

Technical Appendix 8.3: Peat & Slope Stability Risk Assessment

Jennings O'Donovan, ScottishPower Renewables Barnesmore Windfarm Repowering Co. Donegal
Peat & Slope Stability Risk Assessment
MEL Work Item A1 MEL Doc. Ref.: 3006-044 (Slope Stability & Risk Assessment) Rev2
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Attachment

Attachment	Title	Minerex Doc. Ref.
Attachment A	Laboratory Certificates	3006-030.pdf
Attachment B	Risk Matrices	3006-011.xls
Attachment C	Mapped Landslide Susceptibility	3006-008.pdf
Attachment D	Mapped Peat Depths	3006-008.pdf
Attachment E	Gouge Core Logs & Piezo Installations	3006-024.ppt
Attachment F	Conceptual Cross Sections	3006-011.xls
Attachment G	Mapped Surface Water Features	3006-008.pdf
Attachment H	Receptor Significance & Distance	3006-011.xls
Attachment I	Stability Assessment Database	3006-011.xls
Attachment J	Summary of Stability Assessment Results	3006-011.xls

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1. Introduction

Minerex Environmental Limited (MEL) (the Sub- Consultant) has been commissioned by Jennings O'Donovan (JOD) (the Consultant) on behalf of ScottishPower Renewables (SPR) to carry out an Environmental Impact Assessment (EIA) in regard to the Development; Barnesmore Windfarm Repowering. MEL have been commissioned to assess the Site in terms of Soils & Geology (EIAR Chapter 8), and Hydrology & Hydrogeology (EIAR Chapter 9). This report, Slope Stability & Risk Assessment, assesses the existing baseline conditions and potential impact of the Development on same with respect to slope and peat stability, and will supplement the EIA Report as an appendix (Chapter 8: Soils and Geology).

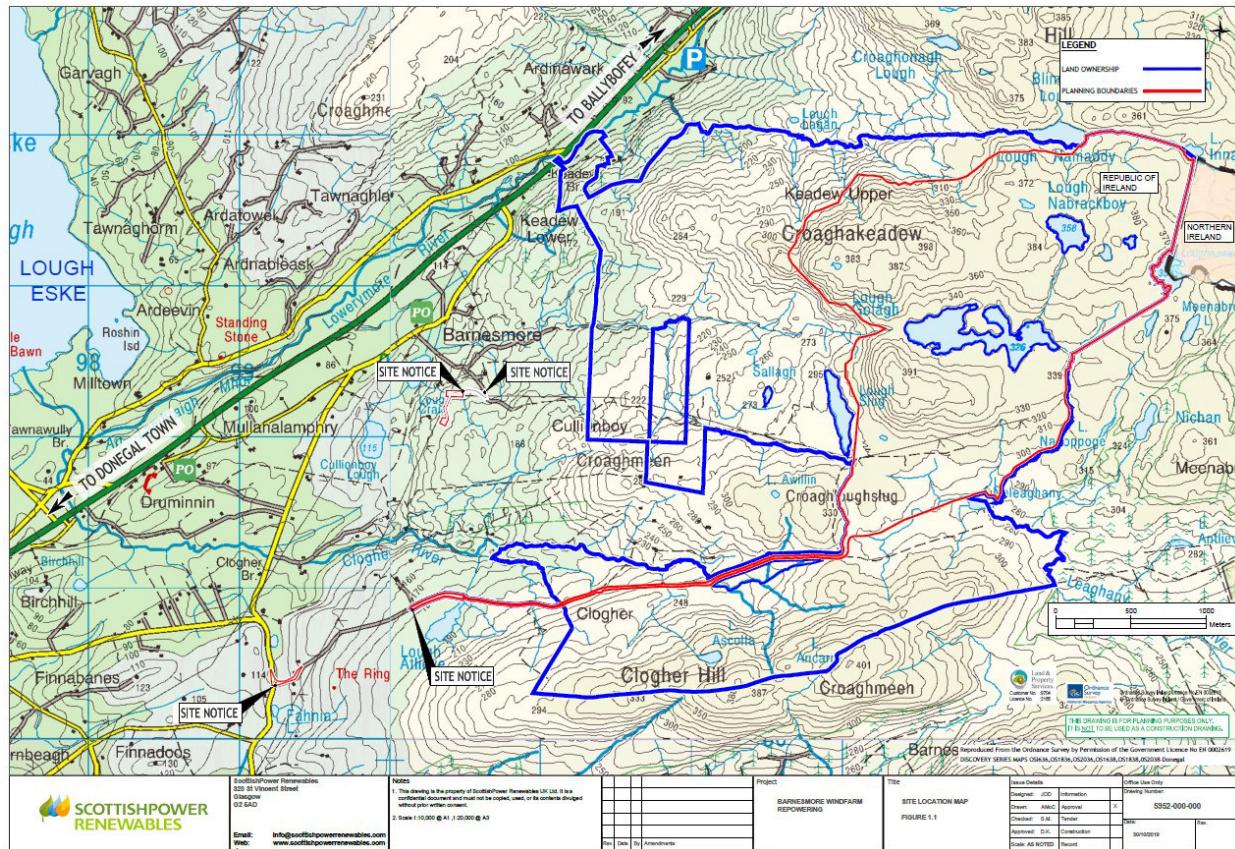


Figure 1.1: Site Location Map

2. Assessment Methodology

The following assessment methodology has been formulated following, inter alia, the following guidance documents;

- a) Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Developments – Prepared for: Energy Consents Unit Scottish Government – Second Edition, April 2017 (Ref. 1).

The assessment architecture is as follows;

- a) Baseline desk study to determine nature of the Site in terms of history of land stability issues.
- b) Consider existing pressures on the receiving environment.
- c) Assess the Site in terms of peat depth at and near proposed infrastructure locations.
- d) Assess the Site in terms of peat quality and condition at and near proposed infrastructure locations.
- e) Assess laboratory data for peat sample obtained on the Site.
- f) Assess proposed infrastructure locations in terms of distance to receptors.
- g) Assess the Site in terms of topography and substrate topology.
- h) Identify an appropriate, and run data through a numerical evaluation system (peat stability).
- i) Derive risk matrices for the purposes of consolidating parameters, including defining parameters and inferred values.
- j) Identify caveats.
- k) Conclusions on slope stability and potential impact of the Development on same.

2.1 Methodology for assessing site conditions

2.1.1 Peat depth probing & topography assessments

Peat depth probing and gouge coring surveys were undertaken at each proposed potential turbine location, and at proposed locations for other infrastructure including an Energy Storage Unit. Depth probing was conducted using a fibreglass depth probe and at each survey point the depth of peat, local incline (incline within a c. 5-10 m radius of the survey point) and grid reference (Irish Grid) were recorded. Notes on observations were also recorded including time of taking photographs, presence of drains etc.

2.1.2 Peat gouge coring & qualitative assessments

Gouge coring surveys were also undertaken at each proposed potential turbine location, that is, obtaining peat core by means of a handheld gouge core for the purpose of observing, logging, qualifying (Von Post Scale) and sampling peat across the entire peat depth profile. At each survey

point the depth of peat, the degree of humification and fibre content (Von Post Scale), the moisture content observed, colour and grid reference (Irish Grid) were recorded. Photos and samples of each 0.5 m core were also taken and samples were sent to an accredited laboratory to analysis (pH and moisture content). Gouge coring survey points were limited to approximately four points per proposed infrastructure location, which is an adequate number of sampling points to determine peat condition on the site. In situ shear strength of the peat was also undertaken at several locations across the proposed site.

2.1.3 Piezometer installation & groundwater assessments

At a limited number of gouge coring sampling locations, a phreatic piezometer was installed and groundwater levels were monitored using a dip meter.

2.1.4 Topography & substrate topology

Using available topographical data provided for the site, and peat thickness / depth data obtained during MEL surveys, the topology (characteristics of a surface) of the substrate underlying the peat on site was assessed and cross sections generated to evaluate variance from the surface topology.

2.1.5 Peat stability numerical assessment

This stability assessment has been undertaken using a relatively simple infinite slope stability approach (Ref. 12) (derived from Bromhead's formula (Ref. 1)), as follows;

$$FoS = \frac{c_u}{yz \sin \alpha \cos \alpha}$$

For the purpose of this assessment, the above formula will be referred to as the *FoS Formula*.

Qualifying peat stability at all peat survey points was done using the following parameters;

Table 1: Formula Parameters & Symbols

Symbol	Description	Unit
FoS	Factor of Safety	FoS
c_u	Effective cohesion or Undrained Shear Strength	kPa
y	Bulk Unit Weight of Peat	kN/m ³
z	Depth to failure plain	m
α	Slope Angle	Degrees

The Factor of Safety (FoS) result will range from 0 to infinity, however the following ranges are prescribed ratings as follows;

Table 2: Factor of Safety (FoS) Classifications (Ref. 1)

Description	FoS Value Range	Classification
Stable	>1.3	Acceptable
Marginally Stable	1.0 > < 1.3	Acceptable
Unstable	<1.0	Unacceptable

As per the guidance listed in Section 2 of this report, FoS values of 1.0 or greater are considered acceptable in terms of peat stability (Ref. 1).

The assessment has been completed on the basis of 2 no. scenarios, which are as follows;

1. Scenario A – Peat stability in terms of the receiving environment as is, that is using the depth of peat observed and recorded during site surveys.
2. Scenario B – Peat stability in terms of the in situ peat with 1m fill (presumed peat) placed on top, that is using the depth of peat observed and recorded during site surveys plus 1 metre fill (depth + 1.0m). This is the assessment worst case scenario and this will be used to assess stability at proposed infrastructure locations.

Undrained shear strength (effective cohesion) (c_u) has been derived by means of assessing moisture content results, that is; there is a correlation between peat moisture content and shear strength (effective cohesion). Shear vane testing has been carried out on the site however, shear vane test, or in situ barrel shear tests are not considered representative of shear strength characteristics of the peat being assessed in terms of stability assessment given numerous flaws with the test itself, namely; the shear vane test evaluates the shear strength where by the force is exerted in a vertical and cylindrical plane, which is not indicative of forces at play with respect slope stability or mass movement; and fibres and roots within the peat will effect the test itself, potentially exaggerating, or giving misleading data. The following graph presents conceptual shear strength values for peat (Ref. 2).

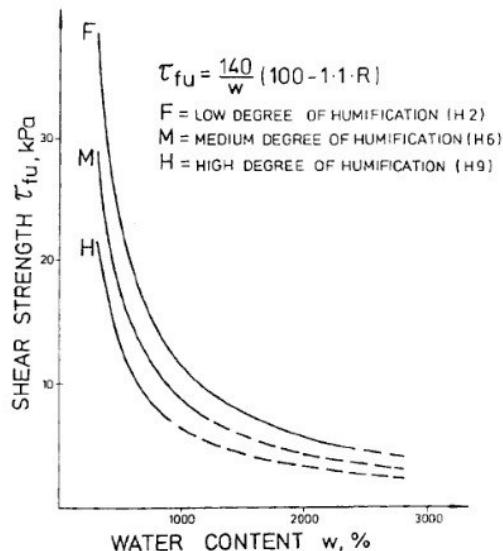


Figure 2: Correlation Between Moisture Content and Shear Strength of Peat (Ref. 2)

The following table presents the minimum, average and maximum moisture content which been used to determine an indicative shear strength values for the Site. Laboratory certificates are presented in **Attachment A**.

Table 3: Peat Moisture Content Range & Indicative Shear Strength

Category	Moisture Content (%)	Indicative Shear Strength (kPa)
Minimum	200	>20
Median	760	10-20

Average	781	10-20
Maximum	1515	<10

For the purpose of assessing peat stability for the Site a conservative undrained shear strength (effective cohesion) value will be used in numerical assessments; i.e. 3.5 kPa.

In situ bulk density (kg/m^3), or bulk unit weight (kN/m^3) of peat (y) is typically within the range of 900-1100 kg/m^3 (Ref. 3), or 8.8-10.8 kN/m^3 . For the purpose of assessing peat stability for the Site a conservative bulk unit weight value will be used in numerical assessments i.e. 11 kN/m^3 .

The depth to failure plane (z) is presumed to be thickness or depth of peat at any given sampling point being assessed, however it should be noted that the failure plane can potentially be within peat (peat on peat movement), or the substrate i.e. weathered rock or underlying soils.

Slope angle (α) is presumed to be topographical incline measured on site at any given sampling point being assessed, however it should be noted that the slope angle (α) relates to the failure plane angle, which is presumed to be the peat and substrate interface, and which is presumed to be parallel to the surface when using FoS Formula (Infinite Slope Formula). In reality the underlying substrate is unlikely to be parallel to the surface topology.

It should be noted that FoS Formula does not account for forces related to the toe and head of an area or mass of soil with the potential for mass movement, that is; in reality the Infinite Slope formula will likely exaggerate stability conditions negatively.

The following table lists parameter values, including inferred conservative parameter values used in numerical assessments.

Table 4: Formula Parameters, Symbols & Inferred Conservative Values

Symbol	Description	Value	Unit
C_u	Effective cohesion	3.5	kPa
y	Bulk Unit Weight of Peat	11	kN/m^3
z	Depth to failure plain	Depth of Peat	m
α	Slope Angle	Surface Topography	Degrees

2.1.6 Risk Matrices & Ranking

In assessing the risk in relation to stability on site it is important to rate the risk in terms of the hazard, the likelihood and the consequences if any such issue should arise. Therefore, the slope stability risk assessment considers the following parameters, which are assessed by means of a series of risk matrices (Ref. 1).

Table 5: Parameters Included In Risk Matrices and Assessed

Category	Description
Landslide History	Considers the likelihood of landslide events occurring based on the history of the site, including the current site use.
Factor of Safety	As described above, includes the following; <ul style="list-style-type: none"> • Peat depth • Peat quality / condition • Moisture content • Incline (surface topography) • Shear strength • Bulk unit weight of peat

Substrate Topology	Identifying and qualifying variance in substrate topology and qualifying variance from theory underlining the stability formula used i.e. Infinite Slope (Parallel and no foot and head forces)
Significance of Receptor	Qualifying potential receptors in terms of significance.
Distance to Receptor	Qualifying localised proposed development areas in terms of distance to nearest receptor.

Considering the above parameters, the stability assessment follows the following steps;

1. FoS_{RAW} - Assess the site in terms of soil stability using the FoS Formula and calculate a Factor of Safety (FoS) using the raw data. This step is considered as preparation of the data obtained for the site i.e. translating the data to a value related to stability, and is not considered the final output of the stability assessment.
2. FoS_{ADJUSTED} - Assess the FoS_{RAW} values in terms of suitability of the application of FoS Formula by considering the history of landslides in relation to the proposed site, and the topology of the substrate compared to the surface topology of the site. This is done by means of a risk matrix which qualifies the point, and also applies a coefficient for the next risk assessment step.
3. Risk Ranking RR_{SF} - The FoS_{ADJUSTED} data is assessed in terms of significance of associated receptor. This is done by means of a risk matrix which qualifies the point, and also applies a coefficient for the next risk assessment step.
4. Risk Ranking RR_D – The RR_{SF} data is assessed in terms of distance to associated receptor. This is done by means of a risk matrix which qualifies the point.

Results and conclusions made by means of the above risk assessment are viewed as two tiered, that is;

1. The likelihood of a stability issue or landslide while considering the significance of the receptor (RR_{SF}).
2. The consequence of a stability issue or landslide while considering the distance to the receptor (RR_D).

For example; (1) The risk of a stability issues or landslide occurring at location X and impacting on receptor Y is negligible. (2) Considering the short distance from location X to receptor Y, in the unlikely event that an issue did arise the risk of adverse impacts effecting receptor Y is moderate.

Risk Matrices are presented in **Attachment B**.

3. Baseline Conditions

3.1 Site Description & History

There are no recorded landslide events within or directly adjacent to the Site (Ref. 4).

There were no indication of stability issues or mass movement observed on the Site during site surveys. There are indications of soil creep.

The Site is mapped as having areas ranging from Low Risk (LR), Moderately Low Risk (MLR), Moderately High Risk (MHR), and High Risk (HR) in terms of Landslide Stability, that is full spectrum of slope stability risk categories (GSI, ND). The infrastructure associated with the existing Barnesmore Windfarm is within areas mapped as being LR, MLR and MLR, no existing infrastructure is within HR areas (Ref. 4). Mapped Landslide Susceptibility (GSI) is presented in **Attachment C**.

Refer to EIAR baseline section for further information (**Chapter 8: Soils and Geology**).

3.2 Site Geology

Consultation with Geological Survey Ireland Spatial Resources (Ref. 4) indicates that the bedrock at 1:1,000,000 scale the Site is underlain by Neoproterzoic Metasedimentary rocks – Dalradian, and at 1:100,000 scale the Site is underlain by the Lough Mourne Formation, described succinctly as; Quartz and feldspar pebbles, green matrix, which occurs chiefly in the western limb of the major Ballybofey Nappe fold structure.

The region contains a multitude of complex geological features however, there are no mapped faults or other significant features underlying the area of the Site.

Rocky outcrops are common within the Site Boundary.

Refer to EIAR baseline section for further information (**Chapter 8: Soils and Geology**).

3.3 Site Soils & Subsoils

Consultation with available maps (Ref. 4) indicate that the soil type across the entire area of the Site, and the general area in the region is Blanket Peat (GSI/Teagasc ref. = BktPt), with several significant areas mapped as being Bedrock at Surface (Rck).

Peat depths observed on the Site range from 0.0m (Rock at surface) to >5.0 m (Extremely deep peat), however depths at most sampling points are within the range of 0.0-2.0 m and areas with deeper, particularly extremely deep peat have been avoided in terms of the Development footprint. Peat depths are mapped and presented in **Attachment D**.

Peat quality assessment (by gouge coring) indicate high Von Post values (generally H7 to H8) across the Site. Gouge core graphical logs have been prepared and are presented in **Attachment E**.

Refer to EIAR baseline section for further information (**Chapter 8: Soils and Geology**).

3.4 Topography & Substrate Topology

The topography at and in the immediate area surrounding the Site is highly variable with multiple peaks, ridges with variable elevations and inclines. At lower elevations the topography is relatively

flat or comprising of low magnitude inclines, however at mid and high elevation relative to the Site, steep high magnitude inclines are common place.

Surface topology has been compared to substrate topology, conceptual cross sections are presented in **Attachment F**. Locations of cross sections are mapped and presented in **Attachment D**.

Conceptual cross sections indicate that the substrate topology varies significantly to surface topology. Highest rates of variance are associated with areas which include deeper peat, that is; areas of deeper peat are contained within “pockets” delineated by areas or ridges of shallow bedrock. Areas with generally shallower peat have less variance from the substrate however such areas are indicatively low risk in terms of stability given the peat is shallow.

3.5 Hydrology & Climate

The Site is associated with two catchments; Donegal Bay North catchment (EPA ID = 37, Area = 805.36km²) and Foyle catchment (EPA ID = 01, Area = 1105.66km²). A detailed flow chart describing; sub-catchments, river sub-basins, and the surface water features contained in each catchment is presented in **Chapter 9: Hydrology and Hydrogeology – Technical Appendix 9.4** (Ref. 5, Ref. 6). The chart also indicates which turbines are associated with each surface water system, note: a small number of proposed turbine locations are on or close to surface water catchment boundaries, and are therefore accounted for more than once. The surface water features associated with the Site are mapped and presented in **Attachment G**.

Maximum effective rainfall data (Ardnawarak Barnesmore) indicates that the Site could potentially receive approximately 206 mm/month of effective rain fall during the wettest months, or approximately an average of 13 mm of effective rainfall per day during the wettest months. However, 100 year return periods, or 1 in100 year storm event data indicates that the site could potentially receive up to or more than 150 mm of rainfall in a day, and potentially 40 mm of rainfall in hour during extreme weather events (Ref. 7).

In 2018 Ireland experienced a significant drought, with absolute drought conditions recorded at twenty one stations at various times between the 22nd May and 14th July. The Site generally experienced drier than average conditions between March and July 2018, with wetter than average conditions in the following months, August and September 2018. This can be viewed as a natural “stress test” for slope stability given that such conditions are indicative triggering mechanisms for peat failure and landslides (Ref. 8, Ref. 9, Ref. 10, Ref. 11).

Refer to EIAR baseline section for further information (**Chapter 9: Hydrology and Hydrogeology**).

3.6 Receptors

Receptors associated with the Development are limited to non-critical infrastructure and water bodies. There are no communities, dwellings, or other similar facilities at risk in terms of slope stability at the Site. Receptors associated with the proposed development, that is; streams, rivers, lakes and groundwater, are considered highly sensitive receptors considering;

- High or good WFD status and objective to protect same.
- Moderate WFD status and objective to restore same to at least good status by 2021.
- The numerous downgradient designations (sensitive protected areas) associated with each of the two associated catchments and the sensitive habitats and species associated with same.
- Designation of some downgradient surface water bodies and all groundwater bodies as sources of drinking water.

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Ultimately, all surface water and groundwater associated with the Site is considered sensitive and must be protected as per numerous legislative instruments relating to same. However, risk to receptors must consider both the hazard, and likelihood of adversely impacting on any given sensitive receptor, and therefore parameters such as; distance from potential source of hazard to receptor, pathway directness and/or connectivity, and assimilative capacity of the receiving water body should also be considered.

Distance of proposed turbine and hard stand areas have been assessed in terms of distance to associates receptors (surface water features), the results for which are presented in **Attachment H**.

Refer to EIAR baseline section for further information (**Chapter 9: Hydrology and Hydrogeology**).

4. Results

The following results are related to Scenario B, that is; peat depth + 1m fill (assessment worst case scenario)

4.1 Factor of Safety Adjusted (FoS_{ADJUSTED}).

There are no recorded landslide events within or in the vicinity of the area Development. The Site experienced extreme weather conditions in 2018 and despite this there were no indications of stability issues observed on the Site during site surveys in 2019. The Site includes the Operational Barnesmore Windfarm and associated infrastructure, and despite it's installation c. 1997 there are no indications of stability issues as a product of the existing windfarm. Considering the above points, within the risk matrix *Accounting for Landslide History and Substrate Topology with a view to adjusting calculated FoS*, the Landslide History Coefficient (μ_{His}) prescribed for the Site is 1 for all sampling points.

As presented in Conceptual Cross Sections (**Attachment F**) there is significant variance between surface topology and substrate topology, therefore the Substrate Topology Characteristics (μ_{Topo}) for the site is 1 for all sampling points.

The resulting FoS Adjustment Coefficient prescribed is 1, that is; $\text{FoS}_{\text{RAW}} + 0.5 = \text{FoS}_{\text{ADJUSTED}}$.

4.2 Risk Ranking Considering Significance of Receptor (RR_{SF})

Each proposed infrastructure unit has been assessed in terms of significance of associated receptor. The Site is remote with no dwellings, populations etc in the vicinity, therefore the most sensitive receptor associated to each infrastructure unit is the closest surface water system, and therefore within *Ranking Risk re Potential for Adverse Consequences on Sensitive Receptors* the Significant Feature Coefficient (μ_{SF}) prescribed to each location is 2, which is assessed against the FoS_{ADJUSTED} value for each sampling point.

Results for the prescription of Significant Feature Coefficient (μ_{SF}) are presented in **Attachment H**.

Results for RR_{SF} are presented in **Attachment I**.

4.3 Risk Ranking Considering Distance to Receptor (RR_D)

Each proposed infrastructure unit has been assessed in terms of distance to associated receptor and prescribed a Distance to Significant Feature Coefficient ($\mu_{\text{Dist.}}$). Thereafter, within *Accounting for distance to Sensitive Receptors* risk matrix, $\mu_{\text{Dist.}}$ is assessed against the RR_{SF} Coefficient (μ_{RRSF}) value for each sampling point.

Results for the prescription of Distance to Significant Feature Coefficient (μ_{D}) are presented in **Attachment H**.

Results for RR_D are presented in **Attachment I**.

4.4 Results Summary

A summary table detailing results has been drafted and is presented in **Attachment J**.

5. Conclusions

The following table further distills and clarifies results as presented in **Attachments I** and **Attachment J**.

Table 6: Stability Risk Assessment Conclusions

Stability Risk Assessment Conclusion Table			
Turbine No. / Unit	RR _{SF} Ranked Risk Considering Sensitive Receptor	RR _D Ranked Risk Considering Distance to Sensitive Receptor	
1	The risk of stability issues arising at this location is NEGLIGIBLE (with a degree of LOW risk)	The risk of significant impact on receptor in the UNLIKELY event of stability issues at this location is NEGLIGIBLE (with a degree of LOW risk)	
2	The risk of stability issues arising at this location is NEGLIGIBLE (with a degree of LOW risk)	The risk of significant impact on receptor in the UNLIKELY event of stability issues at this location is LOW (with a degree of MODERATE risk)	
3	The risk of stability issues arising at this location is NEGLIGIBLE	The risk of significant impact on receptor in the UNLIKELY event of stability issues at this location is MODERATE	
4	The risk of stability issues arising at this location is NEGLIGIBLE	The risk of significant impact on receptor in the UNLIKELY event of stability issues at this location is LOW	
5	The risk of stability issues arising at this location is NEGLIGIBLE (with a degree of LOW risk)	The risk of significant impact on receptor in the UNLIKELY event of stability issues at this location is NEGLIGIBLE (with a degree of LOW risk)	
6	The risk of stability issues arising at this location is NEGLIGIBLE (with a degree of LOW risk)	The risk of significant impact on receptor in the UNLIKELY event of stability issues at this location is NEGLIGIBLE (with a degree of LOW risk)	
7	The risk of stability issues arising at this location is NEGLIGIBLE (with a degree of LOW risk)	The risk of significant impact on receptor in the UNLIKELY event of stability issues at this location is NEGLIGIBLE (with a degree of LOW risk)	
8	The risk of stability issues arising at this location is NEGLIGIBLE	The risk of significant impact on receptor in the UNLIKELY event of stability issues at this location is NEGLIGIBLE	
9	The risk of stability issues arising at this location is NEGLIGIBLE (with a degree of LOW risk)	The risk of significant impact on receptor in the UNLIKELY event of stability issues at this location is NEGLIGIBLE (with a degree of LOW risk)	
10	The risk of stability issues arising at this location is NEGLIGIBLE	The risk of significant impact on receptor in the UNLIKELY event of stability issues at this location is NEGLIGIBLE	
11	The risk of stability issues arising at this location is NEGLIGIBLE (with a degree of LOW risk)	The risk of significant impact on receptor in the UNLIKELY event of stability issues at this location is NEGLIGIBLE (with a degree of LOW risk)	
12	The risk of stability issues arising at this location is NEGLIGIBLE	The risk of significant impact on receptor in the UNLIKELY event of stability issues at this location is LOW	
13	The risk of stability issues arising at this location is NEGLIGIBLE	The risk of significant impact on receptor in the UNLIKELY event of stability issues at this location is MODERATE	
Met Mast	The risk of stability issues arising at this location is NEGLIGIBLE (with a degree of LOW risk)	The risk of significant impact on receptor in the UNLIKELY event of stability issues at this location is NEGLIGIBLE (with a degree of LOW risk)	
Battery Unit	The risk of stability issues arising at this location is NEGLIGIBLE	The risk of significant impact on receptor in the UNLIKELY event of stability issues at this location is LOW	

To conclude;

- The risk of stability issues arising at all proposed infrastructure unit location is **NEGLIGIBLE**.
- The risk of significant impact on associated receptors in the **UNLIKELY** event of stability issues arising ranges from **NEGLIGIBLE** to **MODERATE**.

6. Caveats & Recommendations

The risk of landslides occurring on the proposed site under worst case scenario conditions (plus 1m fill) has been determined to be low (negligible) however, the following points should be noted;

1. The low risk classification is largely driven by shallow peat depths at proposed infrastructure locations, and by the undulating nature of the substrate topology, however the peat condition i.e. highly humified peat (high Von Post values) and the evidence of soil creep on the site suggest that soil stability at a highly localized scale may give rise to some difficulty e.g. collapse of side walls in excavations, and subsidence over time under newly installed floating hardstands (on peat), etc. Such potential issues give rise to the need for vigilance during and after the construction phase of the proposed development and it is recommended that all works are supervised by a competent person (Geotechnical Engineer) and that the site is monitored at a reasonable frequency during the operational phase of the proposed development.
2. The purpose of this report is to assess the proposed infrastructure units associated with the proposed development; Barnesmore Windfarm Repower. The proposed site contains an existing windfarm and associated infrastructure; the existing Barnesmore Windfarm. The proposed development will utilize the existing trackways, therefore the assessment reported here is limited to the proposed locations of new infrastructure units. The proposed site is mapped as having areas classified as high risk in terms of landslide susceptibility however, although stability would likely be an issue in these areas, the footprint of the existing and proposed development does not include these high risk areas.

7. References

No.	Description
1.	Scottish Government (2017) <i>Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Developments</i>
2.	N. Boylan, P. Jennings & M. Long (2008) <i>Peat slope failure in Ireland</i> . Quarterly Journal of Engineering Geology and Hydrogeology. Available at https://www.researchgate.net/publication/245379146 Peat slope failure in Ireland Accessed: 20/08/19
3.	R. Munro (2004) <i>Dealing with bearing capacity problems on low volume roads constructed on peat</i> . Roadex, Northern Periphery.
4.	GSI Map Viewer. Available at: http://dcenr.maps.arcgis.com/apps/MapSeries/index.html?appid=a30af518e87a4c0ab2fbde2aaac3c228 Accessed: 20/08/19
5.	EPA Map Viewer. Available at: https://gis.epa.ie/EPAMaps/ Accessed: 20/08/19
6.	EANI River Basin Viewer. Available at https://appsd.daera-ni.gov.uk/RiverBasinViewer/ . Accessed: 20/08/19
7.	D. L. Fitzgerald (2007) <i>Estimation of point rainfall frequencies</i> . Irish Meteorological Service Technical Note 61
8.	R. A. Lindsay (2005) <i>Wind Farms and Blanket Peat - The Bog Slide of 16th October 2003 at Derrybrien, Co. Galway, Ireland</i> . University of East London and The Derrybrien Development Cooperative Ltd.
9.	Farrell, E.R., Long, M., Gavin, K. Henry, T.; (2006) 'Chapter 4: Geotechnics of Landslides' In: Creighton, R (eds). <i>Landslides in Ireland</i> . Dublin: Geological Survey of Ireland. , pp.23-31
10.	Met Eireann (MET) (2018) <i>2018, A summer of Heat Waves and Droughts</i>
11.	Met Eireann (MET) (2018) <i>Available Data</i> . Available: https://www.met.ie Accessed: 06/08/19
12.	Boylan, N. and Long, M. (2012) <i>Evaluation of peat strength for stability assessments</i> . Geotechnical Engineering Volume 167 Issue GE5, Institution of Civil Engineers (ICE)

REPORT TO

Jennings O'Donovan & ScottishPower Renewables.
Re. Barnesmore WF Repower
Peat & Slope Stability Risk Assessment

REPORT BY

Minerex Environmental Limited
Doc Ref 3006-044 (Slope Stability & Risk Assessment) Rev2

Attachment A

Minerex Environmental Ltd
Taney Hall
Eglinton Terrace
Dundrum
Dublin 14
Ireland



Attention : Jen Caleno
Date : 15th July, 2019
Your reference : 3006-028 (COC3)
Our reference : Test Report 19/11021 Batch 1
Location : Barnesmore WF RP, Co. Donegal
Date samples received : 8th July, 2019
Status : Final report
Issue : 1

Fifty three samples were received for analysis on 8th July, 2019 of which fifty three were scheduled for analysis. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.

All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

Compiled By:

Phil Sommerton BSc
Senior Project Manager

Please include all sections of this report if it is reproduced

Element Materials Technology

Client Name: Minerex Environmental Ltd
Reference: 3006-028 (COC3)
Location: Barnesmore WF RP, Co. Donegal
Contact: Jen Caleno
EMT Job No: 19/11021

Report : Solid

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

Please include all sections of this report if it is reproduced.

QF-PM 3.1.2 v11

Please include all sections of this report if it is reproduced
All solid results are expressed on a dry weight basis unless stated otherwise.

2 of 11

Element Materials Technology

Client Name: Minerex Environmental Ltd
Reference: 3006-028 (COC3)
Location: Barnesmore WF RP, Co. Donegal
Contact: Jen Caleno
EMT Job No: 19/11021

Report : Solid

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

Please include all sections of this report if it is reproduced.

QF-PM 3.1.2 v11

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3 of 11

Element Materials Technology

Client Name: Minerex Environmental Ltd
Reference: 3006-028 (COC3)
Location: Barnesmore WF RP, Co. Donegal
Contact: Jen Caleno
EMT Job No: 19/11021

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Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

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QF-PM 3.1.2 v11

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Element Materials Technology

Client Name: Minerex Environmental Ltd
Reference: 3006-028 (COC3)
Location: Barnesmore WF RP, Co. Donegal
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QF-PM 3.1.2 v11

Please include all sections of this report if it is reproduced
All solid results are expressed on a dry weight basis unless stated otherwise.

5 of 11

Element Materials Technology

Client Name: Minerex Environmental Ltd
Reference: 3006-028 (COC3)
Location: Barnesmore WF RP, Co. Donegal
Contact: Jen Caleno
EMT Job No: 19/11021

Report : Solid

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

EMT Sample No.	41	42	43	44	45	46	47	48	49	50			
Sample ID	3006-GC153-SS2-COC3	3006-GC163-SS1-COC3	3006-GC164-SS1-COC3	3006-GC164-SS2-COC3	3006-GC164-SS3-COC3	3006-GC164-SS4-COC3	3006-GC167-SS1-COC3	3006-GC167-SS2-COC3	3006-GC167-SS3-COC3	3006-GC137-SS1-COC3	Please see attached notes for all abbreviations and acronyms		
Depth	0.50-0.90	0.00-0.65	0.00-0.50	0.50-1.00	1.00-1.50	1.50-2.10	0.00-0.50	0.50-1.00	1.00-1.30	0.00-0.50			
COC No / misc													
Containers	T	T	T	T	T	T	T	T	T	T			
Sample Date	04/07/2019	04/07/2019	04/07/2019	04/07/2019	04/07/2019	04/07/2019	04/07/2019	04/07/2019	04/07/2019	04/07/2019			
Sample Type	Soil												
Batch Number	1	1	1	1	1	1	1	1	1	1			
Date of Receipt	08/07/2019	08/07/2019	08/07/2019	08/07/2019	08/07/2019	08/07/2019	08/07/2019	08/07/2019	08/07/2019	08/07/2019			
Natural Moisture Content	200.0	345.8	685.2	715.4	471.1	664.3	411.6	505.9	568.8	525.7	<0.1	%	PM4/PM0
pH#	4.45	4.16	4.71	4.63	5.38	5.45	5.10	4.54	5.27	4.37	<0.01	pH units	TM73/PM11

Please include all sections of this report if it is reproduced.

QF-PM 3.1.2 v11

Please include all sections of this report if it is reproduced
All solid results are expressed on a dry weight basis unless stated otherwise.

Element Materials Technology

Client Name: Minerex Environmental Ltd
Reference: 3006-028 (COC3)
Location: Barnesmore WF RP, Co. Donegal
Contact: Jen Caleno
EMT Job No: 19/11021

Report : Solid

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

EMT Sample No.	51	52	53									
Sample ID	3006-GC137-SS2-COC3	3006-GC137-SS3-COC3	3006-GC137-SS4-COC3									
Depth	0.50-1.00	1.00-1.50	1.50-2.00									
COC No / misc												
Containers	T	T	T									
Sample Date	04/07/2019	04/07/2019	04/07/2019									
Sample Type	Soil	Soil	Soil									
Batch Number	1	1	1									
Date of Receipt	08/07/2019	08/07/2019	08/07/2019									
											LOD/LOR	Units
												Method No.
Natural Moisture Content	1515.4	1250.0	850.0								<0.1	%
pH #	4.42	4.53	4.52								<0.01	pH units
												TM73/PM11

Please see attached notes for all abbreviations and acronyms

Element Materials Technology

Notification of Deviating Samples

Client Name: Minerex Environmental Ltd
Reference: 3006-028 (COC3)
Location: Barnesmore WF RP, Co. Donegal
Contact: Jen Caleno

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Analysis	Reason
No deviating sample report results for job 19/11021						

Please note that only samples that are deviating are mentioned in this report. If no samples are listed it is because none were deviating.

Only analyses which are accredited are recorded as deviating if set criteria are not met.

NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

EMT Job No.:

19/11021

SOILS

Please note we are only MCERTS accredited (UK soils only) for sand, loam and clay and any other matrix is outside our scope of accreditation.

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation has been performed on clay, sand and loam, only samples that are predominantly these matrices, or combinations of them will be within our MCERTS scope. If samples are not one of a combination of the above matrices they will not be marked as MCERTS accredited.

It is assumed that you have taken representative samples on site and require analysis on a representative subsample. Stones will generally be included unless we are requested to remove them.

All samples will be discarded one month after the date of reporting, unless we are instructed to the contrary.

If you have not already done so, please send us a purchase order if this is required by your company.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

All analysis is reported on a dry weight basis unless stated otherwise. Limits of detection for analyses carried out on as received samples are not moisture content corrected. Results are not surrogate corrected. Samples are dried at $35^{\circ}\text{C} \pm 5^{\circ}\text{C}$ unless otherwise stated. Moisture content for CEN Leachate tests are dried at $105^{\circ}\text{C} \pm 5^{\circ}\text{C}$.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

Where a CEN 10:1 ZERO Headspace VOC test has been carried out, a 10:1 ratio of water to wet (as received) soil has been used.

% Asbestos in Asbestos Containing Materials (ACMs) is determined by reference to HSG 264 The Survey Guide - Appendix 2 : ACMs in buildings listed in order of ease of fibre release.

Sufficient amount of sample must be received to carry out the testing specified. Where an insufficient amount of sample has been received the testing may not meet the requirements of our accredited methods, as such accreditation may be removed.

Negative Neutralization Potential (NP) values are obtained when the volume of NaOH (0.1N) titrated (pH 8.3) is greater than the volume of HCl (1N) to reduce the pH of the sample to 2.0 - 2.5. Any negative NP values are corrected to 0.

The calculation of Pyrite content assumes that all oxidisable sulphides present in the sample are pyrite. This may not be the case. The calculation may be an overestimate when other sulphides such as Barite (Barium Sulphate) are present.

WATERS

Please note we are not a UK Drinking Water Inspectorate (DWI) Approved Laboratory .

ISO17025 accreditation applies to surface water and groundwater and usually one other matrix which is analysis specific, any other liquids are outside our scope of accreditation.

As surface waters require different sample preparation to groundwaters the laboratory must be informed of the water type when submitting samples.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

DEVIATING SAMPLES

All samples should be submitted to the laboratory in suitable containers with sufficient ice packs to sustain an appropriate temperature for the requested analysis. The temperature of sample receipt is recorded on the confirmation schedules in order that the client can make an informed decision as to whether testing should still be undertaken.

SURROGATES

Surrogate compounds are added during the preparation process to monitor recovery of analytes. However low recovery in soils is often due to peat, clay or other organic rich matrices. For waters this can be due to oxidants, surfactants, organic rich sediments or remediation fluids. Acceptable limits for most organic methods are 70 - 130% and for VOCs are 50 - 150%. When surrogate recoveries are outside the performance criteria but the associated AQC passes this is assumed to be due to matrix effect. Results are not surrogate corrected.

DILUTIONS

A dilution suffix indicates a dilution has been performed and the reported result takes this into account. No further calculation is required.

BLANKS

Where analytes have been found in the blank, the sample will be treated in accordance with our laboratory procedure for dealing with contaminated blanks.

NOTE

Data is only reported if the laboratory is confident that the data is a true reflection of the samples analysed. Data is only reported as accredited when all the requirements of our Quality System have been met. In certain circumstances where all the requirements of the Quality System have not been met, for instance if the associated AQC has failed, the reason is fully investigated and documented. The sample data is then evaluated alongside the other quality control checks performed during analysis to determine its suitability. Following this evaluation, provided the sample results have not been effected, the data is reported but accreditation is removed. It is a UKAS requirement for data not reported as accredited to be considered indicative only, but this does not mean the data is not valid.

Where possible, and if requested, samples will be re-extracted and a revised report issued with accredited results. Please do not hesitate to contact the laboratory if further details are required of the circumstances which have led to the removal of accreditation.

Please include all sections of this report if it is reproduced

All solid results are expressed on a dry weight basis unless stated otherwise.

REPORTS FROM THE SOUTH AFRICA LABORATORY

Any method number not prefixed with SA has been undertaken in our UK laboratory unless reported as subcontracted.

Measurement Uncertainty

Measurement uncertainty defines the range of values that could reasonably be attributed to the measured quantity. This range of values has not been included within the reported results. Uncertainty expressed as a percentage can be provided upon request.

ABBREVIATIONS and ACRONYMS USED

#	ISO17025 (UKAS Ref No. 4225) accredited - UK.
SA	ISO17025 (SANAS Ref No.T0729) accredited - South Africa
B	Indicates analyte found in associated method blank.
DR	Dilution required.
M	MCERTS accredited.
NA	Not applicable
NAD	No Asbestos Detected.
ND	None Detected (usually refers to VOC and/SVOC TICs).
NDP	No Determination Possible
SS	Calibrated against a single substance
SV	Surrogate recovery outside performance criteria. This may be due to a matrix effect.
W	Results expressed on as received basis.
+	AQC failure, accreditation has been removed from this result, if appropriate, see 'Note' on previous page.
++	Result outside calibration range, results should be considered as indicative only and are not accredited.
*	Analysis subcontracted to an Element Materials Technology approved laboratory.
AD	Samples are dried at 35°C ±5°C
CO	Suspected carry over
LOD/LOR	Limit of Detection (Limit of Reporting) in line with ISO 17025 and MCERTS
ME	Matrix Effect
NFD	No Fibres Detected
BS	AQC Sample
LB	Blank Sample
N	Client Sample
TB	Trip Blank Sample
OC	Outside Calibration Range

EMT Job No: 19/11021

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/S ANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35°C or 105°C. Calculation based on ISO 11465 and BS1377.	PM0	No preparation is required.			AR	
TM73	Modified US EPA methods 150.1 and 9045D and BS1377:1990. Determination of pH by Metrohm automated probe analyser.	PM11	Extraction of as received solid samples using one part solid to 2.5 parts deionised water.	Yes		AR	No

REPORT TO

Jennings O'Donovan & ScottishPower Renewables.
Re. Barnesmore WF Repower
Peat & Slope Stability Risk Assessment

REPORT BY

Minerex Environmental Limited
Doc Ref 3006-044 (Slope Stability & Risk Assessment) Rev2

Attachment B

Stability Risk Matrices and Ratings.



Landslide History (μ_{His})			
Accounting for Landslide History and Substrate Topology with a view to adjusting calculated FoS (FoS Adjustment = $\mu_{Topo} * \mu_{His}$)	No History of Landslides in the vicinity of site.	Some instances of landslides in the vicinity of site	Recorded landslides occerences within the site
Substrate Topology Characteristics (μ_{Topo})	μ	1 2	4
Substrate is parallel to surface topology.	4	FoS + 0	FoS - 0.25
Substrate varies from surface topology to a minor extent.	2	FoS + 0.25	FoS + 0
Substrate varies from surface topology to a significant extent.	1	FoS + 0.5	FoS + 0.25
FoS Adjustment Coefficient (μ)			
	4	8	16
	2	4	8
	1	2	4
FoS re Slope Stability (μ_{FoS})			
Ranking Risk re Potential for Adverse Consequences on Sensitive Receptors ($RR_{SF} = \mu_{FoS} * \mu_{SF}$)	Acceptable (FoS = >1.3)	Marginally Stable (Acceptable) (FoS = 1-1.3)	Unstable (FoS = <1)
Significant Feature (μ_{SF})	μ	1 2	4
Non-critical infrastructure.	1	Neg.	Neg.
Sensitive receptors e.g. surface water feature	2	Neg.	Low
Community, dwellings and buildings.	4	Low	Mod.
RR_{SF} Coefficient (μ)			
	1	2	4
	2	4	8
	4	8	16
Distance to Sig. Feature ($\mu_{Dist.}$)			
Accounting for distance to Sensitive Receptors ($RR_D = \mu_{RRSF} * \mu_{Dist.}$)	>150m	50-150m	<50m
Risk Ranking re Significant Feature (μ_{RRSF})	μ	1 2	4
Neg. ($RR_{SF} = 1-2$)	1	Neg.	Low
Low ($RR_{SF} = 4$)	2	Low	Mod.
Mod. ($RR_{SF} = 8$)	4	Mod.	High
High ($RR_{SF} = 16$)	8	High	High
RR_D Coefficient (μ)			
	1	2	4
	2	4	8
	4	8	16
	8	16	32

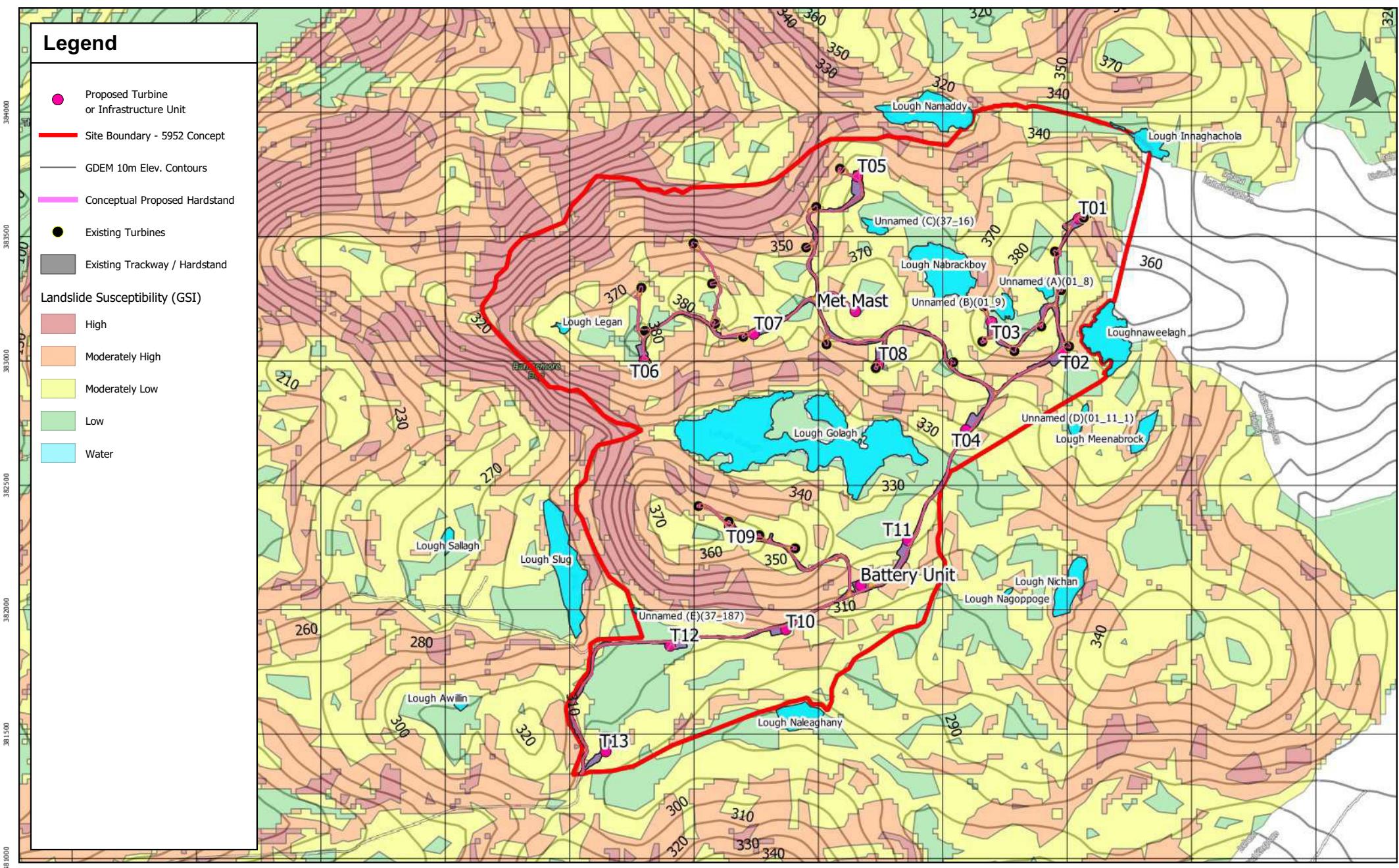
REPORT TO

Jennings O'Donovan & ScottishPower Renewables.
Re. Barnesmore WF Repower
Peat & Slope Stability Risk Assessment

REPORT BY

Minerex Environmental Limited
Doc Ref 3006-044 (Slope Stability & Risk Assessment) Rev2

Attachment C



REPORT TO

Jennings O'Donovan & ScottishPower Renewables.
Re. Barnesmore WF Repower
Peat & Slope Stability Risk Assessment

REPORT BY

Minerex Environmental Limited
Doc Ref 3006-044 (Slope Stability & Risk Assessment) Rev2

Attachment D

205000

3835000
205000

Legend

Proposed Turbine or Infrastructure Unit

Site Boundary - 5952 Concept

GDEM 10m Elev. Contours

Topo Survey Contours

Conceptual Proposed Hardstand

Existing Turbines

Existing Trackway / Hardstand

Landslide Susceptibility (GSI)

High

Moderately High

Moderately Low

Low

Water

Peat Depths

0.0 - 0.1m

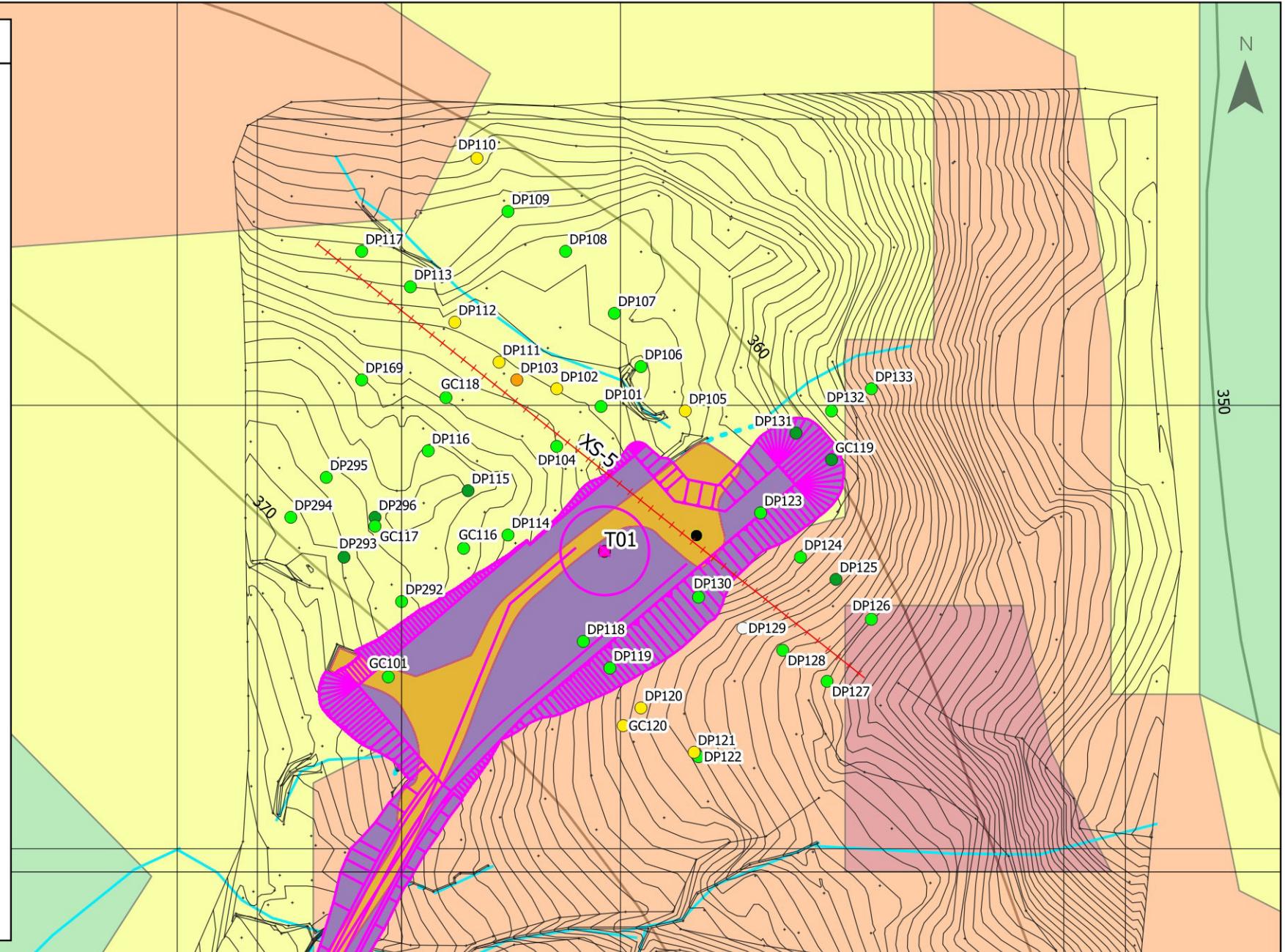
0.1 - 0.5m

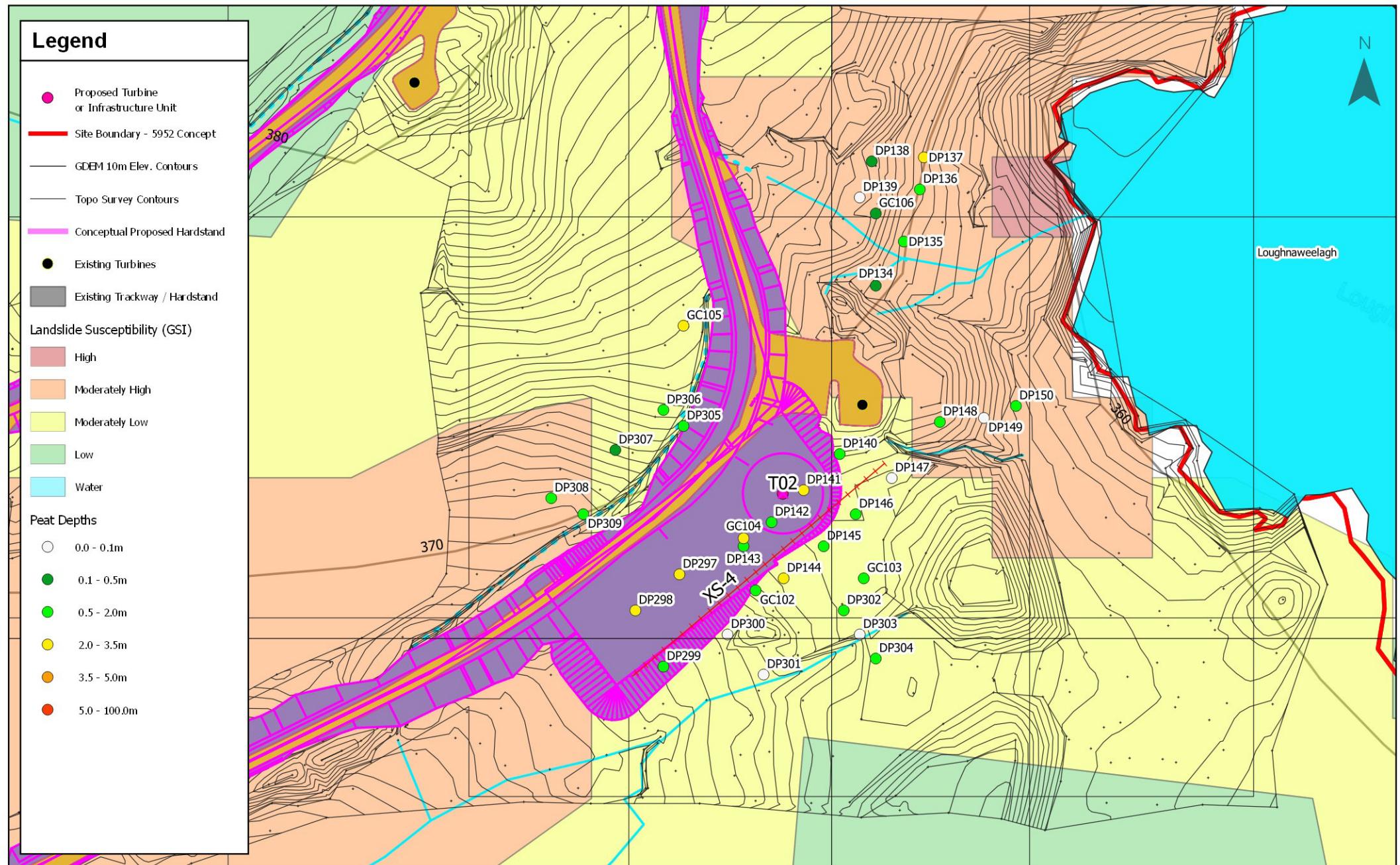
0.5 - 2.0m

2.0 - 3.5m

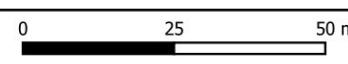
3.5 - 5.0m

5.0 - 100.0m





Rev	Date	By	Comment
0	23/08/19	SK	



Barnesmore Windfarm Repowering
Peat Depths & Landslide Susceptibility (GSI)
T2

Drawing Number: 3006-008	Datum TM65	Projection Irish Grid TNM65
Scale @ A3 1:1,250	Drawing Produced by Minerex Environmental Ltd. www.minerex.ie	3006-008 Slope Stability Risk Assessment Database & Maps

Legend

Proposed Turbine or Infrastructure Unit

Site Boundary - 5952 Concept

GDEM 10m Elev. Contours

Topo Survey Contours

Conceptual Proposed Hardstand

Existing Turbines

Existing Trackway / Hardstand

Landslide Susceptibility (GSI)

High

Moderately High

Moderately Low

Low

Water

Peat Depths

0.0 - 0.1m

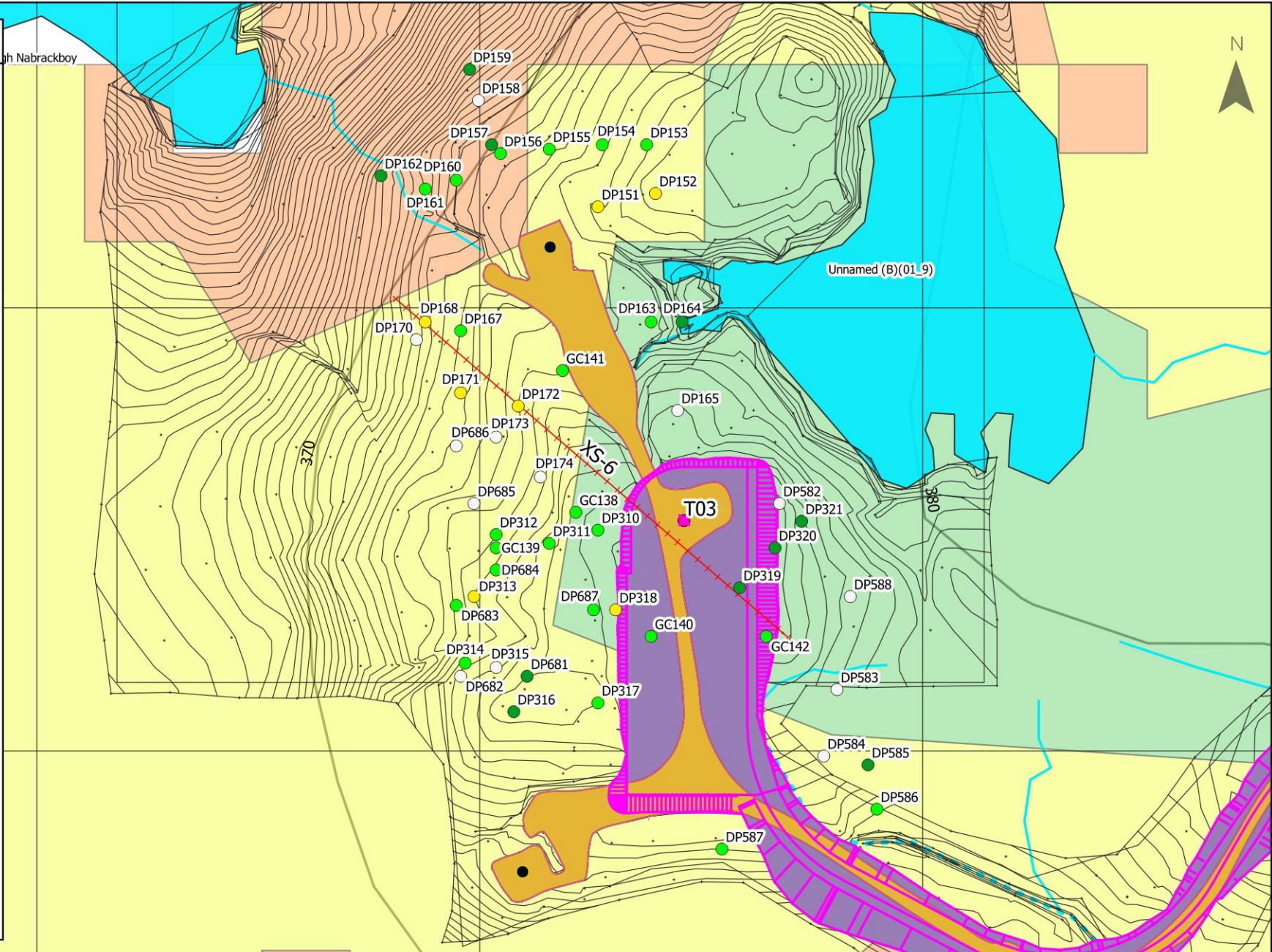
0.1 - 0.5m

0.5 - 2.0m

2.0 - 3.5m

3.5 - 5.0m

5.0 - 100.0m



Legend

Proposed Turbine or Infrastructure Unit

Site Boundary - 5952 Concept

GDEM 10m Elev. Contours

Topo Survey Contours

Conceptual Proposed Hardstand

Existing Turbines

Existing Trackway / Hardstand

Landslide Susceptibility (GSI)

High

Moderately High

Moderately Low

Low

Water

Peat Depths

0.0 - 0.1m

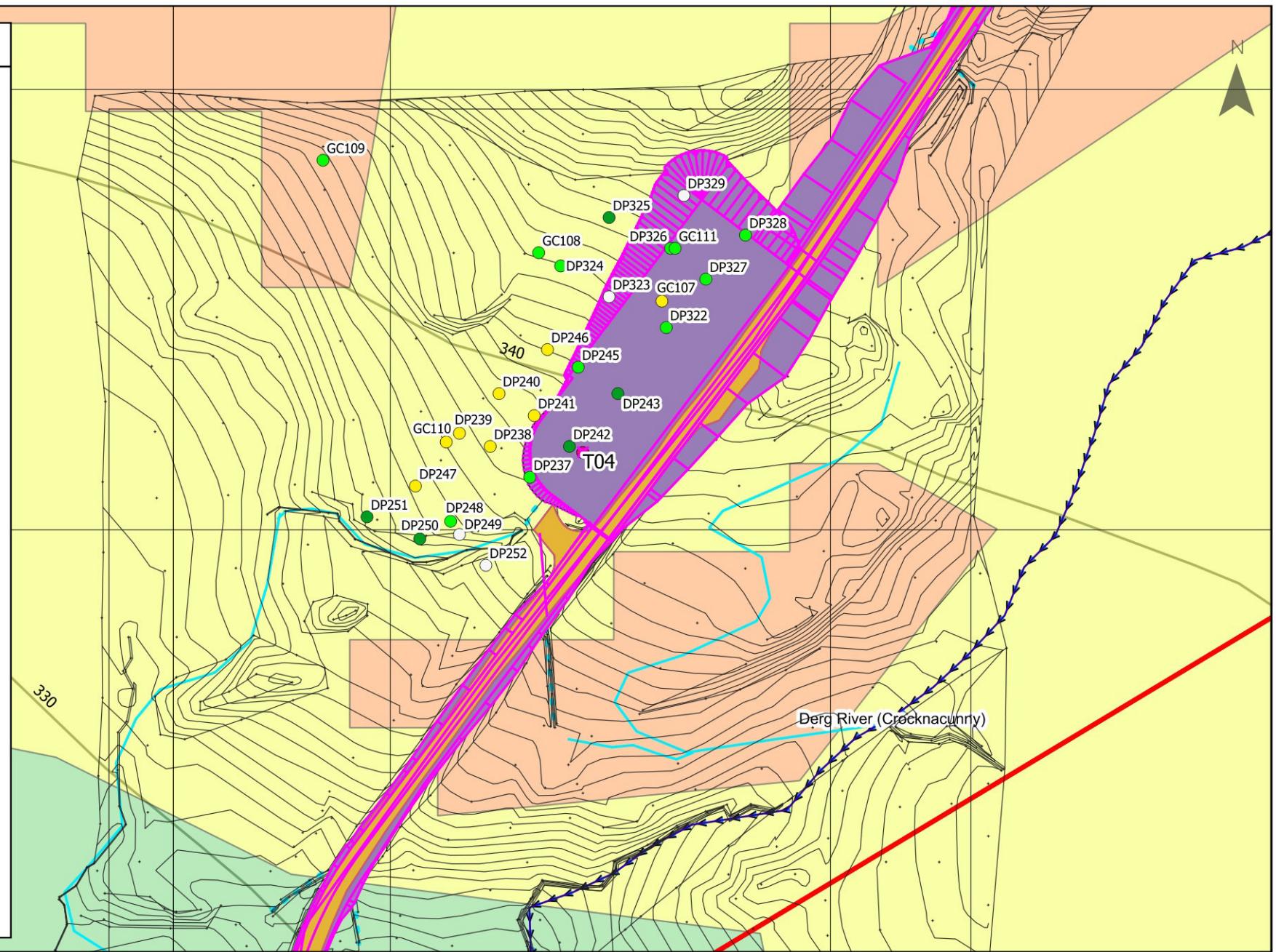
0.1 - 0.5m

0.5 - 2.0m

2.0 - 3.5m

3.5 - 5.0m

5.0 - 100.0m



Rev	Date	By	Comment
0	23/08/19	SK	



Barnesmore Windfarm Repowering
Peat Depths & Landslide Susceptibility (GSI)
T4

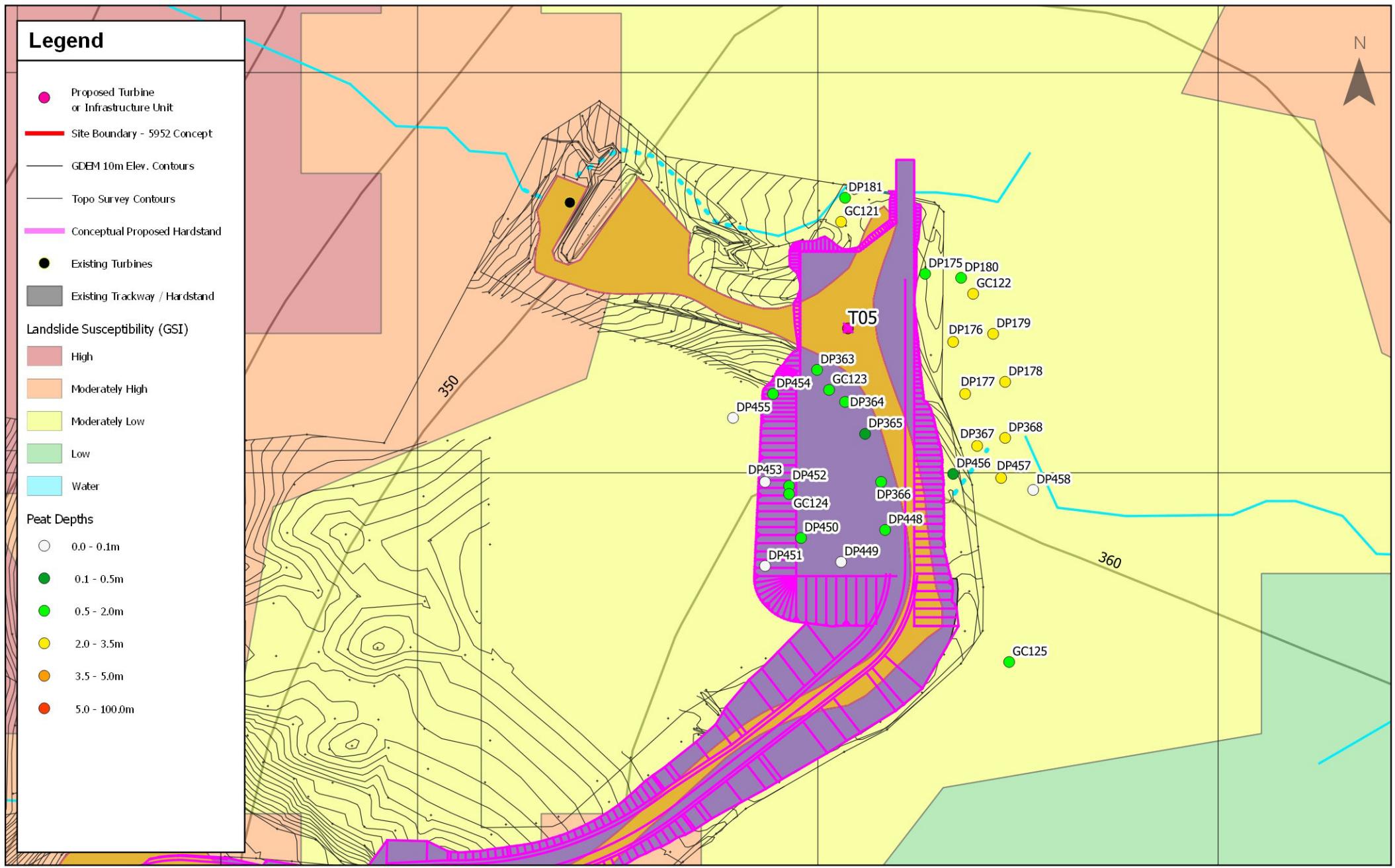
Drawing Number:
3006-008

Datum
TM65

Projection
Irish Grid
TNM65

Scale @ A3
1:1,250

Drawing Produced by
Minerex Environmental Ltd.
www.minerex.ie



 SCOTTISHPOWER RENEWABLES					Barnesmore Windfarm Repowering Peat Depths & Landslide Susceptibility (GSI) T5	Drawing Number: 3006-008 Datum TM65 Projection Irish Grid TNM65
	0	23/08/19	SK			
	Rev	Date	By			

Legend

Proposed Turbine or Infrastructure Unit

Site Boundary - 5952 Concept

GDEM 10m Elev. Contours

Topo Survey Contours

Conceptual Proposed Hardstand

Existing Turbines

Existing Trackway / Hardstand

Landslide Susceptibility (GSI)

High

Moderately High

Moderately Low

Low

Water

Peat Depths

0.0 - 0.1m

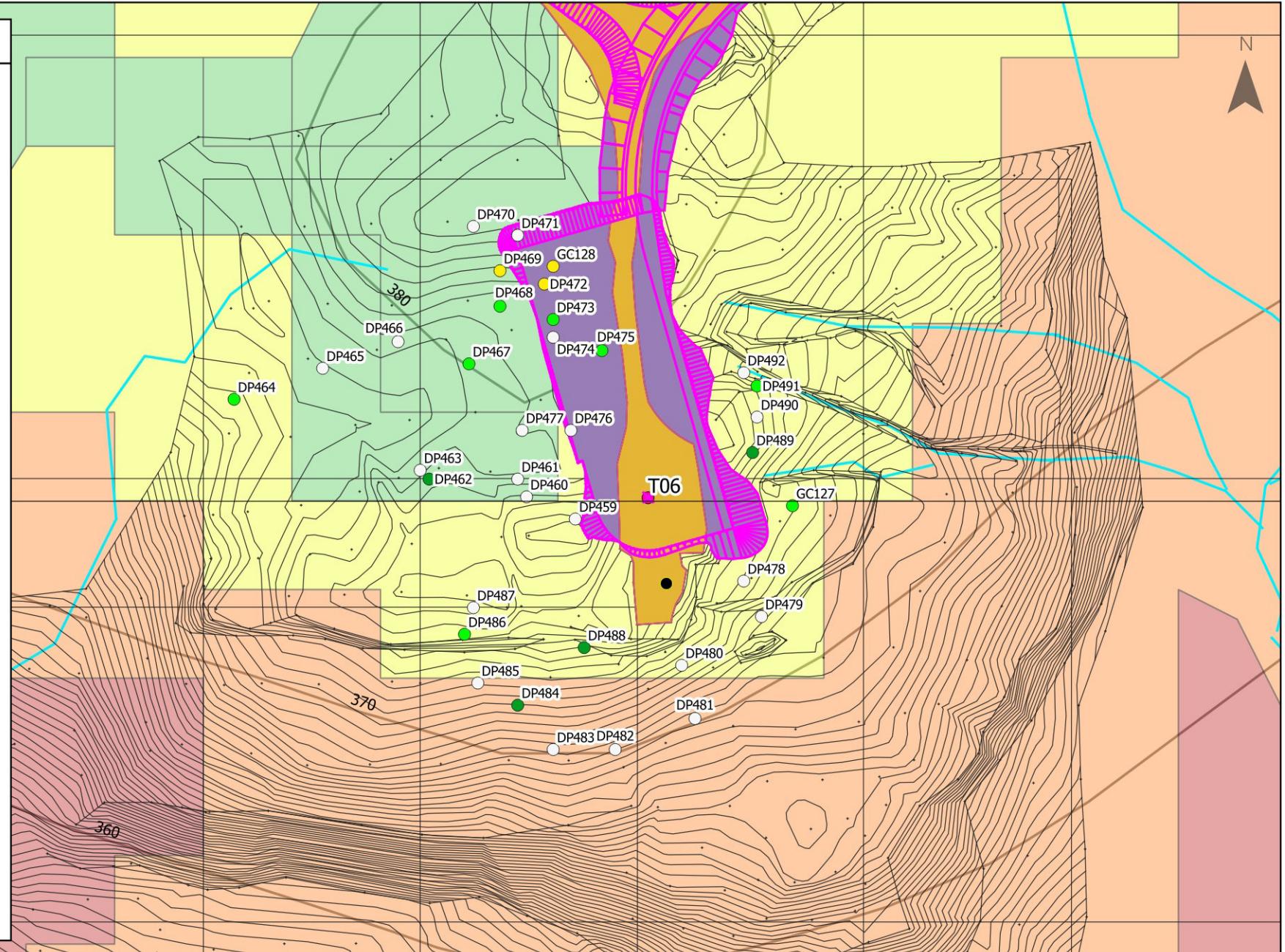
0.1 - 0.5m

0.5 - 2.0m

2.0 - 3.5m

3.5 - 5.0m

5.0 - 100.0m



Rev	Date	By	Comment
0	23/08/19	SK	

0 25 50 m

Barnesmore Windfarm Repowering
Peat Depths & Landslide Susceptibility (GSI)
T6

Drawing Number:
3006-008

Datum
TM65

Projection
Irish Grid
TNM65

Scale @ A3
1:1,250

Drawing Produced by
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Legend

Proposed Turbine or Infrastructure Unit

Site Boundary - 5952 Concept

GDEM 10m Elev. Contours

Topo Survey Contours

Conceptual Proposed Hardstand

Existing Turbines

Existing Trackway / Hardstand

Landslide Susceptibility (GSI)

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Moderately High

Moderately Low

Low

Water

Peat Depths

0.0 - 0.1m

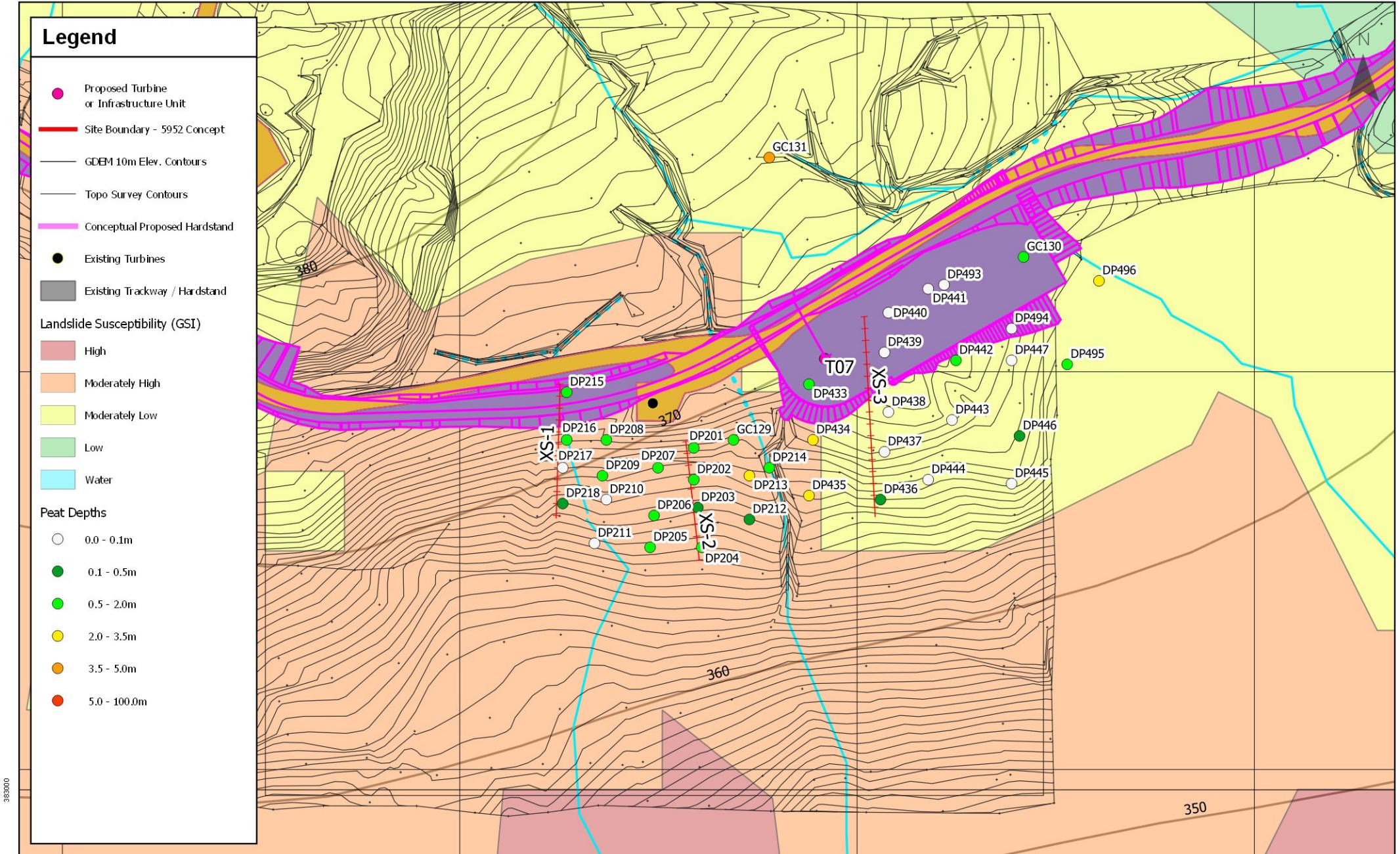
0.1 - 0.5m

0.5 - 2.0m

2.0 - 3.5m

3.5 - 5.0m

5.0 - 100.0m



Rev Date By Comment

0 23/08/19 SK

0 25 50 m

Barnesmore Windfarm Repowering
Peat Depths & Landslide Susceptibility (GSI)
T7

Drawing Number:
3006-008

Datum
TM65

Projection
Irish Grid
TNM65

Scale @ A3
1:1,250

Drawing Produced by
Minerex Environmental Ltd.
www.minerex.ie

Legend

Proposed Turbine or Infrastructure Unit

Site Boundary - 5952 Concept

GDEM 10m Elev. Contours

Topo Survey Contours

Conceptual Proposed Hardstand

Existing Turbines

Existing Trackway / Hardstand

Landslide Susceptibility (GSI)

High

Moderately High

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Low

Water

Peat Depths

0.0 - 0.1m

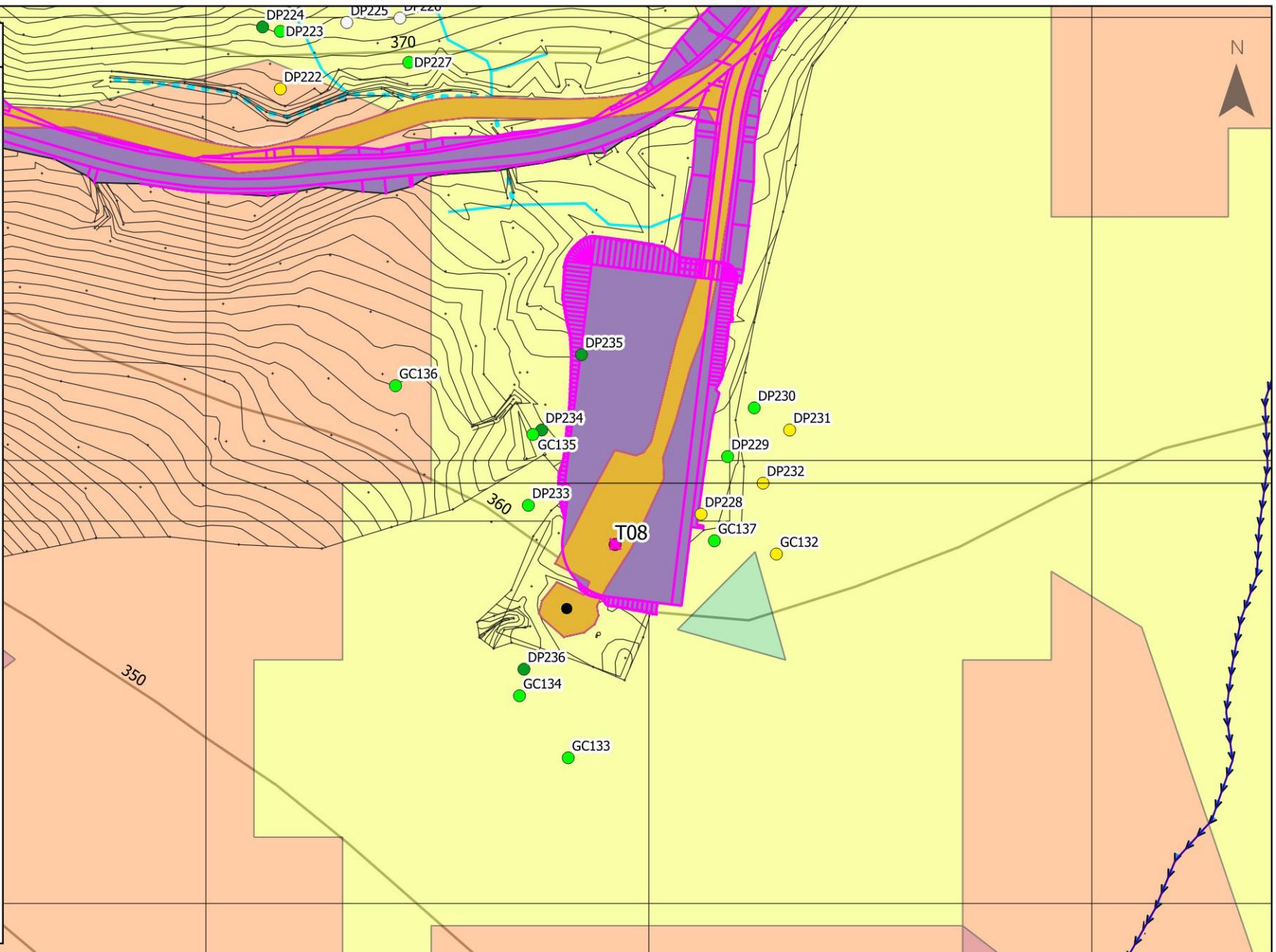
0.1 - 0.5m

0.5 - 2.0m

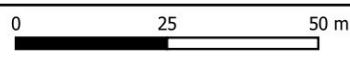
2.0 - 3.5m

3.5 - 5.0m

5.0 - 100.0m



Rev	Date	By	Comment
0	23/08/19	SK	



Barnesmore Windfarm Repowering
Peat Depths & Landslide Susceptibility (GSI)
T8

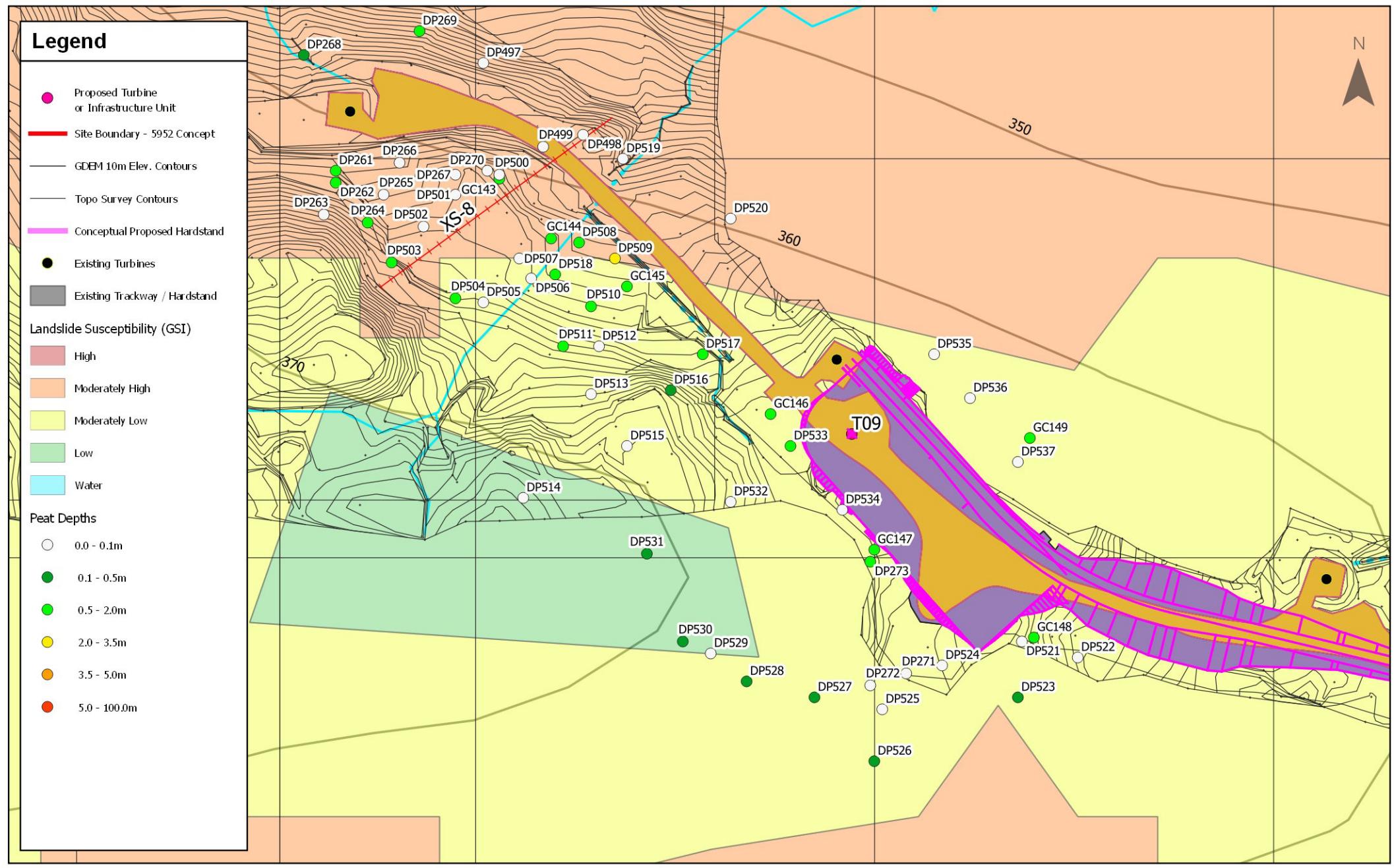
Drawing Number:
3006-008

Datum
TM65

Projection
Irish Grid
TNM65

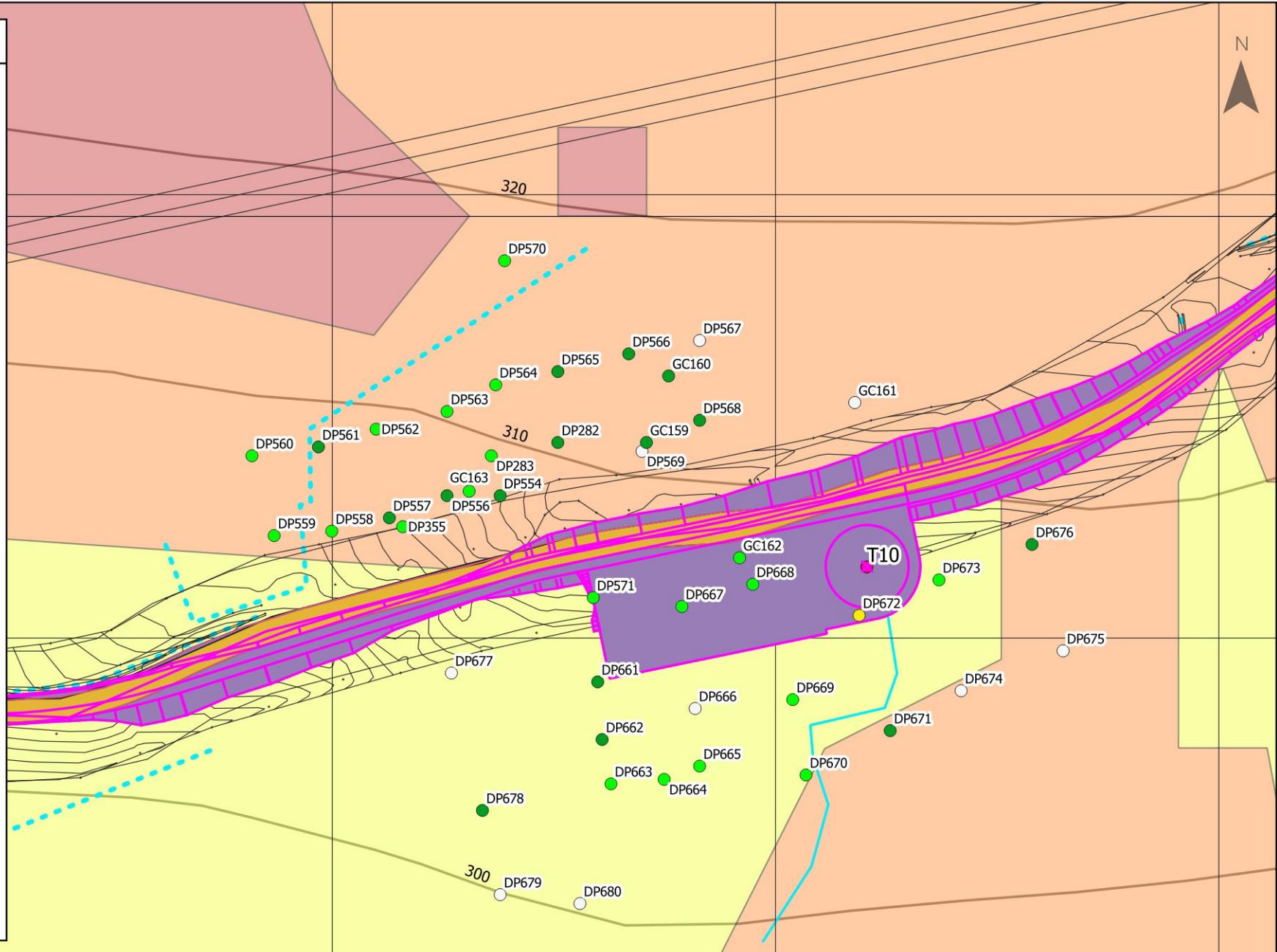
Scale @ A3
1:1,250

Drawing Produced by
Minerex Environmental Ltd.
www.minerex.ie



203500

 SCOTTISHPOWER RENEWABLES					Barnesmore Windfarm Repowering Peat Depths & Landslide Susceptibility (GSI) T9	Drawing Number: 3006-008 Datum: TM65 Projection: Irish Grid TNM65
Rev	Date	By	Comment			
0	23/08/19	SK				Scale @ A3 1:1,250 Drawing Produced by Minerex Environmental Ltd. www.minerex.ie





 SCOTTISHPOWER RENEWABLES				 Barnesmore Windfarm Repowering Peat Depths & Landslide Susceptibility (GSI) T11	Drawing Number: 3006-008	Datum TM65	Projection Irish Grid TNM65
	0	23/08/19	SK				
	Rev	Date	By				
Comment				Scale @ A3 1:1,250	Drawing Produced by Minerex Environmental Ltd. www.minerex.ie		

Unnamed (E)(37_187)

**Legend**

Proposed Turbine or Infrastructure Unit
Site Boundary - 5952 Concept

GDEM 10m Elev. Contours

Topo Survey Contours

Conceptual Proposed Hardstand

Existing Turbines

Existing Trackway / Hardstand

Landslide Susceptibility (GSI)

High

Moderately High

Moderately Low

Low

Water

Peat Depths

0.0 - 0.1m

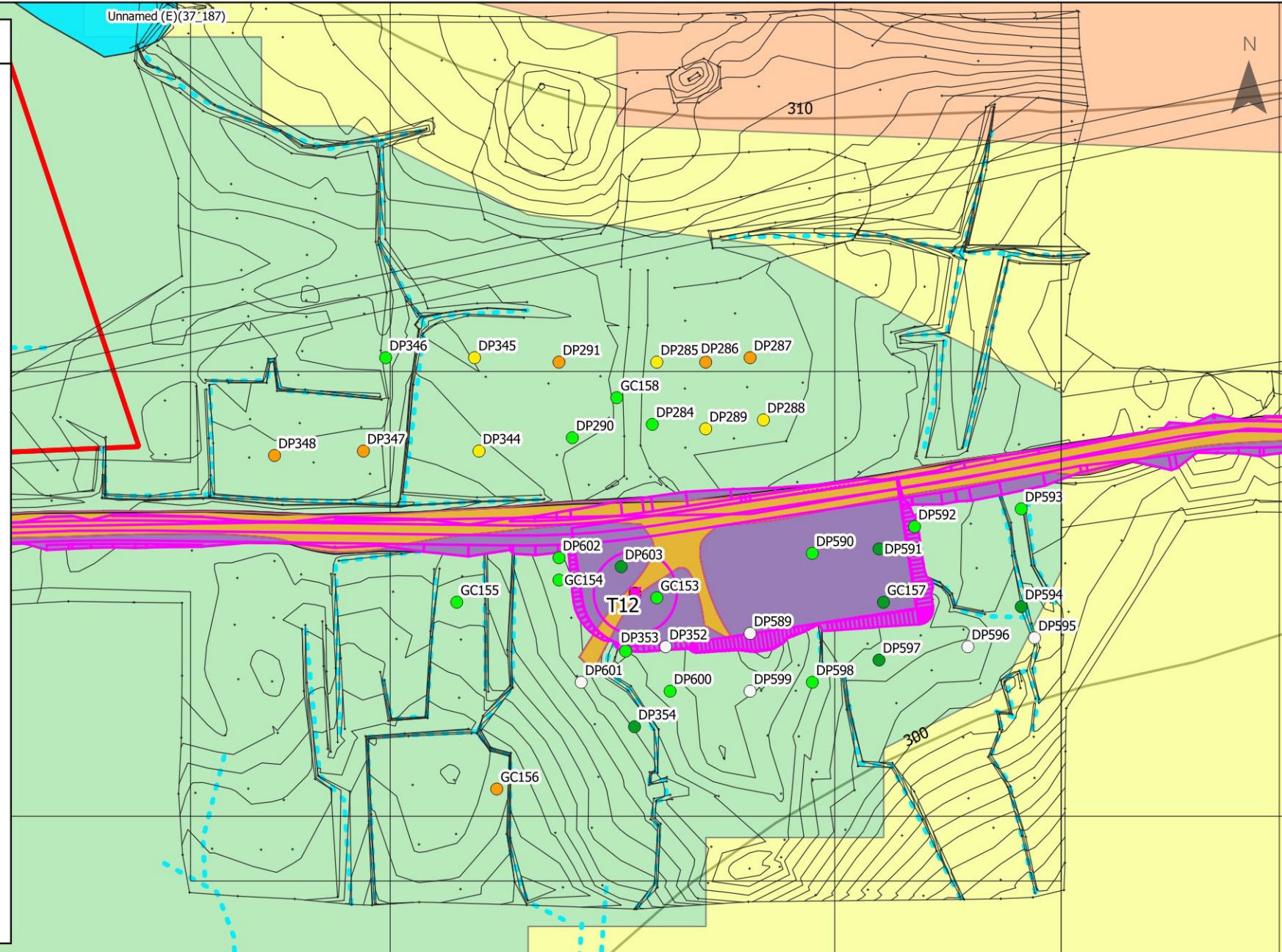
0.1 - 0.5m

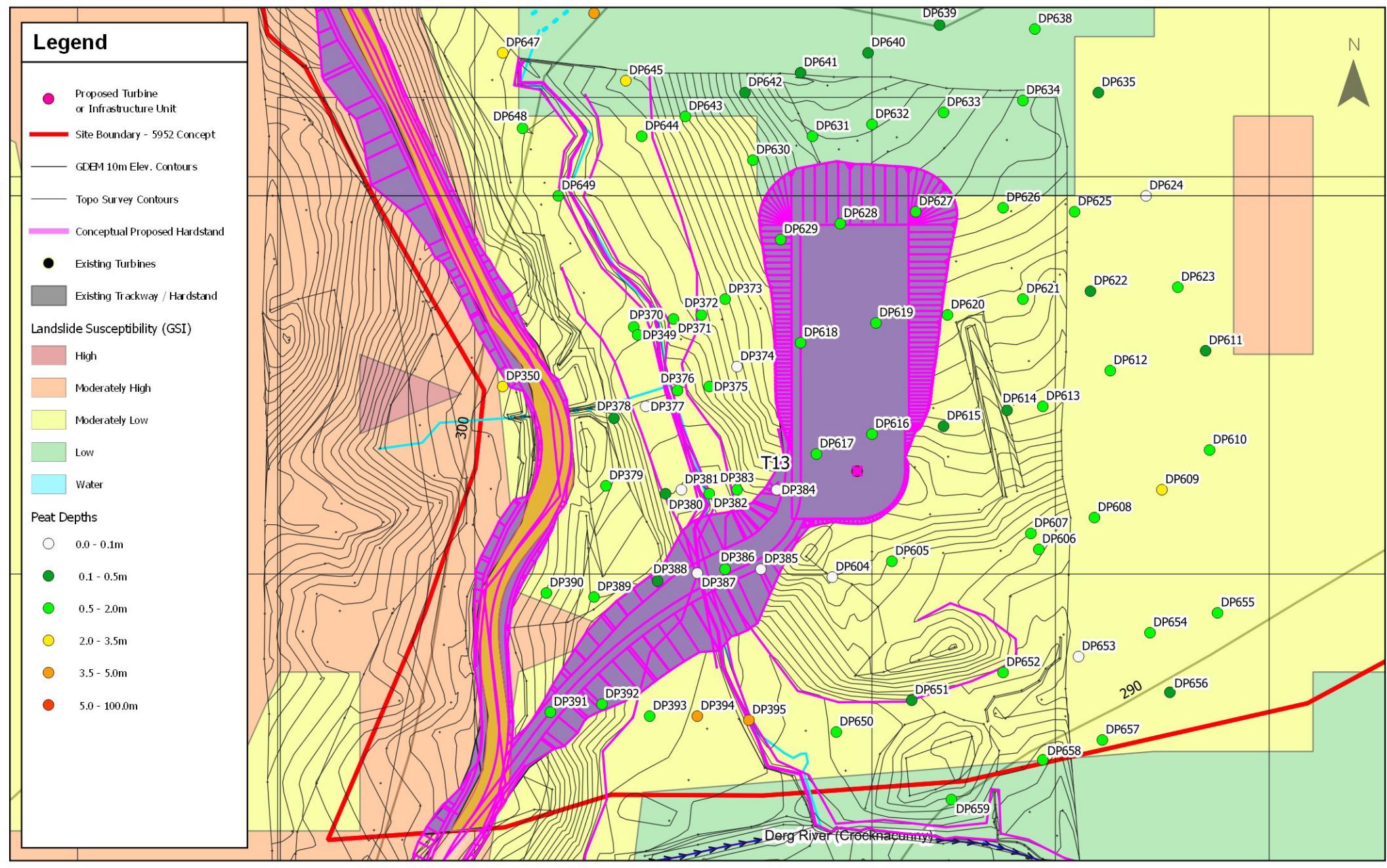
0.5 - 2.0m

2.0 - 3.5m

3.5 - 5.0m

5.0 - 100.0m





0 23/08/19 SK

Rev Date By Comment

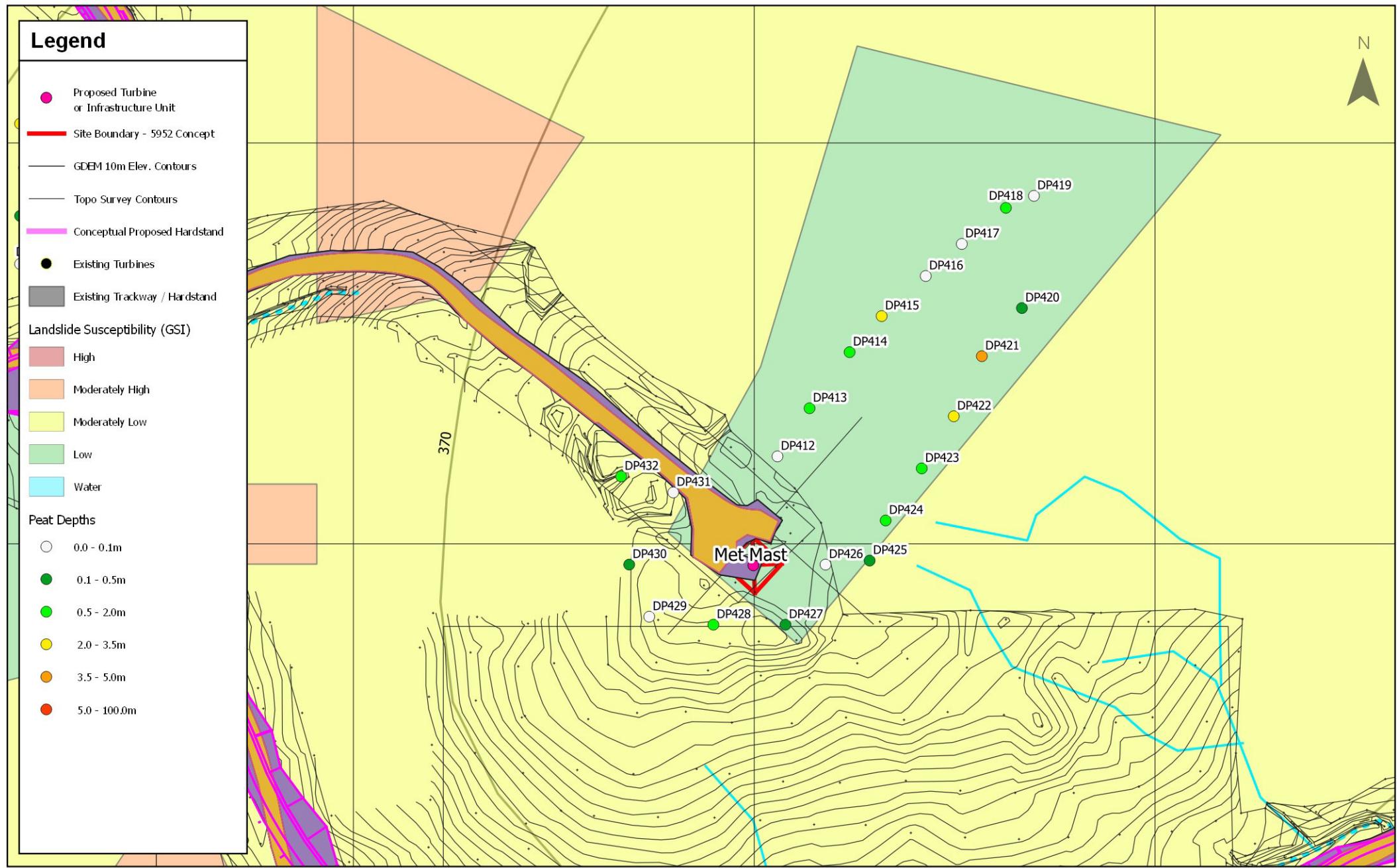
0 25 50 m

Barnesmore Windfarm Repowering
Peat Depths & Landslide Susceptibility (GSI)
T13

Drawing Number: 3006-008 Datum TM65 Projection Irish Grid TBM65

Scale @ A3 1:1,250 Drawing Produced by Minerex Environmental Ltd. www.minerex.ie

3006-008 Slope Stability Risk Assessment Database & Maps



SCOTTISHPOWER RENEWABLES

0	23/08/19	SK	0	25	50 m	Barnesmore Windfarm Repowering	Drawing Number: 3006-008	Datum: TM65	Projection: Irish Grid TNM65
Rev	Date	By	Comment			Peat Depths & Landslide Susceptibility (GSI) Met Mast	Scale @ A3 1:1,250	Drawing Produced by Minerex Environmental Ltd. www.minerex.ie	

3006-008 Slope Stability Risk Assessment Database & Maps

Legend

Proposed Turbine or Infrastructure Unit
Site Boundary - 5952 Concept

GDEM 10m Elev. Contours

Topo Survey Contours

Conceptual Proposed Hardstand

Existing Turbines

Existing Trackway / Hardstand

Landslide Susceptibility (GSI)

High

Moderately High

Moderately Low

Low

Water

Peat Depths

0.0 - 0.1m

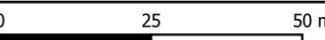
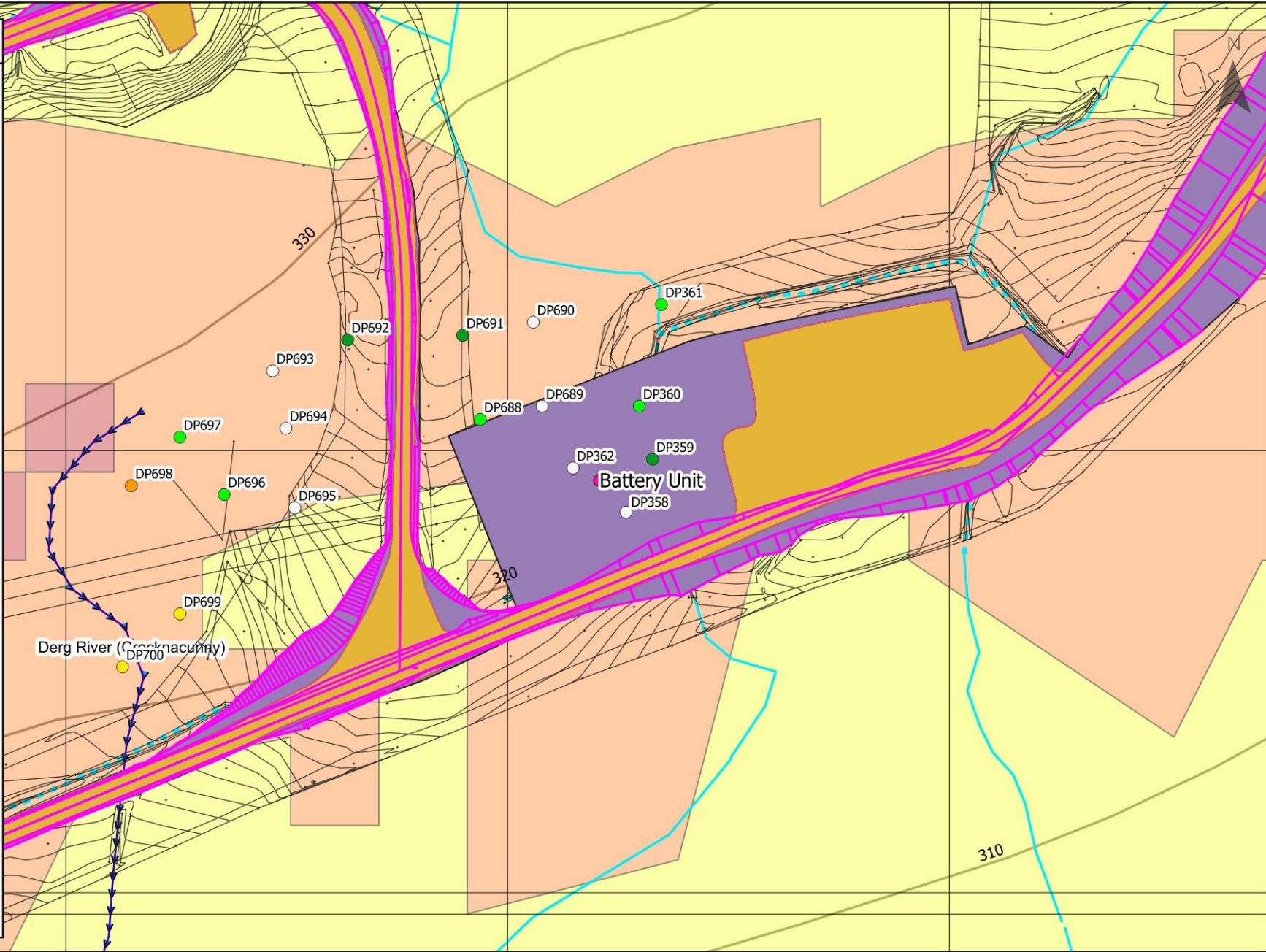
0.1 - 0.5m

0.5 - 2.0m

2.0 - 3.5m

3.5 - 5.0m

5.0 - 100.0m

**Barnesmore Windfarm Repowering**

Peat Depths & Landslide Susceptibility (GSI)
Battery Compound

Drawing Number:
3006-008

Datum:
TM65

Projection:
Irish Grid
TNM65

Scale @ A3
1:1,250

Drawing Produced by
Minerex Environmental Ltd.
www.minerex.ie

Rev	Date	By	Comment
0	23/08/19	SK	

REPORT TO

Jennings O'Donovan & ScottishPower Renewables.
Re. Barnesmore WF Repower
Peat & Slope Stability Risk Assessment

REPORT BY

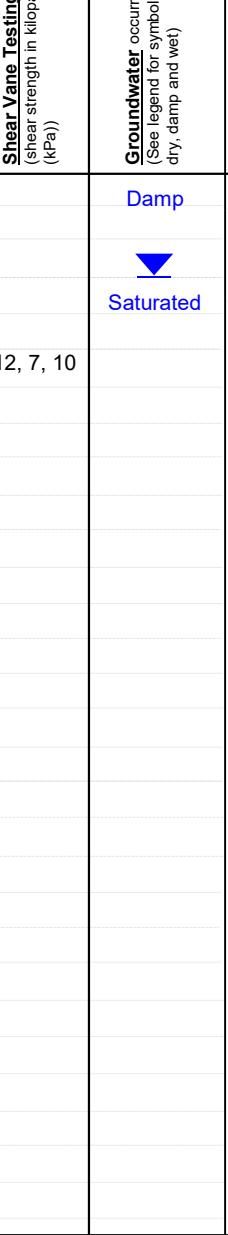
Minerex Environmental Limited
Doc Ref 3006-044 (Slope Stability & Risk Assessment) Rev2

Attachment E

Borehole/ Standpipe Design & Completion	Soil (S) / Water (W) / Vapour (V) Sampling			Geology (graphical log)	INVESTIGATION POINT LOG NUMBER	GC101 (SP101)								
	Sample number & interval (mbGL) (Sample 10 kg minimum)	Shear Vane Testing values (shear strength in kilopascals (kPa))	Groundwater occurrence (See legend for symbols used for dry, damp and wet)			Client, Project, Location	JOD/SPR, Barnesmore, Donegal							
	Red line = Single channel sample (from field) Blue line = Composite sample (generated in office or lab) Green line = Grab sample (acquired on site)		Minerex work item 3006-A1			Page No.	Page 1 of 1							
	Red line = Single channel sample (from field) Blue line = Composite sample (generated in office or lab) Green line = Grab sample (acquired on site)		Date & time drilled / formed: 19/06/19			Logged by (drawn by) [checked by]:	Sven Klinkenbergh (SK) [JC]							
	Red line = Single channel sample (from field) Blue line = Composite sample (generated in office or lab) Green line = Grab sample (acquired on site)		Drilling / Trial pitting co. & equipment Gouge core			Minerex Doc. Ref.	3006-024.ppt							
	Red line = Single channel sample (from field) Blue line = Composite sample (generated in office or lab) Green line = Grab sample (acquired on site)		Irish Grid (IG)** IH 04997 83544 (1)											
	Geological description					VON POST VALUE	PEAT DESCRIPTION	COLOUR	STIFFNESS					
<p>Ground level</p> <p>Upstand 0.65m</p> <p>0.15</p> <p>Black coloured 17mm ID/33.5mm OD PVC casing</p> <p>1.15m = End of Installation (EOI)</p>	SS1		Wet	0.2 [0.5]	H8	Fibrous ie high root content	Medium brown							
	SS2		Saturated	0.5 [0.65] 1.0 1.15	H8	Fibrous ie moderate root content	Medium brown							
				1.5 2.0 2.5 3.0 3.5 4.0		1.15m Obstruction / Rock								
* Non-natural material %s with total % in ()				General notes / Well Head Protection / Plan & Section Sketches										
NON-DEGRADABLE % (ND): 1 = Brick, 2 = Concrete, 3 = Glass, 4 = Ceramic tiles, 5 = ACMs (asbestos containing materials such as roof tiles, piping). 6 = Blue Bangor slate.				20/06/19 Well dipped at 9:20am: water level at 0.52mbGL										
DEGRADABLE % (D): 7 = Plastic, 8 = Metal, 9 = Wood / Organic / Leaves / Twigs / Peat, 10 = Ash & Clinker, 11 = Charcoal, 12 = Tarmacadam, 13 = Leather.														
** 1-From hand held GPS, 2-Estimated from google maps or 3-Surveyed with theodolite.														

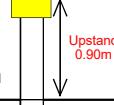
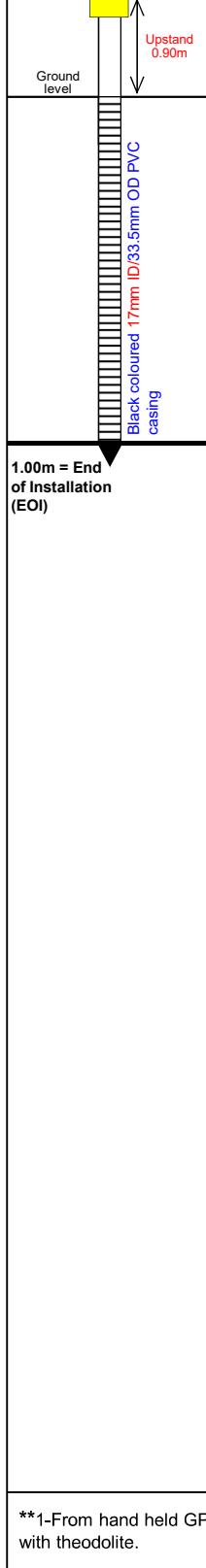
Borehole/ Standpipe Design & Completion	Soil (S) / Water (W) / Vapour (V) Sampling			<p>Groundwater occurrence (See legend for symbols used for dry, damp and wet)</p>	<p>INVESTIGATION POINT LOG NUMBER GC103</p> <p>Client, Project, Location JOD/SPR, Barnesmore, Donegal</p> <p>Minerex work item 3006-A1</p> <p>Page No. Page 1 of 1</p> <p>Date & time drilled / formed: 02/07/19</p> <p>Logged by (drawn by) [checked by]: Sven Klinkenbergh (SK) [JC & GJ]</p> <p>Drilling / Trial pitting co. & equipment Gouge core</p> <p>Minerex Doc. Ref. 3006-024.ppt</p> <p>Irish Grid (IG)** IH 05008 83015 (1)</p>	Geological description			
	VON POST VALUE	PEAT DESCRIPTION	COLOUR						
	14, 31, 8	Wet Saturated			H8-9	Fibrous ie moderate root content	Medium brown		
	10, 9, 10				H9	Fibrous ie moderate root content	Dark brown		
					H9	Fibrous ie minor root content	Dark brown		
					1.50m Obstruction / Rock				
					2.0				
					2.5				
					3.0				
					3.5				
					4.0				
**1-From hand held GPS, 2-Estimated from google maps or 3-Surveyed with theodolite.				General notes / Well Head Protection / Plan & Section Sketches					

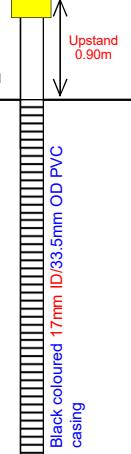
Borehole/ Standpipe Design & Completion	Soil (S) / Water (W) / Vapour (V) Sampling			Geology (graphical log)	INVESTIGATION POINT LOG NUMBER		GC104				
	Sample number & interval (mbGL) (Sample 10 kg minimum)	Shear Vane Testing values (shear strength in kilopascals (kPa))	Groundwater occurrence (See legend for symbols used for dry, damp and wet)								
	Red line = Single channel sample (from field)		Damp ▼ Saturated								
	Blue line = Composite sample (generated in office or lab)										
	Green line = Grab sample (acquired on site)										
	SS1				0.2 [0.5]	H4-5	Fibrous ie high root content	Medium brown			
	SS2		20, 21, 14		0.5 [0.5]	H8	Fibrous ie high root content	Medium brown			
	SS3				1.0 [0.4]	H8-9	Fibrous ie high root content	Medium brown			
	SS4				1.5 [0.60]	H9	Minor root content	Dark brown			
	SS5				2.0 [0.45]	H9-10	Minor root content	Dark brown			
					2.45	2.45m Obstruction / Rock					
**1-From hand held GPS, 2-Estimated from google maps or 3-Surveyed with theodolite.				General notes / Well Head Protection / Plan & Section Sketches							

Borehole/ Standpipe Design & Completion	Soil (S) / Water (W) / Vapour (V) Sampling			Geology (graphical log) Depth in metres below ground level & [Thickness] 	INVESTIGATION POINT LOG NUMBER		GC105								
	Sample number & interval (mbGL) (Sample 10 kg minimum)		Groundwater occurrence (See legend for symbols used for dry, damp and wet)		Client, Project, Location		JOD/SPR, Barnesmore, Donegal								
	Red line = Single channel sample (from field)		Minerex work item		3006-A1										
	Blue line = Composite sample (generated in office or lab)		Page No.		Page 1 of 1										
	Green line = Grab sample (acquired on site)		Date & time drilled / formed:		02/07/19										
	Logged by (drawn by) [checked by]:		Gero Jahns (GJ) [JC]												
	Drilling / Trial pitting co. & equipment		Gouge core												
	Minerex Doc. Ref.		Minerex Doc. Ref.		3006-024.ppt										
	Irish Grid (IG)**		Irish Grid (IG)**		IH 04963 83078 (1)										
	Geological description				VON POST VALUE PEAT DESCRIPTION COLOUR STIFFNESS										
					V3	High root content	Light brown								
					H5	Fibrous ie high root content	Medium brown								
					H8	Fibrous ie high root content	Medium brown								
					H9	Fibrous ie high root content	Dark brown/black								
					H9	Minor root content	Dark brown								
					2.95m Obstruction / Rock										
					General notes / Well Head Protection / Plan & Section Sketches										
**1-From hand held GPS, 2-Estimated from google maps or 3-Surveyed with theodolite.															

Borehole/ Standpipe Design & Completion	Soil (S) / Water (W) / Vapour (V) Sampling			Geology (graphical log)	INVESTIGATION POINT LOG NUMBER	GC106		
	Sample number & interval (mbGL) (Sample 10 kg minimum)	Shear Vane Testing values (shear strength in kilopascals (kPa))	Groundwater occurrence (See legend for symbols used for dry, damp and wet)			Client, Project, Location	JOD/SPR, Barnesmore, Donegal	
	Red line = Single channel sample (from field) Blue line = Composite sample (generated in office or lab) Green line = Grab sample (acquired on site)					Minerex work item	3006-A1	
						Page No.	Page 1 of 1	
						Date & time drilled / formed:	02/07/19	
						Logged by (drawn by) [checked by]:	Gero Jahnz (GJ) [JC]	
						Drilling / Trial pitting co. & equipment	Gouge core	
						Minerex Doc. Ref.	3006-024.ppt	
						Irish Grid (IG)**	IH 05011 83106 (1)	
						Geological description		
						VON POST VALUE	PEAT DESCRIPTION	COLOUR
			Dry	[0.1] 0.1	Acrotelm			
				[0.2] 0.3	H2	Sandy Peat	Dark brown	
				0.5	0.30m Rock			
				1.0				
				1.5				
				2.0				
				2.5				
				3.0				
				3.5				
				4.0				
* Non-natural material %s with total % in ()				General notes / Well Head Protection / Plan & Section Sketches				
NON-DEGRADABLE % (ND): 1 = Brick, 2 = Concrete, 3 = Glass, 4 = Ceramic tiles, 5 = ACMs (asbestos containing materials such as roof tiles, piping). 6 = Blue Bangor slate.				20/06/19				
DEGRADABLE % (D): 7 = Plastic, 8 = Metal, 9 = Wood / Organic / Leaves / Twigs / Peat, 10 = Ash & Clinker, 11 = Charcoal, 12 = Tarmacadam, 13 = Leather.								
** 1-From hand held GPS, 2-Estimated from google maps or 3-Surveyed with theodolite.								

Borehole/ Standpipe Design & Completion	Soil (S) / Water (W) / Vapour (V) Sampling			Geology (graphical log)	INVESTIGATION POINT LOG NUMBER	GC107 (SP103)		
	Sample number & interval (mbGL) (Sample 10 kg minimum)	Shear Vane Testing values (shear strength in kilopascals (kPa))	Groundwater occurrence (See legend for symbols used for dry, damp and wet)			VON POST VALUE	PEAT DESCRIPTION	COLOUR
Ground level	Upstand 0.90m	Red line = Single channel sample (from field) Blue line = Composite sample (generated in office or lab) Green line = Grab sample (acquired on site)						
Black coloured 17mm ID/33.5mm OD PVC casing	SS1		Damp	[0.1] 0.1	Acrotelm			
1.00m = End of Installation (EOI)	SS2	14, 14, 16	Saturated	[0.4] 0.3	H8-9	Fibrous ie high root content	Medium brown	
	SS3			[0.5] 1.0	H9	Fibrous ie high root content	Medium brown	
	SS4			[1.65] 1.5				
				2.0				
				2.15	2.15m Obstruction / Rock			
				2.5				
				3.0				
				3.5				
				4.0				
**1-From hand held GPS, 2-Estimated from google maps or 3-Surveyed with theodolite.				General notes / Well Head Protection / Plan & Section Sketches				

Borehole/ Standpipe Design & Completion	Soil (S) / Water (W) / Vapour (V) Sampling			Geology (graphical log)	INVESTIGATION POINT LOG NUMBER	GC108 (SP104)	
	Sample number & interval (mbGL) (Sample 10 kg minimum)	Shear Vane Testing values (shear strength in kilopascals (kPa))	Groundwater occurrence (See legend for symbols used for dry, damp and wet)			Client, Project, Location	JOD/SPR, Barnesmore, Donegal
Ground level		Red line = Single channel sample (from field) Blue line = Composite sample (generated in office or lab) Green line = Grab sample (acquired on site)	Shear Vane Testing values (shear strength in kilopascals (kPa))	Damp	[0.1] 0.1	Acrotelm	
				Saturated	[0.4] 0.4	H8	Moderate root content
					0.5	H8-9	Moderate root content
					[0.2] 0.7	H9	Moderate root content
					[0.2] 0.9		
					[0.2] 1.10	Sandy peat	Dark brown
					1.5	1.10m Obstruction / Rock	
					2.0		
					2.5		
					3.0		
					3.5		
					4.0		
**1-From hand held GPS, 2-Estimated from google maps or 3-Surveyed with theodolite.				General notes / Well Head Protection / Plan & Section Sketches			

Borehole/ Standpipe Design & Completion	Soil (S) / Water (W) / Vapour (V) Sampling			Geology (graphical log)	INVESTIGATION POINT LOG NUMBER	GC109 (SP105)	
	Sample number & interval (mbGL) (Sample 10 kg minimum)	Shear Vane Testing values (shear strength in kilopascals (kPa))	Groundwater occurrence (See legend for symbols used for dry, damp and wet)			Client, Project, Location	JOD/SPR, Barnesmore, Donegal
Ground level		Red line = Single channel sample (from field) Blue line = Composite sample (generated in office or lab) Green line = Grab sample (acquired on site)	Shear Vane Testing values (shear strength in kilopascals (kPa))	Damp 	[0.1] [0.25] 0.3 0.35 0.5 [0.35] 0.7 [0.2] 0.9 1.0 [0.35] 1.25	Acrotelm H7-8 H8 H9 H9-10	Moderate root content Moderate root content Moderate root content Minor fibres
1.00m = End of Installation (EOI)				1.5 2.0 2.5 3.0 3.5 4.0	1.25m Obstruction / Rock		
**1-From hand held GPS, 2-Estimated from google maps or 3-Surveyed with theodolite.				General notes / Well Head Protection / Plan & Section Sketches			

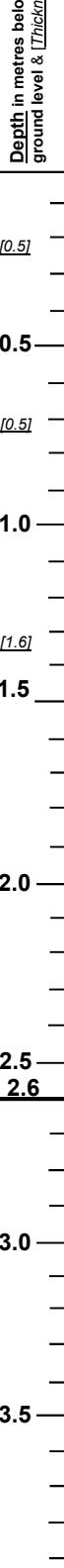
Borehole/ Standpipe Design & Completion	Soil (S) / Water (W) / Vapour (V) Sampling			<p>Geology (graphical log)</p> <p>Depth in metres below ground level & [Thickness]</p> <p>Shear Vane Testing values (shear strength in kilopascals (kPa))</p> <p>Groundwater occurrence (See legend for symbols used for dry, damp and wet)</p>	INVESTIGATION POINT LOG NUMBER		GC110				
	Sample number & interval (mbGL) (Sample 10 kg minimum)				Client, Project, Location	JOD/SPR, Barnesmore, Donegal					
	Red line = Single channel sample (from field) Blue line = Composite sample (generated in office or lab) Green line = Grab sample (acquired on site)				Minerex work item	3006-A1					
					Page No.	Page 1 of 1					
					Date & time drilled / formed:	02/07/19					
					Logged by (drawn by) [checked by]:	Gero Jahns (GJ) [JC]					
					Drilling / Trial pitting co. & equipment	Gouge core					
					Minerex Doc. Ref.	3006-024.ppt					
					Irish Grid (IG)**	IH 04562 82725 (1)					
					Geological description						
					VON POST VALUE	PEAT DESCRIPTION	COLOUR	STIFFNESS			
			<p>Damp</p> <p>Wet</p> <p>Saturated</p>	[0.1]	Acrotelm						
				[0.25]	H5	High root content	Medium brown				
				0.3							
				0.35	H8	Moderate root content	Medium brown				
				0.5							
				[0.35]							
				0.6	H9	Moderate root content	Dark brown				
				0.7							
				[0.8]							
				1.0							
				1.5							
					H10	Minor fibres	Dark brown				
				[1.0]							
				2.0							
				2.5							
					2.50m Obstruction / Rock						
				3.0							
				3.5							
				4.0							
**1-From hand held GPS, 2-Estimated from google maps or 3-Surveyed with theodolite.				General notes / Well Head Protection / Plan & Section Sketches							

Borehole/ Standpipe Design & Completion	Soil (S) / Water (W) / Vapour (V) Sampling			<p>Depth in metres below ground level & [Thickness]</p> <p>Groundwater occurrence (See legend for symbols used for dry, damp and wet)</p>	INVESTIGATION POINT LOG NUMBER Client, Project, Location Minerex work item Page No. Date & time drilled / formed: Logged by (drawn by) [checked by]: Drilling / Trial pitting co. & equipment Minerex Doc. Ref. Irish Grid (IG)** Geological description VON POST VALUE PEAT DESCRIPTION COLOUR STIFFNESS	GC111		
	Sample number & interval (mbGL) (Sample 10 kg minimum)	Shear Vane Testing values (shear strength in kilopascals (kPa))			JOD/SPR, Barnesmore, Donegal			
	Red line = Single channel sample (from field)				Minerex work item	3006-A1		
	Blue line = Composite sample (generated in office or lab)				Page No.	Page 1 of 1		
	Green line = Grab sample (acquired on site)				Date & time drilled / formed:	02/07/19		
					Logged by (drawn by) [checked by]:	Gero Jahns (GJ) [JC]		
					Drilling / Trial pitting co. & equipment	Gouge core		
					Minerex Doc. Ref.	3006-024.ppt		
					Irish Grid (IG)**	IH 04614 82769 (1)		
					VON POST VALUE	PEAT DESCRIPTION	COLOUR	STIFFNESS
			Damp Wet	[0.1] 0.1	Acrotelm			
				[0.2] 0.2	H7-8	High root content	Medium brown	
				[0.5] 0.5				
				[0.7] 1.0	H8-9	Moderate root content	Medium brown	
				[1.2] 1.2	H9	Moderate root content	Dark brown	
				[0.25] 1.5 ^{1.45}	H9-10	Minor fibres	Dark brown/black	
				[0.2] 1.65		1.65m Obstruction / Rock		
				[2.0] 2.0				
				[2.5] 2.5				
				[3.0] 3.0				
				[3.5] 3.5				
				[4.0] 4.0				
**1-From hand held GPS, 2-Estimated from google maps or 3-Surveyed with theodolite.				General notes / Well Head Protection / Plan & Section Sketches				

Borehole/ Standpipe Design & Completion	Soil (S) / Water (W) / Vapour (V) Sampling			Geology (graphical log)	INVESTIGATION POINT LOG NUMBER	GC112	
	Sample number & interval (mbGL) (Sample 10 kg minimum)	Shear Vane Testing values (shear strength in kilopascals (kPa))	Groundwater occurrence (See legend for symbols used for dry, damp and wet)		Client, Project, Location	JOD/SPR, Barnesmore, Donegal	
	Red line = Single channel sample (from field) Blue line = Composite sample (generated in office or lab) Green line = Grab sample (acquired on site)				Minerex work item	3006-A1	
					Page No.	Page 1 of 1	
					Date & time drilled / formed:	02/07/19	
					Logged by (drawn by) [checked by]:	Gero Jahns (GJ) [JC]	
					Drilling / Trial pitting co. & equipment	Gouge core	
					Minerex Doc. Ref.	3006-024.ppt	
					Irish Grid (IG)**	IH 04327 82284 (1)	
					Geological description		
					VON POST VALUE	PEAT DESCRIPTION	COLOUR
							STIFFNESS
			Damp 	[0.1] 0.1 [0.1] 0.2 0.3 [0.3] 0.5 [0.3] 0.8	Acrotelm		
				H8	High root content	Dark brown	
				H8	Moderate root content	Medium brown	
				H9	Moderate root content	Dark brown	
					0.80m Obstruction / Rock		
				1.0 1.5 2.0 2.5 3.0 3.5 4.0			
	**1-From hand held GPS, 2-Estimated from google maps or 3-Surveyed with theodolite.			General notes / Well Head Protection / Plan & Section Sketches			

Borehole/ Standpipe Design & Completion	Soil (S) / Water (W) / Vapour (V) Sampling			Geology (graphical log)	INVESTIGATION POINT LOG NUMBER	GC113 (SP106)		
	Sample number & interval (mbGL) (Sample 10 kg minimum)	Shear Vane Testing values (shear strength in kilopascals (kPa))	Groundwater occurrence (See legend for symbols used for dry, damp and wet)			VON POST VALUE	PEAT DESCRIPTION	COLOUR
Ground level	Upstand 1.09m	Red line = Single channel sample (from field) Blue line = Composite sample (generated in office or lab) Green line = Grab sample (acquired on site)						
Black coloured 17mm ID/33.5mm OD PVC casing	SS1		Damp ▼ Wet	[0.05] 0.05	H8	Moderate root content	Medium brown	
1.00m = End of Installation (EOI)	SS2		Saturated	[0.2] 0.2 [0.45] 0.5	H9	Moderate root content	Medium brown	
	SS3			[1.05] 1.0 [1.25] 1.25 [1.5] 1.5				
	SS4			[1.55] 1.55 [0.35] 1.9	H10	Minor fibres	Black	
				2.0 2.5 3.0 3.5 4.0	1.90m Obstruction / Rock			
**1-From hand held GPS, 2-Estimated from google maps or 3-Surveyed with theodolite.				General notes / Well Head Protection / Plan & Section Sketches				

Borehole/ Standpipe Design & Completion	Soil (S) / Water (W) / Vapour (V) Sampling			Depth in metres below ground level & [Thickness] 	INVESTIGATION POINT LOG NUMBER Client, Project, Location Minerex work item Page No. Date & time drilled / formed: Logged by (drawn by) [checked by]: Drilling / Trial pitting co. & equipment Minerex Doc. Ref. Irish Grid (IG)** Geological description VON POST VALUE PEAT DESCRIPTION COLOUR STIFFNESS	GC114										
	Sample number & interval (mbGL) (Sample 10 kg minimum)	Shear Vane Testing values (shear strength in kilopascals (kPa))	Groundwater occurrence (See legend for symbols used for dry, damp and wet)			Client, Project, Location JOD/SPR, Barnesmore, Donegal										
	Red line = Single channel sample (from field) Blue line = Composite sample (generated in office or lab) Green line = Grab sample (acquired on site)					Minerex work item 3006-A1										
						Page No. Page 1 of 1										
						Date & time drilled / formed: 02/07/19										
						Logged by (drawn by) [checked by]: Gero Jahns (GJ) [JC]										
						Drilling / Trial pitting co. & equipment Gouge core										
						Minerex Doc. Ref. 3006-024.ppt										
						Irish Grid (IG)** IH 04371 82316 (1)										
						Geological description										
						VON POST VALUE	PEAT DESCRIPTION	COLOUR	STIFFNESS							
				Depth in metres below ground level & [Thickness] 	INVESTIGATION POINT LOG NUMBER Client, Project, Location Minerex work item Page No. Date & time drilled / formed: Logged by (drawn by) [checked by]: Drilling / Trial pitting co. & equipment Minerex Doc. Ref. Irish Grid (IG)** Geological description VON POST VALUE PEAT DESCRIPTION COLOUR STIFFNESS	Acrotelm										
						H8	High root content	Medium brown								
						H9	Moderate root content	Dark brown								
						H10	Minor fibres	Dark brown								
						H10	Minor fibres	Medium brown								
						3.50m Obstruction / Rock										
**1-From hand held GPS, 2-Estimated from google maps or 3-Surveyed with theodolite.						General notes / Well Head Protection / Plan & Section Sketches										

Borehole/ Standpipe Design & Completion	Soil (S) / Water (W) / Vapour (V) Sampling				INVESTIGATION POINT LOG NUMBER Client, Project, Location Minerex work item Page No. Date & time drilled / formed: Logged by (drawn by) [checked by]: Drilling / Trial pitting co. & equipment Minerex Doc. Ref. Irish Grid (IG)** Geological description VON POST VALUE PEAT DESCRIPTION COLOUR STIFFNESS	GC115	
	Sample number & interval (mbGL) <i>(Sample 10 kg minimum)</i>	Shear Vane Testing values (shear strength in kilopascals (kPa))	Groundwater occurrence <i>(See legend for symbols used for dry, damp and wet)</i>			Depth in metres below ground level & [Thickness]	Geology (graphical log)
	Red line = Single channel sample (from field) Blue line = Composite sample (generated in office or lab) Green line = Grab sample (acquired on site)	Saturated				[0.5]	H8
						[0.5]	H9
						[1.6]	H9-10
						2.0	
						2.5	
						2.6	
						3.0	2.60m Obstruction / Rock
						3.5	
						4.0	
**1-From hand held GPS, 2-Estimated from google maps or 3-Surveyed with theodolite.				General notes / Well Head Protection / Plan & Section Sketches			

Borehole/ Standpipe Design & Completion	Soil (S) / Water (W) / Vapour (V) Sampling			INVESTIGATION POINT LOG NUMBER Client, Project, Location Minerex work item Page No. Date & time drilled / formed: Logged by (drawn by) [checked by]: Drilling / Trial pitting co. & equipment Minerex Doc. Ref. Irish Grid (IG)** Geological description VON POST VALUE PEAT DESCRIPTION COLOUR STIFFNESS	GC116	
	Sample number & interval (mbGL) (Sample 10 kg minimum)	Shear Vane Testing values (shear strength in kilopascals (kPa))	Groundwater occurrence (See legend for symbols used for dry, damp and wet)		Depth in metres below ground level & [Thickness]	Geology (graphical log)
	Red line = Single channel sample (from field)				[0.1]	Acrotelm
	Blue line = Composite sample (generated in office or lab)				0.1	H8
	Green line = Grab sample (acquired on site)				[0.4]	Moderate root content
			Saturated		0.4	Medium brown
	SS1	10, 9, 9			0.5	H9-10
	SS2				[0.5]	Moderate root content
	SS3				1.0	Minor fibres
					[0.3]	Dark brown/black
					1.3	1.30m Obstruction / Rock
					1.5	
					2.0	
					2.5	
					3.0	
					3.5	
					4.0	
**1-From hand held GPS, 2-Estimated from google maps or 3-Surveyed with theodolite.				General notes / Well Head Protection / Plan & Section Sketches		

Borehole/ Standpipe Design & Completion	Soil (S) / Water (W) / Vapour (V) Sampling			<p>Geology (graphical log)</p> <p>Depth in metres below ground level & [Thickness]</p> <p>Groundwater occurrence (See legend for symbols used for dry, damp and wet)</p> <p>Shear Vane Testing values (shear strength in kilopascals (kPa))</p> <p>Sample number & interval (mbGL) (Sample 10 kg minimum)</p> <p>Red line = Single channel sample (from field) Blue line = Composite sample (generated in office or lab) Green line = Grab sample (acquired on site)</p>	INVESTIGATION POINT LOG NUMBER		GC117		
	Client, Project, Location		JOD/SPR, Barnesmore, Donegal						
	Minerex work item		3006-A1						
	Page No.		Page 1 of 1						
	Date & time drilled / formed:		03/07/19						
	Logged by (drawn by) [checked by]:		Gero Jahns (GJ) [JC]						
	Drilling / Trial pitting co. & equipment		Gouge core						
	Minerex Doc. Ref.		3006-024.ppt						
	Irish Grid (IG)**		IH 04994 83578 (1)						
	Geological description				VON POST VALUE	PEAT DESCRIPTION	COLOUR	STIFFNESS	
			Damp Wet	[0.1] 0.1 [0.2] [0.4] 0.5 [0.6] 1.0 1.1	H9	Moderate root content	Medium brown		
			Saturated	H9-10	Minor root content	Medium brown			
				1.5 2.0 2.5 3.0 3.5 4.0	1.10m Obstruction / Rock				
**1-From hand held GPS, 2-Estimated from google maps or 3-Surveyed with theodolite.				General notes / Well Head Protection / Plan & Section Sketches					

Borehole/ Standpipe Design & Completion	Soil (S) / Water (W) / Vapour (V) Sampling				INVESTIGATION POINT LOG NUMBER Client, Project, Location Minerex work item Page No. Date & time drilled / formed: Logged by (drawn by) [checked by]: Drilling / Trial pitting co. & equipment Minerex Doc. Ref. Irish Grid (IG)** Geological description VON POST VALUE PEAT DESCRIPTION COLOUR STIFFNESS	GC118		
	Sample number & interval (mbGL) (Sample 10 kg minimum)	Shear Vane Testing values (shear strength in kilopascals (kPa))	Groundwater occurrence (See legend for symbols used for dry, damp and wet)		VON POST VALUE	PEAT DESCRIPTION	COLOUR	STIFFNESS
	Red line = Single channel sample (from field)				[0.1]	Acrotelm		
	Blue line = Composite sample (generated in office or lab)				0.1	H8	Moderate root content	Dark brown/black
	Green line = Grab sample (acquired on site)				0.2			
			Damp Wet Saturated		0.25			
					0.35			
					0.5	H9	Minor root content	Dark brown
					[0.6]			
					1.0	H9		Medium brown
					1.1	H9-10		Brown/beige
					1.5	1.10m Rock		
					2.0			
					2.5			
					3.0			
					3.5			
					4.0			
**1-From hand held GPS, 2-Estimated from google maps or 3-Surveyed with theodolite.				General notes / Well Head Protection / Plan & Section Sketches				

Borehole/ Standpipe Design & Completion	Soil (S) / Water (W) / Vapour (V) Sampling			Depth in metres below ground level & [Thickness] 	INVESTIGATION POINT LOG NUMBER		GC119		
	Sample number & interval (mbGL) (Sample 10 kg minimum)		Shear Vane Testing values (shear strength in kilopascals (kPa))		Client, Project, Location		JOD/SPR, Barnesmore, Donegal		
	Minerex work item		3006-A1		Page No.		Page 1 of 1		
	Date & time drilled / formed:		03/07/19		Logged by (drawn by) [checked by]:		Gero Jahns (GJ) [JC]		
	Drilling / Trial pitting co. & equipment		Gouge core		Minerex Doc. Ref.		3006-024.ppt		
	Irish Grid (IG)**		IH 05097 83593 (1)		Geological description				
	VON POST VALUE		PEAT DESCRIPTION		COLOUR		STIFFNESS		
**1-From hand held GPS, 2-Estimated from google maps or 3-Surveyed with theodolite.			General notes / Well Head Protection / Plan & Section Sketches						

Borehole/ Standpipe Design & Completion	Soil (S) / Water (W) / Vapour (V) Sampling				INVESTIGATION POINT LOG NUMBER		GC120			
	Sample number & interval (mbGL) (Sample 10 kg minimum)	Shear Vane Testing values (shear strength in kilopascals (kPa))	Groundwater occurrence (See legend for symbols used for dry, damp and wet)		Client, Project, Location	JOD/SPR, Barnesmore, Donegal				
	Red line = Single channel sample (from field)				Minerex work item	3006-A1				
	Blue line = Composite sample (generated in office or lab)				Page No.	Page 1 of 1				
	Green line = Grab sample (acquired on site)				Date & time drilled / formed:	03/07/19				
					Logged by (drawn by) [checked by]:	Gero Jahns (GJ) [JC]				
					Drilling / Trial pitting co. & equipment	Gouge core				
					Minerex Doc. Ref.	3006-024.ppt				
					Irish Grid (IG)**	IH 05050 83533 (1)				
					Geological description					
					VON POST VALUE	PEAT DESCRIPTION	COLOUR	STIFFNESS		
				0.10	H8-9	Moderate root content	Medium brown			
				0.5	H9	Moderate root content	Medium brown			
				1.0						
				1.5	H9-10	Moderate root content	Medium brown			
				2.0						
				2.5						
				2.85		2.85m Obstruction / Rock				
				3.0						
				3.5						
				4.0						
**1-From hand held GPS, 2-Estimated from google maps or 3-Surveyed with theodolite.				General notes / Well Head Protection / Plan & Section Sketches						

Borehole/ Standpipe Design & Completion	Soil (S) / Water (W) / Vapour (V) Sampling			<p>Depth in metres below ground level & [Thickness]</p> <p>Geology (graphical log)</p>	INVESTIGATION POINT LOG NUMBER		GC121				
	Sample number & interval (mbGL) (Sample 10 kg minimum)	Shear Vane Testing values (shear strength in kilopascals (kPa))	Groundwater occurrence (See legend for symbols used for dry, damp and wet)		Client, Project, Location	JOD/SPR, Barnesmore, Donegal					
	<p>Red line = Single channel sample (from field)</p> <p>Blue line = Composite sample (generated in office or lab)</p> <p>Green line = Grab sample (acquired on site)</p>				Minerex work item	3006-A1					
					Page No.	Page 1 of 1					
					Date & time drilled / formed:	03/07/19					
					Logged by (drawn by) [checked by]:	Gero Jahns (GJ) [JC]					
					Drilling / Trial pitting co. & equipment	Gouge core					
					Minerex Doc. Ref.	3006-024.ppt					
					Irish Grid (IG)**	IH 04155 83768 (1)					
					Geological description						
					VON POST VALUE	PEAT DESCRIPTION	COLOUR	STIFFNESS			
			Damp 		0.2	H8	Moderate root content	Dark brown			
					0.3	H9	Minor root content	Medium brown			
					0.5	H9	Minor root content	Dark brown			
					1.0	H9-10	Moderate root content	Dark brown/black			
					1.5						
					2.0						
					2.1						
						2.10m Obstruction / Rock					
**1-From hand held GPS, 2-Estimated from google maps or 3-Surveyed with theodolite.				General notes / Well Head Protection / Plan & Section Sketches							

Borehole/ Standpipe Design & Completion	Soil (S) / Water (W) / Vapour (V) Sampling			Geology (graphical log)	INVESTIGATION POINT LOG NUMBER	GC122 (SP107)	
	Sample number & interval (mbGL) (Sample 10 kg minimum)	Shear Vane Testing values (shear strength in kilopascals (kPa))	Groundwater occurrence (See legend for symbols used for dry, damp and wet)			Client, Project, Location	JOD/SPR, Barnesmore, Donegal
Ground level	Upstand 1.03m	Red line = Single channel sample (from field) Blue line = Composite sample (generated in office or lab) Green line = Grab sample (acquired on site)	Shear Vane Testing values (shear strength in kilopascals (kPa))	Damp Saturated	Depth in metres below ground level & [Thickness]	Minerex work item	3006-A1
Black coloured 17mm ID/33.5mm OD PVC casing				[0.15] 0.15	Acrotelm	Date & time drilled / formed:	03/07/19
1.00m = End of Installation (EOI)				[0.35] 0.35	H8	Logged by (drawn by) [checked by]:	Gero Jahns (GJ) [JC]
				0.5	H9	Drilling / Trial pitting co. & equipment	Gouge core
				[1.0]		Minerex Doc. Ref.	3006-024.ppt
				1.0		Irish Grid (IG)**	IH 04188 83750 (1)
				1.5		Geological description	
				[1.1]		VON POST VALUE	PEAT DESCRIPTION
				2.0		COLOUR	STIFFNESS
				2.5			
				2.6	H10		
				[0.3]		Fibrous ie minor root content	Medium brown
				2.9	H10	Minor root content	Dark brown
				3.0	2.90m Obstruction / Rock		
				3.5			
				4.0			
**1-From hand held GPS, 2-Estimated from google maps or 3-Surveyed with theodolite.				General notes / Well Head Protection / Plan & Section Sketches			

Borehole/ Standpipe Design & Completion	Soil (S) / Water (W) / Vapour (V) Sampling			Geology (graphical log)	INVESTIGATION POINT LOG NUMBER		GC123				
	Sample number & interval (mbGL) (Sample 10 kg minimum)	Shear Vane Testing values (shear strength in kilopascals (kPa))	Groundwater occurrence (See legend for symbols used for dry, damp and wet)		Client, Project, Location		JOD/SPR, Barnesmore, Donegal				
	Red line = Single channel sample (from field)		Groundwater occurrence (See legend for symbols used for dry, damp and wet)		Minerex work item		3006-A1				
	Blue line = Composite sample (generated in office or lab)				Page No.		Page 1 of 1				
	Green line = Grab sample (acquired on site)				Date & time drilled / formed:		03/07/19				
	Logged by (drawn by) [checked by]:				Gero Jahns (GJ) [JC]						
	Drilling / Trial pitting co. & equipment				Gouge core						
	Minerex Doc. Ref.				Minerex Doc. Ref.		3006-024.ppt				
	Irish Grid (IG)**				Irish Grid (IG)**		IH 04152 83726 (1)				
					Geological description						
					VON POST VALUE	PEAT DESCRIPTION	COLOUR	STIFFNESS			
					[0.15]	Acrotelm					
					0.15	H8	Moderate root content	Dark brown			
					0.3						
					[0.35]						
					0.5	H9	Minor root content	Dark brown			
					[0.65]						
					1.0						
					1.15						
						1.15m Obstruction / Rock					
					1.5						
					2.0						
					2.5						
					3.0						
					3.5						
					4.0						
**1-From hand held GPS, 2-Estimated from google maps or 3-Surveyed with theodolite.				General notes / Well Head Protection / Plan & Section Sketches							

Borehole/ Standpipe Design & Completion	Soil (S) / Water (W) / Vapour (V) Sampling			<p>Geology (graphical log)</p> <p>Depth in metres below ground level & [Thickness]</p> <p>Groundwater occurrence (See legend for symbols used for dry, damp and wet)</p>	INVESTIGATION POINT LOG NUMBER		GC124	
	Sample number & interval (mbGL) (Sample 10 kg minimum)	Shear Vane Testing values (shear strength in kilopascals (kPa))	Groundwater occurrence (See legend for symbols used for dry, damp and wet)		Client, Project, Location		JOD/SPR, Barnesmore, Donegal	
	Red line = Single channel sample (from field) Blue line = Composite sample (generated in office or lab) Green line = Grab sample (acquired on site)		Damp 		Minerex work item		3006-A1	
					Page No.		Page 1 of 1	
					Date & time drilled / formed:		03/07/19	
					Logged by (drawn by) [checked by]:		Gero Jahns (GJ) [JC]	
					Drilling / Trial pitting co. & equipment		Gouge core	
					Minerex Doc. Ref.		3006-024.ppt	
					Irish Grid (IG)**		IH 04142 83700 (1)	
					Geological description			
				VON POST VALUE	PEAT DESCRIPTION	COLOUR	STIFFNESS	
					H8	Moderate root content	Medium brown	
					H9	Minor root content	Dark brown	
					0.90m Obstruction / Rock			
**1-From hand held GPS, 2-Estimated from google maps or 3-Surveyed with theodolite.				General notes / Well Head Protection / Plan & Section Sketches				

Borehole/ Standpipe Design & Completion	Soil (S) / Water (W) / Vapour (V) Sampling			INVESTIGATION POINT LOG NUMBER Client, Project, Location Minerex work item Page No. Date & time drilled / formed: Logged by (drawn by) [checked by]: Drilling / Trial pitting co. & equipment Minerex Doc. Ref. Irish Grid (IG)** Geological description VON POST VALUE PEAT DESCRIPTION COLOUR STIFFNESS	GC124	
	Sample number & interval (mbGL) (Sample 10 kg minimum)	Shear Vane Testing values (shear strength in kilopascals (kPa))	Groundwater occurrence (See legend for symbols used for dry, damp and wet)		Depth in metres below ground level & [Thickness]	Geology (graphical log)
	Red line = Single channel sample (from field)				[0.1]	Acrotelm
	Blue line = Composite sample (generated in office or lab)		Damp  Wet		0.1	H9
	Green line = Grab sample (acquired on site)				[0.2]	Moderate root content
					0.5	Medium brown
					1.0	
					1.3	
					1.5	1.30m Obstruction / Rock
					2.0	
					2.5	
					3.0	
					3.5	
					4.0	
**1-From hand held GPS, 2-Estimated from google maps or 3-Surveyed with theodolite.				General notes / Well Head Protection / Plan & Section Sketches		

Borehole/ Standpipe Design & Completion	Soil (S) / Water (W) / Vapour (V) Sampling			Depth in metres below ground level & [Thickness]	Geology (graphical log)	INVESTIGATION POINT LOG NUMBER	GC126 (SP108)			
	Sample number & interval (mbGL) (Sample 10 kg minimum)	Shear Vane Testing values (shear strength in kilopascals (kPa))	Groundwater occurrence (See legend for symbols used for dry, damp and wet)				Client, Project, Location	JOD/SPR, Barnesmore, Donegal		
Ground level	Upstand 1.12m	Red line = Single channel sample (from field) Blue line = Composite sample (generated in office or lab) Green line = Grab sample (acquired on site)					Minerex work item	3006-A1		
	Black coloured 17mm ID/33.5mm OD PVC casing		Damp Wet	[0.5] 0.3 0.5 1.0	H3 H4	Moderate root content Minor root content	VON POST VALUE	PEAT DESCRIPTION	COLOUR	STIFFNESS
1.00m = End of Installation (EOI)				1.5 2.0 2.5 3.0 3.5 4.0	1.00m Obstruction / Rock					
**1-From hand held GPS, 2-Estimated from google maps or 3-Surveyed with theodolite.				General notes / Well Head Protection / Plan & Section Sketches Could not get core out due to slippage ie peat highly saturated						

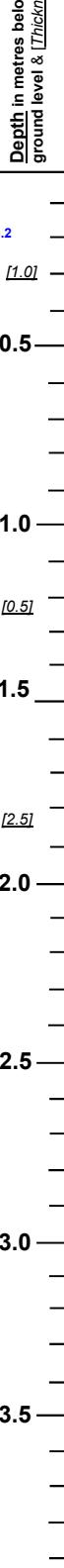
Borehole/ Standpipe Design & Completion	Soil (S) / Water (W) / Vapour (V) Sampling				INVESTIGATION POINT LOG NUMBER Client, Project, Location Minerex work item Page No. Date & time drilled / formed: Logged by (drawn by) [checked by]: Drilling / Trial pitting co. & equipment Minerex Doc. Ref. Irish Grid (IG)** Geological description VON POST VALUE PEAT DESCRIPTION COLOUR STIFFNESS	GC127		
	Sample number & interval (mbGL) (Sample 10 kg minimum)	Shear Vane Testing values (shear strength in kilopascals (kPa))	Groundwater occurrence (See legend for symbols used for dry, damp and wet)	Depth in metres below ground level & [Thickness]				
	Red line = Single channel sample (from field)							
	Blue line = Composite sample (generated in office or lab)							
	Green line = Grab sample (acquired on site)							
**1-From hand held GPS, 2-Estimated from google maps or 3-Surveyed with theodolite.			General notes / Well Head Protection / Plan & Section Sketches					

Borehole/ Standpipe Design & Completion		Soil (S) / Water (W) / Vapour (V) Sampling			Geology (graphical log)	INVESTIGATION POINT LOG NUMBER		GC128 (SP109)	
		Sample number & interval (mbGL) (Sample 10 kg minimum)				Client, Project, Location		JOD/SPR, Barnesmore, Donegal	
		Red line = Single channel sample (from field)	Shear Vane Testing values (shear strength in kilopascals (kPa))	Groundwater occurrence (See legend for symbols used for dry, damp and wet)		Minerex work item		3006-A1	
		Blue line = Composite sample (generated in office or lab)				Page No.		Page 1 of 1	
		Green line = Grab sample (acquired on site)				Date & time drilled / formed:		02/07/19	
						Logged by (drawn by) [checked by]:		Gero Jahns (GJ) [JC]	
						Drilling / Trial pitting co. & equipment		Gouge core	
						Minerex Doc. Ref.		3006-024.ppt	
						Irish Grid (IG)**		IH 03279 83053 (1)	
						Geological description			
					VON POST VALUE	PEAT DESCRIPTION	COLOUR	STIFFNESS	
					[0.5]	H8	Moderate root content	Medium brown	
					0.3				
		SS1		Damp ▼ Wet	0.5	H9	Moderate root content	Dark brown	
		SS2			1.0				
		SS3			1.5	H10	Minor fibres	Dark brown/black	
		SS4			2.0				
		SS5			2.5				
					3.0	2.50m Obstruction / Rock			
					3.5				
					4.0				
					General notes / Well Head Protection / Plan & Section Sketches				

**1-From hand held GPS, 2-Estimated from google maps or 3-Surveyed with theodolite.

Borehole/ Standpipe Design & Completion	Soil (S) / Water (W) / Vapour (V) Sampling			Geology (graphical log)	INVESTIGATION POINT LOG NUMBER	GC129	
	Sample number & interval (mbGL) (Sample 10 kg minimum)	Shear Vane Testing values (shear strength in kilopascals (kPa))	Groundwater occurrence (See legend for symbols used for dry, damp and wet)			Client, Project, Location	JOD/SPR, Barnesmore, Donegal
	Red line = Single channel sample (from field) Blue line = Composite sample (generated in office or lab) Green line = Grab sample (acquired on site)				Minerex work item	3006-A1	
					Page No.	Page 1 of 1	
					Date & time drilled / formed:	03/07/19	
					Logged by (drawn by) [checked by]:	Gero Jahns (GJ) [JC]	
					Drilling / Trial pitting co. & equipment	Gouge core	
					Minerex Doc. Ref.	3006-024.ppt	
					Irish Grid (IG)**	IH 03718 83088 (1)	
					Geological description		
					VON POST VALUE	PEAT DESCRIPTION	COLOUR
							STIFFNESS
			Damp  Wet	0.2 [0.5]	H7	Moderate root content	Dark brown
				0.5 [0.4]	H8	Minor root content	Dark brown
				0.9			
				1.0	0.90m Obstruction / Rock		
				1.5			
				2.0			
				2.5			
				3.0			
				3.5			
				4.0			
**1-From hand held GPS, 2-Estimated from google maps or 3-Surveyed with theodolite.				General notes / Well Head Protection / Plan & Section Sketches Could not get core out due to slippage ie peat highly saturated			

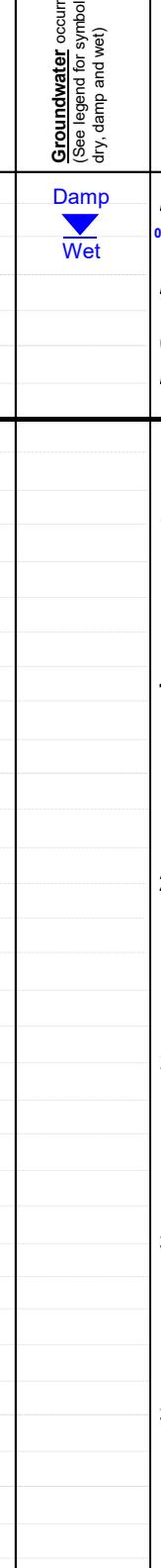
Borehole/ Standpipe Design & Completion	Soil (S) / Water (W) / Vapour (V) Sampling			Geology (graphical log)	INVESTIGATION POINT LOG NUMBER	GC130 (SP110)							
	Sample number & interval (mbGL) (Sample 10 kg minimum)	Shear Vane Testing values (shear strength in kilopascals (kPa))	Groundwater occurrence (See legend for symbols used for dry, damp and wet)			Client, Project, Location	JOD/SPR, Barnesmore, Donegal						
Ground level	Upstand 0.96m	Red line = Single channel sample (from field) Blue line = Composite sample (generated in office or lab) Green line = Grab sample (acquired on site)	Shear Vane Testing values (shear strength in kilopascals (kPa))	Damp  Wet	[0.25]	H8	Moderate root content	Dark brown/black					
	Black coloured 17mm ID/33.5mm OD PVC casing	SS1	14, 16, 16	0.2	H8	Moderate root content	Medium brown						
	1.00m = End of Installation (EOI)	SS2		[0.25]	0.5	H9	Minor root content	Dark brown					
				[0.7]	1.0			1.2	1.20m Obstruction / Rock				
				1.5				2.0					
				2.5				3.0					
				3.5				4.0					
**1-From hand held GPS, 2-Estimated from google maps or 3-Surveyed with theodolite.				General notes / Well Head Protection / Plan & Section Sketches									

Borehole/ Standpipe Design & Completion	Soil (S) / Water (W) / Vapour (V) Sampling			Depth in metres below ground level & [Thickness] 	INVESTIGATION POINT LOG NUMBER Client, Project, Location Minerex work item Page No. Date & time drilled / formed: Logged by (drawn by) [checked by]: Drilling / Trial pitting co. & equipment Minerex Doc. Ref. Irish Grid (IG)** Geological description VON POST VALUE PEAT DESCRIPTION COLOUR STIFFNESS	GC131	
	Sample number & interval (mbGL) (Sample 10 kg minimum)	Shear Vane Testing values (shear strength in kilopascals (kPa))	Groundwater occurrence (See legend for symbols used for dry, damp and wet)				
	Red line = Single channel sample (from field) Blue line = Composite sample (generated in office or lab) Green line = Grab sample (acquired on site)		Damp ▼ Wet		H8	Moderate root content	Medium brown
					H9	Minor root content	Medium brown
					H10	Minor root content	Medium/dark brown
					4.00m Obstruction / Rock		
**1-From hand held GPS, 2-Estimated from google maps or 3-Surveyed with theodolite.				General notes / Well Head Protection / Plan & Section Sketches			

Borehole/ Standpipe Design & Completion	Soil (S) / Water (W) / Vapour (V) Sampling			INVESTIGATION POINT LOG NUMBER Client, Project, Location Minerex work item Page No. Date & time drilled / formed: Logged by (drawn by) [checked by]: Drilling / Trial pitting co. & equipment Minerex Doc. Ref. Irish Grid (IG)** Geological description VON POST VALUE PEAT DESCRIPTION COLOUR STIFFNESS	GC132	
	Sample number & interval (mbGL) (Sample 10 kg minimum)	Shear Vane Testing values (shear strength in kilopascals (kPa))	Groundwater occurrence (See legend for symbols used for dry, damp and wet)		Depth in metres below ground level & [Thickness]	Geology (graphical log)
	Red line = Single channel sample (from field) Blue line = Composite sample (generated in office or lab) Green line = Grab sample (acquired on site)				[0.1]	Acrotelm
			Damp 		0.1	H8
		4.5, 5.5, 6			[0.4]	High root content
					0.5	H9
					[2.0]	Moderate root content
					1.0	
					1.5	
					2.0	H10
**1-From hand held GPS, 2-Estimated from google maps or 3-Surveyed with theodolite.					[0.55]	Minor root content
					2.55	2.55m Obstruction / Rock
					3.0	
					3.5	
					4.0	
General notes / Well Head Protection / Plan & Section Sketches						

Borehole/ Standpipe Design & Completion	Soil (S) / Water (W) / Vapour (V) Sampling			Geology (graphical log)	INVESTIGATION POINT LOG NUMBER	GC133		
	Sample number & interval (mbGL) (Sample 10 kg minimum)	Shear Vane Testing values (shear strength in kilopascals (kPa))	Groundwater occurrence (See legend for symbols used for dry, damp and wet)		Client, Project, Location	JOD/SPR, Barnesmore, Donegal		
	Red line = Single channel sample (from field) Blue line = Composite sample (generated in office or lab) Green line = Grab sample (acquired on site)		Damp 		Date & time drilled / formed:	03/07/19		
					Logged by (drawn by) [checked by]:	Gero Jahns (GJ) [JC]		
					Drilling / Trial pitting co. & equipment	Gouge core		
					Minerex Doc. Ref.	3006-024.ppt		
					Irish Grid (IG)**	IH 04231 82938 (1)		
					Geological description			
					VON POST VALUE	PEAT DESCRIPTION	COLOUR	
							STIFFNESS	
					[0.15]	H3	Moderate root content	Dark brown
					[0.25]	H7	Minor root content	Dark brown
					0.3	Peaty Loam		
					0.55	0.55m Obstruction / Rock		
					1.0			
					1.5			
					2.0			
					2.5			
					3.0			
					3.5			
					4.0			
**1-From hand held GPS, 2-Estimated from google maps or 3-Surveyed with theodolite.				General notes / Well Head Protection / Plan & Section Sketches Could not get core out due to slippage ie peat highly saturated				

Borehole/ Standpipe Design & Completion	Soil (S) / Water (W) / Vapour (V) Sampling			<p>Geology (graphical log)</p> <p>Depth in metres below ground level & [Thickness]</p> <p>Groundwater occurrence (See legend for symbols used for dry, damp and wet)</p>	INVESTIGATION POINT LOG NUMBER		GC134				
	Sample number & interval (mbGL) (Sample 10 kg minimum)	Shear Vane Testing values (shear strength in kilopascals (kPa))			Client, Project, Location	JOD/SPR, Barnesmore, Donegal					
	Red line = Single channel sample (from field) Blue line = Composite sample (generated in office or lab) Green line = Grab sample (acquired on site)				Minerex work item	3006-A1					
					Page No.	Page 1 of 1					
					Date & time drilled / formed:	03/07/19					
					Logged by (drawn by) [checked by]:	Gero Jahns (GJ) [JC]					
					Drilling / Trial pitting co. & equipment	Gouge core					
					Minerex Doc. Ref.	3006-024.ppt					
					Irish Grid (IG)**	IH 04220 82952 (1)					
					Geological description						
			VON POST VALUE	PEAT DESCRIPTION	COLOUR	STIFFNESS					
			[0.1]	Acrotelm							
			0.2	H8	Moderate root content	Medium brown					
			[1.2]								
			0.5								
			1.0	H9	Minor root content	Dark brown					
			1.25		1.25m Obstruction / Rock						
			1.5								
			2.0								
			2.5								
			3.0								
			3.5								
			4.0								
**1-From hand held GPS, 2-Estimated from google maps or 3-Surveyed with theodolite.				General notes / Well Head Protection / Plan & Section Sketches							

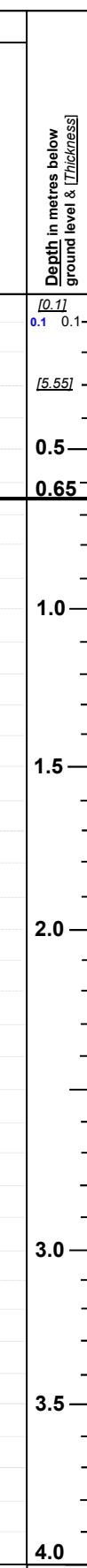
Borehole/ Standpipe Design & Completion	Soil (S) / Water (W) / Vapour (V) Sampling			Depth in metres below ground level & [Thickness] 	INVESTIGATION POINT LOG NUMBER		GC135				
	Sample number & interval (mbGL) (Sample 10 kg minimum)	Shear Vane Testing values (shear strength in kilopascals (kPa))	Groundwater occurrence (See legend for symbols used for dry, damp and wet)		Client, Project, Location	JOD/SPR, Barnesmore, Donegal					
	Red line = Single channel sample (from field) Blue line = Composite sample (generated in office or lab) Green line = Grab sample (acquired on site)				Minerex work item	3006-A1					
					Page No.	Page 1 of 1					
					Date & time drilled / formed:	03/07/19					
					Logged by (drawn by) [checked by]:	Gero Jahns (GJ) [JC]					
					Drilling / Trial pitting co. & equipment	Gouge core					
					Minerex Doc. Ref.	3006-024.ppt					
					Irish Grid (IG)**	IH 04223 83011 (1)					
					Geological description						
					VON POST VALUE	PEAT DESCRIPTION	COLOUR	STIFFNESS			
			Damp  Wet	[0.2] 0.2 [0.3] 0.3 0.5 [0.2] 0.2 0.7	H8 H8 H9	Moderate root content Minor root content Minor root content	Dark brown Medium brown Dark brown				
				1.0 1.5 2.0 2.5 3.0 3.5 4.0	0.70m Obstruction / Rock						
**1-From hand held GPS, 2-Estimated from google maps or 3-Surveyed with theodolite.				General notes / Well Head Protection / Plan & Section Sketches							

Borehole/ Standpipe Design & Completion	Soil (S) / Water (W) / Vapour (V) Sampling			<p>Geology (graphical log)</p> <p>Depth in metres below ground level & [Thickness]</p> <p>Groundwater occurrence (See legend for symbols used for dry, damp and wet)</p>	INVESTIGATION POINT LOG NUMBER		GC136				
	Sample number & interval (mbGL) (Sample 10 kg minimum)	Shear Vane Testing values (shear strength in kilopascals (kPa))			Client, Project, Location	JOD/SPR, Barnesmore, Donegal					
	<p>Red line = Single channel sample (from field)</p> <p>Blue line = Composite sample (generated in office or lab)</p> <p>Green line = Grab sample (acquired on site)</p>				Minerex work item	3006-A1					
					Page No.	Page 1 of 1					
					Date & time drilled / formed:	03/07/19					
					Logged by (drawn by) [checked by]:	Gero Jahns (GJ) [JC]					
					Drilling / Trial pitting co. & equipment	Gouge core					
					Minerex Doc. Ref.	3006-024.ppt					
					Irish Grid (IG)**	IH 04192 83022 (1)					
					Geological description						
					VON POST VALUE	PEAT DESCRIPTION	COLOUR	STIFFNESS			
					[0.1]	Acrotelm					
					0.1	H7	Fibrous ie high root content	Medium brown			
					[0.4]						
					0.3						
					0.5	H8	Moderate root content	Dark brown			
					[0.5]						
					1.0	H8	Moderate root content	Dark brown			
					[0.5]						
					1.5	H9-10	Minor root content	Dark brown/black			
					[0.35]						
					1.85	1.85m Obstruction / Rock					
					2.0						
					3.0						
					3.5						
					4.0						
**1-From hand held GPS, 2-Estimated from google maps or 3-Surveyed with theodolite.				General notes / Well Head Protection / Plan & Section Sketches							

Borehole/ Standpipe Design & Completion	Soil (S) / Water (W) / Vapour (V) Sampling			Geology (graphical log)	INVESTIGATION POINT LOG NUMBER	GC137 (SP111)	
	Sample number & interval (mbGL) (Sample 10 kg minimum)	Shear Vane Testing values (shear strength in kilopascals (kPa))	Groundwater occurrence (See legend for symbols used for dry, damp and wet)			Client, Project, Location	JOD/SPR, Barnesmore, Donegal
Ground level	Upstand 1.02m				Minerex work item	3006-A1	
					Page No.	Page 1 of 1	
					Date & time drilled / formed:	03/07/19	
					Logged by (drawn by) [checked by]:	Gero Jahns (GJ) [JC]	
					Drilling / Trial pitting co. & equipment	Gouge core	
					Minerex Doc. Ref.	3006-024.ppt	
					Irish Grid (IG)**	IH 04264 82987 (1)	
					Geological description		
					VON POST VALUE	PEAT DESCRIPTION	COLOUR
							STIFFNESS
			Damp ▼ Wet		H8	Moderate root content	Medium brown
				0.2 [1.0]			
				0.5			
				1.0			
				1.5 [0.5]	H9	Moderate root content	Medium brown
				2.0	H9-10	Minor fibres	Medium brown
				2.5	2.00m Obstruction / Rock		
				3.0			
				3.5			
				4.0			
**1-From hand held GPS, 2-Estimated from google maps or 3-Surveyed with theodolite.				General notes / Well Head Protection / Plan & Section Sketches			

Borehole/ Standpipe Design & Completion	Soil (S) / Water (W) / Vapour (V) Sampling			Geology (graphical log)	INVESTIGATION POINT LOG NUMBER	GC138 (SP112)	
	Sample number & interval (mbGL) (Sample 10 kg minimum)	Shear Vane Testing values (shear strength in kilopascals (kPa))	Groundwater occurrence (See legend for symbols used for dry, damp and wet)			Client, Project, Location	JOD/SPR, Barnesmore, Donegal
Ground level	Upstand 1.04m	Red line = Single channel sample (from field) Blue line = Composite sample (generated in office or lab) Green line = Grab sample (acquired on site)			Minerex work item	3006-A1	
	Black coloured 17mm ID/33.5mm OD PVC casing				Page No.	Page 1 of 1	
	1.00m = End of Installation (EOI)				Date & time drilled / formed:	03/07/19	
					Logged by (drawn by) [checked by]:	Gero Jahns (GJ) [JC]	
					Drilling / Trial pitting co. & equipment	Gouge core	
					Minerex Doc. Ref.	3006-024.ppt	
					Irish Grid (IG)**	IH 04671 83159 (1)	
					Geological description		
					VON POST VALUE	PEAT DESCRIPTION	COLOUR
							STIFFNESS
					[0.1]	Acrotelm	
			Damp Wet		0.1		
		SS1	13, 10, 14		[0.4]	H8	Moderate root content
		SS2			0.3		Medium brown
		SS3			[1.25]	H9	Moderate root content
		SS4			1.0		Medium brown
					1.5		
					1.75		
					2.0	1.75m Obstruction / Rock	
					2.5		
					3.0		
					3.5		
					4.0		
**1-From hand held GPS, 2-Estimated from google maps or 3-Surveyed with theodolite.				General notes / Well Head Protection / Plan & Section Sketches			

Borehole/ Standpipe Design & Completion	Soil (S) / Water (W) / Vapour (V) Sampling			<p>Depth in metres below ground level & [Thickness]</p> <p>Geology (graphical log)</p>	INVESTIGATION POINT LOG NUMBER		GC139				
	Sample number & interval (mbGL) (Sample 10 kg minimum)	Shear Vane Testing values (shear strength in kilopascals (kPa))	Groundwater occurrence (See legend for symbols used for dry, damp and wet)		Client, Project, Location	JOD/SPR, Barnesmore, Donegal					
	<p>Red line = Single channel sample (from field)</p> <p>Blue line = Composite sample (generated in office or lab)</p> <p>Green line = Grab sample (acquired on site)</p>				Minerex work item	3006-A1					
					Page No.	Page 1 of 1					
					Date & time drilled / formed:	03/07/19					
					Logged by (drawn by) [checked by]:	Gero Jahns (GJ) [JC]					
					Drilling / Trial pitting co. & equipment	Gouge core					
					Minerex Doc. Ref.	3006-024.ppt					
					Irish Grid (IG)**	IH 04653 83151 (1)					
					Geological description						
					VON POST VALUE	PEAT DESCRIPTION	COLOUR	STIFFNESS			
					0.1	H8	Fibrous ie high root content	Medium brown			
					[0.5]						
					0.5	H8-9	Moderate root content	Medium brown			
					[0.5]						
					1.0	H9	Moderate root content	Dark brown			
					[0.35]						
					1.35		1.35m Obstruction / Rock				
					1.5						
					2.0						
					3.0						
					3.5						
					4.0						
**1-From hand held GPS, 2-Estimated from google maps or 3-Surveyed with theodolite.				General notes / Well Head Protection / Plan & Section Sketches							

Borehole/ Standpipe Design & Completion	Soil (S) / Water (W) / Vapour (V) Sampling			 <p>Geology (graphical log)</p> <p>Depth in metres below ground level & [Thickness]</p> <table border="1"> <thead> <tr> <th>VON POST VALUE</th><th>PEAT DESCRIPTION</th><th>COLOUR</th><th>STIFFNESS</th></tr> </thead> <tbody> <tr> <td>[0.1]</td><td>H5</td><td>Moderate root content</td><td>Dark brown</td></tr> <tr> <td>0.1</td><td></td><td></td><td></td></tr> <tr> <td>[5.65]</td><td>H9</td><td>Moderate root content</td><td>Medium brown</td></tr> <tr> <td>0.5</td><td></td><td></td><td></td></tr> <tr> <td>0.65</td><td></td><td></td><td></td></tr> <tr> <td>1.0</td><td></td><td></td><td></td></tr> <tr> <td>1.5</td><td></td><td></td><td></td></tr> <tr> <td>2.0</td><td></td><td></td><td></td></tr> <tr> <td>3.0</td><td></td><td></td><td></td></tr> <tr> <td>3.5</td><td></td><td></td><td></td></tr> <tr> <td>4.0</td><td></td><td></td><td></td></tr> </tbody> </table> <p>Geological description</p>	VON POST VALUE	PEAT DESCRIPTION	COLOUR	STIFFNESS	[0.1]	H5	Moderate root content	Dark brown	0.1				[5.65]	H9	Moderate root content	Medium brown	0.5				0.65				1.0				1.5				2.0				3.0				3.5				4.0				GC141	
VON POST VALUE	PEAT DESCRIPTION	COLOUR	STIFFNESS																																																			
[0.1]	H5	Moderate root content	Dark brown																																																			
0.1																																																						
[5.65]	H9	Moderate root content	Medium brown																																																			
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Red line = Single channel sample (from field)	Blue line = Composite sample (generated in office or lab)	Green line = Grab sample (acquired on site)		Minerex work item	3006-A1																																																	
Blue line = Composite sample (generated in office or lab)				Page No.	Page 1 of 1																																																	
Green line = Grab sample (acquired on site)				Date & time drilled / formed:	04/07/19																																																	
				Logged by (drawn by) [checked by]:	Gero Jahns (GJ) [JC]																																																	
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				Minerex Doc. Ref.	3006-024.ppt																																																	
				Irish Grid (IG)**	IH 04668 83191 (1)																																																	
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		VON POST VALUE	PEAT DESCRIPTION	COLOUR	STIFFNESS																																																	

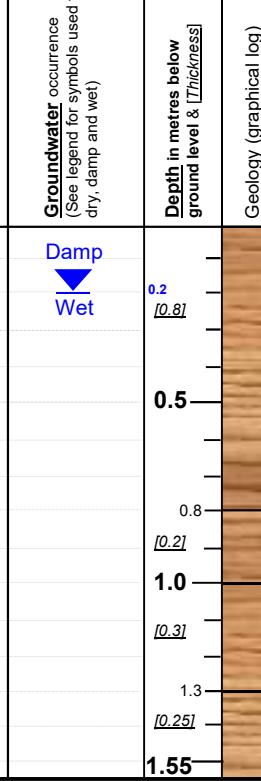
**1-From hand held GPS, 2-Estimated from google maps or 3-Surveyed with theodolite.

General notes / Well Head Protection / Plan & Section Sketches

Borehole/ Standpipe Design & Completion	Soil (S) / Water (W) / Vapour (V) Sampling			<p>Geology (graphical log)</p> <p>Depth in metres below ground level & [Thickness]</p> <p>Shear Vane Testing values (shear strength in kilopascals (kPa))</p> <p>Groundwater occurrence (See legend for symbols used for dry, damp and wet)</p>	INVESTIGATION POINT LOG NUMBER		GC142				
	Sample number & interval (mbGL) (Sample 10 kg minimum)				Client, Project, Location	JOD/SPR, Barnesmore, Donegal					
	<p>Red line = Single channel sample (from field)</p> <p>Blue line = Composite sample (generated in office or lab)</p> <p>Green line = Grab sample (acquired on site)</p>				Minerex work item	3006-A1					
					Page No.	Page 1 of 1					
					Date & time drilled / formed:	04/07/19					
					Logged by (drawn by) [checked by]:	Gero Jahns (GJ) [JC]					
					Drilling / Trial pitting co. & equipment	Gouge core					
					Minerex Doc. Ref.	3006-024.ppt					
					Irish Grid (IG)**	IH 04714 83131 (1)					
					Geological description						
					VON POST VALUE	PEAT DESCRIPTION	COLOUR	STIFFNESS			
			Damp Wet	[0.4] 0.2 0.4 0.5 [0.4] 0.8	H8 	Moderate root content	Medium brown				
				1.0 1.5 2.0 3.0 3.5 4.0	H9 	Minor root content	Dark brown				
					0.80m Obstruction / Rock						
**1-From hand held GPS, 2-Estimated from google maps or 3-Surveyed with theodolite.				General notes / Well Head Protection / Plan & Section Sketches							

Borehole/ Standpipe Design & Completion	Soil (S) / Water (W) / Vapour (V) Sampling			Depth in metres below ground level & [Thickness]	Geology (graphical log)	INVESTIGATION POINT LOG NUMBER	GC143
	Sample number & interval (mbGL) (Sample 10 kg minimum)	Shear Vane Testing values (shear strength in kilopascals (kPa))	Groundwater occurrence (See legend for symbols used for dry, damp and wet)			Client, Project, Location	JOD/SPR, Barnesmore, Donegal
	Red line = Single channel sample (from field) Blue line = Composite sample (generated in office or lab) Green line = Grab sample (acquired on site)		Damp Wet	[0.05] 0.05 [0.3] 0.35 0.25 0.5 0.6	H5 H8 H9	High root content Moderate root content Minor root content	Med brown Medium brown Medium brown
				1.0 1.5 2.0 3.0 3.5 4.0	0.60m Obstruction / Rock		
**1-From hand held GPS, 2-Estimated from google maps or 3-Surveyed with theodolite.				General notes / Well Head Protection / Plan & Section Sketches			

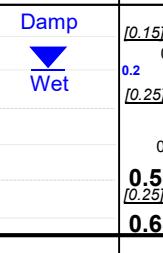
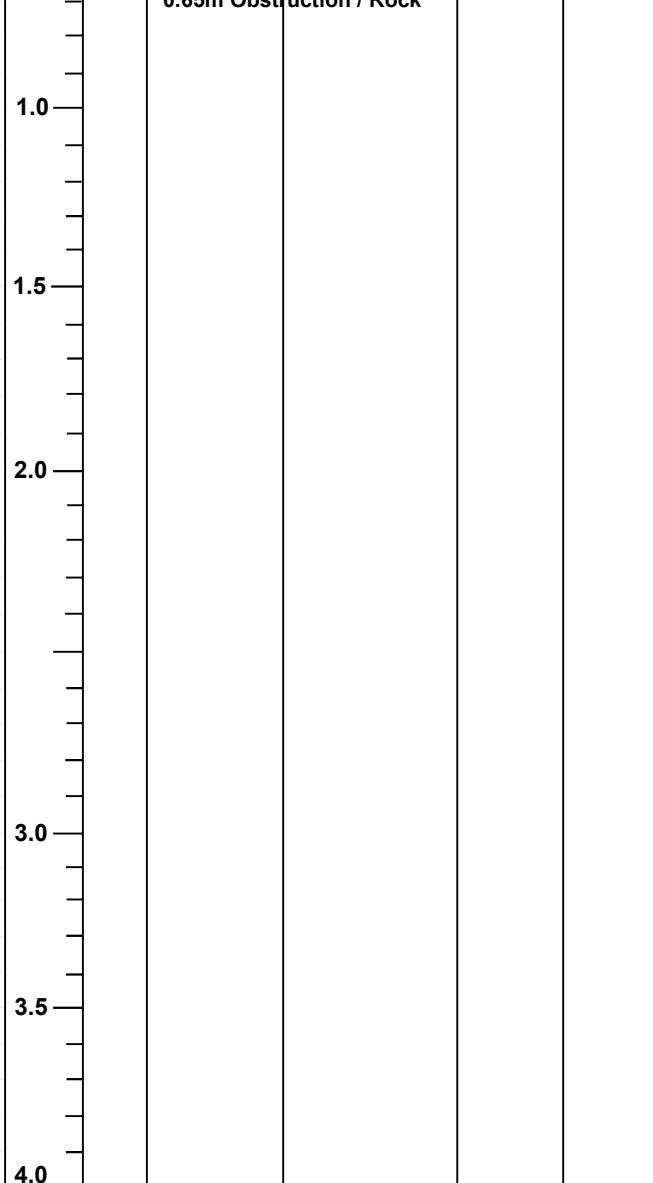
Borehole/ Standpipe Design & Completion	Soil (S) / Water (W) / Vapour (V) Sampling			INVESTIGATION POINT LOG NUMBER Client, Project, Location Minerex work item Page No. Date & time drilled / formed: Logged by (drawn by) [checked by]: Drilling / Trial pitting co. & equipment Minerex Doc. Ref. Irish Grid (IG)** Geological description VON POST VALUE PEAT DESCRIPTION COLOUR STIFFNESS 	GC145 (SP114)	
	Sample number & interval (mbGL) (Sample 10 kg minimum)	Shear Vane Testing values (shear strength in kilopascals (kPa))	Groundwater occurrence (See legend for symbols used for dry, damp and wet)	Depth in metres below ground level & [Thickness]	Geology (graphical log)	
	Red line = Single channel sample (from field) Blue line = Composite sample (generated in office or lab) Green line = Grab sample (acquired on site)	19, 17, 14	Damp ▼ Wet	[0.05] 0.05 [0.2] 0.2 [0.35] 0.35 0.4 0.5 [0.85] 0.85 1.0 1.25 [0.15] 0.15 [0.1] 0.1 1.5	Acrotelm H7 H8 H8 Peaty sand/H9	Moderate root content Moderate root content Moderate root content Dark brown/black 1.50m Obstruction / Rock
	Black coloured 17mm ID/33.5mm OD PVC casing			2.0 2.5 3.0 3.5 4.0		
	Upstand 1.00m					
	Ground level					
	1.00m = End of Installation (EOI)					
**1-From hand held GPS, 2-Estimated from google maps or 3-Surveyed with theodolite.			General notes / Well Head Protection / Plan & Section Sketches			

Borehole/ Standpipe Design & Completion	Soil (S) / Water (W) / Vapour (V) Sampling			 Groundwater occurrence (See legend for symbols used for dry, damp and wet)	INVESTIGATION POINT LOG NUMBER Client, Project, Location Minerex work item Page No. Date & time drilled / formed: Logged by (drawn by) [checked by]: Drilling / Trial pitting co. & equipment Minerex Doc. Ref. Irish Grid (IG)** Geological description VON POST VALUE PEAT DESCRIPTION COLOUR STIFFNESS	GC146			
	Sample number & interval (mbGL) <i>(Sample 10 kg minimum)</i>	Shear Vane Testing values (shear strength in kilopascals (kPa))	Depth in metres below ground level & [Thickness]						
	Red line = Single channel sample (from field) Blue line = Composite sample (generated in office or lab) Green line = Grab sample (acquired on site)	9, 9, 8	0.2 [0.8]			H8	Moderate root content	Medium brown	
			0.5			H9	Moderate root content	Dark brown	
			0.8 [0.2]			H9	Moderate to minor root content	Medium brown	
			1.0 [0.3]			H10	Minor root content	Dark brown	
			1.3 [0.25]			1.55	1.55m Obstruction / Rock		
			2.0						
			2.5						
			3.0						
			3.5						
			4.0						
**1-From hand held GPS, 2-Estimated from google maps or 3-Surveyed with theodolite.				General notes / Well Head Protection / Plan & Section Sketches					

Borehole/ Standpipe Design & Completion	Soil (S) / Water (W) / Vapour (V) Sampling			Geology (graphical log)	INVESTIGATION POINT LOG NUMBER	GC147 (SP115)		
	Sample number & interval (mbGL) (Sample 10 kg minimum)	Shear Vane Testing values (shear strength in kilopascals (kPa))	Groundwater occurrence (See legend for symbols used for dry, damp and wet)			Client, Project, Location	JOD/SPR, Barnesmore, Donegal	
Ground level						H7	Moderate root content	Medium brown
	SS1		Damp ▼ Wet	[0.25] 0.2 0.25 [0.75] 0.5 1.0	H8	Moderate root content	Dark brown	
	SS2							
1.00m = End of Installation (EOI)								
				1.5 2.0 2.5 3.0 3.5 4.0	1.00m Obstruction / Rock			
**1-From hand held GPS, 2-Estimated from google maps or 3-Surveyed with theodolite.				General notes / Well Head Protection / Plan & Section Sketches				

Borehole/ Standpipe Design & Completion	Soil (S) / Water (W) / Vapour (V) Sampling			<p>Geology (graphical log)</p> <p>Depth in metres below ground level & [Thickness]</p> <p>Groundwater occurrence (See legend for symbols used for dry, damp and wet)</p>	INVESTIGATION POINT LOG NUMBER		GC148				
	Sample number & interval (mbGL) (Sample 10 kg minimum)	Shear Vane Testing values (shear strength in kilopascals (kPa))			Client, Project, Location	JOD/SPR, Barnesmore, Donegal					
	<p>Red line = Single channel sample (from field)</p> <p>Blue line = Composite sample (generated in office or lab)</p> <p>Green line = Grab sample (acquired on site)</p>				Minerex work item	3006-A1					
					Page No.	Page 1 of 1					
					Date & time drilled / formed:	04/07/19					
					Logged by (drawn by) [checked by]:	Gero Jahns (GJ) [JC]					
					Drilling / Trial pitting co. & equipment	Gouge core					
					Minerex Doc. Ref.	3006-024.ppt					
					Irish Grid (IG)**	IH 03689 82285 (1)					
					Geological description						
					VON POST VALUE	PEAT DESCRIPTION	COLOUR	STIFFNESS			
		<p>Damp ▼ Wet</p>	<p>0.2 [0.5]</p> <p>0.5 [0.5]</p> <p>1.0 [0.35]</p> <p>1.35</p> <p>2.0</p> <p>2.5</p> <p>3.0</p> <p>3.5</p> <p>4.0</p>		H8	Moderate root content	Medium brown				
					H9	Moderate root content	Dark brown				
					H10	Minor root content	Dark brown				
					1.35m Obstruction / Rock						
					General notes / Well Head Protection / Plan & Section Sketches						
<p>**1-From hand held GPS, 2-Estimated from google maps or 3-Surveyed with theodolite.</p>											

Borehole/ Standpipe Design & Completion	Soil (S) / Water (W) / Vapour (V) Sampling			<p>Geology (graphical log)</p> <p>Depth in metres below ground level & [Thickness]</p> <p>Legend: Damp (red), Wet (blue), Dry (green).</p>	INVESTIGATION POINT LOG NUMBER		GC149				
	Sample number & interval (mbGL) (Sample 10 kg minimum)	Shear Vane Testing values (shear strength in kilopascals (kPa))	Groundwater occurrence (See legend for symbols used for dry, damp and wet)		Client, Project, Location	JOD/SPR, Barnesmore, Donegal					
	<p>Red line = Single channel sample (from field)</p> <p>Blue line = Composite sample (generated in office or lab)</p> <p>Green line = Grab sample (acquired on site)</p>				Minerex work item	3006-A1					
					Page No.	Page 1 of 1					
					Date & time drilled / formed:	04/07/19					
					Logged by (drawn by) [checked by]:	Gero Jahns (GJ) [JC]					
					Drilling / Trial pitting co. & equipment	Gouge core					
					Minerex Doc. Ref.	3006-024.ppt					
					Irish Grid (IG)**	IH 03688 82335 (1)					
					Geological description						
			VON POST VALUE	PEAT DESCRIPTION	COLOUR	STIFFNESS					
			[0.5]	H7	Moderate root content	Medium brown					
			0.5	H8	Moderate root content	Medium brown					
			[0.8]								
			1.0								
			1.3	H9	Minor root content	Dark brown					
			[0.2]								
			1.5		1.50m Obstruction / Rock						
**1-From hand held GPS, 2-Estimated from google maps or 3-Surveyed with theodolite.			General notes / Well Head Protection / Plan & Section Sketches								

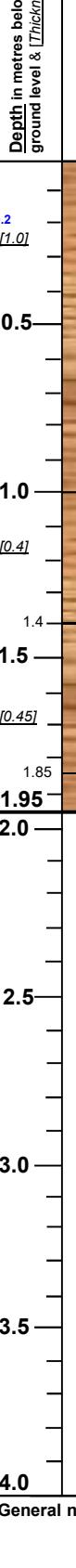
Borehole/ Standpipe Design & Completion	Soil (S) / Water (W) / Vapour (V) Sampling			Depth in metres below ground level & [Thickness]  Geology (graphical log)	INVESTIGATION POINT LOG NUMBER		GC150				
	Sample number & interval (mbGL) (Sample 10 kg minimum)	Shear Vane Testing values (shear strength in kilopascals (kPa))	Groundwater occurrence (See legend for symbols used for dry, damp and wet)		Client, Project, Location	JOD/SPR, Barnesmore, Donegal					
	Red line = Single channel sample (from field) Blue line = Composite sample (generated in office or lab) Green line = Grab sample (acquired on site)				Minerex work item	3006-A1					
					Page No.	Page 1 of 1					
					Date & time drilled / formed:	04/07/19					
					Logged by (drawn by) [checked by]:	Gero Jahns (GJ) [JC]					
					Drilling / Trial pitting co. & equipment	Gouge core					
					Minerex Doc. Ref.	3006-024.ppt					
					Irish Grid (IG)**	IH 03876 82274 (1)					
					Geological description						
					VON POST VALUE	PEAT DESCRIPTION	COLOUR	STIFFNESS			
				0.15	H2	Moderate root content	Med brown				
				0.2	H4	Moderate root content	Medium brown				
				0.4							
				0.5	H7	Minor root content	Medium brown				
				0.65							
				1.0							
				1.5							
				2.0							
				3.0							
				3.5							
				4.0							
**1-From hand held GPS, 2-Estimated from google maps or 3-Surveyed with theodolite.				General notes / Well Head Protection / Plan & Section Sketches							

Borehole/ Standpipe Design & Completion	Soil (S) / Water (W) / Vapour (V) Sampling			Geology (graphical log)	INVESTIGATION POINT LOG NUMBER	GC151 (SP116)		
	Sample number & interval (mbGL) (Sample 10 kg minimum)	Shear Vane Testing values (shear strength in kilopascals (kPa))	Groundwater occurrence (See legend for symbols used for dry, damp and wet)			Client, Project, Location	JOD/SPR, Barnesmore, Donegal	
Ground level	Upstand 1.00m	Red line = Single channel sample (from field) Blue line = Composite sample (generated in office or lab) Green line = Grab sample (acquired on site)			Minerex work item	3006-A1		
	Black coloured 17mm ID/33.5mm OD PVC casing		Damp ▼ Wet		Page No.	Page 1 of 1		
	1.00m = End of Installation (EOI)				Date & time drilled / formed:	04/07/19		
					Logged by (drawn by) [checked by]:	Gero Jahns (GJ) [JC]		
					Drilling / Trial pitting co. & equipment	Gouge core		
					Minerex Doc. Ref.	3006-024.ppt		
					Irish Grid (IG)**	IH 03891 82288 (1)		
					Geological description			
					VON POST VALUE	PEAT DESCRIPTION	COLOUR	
							STIFFNESS	
					[0.2]	H5	High root content	Dark brown
					0.2	H8	Moderate root content	Medium brown
					0.5	H8-9	Moderate root content	Medium brown
					[1.0]			
					1.0			
					1.5			
					[0.5]	H9	Minor root content	Dark brown
					2.0	H10	Minor fibres	Dark brown
					[0.5]			
					2.5			
						2.50m Obstruction / Rock		
					3.0			
					3.5			
					4.0			
**1-From hand held GPS, 2-Estimated from google maps or 3-Surveyed with theodolite.				General notes / Well Head Protection / Plan & Section Sketches				

Borehole/ Standpipe Design & Completion	Soil (S) / Water (W) / Vapour (V) Sampling			Geology (graphical log)	INVESTIGATION POINT LOG NUMBER		GC152																																																																																					
	Sample number & interval (mbGL) (Sample 10 kg minimum)				Client, Project, Location	JOD/SPR, Barnesmore, Donegal																																																																																						
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					Date & time drilled / formed:	04/07/19																																																																																						
					Logged by (drawn by) [checked by]:	Gero Jahns (GJ) [JC]																																																																																						
					Drilling / Trial pitting co. & equipment	Gouge core																																																																																						
					Minerex Doc. Ref.	3006-024.ppt																																																																																						
					Irish Grid (IG)**	IH 03835 82281 (1)																																																																																						
					Geological description																																																																																							
			<table border="1"> <thead> <tr> <th>VON POST VALUE</th> <th>PEAT DESCRIPTION</th> <th>COLOUR</th> <th>STIFFNESS</th> </tr> </thead> </table>						VON POST VALUE	PEAT DESCRIPTION	COLOUR	STIFFNESS																																																																																
VON POST VALUE	PEAT DESCRIPTION	COLOUR	STIFFNESS																																																																																									
			<table border="1"> <tr> <td>Damp</td> <td>H8</td> <td>Moderate root content</td> <td>Medium brown</td> </tr> <tr> <td> Wet</td> <td>[1.3] 0.3</td> <td></td> <td></td> </tr> <tr> <td></td> <td>0.5</td> <td></td> <td></td> </tr> <tr> <td></td> <td>1.0</td> <td></td> <td></td> </tr> <tr> <td></td> <td>1.3</td> <td></td> <td></td> </tr> <tr> <td></td> <td>[0.2] [0.3]</td> <td>H9</td> <td>Minor root content</td> </tr> <tr> <td></td> <td>1.5</td> <td>H9</td> <td>Minor root content</td> </tr> <tr> <td></td> <td>1.8</td> <td></td> <td>Dark brown</td> </tr> <tr> <td colspan="3"></td><td colspan="6"> <table border="1"> <tr> <td>2.0</td> <td>1.80m Obstruction / Rock</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>2.5</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>3.0</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>3.5</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>4.0</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </table> </td></tr> <tr> <td colspan="3"></td><td colspan="6">General notes / Well Head Protection / Plan & Section Sketches</td></tr> <tr> <td colspan="3">**1-From hand held GPS, 2-Estimated from google maps or 3-Surveyed with theodolite.</td><td colspan="6"></td></tr> </table>	Damp	H8	Moderate root content	Medium brown	 Wet	[1.3] 0.3				0.5				1.0				1.3				[0.2] [0.3]	H9	Minor root content		1.5	H9	Minor root content		1.8		Dark brown				<table border="1"> <tr> <td>2.0</td> <td>1.80m Obstruction / Rock</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>2.5</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>3.0</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>3.5</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>4.0</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </table>						2.0	1.80m Obstruction / Rock					2.5						3.0						3.5						4.0									General notes / Well Head Protection / Plan & Section Sketches						**1-From hand held GPS, 2-Estimated from google maps or 3-Surveyed with theodolite.								
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Borehole/ Standpipe Design & Completion	Soil (S) / Water (W) / Vapour (V) Sampling			<p>Geology (graphical log)</p> <p>Depth in metres below ground level & [Thickness]</p> <p>Legend: Damp (blue arrow), Wet (red line), Shear Vane Testing values (shear strength in kilopascals (kPa))</p> <p>Groundwater occurrence (See legend for symbols used for dry, damp and wet)</p>	INVESTIGATION POINT LOG NUMBER		GC153				
	Sample number & interval (mbGL) (Sample 10 kg minimum)				Client, Project, Location	JOD/SPR, Barnesmore, Donegal					
	<p>Red line = Single channel sample (from field)</p> <p>Blue line = Composite sample (generated in office or lab)</p> <p>Green line = Grab sample (acquired on site)</p>				Minerex work item	3006-A1					
					Page No.	Page 1 of 1					
					Date & time drilled / formed:	04/07/19					
					Logged by (drawn by) [checked by]:	Gero Jahns (GJ) [JC]					
					Drilling / Trial pitting co. & equipment	Gouge core					
					Minerex Doc. Ref.	3006-024.ppt					
					Irish Grid (IG)**	IH 03409 81854 (1)					
					Geological description						
					VON POST VALUE	PEAT DESCRIPTION	COLOUR	STIFFNESS			
<p>SS1</p> <p>SS2</p> <p>9, 10, 12</p>	<p>Damp Wet</p> <p>Shear Vane Testing values (shear strength in kilopascals (kPa))</p> <p>Groundwater occurrence (See legend for symbols used for dry, damp and wet)</p>	<p>0.2</p> <p>0.20</p> <p>0.5</p> <p>0.5</p> <p>0.70</p> <p>0.21</p> <p>0.9</p>	<p>H7</p> <p>H8</p> <p>H9</p> <p>0.90m Obstruction / Rock</p>	<p>Moderate root content</p> <p>Minor root content</p> <p>Minor root content</p> <p>0.90m Obstruction / Rock</p>	<p>Dark brown</p> <p>Dark brown</p> <p>Dark brown</p> <p></p>	<p></p> <p></p> <p></p> <p></p>	<p></p> <p></p> <p></p> <p></p>	<p></p> <p></p> <p></p> <p></p>			
<p>**1-From hand held GPS, 2-Estimated from google maps or 3-Surveyed with theodolite.</p>				<p>General notes / Well Head Protection / Plan & Section Sketches</p> <p>Sample taken on a mound surrounded by cut back peat and rocky outcrops</p>							

Borehole/ Standpipe Design & Completion	Soil (S) / Water (W) / Vapour (V) Sampling			Geology (graphical log)	INVESTIGATION POINT LOG NUMBER	GC154 (SP117)	
	Sample number & interval (mbGL) (Sample 10 kg minimum)	Shear Vane Testing values (shear strength in kilopascals (kPa))	Groundwater occurrence (See legend for symbols used for dry, damp and wet)		Client, Project, Location	JOD/SPR, Barnesmore, Donegal	
Ground level	Upstand 1.20m	Red line = Single channel sample (from field) Blue line = Composite sample (generated in office or lab) Green line = Grab sample (acquired on site)			Minerex work item	3006-A1	
					Page No.	Page 1 of 1	
					Date & time drilled / formed:	04/07/19	
					Logged by (drawn by) [checked by]:	Gero Jahns (GJ) [JC]	
					Drilling / Trial pitting co. & equipment	Gouge core	
					Minerex Doc. Ref.	3006-024.ppt	
					Irish Grid (IG)**	IH 03387 81858 (1)	
					Geological description		
					VON POST VALUE	PEAT DESCRIPTION	COLOUR
							STIFFNESS
	Black coloured 17mm ID/33.5mm OD PVC casing		Wet	0.1 [0.3]	H7	Moderate root content	Dark brown
				0.30	H8-9	Minor root content	Dark brown
				0.5 [0.6]			
				0.9			
				1.0	0.90m Obstruction / Rock		
				1.5			
				2.0			
				2.5			
				3.0			
				3.5			
				4.0			
**1-From hand held GPS, 2-Estimated from google maps or 3-Surveyed with theodolite.				General notes / Well Head Protection / Plan & Section Sketches			

Borehole/ Standpipe Design & Completion	Soil (S) / Water (W) / Vapour (V) Sampling				INVESTIGATION POINT LOG NUMBER Client, Project, Location Minerex work item Page No. Date & time drilled / formed: Logged by (drawn by) [checked by]: Drilling / Trial pitting co. & equipment Minerex Doc. Ref. Irish Grid (IG)** Geological description VON POST VALUE PEAT DESCRIPTION COLOUR STIFFNESS	GC155	
	Sample number & interval (mbGL) <i>(Sample 10 kg minimum)</i>	Shear Vane Testing values (shear strength in kilopascals (kPa))	Groundwater occurrence <i>(See legend for symbols used for dry, damp and wet)</i>			Depth in metres below ground level & [Thickness]	Geology (graphical log)
	Red line = Single channel sample (from field) Blue line = Composite sample (generated in office or lab) Green line = Grab sample (acquired on site)	19, 12, 6	Dry  Wet			0.2 [1.0]	H8
						0.5	Moderate root content
						1.0 [0.4]	Medium brown
						1.4	
						1.5 [0.45]	H9
						1.85	H9
						1.95	High root content
						2.0	Dark brown
					2.5	1.95m Obstruction / Rock	
					3.0		
					3.5		
					4.0		
**1-From hand held GPS, 2-Estimated from google maps or 3-Surveyed with theodolite.				General notes / Well Head Protection / Plan & Section Sketches			

Borehole/ Standpipe Design & Completion	Soil (S) / Water (W) / Vapour (V) Sampling			<p>Depth in metres below ground level & [Thickness]</p> <p>Geology (graphical log)</p>	INVESTIGATION POINT LOG NUMBER		GC156	
	Sample number & interval (mbGL) (Sample 10 kg minimum)	Shear Vane Testing values (shear strength in kilopascals (kPa))	Groundwater occurrence (See legend for symbols used for dry, damp and wet)		Client, Project, Location		JOD/SPR, Barnesmore, Donegal	
	Red line = Single channel sample (from field) Blue line = Composite sample (generated in office or lab) Green line = Grab sample (acquired on site)		Dry Wet		Minerex work item		3006-A1	
					Page No.		Page 1 of 1	
					Date & time drilled / formed:		04/07/19	
					Logged by (drawn by) [checked by]:		Gero Jahns (GJ) [JC]	
					Drilling / Trial pitting co. & equipment		Gouge core	
					Minerex Doc. Ref.		3006-024.ppt	
					Irish Grid (IG)**		IH 03373 81811 (1)	
					Geological description			
					VON POST VALUE	PEAT DESCRIPTION	COLOUR	STIFFNESS
					[0.1]	H7		Black
					[0.2]	H7	High root content	Light brown
		12, 19, 12			[0.4]			
					0.5	H8	Moderate root content	Medium brown
					[0.5]			
					1.0	H8	Moderate root content	Medium brown
					[1.0]			
					1.5			
					2.0	H9	Minor root content	Medium brown
					[0.4]			
					2.5			
					3.0	H9	Minor root content and pieces of timber	Dark brown
					3.5			
					3.65			
					4.0	3.65m Obstruction / Rock		
**1-From hand held GPS, 2-Estimated from google maps or 3-Surveyed with theodolite.				General notes / Well Head Protection / Plan & Section Sketches				

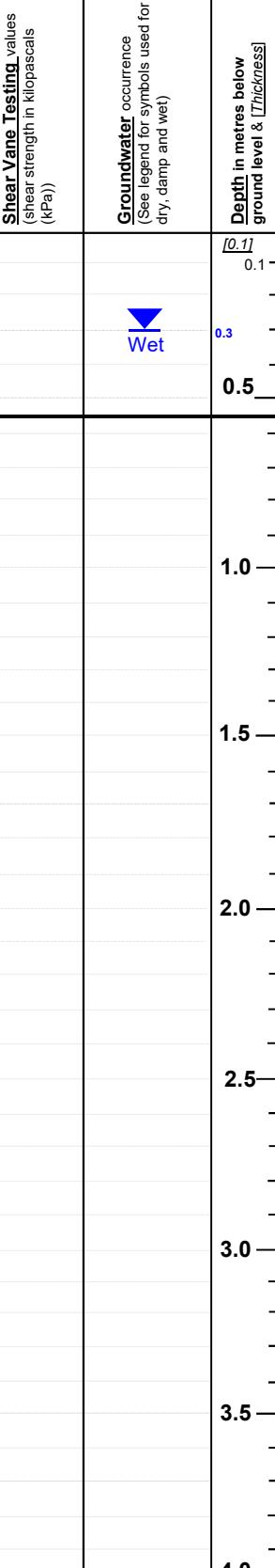
Borehole/ Standpipe Design & Completion	Soil (S) / Water (W) / Vapour (V) Sampling				INVESTIGATION POINT LOG NUMBER Client, Project, Location Minerex work item Page No. Date & time drilled / formed: Logged by (drawn by) [checked by]: Drilling / Trial pitting co. & equipment Minerex Doc. Ref. Irish Grid (IG)** Geological description VON POST VALUE PEAT DESCRIPTION COLOUR STIFFNESS	GC157	
	Sample number & interval (mbGL) (Sample 10 kg minimum)	Shear Vane Testing values (shear strength in kilopascals (kPa))	Groundwater occurrence (See legend for symbols used for dry, damp and wet)		Depth in metres below ground level & [Thickness]		Geology (graphical log)
	Red line = Single channel sample (from field)				[0.1]	H8	Moderate root content
	Blue line = Composite sample (generated in office or lab)				0.1		Dark brown
	Green line = Grab sample (acquired on site)				[0.2]	H8	Moderate root content
					0.3		Medium brown
					[0.2]	H8	
					0.5		Dark brown
					[0.5]		
					1.0		
**1-From hand held GPS, 2-Estimated from google maps or 3-Surveyed with theodolite.				[1.0]			
				1.5			
				2.0			
				[0.4]			
				2.5			
				3.0			
				3.5			
				4.0			
General notes / Well Head Protection / Plan & Section Sketches							

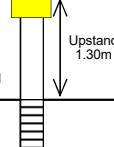
Borehole/ Standpipe Design & Completion	Soil (S) / Water (W) / Vapour (V) Sampling			<p>Depth in metres below ground level & [Thickness]</p> <p>Geology (graphical log)</p>	INVESTIGATION POINT LOG NUMBER		GC158				
	Sample number & interval (mbGL) (Sample 10 kg minimum)	Shear Vane Testing values (shear strength in kilopascals (kPa))	Groundwater occurrence (See legend for symbols used for dry, damp and wet)		Client, Project, Location	JOD/SPR, Barnesmore, Donegal					
	<p>Red line = Single channel sample (from field)</p> <p>Blue line = Composite sample (generated in office or lab)</p> <p>Green line = Grab sample (acquired on site)</p>				Minerex work item	3006-A1					
					Page No.	Page 1 of 1					
					Date & time drilled / formed:	04/07/19					
					Logged by (drawn by) [checked by]:	Gero Jahns (GJ) [JC]					
					Drilling / Trial pitting co. & equipment	Gouge core					
					Minerex Doc. Ref.	3006-024.ppt					
					Irish Grid (IG)**	IH 03460 81853 (1)					
					Geological description						
				VON POST VALUE	PEAT DESCRIPTION	COLOUR	STIFFNESS				
				[0.5]	H9	High root content	Dark brown				
				0.2							
				0.5	H10	Moderate root content	Dark brown				
				[0.25]							
					0.75m Obstruction / Rock						
				1.0							
				1.5							
				2.0							
				2.5							
				3.0							
				3.5							
				4.0							
<p>**1-From hand held GPS, 2-Estimated from google maps or 3-Surveyed with theodolite.</p>				General notes / Well Head Protection / Plan & Section Sketches							

Borehole/ Standpipe Design & Completion	Soil (S) / Water (W) / Vapour (V) Sampling			Geology (graphical log)	INVESTIGATION POINT LOG NUMBER	GC159		
	Sample number & interval (mbGL) (Sample 10 kg minimum)	Shear Vane Testing values (shear strength in kilopascals (kPa))	Groundwater occurrence (See legend for symbols used for dry, damp and wet)		Client, Project, Location	JOD/SPR, Barnesmore, Donegal		
	Red line = Single channel sample (from field) Blue line = Composite sample (generated in office or lab) Green line = Grab sample (acquired on site)				Minerex work item	3006-A1		
					Page No.	Page 1 of 1		
					Date & time drilled / formed:	04/07/19		
					Logged by (drawn by) [checked by]:	Gero Jahns (GJ) [JC]		
					Drilling / Trial pitting co. & equipment	Gouge core		
					Minerex Doc. Ref.	3006-024.ppt		
					Irish Grid (IG)**	IH 03820 81949 (1)		
					Geological description			
					VON POST VALUE	PEAT DESCRIPTION	COLOUR	STIFFNESS
			Wet	[0.2]	H8	Moderate root content	Medium brown	
				0.5		0.20m Obstruction / Rock		
				1.0				
				1.5				
				2.0				
				2.5				
				3.0				
				3.5				
				4.0				
**1-From hand held GPS, 2-Estimated from google maps or 3-Surveyed with theodolite.				General notes / Well Head Protection / Plan & Section Sketches				

Borehole/ Standpipe Design & Completion	Soil (S) / Water (W) / Vapour (V) Sampling			Depth in metres below ground level & [Thickness]	Geology (graphical log)	INVESTIGATION POINT LOG NUMBER	GC160		
	Sample number & interval (mbGL) (Sample 10 kg minimum)	Shear Vane Testing values (shear strength in kilopascals (kPa))	Groundwater occurrence (See legend for symbols used for dry, damp and wet)			Client, Project, Location	JOD/SPR, Barnesmore, Donegal		
	Red line = Single channel sample (from field) Blue line = Composite sample (generated in office or lab) Green line = Grab sample (acquired on site)					Minerex work item	3006-A1		
						Page No.	Page 1 of 1		
						Date & time drilled / formed:	04/07/19		
						Logged by (drawn by) [checked by]:	Gero Jahns (GJ) [JC]		
						Drilling / Trial pitting co. & equipment	Gouge core		
						Minerex Doc. Ref.	3006-024.ppt		
						Irish Grid (IG)**	IH 03825 81964 (1)		
						Geological description			
						VON POST VALUE	PEAT DESCRIPTION	COLOUR	STIFFNESS
			Wet	[0.2]	H8	Moderate root content	Dark brown		
				0.5		0.20m Obstruction / Rock			
				1.0					
				1.5					
				2.0					
				2.5					
				3.0					
				3.5					
				4.0					
**1-From hand held GPS, 2-Estimated from google maps or 3-Surveyed with theodolite.				General notes / Well Head Protection / Plan & Section Sketches					

Borehole/ Standpipe Design & Completion	Soil (S) / Water (W) / Vapour (V) Sampling				INVESTIGATION POINT LOG NUMBER Client, Project, Location Minerex work item Page No. Date & time drilled / formed: Logged by (drawn by) [checked by]: Drilling / Trial pitting co. & equipment Minerex Doc. Ref. Irish Grid (IG)** Geological description VON POST VALUE PEAT DESCRIPTION COLOUR STIFFNESS	GC161	
	Sample number & interval (mbGL) (Sample 10 kg minimum)	Shear Vane Testing values (shear strength in kilopascals (kPa))	Groundwater occurrence (See legend for symbols used for dry, damp and wet)				
	Red line = Single channel sample (from field)						
	Blue line = Composite sample (generated in office or lab)						
	Green line = Grab sample (acquired on site)						
**1-From hand held GPS, 2-Estimated from google maps or 3-Surveyed with theodolite.			General notes / Well Head Protection / Plan & Section Sketches				

Borehole/ Standpipe Design & Completion	Soil (S) / Water (W) / Vapour (V) Sampling			 <p>Geology (graphical log)</p> <p>Depth in metres below ground level & [Thickness]</p> <p>VON POST VALUE PEAT DESCRIPTION COLOUR STIFFNESS</p>	INVESTIGATION POINT LOG NUMBER		GC162	
	Sample number & interval (mbGL) (Sample 10 kg minimum)	Shear Vane Testing values (shear strength in kilopascals (kPa))	Groundwater occurrence (See legend for symbols used for dry, damp and wet)		Client, Project, Location	JOD/SPR, Barnesmore, Donegal		
	Red line = Single channel sample (from field)				Minerex work item	3006-A1		
	Blue line = Composite sample (generated in office or lab)				Page No.	Page 1 of 1		
	Green line = Grab sample (acquired on site)				Date & time drilled / formed:	04/07/19		
					Logged by (drawn by) [checked by]:	Gero Jahns (GJ) [JC]		
					Drilling / Trial pitting co. & equipment	Gouge core		
					Minerex Doc. Ref.	3006-024.ppt		
					Irish Grid (IG)**	IH 03841 81923 (1)		
					Geological description			
					VON POST VALUE	PEAT DESCRIPTION	COLOUR	STIFFNESS
					0.1	H6	Moderate root content	Dark brown
					0.3	H7	Moderate root content	Dark brown
					0.5			
					1.0			
					1.5			
					2.0			
					2.5			
					3.0			
					3.5			
					4.0			
**1-From hand held GPS, 2-Estimated from google maps or 3-Surveyed with theodolite.				General notes / Well Head Protection / Plan & Section Sketches				

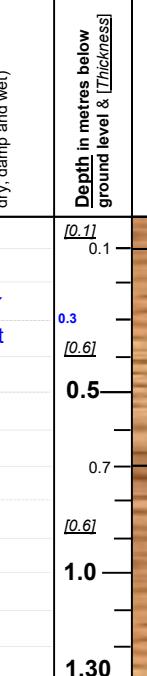
Borehole/ Standpipe Design & Completion	Soil (S) / Water (W) / Vapour (V) Sampling			Depth in metres below ground level & [Thickness]	Geology (graphical log)	INVESTIGATION POINT LOG NUMBER	GC163 (SP118)		
	Sample number & interval (mbGL) (Sample 10 kg minimum)	Shear Vane Testing values (shear strength in kilopascals (kPa))	Groundwater occurrence (See legend for symbols used for dry, damp and wet)				Client, Project, Location	JOD/SPR, Barnesmore, Donegal	
Ground level		Red line = Single channel sample (from field) Blue line = Composite sample (generated in office or lab) Green line = Grab sample (acquired on site)	SS1			[0.55] 0.2 0.5 0.55 [0.15] 0.7	H6 H7	Moderate root content Minor root content	Medium brown Dark brown
Black coloured 17mm ID / 33.5mm OD PVC casing						0.70m Obstruction / Rock			
0.70m = End of Installation (EOI)				1.0 1.5 2.0 2.5 3.0 3.5 4.0					
**1-From hand held GPS, 2-Estimated from google maps or 3-Surveyed with theodolite.				General notes / Well Head Protection / Plan & Section Sketches					

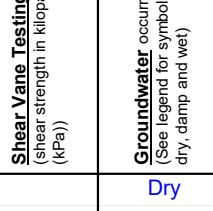
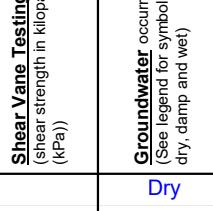
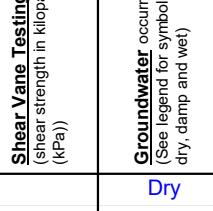
Borehole/Standpipe Design & Completion		Soil (S) / Water (W) / Vapour (V) Sampling			Geology (graphical log)	INVESTIGATION POINT LOG NUMBER	GC164	
Sample number & interval (mbGL) (Sample 10 kg minimum)	Shear Vane Testing values (shear strength in kilopascals (kPa))	Groundwater occurrence (See legend for symbols used for dry, damp and wet)	Depth in metres below ground level & [Thickness]	VON POST VALUE			PEAT DESCRIPTION	COLOUR
		Dry  Wet 	0.2 [0.55] 0.5 0.55 [0.45] 1.0 1.0 [0.7] 1.5 1.7 [0.3] 2.0 2.1 2.5 3.0 3.5 4.0	H7 H8 H9 H9 H10	High root content Moderate root content Moderate root content Minor root content Minor root content	Medium brown Dark brown Dark brown Dark brown Dark brown		
		Dry  Wet 	0.2 [0.55] 0.5 0.55 [0.45] 1.0 1.0 [0.7] 1.5 1.7 [0.3] 2.0 2.1 2.5 3.0 3.5 4.0	2.10m Obstruction / Rock				
				General notes / Well Head Protection / Plan & Section Sketches				
**1-From hand held GPS, 2-Estimated from google maps or 3-Surveyed with theodolite.								

**1-From hand held GPS, 2-Estimated from google maps or 3-Surveyed with theodolite.

General notes / Well Head Protection / Plan & Section Sketches

Borehole/ Standpipe Design & Completion	Soil (S) / Water (W) / Vapour (V) Sampling			Geology (graphical log)	INVESTIGATION POINT LOG NUMBER		GC165				
	Sample number & interval (mbGL) (Sample 10 kg minimum)	Shear Vane Testing values (shear strength in kilopascals (kPa))	Groundwater occurrence (See legend for symbols used for dry, damp and wet)		Client, Project, Location	JOD/SPR, Barnesmore, Donegal					
	<small>Red line = Single channel sample (from field) Blue line = Composite sample (generated in office or lab) Green line = Grab sample (acquired on site)</small>				Minerex work item	3006-A1					
					Page No.	Page 1 of 1					
					Date & time drilled / formed:	04/07/19					
					Logged by (drawn by) [checked by]:	Gero Jahns (GJ) [JC]					
					Drilling / Trial pitting co. & equipment	Gouge core					
					Minerex Doc. Ref.	3006-024.ppt					
					Irish Grid (IG)**	IH 03032 81643 (1)					
					Geological description						
				VON POST VALUE	PEAT DESCRIPTION	COLOUR	STIFFNESS				
			 Wet	0.1 [0.6]	H7	High root content	Medium brown				
				0.5 [0.4]	H8	High root content	Medium brown				
				1.0 [0.45]	H9	Moderate root content	Dark brown				
				1.45 1.5	1.45m Obstruction / Rock						
				2.0							
				2.5							
				3.0							
				3.5							
				4.0							
**1-From hand held GPS, 2-Estimated from google maps or 3-Surveyed with theodolite.				General notes / Well Head Protection / Plan & Section Sketches							

Borehole/ Standpipe Design & Completion	Soil (S) / Water (W) / Vapour (V) Sampling			 <p>Depth in metres below ground level & [Thickness]</p> <p>Geology (graphical log)</p>	INVESTIGATION POINT LOG NUMBER		GC166				
	Sample number & interval (mbGL) (Sample 10 kg minimum)	Shear Vane Testing values (shear strength in kilopascals (kPa))	Groundwater occurrence (See legend for symbols used for dry, damp and wet)		Client, Project, Location	JOD/SPR, Barnesmore, Donegal					
	Red line = Single channel sample (from field) Blue line = Composite sample (generated in office or lab) Green line = Grab sample (acquired on site)				Minerex work item	3006-A1					
					Page No.	Page 1 of 1					
					Date & time drilled / formed:	04/07/19					
					Logged by (drawn by) [checked by]:	Gero Jahns (GJ) [JC]					
					Drilling / Trial pitting co. & equipment	Gouge core					
					Minerex Doc. Ref.	3006-024.ppt					
					Irish Grid (IG)**	IH 03050 81621 (1)					
					Geological description						
					VON POST VALUE	PEAT DESCRIPTION	COLOUR	STIFFNESS			
					0.11	H9	High root content	Dark brown			
					0.3	H8	High root content	Medium brown			
					0.6						
					0.5						
					0.7	H9	Moderate root content	Dark brown			
					1.0						
					1.30						
					1.5	1.30m Obstruction / Rock					
					2.0						
					2.5						
					3.0						
					3.5						
					4.0						
**1-From hand held GPS, 2-Estimated from google maps or 3-Surveyed with theodolite.				General notes / Well Head Protection / Plan & Section Sketches							

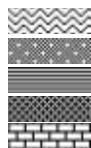
Borehole/ Standpipe Design & Completion	Soil (S) / Water (W) / Vapour (V) Sampling			 <p>Depth in metres below ground level & [Thickness]</p> <p>Geology (graphical log)</p>	INVESTIGATION POINT LOG NUMBER		GC168			
	Sample number & interval (mbGL) (Sample 10 kg minimum)				Client, Project, Location	JOD/SPR, Barnesmore, Donegal				
	Red line = Single channel sample (from field)				Minerex work item	3006-A1				
	Blue line = Composite sample (generated in office or lab)				Page No.	Page 1 of 1				
	Green line = Grab sample (acquired on site)				Date & time drilled / formed:	04/07/19				
					Logged by (drawn by) [checked by]:	Gero Jahns (GJ) [JC]				
					Drilling / Trial pitting co. & equipment	Gouge core				
					Minerex Doc. Ref.	3006-024.ppt				
					Irish Grid (IG)**	IH 03158 81882 (1)				
					Geological description					
					VON POST VALUE	PEAT DESCRIPTION	COLOUR	STIFFNESS		
		<p>Dry</p> <p>Wet</p>	 <p>Depth in metres below ground level & [Thickness]</p> <p>Geology (graphical log)</p>	 <p>Depth in metres below ground level & [Thickness]</p> <p>Geology (graphical log)</p>	H8	Moderate root content	Dark brown / black			
					0.4					
					0.5	H9	Moderate root content	Medium brown		
					1.0	H9	Minor root content	Medium brown		
					1.5					
					2.0	H9	Minor root content	Dark brown		
					2.35	2.35m Obstruction / Rock				
					2.5					
					3.0					
					3.5					
					4.0					
**1-From hand held GPS, 2-Estimated from google maps or 3-Surveyed with theodolite.				General notes / Well Head Protection / Plan & Section Sketches						

Borehole/ Standpipe Design & Completion	Soil (S) / Water (W) / Vapour (V) Sampling			 <p>Depth in metres below ground level & [Thickness]</p> <p>Geology (graphical log)</p>	INVESTIGATION POINT LOG NUMBER		GC169						
	Sample number & interval (mbGL) (Sample 10 kg minimum)	Shear Vane Testing values (shear strength in kilopascals (kPa))	Groundwater occurrence (See legend for symbols used for dry, damp and wet)		Client, Project, Location	JOD/SPR, Barnesmore, Donegal							
	Red line = Single channel sample (from field) Blue line = Composite sample (generated in office or lab) Green line = Grab sample (acquired on site)				Minerex work item	3006-A1							
					Page No.	Page 1 of 1							
					Date & time drilled / formed:	04/07/19							
					Logged by (drawn by) [checked by]:	Gero Jahns (GJ) [JC]							
					Drilling / Trial pitting co. & equipment	Gouge core							
					Minerex Doc. Ref.	3006-024.ppt							
					Irish Grid (IG)**	IH 03077 81868 (1)							
					Geological description								
					VON POST VALUE	PEAT DESCRIPTION	COLOUR	STIFFNESS					
					[0.3]	H9	Moderate root content	Dark brown / black					
					0.3	H9	Moderate root content	Medium brown					
					0.5	H9	Minor root content	Dark brown					
					0.8	0.8m Obstruction / Rock							
					1.0								
					1.5								
					2.0								
					2.5								
					3.0								
					3.5								
					4.0								
**1-From hand held GPS, 2-Estimated from google maps or 3-Surveyed with theodolite.				General notes / Well Head Protection / Plan & Section Sketches									

GENERAL LEGEND, ABBREVIATIONS AND INSTALLATION DETAILS

BEDROCK

- Metamorphic bedrock
- Igneous bedrock
- Mudstone / Shale bedrock
- Siltstone / Sandstone bedrock
- Limestone bedrock

**COLOUR**

- Brown (Light, medium, dark)
- Grey (Light, medium, dark)
- Mustard
- Beige (tan)
- Olive
- Mottled
- Orange

GRAIN SIZE (Soil)

- | | |
|-------------------------|-----------------------|
| Clay (% of) | C(20) |
| Silt (% of) | St(20) |
| Sand (% of) | Sd(20) |
| Gravel (% of) | G(20) |
| Sand (Fine to Medium) | Sd _{F-M} |
| Gravel (Fine to Coarse) | G _{F-C} SA-A |
| Subangular to angular) | |

MONITORING POINT COMPLETIONS

- TS/C1/PH1 Terminal Site/Couple no./Phreatic no.
- PR/C2/P2 Peat Repository/Couple no./Piezometer no.
- H7 Von Post humification scale
- Push-on cap
- Screen
- Casing
- Porous tip
- Drive cone
- Piezometer no. and Phreatic tube no.
- Bentonite pellets
- Cement-Bentonite grout
- Gravel pack, nominal 2-5mm in diameter
- Damp, wet and water strike respectively
- Static water table (with date measured and hours since installation)
- 1/2/03

PLAN SKETCHES

- PWS1 Hand dug trial pits / Shallow pit excavations (JCB)
- TP1 Percussion Window Sampler (PWS) boreholes
- 100 BG FID/PID in ppm Hydrocarbons with BG = background
- 99.791 Reduced levels - maOD Malin
- Oil pipeline
- Storage tanks (Overground and underground)

OVERBURDEN

(Description uses BS 5930 and GSI guidelines)

BOULDER(S) (>200mm)**COBBLES (60 to 200mm)****GRAVEL (Homogeneous larger sized particles from 2 to 60 mm)****SAND (General, if without grain size description)**

Particle sizes: 2 to 0.06mm. Three sub-categories distinguishable to the eye

Coarse SAND (2-0.6mm)**Medium SAND (0.6-0.2mm)****Fine SAND (0.2-0.06mm)****SILT (0.06 - 0.002mm)****CLAYS (<0.002mm)****CONCRETE****TARMACADAM****CRUSHED STONE or AGGREGATE****LANDFILL (eg plastic, glass, wood, domestic waste, concrete etc.)****FILL OR BACKFILLED GROUND (unspecified)****COLLAPSED FORMATION (with possible voids) or DRILL CHIPPINGS / MATERIAL RETURNED BY AIR FLUSH DRILLING****LOSS (Blank - white)****TOP SOIL****PEAT (General) (with descriptions such as colour, plant remains evident, distinct H₂S smell etc) (H (Von Post) value associated commonly)****MONITORING POINT DESIGN FOR PEAT SUBSOILS****Push-on, female cap**

The cap is loosely fitted to allow easy removal. The piezometer is labelled using indelible ink inside and outside the cap.
A small hole is drilled in the side to enable air movement in and out of the piezometer.

Casing up-stand

The upstand is the height of the casing above ground level in meters. The height depends on local groundwater and surface water circumstances. The piezometer number is scrapped onto the side of the casing near the cap as with time the writing on the cap wears off. Upstands vary from 0.3 to 1.0m in height. The convention is to allow a higher upstand for those piezometers positioned at a higher level.



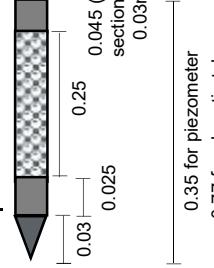
Ground level

Casing

The casing is black or dark grey coloured, flush-threaded, uPVC. The OD is 26.80mm and the ID is 18.40. The casing is flush-threaded to the piezometer tip.



0.045 (threaded section of this is 0.03m long)

**Tube or Piezometer tip**

This section is installed opposite the required formation. There are two sections to the piezometer tip. The inner tube section is 18.40mm ID, white in colour and involves extruded microporous polyethylene. The outer comprises grey or black coloured uPVC with 10 x 0.013m diameter holes per 0.10m of piezometer tip. Therefore the surface area exposed to the formation (peat) is small. The piezometer tube tip is flush-threaded, either male or female, to the piezometer casing. Threaded part is 0.03m long. The phreatic tube tip is longer than the piezometer tube tip to allow for greater water level fluctuations.

Drive cone

This is grey coloured, solid, uPVC, pushed or screwed into the tube or piezometer tip. No glue has been used. If the ground is soft, a push-in button cap may be used instead of a drive cone.

**NOTES:-**

The phreatic tubes are pushed by hand into the peat. The piezometers are pushed or driven into the peat and mineral soil after a narrow diameter hole has been formed using overburden drilling (Cobra or Percussion Window Sampler) / coring equipment (Gouge corer). The tubes and piezometers have three main functions: water table measurements, water sampling, permeability measurements.

REPORT TO

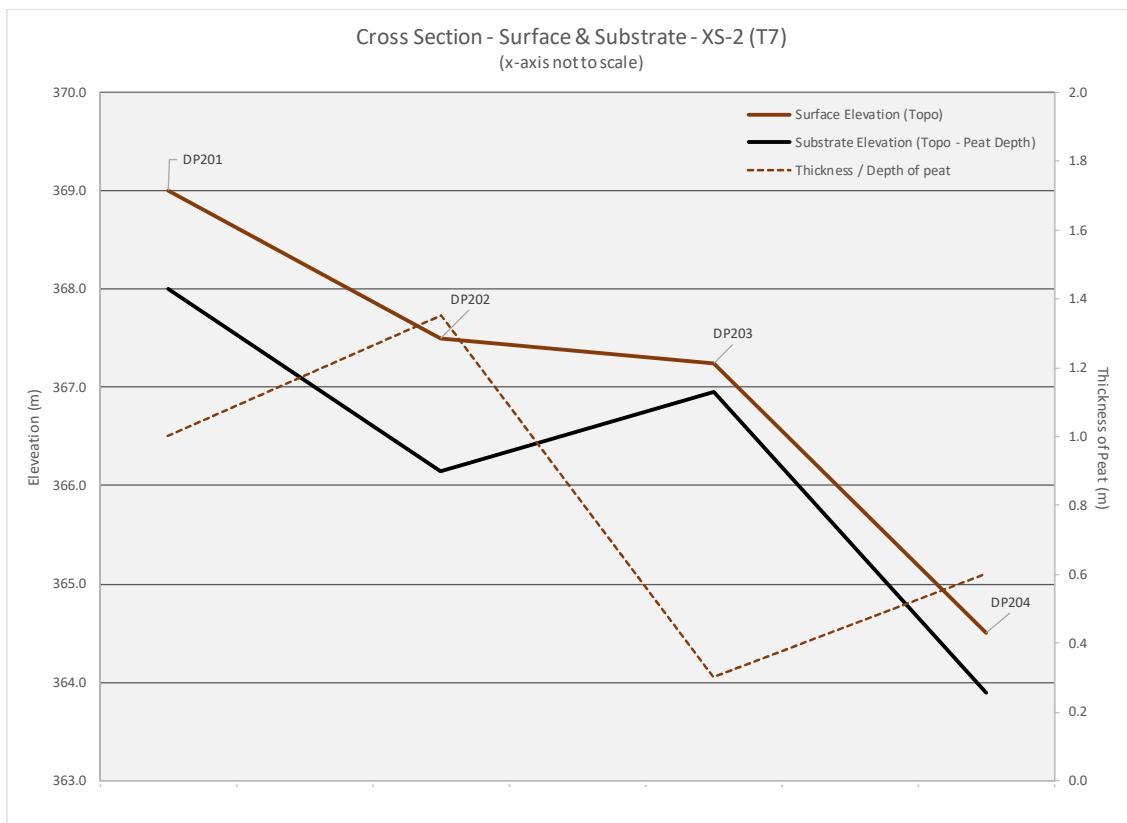
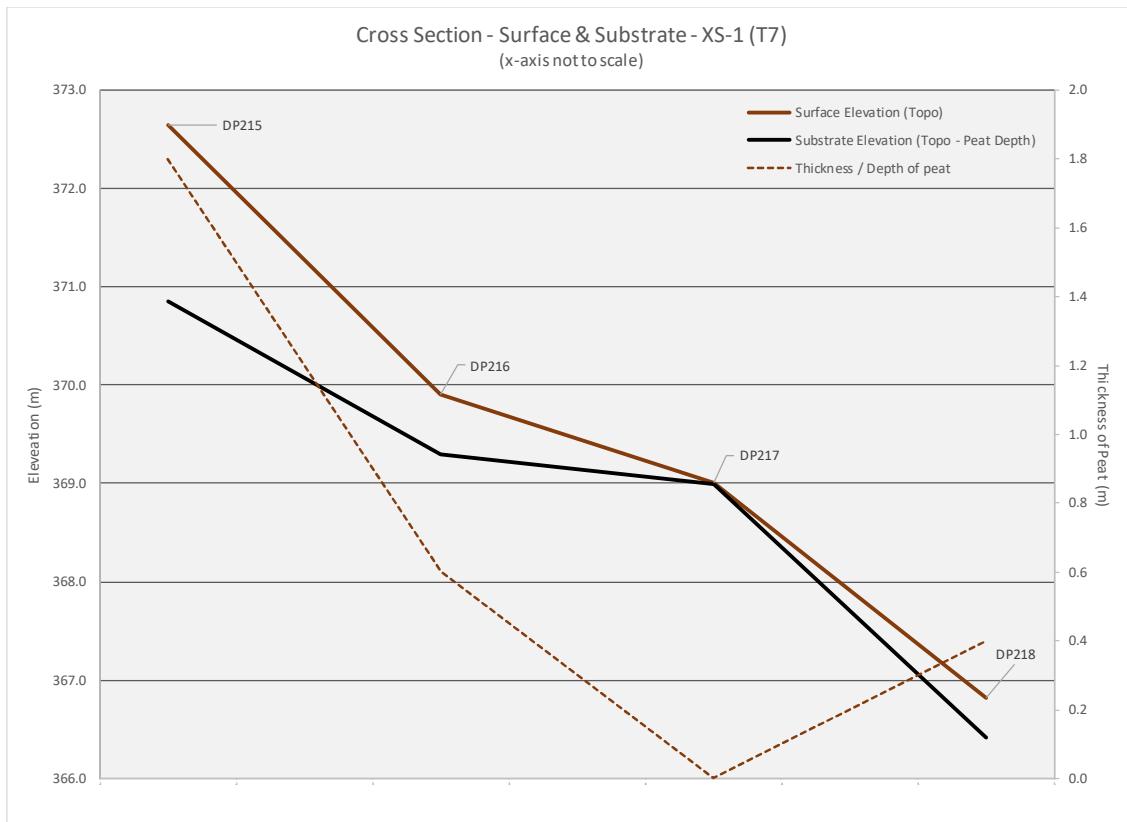
Jennings O'Donovan & ScottishPower Renewables.
Re. Barnesmore WF Repower
Peat & Slope Stability Risk Assessment

REPORT BY

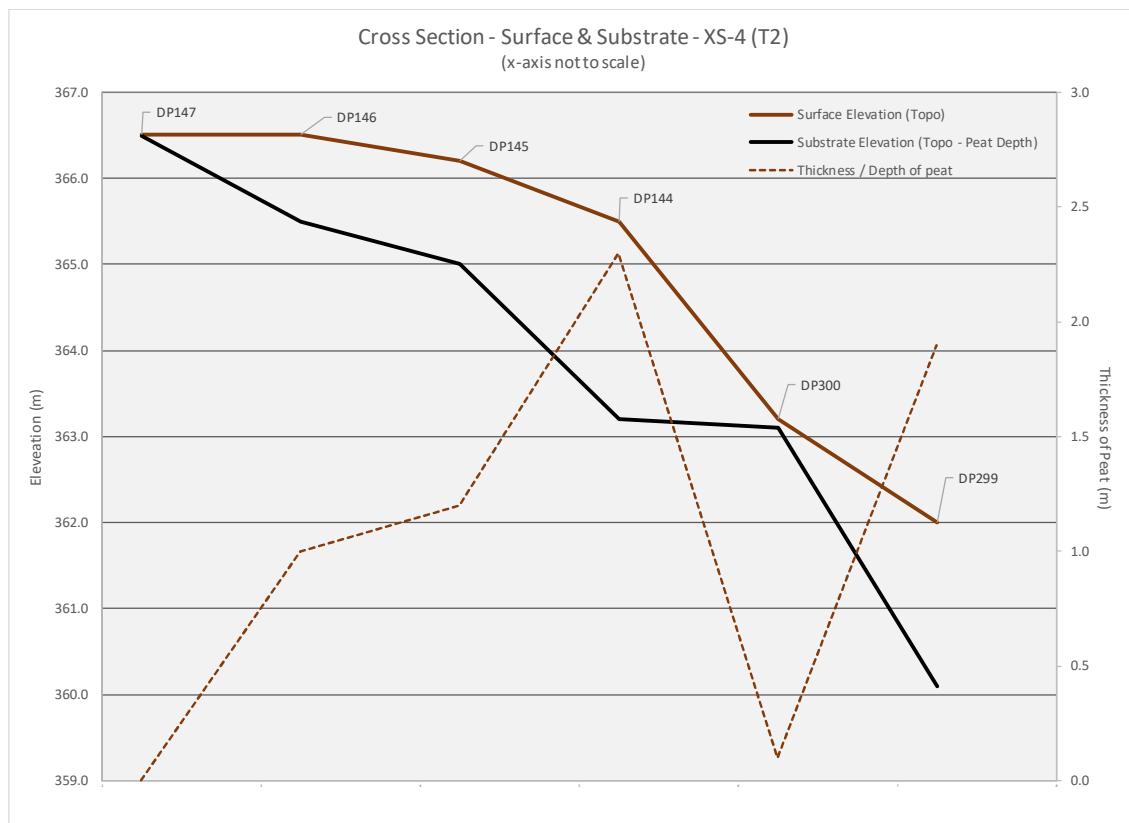
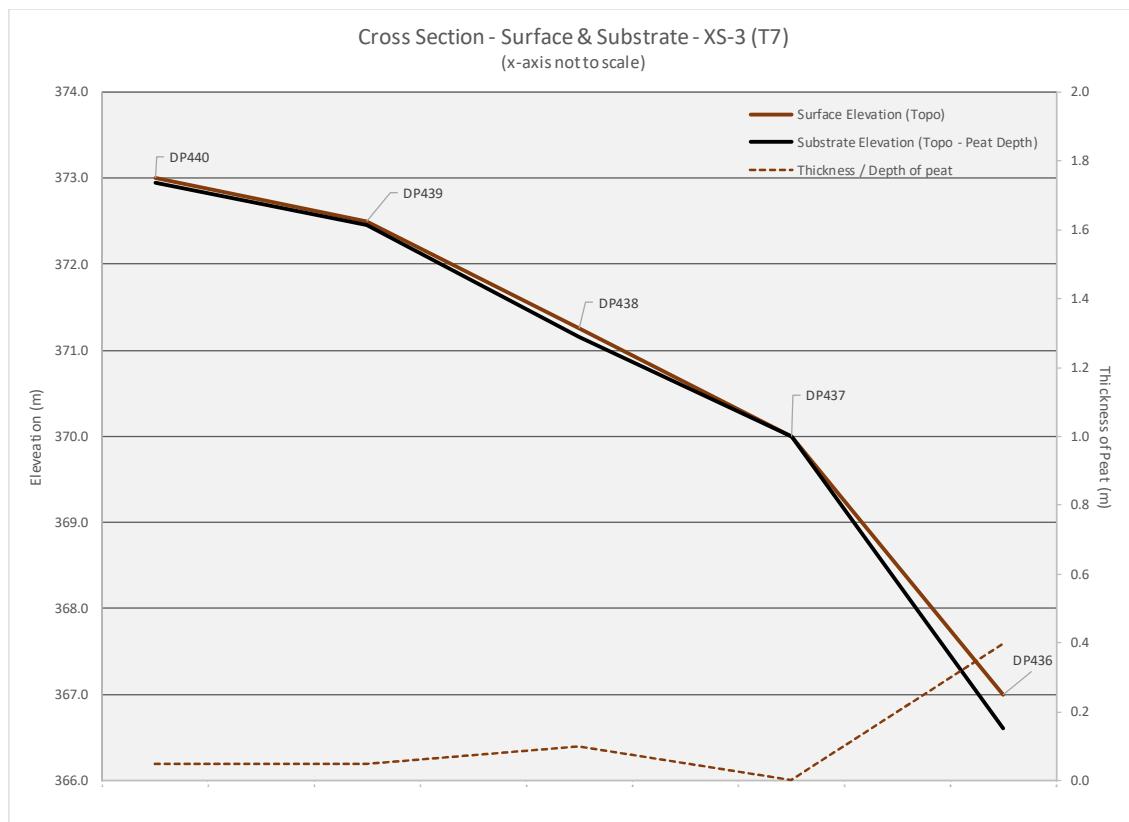
Minerex Environmental Limited
Doc Ref 3006-044 (Slope Stability & Risk Assessment) Rev2

Attachment F

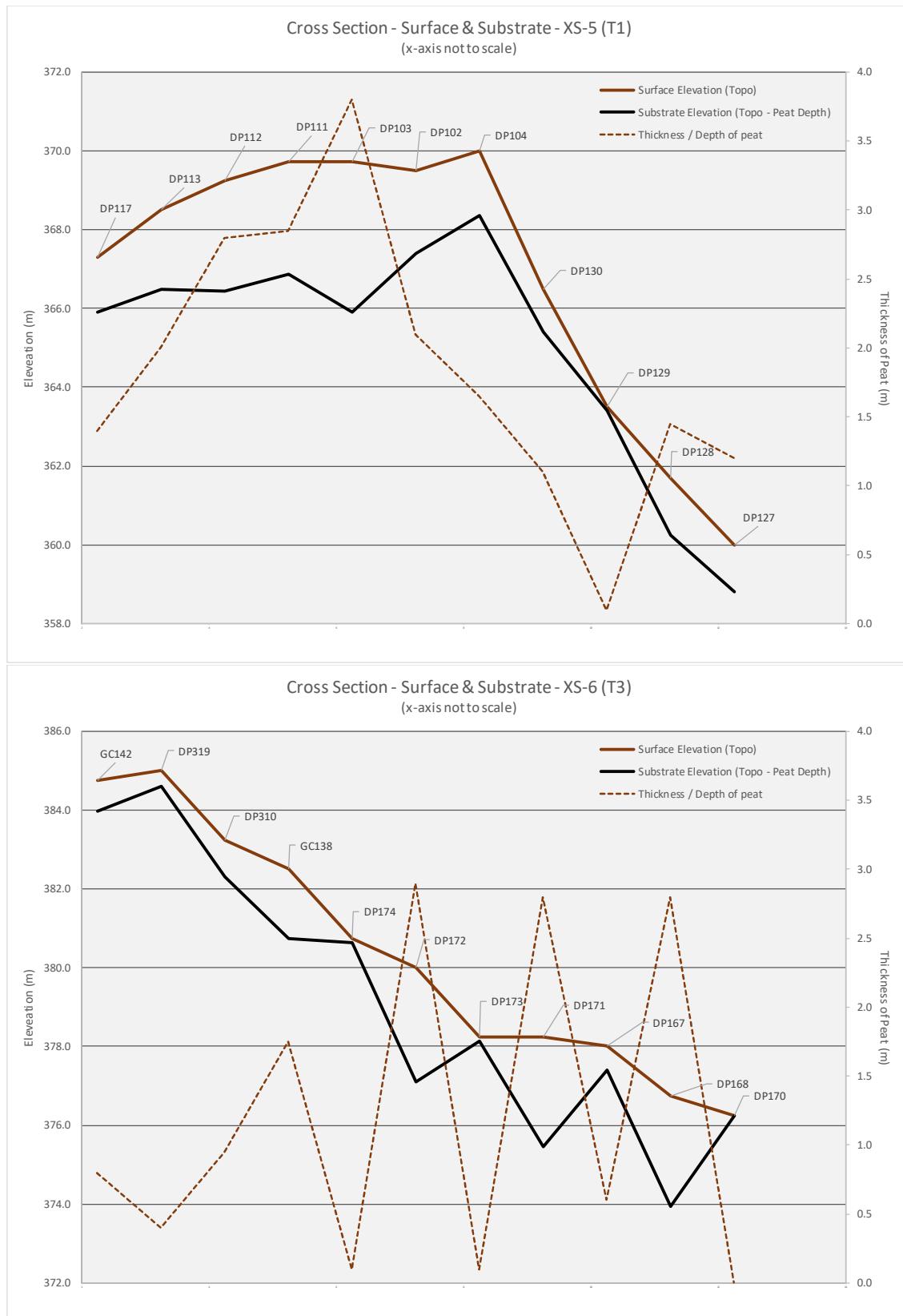
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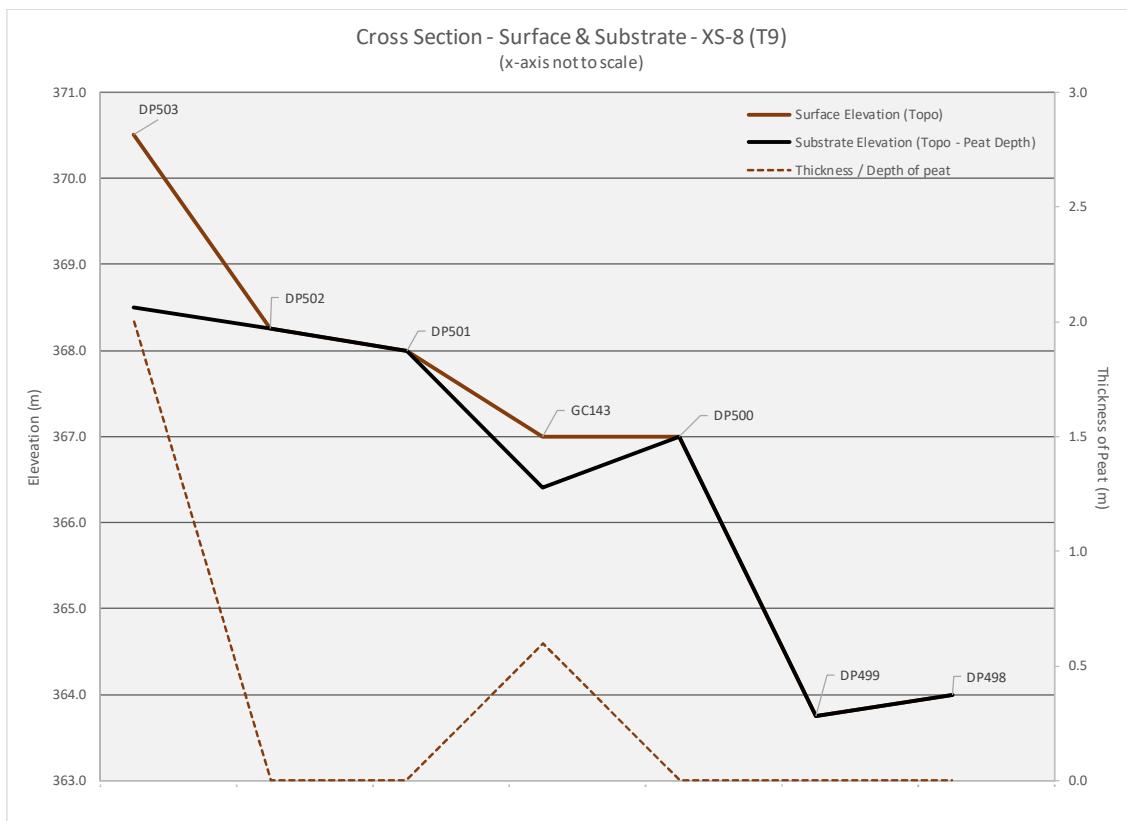
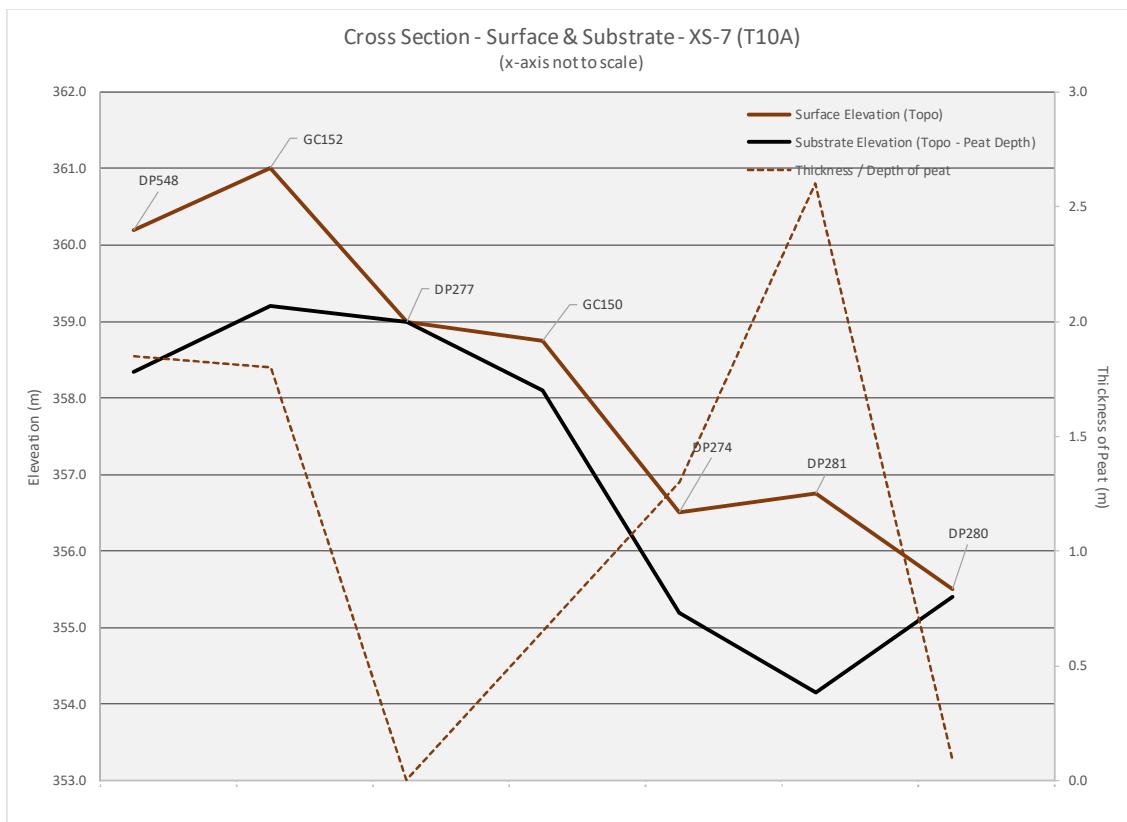
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Date: 21/08/19



Date: 21/08/19



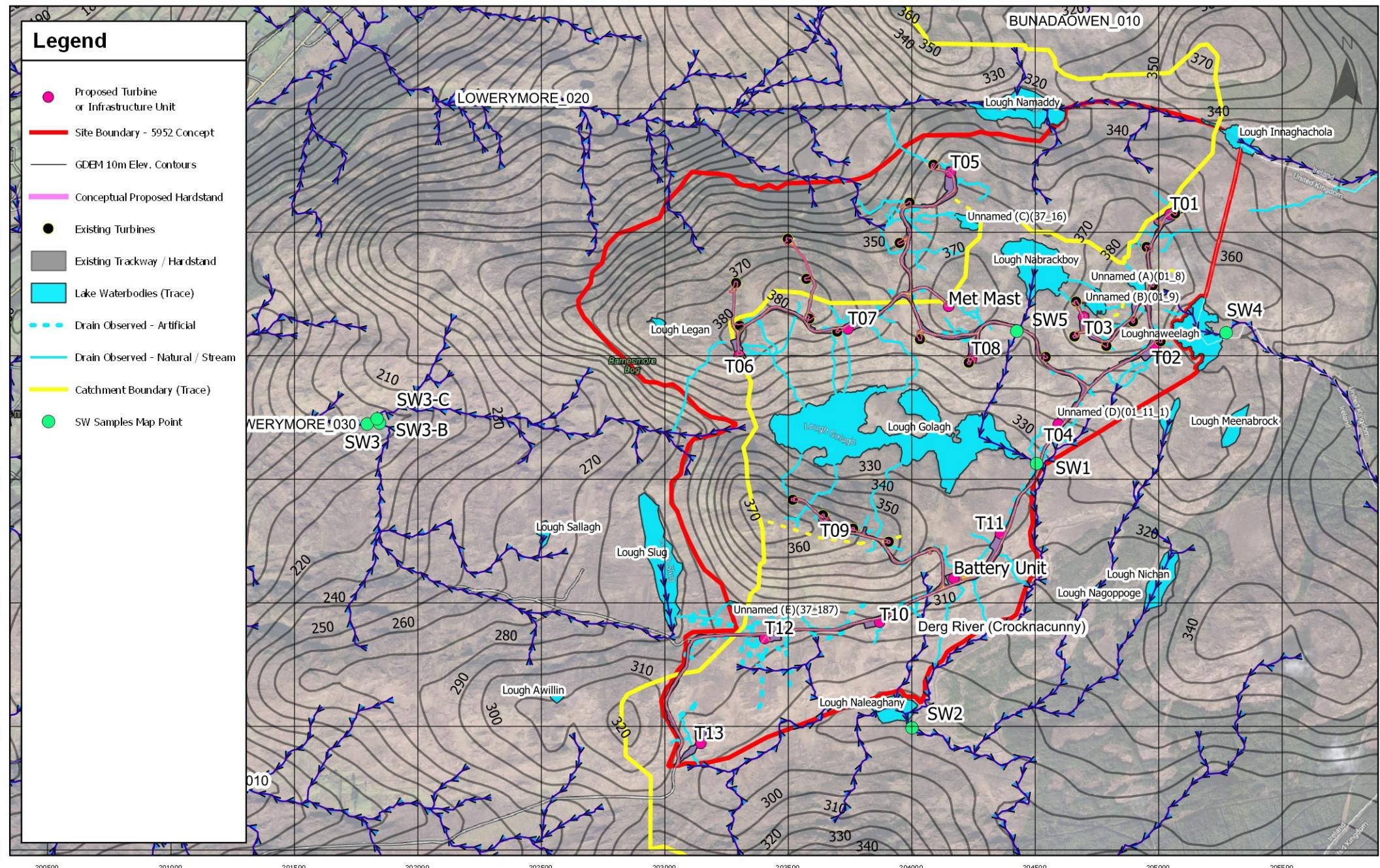
REPORT TO

Jennings O'Donovan & ScottishPower Renewables.
Re. Barnesmore WF Repower
Peat & Slope Stability Risk Assessment

REPORT BY

Minerex Environmental Limited
Doc Ref 3006-044 (Slope Stability & Risk Assessment) Rev2

Attachment G



REPORT TO

Jennings O'Donovan & ScottishPower Renewables.
Re. Barnesmore WF Repower
Peat & Slope Stability Risk Assessment

REPORT BY

Minerex Environmental Limited
Doc Ref 3006-044 (Slope Stability & Risk Assessment) Rev2

Attachment H

Receptor Distance & Significance.

Turbine No.	Feature Considered	Feature Name / Association	Coeficient (μ_{SF})	Distance (m) (From Proposed T to nearest significant (mapped) feature) (Approximate)	Coeficient ($\mu_{Dist.}$)
T1	Surface Water	Glendergan River	2	450	1
T2	Surface Water	Unnamed lake (Glendergan River)	2	75	2
T3	Surface Water	Unnamed lake (Derg River)	2	30	4
T4	Surface Water	Derg River	2	80	2
T5	Surface Water	Lowerymore River	2	300	1
T6	Surface Water	Lowerymore River	2	300	1
T7	Surface Water	Lough Gologh	2	250	1
T8	Surface Water	Lough Gologh	2	225	1
T9	Surface Water	Lough Gologh	2	200	1
T10	Surface Water	Unnamed lake (Derg River)	2	340	1
T11	Surface Water	Derg River	2	200	1
T12	Surface Water	Derg River	2	130	2
T13	Surface Water	Derg River	2	20	4
Met Mast	Surface Water	Derg River	2	300	1
Battery Unit	Surface Water	Derg River	2	100	2

REPORT TO

Jennings O'Donovan & ScottishPower Renewables.
Re. Barnesmore WF Repower
Peat & Slope Stability Risk Assessment

REPORT BY

Minerex Environmental Limited
Doc Ref 3006-044 (Slope Stability & Risk Assessment) Rev2

Attachment I

Peat Survey Database

Peat Database (Data obtained on site)

 Minerex Environmental

Soil & Slope Stability Database

Prepared by: SK
Mineerex File Ref.: 3006-011.xls



Prepared by: SK		Environmental																	Parameter Values		Scenario A		Scenario B		Scenario A		Scenario B		Scenario A		Scenario B		Scenario A		Scenario B		Scenario A		Scenario B		
Sample / Test Date	Associated Proposed Turbine	Sample / Test Point ID	Piezometer No.	IG Ref.	IG Easting	IG Northing	Thickness / Depth of peat	Classification of Thickness / Depth of peat	Local Incline (c.5m rad.)	Elevation (GPS) XS	Shear Test Depth	Shear Vane No. 1	Shear Vane No. 2	Shear Vane No. 3	Shear Vane Average	Slope Angle (For Excel Formula)	Un drained Shear Strength (Conservative Value)	Bulk Unit weight of Peat (Conservative Value)	Depth to failure plane i.e. Peat Depth	Surcharge Equivalent Placed Fill Depth i.e. +1m	FoS RAW Factor of Safety (FoS) for Peat Stability		FoS RAW Factor of Safety (FoS) for Peat Stability		FoS ADJ Adjusted Factor of Safety (FoS) for Peat Stability		FoS ADJ Adjusted Factor of Safety (FoS) for Peat Stability		RR SF Ranking Risk re Potential for Adverse Consequences on Sensitive Receptors		RR SF Ranking Risk re Potential for Adverse Consequences on Sensitive Receptors		RR D Risk Ranking Accounting for Distance to Sensitive Receptors		RR D Risk Ranking Accounting for Distance to Sensitive Receptors						
dd/mm/yy							m				Degrees	mOD	No.	m	kPa	kPa	kPa	kPa	Degrees	Radians	kPa	kN/m ³	m	m	FoS	U	FoS	U	U	#	FoS	U	FoS	U	U	RR-SF	U	RR-SF	U	RR-D	RR-D
							m																																		
09/05/2019	Depth Probe	T1	DP101	IH	5045	83605	1.20	C - Shallow (0.5-2.0m)																																	
09/05/2019	Depth Probe	T1	DP102	IH	5035	83609	2.10	D - Moderately Deep (2.0-3.5m)																																	
09/05/2019	Depth Probe	T1	DP103	IH	5026	83611	3.80	E - Deep (3.5-5.0m)																																	
09/05/2019	Depth Probe	T1	DP104	IH	5045	83608	1.65	C - Shallow (0.5-2.0m)																																	
11/06/2019	Depth Probe	T1	DP105	IH	5064	83604	2.15	D - Moderately Deep (2.0-3.5m)																																	
11/06/2019	Depth Probe	T1	DP106	IH	5084	83614	1.45	C - Shallow (0.5-2.0m)																																	
11/06/2019	Depth Probe	T1	DP107	IH	5048	83626	1.85	C - Shallow (0.5-2.0m)																																	
11/06/2019	Depth Probe	T1	DP108	IH	5037	83640	1.30	C - Shallow (0.5-2.0m)																																	
11/06/2019	Depth Probe	T1	DP109	IH	5024	83649	1.25	C - Shallow (0.5-2.0m)																																	
11/06/2019	Depth Probe	T1	DP110	IH	5017	83661	2.30	D - Moderately Deep (2.0-3.5m)																																	
11/06/2019	Depth Probe	T1	DP111	IH	5022	83615	2.85	D - Moderately Deep (2.0-3.5m)																																	
11/06/2019	Depth Probe	T1	DP112	IH	5012	83624	2.80	D - Moderately Deep (2.0-3.5m)																																	
11/06/2019	Depth Probe	T1	DP113	IH	5002	83632	2.00	C - Shallow (0.5-2.0m)																																	
11/06/2019	Depth Probe	T1	DP114	IH	5024	83576	1.50	C - Shallow (0.5-2.0m)																																	
11/06/2019	Depth Probe	T1	DP115	IH	5015	83586	0.40	B - Very Shallow (0.01-0.5m)																																	
11/06/2019	Depth Probe	T1	DP116	IH	5006	83595	0.90	C - Shallow (0.5-2.0m)																																	
11/06/2019	Depth Probe	T1	DP117	IH	4991	83640	1.40	C - Shallow (0.5-2.0m)																																	
11/06/2019	Depth Probe	T1	DP118	IH	5041	83552	1.00	C - Shallow (0.5-2.0m)																																	
11/06/2019	Depth Probe	T1	DP119	IH	5047	83546	1.90	C - Shallow (0.5-2.0m)																																	
11/06/2019	Depth Probe	T1	DP120	IH	5043	83537	2.40	D - Moderately Deep (2.0-3.5m)																																	
11/06/2019	Depth Probe	T1	DP121	IH	5006	83527	2.59	D - Moderately Deep (2.0-3.5m)																																	
11/06/2019	Depth Probe	T1	DP122	IH	5087	83526	1.60	C - Shallow (0.5-2.0m)																																	
11/06/2019	Depth Probe	T1	DP123	IH	5081	83841	0.60	C - Shallow (0.5-2.0m)																																	
11/06/2019	Depth Probe	T1	DP124	IH	5090	83571	0.60	C - Shallow (0.5-2.0m)																																	
11/06/2019	Depth Probe	T1	DP125	IH	5098	83566	0.20	B - Very Shallow (0.01-0.5m)																																	
11/06/2019	Depth Probe	T1	DP126	IH	5106	83557	1.70	C - Shallow (0.5-2.0m)																																	
11/06/2019	Depth Probe	T1	DP127																																						

Peat Survey Database

Peat Database (Data obtained on site)

Prepared by: SK

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at & Slope Stability Database

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Peat Survey Database



Earth & Slope Stability Database

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Peat Database (Data obtained on site)

Peat Survey Database

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Peat & Slope Stability Database

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Sample / Test Date	Sample / Test Category	Associated Proposed Turbine	Sample / Test Point ID No.	Piezometer No.	IG Ref.	IG Easting	IG Northing	Thickness / Depth of peat	Classification of Thickness / Depth of peat	Local Incline (c.5m rad.)	Elevation (GPS) XS	Shear Vane Test Depth	Shear Vane No. 1	Shear Vane No. 2	Shear Vane No. 3	Shear Vane Average	Slope Angle (For Excel Formula)	Undrained Shear Strength	Bulk Unit weight of Peat	Depth to failure plane i.e. Peat Depth	Surcharge Equivalent Placed Fill Depth i.e. +1m	Parameter Values		Scenario A		Scenario B		Scenario A		Scenario B		Scenario A		Scenario B		Scenario A		Scenario B		Scenario A		Scenario B	
																					FoS _{RAW} Factor of Safety (FoS) for Peat Stability	FoS _{RAW} Factor of Safety (FoS) for Peat Stability	FoS _{ADJ} Adjusted Factor of Safety (FoS) for Peat Stability	FoS _{ADJ} Adjusted Factor of Safety (FoS) for Peat Stability	FoS Adjustment Coefficient	FoS Adjustment Value	FoS _{ADJ} Adjusted Factor of Safety (FoS) for Peat Stability	FoS _{ADJ} Adjusted Factor of Safety (FoS) for Peat Stability	FoS Adjustment Coefficient	FoS Adjustment Value	FoS _{ADJ} Adjusted Factor of Safety (FoS) for Peat Stability	FoS _{ADJ} Adjusted Factor of Safety (FoS) for Peat Stability	FoS Significant Feature Ranking Coefficient	FoS Coefficient	RR _{SF} Ranking Risk re Potential for Adverse Consequences on Sensitive Receptors	RR _{SF} Ranking Risk re Potential for Adverse Consequences on Sensitive Receptors	RR _D Risk Ranking Accounting for Distance to Sensitive Receptors	RR _D Risk Ranking Accounting for Distance to Sensitive Receptors					
																					$FoS = \frac{c_u}{y_s \sin \alpha \cos \alpha} + \text{Adjustment Value}$	μ_{FoS}	FoS	μ_{FoS}	#	FoS	μ_{FoS}	FoS	μ_{FoS}	$RR-SF$	μ_{RR-SF}	$RR-SF$	μ_{RR-SF}	$RR-D$	$RR-D$								
12/09/2019	Depth Probe	T13	DP620	IH	3168	81470	1.10	C - Shallow (0.5-2.0m)			4											4.0698132	3.5	11	1.10	2.10	4.16	3.0	2.18	1.0	0.5	4.66	1.0	2.68	1.0	2.0	1.0	2.0	1.0	4.0	4.0	4.0	4.0
12/09/2019	Depth Probe	T13	DP621	IH	3187	81474	1.70	C - Shallow (0.5-2.0m)			4											4.0698132	3.5	11	1.70	2.10	2.69	3.0	1.99	1.0	0.5	1.29	1.0	2.19	1.0	2.0	1.0	2.0	1.0	4.0	4.0	4.0	4.0
12/09/2019	Depth Probe	T13	DP622	IH	3204	81475	0.40	Very Shallow (0.01-0.5m)			4											4.0698132	3.5	11	0.40	1.40	1.63	3.0	1.99	1.0	0.5	1.13	1.0	2.09	1.0	2.0	1.0	2.0	1.0	4.0	4.0	4.0	4.0
12/09/2019	Depth Probe	T13	DP623	IH	3226	81477	0.80	C - Shallow (0.5-2.0m)			5										5.0872665	3.5	11	0.80	1.80	4.58	3.0	2.04	1.0	0.5	5.08	1.0	2.54	1.0	2.0	1.0	2.0	1.0	4.0	4.0	4.0	4.0	
12/09/2019	Depth Probe	T13	DP624	IH	3218	81500	0.10	B - Very Shallow (0.01-0.5m)			5										5.0872665	3.5	11	0.10	1.10	3.65	3.0	3.33	1.0	0.5	3.71	1.0	3.83	1.0	2.0	1.0	2.0	1.0	4.0	4.0	4.0	4.0	
12/09/2019	Depth Probe	T13	DP625	IH	3200	81496	1.00	C - Shallow (0.5-2.0m)			4										4.0698132	3.5	11	1.00	2.00	4.57	1.0	2.29	1.0	0.5	5.07	1.0	2.79	1.0	2.0	1.0	2.0	1.0	4.0	4.0	4.0	4.0	
12/09/2019	Depth Probe	T13	DP626	IH	3182	81497	2.00	C - Shallow (0.5-2.0m)			3									3.0152399	3.5	11	2.00	3.00	3.04	1.0	2.03	1.0	0.5	3.54	1.0	2.53	1.0	2.0	1.0	2.0	1.0	4.0	4.0	4.0	4.0		
12/09/2019	Depth Probe	T13	DP627	IH	3160	81496	1.00	C - Shallow (0.5-2.0m)			3									3.0152399	3.5	11	1.00	2.00	6.09	1.0	3.04	1.0	0.5	6.59	1.0	3.54	1.0	2.0	1.0	2.0	1.0	4.0	4.0	4.0	4.0		
12/09/2019	Depth Probe	T13	DP628	IH	3141	81493	1.10	C - Shallow (0.5-2.0m)			5									5.0872665	3.5	11	1.10	2.10	3.33	1.0	1.75	1.0	0.5	3.83	1.0	2.25	1.0	2.0	1.0	2.0	1.0	4.0	4.0	4.0	4.0		
12/09/2019	Depth Probe	T13	DP629	IH	3206	81549	1.80	C - Shallow (0.5-2.0m)			10								10.01454529	3.5	11	0.80	2.00	1.93	2.3	1.03	1.0	0.5	2.83	1.0	1.53	1.0	2.0	1.0	2.0	1.0	4.0	4.0	4.0	4.0			
12/09/2019	Depth Probe	T13	DP630	IH	3119	81549	1.00	C - Shallow (0.5-2.0m)			10								10.01454529	3.5	11	1.00	2.00	2.00	2.3	1.03	1.0	0.5	2.36	1.0	1.45	1.0	2.0	1.0	2.0	1.0	4.0	4.0	4.0	4.0			
12/09/2019	Depth Probe	T13	DP631	IH	3134	81515	0.90	B - Very Shallow (0.01-0.5m)			8								8.0136263	3.5	11	0.90	2.57	1.22	1.50	0.5	0.5	3.01	1.0	1.72	1.0	2.0	1.0	2.0	1.0	4.0	4.0	4.0	4.0				
12/09/2019	Depth Probe	T13	DP632	IH	3149	81518	0.90	C - Shallow (0.5-2.0m)			3								3.0523399	3.5	11	0.90	1.90	6.76	1.0	3.20	1.0	0.5	7.26	1.0	3.70	1.0	2.0	1.0	2.0	1.0	4.0	4.0	4.0	4.0			
12/09/2019	Depth Probe	T13	DP633	IH	3167	81521	1.																																				

Peat Survey Database

Peat Database (Data obtained on site)

Prepared by: SK
Minerex File Ref.: 3006-011.xls



Peat & Slope Stability Database

Prepared by: SK
Minerex File Ref.: 3006-011.xls



Sample / Test Date	Sample / Test Category	Associated Proposed Turbine	Sample / Test Point ID No.	Piezometer	IG Ref.	IG Easting	IG Northing	Thickness / Depth of peat	Classification of Thickness / Depth of peat	Local Incline	Elevation (GPS)	XS	Note	Shear Vane Test Depth	Shear Van e No. 1	Shear Van e No. 2	Shear Van e No. 3	Shear Vane Average	Slope Angle	Undrained Shear Strength (For Excel Formula)	Bulk Unit weight of Peat (Conservative Value)	Depth to failure plane i.e. Peat Depth	Surcharge Equivalent Placed Fill Depth i.e. +1m	Parameter Values		Scenario A		Scenario B		Scenario A		Scenario B		Scenario A		Scenario B		Scenario A		Scenario B		Scenario A		Scenario B	
																					FoS _{RAW}	Factor of Safety (FoS) for Peat Stability	Coefficient	FoS _{RAW}	Factor of Safety (FoS) for Peat Stability	Coefficient	FoS _{ADJ}	Adjusted Factor of Safety (FoS) for Peat Stability	Coefficient	FoS _{ADJ}	Adjusted Factor of Safety (FoS) for Peat Stability	Coefficient	FoS Adjustment Coefficient	FoS Adjustment Value	R _{RF} _{SF}	Ranking Risk re Potential for Adverse Consequences on Sensitive Receptors	R _{RF} _{SF}	Ranking Risk re Potential for Adverse Consequences on Sensitive Receptors	R _{RD} _D						
dd/mm/yy			m			Degrees	mOD	No.	m	kPa	kPa	kPa	kPa	Degrees	Radians	m	m	FoS	μ	FoS	μ	#	FoS	μ	FoS	μ	RR-SF	μ	RR-SF	μ	RR-D	RR-D	RR-D	RR-D											
04/07/2019	Gouge Core	T9	GC149	IH	3688	82335	1.5	C - Shallow (0.5-2.0m)		10	367						10	0.1745329	3.5	11	1.50	2.50	1.24	2.0	0.74	4.0	1.0	0.5	1.74	1.0	1.24	2.0	2.0	2.0	1.0	1.0	2.0	2.0							
04/07/2019	Gouge Core	n/a (Potential Alternative (T10A))	GC150	IH	3876	82274	0.65	C - Shallow (0.5-2.0m)		3	358	XS-7					3	0.043099	3.5	11	0.50	1.25	9.31	3.0	3.69	1.0	1.0	0.5	9.15	1.0	2.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0						
04/07/2019	Gouge Core	n/a (Potential Alternative (T10A))	GC151	SP116	IH	3851	82295	2.0	D - Moderately Deep (2.0-3.5m)		5	354				0.5	15	15	14	14.7		2.034906	3.5	11	2.50	3.50	2.55	3.0	0.5	4.15	1.0	1.11	1.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0					
04/07/2019	Gouge Core	n/a (Potential Alternative (T10A))	GC152	IH	3835	82281	1.8	C - Shallow (0.5-2.0m)		5	360	XS-7					5	0.0872665	3.5	11	1.80	2.80	2.04	3.0	1.31	1.0	1.0	0.5	2.54	1.0	1.81	1.0	2.0	2.0	1.0	1.0	1.0	1.0	1.0						
04/07/2019	Gouge Core	T12	GC153	IH	3409	81854	0.9	C - Shallow (0.5-2.0m)		1	305					0.5	9	10	12	10.3		1.0174533	3.5	11	0.90	1.90	20.26	1.0	1.0	0.5	9.60	1.0	1.0	0.5	20.76	1.0	10.10	1.0	2.0	2.0	2.0				
04/07/2019	Gouge Core	T12	GC154	SP117	IH	3387	81858	0.9	C - Shallow (0.5-2.0m)		4	303					4	0.0698132	3.5	11	0.90	1.90	5.08	1.0	1.0	0.5	5.58	1.0	2.91	1.0	2.0	2.0	1.0	1.0	2.0	2.0	2.0								
04/07/2019	Gouge Core	T12	GC155	IH	3364	81853	1.95	C - Shallow (0.5-2.0m)		4	301					0.5	19	12	6	12.3		4.0698132	3.5	11	1.95	2.95	2.34	1.0	1.0	0.5	2.84	1.0	2.05	1.0	2.0	2.0	1.0	1.0	2.0	2.0	2.0				
04/07/2019	Gouge Core	T12	GC156	IH	3373	81811	3.65	E - Deep (3.5-5.0m)		301						0.5	12	19	12	14.3		2.0349066	3.5	11	3.65	4.65	2.50	1.0	1.0	0.5	3.00	1.0	2.46	1.0	2.0	2.0	1.0	1.0	2.0	2.0	2.0				
04/07/2019	Gouge Core	T12	GC157	IH	3460	81853	0.5	B - Very Shallow (0.01-0.5m)		1	305					1	0.0174533	3.5	11	0.50	1.50	36.47	3.0	12.16	1.0	1.0	0.5	36.97	1.0	2.0	2.0	1.0	2.0	2.0	2.0	2.0	2.0	2.0							
04/07/2019	Gouge Core	T12	GC158	IH	3400	81899	0.75	C - Shallow (0.5-2.0m)		1	305					0.1	0.0017453	3.5	11	0.75	1.75	243.07	3.0	104.17	1.0	1.0	0.5	243.07	1.0	104.67	1.0	2.0	2.0	1.0	2.0	2.0	2.0	2.0	2.0	2.0					
04/07/2019	Gouge Core	T10	GC159	IH	3862	81949	0.4	B - Very Shallow (0.01-0.5m)		5						0.5	0.043099	3.5	11	0.20	1.20	1.00	3.0	0.5	1.65	1.0	1.0	0.5	1.65	1.0	3.55	1.0	2.0	2.0	1.0	2.0	2.0	2.0	2.0	2.0	2.0				
04/07/2019	Gouge Core	T10	GC160	IH	3825	81964	0.2	B - Very Shallow (0.01-0.5m)		5						5	0.0872665	3.5	11	0.20	1.20	18.32	3.0	3.05	1.0	1.0	0.5	18.82	1.0	3.55	1.0	2.0	2.0	1.0	2.0	2.0	2.0	2.0	2.0						
04/07/2019	Gouge Core	T10	GC161	IH	3867	81958	0.1	B - Very Shallow (0.01-0.5m)		3						3	0.0523599	3.5	11	0.10	1.10	6.08	1.0	1.0	0.5	6.138	1.0	6.03	1.0	2.0	2.0	1.0	2.0	2.0	2.0	2.0									
04/07/2019	Gouge Core	T10	GC162	IH	3841	81923	0.55	C - Shallow (0.5-2.0m)		5	306					0.5	46	51	30	42.3		5.0872665	3.5	11	0.55	1.55	6.66	1.0	1.0	0.5	7.16	1.0	2.86	1.0	2.0	2.0	1.0	1.0	2.0	2.0	2.0				
04/07/2019	Gouge Core	T10	GC163	SP118	IH	3780	81938	0.7	C - Shallow (0.5-2.0m)		0	306				0.1	0.0017453	3.5	11	0.70	1.70	260.44	1.0	1.0	0.5	260.94	1.0	107.74	1.0	2.0	2.0	1.0	2.0	2.0	2.0	2.0									

REPORT TO

Jennings O'Donovan & ScottishPower Renewables.
Re. Barnesmore WF Repower
Peat & Slope Stability Risk Assessment

REPORT BY

Minerex Environmental Limited
Doc Ref 3006-044 (Slope Stability & Risk Assessment) Rev2

Attachment J

Summary Table of Stability Assessment Results

Prepared by: SK Date: 11/11/19. File Ref.: 3006-011.xls



Turbine No.	FoS (Adjusted) for Scenario B	No. of Points	Conclusion & Comment	RR _{sf} - Ranked Risk Considering Sensitive Receptor	No. of Points	Conclusion & Comment	RR _d - Ranked Risk Considering Distance to Sensitive Receptor	No. of Points	Conclusion & Comment
T1	Stable (Acceptable)	41	Area of proposed hardstand is acceptable in terms of peat stability. Low number (2 no.) unstable points, but as a whole risk is negligible. Unstable points are at the limits of the survey area and are not within the area of proposed infrastructure.	Negligible Risk	41	Area of proposed hardstand is negligible risk in terms of peat stability. Significance of receptor has not influenced risk rating.	Negligible Risk	41	Area of proposed hardstand is negligible risk in terms of peat stability when considering distance to receptor. Distance to receptor has not influenced risk rating.
	M marginally Stable (Acceptable)	1		Low Risk	1		Low Risk	1	
	Unstable (Unacceptable)	2		Moderate Risk	2		Moderate Risk	2	
				High Risk	0		High Risk	0	
T2	Stable (Acceptable)	32	Area of proposed hardstand is acceptable in terms of peat stability.	Negligible Risk	32	Area of proposed hardstand is of negligible risk in terms of peat stability. Significance of receptor has not influenced risk rating.	Negligible Risk	0	Area of proposed hardstand is low risk in terms of peat stability when considering distance to receptor. Distance to receptor has influenced risk rating.
	M marginally Stable (Acceptable)	3		Low Risk	3		Low Risk	32	
	Unstable (Unacceptable)	0		Moderate Risk	0		Moderate Risk	3	
				High Risk	0		High Risk	0	
T3	Stable (Acceptable)	51	Area of proposed hardstand is acceptable in terms of peat stability. Low number (3 no.) marginally stable points, but as a whole risk is negligible. Marginally stable points are at the limits of the survey area and are not within the area of proposed infrastructure.	Negligible Risk	51	Area of proposed hardstand is of negligible risk in terms of peat stability. Significance of receptor has not influenced risk rating.	Negligible Risk	0	Area of proposed hardstand is moderate risk in terms of peat stability when considering distance to receptor. Distance to receptor has influenced risk rating. High Risk points are located at the limit of the survey area and are not within the area of proposed infrastructure.
	M marginally Stable (Acceptable)	3		Low Risk	3		Low Risk	0	
	Unstable (Unacceptable)	0		Moderate Risk	0		Moderate Risk	51	
				High Risk	0		High Risk	3	
T4	Stable (Acceptable)	28	Area of proposed hardstand is acceptable in terms of peat stability.	Negligible Risk	28	Area of proposed hardstand is of negligible risk in terms of peat stability. Significance of receptor has not influenced risk rating.	Negligible Risk	0	Area of proposed hardstand is low risk in terms of peat stability when considering distance to receptor. Distance to receptor has influenced risk rating.
	M marginally Stable (Acceptable)	0		Low Risk	0		Low Risk	28	
	Unstable (Unacceptable)	0		Moderate Risk	0		Moderate Risk	0	
				High Risk	0		High Risk	0	
T5	Stable (Acceptable)	26	Area of proposed hardstand is acceptable in terms of peat stability.	Negligible Risk	26	Area of proposed hardstand is of negligible risk in terms of peat stability. Significance of receptor has not influenced risk rating.	Negligible Risk	26	Area of proposed hardstand is negligible risk in terms of peat stability when considering distance to receptor. Distance to receptor has not influenced risk rating.
	M marginally Stable (Acceptable)	3		Low Risk	3		Low Risk	3	
	Unstable (Unacceptable)	0		Moderate Risk	0		Moderate Risk	0	
				High Risk	0		High Risk	0	
T6	Stable (Acceptable)	34	Area of proposed hardstand is acceptable in terms of peat stability.	Negligible Risk	34	Area of proposed hardstand is of negligible risk in terms of peat stability. Significance of receptor has not influenced risk rating.	Negligible Risk	34	Area of proposed hardstand is negligible risk in terms of peat stability when considering distance to receptor. Distance to receptor has not influenced risk rating.
	M marginally Stable (Acceptable)	2		Low Risk	2		Low Risk	2	
	Unstable (Unacceptable)	0		Moderate Risk	0		Moderate Risk	0	
				High Risk	0		High Risk	0	
T7	Stable (Acceptable)	37	Area of proposed hardstand is acceptable in terms of peat stability.	Negligible Risk	37	Area of proposed hardstand is of negligible risk in terms of peat stability. Significance of receptor has not influenced risk rating.	Negligible Risk	37	Area of proposed hardstand is negligible risk in terms of peat stability when considering distance to receptor. Distance to receptor has not influenced risk rating.
	M marginally Stable (Acceptable)	6		Low Risk	6		Low Risk	6	
	Unstable (Unacceptable)	0		Moderate Risk	0		Moderate Risk	0	
				High Risk	0		High Risk	0	
T8	Stable (Acceptable)	15	Area of proposed hardstand is acceptable in terms of peat stability.	Negligible Risk	15	Area of proposed hardstand is of negligible risk in terms of peat stability. Significance of receptor has not influenced risk rating.	Negligible Risk	15	Area of proposed hardstand is negligible risk in terms of peat stability when considering distance to receptor. Distance to receptor has not influenced risk rating.
	M marginally Stable (Acceptable)	0		Low Risk	0		Low Risk	0	
	Unstable (Unacceptable)	0		Moderate Risk	0		Moderate Risk	0	
				High Risk	0		High Risk	0	

Summary Table of Stability Assessment Results

Prepared by: SK Date: 11/11/19. File Ref.: 3006-011.xls



Turbine No.	FoS (Adjusted) for Scenario B	No. of Points	Conclusion & Comment	RR _{sf} - Ranked Risk Considering Sensitive Receptor	No. of Points	Conclusion & Comment	RR _d - Ranked Risk Considering Distance to Sensitive Receptor	No. of Points	Conclusion & Comment
T9	Stable (Acceptable)	30	Area of proposed hardstand is acceptable in terms of peat stability.	Negligible Risk	30	Area of proposed hardstand is of negligible risk in terms of peat stability. Significance of receptor has not influenced risk rating.	Negligible Risk	30	Area of proposed hardstand is negligible risk in terms of peat stability when considering distance to receptor. Distance to receptor has not influenced risk rating.
	Marginally Stable (Acceptable)	6		Low Risk	6		Low Risk	6	
	Unstable (Unacceptable)	0		Moderate Risk	0		Moderate Risk	0	
				High Risk	0		High Risk	0	
T10	Stable (Acceptable)	45	Area of proposed hardstand is acceptable in terms of peat stability.	Negligible Risk	45	Area of proposed hardstand is of negligible risk in terms of peat stability. Significance of receptor has not influenced risk rating.	Negligible Risk	45	Area of proposed hardstand is negligible risk in terms of peat stability when considering distance to receptor. Distance to receptor has not influenced risk rating.
	Marginally Stable (Acceptable)	0		Low Risk	0		Low Risk	0	
	Unstable (Unacceptable)	0		Moderate Risk	0		Moderate Risk	0	
				High Risk	0		High Risk	0	
T11	Stable (Acceptable)	21	Area of proposed hardstand is acceptable in terms of peat stability. Low number (1 no.) unstable points, but as a whole risk is negligible.	Negligible Risk	21	Area of proposed hardstand is of negligible risk in terms of peat stability. Significance of receptor has not influenced risk rating. Moderate risk point is not within area of proposed infrastructure.	Negligible Risk	25	Area of proposed hardstand is negligible risk in terms of peat stability when considering distance to receptor. Distance to receptor has not influenced risk rating. Moderate risk point is not within area of proposed infrastructure.
	Marginally Stable (Acceptable)	4		Low Risk	4		Low Risk	4	
	Unstable (Unacceptable)	1		Moderate Risk	1		Moderate Risk	1	
				High Risk	0		High Risk	0	
T12	Stable (Acceptable)	37	Area of proposed hardstand is acceptable in terms of peat stability.	Negligible Risk	37	Area of proposed hardstand is of negligible risk in terms of peat stability. Significance of receptor has not influenced risk rating.	Negligible Risk	0	Area of proposed hardstand is low risk in terms of peat stability when considering distance to receptor. Distance to receptor has influenced risk rating.
	Marginally Stable (Acceptable)	0		Low Risk	0		Low Risk	37	
	Unstable (Unacceptable)	0		Moderate Risk	0		Moderate Risk	0	
				High Risk	0		High Risk	0	
T13	Stable (Acceptable)	82	Area of proposed hardstand is acceptable in terms of peat stability.	Negligible Risk	82	Area of proposed hardstand is of negligible risk in terms of peat stability. Significance of receptor has not influenced risk rating.	Negligible Risk	0	Area of proposed hardstand is moderate risk in terms of peat stability when considering distance to receptor. Distance to receptor has influenced risk rating.
	Marginally Stable (Acceptable)	3		Low Risk	3		Low Risk	0	
	Unstable (Unacceptable)	0		Moderate Risk	0		Moderate Risk	82	
				High Risk	0		High Risk	3	
Met Mast	Stable (Acceptable)	20	Area of proposed hardstand is acceptable in terms of peat stability.	Negligible Risk	20	Area of proposed hardstand is of negligible risk in terms of peat stability. Significance of receptor has not influenced risk rating.	Negligible Risk	20	Area of proposed hardstand is negligible risk in terms of peat stability when considering distance to receptor. Distance to receptor has not influenced risk rating.
	Marginally Stable (Acceptable)	1		Low Risk	1		Low Risk	1	
	Unstable (Unacceptable)	0		Moderate Risk	0		Moderate Risk	0	
				High Risk	0		High Risk	0	
Battery Compound	Stable (Acceptable)	18	Area of proposed hardstand is acceptable in terms of peat stability.	Negligible Risk	18	Area of proposed hardstand is of negligible risk in terms of peat stability. Significance of receptor has not influenced risk rating.	Negligible Risk	0	Area of proposed hardstand is low risk in terms of peat stability when considering distance to receptor. Distance to receptor has influenced risk rating.
	Marginally Stable (Acceptable)	0		Low Risk	0		Low Risk	18	
	Unstable (Unacceptable)	0		Moderate Risk	0		Moderate Risk	0	
				High Risk	0		High Risk	0	

Note: The above assessment and commentary does not consider the potential for fill required significantly increasing the effective area of the proposed hardstand. This will need to be considered as part of the final design phase when establishing frozen layout.

REPORT TO

Jennings O'Donovan & ScottishPower Renewables.

Re. Barnesmore WF Repower

Peat & Slope Stability Risk Assessment

REPORT BY

Minerex Environmental Limited

Doc Ref 3006-044 (Slope Stability & Risk Assessment) Rev2
