1.80	15.19	Negligible
0.00	304260	278718	3.42		None
0.00	304200	278558	6.60		None
0.00	304230	278708	1.18		None
0.00	304302	278757	5.60		None
0.00	304210	278558	6.60		None
0.00	304351	278760	7.05		None
0.00	304220	278558	6.60		None
0.00	304400	278759	7.59		None
0.00	304230	278558	6.60		None
0.00	304443	278751	7.59		None
0.00	304485	278718	4.52		None
0.00	304180	278568	3.43		None
0.00	304220	278568	6.60		None
0.00	304536	278725	3.18		None
0.00	304180	278558	3.43		None
0.00	304534	278705	3.18		None
0.00	304190	278558	3.43		None
0.00	304180	278588	3.43		None
0.00	304210	278588	6.60		None
0.00	304180	278748	1.80		None
0.00	304180	278578	3.43		None
0.00	304230	278578	6.60		None
0.20	304484	278708	4.52	10.60	Negligible
0.00	304180	278608	3.89		None
0.00	304200	278608	4.18		None
0.00	304180	278598	3.43		None
0.13	304210	278638	4.18	17.63	Negligible
0.13	304210	278628	4.18	17.63	Negligible
0.00	304260	278828	5.74		None
0.00	304351	278750	7.92		None
0.00	304401	278769	7.59		None
0.00	304180	278818	2.05		None
0.00	304400	278749	7.92		None
0.00	304449	278759	7.59		None
0.00	304437	278743	8.22		None
0.00	304486	278728	4.52		None
0.00	304180	278548	3.70		None
0.00	304190	278548	3.70		None

C30 Refined Likelihood Ratings					
Peat Depth (m)	Easting	Northing	Slope (deg)	Factor of Safety	Likelihood Rating
0.00	304301	278766	5.60		None
0.00	304304	278747	5.09		None
0.00	304351	278770	7.05		None
0.00	304150	278548	3.70		None
0.00	304160	278548	3.70		None
0.00	304170	278548	3.70		None
0.00	304180	278758	3.50		None
0.00	304270	278748	3.42		None
0.00	304535	278715	3.18		None
0.00	304260	278738	3.42		None
0.00	304180	278778	3.50		None
0.00	304270	278778	4.36		None
0.00	304180	278768	3.50		None
0.00	304270	278768	4.36		None
0.00	304180	278798	3.50		None
0.00	304250	278798	4.36		None
0.00	304270	278798	4.36		None
0.00	304270	278788	4.36		None
0.00	304250	278818	5.74		None
0.00	304270	278818	5.74		None

C34 Refined Likelihood Ratings					
Peat Depth (m)	Easting	Northing	Slope (deg)	Factor of Safety	Likelihood Rating
0.17	304555	278409	4.43	12.72	Negligible
0.00	304539	278399	3.94		None
0.25	304565	278409	4.43	8.65	Negligible
0.20	304575	278379	5.21	9.22	Negligible
0.23	304585	278379	5.21	8.02	Negligible
0.20	304595	278379	5.21	9.22	Negligible
0.22	304545	278389	3.94	11.06	Negligible
0.25	304555	278389	5.21	7.38	Negligible
0.24	304565	278389	5.21	7.68	Negligible
0.22	304575	278389	5.21	8.38	Negligible
0.20	304585	278389	5.21	9.22	Negligible
0.00	304540	278115	5.80		None
0.00	304534	277969	5.88		None
0.00	304531	277778	4.30		None
0.21	304553	277828	5.03	9.09	Negligible
0.10	304543	277828	4.64	20.69	Negligible
0.08	304533	277828	4.64	25.86	Negligible

C34 Refined Likelihood Ratings					
Peat Depth (m)	Easting	Northing	Slope (deg)	Factor of Safety	Likelihood Rating
0.15	304535	277878	6.21	10.34	Negligible
0.14	304545	277878	6.21	11.07	Negligible
0.10	304555	277878	5.60	17.17	Negligible
0.11	304557	277927	6.45	13.57	Negligible
0.00	304551	277777	5.76		None
0.08	304541	277778	4.30	27.87	Negligible
0.00	304588	278338	6.67		None
0.00	304575	278353	5.21		None
0.00	304540	277857	6.21		None
0.00	304532	277807	4.64		None
0.12	304562	278326	6.67	12.04	Negligible
0.18	304571	278329	6.67	8.02	Negligible
0.22	304545	278369	3.94	11.06	Negligible
0.21	304555	278369	5.21	8.78	Negligible
0.23	304575	278369	5.21	8.02	Negligible
0.21	304545	278379	3.94	11.59	Negligible
0.24	304555	278379	5.21	7.68	Negligible
0.00	304549	278101	5.80		None
0.00	304558	278052	5.46		None
0.19	304565	278379	5.21	9.70	Negligible
0.16	304552	278178	6.15	9.79	Negligible
0.00	304555	277955	6.39		None
0.22	304576	278226	6.44	6.80	Negligible
0.00	304548	277906	6.33		None
0.15	304566	278227	6.44	9.97	Negligible
0.18	304556	278228	6.44	8.31	Negligible
0.25	304581	278276	6.06	6.35	Negligible
0.15	304571	278277	6.06	10.58	Negligible
0.18	304561	278277	6.06	8.82	Negligible
0.34	304552	278323	6.67	4.25	Negligible
0.63	304563	278077	5.46	2.79	Negligible
0.08	304553	278078	5.46	22.01	Negligible
0.42	304543	278078	5.54	4.13	Negligible
0.27	304568	278127	7.04	5.08	Negligible
0.10	304558	278127	7.04	13.71	Negligible
0.00	304532	277869	6.21		None
0.21	304548	278128	5.80	7.89	Negligible
0.20	304572	278176	6.15	7.83	Negligible
0.14	304562	278177	6.15	11.18	Negligible
0.10	304547	277928	6.33	15.22	Negligible
0.18	304537	277928	6.33	8.45	Negligible

C34 Refined Likelihood Ratings					
Peat Depth (m)	Easting	Northing	Slope (deg)	Factor of Safety	Likelihood Rating
0.10	304539	278064	5.54	17.34	Negligible
0.21	304559	277977	6.39	7.17	Negligible
0.14	304549	277978	5.88	11.68	Negligible
0.21	304539	277978	5.88	7.78	Negligible
0.22	304561	278027	6.30	6.94	Negligible
0.08	304551	278028	6.30	19.09	Negligible
0.13	304541	278028	5.40	13.67	Negligible
0.00	304567	278053	5.46		None
0.00	304570	278004	6.30		None
0.00	304545	278016	5.40		None
0.00	304565	277954	6.39		None
0.00	304544	277968	5.88		None
0.00	304558	277904	6.45		None
0.25	304585	278429	4.43	8.65	Negligible
0.00	304538	277918	6.33		None
0.00	304550	277855	6.21		None
0.00	304542	277806	4.64		None
0.25	304575	278409	4.43	8.65	Negligible
0.23	304585	278409	4.43	9.40	Negligible
0.00	304582	278346	6.67		None
0.00	304550	278152	6.15		None
0.22	304575	278419	4.43	9.83	Negligible
0.00	304559	278103	7.04		None
0.23	304585	278419	4.43	9.40	Negligible
0.00	304539	278099	5.54		None
0.18	304545	278399	3.94	13.52	Negligible
0.21	304555	278399	5.21	8.78	Negligible

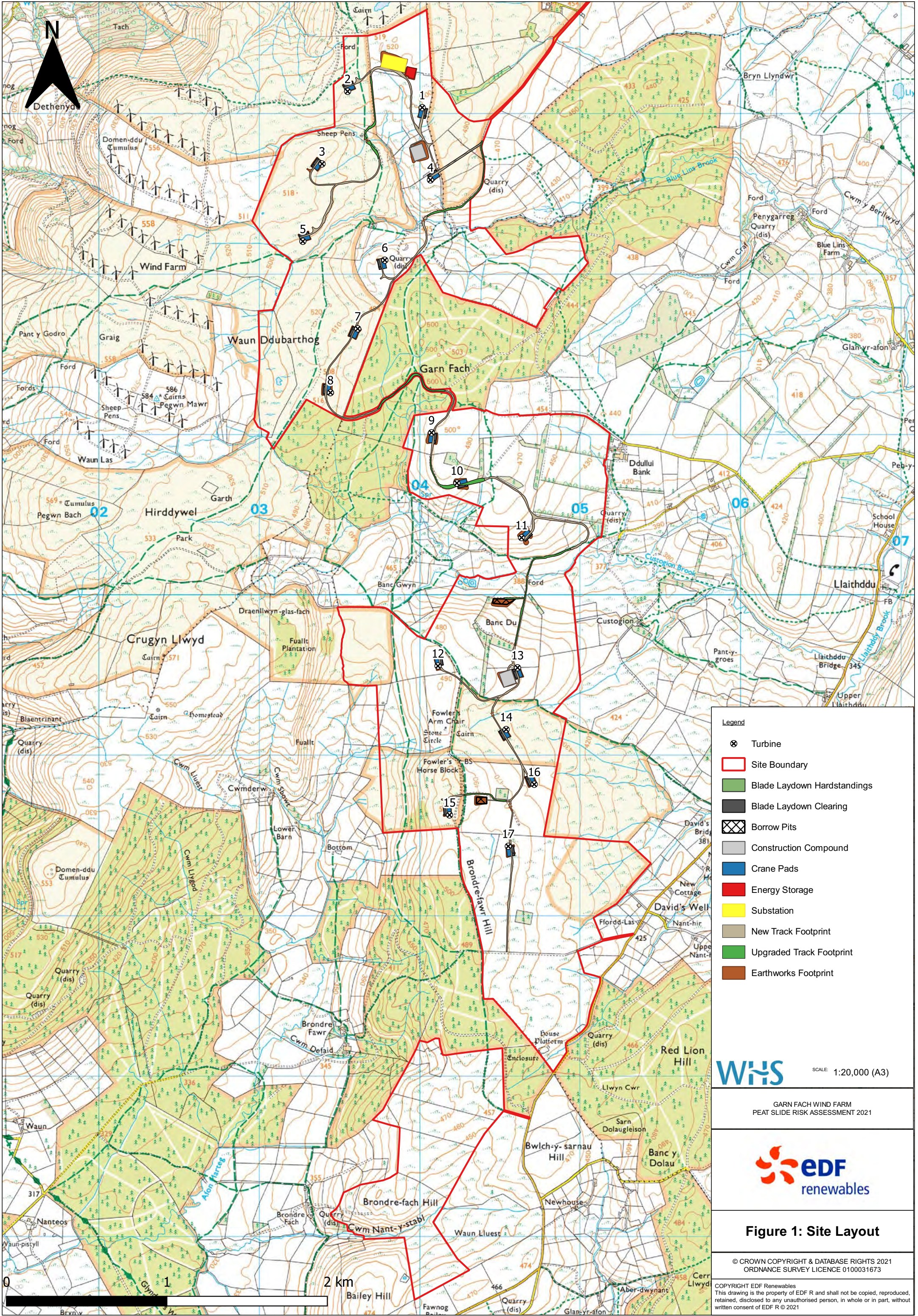
C34 Refined Likelihood Ratings					
Peat Depth (m)	Easting	Northing	Slope (deg)	Factor of Safety	Likelihood Rating
0.23	304565	278399	5.21	8.02	Negligible
0.21	304575	278399	5.21	8.78	Negligible
0.21	304585	278399	5.21	8.78	Negligible

C36 Refined Likelihood Ratings					
Peat Depth (m)	Easting	Northing	Slope (deg)	Factor of Safety	Likelihood Rating
0.19	304915	277729	5.60	9.03	Negligible
0.13	304925	277729	5.60	13.20	Negligible
0.15	304905	277739	5.60	11.44	Negligible
0.20	304915	277739	5.60	8.58	Negligible
0.19	304945	277749	5.60	9.03	Negligible
0.18	304955	277749	5.33	10.01	Negligible
0.20	304915	277759	1.91	25.00	Negligible
0.10	304925	277759	1.91	49.99	Negligible
0.17	304935	277759	1.91	29.41	Negligible
0.18	304945	277759	1.91	27.77	Negligible
0.19	304925	277739	5.60	9.03	Negligible
0.19	304935	277739	5.60	9.03	Negligible
0.17	304945	277739	5.60	10.09	Negligible
0.13	304955	277739	5.33	13.86	Negligible
0.16	304905	277749	5.60	10.72	Negligible
0.12	304915	277749	5.60	14.30	Negligible
0.12	304925	277749	5.60	14.30	Negligible
0.20	304935	277749	5.60	8.58	Negligible

Appendix 4 Refined Hazard and Risk Ratings

Sub-Area	Easting	Northing	Peat Depth (m)	Likelihood	Relief	Relief Coefficient	Peat Depth Coefficient	Potential receptor	Potential receptor coefficient	Receptor Distance	Receptor Distance Coefficient	Hazard Value	Hazard Rating	Risk Rating
N03	303455	282448	0.66	Unlikely	Rolling	2	3	minor watercourses, critical infrastructure	4	100 - 150	2	48	Low	Negligible
N03	303457	282448	0.73	Unlikely	Rolling	2	3	minor watercourses, critical infrastructure	4	100 - 150	2	48	Low	Negligible
N06	303960.4	282767.9	1.13	Unlikely	Rolling	2	4	minor watercourses, critical infrastructure	4	50 - 100	3	96	High	Low
N06	303950.4	282737.9	0.62	Unlikely	Rolling	2	3	minor watercourses, critical infrastructure	4	50 - 100	3	72	Moderate	Low
N06	303950.4	282747.9	0.58	Unlikely	Rolling	2	3	minor watercourses, critical infrastructure	4	50 - 100	3	72	Moderate	Low
N06	303980.4	282747.9	0.79	Unlikely	Rolling	2	3	minor watercourses, critical infrastructure	4	50 - 100	3	72	Moderate	Low
N06	303990.4	282747.9	0.8	Unlikely	Rolling	2	3	minor watercourses, critical infrastructure	4	100 - 150	2	48	Low	Negligible
N08	303318.1	282215.9	1.09	Likely	Long uninterrupted	3	4	minor watercourses, critical infrastructure	4	50 - 100	3	144	Extremely High	Moderate
N08	303268.1	282225.9	1.05	Unlikely	Long uninterrupted	3	4	minor watercourses, critical infrastructure	4	50 - 100	3	144	Extremely High	Moderate
N08	303308.1	282225.9	0.7	Unlikely	Long uninterrupted	3	3	minor watercourses, critical infrastructure	4	50 - 100	3	108	High	Low
N08	303278.1	282245.9	1.04	Unlikely	Long uninterrupted	3	4	minor watercourses, critical infrastructure	4	100 - 150	2	96	High	Low
N08	303305	282239	0.64	Unlikely	Long uninterrupted	3	3	minor watercourses, critical infrastructure	4	50 - 100	3	108	High	Low
N08	303319	282239	0.66	Unlikely	Long uninterrupted	3	3	minor watercourses,	4	50 - 100	3	108	High	Low

Sub-Area	Easting	Northing	Peat Depth (m)	Likelihood	Relief	Relief Coefficient	Peat Depth Coefficient	Potential receptor	Potential receptor coefficient	Receptor Distance	Receptor Distance Coefficient	Hazard Value	Hazard Rating	Risk Rating
N08	303315	282248	0.86	Unlikely	Long uninterrupted	3	3	critical infrastructure minor watercourses, critical infrastructure	4	50 - 100	3	108	High	Low
N14	303912.7	282017.6	1.12	Unlikely	Rolling	2	4	minor watercourses, critical infrastructure	4	< 50	4	128	Extremely High	Moderate
N14	303979.8	282091.8	0.66	Unlikely	Rolling	2	3	minor watercourses, critical infrastructure	4	< 50	4	96	High	Low
N14	303972.4	282098.5	1.15	Likely	Rolling	2	4	minor watercourses, critical infrastructure	4	< 50	4	128	Extremely High	Moderate
N15 & 16	304034.9	282172.6	0.79	Likely	Rolling	2	3	minor watercourses, critical infrastructure	4	< 50	4	96	High	Moderate
N15 & 16	304057	282216.1	0.63	Unlikely	Rolling	2	3	minor watercourses, critical infrastructure	4	< 50	4	96	High	Low
C25	304715	278859	1.3	Unlikely	Rolling	2	4	minor watercourses, critical infrastructure	4	100 - 150	2	64	Moderate	Low



- Legend
- Turbine
 - Site Boundary
 - Blade Laydown Hardstandings
 - Blade Laydown Clearing
 - Borrow Pits
 - Construction Compound
 - Crane Pads
 - Energy Storage
 - Substation
 - New Track Footprint
 - Upgraded Track Footprint
 - Earthworks Footprint

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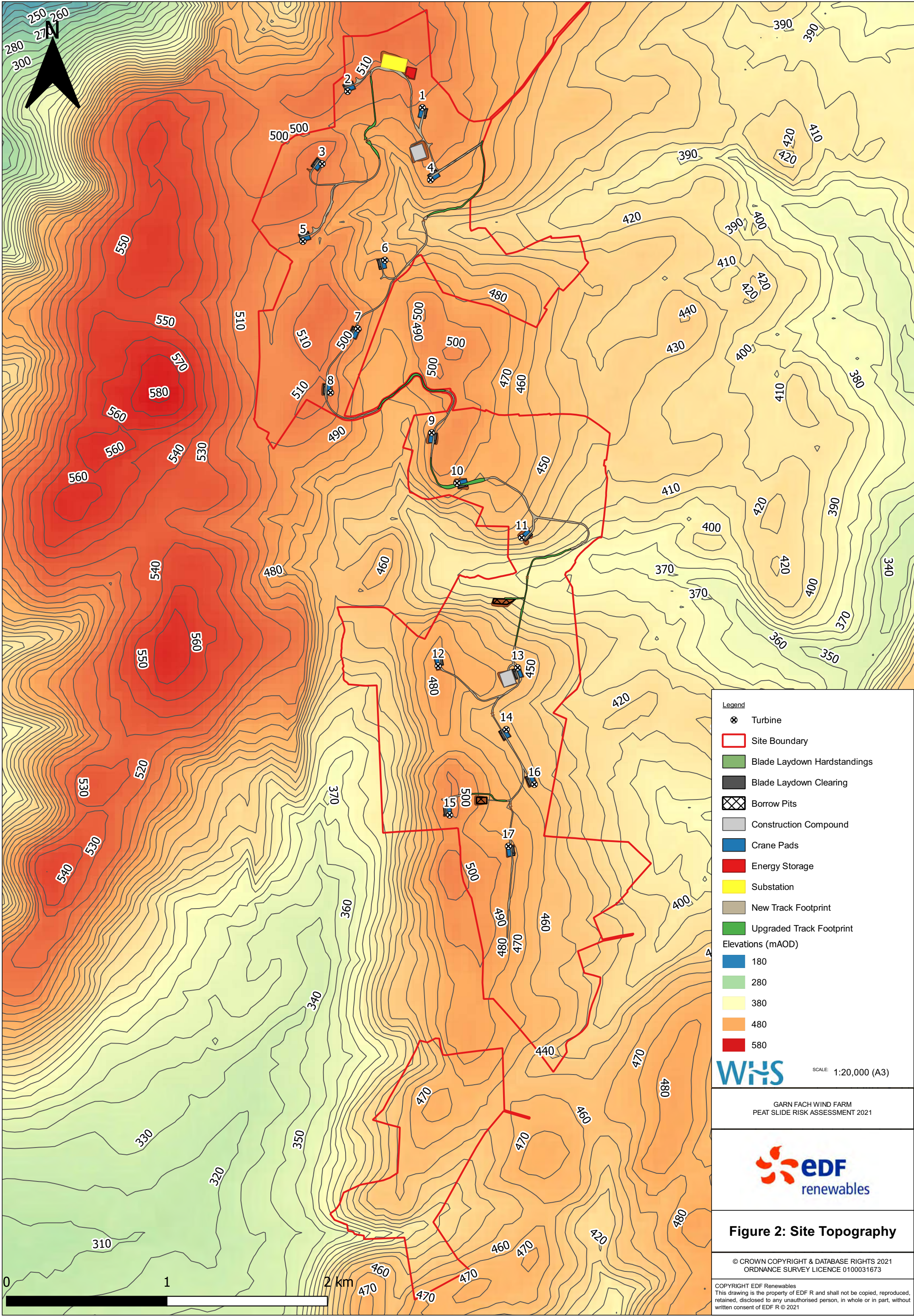
GARN FACH WIND FARM
PEAT SLIDE RISK ASSESSMENT 2021

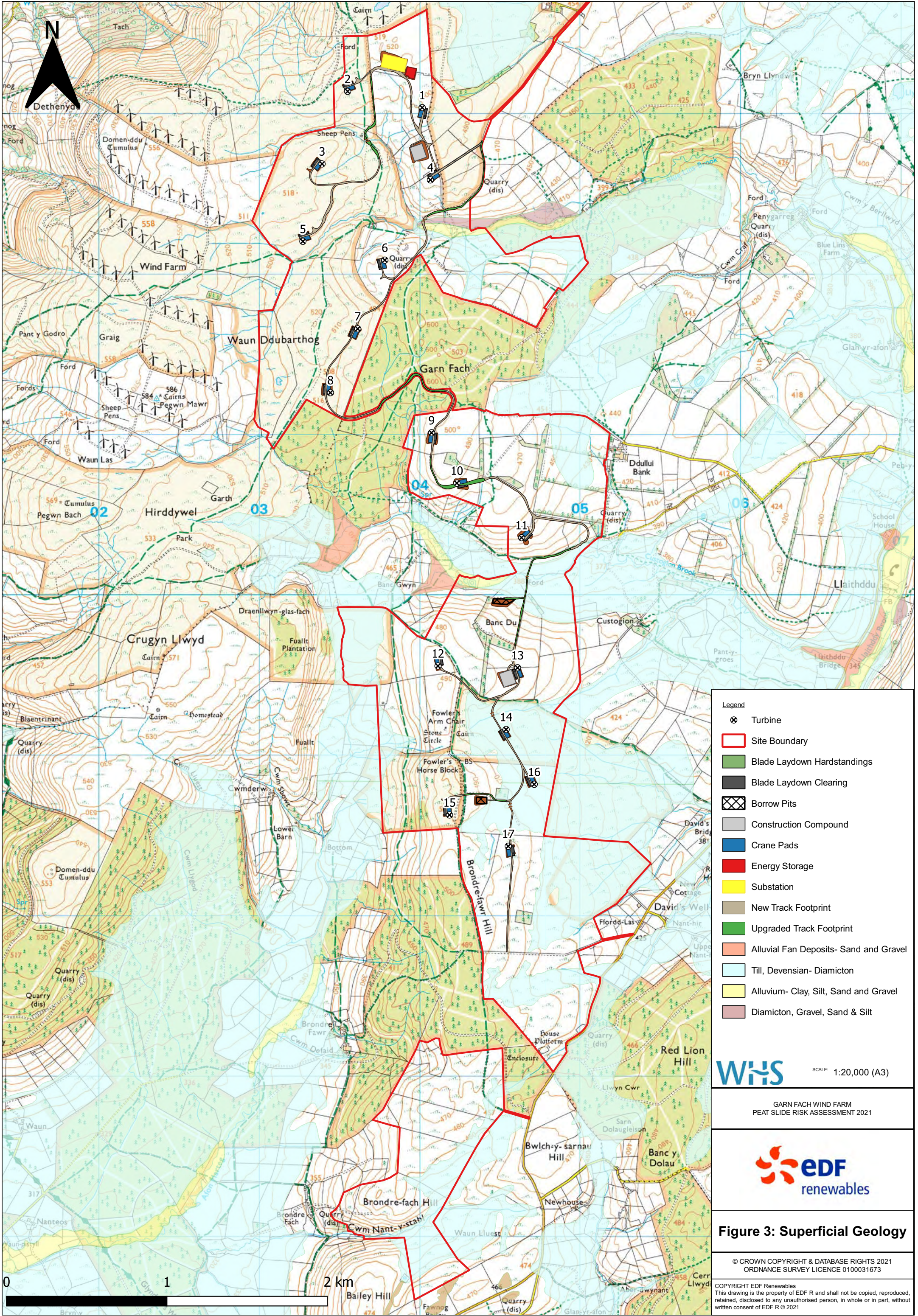


Figure 1: Site Layout

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- Legend**
- Turbine
 - Site Boundary
 - Blade Laydown Hardstandings
 - Blade Laydown Clearing
 - Borrow Pits
 - Construction Compound
 - Crane Pads
 - Energy Storage
 - Substation
 - New Track Footprint
 - Upgraded Track Footprint
 - Alluvial Fan Deposits- Sand and Gravel
 - Till, Devensian- Diamicton
 - Alluvium- Clay, Silt, Sand and Gravel
 - Diamicton, Gravel, Sand & Silt

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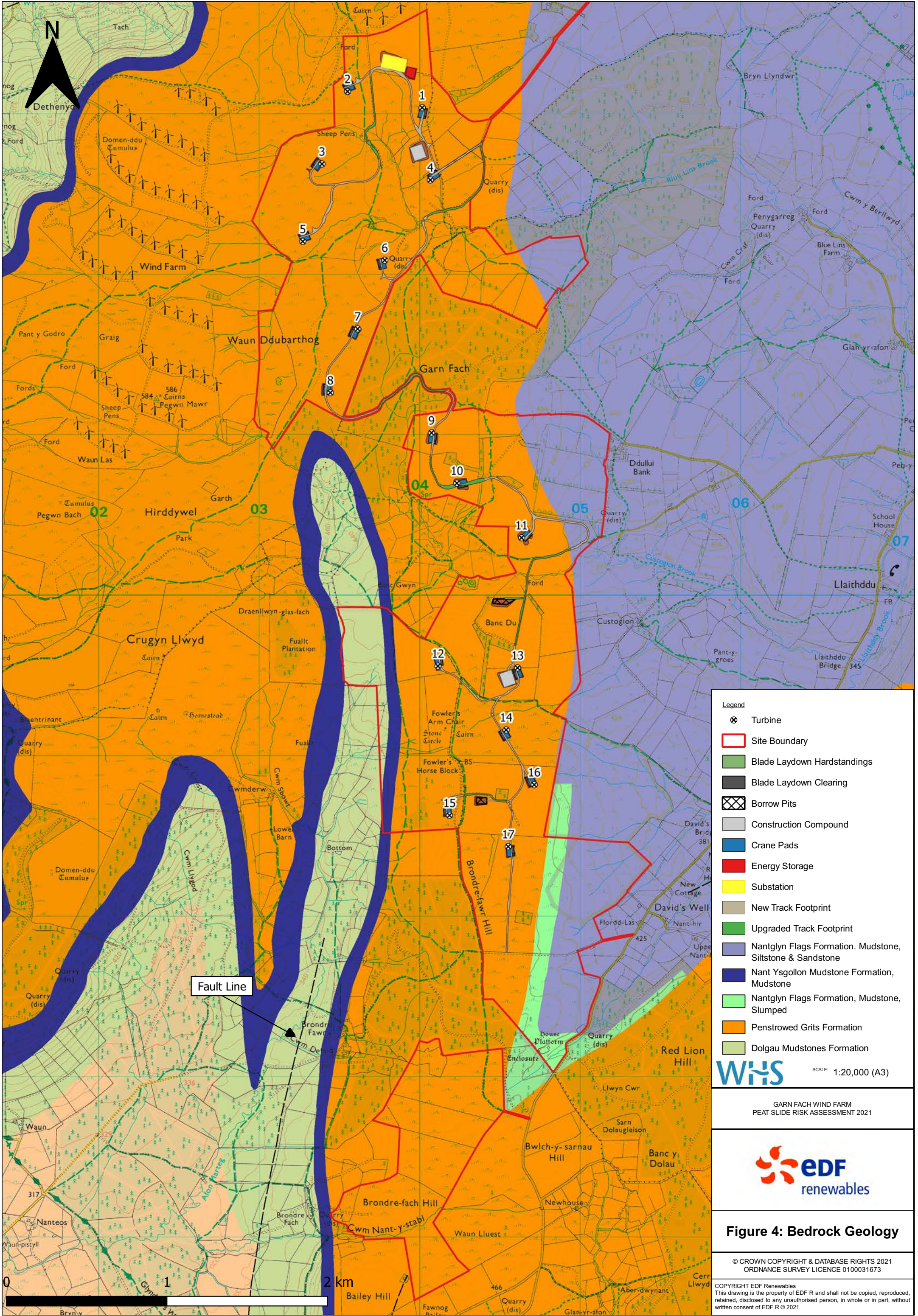
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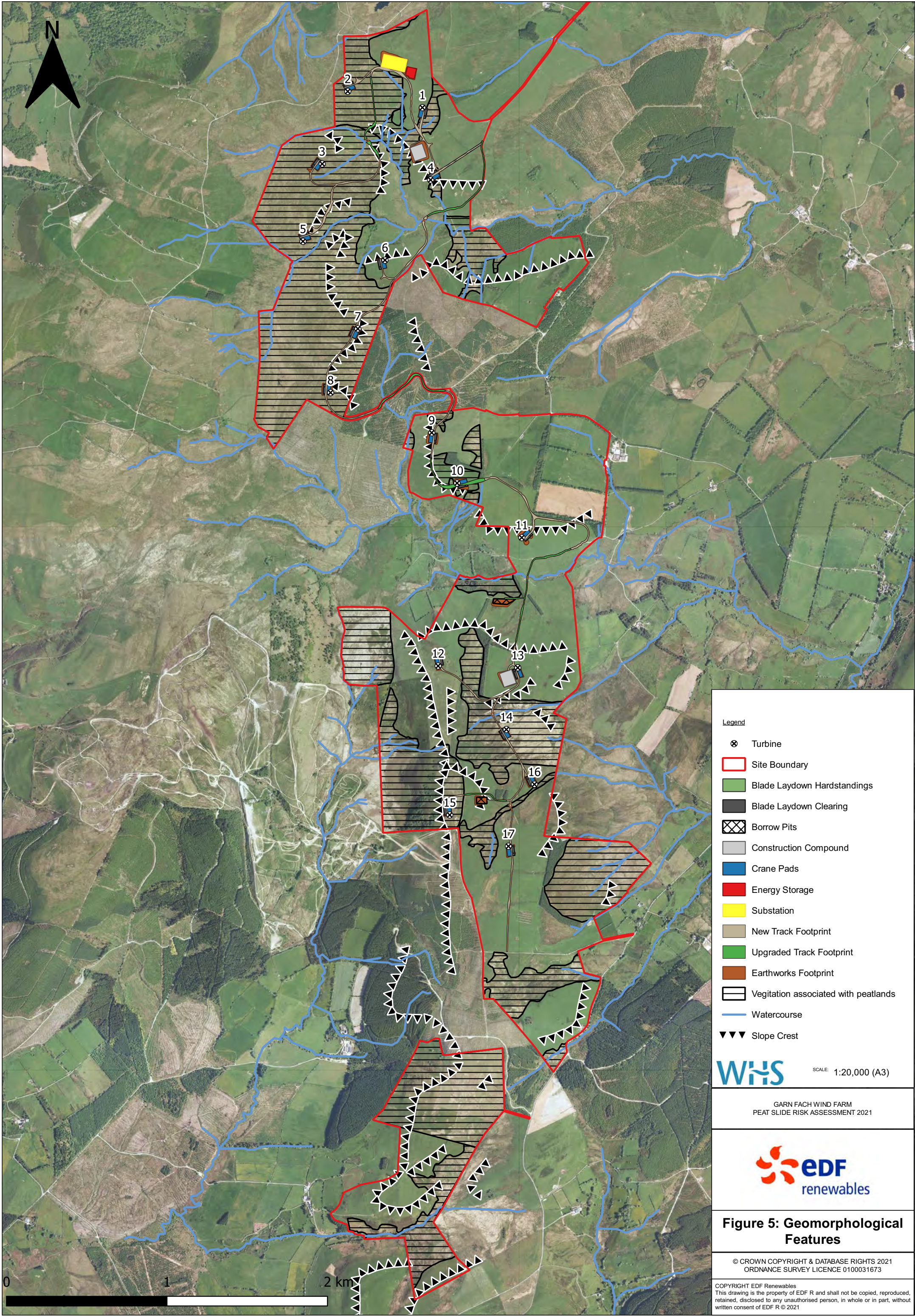


Figure 3: Superficial Geology

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Legend

- ⊗ Turbine
- Site Boundary
- Blade Laydown Hardstandings
- Blade Laydown Clearing
- Borrow Pits
- Construction Compound
- Crane Pads
- Energy Storage
- Substation
- New Track Footprint
- Upgraded Track Footprint
- Earthworks Footprint
- Vegetation associated with peatlands
- Watercourse
- ▼▼▼ Slope Crest

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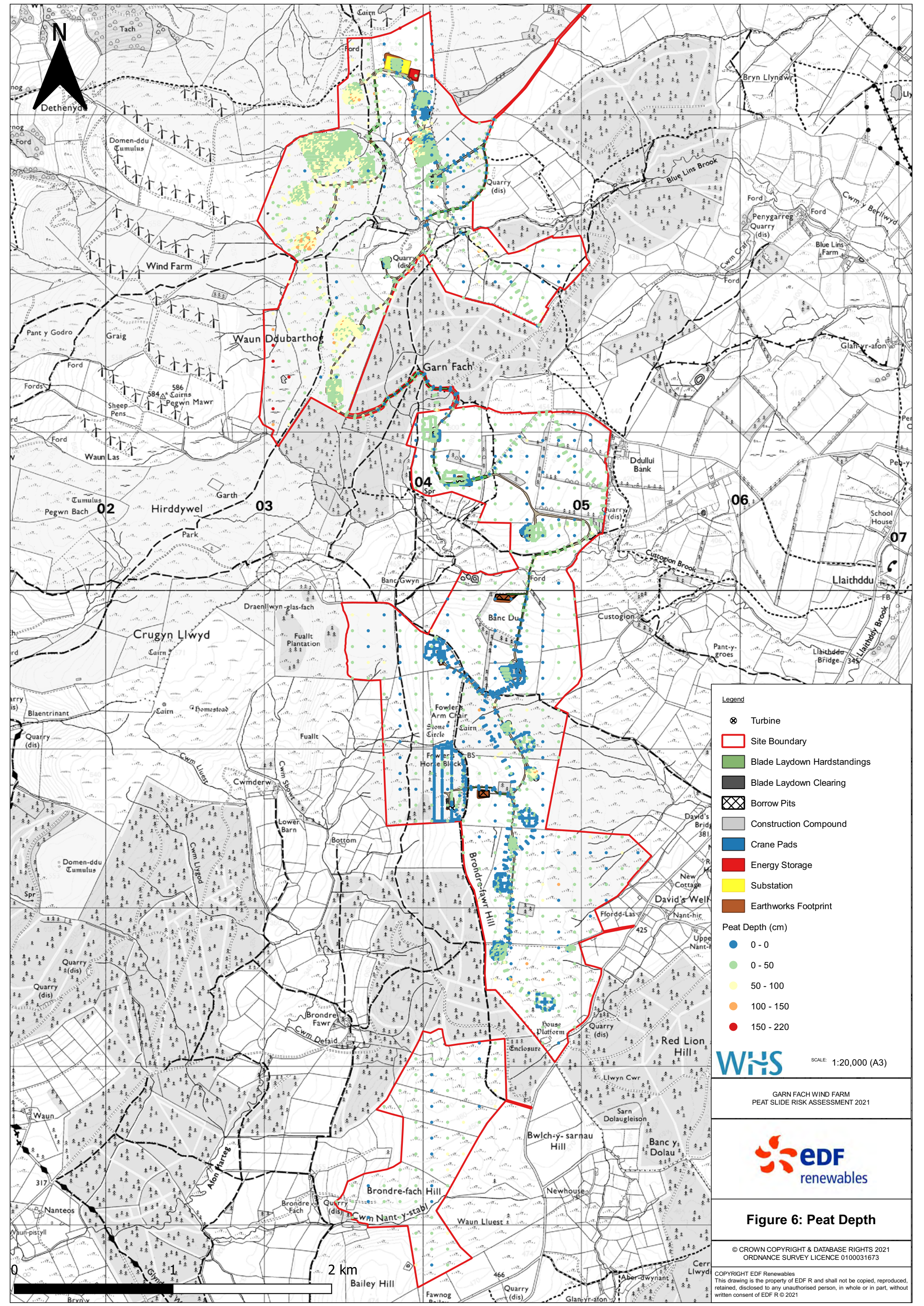
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Figure 5: Geomorphological Features

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Legend

- Turbine
- Site Boundary
- Blade Laydown Hardstandings
- Blade Laydown Clearing
- Borrow Pits
- Construction Compound
- Crane Pads
- Energy Storage
- Substation
- Earthworks Footprint

Peat Depth (cm)

- 0 - 0
- 0 - 50
- 50 - 100
- 100 - 150
- 150 - 220

WHS

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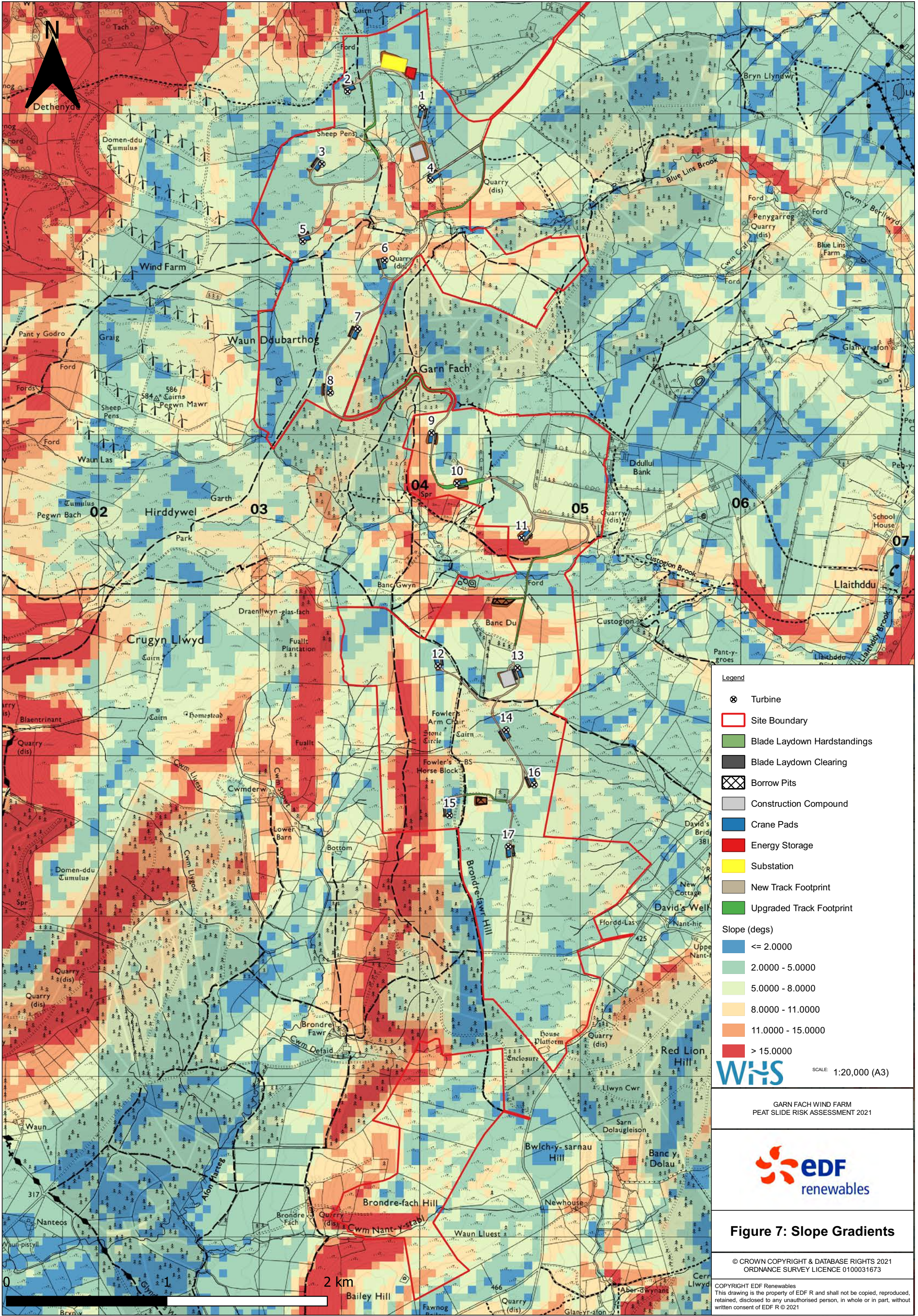
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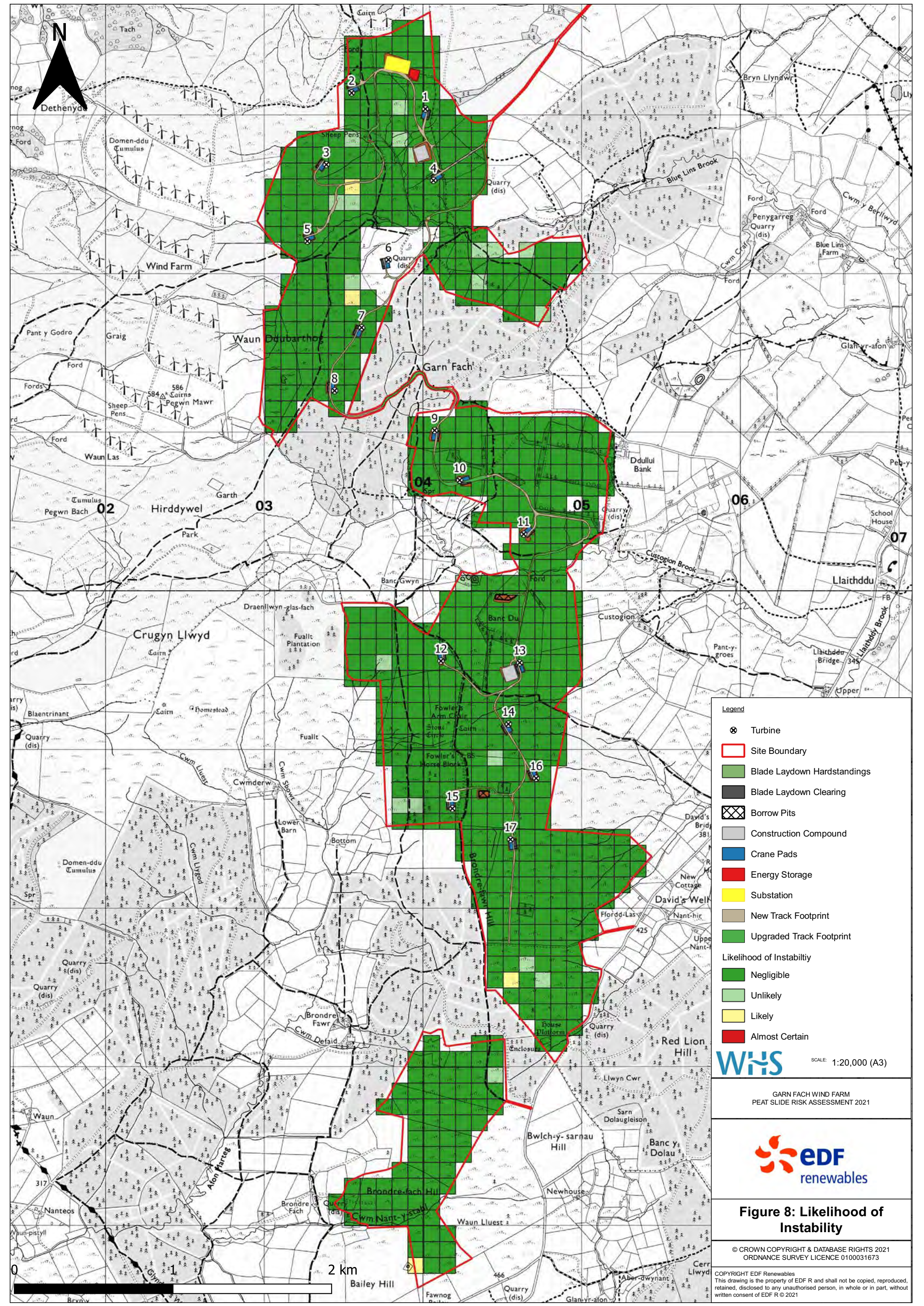
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Figure 6: Peat Depth

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Legend

- Turbine
- Site Boundary
- Blade Laydown Hardstandings
- Blade Laydown Clearing
- Borrow Pits
- Construction Compound
- Crane Pads
- Energy Storage
- Substation
- New Track Footprint
- Upgraded Track Footprint

Likelihood of Instability

- Negligible
- Unlikely
- Likely
- Almost Certain

WHS

SCALE: 1:20,000 (A3)

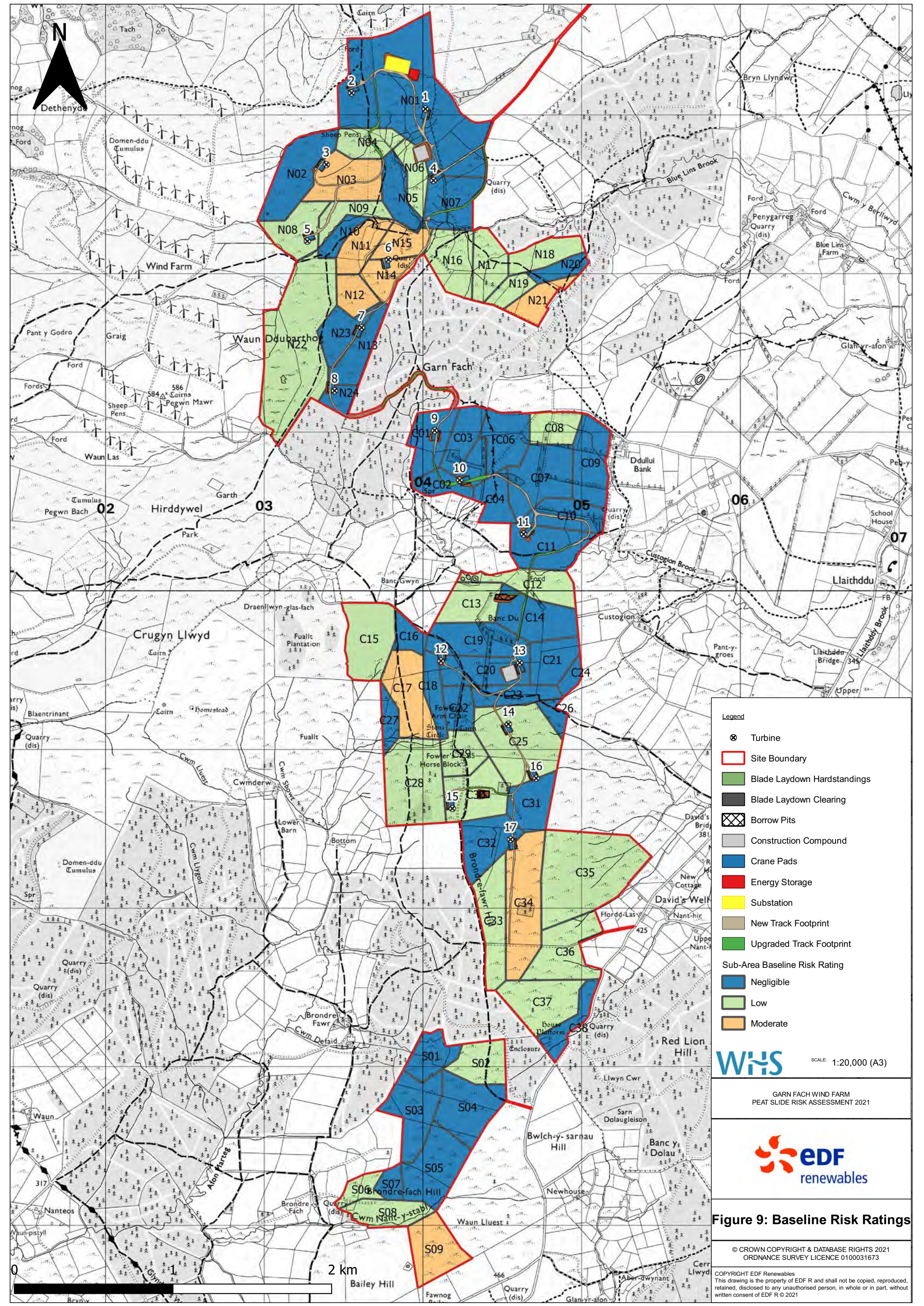
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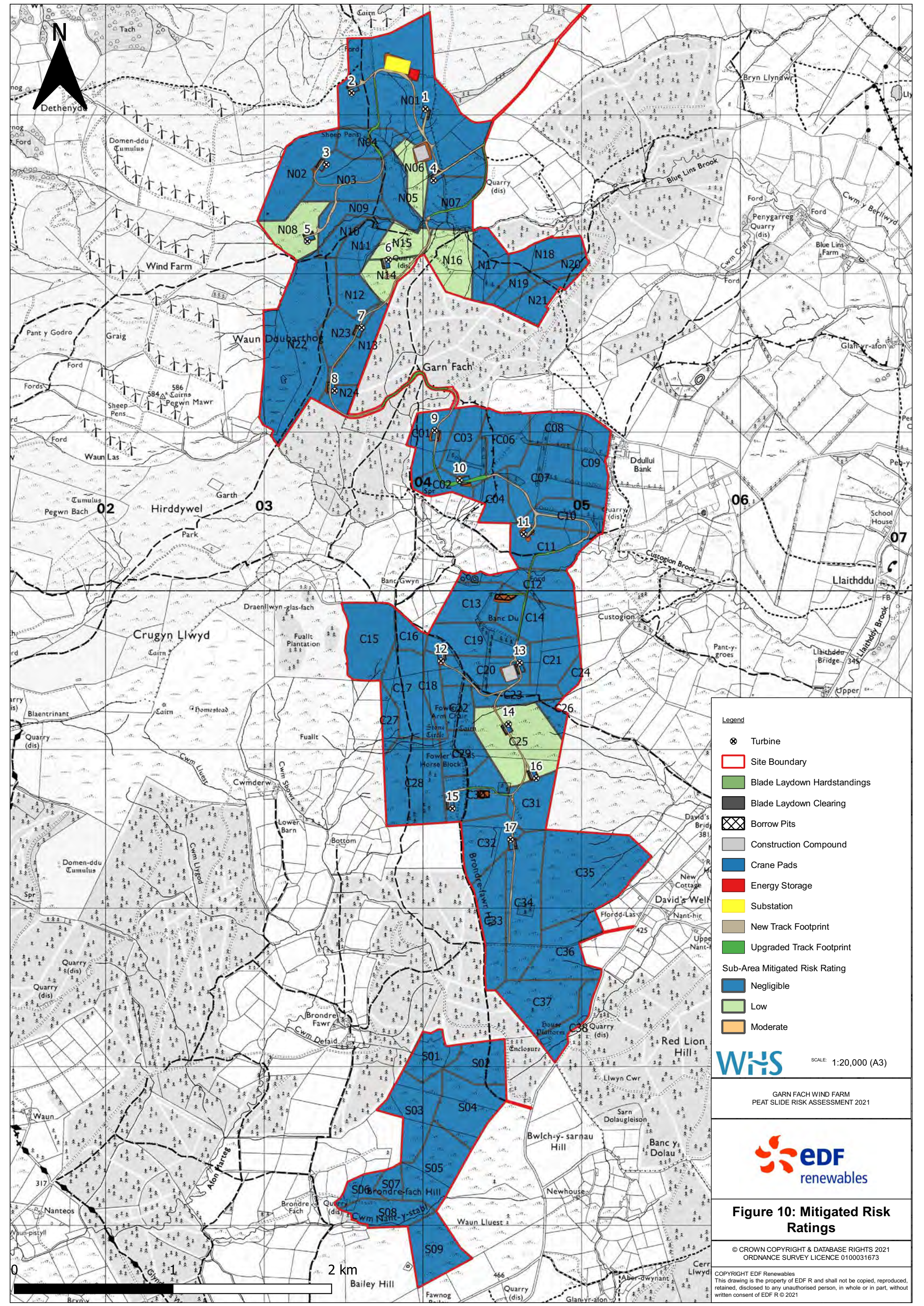
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Figure 8: Likelihood of Instability

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Legend

- Turbine
- Site Boundary
- Blade Laydown Hardstandings
- Blade Laydown Clearing
- Borrow Pits
- Construction Compound
- Crane Pads
- Energy Storage
- Substation
- New Track Footprint
- Upgraded Track Footprint

Sub-Area Mitigated Risk Rating

- Negligible
- Low
- Moderate

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GARN FACH WIND FARM
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Figure 10: Mitigated Risk Ratings

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Appendix 10-2: Peat Management Plan

Executive Summary

This draft Peat Management Plan (PMP) has been completed using the best available guidance regarding re-use of peat and peat reinstatement on wind farm sites. The document outlines the best practice guidance for handling excavated peat, providing temporary peat storage and reinstating peat. Peat has been identified at various locations across the site, most of which are below 0.5m thick and are mainly highly decomposed. The proposed development has been designed to avoid the placing of infrastructure on areas of deep peat deposits.

This PMP identifies that excavated peat will be stored appropriately and used for the reinstatement of access track verges, turbine hardstanding's and borrow pits. Constraints to the location of these storage areas is presented within this document. Care will be taken while peat is being excavated to ensure the acrotelmic and catotelmic peat is kept separate and stored appropriately in the specified areas.

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1 Introduction

Wallingford HydroSolutions Ltd (WHS) has been commissioned by Dulas Ltd to complete a Draft Peat Management Plan (PMP) for the Garn Fach Wind Farm. This document forms an appendix to the Environmental Statement (ES) to accompany a planning application for a proposed 17 turbine wind farm to the south of Newtown, Powys, NGR: SO 03413 81467 and covers an area of approximately 700ha. This draft PMP has been completed in accordance with the Scottish Renewables and SEPA Guidance on the effective management of peat, along with the relevant Welsh Government Guidance on peatlands.

This draft PMP qualitatively details temporary storage requirements and potential uses of excavated peat material including reinstatement and/or restoration to prevent degradation of the peat habitat or carbon release. It details the proposed peat and soils management methodologies to be employed during construction.

This draft PMP is expected to form part of an overarching Construction Environmental Management Plan (CEMP) and would be used by environmental managers on site to ensure peat is managed appropriately and remains in a good condition for future use. The PMP will be developed further post-consent informed by further site investigation, detailed design and detailed construction method statements. Volumes to be excavated would be reviewed, including estimated volumes of acrotelmic and catotelmic peat, with temporary storage and reuse areas quantified.

2 Relevant Legislation and Guidance

There is a wealth of legislation and guidance relating to peat environments in Wales, however, there is no specific guidance on building wind farms on areas of peat. As such a combination of Welsh and Scottish guidance has informed the site layout and PMP.

- Scottish Renewables, SNH, SEPA, Forestry Commission Scotland (FCS) 2010. Good Practice During Wind Farm Construction.
- SEPA 2010. SEPA Regulatory Position Statement: Developments on Peat.
- Scottish Renewables and SEPA 2012. Guidance on the Assessment of Peat Volumes, Reuse of Excavated Peat and the Minimisation of Waste.
- SEPA 2012. Land Use Planning System SEPA Guidance Note 4 Planning guidance on wind farm developments.
- Calculating Carbon Savings from Wind Farms on Scottish Peatlands – A new Approach (Nayak et al., 2008; Nayak et al., 2010 and Smith et al., 2011).
- SNH, SEPA, Scottish Government and The James Hutton Institute 2011. Guidance Developments on Peatland: Site Surveys.
- SNH/FCS 2010. Floating Roads on Peat.
- CCW Guidance Note: Assessing the Impact of Windfarm Development on Peatlands in Wales (Countryside Council for Wales, 2010).
- Welsh Government, Woodlands for Wales. The Welsh Government's Strategy for Woodlands and Trees (2018)
- Welsh Assembly Government, Practice Guidance. Planning Implication of Renewable and Low Carbon Energy. February 2011.
- Natural Resources Wales, Information Note. Peatlands. (Available on NRW's website via: <https://naturalresources.wales/guidance-and-advice/business-sectors/education-learning-and-skills/looking-for-learning-resources/learning-resources-search-by-topic/peatland-bogs/?lang=en>. Accessed May 2021.)

3 Wind Farm Design Considerations

The proposed wind farm layout has been designed to minimise the quantity of peat to be excavated during the construction phase of the project. A Phase 1 peat survey was completed by WHS in May 2020 to inform embedded mitigation in terms of the turbine locations, tracks and associated infrastructure (Appendix 1). Where practicable the final footprint of the layout has been designed to avoid the following:

- Areas of deep peat;
- Areas with steep gradients; and
- Natural and man-made drainage within the peat.

To minimise the disturbance of peat the following design features and construction practices have been incorporated into the project:

- Existing site drainage would be maintained at all times, aided by the SUDS design outlined in Appendix 10.6; and
- Construction works would be phased to minimise areas under construction.

Despite the incorporation of design features and construction practices, there will be areas of peat that are disturbed due to the construction of the proposed wind farm. This report provides the estimated volume of peat to be excavated due to the development and describe how this can be sustainably managed during and following the construction phases of the project.

4 Peat Conditions

4.1 Introduction

Wind farm developments have the potential to impact upon the ecology of peatlands and the role that peatland areas play in carbon storage. Wind farms can cause direct and indirect impacts to the peat environment through both the direct excavation of peat and as an indirect result of temporary or permanent changes in the drainage or quality and quantity of surface and ground water. This can result in down-slope droughting or up-slope flooding of peat-based habitats.

Peat is found in both 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 water logging 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. Peat is characterised by low density, high moisture content, high compressibility and low shear strength, all of which are related to the degree of decomposition and hence residual plant fabric and structure.

There are two distinct layers within a peat bog, the upper acrotelm and the lower catotelm. The acrotelm is the fibrous surface to the peat bog, these deposits are typically found in the upper 0.5m of peat deposits; 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 lower (catotelm) layers can be highly amorphous, with very high water content and very low tensile strength. Where this is the case, material excavated from this layer tends to disrupt completely on excavation and handling. The suitability for reuse of this peat generally depends upon the fibre and water content. The upper catotelm is deemed as appropriate for reuse in restoration.

Peat lands also hold large stores of carbon and the excavation of peat can result in large carbon losses from the excavated peat and the areas affected by changes in drainage patterns. Minimising peat excavation and

promoting re-use and restoration will reduce the potential carbon losses and consequently reduce carbon payback associated with developments on peat.

4.2 Peat Condition and Distribution at Garn Fach

As peat is present on the development site, Phase 1 and Phase 2 peat surveys have been undertaken to establish the extent and depth of peat soils across the site. Appendix 10.1 of the ES, the Peat Slide Risk Assessment, details the results of the peat survey which are summarised here. Peat probing was conducted using a phased approach. A Phase 1 peat survey was completed in May 2020 by WHS and consisted of sampling peat depths across the entire site on a 100m grid. A Phase 2 peat survey was completed in two separate site visits in November 2020 and March 2021, where points were surveyed on a 10m grid within a 50m radius of turbine locations and at 50m intervals along the track centre line and 10m perpendicular to the centre line.

The Phase 1 probing indicated that only a small portion of the site is underlain with peaty soils. 83% of the auger samples found no peat. Where peat was identified, 86% of Phase 1 recorded depths were <0.5m thick. During the Phase 2 survey auger samples were taken, the depth of soil and general soil classification (i.e. peat, clay or non-peat) was recorded, where both peat and clay were present the depth of both was recorded. 77% of the samples taken during the Phase 2 survey were not peat. Where peat was present the degree of humidification was recorded using the Von Post Scale. The peat depths observed are summarised in Table 4-1.

The deepest peat depths on site were observed around Turbine 2 (T2) and Turbine 5 (T5) and the northern construction compound, where peat depths are shown to range from 1-1.5m. Depths around Turbine 7 (T7) are between 0.5-1m deep, at all other proposed infrastructure points peat depths are mostly shown to be below 0.5m. Observed peat depths are shown in Appendix 1.

Table 4-1- Phase 2 Peat Survey Peat Depth Summary

Peat Thickness	% (of peat samples identified during Phase 2 survey)
>0.5m	89%
0.5-1.0m	9%
1.0-1.5m	1.5%
>1.5m	0.5%

The degree of composition (humidification) was estimated for the auger samples based on field descriptions using the Von Post Classification¹ where the humidification value ranges from H1 (no decomposition) to H10 (highly decomposed). The survey concluded that the majority of peat samples are classified between H5, H6, H7 and H10, showing a range of decomposition but mostly high decomposition rates. The sample classifications can be seen in Table 4-2 below.

Table 4-2- Auger Sample Peat Classifications

Peat Classification	Number of Samples	Percentage (%)
H1	1	0.5

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

H3	6	2.8
H4	4	1.9
H5	37	17.2
H6	28	13.0
H7	35	16.3
H8	14	6.5
H9	12	5.6
H10	41	19.1
Peat mineral soil mixture	37	17.2

5 Approach to Peat Management

5.1 Introduction

The Phase 1 peat survey identified the site characteristics and presence of peat across the site at an early stage of the wind farm development process. As such this information was used as a design constraint to inform the final turbine layout to minimise peat disturbance on site.

During the construction of the wind farm, where possible peat would be reused on site as part of site restoration following the completion of the construction phase. This draft PMP aims to set out, based upon the available data, how the construction of the proposed wind farm could impact on the peat and the measures that would be implemented to reduce the overall impact and carbon losses. This plan will be revisited prior to construction following further detailed design and ground investigation work. Revisions will be made as required to ensure suitable handling and re-use measures are undertaken.

Where infrastructure is located on areas of peat it is proposed that all peat would be excavated and re-used in line with this draft PMP. It is proposed that all peat excavated on site would be stored and used during and following construction for ground reinstatement within the site. This approach is considered the most sustainable as it would avoid any waste peat being transported off-site.

The handling and storage of peat would seek to ensure that excavated peat does not lose either its structure or moisture content. The character of the peat varies across the site and an estimated² total of 61,457m³ of peat is to be excavated as a result of construction (see Appendix 2 for a breakdown of this volume and outline of calculation method). It is recommended that when the peat is excavated it is assessed for quality and stored within a defined area. This process will ensure that peat of the same character and originating from a similar area is stored separately allowing for easier management during storage and reinstatement.

A number of policy guidelines are available to inform the management, reuse and storage of peat during wind farm construction, where these are appropriate, they are detailed in the following section. This draft PMP aims to set out clearly for statutory consultees and construction contractors how peat would be most sustainably managed on site as part of the proposed wind farm.

5.2 Prevention

The design of the wind farm including turbine and track layout has taken into consideration the presence of peat on site with the aim of avoiding areas that are sensitive and with large peat depths. The results of the Phase 1 peat survey were used to inform the initial layout, allowing areas of deep peat to be avoided where

possible. Following the design freeze a more detailed Phase 2 peat survey was undertaken concentrating on the proposed layout and allowing for refinement of the layout design taking into consideration additional peat depth information.

The turbine foundations, hardstandings, substations, construction compounds, access tracks and cable runs have been micro sited and placed where possible in areas with shallow peat depths in relation to peat depths locally and across the site. The detailed peat probing surveys identified areas on site that were likely to generate large volumes of peat should infrastructure be placed in these locations.

5.3 Peat Excavation Volumes

A total estimated volume of 61,457m³ of peat would be excavated from the construction of the tracks and cable runs, turbine bases, temporary compounds and borrow pits. These volumes will be reviewed in the final PMP considering all construction activities following further detailed site investigation post-consent. It is assumed that no floating tracks would be required and all volumes of peat located in areas of infrastructure would be excavated and re-used. The calculations used to determine the excavated peat volumes is provided in Appendix 2. Temporary Peat Storage for Re-use

Where peat excavation is required to construct turbine foundations and access tracks/cable runs, consolidated peat turves (whether the vegetated top layer or deeper layers) would need to be sorted appropriately and stored on site before being re-used or reinstated onsite post-construction. These storage areas would be located close to the location of excavation at defined points within the project boundary. Care would be taken to ensure the peat storage does not cause environmental pollution as highly organic materials such as peat can negatively impact watercourses if there is wash off from storage areas. Peat would be stored for the shortest time possible following excavation to minimise exposure of the peat to the air and maintain moisture conditions in the peat to keep carbon losses to a minimum.

During the construction phase of the project the selection of areas for the temporary storage of peat would take into account site constraints (as defined within the Environmental Statement - Chapter 10) and consider the following criteria.

- Minimise the distance excavated peat is transported.
- Storage in a manner that will avoid oxidation of excavated peat (such as covering and re-wetting as required), thus maintaining its function as a carbon sink.
- Avoidance of areas which have a Peat Landslide Hazard risk classification of Moderate to Extremely High as defined within Appendix 10.1 of the ES.
- Avoidance of areas within 50m of a watercourse.
- Avoidance of ecologically sensitive habitats (See Chapter 8 of the ES).
- Avoidance of cultural heritage constraints (See Chapter 11 of the ES).
- Utilisation of natural surface depressions.

The standard protocol for temporarily stored peat will be that it is placed as close to source as possible, laid on a geotextile membrane or onto heavy duty polythene sheeting, not stockpiled into mounds any higher than 1.5m and covered with additional weighted down polythene sheeting to prevent desiccation. Storage areas will be located in flatter areas as far away as possible from watercourses or drains. Silt traps (e.g. fencing) will be used to capture any suspended solids generated. Peat stored for longer than 1 week or during dry conditions will be regularly wetted to maintain near-saturated conditions.

The exact areas to use for peat storage will be identified in the final PMP following detailed site investigation post-consent.

During construction the correct storage of peat in line with the final PMP will be monitored by the ecological clerk of works (ECoW). The ECoW will identify any additional measures that should be implemented to ensure

the excavated materials remain in a condition to be re-used on site. If required material will be moved to a more suitable storage area within the site.

The following lists the assumptions regarding the re-use of excavated peat.

- Peat would be placed with sufficient depth and at a gentle slope to maintain hydrology with adjacent deposits to minimise drying out and encourage growth.
- Temporary hard standings consist of 2 construction compounds, these would be restored using the same excavated material post construction.
- The peat generated from cable trench excavation would be backfilled using the same excavated peat, thus these areas are not considered in the draft PMP.

5.4 Peat Re-use Requirements

Stored peat turves and unconsolidated peat, depending upon the character of the material, can be used for the following purposes:

- Borrow pit reinstatement;
- Trackside bunds;
- Turbine backfill and landscaping;
- Construction compound reinstatement; and
- Hardstanding reinstatement and landscaping.

Wherever possible, excavated material would be used to backfill around the infrastructure elements. Where this is not possible, re-profiling of the spoil and capping with a layer of acrotelmic peat would be undertaken to form areas of permanent landscaping. These storage areas would be located adjacent to the respective foundations where practicable to avoid unnecessary disturbance through transportation around site. The final locations would be identified in the final PMP following detailed design and site investigation post-consent.

It is assumed that excavated peat will be re-used and reinstated on site within the borrow pits, tracks and hardstanding areas, the largest volumes of excavated peat will be used to cap the reinstated borrow pits. Due to the stronger structure and presence of living vegetation and seed source, acrotelmic peat is generally considered more suitable for use and thus may be used instead of catotelmic peat in many restoration purposes. Any wet catotelmic peat will be placed at the bottom of the restoration profile followed by semi fibrous catotelmic peat. Restoration activities would all be overseen by the Ecological Clerk of Works to ensure best practice methods are adhered to. With careful design, unconsolidated peat may be used to create a wetland habitat, as illustrated within the available guidance³.

5.5 Handling Excavated Peat

The following principles will be applied within the final PMP following detailed site investigation post-consent.

- The surface layer of peat and vegetation (acrotelm) would be stripped separately from the catotelmic peat.
- The removal of vegetation will be minimised so that the area of exposed or bare peat is limited as far as practicable. When the site infrastructure is being excavated, the surface vegetation would be removed in sods which can be stored (vegetation site up) and later replaced around the foundation and infrastructure. This would allow for more rapid re-vegetation of bare peat and help reduce erosion.
- Reuse would occur as soon as possible after excavations where practicable.
- Acrotelmic material would be stored separately from catotelmic material.
- Handling and storage of peat would seek to ensure that excavated peat does not lose either its structure or moisture content.
- Careful handling is essential to retain any existing structure and integrity of the excavated materials and thereby maximise the potential for excavated material to be reused.

- The less humified catotelmic peat which maintains its structure upon excavation would be kept separate from the highly humified amorphous peat.
- Acrotelmic material would be replaced as intact as possible once construction is complete.
- To minimise handling and transportation of peat, acrotelmic and catotelmic peat would be replaced, as far as is reasonably practicable, in the location from which it was removed. Acrotelmic peat would always be placed on the surface.
- Within permanent landscaping areas and bunds the catotelmic peat would be capped with acrotelmic peat.
- Where on-site uses for excavated peat have been exhausted, excavated waste peat may be suitable for use off-site for peatland restoration elsewhere, if required this will be subject to correspondence and agreement with NRW.

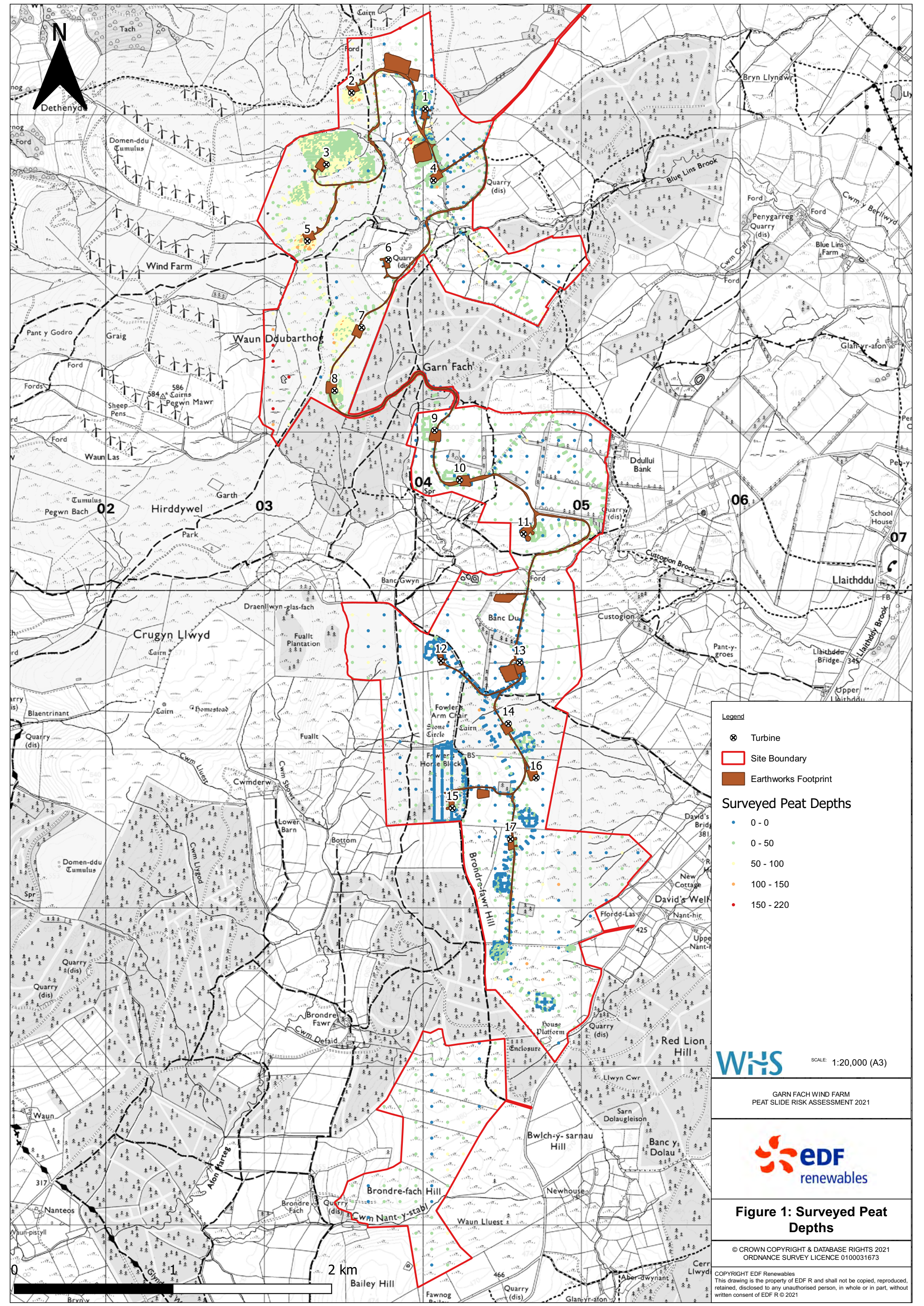
6 Conclusion

This draft PMP has been completed using the best available guidance regarding re-use of peat and peat reinstatement on wind farm sites. The document outlines the best practice guidance for handling excavated peat, providing temporary peat storage and reinstating peat. The main conclusions from this draft PMP are as follows:

- Peat has been identified at various locations across the site, the peat depths are mostly below 0.5m thick and are mainly highly decomposed.
- Layout constraints and micro siting of the development has avoided the placing of infrastructure on areas of deep peat deposits.
- It is expected that excavated peat will be stored appropriately and used for the reinstatement of access track verges, turbine hardstanding's and borrow pits.
- During the construction of the proposed wind farm, temporary storage of peat would be required prior to reinstatement post construction. This document specifies the constraints upon the siting of these areas to aid identification of areas for peat storage. The exact areas will be considered in the final PMP following further detailed design and site investigation post-consent.
- Care would be taken while peat is being excavated to ensure the acrotelmic and catotelmic peat is kept separate and stored appropriately in the specified areas.

It should be noted that this draft PMP is a live document and will be developed into a final PMP post-consent. The final PMP will be informed by further site investigation, detailed design and detailed construction method statements.

³ Scottish Renewables and SEPA 2012. Guidance on the Assessment of Peat Volumes, Reuse of Excavated Peat and the Minimisation of Waste



Legend

- ⊗ Turbine
- Site Boundary
- Earthworks Footprint

Surveyed Peat Depths

- 0 - 0
- 0 - 50
- 50 - 100
- 100 - 150
- 150 - 220



SCALE: 1:20,000 (A3)

GARN FACH WIND FARM
PEAT SLIDE RISK ASSESSMENT 2021



Figure 1: Surveyed Peat Depths

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Appendix 2 Garn Fach Peat Volumes Calculation

The peat volumes cut from the site during construction have been approximated using topographical data and the Phase 2 peat survey data⁴. The expected volumes of peat have been tabulated below, ordered according the infrastructure elements planned within the site (Table 3).

The method for calculation of the peat volumes cut from the site, involved first creating a surface model by triangulating between the points (depths) collected as part of the phase 2 peat survey. This was then overlayed upon elevations extracted from OS mapping (extracted on to 5x5m grid). The volume between the two surfaces was then calculated by Civils 3D software for the locations of the proposed infrastructure, which enabled the volume of peat to be extracted for each feature.

Table 3 Peat volumes cut from site

Infrastructure ID	Peat Volume (m³)
Track 1	2433
Track 2	1809
Track 3	4493
Track 4	1257
Track 5	2118
Track 6	832
Track 7	2581
Track 8	914
Track 9	6094
Track 10	392
Track 11	1302
Track 12	2549
Track 13	491
T1 (Turbine)	249
T2	1674
T3	1959
T4	1115
T5	2517
T6	376
T7	2370

T8	1681
T9	617
T10	685
T11	654
T12	3040
T13	491
T14	1052
T15	1098
T16	1902
T17	628
Substation	1655
CC North	3743
CC South	960
PB North	5726
Total	61,457

⁴ Pell Frischmann. 2021.

Appendix 10-3: Water Framework Directive Assessment

Executive Summary

The Water Environment (Water Framework Directive) (WFD) (England and Wales) Regulations 2003 seeks to protect and enhance the ecological and chemical health of rivers, lakes, estuaries and coastal and groundwaters. The aim of the WFD is for all waterbodies to achieve “good status” by 2027. Waterbodies are assessed within River Basin Management Plans which allows the waterbody to be managed as a natural geographical and hydrological unit. Surface water bodies can be classes as high, good, moderate, poor or bad status.

The site drains to three separate WFD waterbodies. These waterbodies are the Afon Marteg- Source to Confluence with the River Wye, Llaethdy Brook- Source to Confluence with the River Ithon and the River Ithon- Source to Confluence with the Llaethdy Brook. The Afon Marteg is a source to the tributary of the River Wye, the River Wye is classified as a Special Area of Conservation (SAC). The overall status of the Afon Marteg and Llaethdy Brook is Moderate while the River Ithon is classified as Good. The site lies within the Wye Uplands Lower Palaeozoic groundwater body which covers a total area of 1,681km². The waterbody currently has an overall status of poor and the available information notes that no known solution for improving the status is available.

The WFD assessment has concluded that with the appropriate mitigation in place, the proposed development will not be detrimental to the objectives of the WFD waterbodies. The assessment also concludes that with appropriate mitigation the development will not impact upon nutrient levels within the River Wye SAC.

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1.1 Introduction

Wallingford HydroSolutions Ltd (WHS) has been commissioned by Dulas Ltd to complete a Water Framework Directive (WFD) Assessment for the Garn Fach Wind Farm. This document forms an appendix to the Environmental Statement (ES) to accompany a planning application for a proposed 17 turbine windfarm to the south of Newtown, Powys, NGR: SO 03413 81467 and covers an area of approximately 700ha. A WFD assessment was requested within the Scoping Direction provided by The Planning Inspectorate in 2020 following a review of the submitted scoping report.

The aim of this report is to identify the relevant WFD ground water and surface water bodies located within the vicinity of the site and to assess if the proposed development is compliant with the objectives of the WFD for the identified areas.

1.2 Legislation

The legislative framework for the WFD comprises the Water Environment (Water Framework Directive) (England and Wales) Regulations 2003. The regulations seek to protect and enhance the ecological and chemical health of rivers, lakes, estuaries and coastal and groundwaters. The aim of the WFD is for all waterbodies to achieve “good status” by 2027. Waterbodies are assessed within River Basin Management Plans which allows the waterbody to be managed as a natural geographical and hydrological unit.

Each river basin has a River Basin Management Plan (RBMP) which sets out the current status and objectives for the waterbody required to achieve good status by 2027 in terms of ecological, chemical and protected area objectives. The status of each waterbody is reassessed every under 6 year cycles with interim updates every 3 years as part of WFD cycles. The first cycle ended in 2015 and the data were most recently updated in 2018. For those waterbodies which did not achieve good status the target date was extended to either 2021 (cycle 2) or 2027 (cycle 3). At the time of writing the 2021 cycle 2 update was yet to be published.

To achieve good ecological status or potential, good chemical status or good groundwater status each element must be assessed as good status or better. If a single element is below the threshold for good status, then the water body’s status cannot be classed as good.

Surface Water Criteria

Surface water bodies can be classes as high, good, moderate, poor or bad status. The ecological status of surface waters are assessed based on the following.

- Biological quality – fish, benthic invertebrates, aquatic flora.
- Hydromorphological quality – riverbank structure, continuity of channel or substrate of the river bed.
- Physico-chemical quality – temperature, oxygenation and nutrient conditions.

The chemical status refers to the environmental quality standards specific water pollutants.

Groundwater Criteria

The groundwater bodies are assessed according to their “quantitative” or “chemical” status.

1.3 Guidance and Methodology

There is no formal guidance for producing WFD Assessments for surface water bodies in England and Wales. The Government however do provide guidance from the Environment Agency (EA) on completing WFD

assessments for estuarine and coastal waters¹, this guidance has been taken into consideration for the completion of this assessment. The following approach has been taken for this assessment.

- **Screening:** Identify and record current water body status, future objectives and any activities within the vicinity of the waterbody which may influence the status of the waterbody.
- **Scoping:** For each WFD element, identify where the proposed development may affect the current or achievable status.
- **Assessment and mitigation:** Identify the extent to which the development will influence (positively or negatively) the WFD elements. Identify where actions can be incorporated into the development to mitigate any negative effects of the development.

1.4 Site Description

The proposed development site covers an area of approximately 700ha located approximately 10km south west of Newtown, Powys (NGR: SO 03413 81467). The site area is characterised by peatland, rough grasslands, and isolated areas of coniferous forest. The proposed wind farm would include the following main components spread over three site areas (Northern, Central, and Southern):

- 17 turbines with external transformers and related switchgear at each turbine.
- Associated turbine foundations and hardstanding areas.
- A substation compound which will initially be used as a borrow pit.
- Two temporary site construction compounds, with the northern area initially used as a borrow pit.
- Two on-site borrow pit areas.
- A network of on-site buried electrical cables.
- An energy storage facility.
- Approximately 13.4 km of on-site tracks, including 9.8 km of new tracks and 3.6 km of upgraded existing tracks.

1.5 Screening

The site lies within the River Severn River Basin District. This section identifies the WFD surface water and groundwater bodies located within the draining catchments of the site as determined by the surrounding topography. The land use of the site and surrounding area is predominantly for agriculture, this has the potential to contribute to a reduction in water quality of the waterbodies through leaching of pesticides and herbicides into the water.

1.6 Surface Waterbody Catchments

The site drains to three separate WFD waterbodies. These waterbodies are the Afon Marteg- Source to Confluence with the River Wye, Llaethdy Brook- Source to Confluence with the River Ithon and the River Ithon- Source to Confluence with the Llaethdy Brook. The Afon Marteg is a source to the tributary of the River Wye, the River Wye is classified as a Special Area of Conservation (SAC).

Appendix 1 shows the location of the waterbodies relative to the site and Appendix 2 shows the catchments for these waterbodies. Table 0-1 shows the WFD details of the three surface waterbodies, indicating their status and objectives.

Table 0-1: WFD Waterbody Characteristics²

WDF Indicator	Afon Marteg	Llaethdy Brook	River Ithon
Water Body ID	GB109055042310	GB109055042160	GB109055042180

¹ Environment Agency, Water Framework Directive assessment: estuarine and coastal waters, published December 2016. Available via: <https://www.gov.uk/guidance/water-framework-directive-assessment-estuarine-and-coastal-waters>

WDF Indicator	Afon Marteg	Llaethdy Brook	River Ithon
Overall Status	Moderate	Moderate	Good
Ecological Status	Moderate	Moderate	Good
Chemical Status	Good	Good	Good
Overall Objective	Good by 2021	Good by 2021	Good by 2015
Chemical Objective	Good by 2015	Good by 2015	Good by 2015
Ecological Objective	Good by 2021	Good by 2021	Good by 2015

1.7 Groundwater Body

The site lies within the Wye Uplands Lower Palaeozoic groundwater body which covers a total area of 1,681km². The waterbody currently has an overall status of poor and the available information notes that no known solution for improving the status is available hence forth there are no proposed objectives. The details of this waterbody are shown in Table 0-2.

Table 0-2: Wye Uplands Lower Palaeozoic Ground Water Body characteristics

WDF Indicator	Current Status/Information
Water Body Name	Wye Uplands Lower Palaeozoic
Water Body ID	GB40902G205100
Overall Status	Poor
Chemical Status	Poor
Quantitative Status	Poor
Reason for failure	Chemical Dependent Surface Water Body Status
Chemical Objective	Poor by 2015*

*this objective was taken from data updated in 2017.

1.8 Severn River Basin Management Plan

The site lies within the Severn River Basin Management Plan (RBMP), which covers over 21,000km² and lies within both England and Wales, divided into 10 catchments. The catchments are characterised by mainly agriculture and forestry. The RBMP outlines water management issues and objectives with the aim of protecting and enhancing the water environment.

The environmental objectives of the WFD are:

- To prevent deterioration of the status of surface waters and groundwaters.
- To achieve objectives and standards for protected areas.
- To aim to achieve good status for all water bodies.
- To reverse any significant and sustained upward trends in pollutant concentrations in groundwater.
- To end discharges, emissions and losses of hazard substances into surface waters.
- To reduce the pollution of groundwater and prevent or limit the entry of pollutants.

² Data available for download from: <http://lle.gov.wales/catalogue/item/WaterFrameworkDirectiveRiverCatchmentWaterbodiesCycle2?lang=en>

1.9 River Wye Special Area of Conservation objectives

The River Wye Special Area of Conservation (SAC) is situated mainly within Wales but extends just over the border in England. It is divided into 43 water bodies in Wales, two of which are located along the border and four in England. SAC's are designated under the Habitats Directive for their habitats and/or species of European Importance. The River Wye SAC has been designated due to the presence of varies water-crowfoot *Ranunculus* flora; stream water-crowfoot *R. penicillatus* ssp. *pseudofluitans* is abundant, with other *Ranunculus* species – including the uncommon river water-crowfoot *R. fluitans*, found within the catchments. Further species include the White-clawed crayfish, Sea lamprey, Brook lamprey, River lamprey, and further downstream, Twaite shad, Atlantic salmon, Bullhead and Otter. The River Wye SAC Core Management plan³ outlines the objectives for the area. Conservation objectives are required under the Habitats Directive, as such there are numerous objectives for the watercourse. These mostly relate to ensuring the ecological status of the water environment is suitable to maintain or increase populations of the defined species.

A summary of the objectives is provided below:

- Maintain and improve the ecological status of the water environment.
- Maintain the flow regime, water quality and physical habitat of the watercourse.
- Known breeding, spawning and nursery sites should be maintained expect where natural processes cause them to change.
- The river platform and profile should be predominantly unmodified.
- Levels of nutrients, in particular phosphate, will be agreed with the EA for each WFD water body in the Wye SAC with measures taken to maintain pollution below the levels identified.

The potential for the proposed development to impact upon these objectives is discussed in section 2.4.

1.9.1 River Wye Special Area of Conservation Phosphorous Targets

The River Wye SAC has specific targets relating to phosphorous concentrations within the waterbodies. These targets were incorporated into the SAC management plan in 2017. The majority of the upper Wye catchment is rural and used predominantly for sheep and beef cattle. In recent years there has been an expansion in chicken farming which has caused public concern regarding water quality. However, the recent compliance review indicated the patterns of failures within the Wye does not support this hypothesis.

The target⁴ for the headwaters of the River Wye is for phosphorous concentrations to remain below 10 µg l⁻¹.
1. The catchments within the development boundary which form the head waters of the River Wye are currently shown to pass in terms of phosphorous compliance.

- The Afon Marteg tributary has been assessed 33 times with the annual mean concentration sitting at 7 µg l⁻¹.
- The River Ithon tributary has been assessed 29 times with the annual mean concentration sitting at 8 µg l⁻¹.
- The Llaethdy Brook tributary has been assessed 16 times with the annual mean concentration sitting at 7 µg l⁻¹.

2 Scoping and assessment

This section presents the scoping and impact assessment of the proposed development upon the WFD surface water bodies, groundwater catchment and the River Wye SAC.

The assessment takes into consideration specific crossing points of the development and the watercourses along with the wider draining catchment. Additionally, mitigation measures are taken into consideration. Appendix 1 and 2 shows the WFD catchments and surface water bodies in relation to the proposed development and Appendix 3 indicates the areas of crossing of the development and watercourses. The WFD assessment for each WFD component is presented in Table 2-1, Table 2-2, and Table 2-3.WFD Surface Water Body Impact Assessment

2.1.1 River Ithon- Source to confluence with Llaethdy Brook

Table 2-1: River Ithon WFD waterbody impact assessment. GB109055042180.

WFD and Status	Element Current	Objective	WFD Assessment
Ecological Status	Good	by 2015	Ecological status of surface waterbodies is based upon the biological quality, chemical and physico-chemical quality, water quality and hydromorphological quality. It is unlikely that the proposed development will directly impact upon the current ecological status of the waterbody as there are no direct works proposed within the watercourse. The residual effects assessed within Chapter 10 of the ES of reduced water quality from increased sediment loads and acidification with runoff from disturbed ground, soil heaps and excavations and as a result of accidental spillage/loss of chemicals and other construction materials would be controlled through mitigation measures implemented through the Outline Construction and Environmental Management Plan (CEMP) and are assessed as not significant. The development crosses the watercourse in two locations as indicated above. Water crossings have been designed accordingly to use the natural bed of the watercourse and be of sufficient capacity to prevent detriment or flow changes from the baseline watercourse. Mitigation is also proposed to prevent polluted runoff from entering the watercourse.
Chemical Status	Good	by 2015	The residual effects assessed within the ES Chapter 10 of reduced water quality are not significant as a result of the mitigation measures implemented within the Outline CEMP. Monitoring of PWS abstracting from the WFD waterbody sources will be undertaken to ascertain chemical concentrations to confirm there are no changes to the baseline.
Hydrology	N/A		The residual effects assessed within the ES Chapter 10 of changes to runoff and peak flow through increased impervious surfaces across catchments are not significant as a result of the mitigation measures implemented within the Outline CEMP.

³ Natural Resources Wales (2017) River Wye special Area of Conservation (SAC) Core Management Plan (first published 2008). Accessed via: https://consult.environment-agency.gov.uk/psc/ta5-1ud-nnb-generation-company-hpc-limited-2/supporting_documents/EA5%20%20River%20Wye%20SAC%20Core%20Management%20Plan%20Natural%20Resources%20Wales%20September%202017.pdf

⁴ Compliance Assessment of Welsh River SACs against Phosphorous Targets. Natural Resources Wales. January 2021. Accessed via: <https://cdn.cyfoethnaturiol.cymru/media/693025/compliance-assessment-of-welsh-sacs-against-phosphorus-targets-final-v10.pdf?mode=pad&rnd=132557227300000000>

WFD and Status	Element and Current	Objective	WFD Assessment
			There are no direct works proposed within the watercourse, where water crossings are required the natural bed of the channel would be maintained.
Other		N/A	No additional classifications are distinguished for this water body.

2.1.2 Llaethdy Brook- Source to confluence with the River Ithon

Table 2-2- Llaethdy Brook WFD waterbody impact assessment. GB109055042160.

WFD and Status	Element and Current	Objective	WFD Assessment
Ecological Status Moderate		Good by 2021	The ecological status of the waterbody is moderate with the reason for failure being fish. The proposed development and associated works will not directly impact upon the watercourse and therefore the development is not expected to cause physical destruction to fish habitats. The residual effects assessed within Chapter 10 of the ES of reduced water quality from increased sediment loads and acidification with runoff from disturbed ground, soil heaps and excavations and as a result of accidental spillage/loss of chemicals and other construction materials are assessed as not significant as a result of the proposed mitigation measures implemented within the Outline CEMP. Two watercourse crossings are identified on this surface water body. The crossings are over very small sections of the watercourse which may not be present during drier periods. Cross track drainage will be provided where required to enable species to pass as normal and prevent disruption to the natural site drainage. An appropriate structure such as a bottomless culvert will be used to preserve the natural flow of the watercourse.
Chemical Status Good		Good by 2015	The residual effects assessed within the ES Chapter 10 of reduced water quality are not significant with the implementation of the proposed mitigation measures implemented within the Outline CEMP. Furthermore there are no large excavations planned within close vicinity of the draining watercourse. It is unlikely that the construction process will influence the nutrients, temperature, dissolved oxygen or pH of the watercourse.
Hydrology		N/A	The residual effects assessed within the ES Chapter 10 of changes to runoff and peak flow through increased impervious surfaces across

⁵ Updated Recommendations on Environmental Standards, River Basin Management (2015-21). UK Technical Advisory Group on the Water Framework Directive. April 2012. Available via: http://www.wfduk.org/sites/default/files/Media/UKTAG%20Summary%20Report_final_260412.pdf

		catchments are not significant with the implementation of the proposed mitigation measures within the Outline CEMP.
Other	N/A	No additional classifications are distinguished for this water body.

2.1.3 Afon Marteg- Source to Confluence with River Wye

Table 2-3- Afon Marteg WFD waterbody impact assessment. GB109055042310.

WFD and Status	Element and Current	Objective	WFD Assessment
Ecological Status Moderate		Good by 2021	The ecological status of the waterbody is moderate with the reason for failure being copper concentration. The Updated Recommendations on Environmental Standards produced by the UK Technical Advisory Group (UKTAG)⁵ indicates that the likely source of copper in surface waters is from domestic sources (waste treatment works), industrial effluents, mine waters and sediments. Given the embedded mitigations, proposed drainage strategy and on-site pollution prevention best practice methods outlined in Chapter 10, concentrations of copper within the watercourse are not expected to increase due to the development. The residual effects assessed within Chapter 10 of the ES of reduced water quality from increased sediment loads and acidification with runoff from disturbed ground, soil heaps and excavations and as a result of accidental spillage/loss of chemicals and other construction materials are not significant with the implementation of the mitigation measures presented within the Outline CEMP.
Chemical Status Good		Good by 2015	The residual effects assessed within the ES Chapter 10 of reduced water quality are not significant through the mitigation measures implemented within the Outline CEMP. A very small portion of the site drains into this watercourse.
Hydrology		N/A	The residual effects assessed within the ES Chapter 10 of changes to runoff and peak flow through increased impervious surfaces across catchments are not significant with the implementation of the mitigation measures outlined within the Outline CEMP. There are no direct works proposed within the watercourse.
Other		SAC	The water is classified as a Special Area of Conservation, this is due to the watercourse forming a tributary to the River Wye which is protected as a Special Area of Conservation (SAC). This is discussed further in section 2.4.

2.2 Summary of Surface Waterbody WFD Assessment

Table 2-4: Summary of Surface Waterbody WFD Assessment

Waterbody ID	Does the Development Comply with the WFD objectives?	Justification and Mitigation
All Waterbodies	N/A	The proposed development will not discharge hazardous substances into the watercourse. The embedded mitigation measures proposed within Chapter 10 of the ES and Outline Drainage Strategy (Appendix 10.3) are appropriate to ensure there are no significant impacts to the waterbody.
GB109055042180 (3.2.1 River Ithon- Source to confluence with Llaethdy Brook)	Yes	The proposed development is not expected to impact upon the Chemical or Ecological Status of the River Ithon WFD waterbody. Mitigation measures proposed as part of the proposed development would adequately mitigate potential effects that could occur in this waterbody. Therefore, no deterioration of the overall status of the waterbody is expected and the development will not be detrimental to the waterbody maintaining it's good status.
GB109055042160 (3.2.2 Llaethdy Brook- Source to confluence with the River Ithon	Yes	The proposed development is not expected to impact upon the Chemical or Ecological Status of the Llaethdy Brook WFD waterbody. Therefore, no deterioration of the overall status of the waterbody is expected.
GB109055042310 (3.2.3 Afon Marteg- Source to Confluence with River Wye)	Yes	The proposed development is not expected to impact upon the Chemical or Ecological Status of the Afon Marteg WFD waterbody. Therefore, no deterioration of the overall status of the waterbody is expected. The proposed development will not be detrimental to the waterbody or the potential to achieve good status.

2.3 WFD Groundwater Catchment Impact Assessment

2.3.1 Wye Uplands Lower Palaeozoic

Table 2-5- Wye Uplands Lower Palaeozoic groundwater body impact assessment

WFD and Status	Element Current	Objective	WFD Assessment
Quantitative Status Poor	Poor 2015	by	Quantitative status is defined by the quantity of groundwater available as baseflow to watercourses and groundwater dependant terrestrial ecosystems (GWDTE), and as a drinking water resource. GWDTE have been addressed within the GWDTE Assessment in Appendix 10.4. The residual effects assessed within Chapter 10 of the ES of reduced water quality from increased sediment loads and acidification with runoff from disturbed ground, soil heaps and excavations and as a result of accidental spillage/loss of chemicals and other construction materials are not significant with the implementation of the mitigation measures presented within the Outline CEMP. The impermeable area covered by the proposed development makes up a very small portion of the groundwater catchment, therefore the impact of the development on groundwater supply is expected to be negligible. Furthermore, the site area contributes to only 0.4% of the entire groundwater body catchment. The Private Water Supply Risk Assessment (available as Appendix 10.5) concluded that through incorporating appropriate mitigation where required the development will not impact upon Private Water Supplies (PWS) in the draining catchments of the site. A period of PWS monitoring will be implemented to confirm there are no changes to the baseline. The outline peat management plan indicates guidelines for the disposal/ re-use of peat and excavated material to ensure minimal impacts and degradation to the peat deposits across the site. Chapter 10 of the ES concludes that through the implementation of mitigation and following of best practice construction guidelines and pollution prevention guidelines the impact of the development can be managed to an appropriate level that would not cause deterioration to the wider catchment.
Chemical Status Poor	Poor 2015	by	This is defined by the concentrations of a range of key pollutants within the groundwater which may feed into watercourses and the GWDTE. The waterbody failed due to the Chemical Dependant Surface Waterbody Status. The outline drainage system for the site has been designed to trap sediment laden runoff from entering the watercourses. The impact upon the GWDTE is discussed within the GWDTE Assessment and Chapter 10 of the ES, the assessment concluded that with the proposed embedded mitigation measures the impact to the hydrogeology feeding GWDTE is considered not significant.

WFD and Status	Element Current	Objective	WFD Assessment
Other		N/A	No known technical solution is available to achieve good status of the groundwater body.
Does the development comply with the WFD objectives?		Justification and Mitigation	
Yes		Due to the failure of the groundwater body the WFD objective is for no deterioration of the WFD area. The proposed development it unlikely to impact upon the status of the groundwater body within the catchment.	

2.4 River Wye SAC Impact assessment

The proposed development site drains to the River Wye SAC through the River Ithon and it’s tributaries. The objectives of the River Wye SAC are outlined in section 1.9. The assessment of the WFD Surface Waterbodies draining the site concluded that the development will not have a negative impact upon the ecological or hydrological status of the waterbodies. As no changes are to be made directly to the watercourses there will be no impacts upon breeding, spawning and nursery sites within the watercourse and the river profile will remain unmodified.

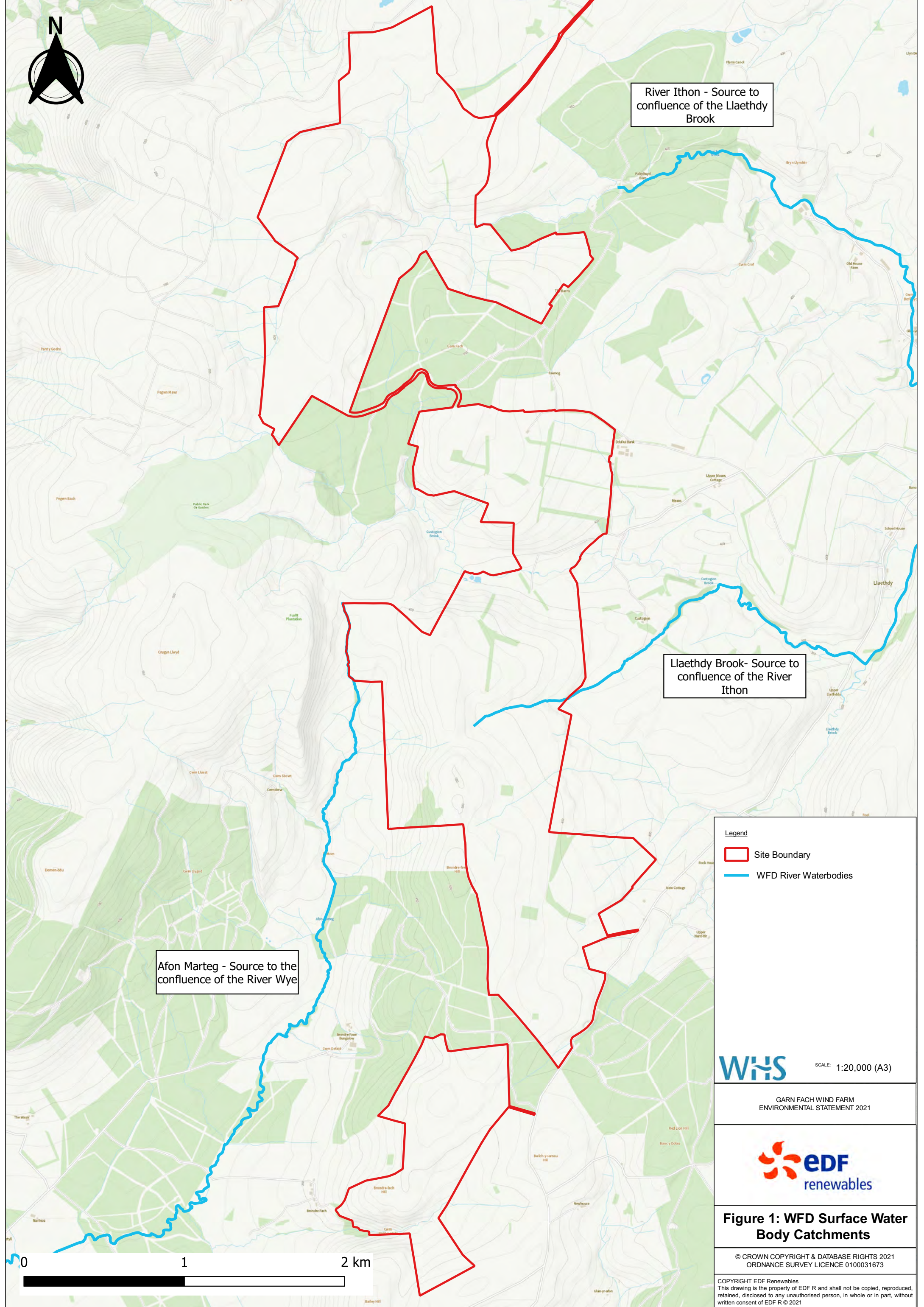
Phosphorous can enter the watercourse via point source (waste pipes discharging into the river) or diffuse source pollution from runoff from agricultural land and roads. Given the embedded design mitigation measures to trap and filter surface water runoff and best practice construction guidance it is unlikely that the development will lead to an increase of phosphorous in the watercourse. If required a period of monitoring of the watercourse would be implemented to track phosphorous levels in the watercourses draining the site.

During the construction period a number of welfare facilities would be located within the construction compound. It is proposed that these facilities would store all foul water within a tank which would be removed from site regularly by a licenced carrier. The small volumes of foul water would be treated at a suitable waste treatment works, thereby mitigating the effect of any potential increase in phosphorous as a result of temporary welfare facilities. No permanent welfare facilities are proposed for the operational phase of the development.

The outline drainage strategy for the development indicates how surface water runoff will be managed to prevent chemicals and construction sediment from entering the watercourse. With appropriate mitigation it is understood that the development will not impact upon nutrient levels within the SAC.

3 Conclusion

The WFD assessment has concluded that the proposed development will not be detrimental to the objectives of the WFD waterbodies.



River Ithon - Source to
confluence of the Llaethdy
Brook

Llaethdy Brook- Source to
confluence of the River
Ithon

Afon Marteg - Source to
the confluence of the River Wye

Legend

- Site Boundary
- WFD River Waterbodies

WHS

SCALE: 1:20,000 (A3)

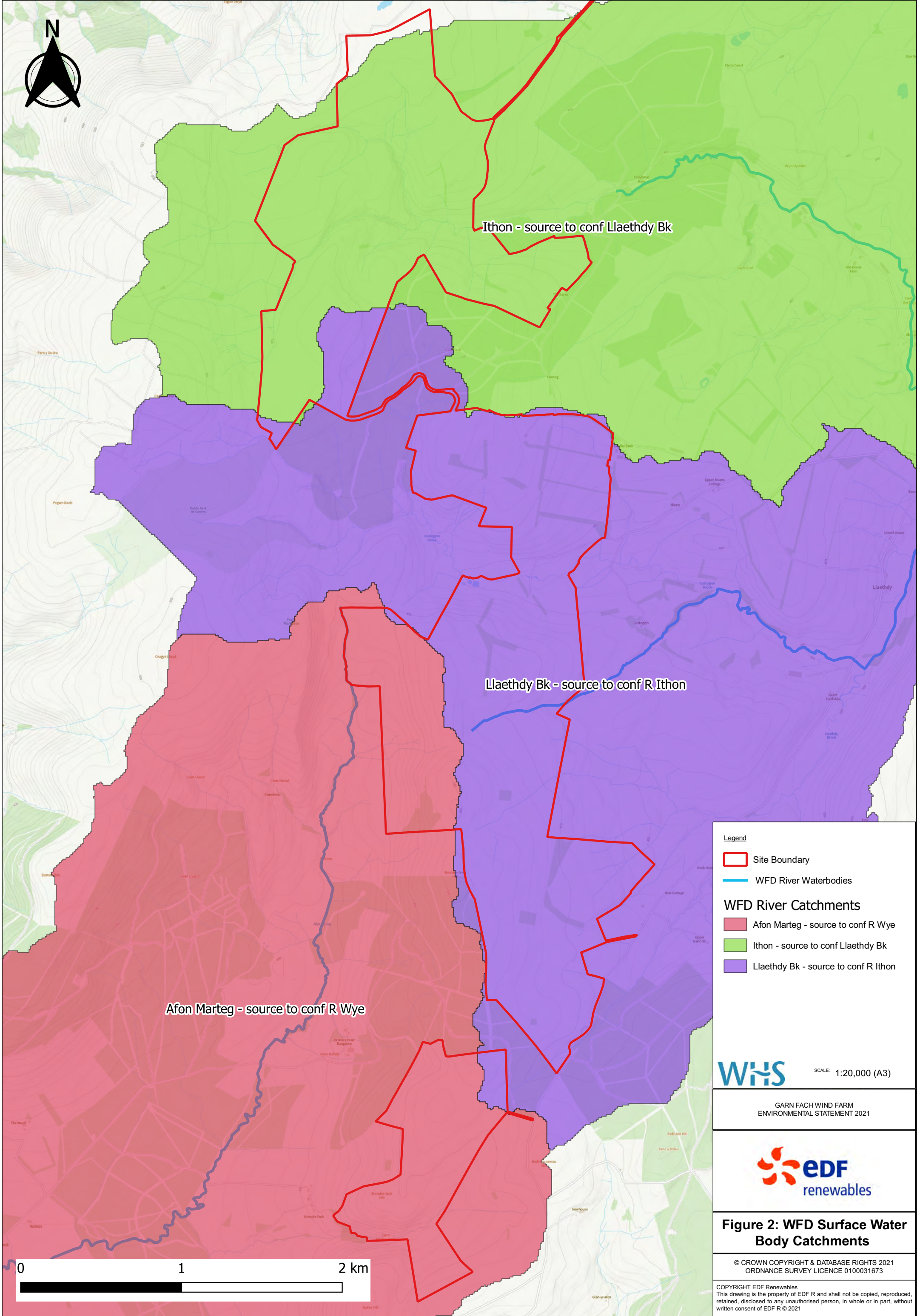
GARN FACH WIND FARM
ENVIRONMENTAL STATEMENT 2021

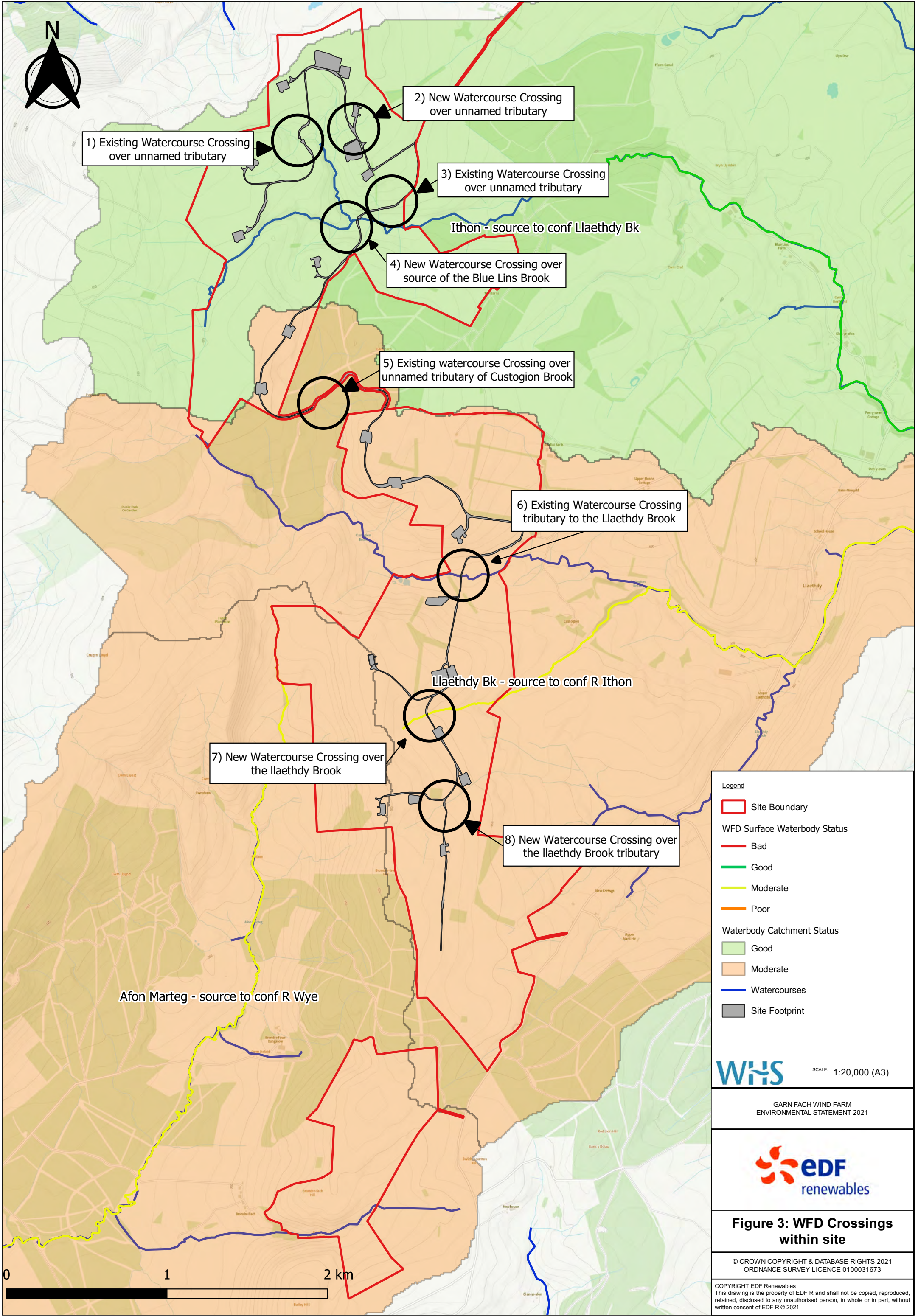


Figure 1: WFD Surface Water
Body Catchments

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Appendix 10-4: Flood Consequence Assessment

Executive Summary

This document forms the Flood Consequence Assessment for the Garn Fach windfarm. A review of the Development Advice Map indicates that localised sections of the proposed tracks crosses through Flood Zones 2 and 3 defined as areas at risk of flooding during the 1% AEP and 0.1% AEP events respectively, originating from the Custogion Brook. Other areas located within flood zones 2 and 3 are associated with the Blue Lins Brooks, however no infrastructure is located within these areas.

All proposed infrastructure that is classified as highly vulnerable is located within DAM zone A, and therefore is at little or no risk of fluvial or coastal flooding. The Custogion Brook, which is mapped as flooding during the 1% and 0.1% AEP events, runs through the whole width of the central development area and therefore it is not feasible to avoid construction of the access track outside of this flood zone.

To ensure that surface water runoff rates are not increased which could affect flooding both on and off the site, an outline drainage strategy for surface water is presented in the Garn Fach Wind Farm Surface Water Management Plan.

While there are multiple small watercourses within the site boundary that create localised risk of pluvial flooding, areas of highly vulnerable development have been located outside of these extents. An outline surface water management plan has also been developed for the site to have a neutral or beneficial effect on the surface water flood risk on and off site, as such the risk of pluvial flooding to the development is low.

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1 Introduction

1.1 Background

Wallingford HydroSolutions Ltd has been commissioned by Dulas Ltd to complete a Flood Consequence Assessment (FCA). This FCA is an appendix to an Environmental Statement (ES) to accompany a planning application for a proposed 17 turbine windfarm to the south of Newtown, Powys, NGR: SO 03413 81467. The site is located on greenfield land and covers an area of approximately 700ha.

1.2 Scope

This report provides a comprehensive review of flood risk to the proposed development site and presents mitigation scenarios to manage fluvial flood risk. This report should be read in conjunction with the surface water management plan, which addresses the management of surface water runoff onsite during the construction and operational phase of the proposed development in accordance with Sustainable Urban Drainage Systems (SuDS) design philosophies.

In summary this FCA;

- Collates and analyses environmental flood risk to the proposed development site obtained through a desk-based review identifying the risk of flooding to the site from a range of sources including, fluvial, pluvial, groundwater, coastal and reservoir flooding.
- Identifies historical flood risk to the site and any existing flood protections schemes and flood risk management infrastructure.

1.3 Sources of Information

This FCA uses a range of data sources including:

- LiDAR data¹
- Natural Resources Wales (NRW) Flood Mapping²
- The British Geological Survey (BGS) Geology of Britain viewer³ to identify groundwater flood risk to the site.
- Proposed development plans

2 Site Description

2.1 Location

The proposed development site covers an area of approximately 700ha and is located on greenfield land approximately 10km south west of Newtown, Powys, (NGR: SO 03413 81467). The site has several watercourses running through the site. The site location and layout can be seen in Appendix 1.

2.2 Topography

The topography of the site is generally comprised of conical hills with gentle slopes, with a highest point of 520mAOD and a lowest point of 370mAOD.

To the north and west of the site areas of higher topography are found by; Craig Y Paen (534mAOD) to the North, Domen-Ddu (556mAOD) to the north west, Pegwyn Mawr (586mAOD) and Crugyn Llwyd (571mAOD) to the west. To the south west a south westerly sloping valley is found. To the south and south east hills of similar elevation are found by; Bwlch-y-sarnau Hill (474mAOD) and Banc y Dolau (484mAOD) to the south.

To the east hills of lower elevation are found, with easterly sloping small valleys. A map of the site topography can be seen in Appendix 2.

2.3 Proposed Development

The proposed development is a 17-turbine windfarm. The site would include the following main components:

- 17 wind turbines with external transformers and related switchgear at each turbine.
- Associated turbine foundations and hardstanding areas.
- A site access route with necessary road improvement works.
- A substation compound which will be used as a borrow pit initially
- Two temporary site construction compounds, one in the northern area to be used as a borrow pit initially and one in the central area.
- A network of on-site buried electrical cables.
- An energy storage facility.
- Two borrow pits.

3 Flood Risk

3.1 Historic Flooding

There have been no recorded incidents of historical flooding at the site.

3.2 Existing Flood Defences

The site is not shown to be in an area benefiting from existing flood defences. The closest area shown to benefit from flood defences is Caersws approximately 7.5km to the north of the site.

3.3 Development Advice Map

To assess the risk of fluvial flooding on site the NRW DAM flood map has been reviewed.

The Development Advice Map (DAM) shows areas at risk of flooding for the purposes of land-use planning. The DAM should be used alongside Planning Policy Wales and Technical Advice Note (TAN) 15 to guide new development away from areas at risk of flooding wherever possible.

Appendix 3 shows the DAM map in the location of the site and indicates that a section of the proposed tracks crosses through zone C2 at one location, defined as areas which are modelled to flood in the 0.1% AEP event and are not served by flood defence infrastructure. There is another section of the site located in zone C2 where there is no infrastructure in the proposed development. In zone C2 only less vulnerable development is appropriate, which applies to the track infrastructure for this development.

3.4 Fluvial Flood Risk

To assess the risk of fluvial flooding at the site further, the NRW fluvial flood map has been reviewed.

The NRW flood map considers the flood risk associated with fluvial and tidal flood events during an undefended scenario, i.e. the presence of fluvial or tidal defences are not considered. They are based on model data, as well as recorded historical flood outlines.

Appendix 4 shows NRW's fluvial flood map, which indicates that localised sections of the proposed tracks crosses through Flood Zone 2 and 3 defined as areas at risk of flooding during the 1% AEP and 0.1% AEP events respectively. This originates from the Custogion Brook. The other section of the site located in flood

¹ NRW LiDAR Composite Dataset (2021), <https://lle.gov.wales/catalogue/item/LidarCompositeDataset/?lang=en>

² Natural Resources Wales National Flood Hazard Maps (2021), <http://lle.gov.wales/catalogue/item/NationalFloodHazardMaps/?lang=en>

³ BGS Geology of Britain viewer (2021), mapapps.bgs.ac.uk/geologyofbritain/home.html

zones 2 and 3 is where there is no infrastructure in the proposed development. This originates from the Blue Lins Brook.

3.5 Surface Water Flood Risk

Appendix 5 shows NRW’s Surface Water and Small Watercourses flood map, which indicates that most of the site is not at risk of pluvial flooding. The proposed tracks cross several locations shown to be at risk of flooding, these are along small watercourses which are not included in the national scale fluvial flood mapping.

3.6 Coastal Flooding

According to NRW’s online flood maps, the site is not at risk of coastal flooding.

3.7 Groundwater Flooding

Groundwater flooding is defined as the emergence of groundwater at ground level. A review of the BGS Geology of Britain mapping indicated that the site is underlain by sedimentary bedrocks comprising of sandstone, mudstone and siltstone. The proportion of soil deposits present for each area is shown in Table 1. For these soils and given the topography of the site it is concluded groundwater flooding is not a risk posed to this site.

Table 1 - Site Surface Soil Types

Site Area	Freely draining acid loamy soils over rock	Very acid loamy upland soils with wet peaty surface	Slowly permeable seasonally wet acid loamy and clayey soils	Slowly permeable wet very acid upland soils with a peaty surface
Northern	-	27%	-	73%
Central	15%	30%	10%	45%
Southern	38%	26%	-	36%

3.8 Reservoir Flooding

According to NRW’s online flood maps, the site is not at risk of flooding as a consequence of reservoir failure. The closest area shown to be at risk is approximately 4km to the north west of the site.

4 Flood Consequence Assessment

This FCA serves to quantify the current level of risk posed with regards to the developments use and its impact on flood risk elsewhere.

4.1 Planning Policy

TAN 15 outlines the requirements for planning policy in Wales in relation to development and flooding. TAN 15 requires that the development site will remain safe over its lifetime and will not increase flood risk elsewhere while ensuring minimal risk to life for site users. TAN 15 states that less vulnerable development can take place in DAM zone C2 subject to the application of the Justification Test. This applies to the access tracks for the site, as transport and utilities infrastructure. In terms of pluvial flood risk, the infrastructure and buildings should be designed to be located outside of areas shown to be at a high risk of surface water flooding. In addition, surface water drainage measures should have a neutral or beneficial effect on the risk of flooding both on and off the site, taking account of rain falling on the site and run-off from adjacent areas.

4.2 Justification for Development

All proposed infrastructure that is classified as highly vulnerable is located within DAM zone A, and therefore is at little or no risk of fluvial or coastal flooding. In terms of pluvial flood risk, there is a small area of the northern temporary construction compound within the flood risk zone. The design of this compound and surface water drainage will be undertaken to ensure that it will be free of surface water flooding up to and including the 1.0% AEP + CC event.

Where the proposed access track runs through fluvial flood zone C2 the track will be constructed at grade, and with an appropriately sized culvert to prevent flooding of the track, while minimising any impacts on flood risk. The Custogion Brook, which is mapped as flooding during the 1% and 0.1% AEP events, runs through the whole width of the central development area and therefore it is not feasible to avoid construction of the access track outside of this flood zone. There are no sensitive receptors upstream of the crossing that could be affected by any backwater effect or blockage, with the only potential receptor being a proposed access track approximately 1.7km upstream. In terms of pluvial flooding the tracks will be constructed at grade and with appropriate drainage measures in order to have a neutral or better effect on the risk of flooding. Where access tracks run over small watercourses appropriate cross road drainage will be provided, to ensure that natural flow paths on site are maintained.

4.3 Residual Risk and Flood Resilience

To ensure that surface water runoff rates are not increased which could affect flooding both on and off the site, an outline drainage strategy for surface water is presented in the Garn Fach Wind Farm Surface Water Management Plan.

4.4 Access/Egress

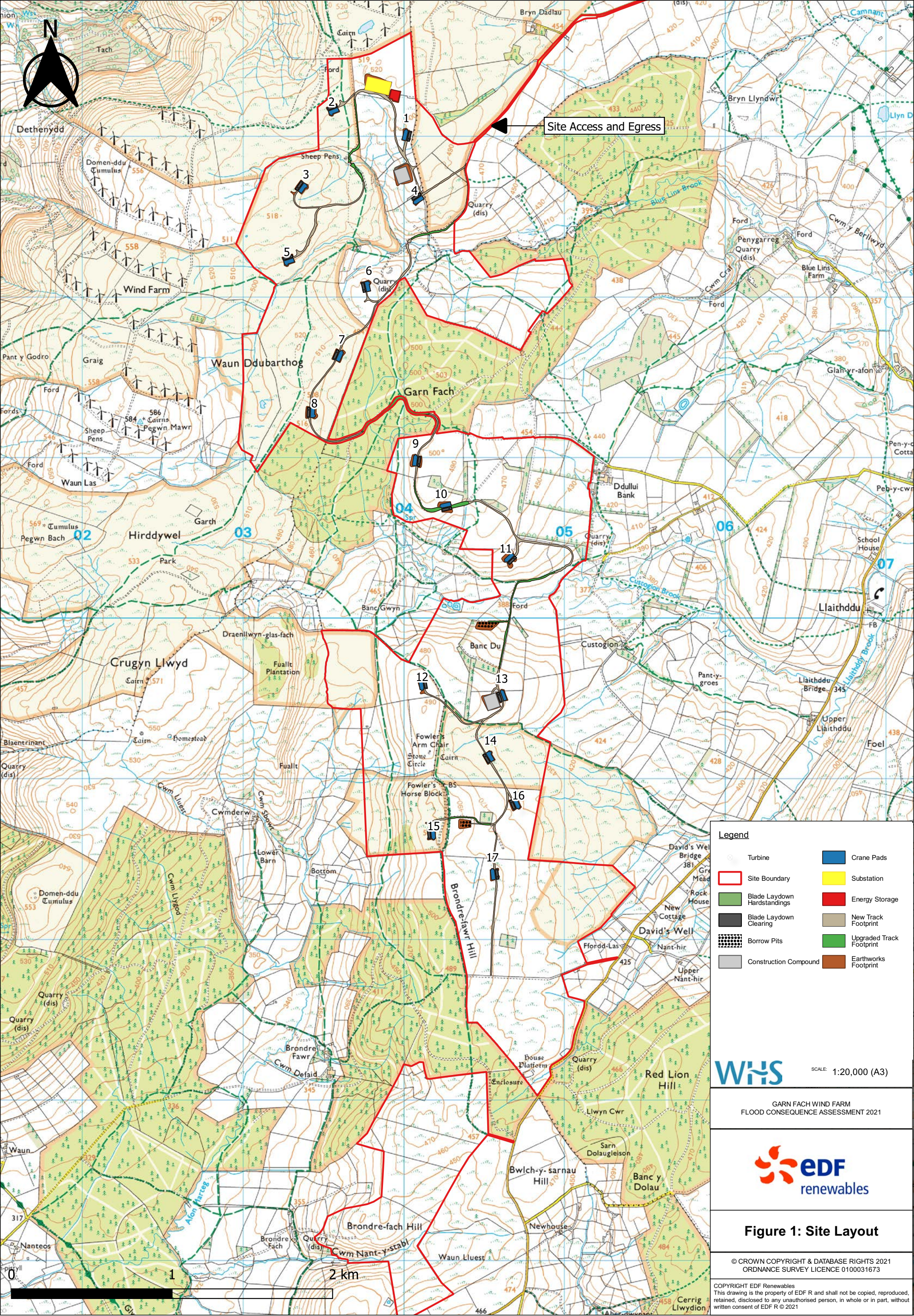
Access and egress to the site is provided by an unnamed road to the north east of the site (NGR: 304444 , 282972), which joins the A483 at NGR: 308436 , 284253. This acts as the sole access point for the north of the site and will serve as Operational and Maintenance access also. This unnamed road is not at risk of fluvial flooding. While small areas of the road are shown to be at risk of pluvial flooding, this looks to originate from small watercourses. Any cross road drainage features would not be included in national scale mapping and therefore true pluvial flood risk to this road is likely to be lower. National scale hazard mapping shows the flooding along this road to be in the low hazard category. Operational and maintenance access to the southern areas of the site will be via David’s Well Road which will supply LGVs only, this access track is not shown to be at risk of pluvial flooding.

5 Conclusion

The majority of the site is not at risk of fluvial flooding, with a small section of access track running through Flood Zone 3 according to NRW flood maps and DAM zone C2. It is not possible to locate this track outside DAM zone C2 and hence its location can be justified as the consequences of flooding are acceptable.

While there are multiple small watercourses within the site boundary that create localised risk of pluvial flooding, areas of highly vulnerable development have been located outside of these extents. An outline surface water management plan has also been developed for the site to have a neutral or beneficial effect on the surface water flood risk on and off site, as such the risk of pluvial flooding to the development is low.

The site is not at risk of flooding from coastal, groundwater or reservoir sources.



Legend

	Turbine		Crane Pads
	Site Boundary		Substation
	Blade Laydown Hardstandings		Energy Storage
	Blade Laydown Clearing		New Track Footprint
	Borrow Pits		Upgraded Track Footprint
	Construction Compound		Earthworks Footprint

WHS SCALE: 1:20,000 (A3)

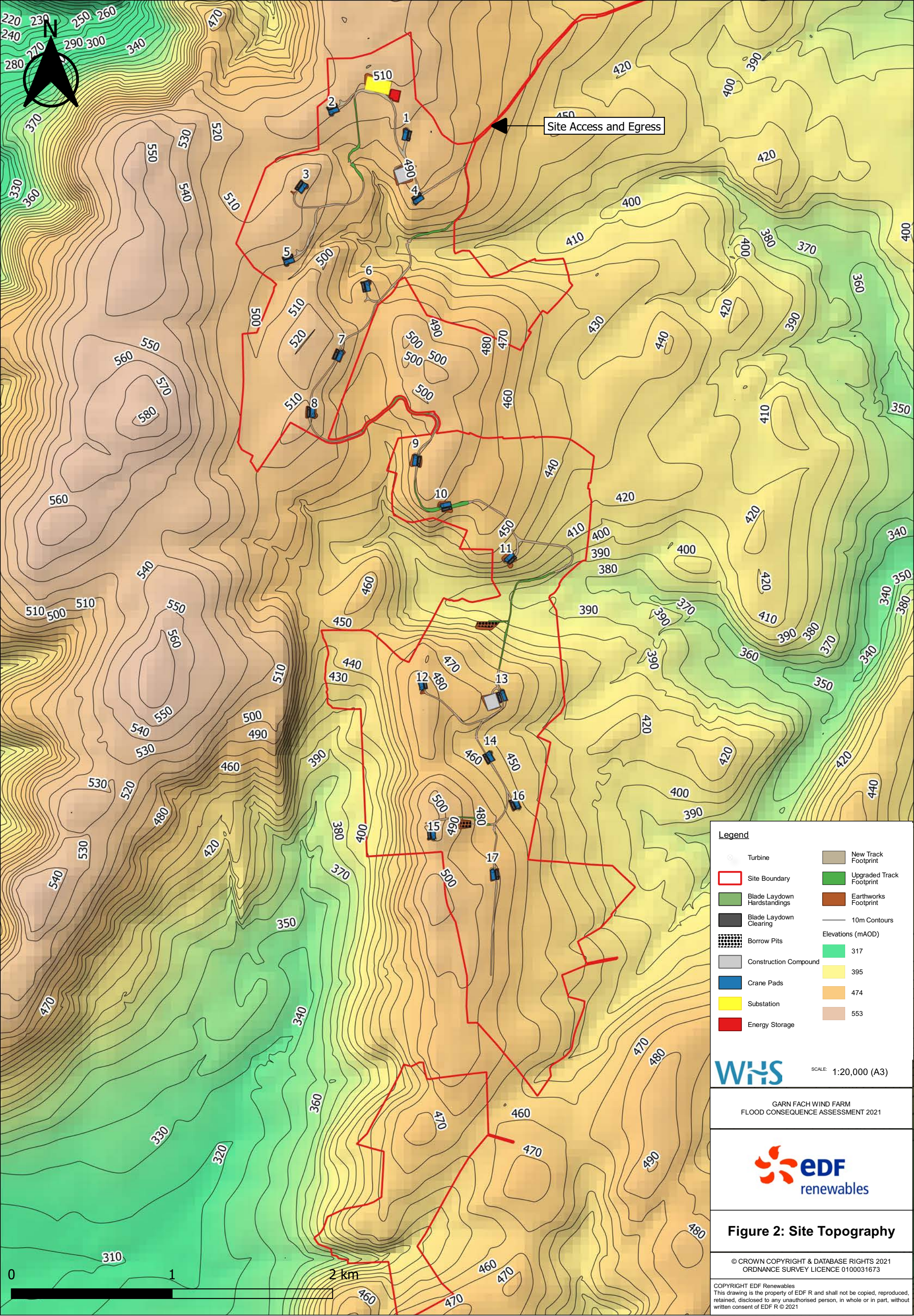
GARN FACH WIND FARM
FLOOD CONSEQUENCE ASSESSMENT 2021



Figure 1: Site Layout

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Legend

Turbine	New Track Footprint
Site Boundary	Upgraded Track Footprint
Blade Laydown Hardstandings	Earthworks Footprint
Blade Laydown Clearing	10m Contours
Borrow Pits	Elevations (mAOD)
Construction Compound	317
Crane Pads	395
Substation	474
Energy Storage	553

WHS SCALE: 1:20,000 (A3)

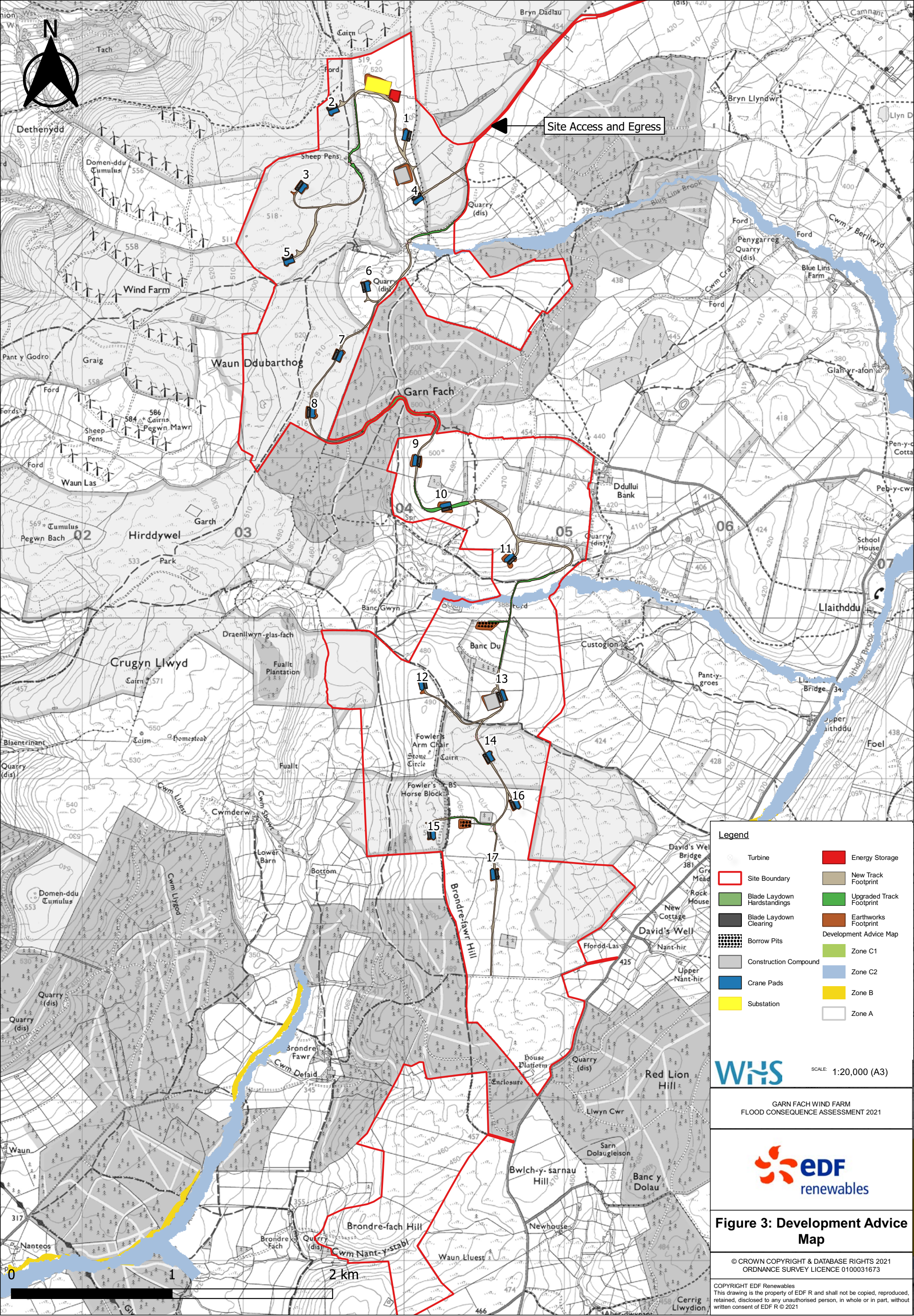
GARN FACH WIND FARM
FLOOD CONSEQUENCE ASSESSMENT 2021



Figure 2: Site Topography

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Legend

	Turbine		Energy Storage
	Site Boundary		New Track Footprint
	Blade Laydown Hardstandings		Upgraded Track Footprint
	Blade Laydown Clearing		Earthworks Footprint
	Borrow Pits	Development Advice Map	
	Construction Compound		Zone C1
	Crane Pads		Zone C2
	Substation		Zone B
			Zone A

WHS SCALE: 1:20,000 (A3)

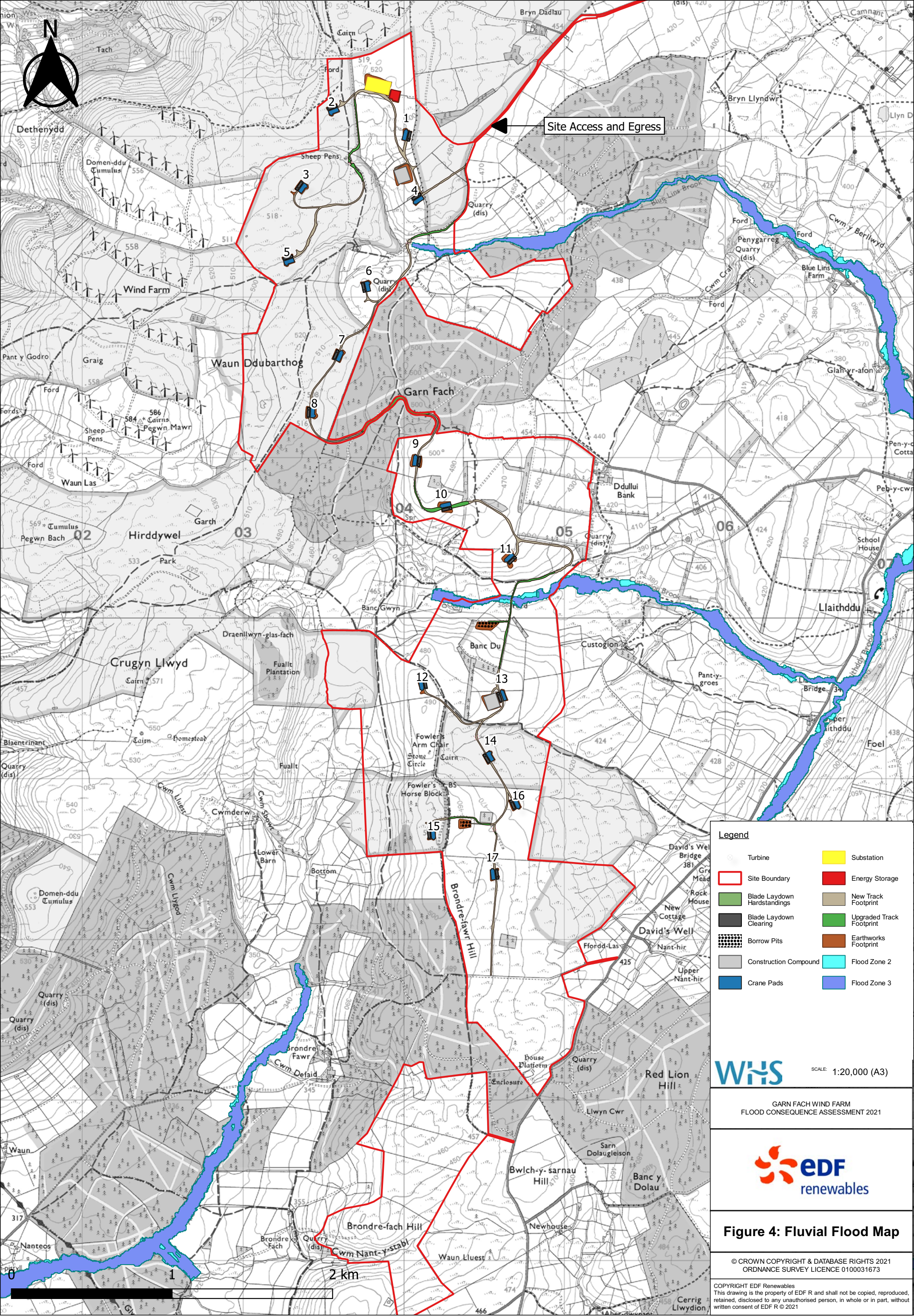
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Figure 3: Development Advice Map

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Legend

- | | | | |
|--|-----------------------------|--|--------------------------|
| | Turbine | | Substation |
| | Site Boundary | | Energy Storage |
| | Blade Laydown Hardstandings | | New Track Footprint |
| | Blade Laydown Clearing | | Upgraded Track Footprint |
| | Borrow Pits | | Earthworks Footprint |
| | Construction Compound | | Flood Zone 2 |
| | Crane Pads | | Flood Zone 3 |

WHS

SCALE: 1:20,000 (A3)

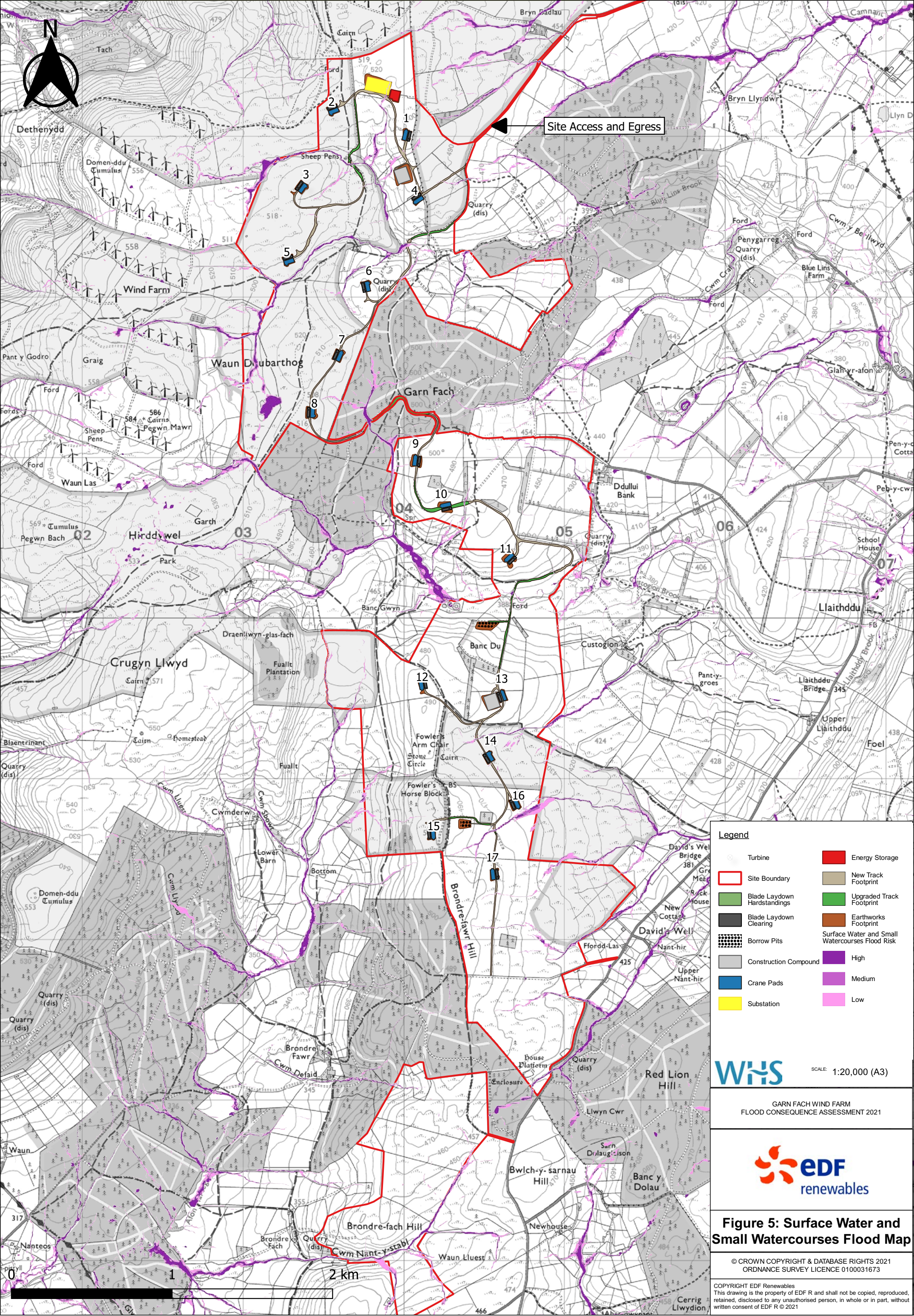
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Figure 4: Fluvial Flood Map

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Legend

	Turbine		Energy Storage
	Site Boundary		New Track Footprint
	Blade Laydown Hardstandings		Upgraded Track Footprint
	Blade Laydown Clearing		Earthworks Footprint
	Borrow Pits		Surface Water and Small Watercourses Flood Risk
	Construction Compound		High
	Crane Pads		Medium
	Substation		Low

WHS SCALE: 1:20,000 (A3)

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Figure 5: Surface Water and Small Watercourses Flood Map

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