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ENVIRONMENTAL SCIENCE &
PLANNING

DERRYCLARE PEATLAND REHABILITATION

Addendum to Geotechnical & Peat Stability Assessment Report

Prepared for:
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Addendum to Geotechnical & Peat Stability Assessment Report

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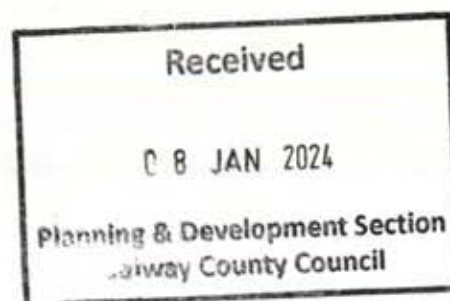
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Abstract: Fehily Timoney and Company is pleased to submit this Addendum Report in response to an FIR response to Galway County Council (GCC) on behalf of MKO Ltd (Client). This document will aim to respond to queries raised by GCC in relation to peat stability at Derryclare.



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1. INTRODUCTION

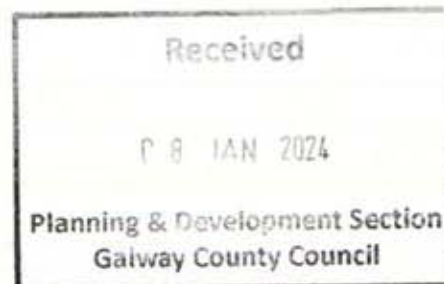
1.1 General

The following Addendum Report should be read in conjunction with the *Geotechnical & Peat Stability Assessment Report* (herein referred to as the Assessment Report) and the *Technical Note in Response to Further Information Required – Galway County Council (Ref. 23/60)* (herein referred to as the Technical Note).

1.2 Summary of Works Completed as Part of the Addendum Report

Fehily Timoney and Company (FT) were commissioned by MKO Ltd. (Client) on behalf of Coillte (Applicant) to undertake an addendum to the original Assessment Report. The purpose of the Addendum Report is to further strengthen the findings of the original Phase 1 surveys and Assessment Report, and comprised the following works:

1. Phase 2 Surveys:
 - Further site reconnaissance to include additional peat probe locations
 - Design and implementation of a Ground Penetrating Radar (GPR) survey at key profile locations across the site
2. Additional Factor of Safety (FoS) assessment using:
 - Phase 2 peat probe locations (77 no. data points)
 - RPS peat probe locations (29 no. data points)
 - Peat depths and base of peat slopes data derived from the GPR survey (328 no. data points)
3. Interpretation of results and development of the existing Conceptual Ground Model (CGM)





2. PHASE 2 SITE SURVEYS

2.1 General

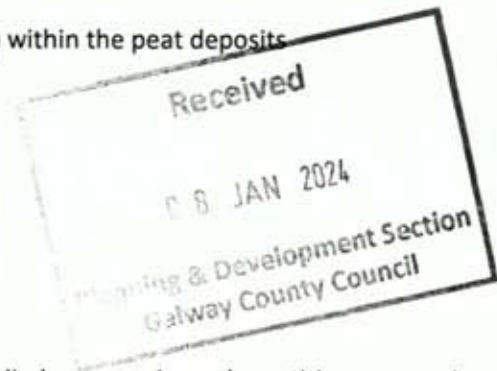
Following consultation with MKO and Coillte, a second phase of site reconnaissance was undertaken by FT. The purpose of the site reconnaissance was to further constrain the findings of the Assessment Report. The works were undertaken by the following members of FT staff:

- Aaron Clarke BSc, MSc (MCSM), PGeo, EurGeol – Principal Geologist with over 19 years' experience working in the Geoscience and Ground Engineering sectors; and
- Alan Whelan, BEng (Hons), MIEI, GMICE – Project Engineer with 3.5 years' experience working in Ground Engineering.

Photographs taken during the reconnaissance are included in Appendix A.

Similar to the Assessment Report, the following salient geomorphological features were considered during the site reconnaissance:

- Active, incipient or relict instability (where present) within the peat deposits
- Presence of shallow valley or drainage line
- Wet areas
- Any change in vegetation
- Peat depth and undrained shear strength
- Slope inclination and break in slope



The method adopted for carrying out the site reconnaissance relied on experienced practitioners carrying out a visual assessment of the site supplemented with measurement of slope inclinations.

2.2 Summary of Site Reconnaissance Findings

A site walkover was undertaken by FT over four days between 31st October and 3rd November 2023. Weather conditions during the site walkover were cloudy to overcast with periods of heavy rainfall and strong gusts.

With respect to site characterisation, the findings from the Phase 2 reconnaissance highlighted no additional factors that could potentially contribute towards instability within the peat deposits.

The main findings from the site walkover are summarised as follows:

1. In total, 77 no. additional peat probe locations were visited. The distribution of the combined Phase 1, Phase 2 and RPS probe locations are presented in Drawing No. 001.
2. Peat depths range from 0.0 to 6.3m bgl (PP087) with mean and median depths of 1.0 and 0.60m bgl respectively. The peat depths from both the Phase 1, Phase 2 and RPS surveys are presented in Drawing No. 002. The deepest peat deposits were almost exclusively found in areas of flatter terrain within the north, northeastern and southmost portions of the site.
3. Base of peat was typically recorded as bedrock. However, granular till and scree deposits were also noted. Profiles showing these geological sequences could often be observed in road cuttings and stream



sections (Plates 1 and 2). No fine-grained material was encountered.

4. The sites' topography typically displays an angular and hummocky relief, frequently punctuated by bedrock outcrops. This type of morphology is indicative of shallow bedrock.
5. Buoyant peat was recorded at six peat probe locations (PP087, PP088, PP093, PP094, PP095, PP097) where peat depths range from 1.6 (PP095) to 6.3m bgl (PP087).
6. Localised areas of ponded water were recorded. This is not unexpected given the ground conditions and the flat terrain present in localised areas across the site.
7. Slope angles across the site range from 2 to 30 degrees with a mean and median value of 10 and 7 degrees respectively. The slope angle was obtained on site using a handheld Silva Clino Master, which has an accuracy of +/- 0.25 degrees. The slope angle quoted typically reflects the representative slope at each of the peat probe locations.
8. The undrained shear strength of the peat was determined in-situ using a Geonor H-60 Hand-Field Vane Tester. Undrained shear strengths ranged from 5 to 53kPa with a mean and median value of 17 and 15kPa respectively.
9. Other than the historic peat failure identified during the Phase 1 survey at probe location POI008, no other evidence of historic or recent peat instability was recorded.

Findings from the peat probe survey were used to determine FoS values across the site and further develop the CGM. The combined Phase 1, Phase 2 and RPS FoS results and CGM is discussed in Sections 3. and 4. respectively.



Plate 1 Peat overlain by bedrock along a stream section (Phase 1 - POI002)

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Plate 2 Exposure of peat underlain by granular till deposits (Phase 1 – PO1005)

2.3 Ground Penetrating Radar Survey

In addition to the peat probe survey, 12.62 line kilometres of GPR survey comprising 24 no. profiles were undertaken by Minerex Geophysics Limited (MGL) between 23rd October and 2nd November 2023. The survey was completed using a MALA ProEx GPR with a Rough Terrain Antenna (RTA100). The GPR profile locations are presented in Drawing No. 003. Peat depths derived from the GPR survey are included in Drawing No 002.

2.3.1 Scope

The GPR profiles were sited along areas where the Assessment Report had identified low FoS values (<1.3) and over areas of steeper terrain/deeper peat where the risk of peat instability was deemed to be higher. The purpose of the survey was to determine:

- Depth and lateral extent of peat deposits along the GPR profile lines.
- Surface slopes.
- Base of peat slopes – these are deemed to be more critical to peat stability than surface slopes. The base of peat slope angles were used instead of surface slope angles in the stability assessment of all peat depths derived from the GPR survey.
- Nature of the interface between the peat and underlying geology.
- Further develop the CGM developed by FT in the Assessment Report and Technical Note.



The resulting geophysical report is included in Appendix B.

2.3.2 Summary of Findings

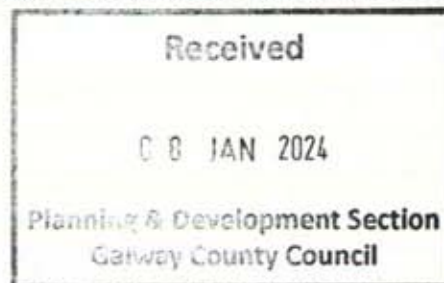
The findings of the geophysical report are summarised as follows:

- There is a strong correlation between peat depths derived from the GPR survey with those taken during the Phase 1, Phase 2 and RPS peat probe surveys.
- In total, 116 areas of peat were identified, ranging in length from <10 to 282m (GPR Profile G54-55). The larger extents of peat (>150m in length) are exclusively found in areas of flatter topography. 41 no. of these areas were described as "pods" having lengths of <20m and often displaying a "bowl" morphology. These "pods" were not assessed for peat thickness and base of peat slope as the risk of instability was deemed to be negligible¹. The remaining 75 no. areas were assessed for peat thickness and base of peat slope.
- A total of 115 no. peat depths and associated surface and base of peat slope angles were recorded by MGL.
- Peat depths range from 0.8 to 5.0m bgl with an average peat depth of 2.38m bgl²
- Peat occurs in isolated areas rather than large laterally continuous deposits.
- In general, the steeper areas of the site show limited extents of peat.
- Base of peat slopes follow the undulating and often rough surface of the underlying geology (typically bedrock).
- Base of peat slope angles broadly correlate with surface slope angles and are on average 2.5 degrees steeper. Localised steeper base of peat slopes are recorded; these predominantly occur over short distances (typically <20m) along the flanks of bedrock ridges. The base of peat slope angles were used in the peat stability assessment analyses for all GPR peat depth locations.

2.3.3 Further Assessment of GPR Results by FT

To supplement the findings of the GPR results, FT undertook further assessment of the GPR profiles and associated data provided by MGL. An additional 213 no. peat depths and base of peat slopes were ascertained from the 24 no. GPR profiles.

Findings from the GPR survey were used to determine FoS results. The combined Phase 1, Phase 2, RPS and GPR FoS results are discussed further in Section 3.



¹ Where data resolution allowed, FT later assessed these features and included their depths and base of peat slope angles in the final FoS assessment.

² Additional peat depths were determined by FT within all of the 75 areas assessed by MGL. However, the maximum peat depths in all 75 no. areas were captured within MGL's geophysical report.

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3. RESULTING PEAT STABILITY ASSESSMENT

3.1 Peat Stability Assessment Methodology and Analysis Type

The peat slope stability assessment was undertaken using the Infinite Slope method. The methodology used to derive FoS values is outlined in Sections 6.1 and 6.2 of the Assessment Report.

As discussed in Section 2.3, the base of peat slope angles calculated from the GPR survey (Appendix B) were used in the stability assessment for all GPR derived peat depth locations. This is deemed a more critical slope angle as it represents the potential failure surface that exists between the peat and underlying geology. However, it should be noted that the recorded surface slope angles and base of peat slope angles are generally analogous.

3.2 Peat Stability Assessment Results

The drained and undrained FoS results for the Phase 1 survey are presented in Section 6.3 (Tables 6-3 and 6-4) of the Assessment Report. In summary, 5 no. locations gave FoS values of between 1.0 and 1.3 and 3 no. locations gave FoS values of <1.0.

The Phase 1 results, along with the Phase 2 and RPS results (comprising 520 no. individual peat depth points) are presented in Drawing Number 004 (undrained condition) and Drawing No. 005 (drained condition). These drawings also include a number of exclusion zones based on areas having FoS values of <1.3 and will be discussed further in Section 3.2.4.

The results of the undrained and drained analyses for the natural peat slopes at the Phase 2 and RPS locations are presented in Appendix C. Results from the Phase 1 locations are presented in Appendix C of the Assessment Report.

The results of the assessment are discussed in the following sections and summarised in Table 3-1 below.

Table 3-1 Summary of FoS Results for the Phase 2 and RPS Peat Depth Locations

Analysis Type	Total No. of Peat Depth Points Analysed	No. of Peat Depth Locations with FoS > 1.3 (% Note1)		No. of Peat Depth Locations with FoS 1.0 to 1.3 (% Note1)		No. of Peat Depth Locations with FoS <1.0 (% Note1)	
		Condition 1	Condition 2	Condition 1	Condition 2	Condition 1	Condition 2
Undrained	432	431 (99.77%)	425 (98.37%)	1 (0.23%)	7 (1.62%)	0 (0%)	0 (0%)
Drained		406 (93.98%)	431 (99.77%)	18 (4.16%)	1 (0.23%)	8 (1.85%)	0 (0%)

Note 1 - The total percentage of peat depth locations for each FoS range.

3.2.1 Undrained Analysis of the Peat

For load condition 1, 431 no. out of the 432 no. peat depth locations analysed gave a calculated FoS of >1.3 (FoS range 1.46 to 239). One peat depth location gave a FoS <1.3 (FoS of 1.25 at GPR profile location G25-278).

For load condition 2, a calculated FoS in excess of 1.3 (FoS range 1.31 to 60.32) was determined for 425 no. peat depth locations. Seven peat depth locations gave a FoS <1.3 but >1.0.

In general, results from both analyses indicate the site has a low risk of peat instability. Analysed values <1.3 occur in isolation and are flanked by peat depth locations with FoS values >1.3.

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3.2.2 Drained Analysis of the Peat

For load condition 1, out of the 432 no. peat depth locations analysed, a total of 406 no. gave a calculated FoS of >1.3 (FoS range 1.34 to 239). 18 no. peat depth locations gave FoS values of between 1.3 and 1.0. The remaining 8 no. locations gave FoS values of <1.0.

For load condition 2, a calculated FoS in excess of 1.3 (FoS range 1.32 to 130) was determined for 431 no. peat depth locations. One peat depth location gave a FoS <1.3 (FoS of 1.03 at GPR profile location G51-014).

In general, results from the drained analyses indicate the site has a low risk of peat instability. Similar to the undrained results, drained FoS values <1.3 and <1.0 typically occur in isolation and are flanked in every instance by peat depth locations with FoS values >1.3.

3.2.3 Sensitivity Analysis

Based on the findings from the initial drained analysis (assuming water level at 100%) a sensitivity analysis was undertaken to assess varying degrees of saturation within the peat slopes. The analysis was undertaken using water levels ranging from 0 to 100% (at 25% intervals). The results from this analysis are presented in Appendix C.

Existing water monitoring data captured by RPS in 2021, coupled with field observations made during FT's 2022 and 2023 site walkovers, indicate groundwater depths, particularly on sloping ground (>6°) are deeper than assumed in the initial analyses. To reflect actual site conditions, a water level of 75% within the peat was chosen. This is still deemed to be a conservative estimate.

The FoS was recalculated using the 75% water level for locations that initially returned a drained FoS of <1.3. The results of this analysis are summarised in Table 3-2 and show drained FoS values all in excess of 1.3 at 75% water level. This is a strong indication that the peat slopes at these locations will be stable in the drained condition provided the natural drainage system is maintained during the restoration works.

Table 3-2 Comparison of Factor of Safety at 100% and 75% Water Levels within the Peat

Peat Depth Location ID	Phase No.	Factor of Safety for Load Condition (Assuming 100% Water)		Factor of Safety for Load Condition (Assuming 75% Water)	
		Condition 1	Condition 2	Condition 1	Condition 2
G72-120	2	1.21	1.77	1.96	2.29
G84-564	2	1.23	1.80	1.99	2.33
G19-36	2	1.26	1.89	2.09	2.47
G51-108	2	1.20	1.80	1.99	2.35
G49-22	2	1.12	1.69	1.88	2.22
G1-288	2	1.24	1.92	2.17	2.59
G51-140	2	1.16	1.79	2.02	2.42
G70-228	2	1.12	1.75	1.98	2.37
G67-266	2	1.09	1.72	1.97	2.37
G67-276	2	1.05	1.68	1.93	2.33
G42-136	2	1.03	1.65	1.91	2.31
G72-366	2	1.11	1.80	5.05	4.78

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Peat Depth Location ID	Phase No.	Factor of Safety for Load Condition (Assuming 100% Water)		Factor of Safety for Load Condition (Assuming 75% Water)	
		Condition 1	Condition 2	Condition 1	Condition 2
G54-60	2	0.97	1.57	4.43	4.20
G66-148	2	1.25	2.05	2.40	2.93
G42-220	2	1.26	2.07	2.44	2.98
G68-40	2	1.23	2.04	2.43	2.97
G86-60	2	0.99	1.65	1.97	2.40
G54-0	2	0.93	1.57	1.90	2.32
G65-50	2	1.01	1.70	2.05	2.51
G15-60	2	0.95	1.61	1.98	2.43
G54-14	2	0.88	1.50	1.85	2.27
G65-236	2	1.04	1.79	2.24	24.87
G54-160	2	0.86	1.53	2.01	2.47
G51-14	2	0.58	1.03	1.38	1.69
G50-64	2	0.80	1.43	1.93	2.37
G25-278	2	1.25	2.25	3.06	3.76

3.2.4 Exclusion Zones

In total 38 no. (7.3% of the total number of peat depth locations assessed across the site) peat depth locations from the Phase 1, Phase 2 and RPS surveys gave FoS values of <1.3. At these locations, a minimum 50m exclusion zone has been used as presented in Drawing Numbers 004 and 005. Within these exclusion zones the use of machinery for restoration purposes shall be restricted.

It should be noted that in nearly every instance where there is a low FoS (<1.3), they are immediately flanked by peat depth locations with FoS values in excess of 1.3. The 50m exclusion zone is therefore considered a conservative distance.





4. CONCEPTUAL GROUND MODEL & INTERPRETATION OF RESULTS

4.1 Development of the Conceptual Ground Model

A Conceptual Ground Model (CGM) was developed as part of the Assessment Report and later expanded upon within the Technical Note. The CGM was derived using both desk top information, and observations made during the Phase 1 site reconnaissance. The addition of the Phase 2 GPR survey data has allowed for a greater understanding of sub-surface interactions between peat and underlying geology (typically comprising bedrock but also including thin deposits of scree and granular till).

The development of the CGM is illustrated in Figure 1 (A-C). The schematic section (Figure 1A) taken from the Technical Note shows an initial interpretation of the sites surface and sub-surface morphology. This interpretation was based on site observations, which recorded a series of staggered ridges present across the site. These ridges, which are particularly evident in the upland areas, form natural breaks across the slopes, thereby restricting the presence of laterally continuous peat layers. It was also postulated that areas of deeper peat identified during the peat probe surveys were often confined to pockets representing low points within the underlying bedrock-soil interface.

GPR profile G1 (Figure 1B employing a horizontal to vertical exaggeration of 1:5) which is located to the south of the site (Drawing No. 003), confirms the initial CGM interpretation whereby the peat forms in discrete, laterally discontinuous pockets. Importantly, this morphology is also clearly visible in nearly all of the GPR profiles. Site observations coupled with the GPR survey results show little to no interaction or interconnectivity between these pockets of isolated peat. These peat deposits are punctuated by ridges of outcropping to shallow sub-cropping bedrock. The flanks of these ridges are often steep and form bowl shaped depressions, which presumably have allowed in part for the development of blanket peat deposits at Derryclare. The relationship between the peat deposits and underlying bedrock is also illustrated in Figure 1C, which is a view of the lands to the immediate south of the site where there is significantly less vegetation coverage to obscure the terrain in its natural state.



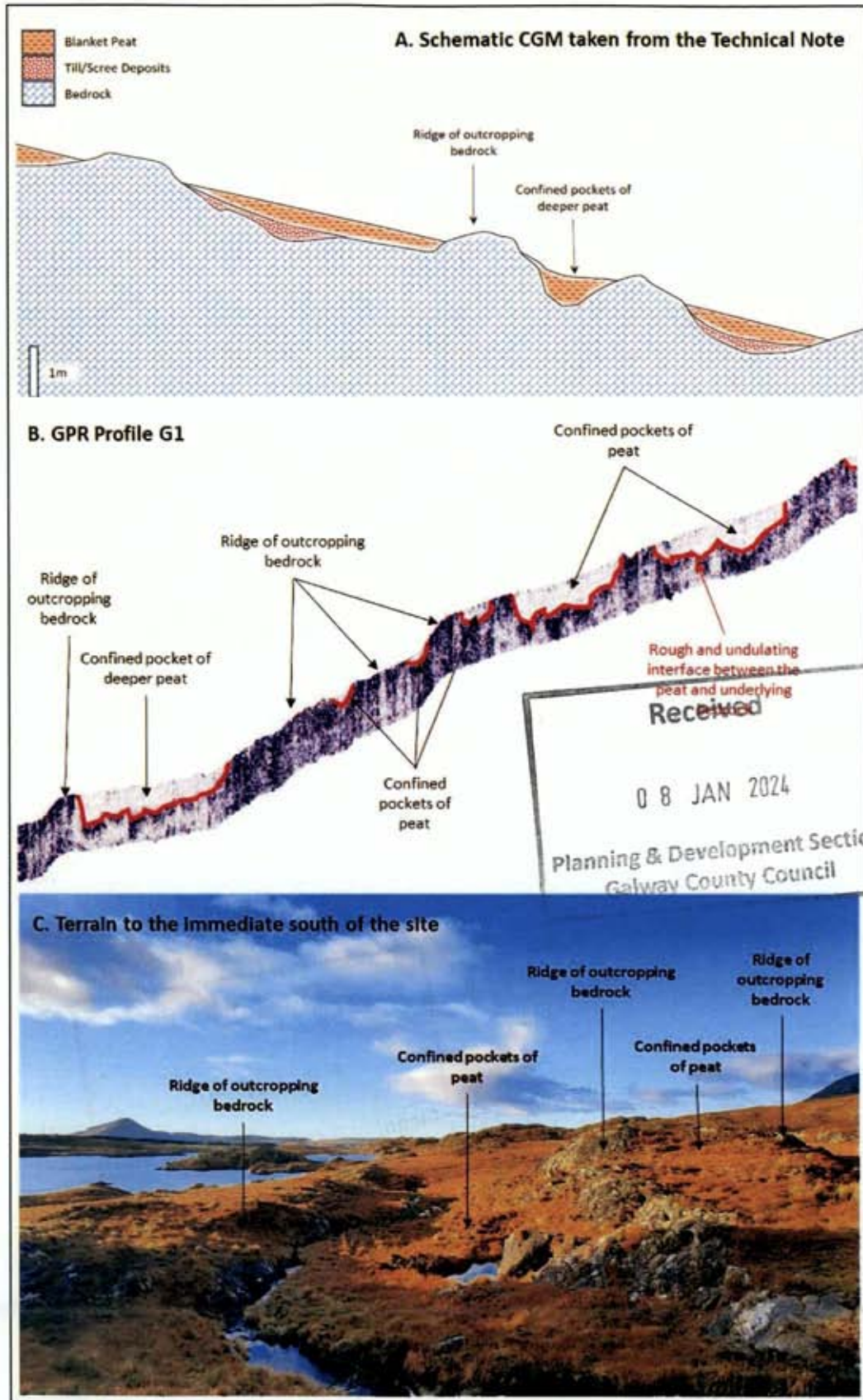


Figure 1 Conceptual Ground Model Interpretation



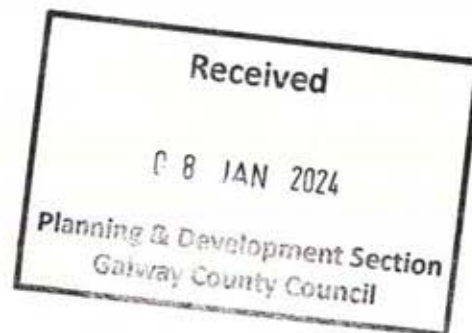
4.2 Interpretation of Results Based on the CGM

Results from the peat stability assessment (Section 3.2) show a relatively small percentage of FoS values <1.3 (7.3% of the total data set). Initial interpretation made as part of the Assessment Report indicated that these low FoS values occur in isolation, typically presenting themselves as individual points or as small clusters.

Further assessment using the Phase 2 and RPS peat depth locations verify this interpretation. In nearly every instance, low FoS (<1.3) values are surrounded by either peat depth locations with FoS values >1.3 or areas where little to no peat was recorded.

Similarly, the CGM indicates that the deeper areas of peat occur in isolation (Figure 1), where the peat deposits are confined to relatively small pockets and buttressed by shallow and outcropping bedrock. The largest extent of peat identified at the site can be found along GPR Profile G54-55. This exhibits as a continuous 285m long deposit of peat. Depths along this deposit vary, typically ranging from 1.3 to 4.5m bgl. The downslope extent of this deposit is confined by an almost continuous 148m length of shallow bedrock. However, most of the pockets of peat identified during the GPR survey typically have lateral extents of $<100\text{m}$, all of which are confined on both their upslope and downslope margins by buttresses of shallow/outcropping bedrock. As a result, should a failure occur in one of these pockets, the risk of a resulting large-scale translational failure would be considered negligible.

Where open exposures of peat were encountered, they were exclusively underlain by either bedrock, granular till deposits or scree deposits (Plate 1 and Plate 2). This interface should be considered with respect to potential slip surfaces at the base of peat. Where large-scale peat failures have occurred in Ireland, the interface between the peat deposits and underlying geology is often planar in morphology, and typically underlain by fine grained mineral soils. In the instance of Derryclare, this interface is defined by a hummocky, irregular and high friction surface, thereby significantly limiting the risk of large-scale peat failures. If however, a smaller scale failure were to occur, it would likely take the form of a narrow channelised failure or debris flow. Due to the site's geology such failure mechanisms would not have the capacity to propagate downslope for any significant distance. This is evidence by the small failure observed at POI008 (Section 3.9 of the Assessment Report), where the total distance between the backscarp and leading edge of the failure lobe was measured at 40 in length. Peat probe depths taken immediately downslope of this historic failure showed peat depths of 0.3m (PP105).





5. SUMMARY

As part of the Phase 2 works, 77 no. peat probe locations and 12.62 line kilometres of GRP profiles were completed. Through processing of the GPR data by both FT and MGL an additional 328 peat depths were ascertained.

The deepest areas of peat can be found in the north, northeast and southernmost portions of the site (Drawing No. 002).

The Phase 2 and RPS peat depth locations were analysed for FoS using the infinite slope method. In total 432 locations were assessed for both the drained and undrained condition. Results from this assessment strongly indicates that the site is in a stable condition with over 90% of all results returning FoS values in excess of 1.3 and less than 2% returning FoS values of <1.0 (Table 3-1).

Results from the Phase 1, Phase 2 and RPS surveys coupled with site observations and the CGM indicate the peat deposits at Derryclare occur in relatively small, isolated pockets contained by buttresses of bedrock which either exhibit as outcrops or as hummocky mounds (indicative of shallow sub-cropping rock). Findings from the phased site reconnaissance and GPR survey indicate that there is little to no interconnectivity between these pockets of peat. As a result, the risk of any significant peat failure across the site is deemed negligible.

In addition, with the exception of peat probe location POI008 (which lies outside of the proposed restoration area), there is no indication of historic or recent small scale peat failures. Given that harvesting operations have been undertaken across the site, the absence of peat instability strongly suggests the peat slopes are in a stable condition and will remain in a stable condition during the restoration works, provided appropriate mitigation measures are employed.

To further maintain the stability of the peat slopes, 50m exclusion zones have been established around peat depth locations attaining FoS results of <1.3. The use of machinery for restoration purposes shall be restricted within these exclusion zones.

Further recommendations with respect to best practice and mitigation is discussed within Section 10 of the Assessment Report and Section 3 of the Technical Note.



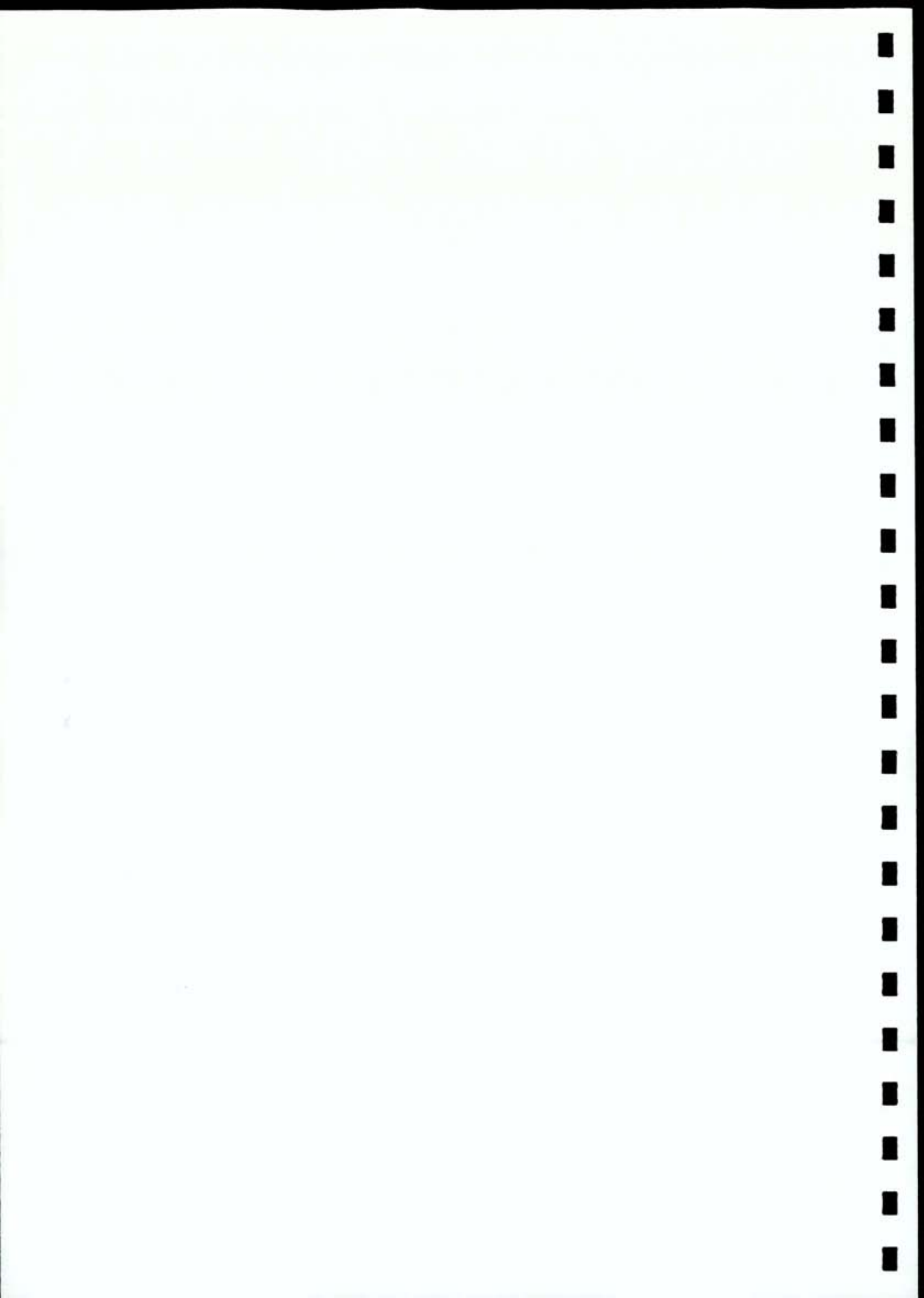


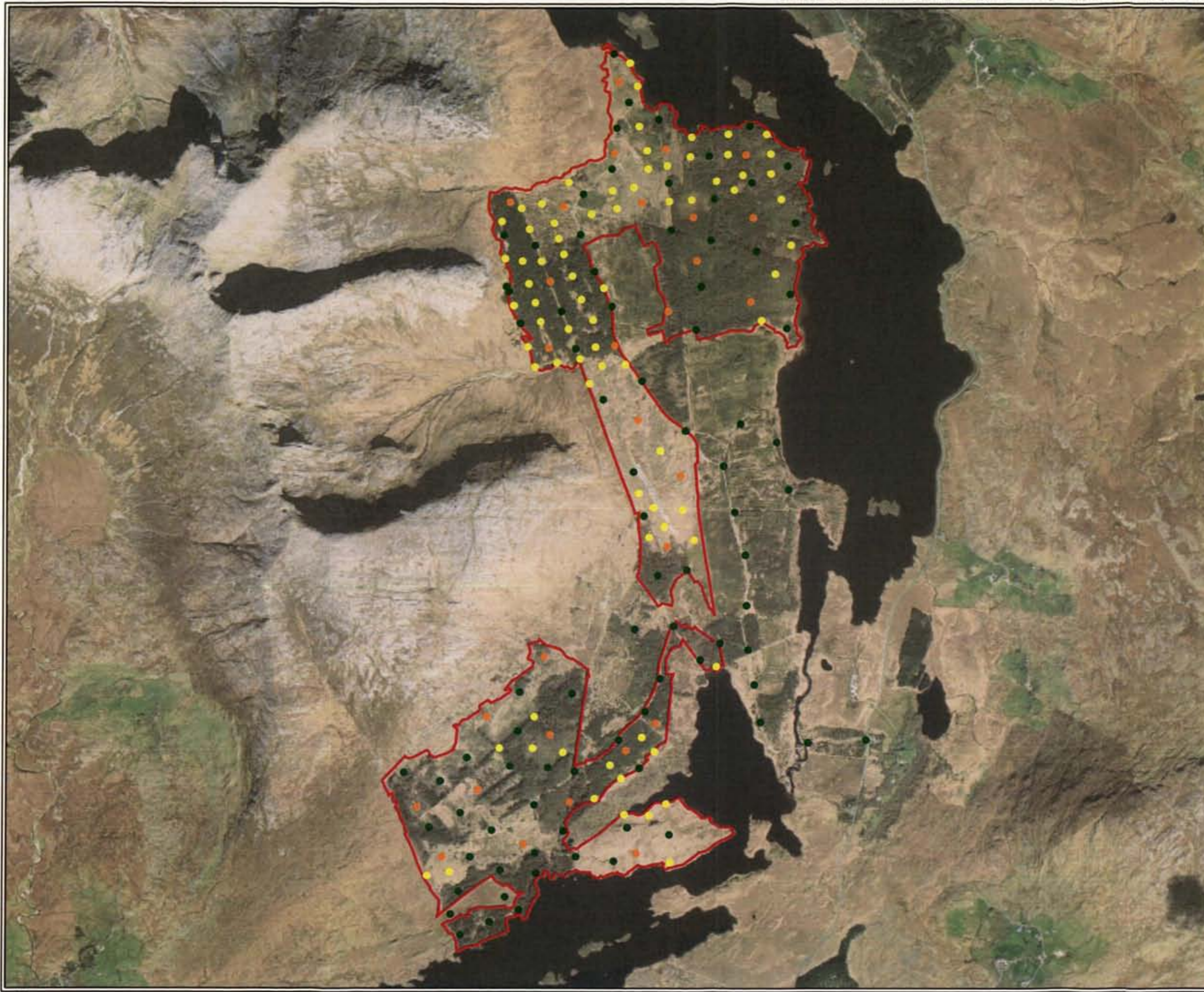
6. DRAWINGS

Table 6-1 Schedule of Drawings

Drawing Number	Drawing Name
001	Peat Probe Location Map
002	Peat Depth Map
003	GPR Profile Locations
004	Factor of Safety Plan (Minimum Undrained)
005	Factor of Safety Plan (Minimum Drained)

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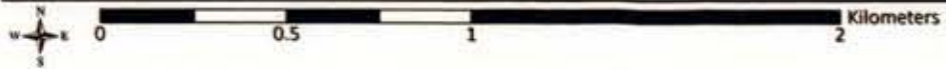
- Legend**
- Site Boundary
 - Phase 1 Peat Probe Locations
 - Phase 2 Peat Probe Locations
 - RPS Peat Probe Locations

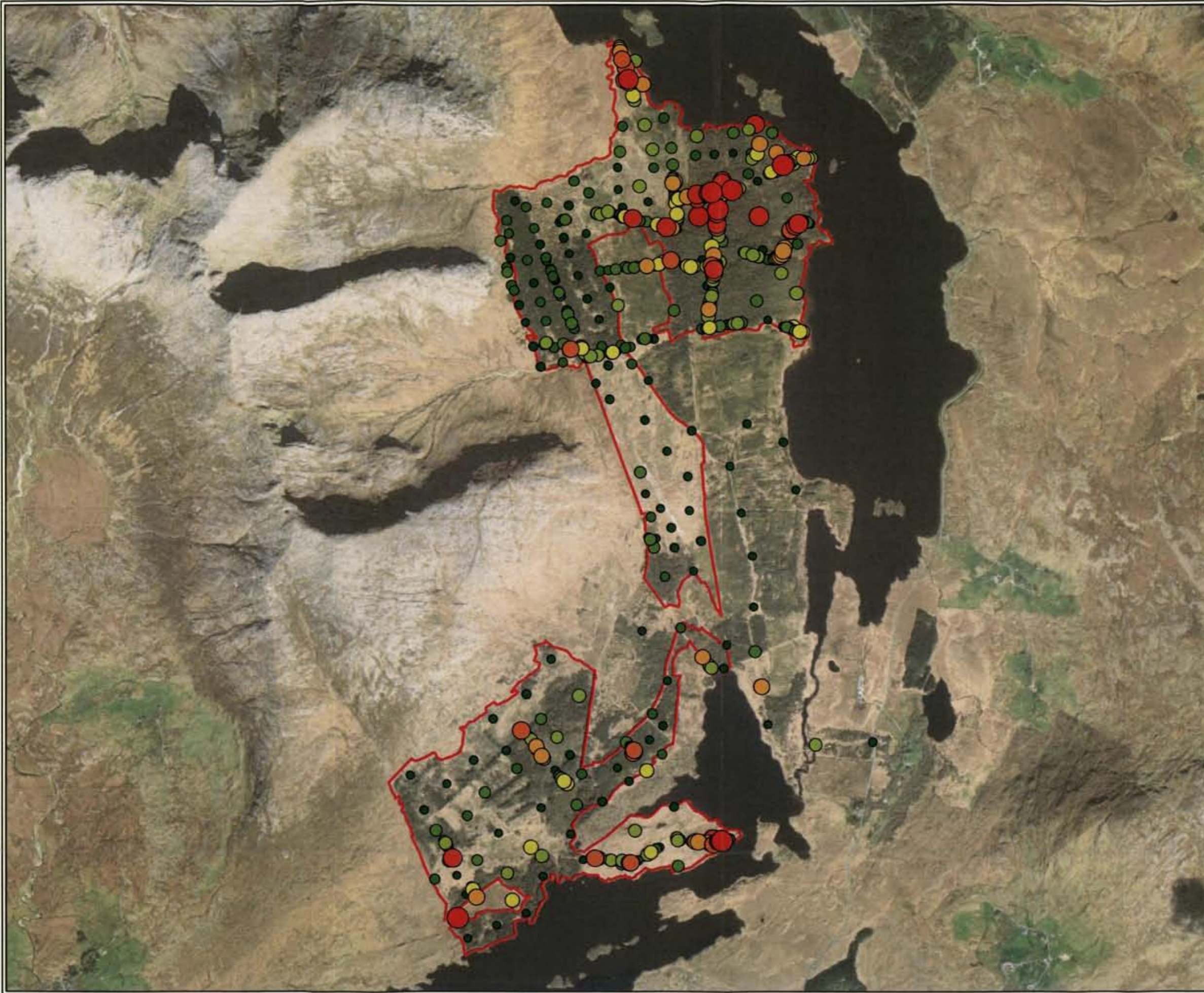
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TITLE:	
Peat Probe Location Map (Phase 1, Phase 2 & RPS probe locations)	
PROJECT:	
Derryclare Peatland Rehabilitation	
DRAWING NO:	001
CLIENT:	MKO
SCALE:	1:20,000
REVISION:	0
DATE:	03/01/2024
PAGE SIZE:	A3





Legend

Site Boundary

Peat Depths (Including Phase 1, Phase 2 and RPS Survey Results)

Peat Depths (m)

- 0.1 - 0.5
- 0.5 - 1
- 1 - 1.5
- 1.5 - 2
- 2 - 2.5
- 2.5 - 3
- 3 - 3.5
- 3.5 - 4
- 4 - 4.5
- 4.5 - 5

Peat Depth (Symbol Size) m

- 0.1
- 1.63333
- 3.16667
- 4.7

Received

08 JAN 2024

Planning & Development Section
Kesh County Council

TITLE: Peat Depth Map (Including Phase 1, Phase 2 and RPS Survey Results)	
PROJECT: Derryclare Peatland Rehabilitation	
DRAWING NO:	002
CLIENT:	MKO
SCALE: 1:20,000	REVISION: 0
DATE: 20/12/2023	PAGE SIZE: A3



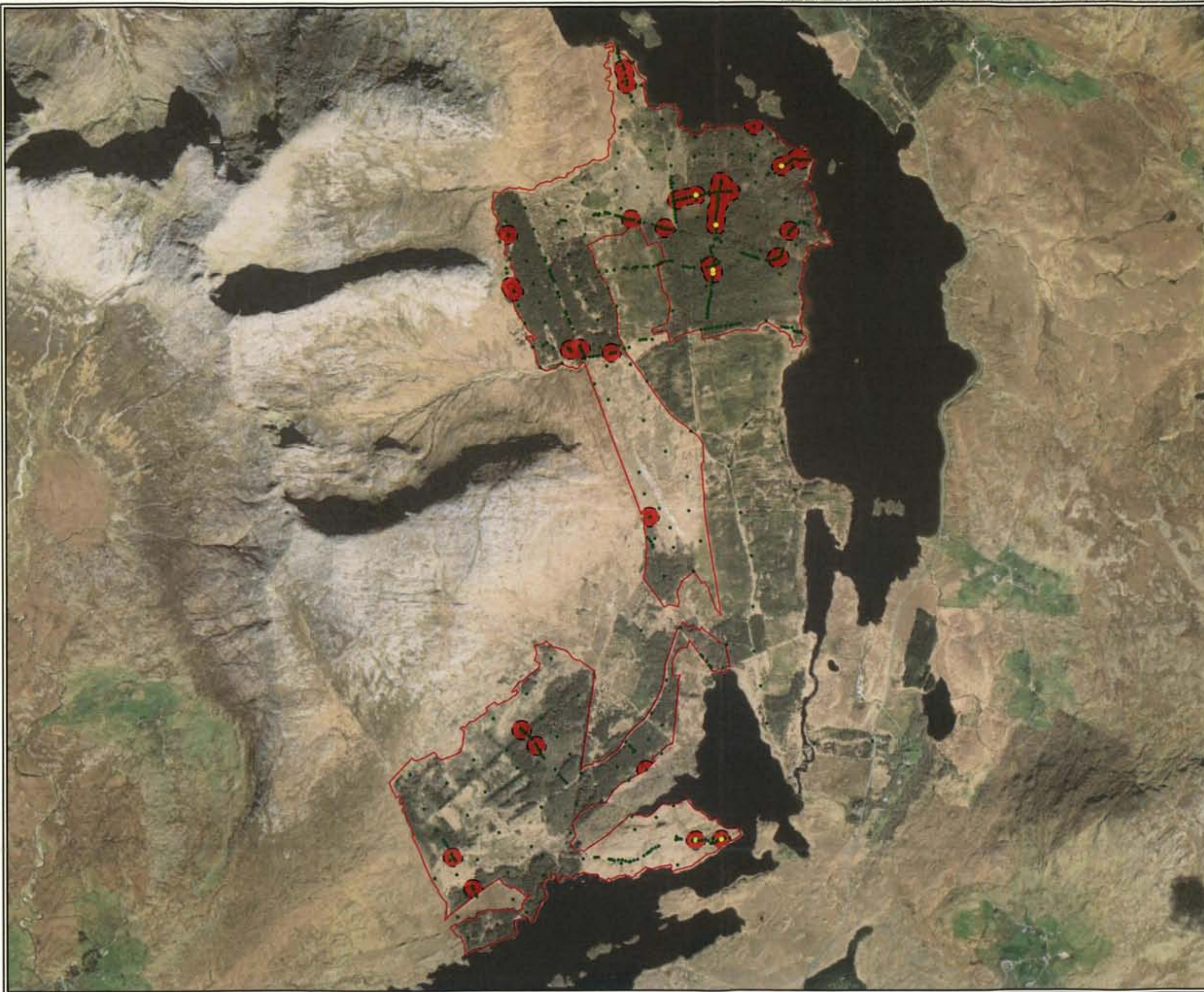


- Legend**
- Site Boundary
 - No Peat Encountered
 - Peat Encountered

Received
08 JAN 2024
Planning & Development Section
Galway County Council

TITLE:	
GPR Profile Locations	
PROJECT:	
Derryclare Peatland Rehabilitation	
DRAWING NO:	003
CLIENT:	MKO
SCALE:	1:20,000
REVISION:	0
DATE:	20/12/2023
PAGE SIZE:	A3

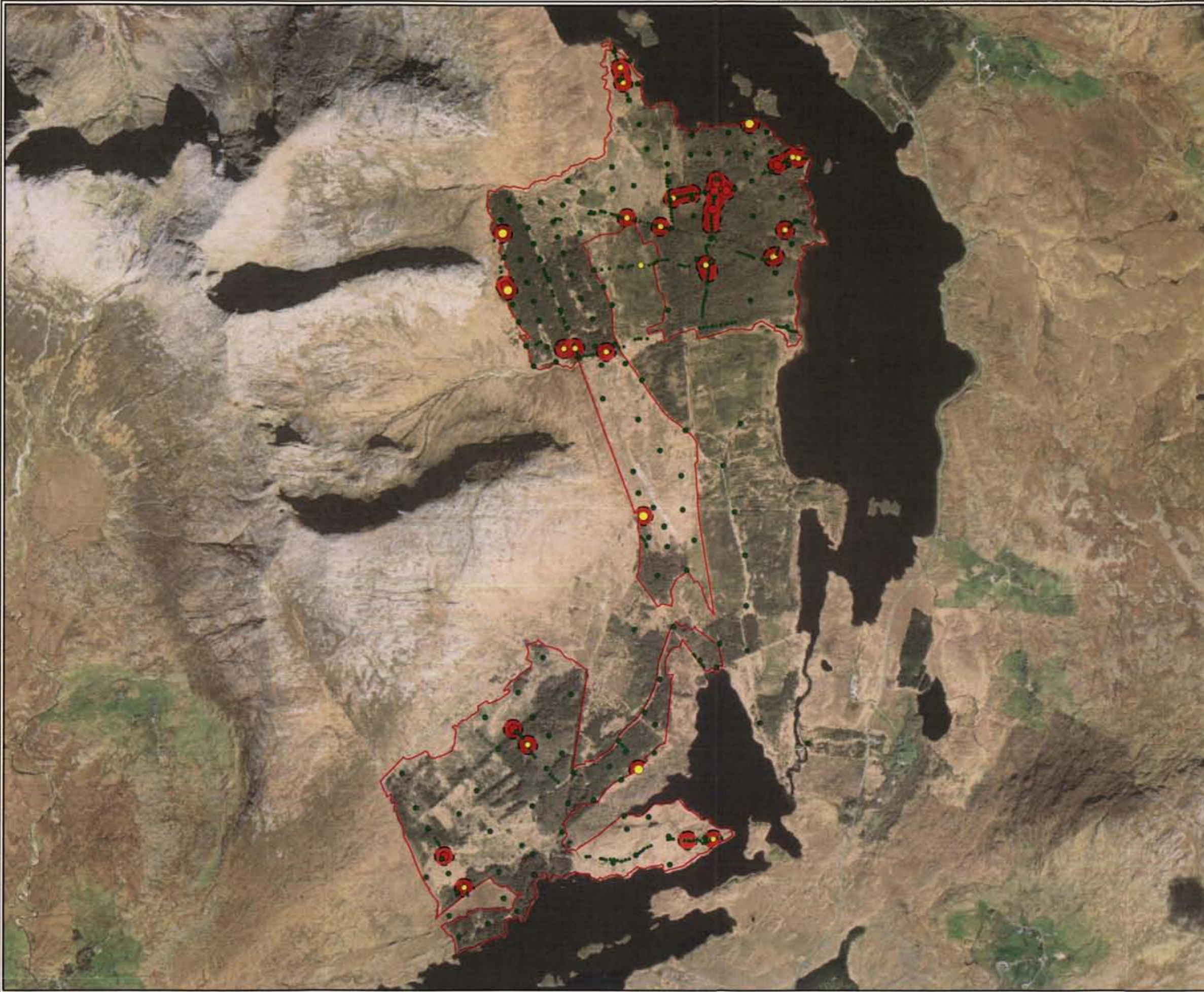




- Legend**
- Site Boundary
 - 50m Exclusion Zone
- Minimum Undrained FoS**
(Including Phase 1, Phase 2 and RPS Survey Results):
- <1
 - 1 - 1.3
 - > 1.3

Received
09 JAN 2024
Planning & Development Section
Wexford County Council

TITLE:	Factor of Safety Plan - Minimum Undrained	
PROJECT:	Derryclare Peatland Rehabilitation	
DRAWING NO:	004	
CLIENT:	MKO	
SCALE:	1:20,000	REVISION: 0
DATE:	03/01/2024	PAGE SIZE: A3



Legend

- Site Boundary
- 50m Exclusion Zone

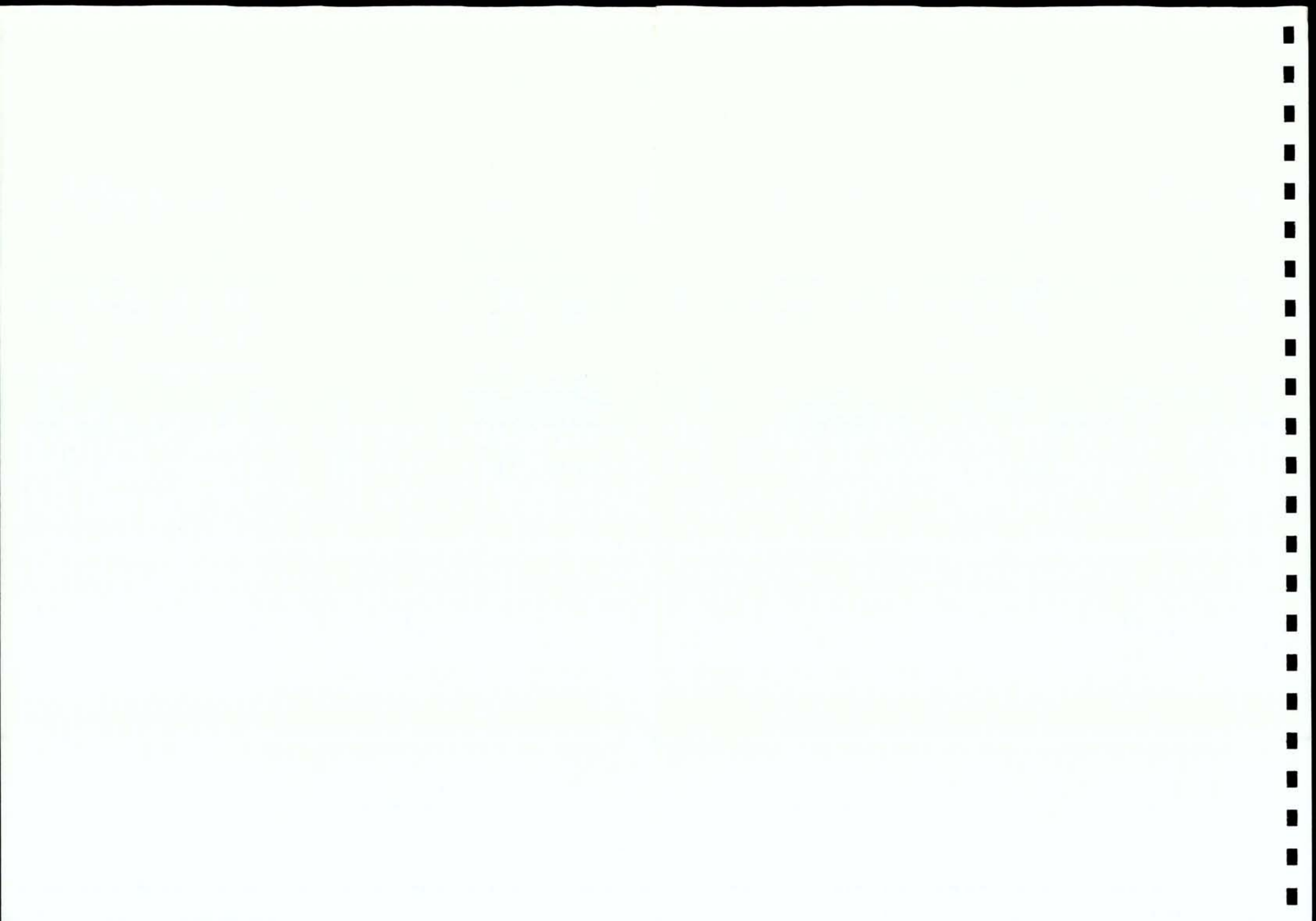
Minimum Drained FoS
(Including Phase 1, Phase 2 and RPS Survey Results):

- <1
- 1 - 1.3
- > 1.3

Received
08 JAN 2024
Planning & Development Section
Kerry County Council

TITLE:	Factor of Safety Plan - Minimum Drained	
PROJECT:	Derryclare Peatland Rehabilitation	
DRAWING NO:	005	
CLIENT:	MKO	
SCALE:	1:20,000	REVISION: 0
DATE:	03/01/2024	PAGE SIZE: A3







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APPENDIX A

Site Photographs

Received
17 JAN 2024
Development Section
County Council

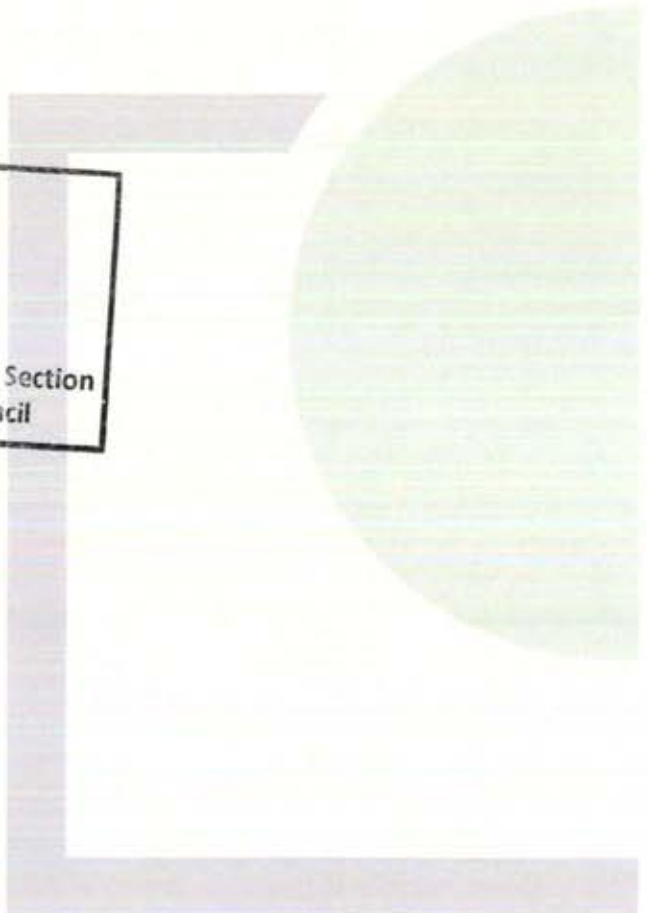






Photo 1 PP086 view west



Photo 2 PP087 view east

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08 JAN 2024

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Photo 3 PP088 view east



Photo 4 PP090 view south

Received
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Planning & Development Section
Galway County Council



Photo 5 PP091 view south east



Photo 6 PP092 view north east

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Planning & Development Section
Galway County Council



Photo 7 PP093 view south



Photo 8 PP094 view west

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08 JAN 2024
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Galway County Council



Photo 9 PP098 view north



Photo 10 PP099 view north

RECEIVED

10 JAN 2024

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Galway County Council



Photo 11 PP100 view north east



Photo 12 PP101 view north

Received
08 JAN 2024
Planning & Development Section
Galway County Council



Photo 13 PP102 view north



Photo 14 PP103 view south west

8 JAN 2024

Planning & Development Section
Galway County Council



Photo 15 PP105 view south west



Photo 16 PP106 view south west

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06 JAN 2024
Planning & Development Section
Galway County Council



Photo 17 PP107 view south west



Photo 18 PP112 view south west

Received
06 JAN 2024
Planning & Development Section
Galway County Council



Photo 19 PP113 view south



Photo 20 PP115 view south west

Received
08 JAN 2024
Planning & Development Section
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Photo 21 P116 view west



Photo 22 P117 view south east

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Planning & Development Section
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Photo 23 PP118 view north



Photo 24 PP119 view north

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Photo 25 PP120 view south east



Photo 26 PP122 view east

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Planning & Development Section
Galway County Council



Photo 27 PP123 view south



Photo 28 PP124 view north

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08 JAN 2024
Planning & Development Section
Galway County Council

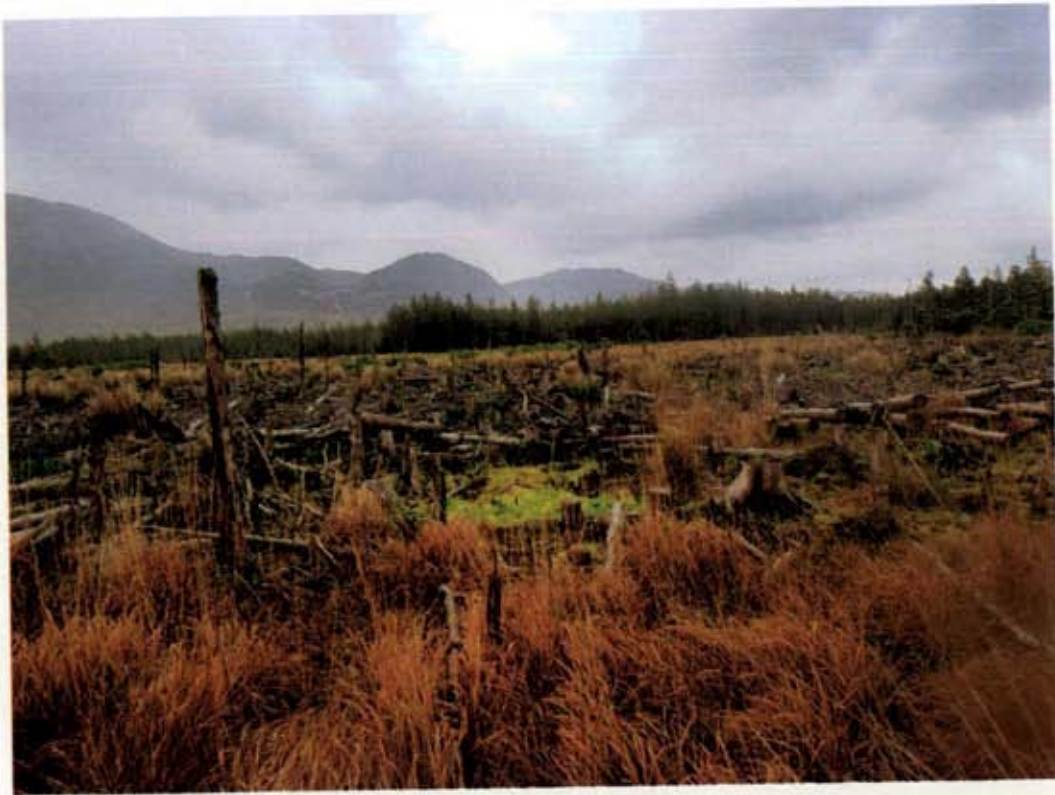


Photo 29 PP125 view east



Photo 30 PP128 view west

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08 JAN 2024
Planning & Development Section
Galway County Council



Photo 31 PP129 view north

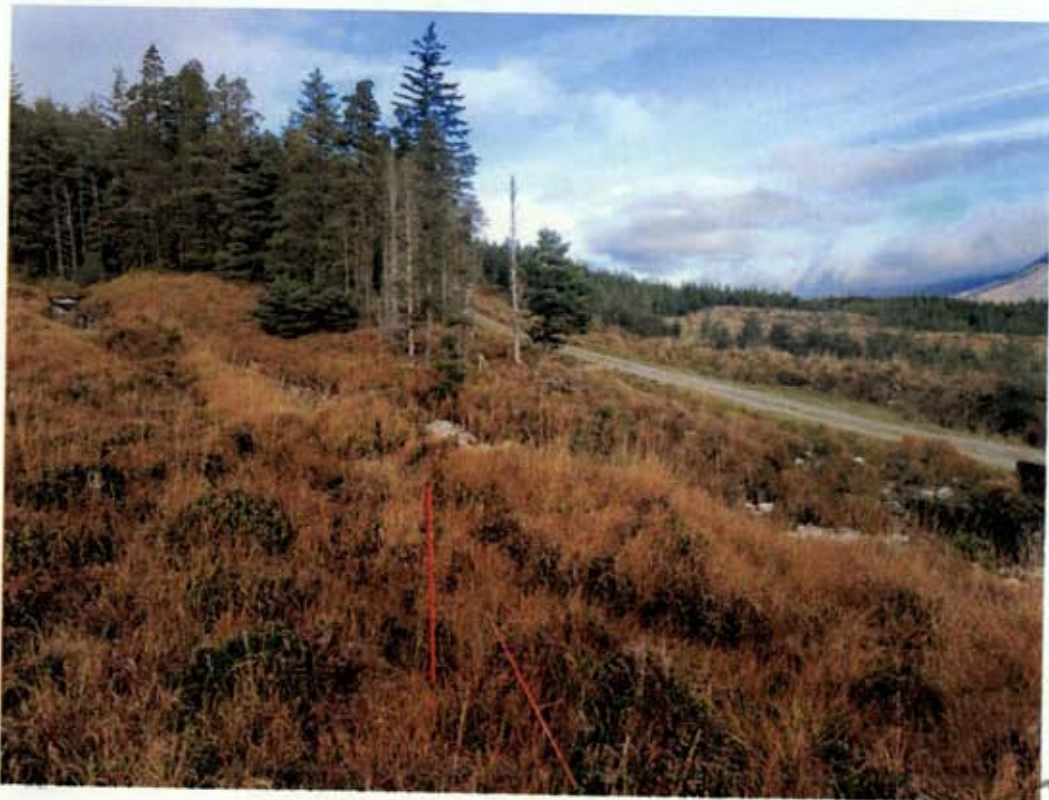


Photo 32 PP130 view north

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08 JAN 2024
Planning & Development Section
Gateway County Council



Photo 33 PP131 view north east



Photo 34 PP123 view east

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Planning & Development Section
Galway County Council



Photo 35 PP133 view south west



Photo 36 PP136 view south

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Photo 37 PP137 view north



Photo 38 PP138 view north

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Galway County Council



Photo 39 PP139 view north



Photo 40 PP140 view north west

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Planning & Development Section
Galway County Council



Photo 41 PP142 view north

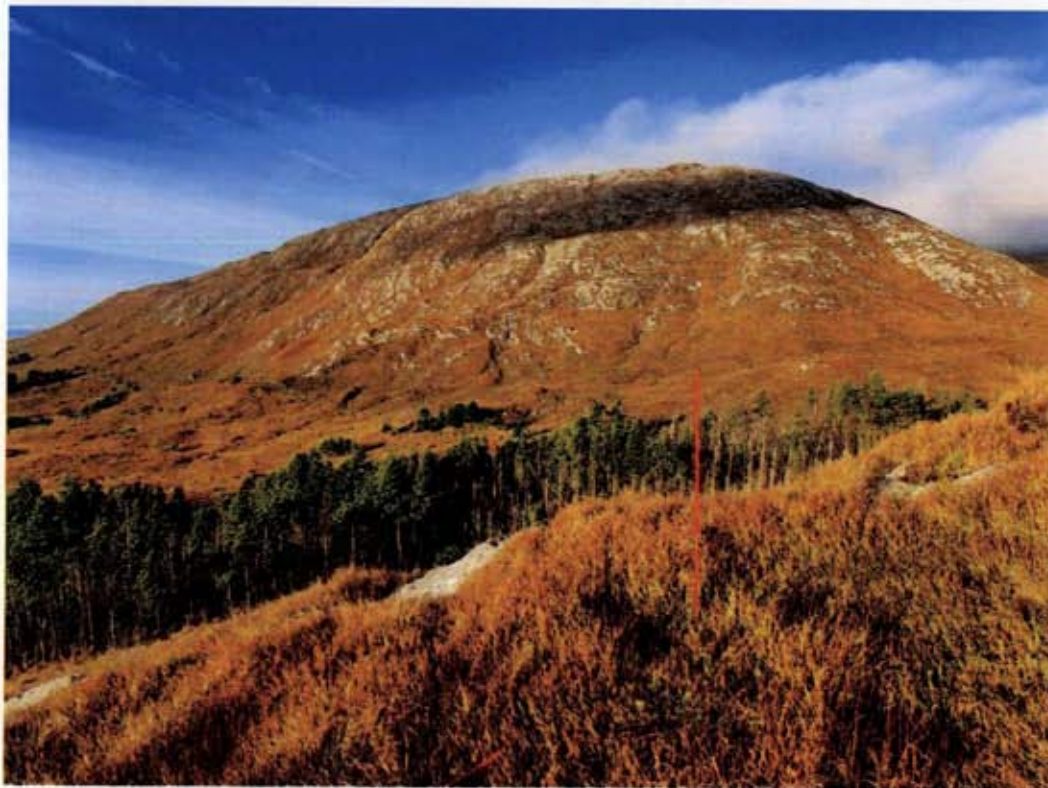


Photo 42 PP143 view north west

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Galway County Council



Photo 43 PP144 view north



Photo 44 PP145 view north

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08 JAN 2024
Planning & Development Section
Galway County Council



Photo 45 PP146 view south west



Photo 46 PP147 view west

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Photo 47 PP150 view south east



Photo 48 PP151 view south

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Photo 49 PP152 view west



Photo 50 PP153 view south (water localised to ruts in brush tracks)

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Photo 51 PP153 view north (water localised to ruts in brush tracks)



Photo 52 PP155 view east

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Photo 53 PP156 view south west



Photo 54 PP157 view south

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Photo 55 PP158 view south east



Photo 56 PP159 view north

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Galway County Council

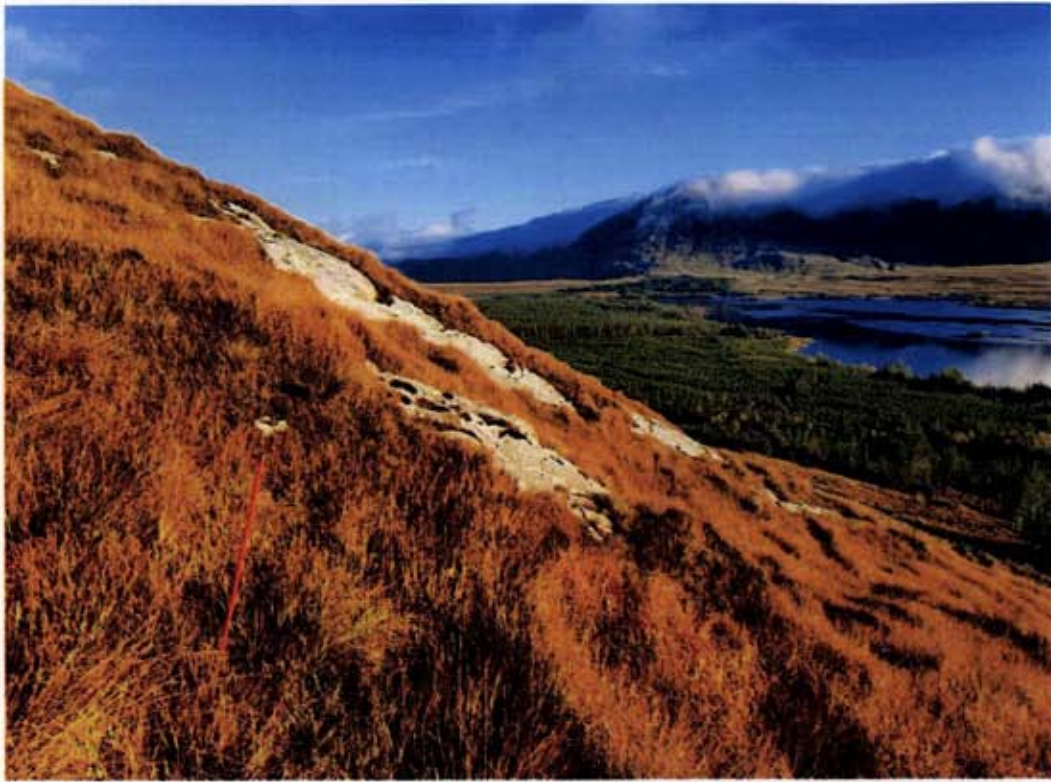


Photo 57 PP160 view north

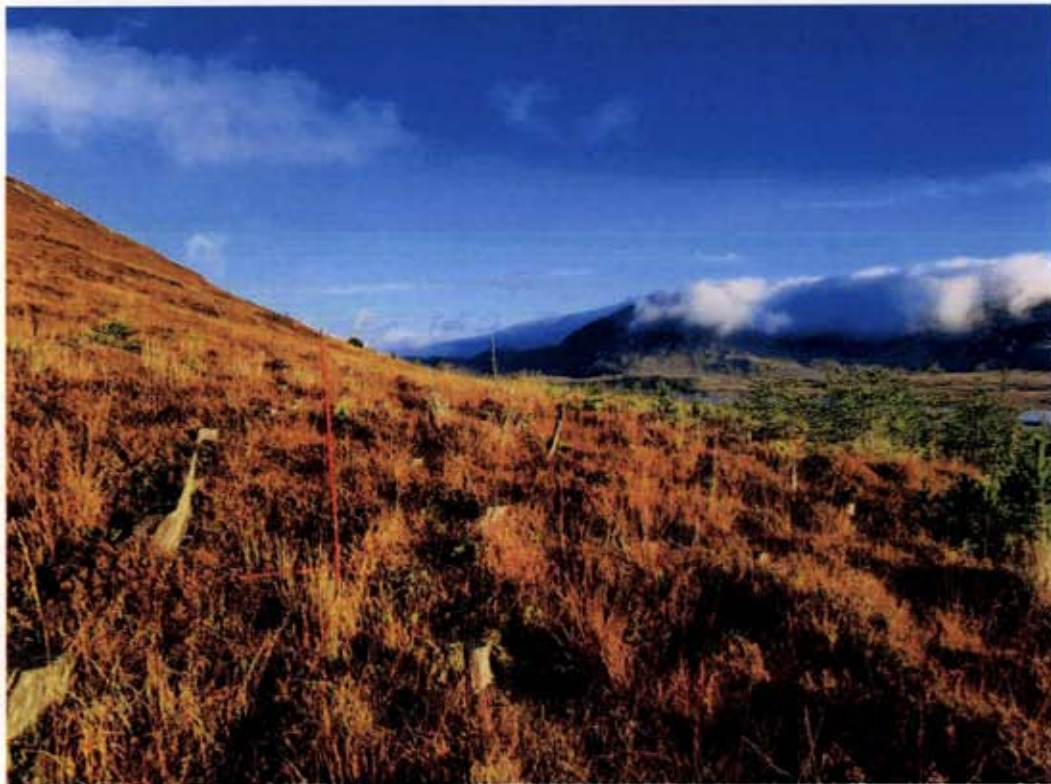


Photo 58 PP161 view north

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Photo 59 PP162 view south

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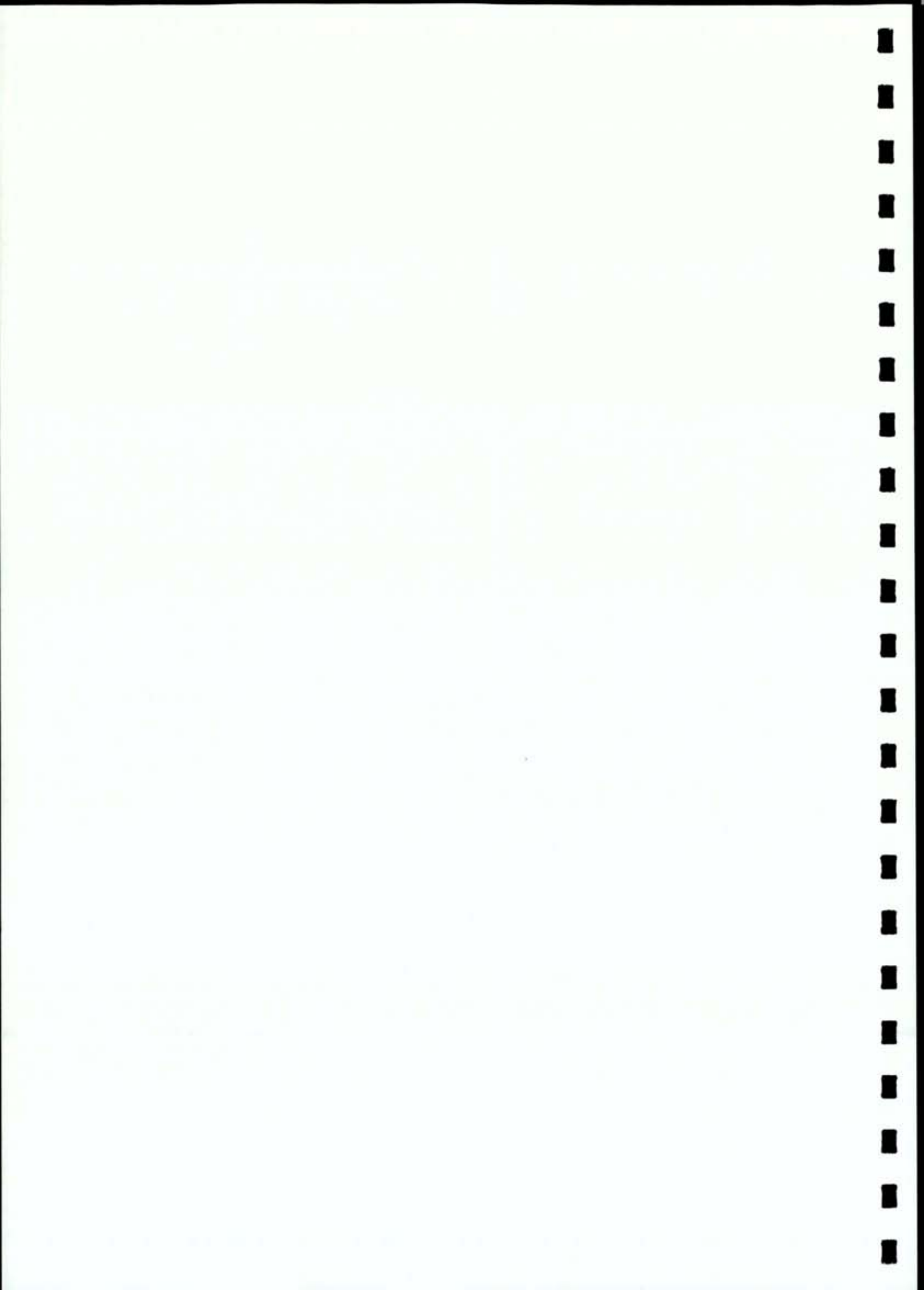
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APPENDIX B

Geophysical Report

Received
08 JAN 2024
Planning & Development Section
Galway County Council



Derryclare Peatland Rehabilitation
Connemara, Co Galway
GPR Survey for Peat Thickness

Report Status: Draft

MGX Project Number: 6737

MGX File Ref: 6737d-005.doc

12th December 2023

Confidential Report To:

Coillte
Dublin Road, Mount Kenndy Demesne
Newtown Mount Kennedy
Co. Wicklow, A63 DN25

Fehily Timoney and Company
Unit 6
Bagenalstown Industrial Park
Royal Oak Road, Muine Bheag
County Carlow, R21 XW81



Report submitted by:
Minerex Geophysics Limited

Issued by:

Unit F4, Maynooth Business Campus
Maynooth, Co. Kildare, W23X7Y5

Author: Hartmut Krahn (Senior Geophysicist)

Ireland
Tel.: 01-6510030
Email: info@mgx.ie

Reviewer: John Connaughton (Geophysicist)



Subsurface Geophysical Investigations

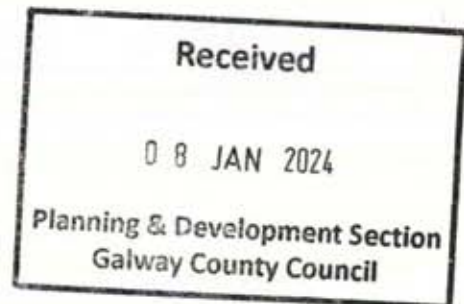
EXECUTIVE SUMMARY

1. Minerex Geophysics Ltd. (MGX) carried out a geophysical survey consisting of Ground Penetrating Radar (GPR) for peat thickness investigation for the Derryclare Peatland Rehabilitation in Connemara, Co. Galway.
2. The main objective of the survey was to determine the extent of peat, the peat thickness and the slope angle for the ground surface and the base of the peat. The client is using this data for a peat stability risk assessment.
3. The survey area is poorly accessible ground and the large tree cover reduced the GPS signal.
4. The interpretation determined the areas where peat is present, and where not. This could be done with a high degree of confidence.
5. 116 areas with peat were found, of which 41 are small and described as 'pods'. 75 areas have been treated with a peat thickness and slope analysis.
6. Smaller pockets of peat may exist along the survey lines, though less than 20m long and less than 1m thick.
7. In the 75 larger areas with peat, values for peat thickness, ground surface slope and base of peat slope have been determined and are tabulated in Table 2 versus the line distance.



CONTENTS

1. INTRODUCTION.....	1
1.1 Background.....	1
1.2 Objectives.....	1
1.3 Site Description.....	1
1.4 Geology	1
1.5 Report	2
2. GEOPHYSICAL SURVEY	3
2.1 Methodology	3
2.2 Site Work	3
3. RESULTS AND INTERPRETATION	4
3.1 GPR Data Processing.....	4
3.2 Display GPR Sections	5
3.3 Interpretation for Peat Thickness	6
4. CONCLUSIONS.....	7
5. REFERENCES	8



List of Tables, Maps and Figures:

Title	Pages	Document Reference
Table 1: GPR Survey Locations and Acquisition Parameters	1 x A4	6737d-Tab1.xls
Table 2: GPR and Peat Data	1 x A4	6737d-Tab2.xls
Map 1: Geophysical Survey Location Map	1 x A3	6737d_Drawings.dwg
Map 2: Geophysical Survey Location Map with Aerial Image	1 x A3	6737d_Drawings.dwg
Figure 1a: GPR Survey Images (No elevation)	1 X A3	6737d_Drawings.dwg
Figure 1b: GPR Survey Images (No elevation)	1 X A3	6737d_Drawings.dwg
Figure 1c: GPR Survey Images (No elevation)	1 X A3	6737d_Drawings.dwg
Figure 2a: GPR Survey Images with elevation and VE 1:5	1 X A3	6737d_Drawings.dwg
Figure 2b: GPR Survey Images with elevation and VE 1:5	1 X A3	6737d_Drawings.dwg
Figure 2c: GPR Survey Images with elevation and VE 1:5	1 X A3	6737d_Drawings.dwg
Figure 2d: GPR Survey Images with elevation and VE 1:5	1 X A3	6737d_Drawings.dwg
Figure 2e: GPR Survey Images with elevation and VE 1:5	1 X A3	6737d_Drawings.dwg
Figure 2f: GPR Survey Images with elevation and VE 1:5	1 X A3	6737d_Drawings.dwg



1. INTRODUCTION

1.1 Background

Minerex Geophysics Ltd. (MGX) carried out a geophysical survey for the Derryclare Peatland Rehabilitation in Connemara, Co. Galway. The survey consisted of Ground Penetrating Radar (GPR) measurements.

GPR is a reliable and well established method to determine the thickness of peat deposits.

1.2 Objectives

The main objective of the geophysical survey was to determine the peat thickness and base of peat elevation along given lines. The ground surface slope, peat thickness and peat base slope are used in a risk assessment for peat stability by the engineers.

1.3 Site Description

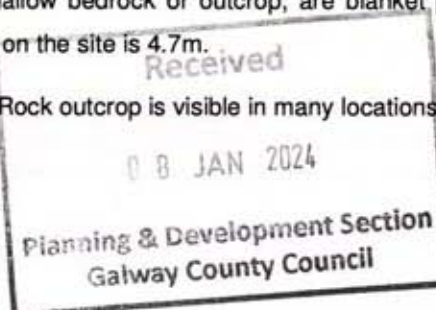
The survey lines given by the client have a combined length of 12.2km within the Coillte forestry area that has a total size of 560ha. The GPR survey lines crossed through forestry, cut-down forestry and some natural areas. Some areas were wet, water covered and very soft underfoot. In some places the operators had to climb over lying trees and pull the GPR antenna over the tree trunks. Generally, the lines were difficult to walk, in some spots walking was barely possible, and in one location (NW of G32) walking was not possible. Many survey lines curve around and weave through wet spots, felled trees and windrows.

The Coillte Derryclare forestry area is located to the west of Lough Inagh and to the NW of Derryclare Lough. To the west of the forestry are the Twelve Bens. The elevations range from 15 to 180mOD. The forestry is mainly conifers with some broadleaves in the Derryclare Nature Reserve. Invasive plants are occurring quite a lot on the land.

1.4 Geology

The overburden and bedrock geological conditions as taken from the Geological Survey of Ireland (GSI, 2023). The quaternary sediments, mapped outside the shallow bedrock or outcrop, are blanket peat and glacial till. The maximum peat thickness previously mapped on the site is 4.7m.

The bedrock consists of quartzite, schist and some marble. Rock outcrop is visible in many locations.



1.5 Report

This report includes the results and interpretation of the GPR survey. Maps, figures and tables are included to illustrate the results of the survey. More detailed descriptions of geophysical methods and measurements can be found in GSEG (2002), Milsom (1989) and Reynolds (1997).

The client did not provide background maps and an aerial image was used as the background map in this report. Elevations were surveyed on site and are used in the vertical sections.

The interpretative nature and the non-invasive survey methods must be taken into account when considering the results of this survey and Minerex Geophysics Limited, while using appropriate practice to execute, interpret and present the data, give no guarantees in relation to the existing subsurface.



2. GEOPHYSICAL SURVEY

2.1 Methodology

The methodology consisted of GPR surveying at proposed line locations.

The survey locations are indicated on Map 1. The lines, locations, length and directions are tabulated in Table 1. All results with coordinates and elevations are in Table 2.

The GPR system was a MALA ProEx GPR with a Rough Terrain Antenna (RTA100). The system was connected to an RTK-GPS to give accurate locations and elevations in ground with an open sky. The scan spacing along each line was 4 readings per second. The walking speed varied between 1.5m/sec and very slow walking coming to a halt in many places. The locations and ground elevations were combined with the GPR data in the REFLEXW software.

The expected peat thickness on site was up to 4.2m deep and the 100MHz antenna was selected because it has the penetration depth to reach 4.2m through peat, but also good resolution at shallower depth.

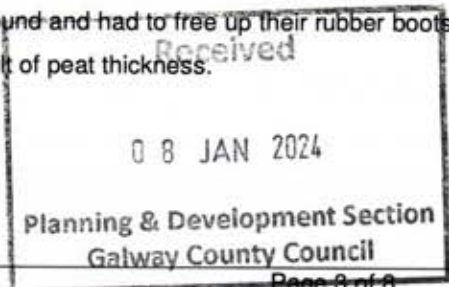
The rough terrain antenna is like a 6m long snake and pulled by the operator. On rough ground it averages the ground surface when gliding over ditches or holes, or when moving over heather bushes, other vegetation and felled trees.

The depth penetration of the EM pulse emitted by the Ground Penetrating Radar is dependent on the soil and rock physics properties of the subsurface. The greater the level of absorption of the EM energy the less penetration is achieved. Based on a time – depth conversion velocity of 0.035 m/ns, which is typical for peat, the 100 MHz antenna achieved penetration depth to the maximum peat thickness.

2.2 Site Work

The data acquisition was carried out between on the 23th October to 2nd November 2023. The weather conditions were fair and rainy throughout the acquisition period. Health and safety standards were adhered to at all times. The locations and elevations were surveyed with a Carlson NR3 RTK-GPS. The accuracy depended on the tree cover.

The rough nature of forestry and peat bogs with swampy ground in places and felled or windblown trees made the terrain very difficult to walk on. One operator was leading the way with a GPS, while the second operator was pulling the GPR antenna and carrying the RTK-GPS. In some places sharp turns had to be taken and occasionally the operator would sink into soft watery ground and had to free up their rubber boots. This led to disruptions along the line but did not affect the final result of peat thickness.



3. RESULTS AND INTERPRETATION

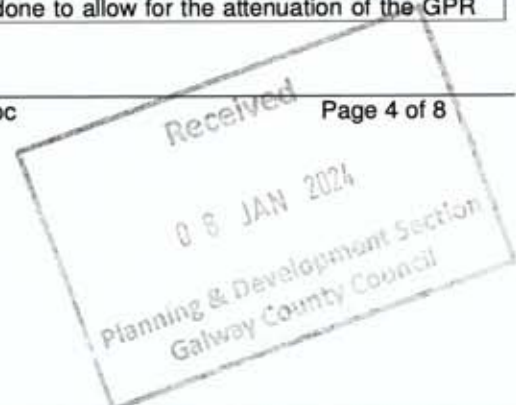
The interpretation of the GPR data was executed utilizing the known response of geophysical measurements, typical physical parameters for subsurface features that may underlay the site, and the experience of the authors.

3.1 GPR Data Processing

The GPR data was processed and analysed in the REFLEXW reflection and transmission data processing software package. The datasets were converted from 'RADAN' format to 16-bit REFLEXW format for digital signal processing. Data processing testing was carried out to optimise parameters. The acquired lines names G1 to G86 were sorted for productive lines, as there are some failed lines or repeat lines involved. The lines used in the report are given in Table 1. The following processing sequence was designed and applied to lines, with some individual adjustments:

Table 3: GPR Processing Sequence

Seq. No.	Processing	Parameter Details
1	Positioning	The geographic coordinates of the Ramac system get converted to ITM in Gridinquest2.
2	Offset	The offset between GPS and GPR was determined and added to the location and elevation information. Then GPS coordinates and elevations were combined with the GPR records in order to have continuous location information in the traceheaders
3	Location QC	The data is then viewed with location and elevation. Because of tree cover they are often not 'fixed' but have a lower accuracy. Corrections are done manually in a time consuming process. This is sometimes done several times over. There was a lot of tree cover on the land
4	Positioning Merge	Coordinates and elevations were merged with the GPR traces. A smoothing factor of 50 was used 5 times. This removes the wobble of the antenna on the back pack and small GPR inaccuracies
5	Bandpass Butterworth Frequency Filter	A bandpass filter with 33 – 300 Hz was used that removes frequencies outside the useful antenna frequencies
6	Energy Decay	An energy decay was done to allow for the attenuation of the GPR



		wave
7	Dynamic Correction	The dynamic correction applies a correction for the antenna transmitter and receiver spacing of 2.2m (100MHz)
8	Equidistant Traces	The traces were resampled at a trace spacing of 0.2m to create a homogeneous dataset
9	Gain Function (Mala Data)	The gain function was applied to increase amplitudes at larger times
10	2D-Background Removal	A background removal was carried out to remove horizontal banded noise derived from reverberation and system noise
11	Topographic Correction	The data was stretched from time to depth for display purposes using a velocity of 0.035 m/ns that was obtained by calibrating the depth for the base of the peat from GPR and from Peat Push Probe information.
12	Display Optimisation	The profiles were plotted with a trace and profile normalisation. A blue-grey-magenta colour scheme was chosen for sections with topography and 1 1:5 VE in order to highlight the full range of amplitudes within the data. A grey scale display with flat surface and a vertical exaggeration of 1:10 was also used and both image types were imported into AutoCAD for use in the interpretation.

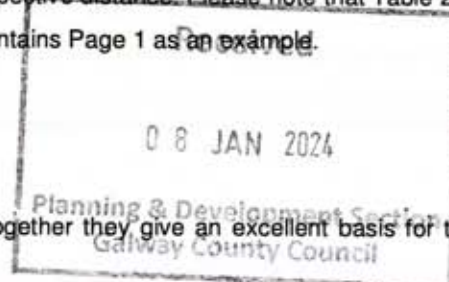
The obtained GPR wave velocity for peat of 0.035 m/ns ties in well with the client's peat push probe results.

Other factors to be considered are that the peat probe has a small cone that could also penetrate soft layers other than peat or might refuse on a harder piece of material in the peat. The GPR wave on the other hand has a first Fresnel zone of 1 – 2 m which means that the reflection at the base of the peat comes from the average over a 1 – 2 m radius.

The lines were also resampled to equidistant traces with 2m spacing and then the traceheader coordinates and elevations were written into the file for Table 2 with their respective distance. Please note that Table 2 is supplied digitally as an Excel file and that the report PDF only contains Page 1 as an example.

3.2 Display GPR Sections

The GPR sections are displayed as two image types. Taken together they give an excellent basis for the interpretation.



Flat Display without elevations in Figures 1a to 1c: The processed GPR data is displayed in flat images with a vertical exaggeration of 1:10, no topography shown.

Elevation display: The processed GPR data for lines that contain interpreted peat is displayed as sections with elevation and a vertical exaggeration of 1:5 in Figures 2a to 2f.

3.3 Interpretation for Peat Thickness

Peat can be seen as an area of faint or no reflections and is generally 'white' or 'light grey' in the sections.

Areas with peat are marked above the cross sections by a magenta horizontal bar. The distance of the bar along each line is marked in Table 2 by a '1' in column H.

The locations of all peat areas are visible on Map 1 and 2 by a magenta circle.

Presence of peat is often interrupted by area without peat so that most of the peat occurs in isolated areas rather than large continuous stretches.

Where the peat occurs in relatively small 'pods' this is written in Column G (Table 2), these are typically around 20m long or less. They are often shaped like a bowl, and no further analysis is done here.

Where areas of peat are larger than 'pods', the peat thickness, ground surface slope angle and base of peat slope angle were determined. These are marked in the CAD section by vertical magenta bars (thickness), sloping blue bars (ground surface) and sloping red bars (base of peat).

The values are listed in Table 2 along the row where the peat thickness is determined. The blue and red sloping bars are drawn to fit the slopes across the area and are not necessarily centred at the peat thickness location.

The values above will feed into a risk assessment for peat stability by the client.

The locations where peat thickness and slope data are drawn depends on the person doing the drawings, we generally took locations where the peat is thickest and the slope are largest. This is leaning towards a higher risk for a peat area, but the risk overall could be still very small.

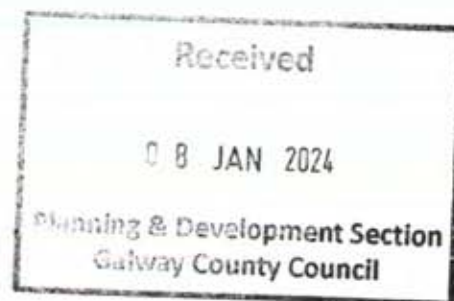
The data in this report is delivered in AutoCAD maps and Excel, some items may not be visible in the PDF version of the report, but all data is made available in digital files that the client can work with.



4. CONCLUSIONS

The following conclusions are made:

- The largest difficulties in this survey arose from the poorly accessible ground and tree cover that reduced GPS signal.
- Extensive positional processing tried to remove this in as much as possible.
- The first interpretation step was to determine where the peat is located, and where there is no peat. The solution is considered very reliable as the peat could be very well identified. The results are processed as a CAD map and in a numerical table, sampled to 2m distance. In these formats the results are very easy to use.
- Areas of peat 'pods' with lengths of around 20m or less and often shaped like a bowl are indicated, and no further analysis is done here.
- Smaller pockets of peat may exist though they would be less than 20m long and less than 1m thick and they have no impact on peat stability.
- In total we interpret 116 areas with peat of which 41 are described as 'pods' and 75 have been treated with a peat thickness and slope analysis.
- In all other peat areas, values for peat thickness, ground surface slope and base of peat slope have been determined and are tabulated in Table 2 versus the line distance.



5. REFERENCES

1. **BSI, 2015.** BS5930, Code of Practice for Ground Investigations, British Standards Institute 2015
2. **GSEG, 2002.** Geophysics in Engineering Investigations. Geological Society Engineering Geology Special Publication 19, London, 2002
3. **GSI, 2023.** Online Bedrock Geological Map of Ireland. Geological Survey of Ireland 2023
4. **Milsom, 1989.** Field Geophysics. John Wiley and Sons, 1989
5. **Reynolds, 1997.** An Introduction to Applied and Environmental Geophysics. John Wiley and Son, 1997



Table 1: Geophysical Survey Locations and Acquisition Parameters

Line Name	Any Peat Interpreted?	Line Distance (m)	Direction
1	Yes	372.3	SE-NW
5	Yes	158.6	SE-NW
8	No	101.8	NW-SE
9	No	110.7	NW-SE
11	No	44.8	NW-SE
12	No	48.2	NW-SE
13	Yes	196.4	NW-SE
14	Yes	124.1	NW-SE
15	Yes	121.4	NW-SE
16	No	67.3	NW-SE
17	No	37.9	NW-SE
18	No	20.0	NW-SE
19	Yes	83.2	NW-SE
24	Yes	467.6	W-E
25	Yes	346.3	W-E
32	Yes	192.3	SE-NW
33	Yes	261.1	NW-SE
38	No	125.2	SE-NW
39	No	65.6	NW-SE
40	Yes	126.7	NW-SE
41	No	399.1	NW-SE
42	Yes	352.4	SE-NW
44	Yes	175.4	N-S
45	Yes	242.6	N-S
49	Yes	251.3	SW-NE
50	Yes	370.1	SW-NE
51	Yes	181.8	SW-NE
53	Yes	358.6	N-S
54	Yes	338.0	N-S
55	Yes	92.1	N-S
56	Yes	111.9	N-S
58	Yes	350.7	N-S
59	Yes	549.0	W-E
60	No	264.2	NE-SW
61	Yes	231.0	NE-SW
64	Yes	255.9	W-E
65	Yes	292.1	W-E
66	Yes	278.4	SW-NE
67	Yes	394.7	SW-NE
68	Yes	204.0	SW-NE
70	Yes	250.6	E-W
71	Yes	247.8	E-W
72	Yes	476.2	E-W
73	Yes	20.4	E-W

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Table 1: Geophysical Survey Locations and Acquisition Parameters

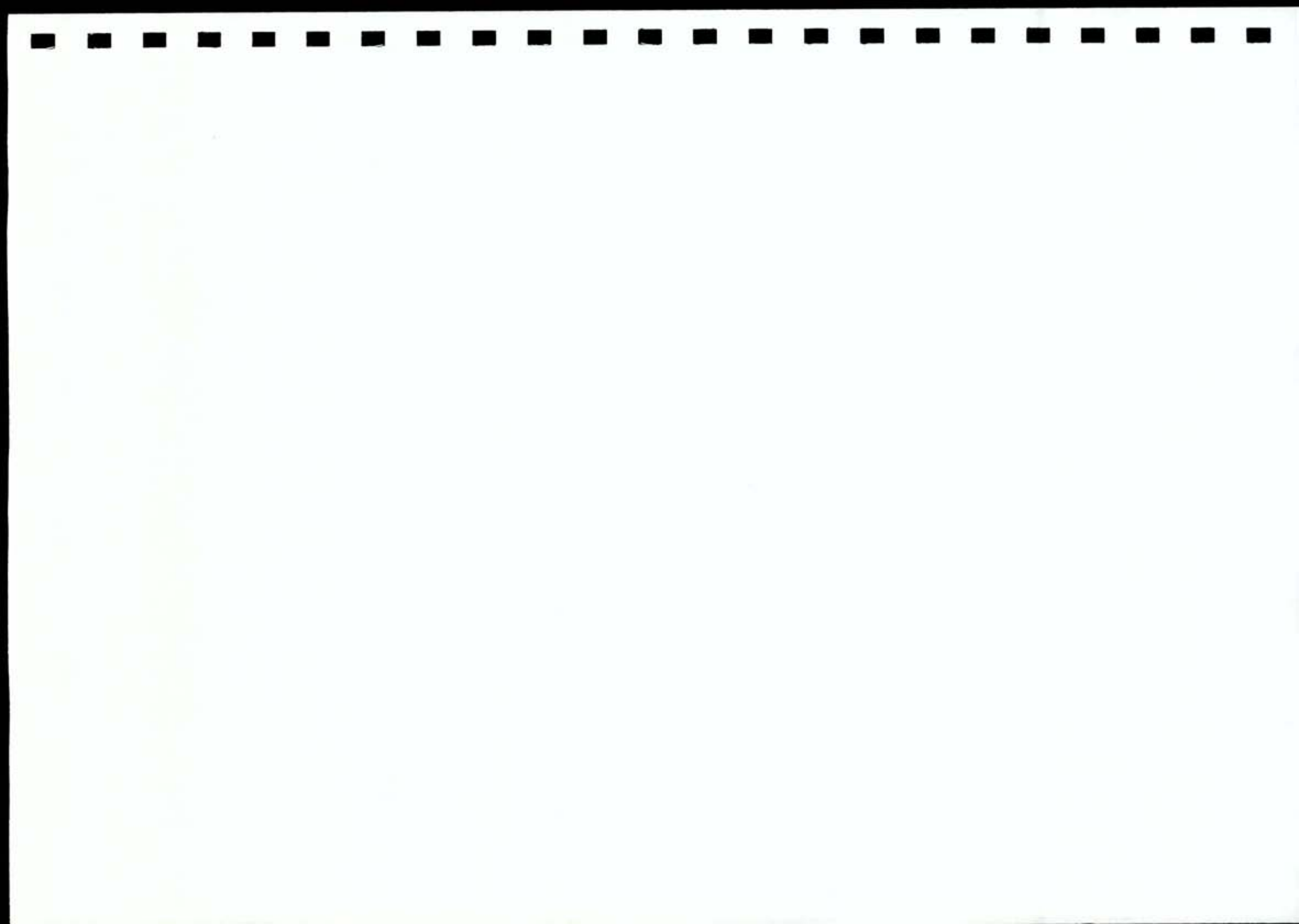
74	Yes	140.2	E-W
76	No	387.5	S-N
77	Yes	358.7	S-N
78	Yes	423.1	W-E
80	No	489.6	NW-SE
83	Yes	331.7	NW-SE
84	Yes	626.9	NW-SE
86	Yes	108.4	SE-NW

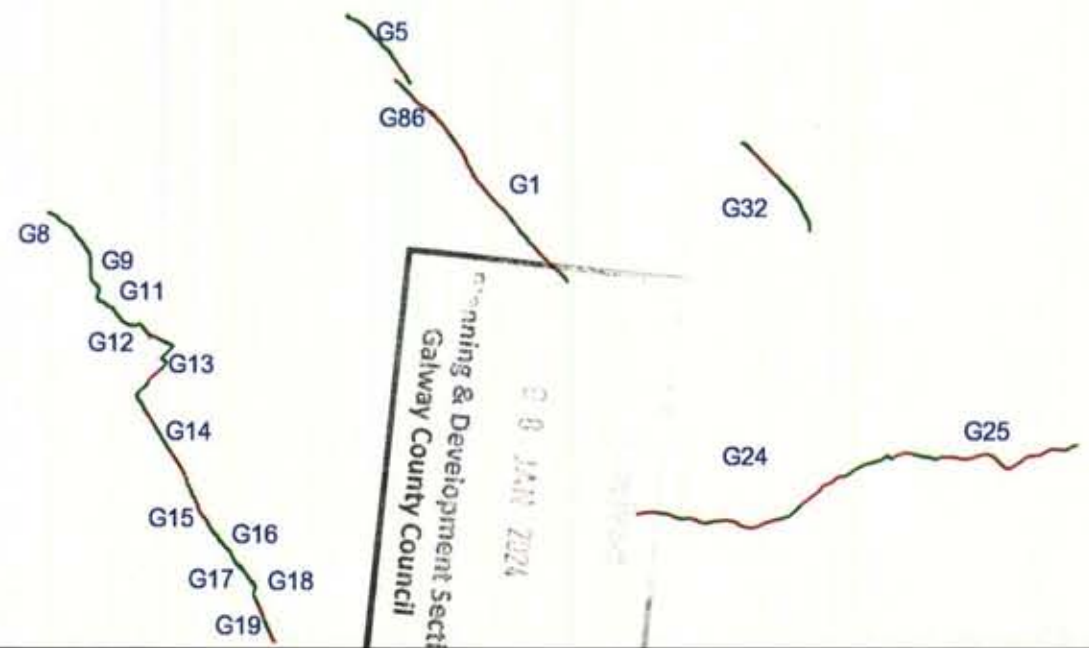
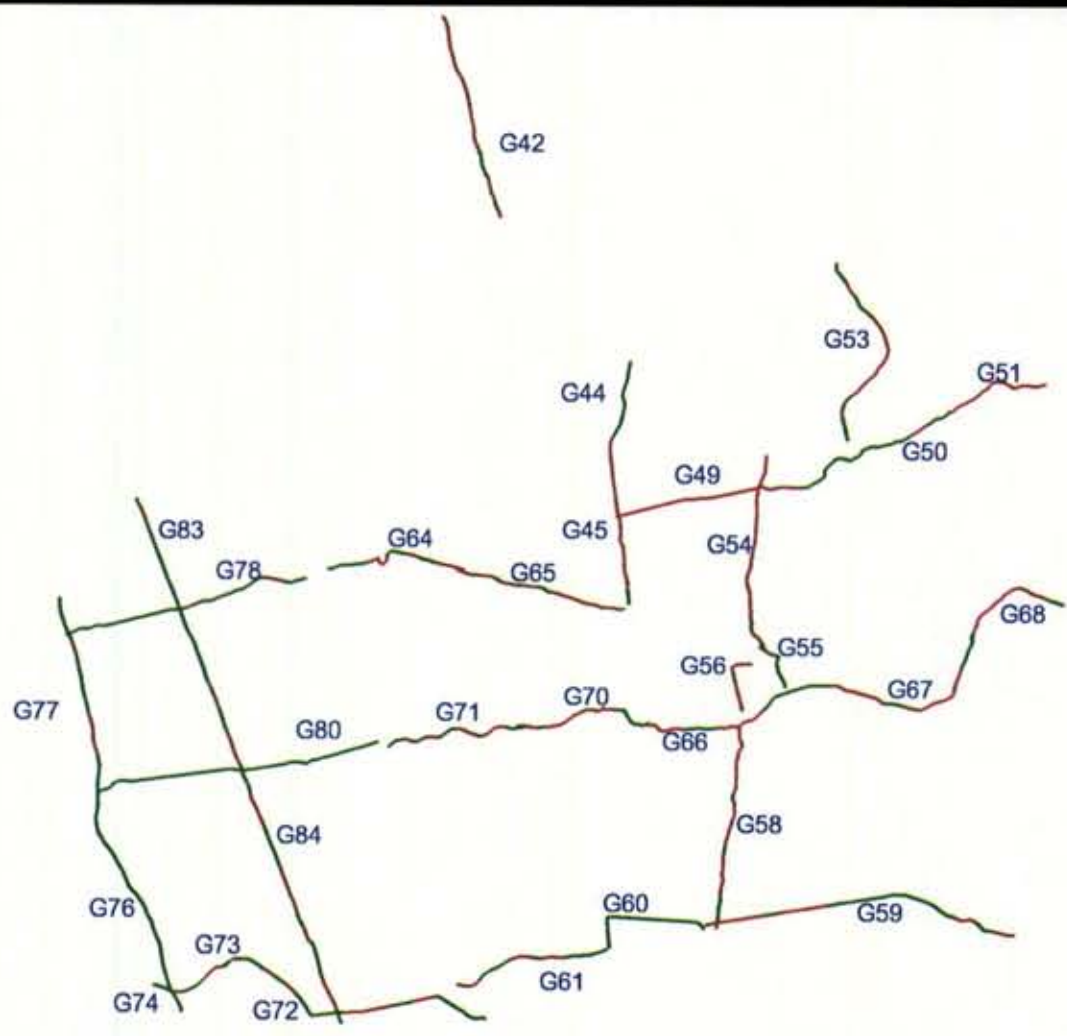
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Table 2 GPR and Peat Data

Trace	Distance	East	North	Elev	Line	Distance	Peat	Type	Thickness (m)	Surface Slope 5VE (deg) ACAD	Base Slope 5VE (deg) ACAD	Surface Slope (deg)	Base Slope (deg)
1	0	482915.8	749706.7	41.6	G1	0							
2	2	482914.7	749708.3	41.6		2							
3	4	482913.5	749710.0	41.7		4							
4	6	482912.4	749711.6	41.7		6							
5	8	482911.2	749713.2	41.9		8							
6	10	482909.9	749714.8	42.0		10							
7	12	482908.6	749716.3	42.5		12							
8	14	482907.2	749717.7	43.1		14							
9	16	482905.7	749719.1	43.5		16							
10	18	482904.3	749720.4	43.7		18							
11	20	482902.8	749721.8	43.9		20							
12	22	482901.3	749723.1	44.0		22	1						
13	24	482899.7	749724.4	43.9		24	1						
14	26	482898.2	749725.6	44.0		26	1						
15	28	482896.6	749726.8	44.0		28	1						
16	30	482894.9	749727.9	44.0		30	1						
17	32	482893.2	749729.0	44.2		32	1						
18	34	482891.5	749730.1	44.3		34	1						
19	36	482889.9	749731.3	44.3		36	1						
20	38	482888.5	749732.6	44.2		38	1						
21	40	482887.1	749734.1	44.4		40	1						
22	42	482885.8	749735.6	44.5		42	1						
23	44	482884.5	749737.1	44.6		44	1						
24	46	482883.2	749738.6	44.6		46	1	2.4	9.1	13.3	1.8	2.6	
25	48	482881.8	749740.1	44.7		48	1						
26	50	482880.5	749741.6	44.8		50	1						
27	52	482879.2	749743.1	44.8		52	1						
28	54	482877.8	749744.6	44.8		54	1						
29	56	482876.4	749746.0	44.8		56	1						
30	58	482874.9	749747.3	44.9		58	1						
31	60	482873.4	749748.6	45.0		60	1						
32	62	482871.9	749750.0	45.1		62	1						
33	64	482870.5	749751.4	45.2		64	1						
34	66	482869.2	749752.9	45.2		66	1						
35	68	482867.8	749754.4	45.3		68	1						
36	70	482866.5	749755.8	45.5		70	1						
37	72	482865.1	749757.3	45.7		72	1						

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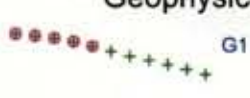




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CLIENT Coillte, MKO
Fehily Timoney and Company
PROJECT Derryclare Peatland Rehabilitation
Geophysical Survey
TITLE Map 1: Geophysical Survey
Location Map

SCALE: 1:12500 @ A3
PROJECT: 6737
DRAWN: CK
DATE: 10/11/2023
MGX FILE: 6737d_Drawings.dwg
STATUS: Draft

Geophysical Survey Locations:

 G1 Ground Penetrating Radar Line
 Green cross indicates locations every 2m, magenta indicates the presence of interpreted peat
 Locations are in Irish Transverse Mercator (ITM), Elevations are in mOD (Malin Head)



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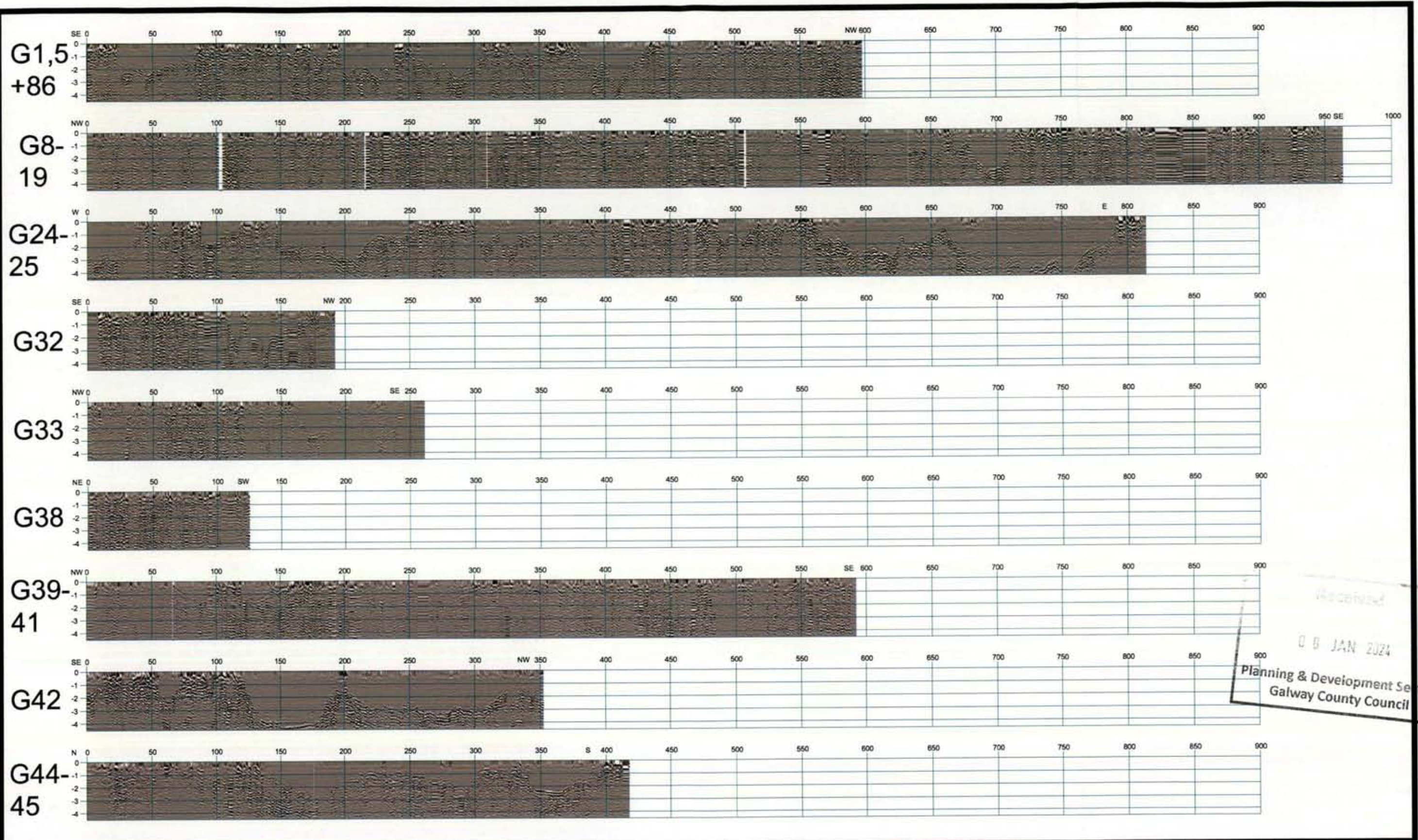
CLIENT	Coillte, MKO Fehily Timoney and Company
PROJECT	Derryclare Peatland Rehabilitation Geophysical Survey
TITLE	Map 2: Geophysical Survey Location Map with Aerial Image

SCALE:	1:12500 @ A3
PROJECT:	6737
DRAWN:	CK
DATE:	10/11/2023
MGX FILE:	6737d_Drawings.dwg
STATUS:	Draft


Geophysical Survey Locations:

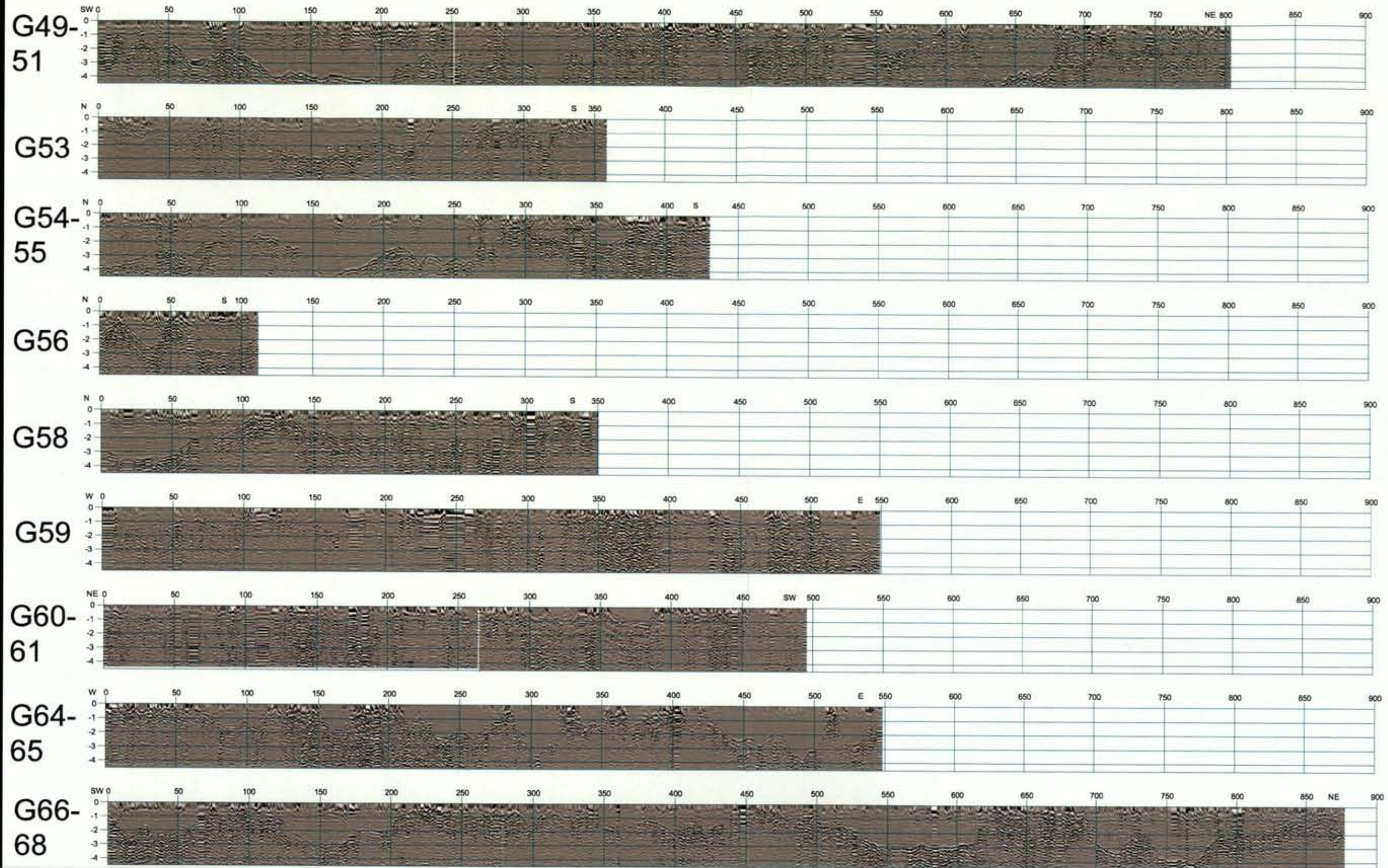
G1 Ground Penetrating Radar Line
 Green cross indicates locations every 2m, magenta indicates the presence of interpreted peat

Locations are in Irish Transverse Mercator (ITM), Elevations are in mOD (Malin Head)



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	PROJECT	Derryclare Peatland Rehabilitation Geophysical Survey	PROJECT:	6737	
	TITLE	Figure 1a: GPR Survey Images (no elevation)	DRAWN:	CK	
			DATE:	10/11/2023	
			MGX FILE:	6737d_Drawings.dwg	
		STATUS:	Draft		



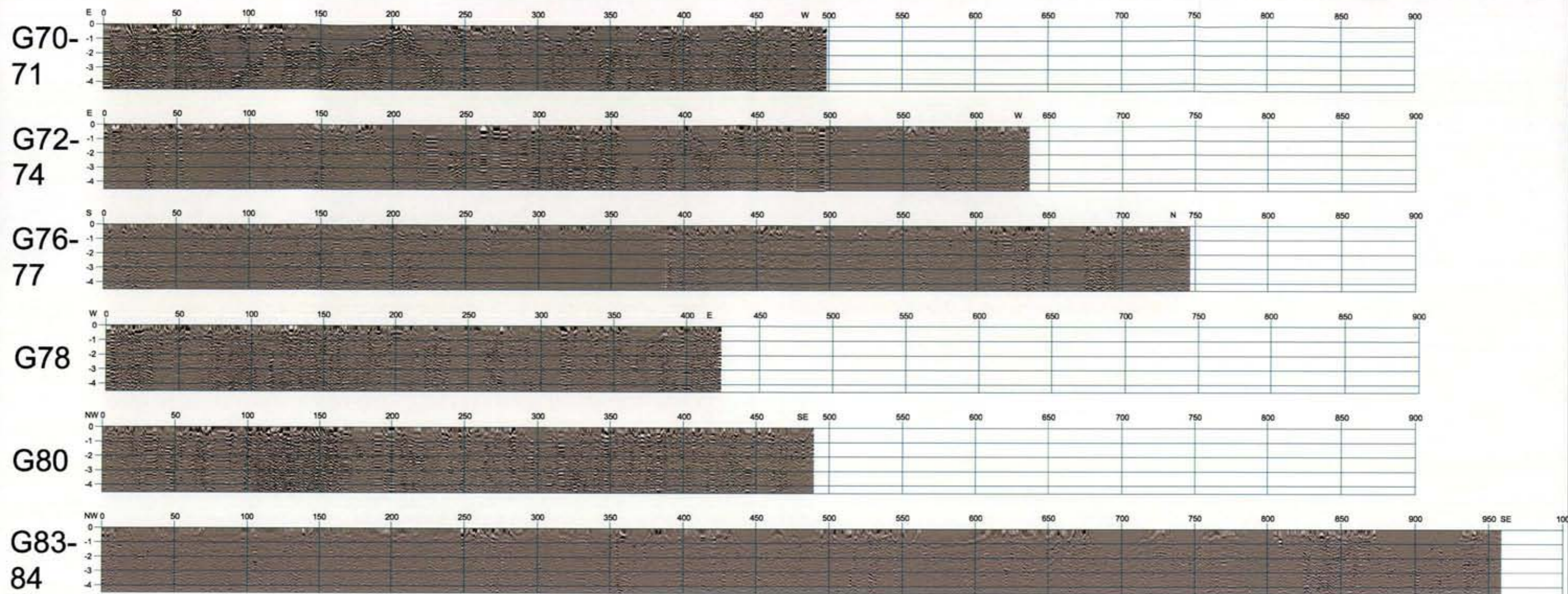
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CLIENT: Coillte / MKO
Fehily Timoney and Company
PROJECT: Derryclare Peatland Rehabilitation
Geophysical Survey
TITLE: Figure 1b: GPR Survey Images
(no elevations)

SCALE: NTS @ A3, VE x 10
PROJECT: 6737
DRAWN: CK
DATE: 10/11/2023
MGX FILE: 6737d_Drawings.dwg
STATUS: Draft

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PROJECT Derryclare Peatland Rehabilitation
Geophysical Survey

TITLE Figure 1c: GPR Survey Images
(no elevation)

SCALE: NTS @ A3, VE x 10

PROJECT: 6737

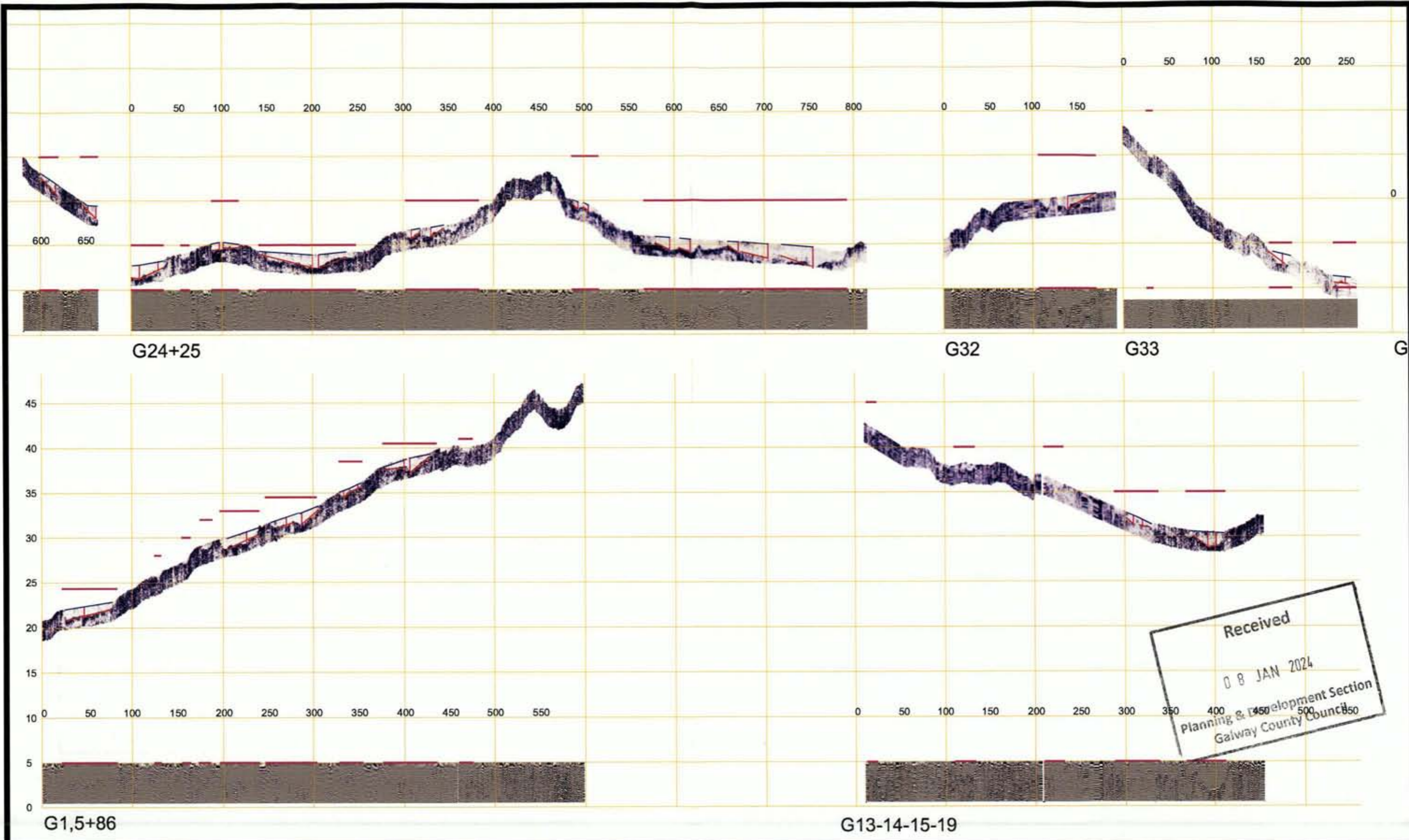
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DATE: 10/11/2023

MGX FILE: 6737d_Drawings.dwg

STATUS: Draft

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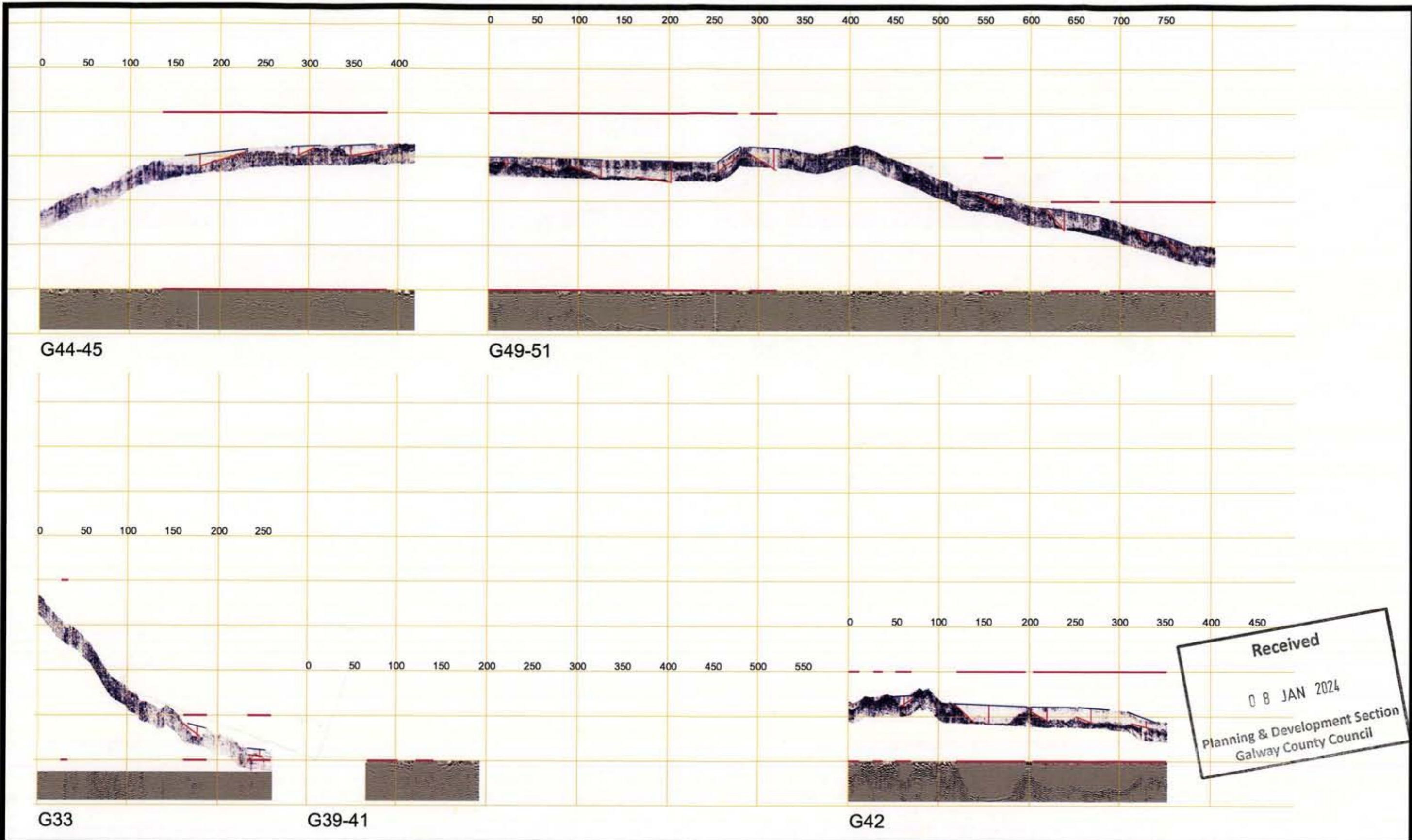
CLIENT: Coillte / MKO
 Fehily Timoney and Company
 PROJECT: Derryclare Peatland Rehabilitation
 Geophysical Survey
 TITLE: Figure 2a: GPR Survey Images
 with elevation and VE 1:5

SCALE: 1:4000 @ A3, VE x 5
 PROJECT: 6737
 DRAWN: CK
 DATE: 10/11/2023
 MGX FILE: 6737d_Drawings.dwg
 STATUS: Draft

Blue-grey-magenta scale images are depth stretch sections from 100MHz GPR survey. The vertical depth is approximate and computed with GPR wave velocity of 0.035 m/ns. The elevation is displayed with a VE of 5.
 GreyScale 1:10 at bottom display.

Geophysical Survey Interpretation:

- Location of Peat
- Ground Elevation Slope
- Depth of Peat
- Base of Peat Slope



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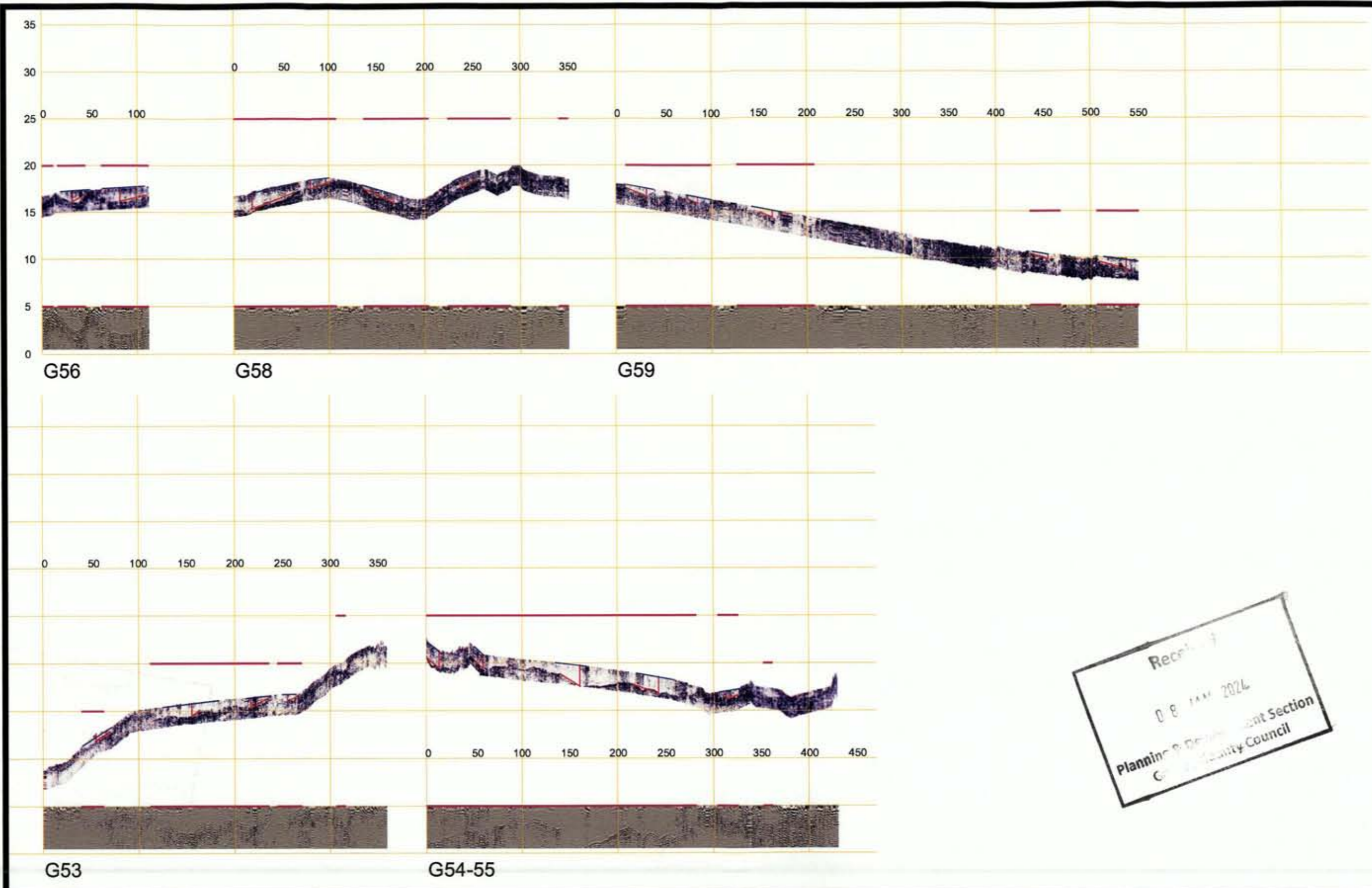
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CLIENT Coillte / MKO
 Fehily Timoney and Company
 PROJECT Derryclare Peatland Rehabilitation
 Geophysical Survey
 TITLE Figure 2b: GPR Survey Images
 with elevation and VE 1:5

SCALE: 1:4000 @ A3, VE x 5
 PROJECT: 6737
 DRAWN: CK
 DATE: 10/11/2023
 MGX FILE: 6737d_Drawings.dwg
 STATUS: Draft

Blue-grey-magenta scale images are depth stretch sections from 100MHz GPR survey. The vertical depth is approximate and computed with GPR wave velocity of 0.035 m/ns. The elevation is displayed with a VE of 5. GreyScale 1:10 at bottom display.

Geophysical Survey Interpretation:



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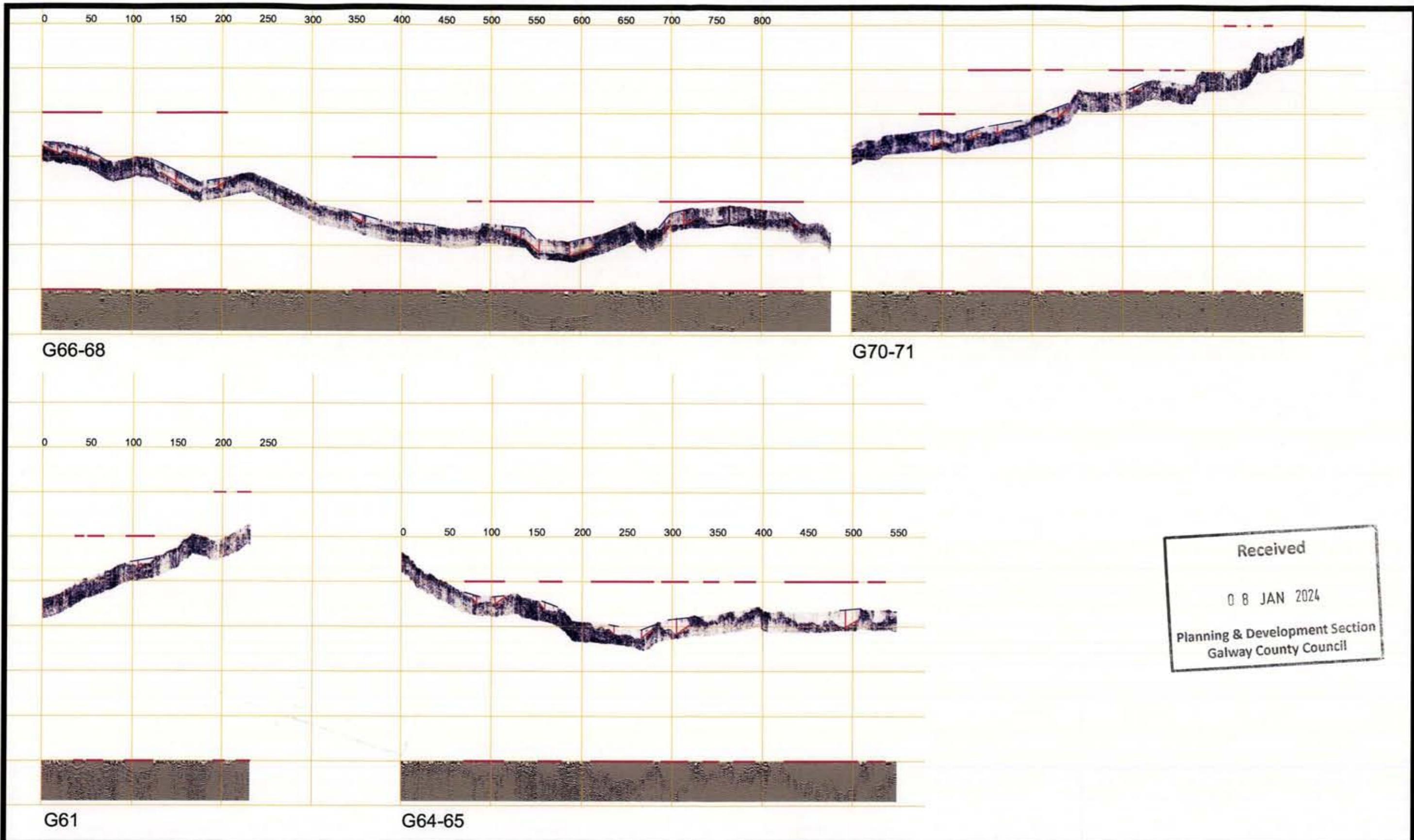
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 Fehily Timoney and Company
 PROJECT: Derryclare Peatland Rehabilitation
 Geophysical Survey
 TITLE: Figure 2c: GPR Survey Images
 with elevation and VE 1:5

SCALE: 1:4000 @ A3, VE x 5
 PROJECT: 6737
 DRAWN: CK
 DATE: 10/11/2023
 MGX FILE: 6737d_Drawings.dwg
 STATUS: Draft

Blue-grey-magenta scale images are depth stretch sections from 100MHz GPR survey. The vertical depth is approximate and computed with GPR wave velocity of 0.035 m/ns. The elevation is displayed with a VE of 5.
 GreyScale 1:10 at bottom display.

Geophysical Survey Interpretation:

- Location of Peat
- Ground Elevation Slope
- Depth of Peat
- Base of Peat Slope



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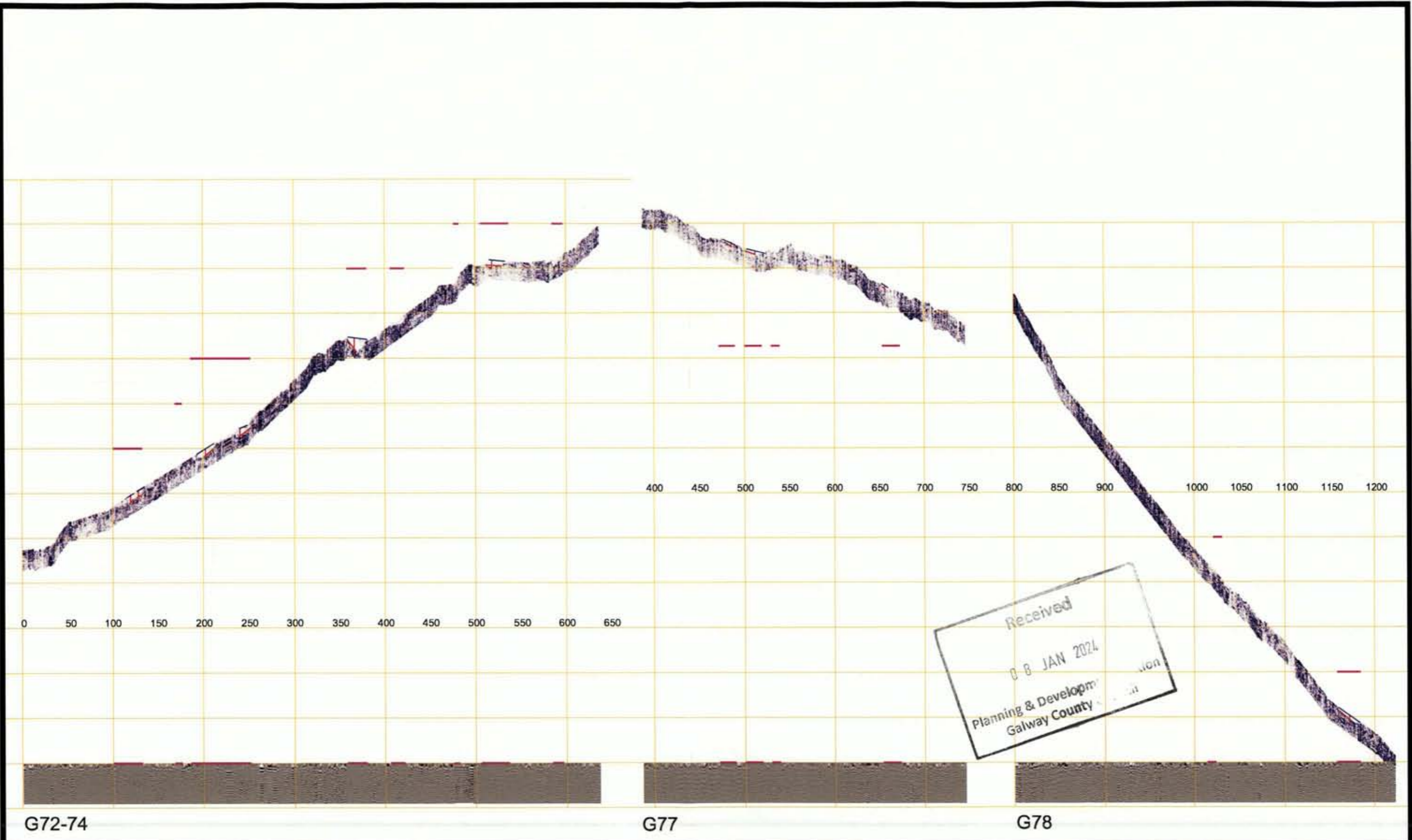
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PROJECT: Derryclare Peatland Rehabilitation
Geophysical Survey
TITLE: Figure 2d: GPR Survey Images
with elevation and VE 1:5

SCALE: 1:4000 @ A3, VE x 5
PROJECT: 6737
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DATE: 10/11/2023
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STATUS: Draft

Blue-grey-magenta scale images are depth stretch sections from 100MHz GPR survey. The vertical depth is approximate and computed with GPR wave velocity of 0.035 m/ns. The elevation is displayed with a VE of 5. GreyScale 1:10 at bottom display.

Geophysical Survey Interpretation:

- Location of Peat
- Ground Elevation Slope
- Depth of Peat
- Base of Peat Slope



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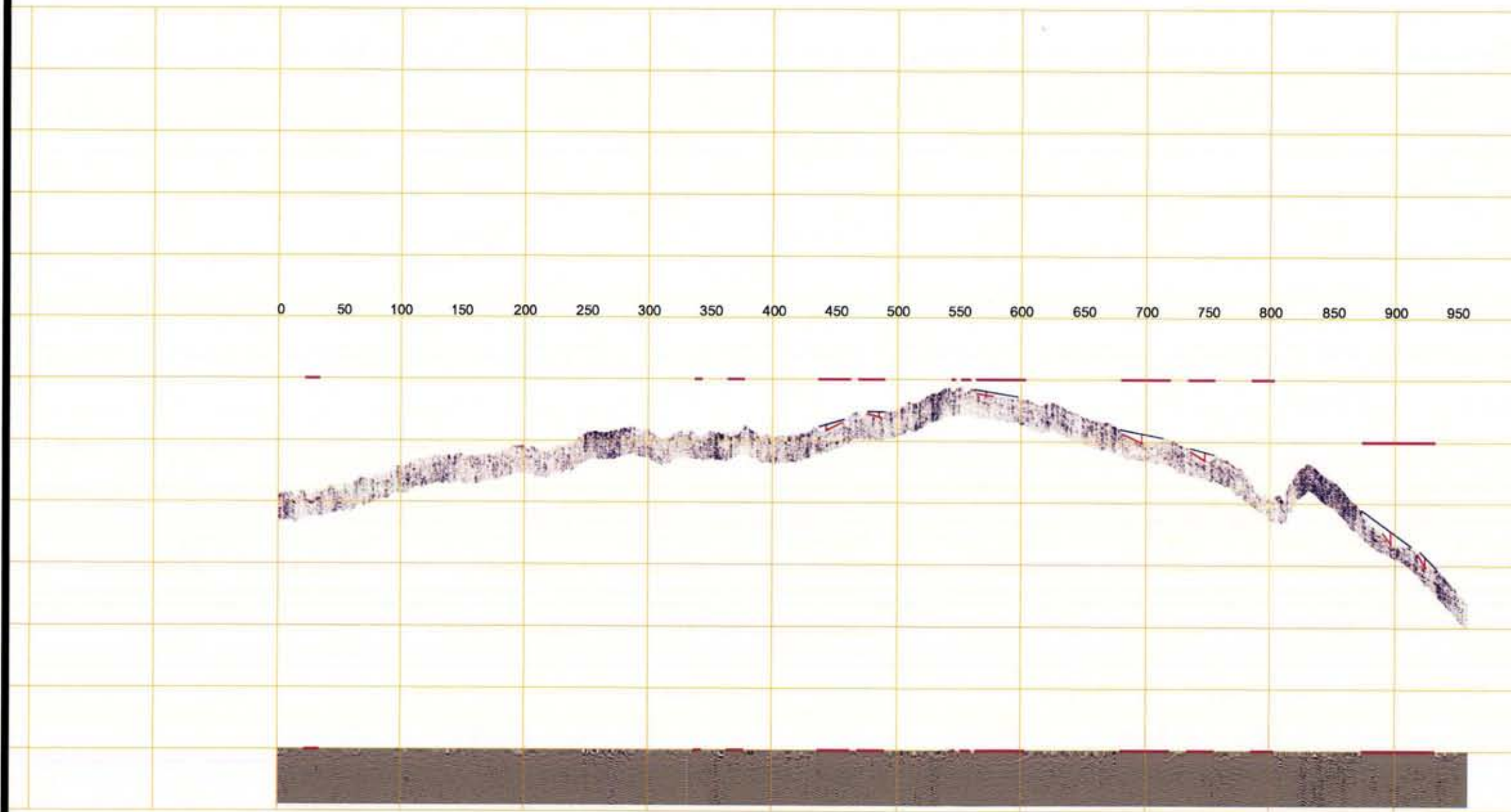
CLIENT: Coillte / MKO
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 PROJECT: Derryclare Peatland Rehabilitation
 Geophysical Survey
 TITLE: Figure 2e: GPR Survey Images
 with elevation and VE 1:5

SCALE: 1:4000 @ A3, VE x 5
 PROJECT: 6737
 DRAWN: CK
 DATE: 10/11/2023
 MGX FILE: 6737d_Drawings.dwg
 STATUS: Draft

Blue-grey-magenta scale images are depth stretch sections from 100MHz GPR survey. The vertical depth is approximate and computed with GPR wave velocity of 0.035 m/ns. The elevation is displayed with a VE of 5. GreyScale 1:10 at bottom display.

Geophysical Survey Interpretation:

- Location of Peat
- Ground Elevation Slope
- Depth of Peat
- Base of Peat Slope



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PROJECT Derryclare Peatland Rehabilitation
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TITLE Figure 2f: GPR Survey Images
 with elevation and VE 1:5

SCALE: 1:4000 @ A3, VE x 5

PROJECT: 6737

DRAWN: CK





DATE: 10/11/2023

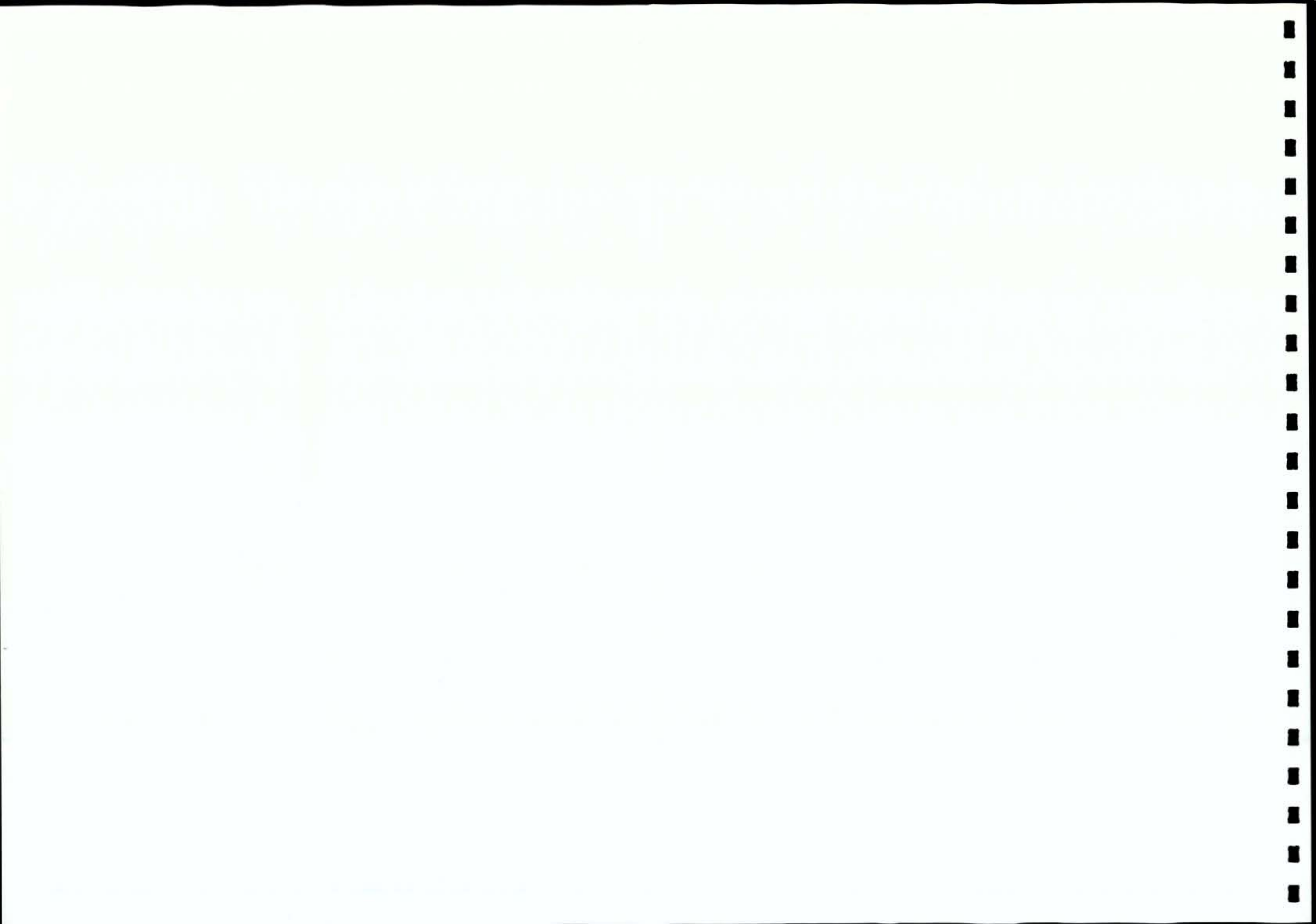
MGX FILE: 6737d_Drawings.dwg

STATUS: Draft

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 GreyScale 1:10 at bottom display.

Geophysical Survey Interpretation:

-  Location of Peat
-  Ground Elevation Slope
-  Depth of Peat
-  Base of Peat Slope





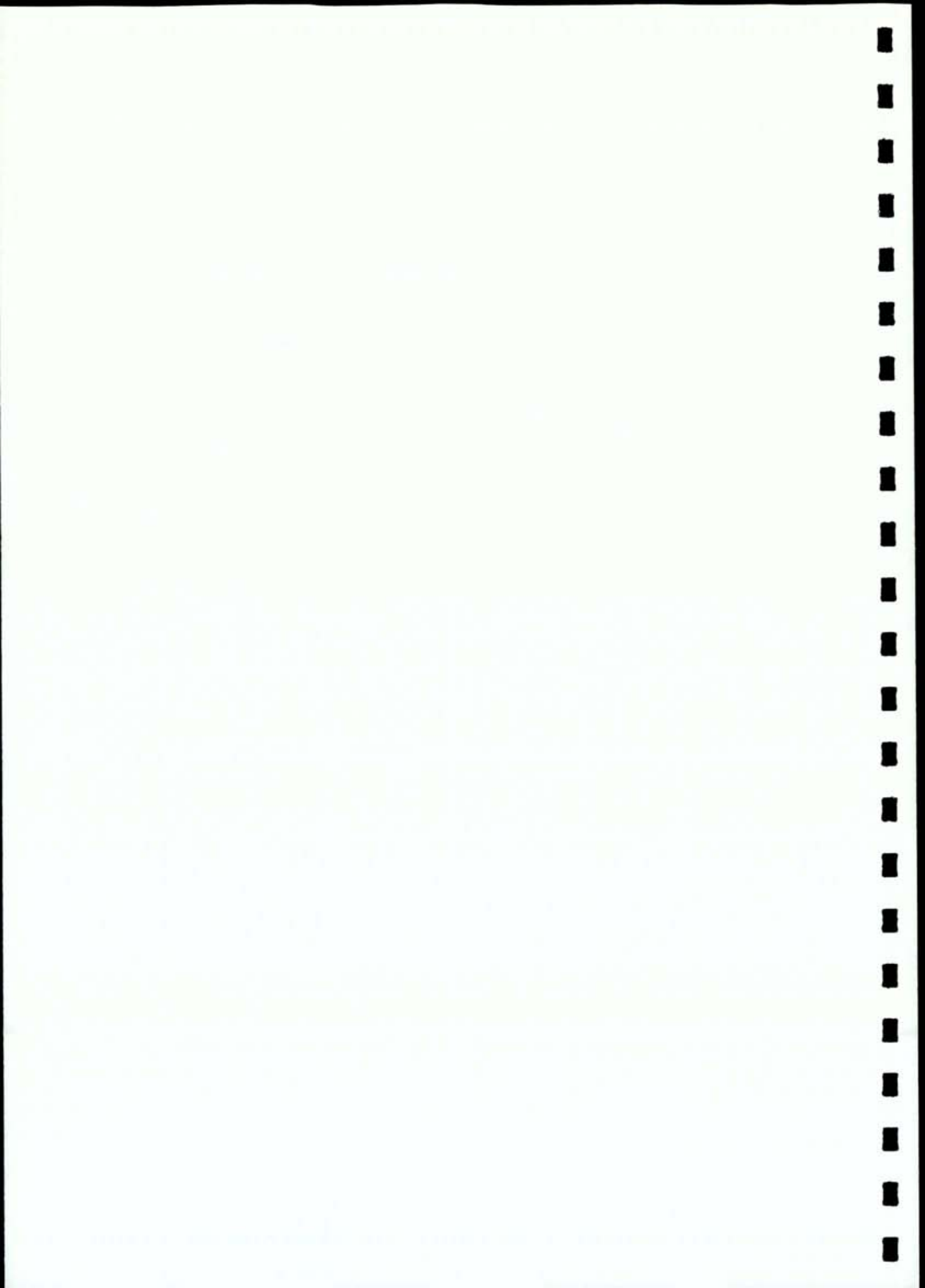
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TIMONEY**

**CONSULTANTS IN ENGINEERING,
ENVIRONMENTAL SCIENCE &
PLANNING**

APPENDIX C

FOS Analyses





Calculated FoS of Natural Peat Slopes for Derryclare Peatland Rehabilitation - Undrained Analysis (Phase 2 and RPS Peat Probe Locations)									
Location ID	Easting	Northing	Slope	Undrained shear strength	Bulk unit weight of Peat	Peat Depth	Surcharge Equivalent Placed Fill Depth (m)	Factor of Safety for Load Condition	
			β (deg)	c_u (kPa)	γ (kN/m ³)	(m)	Condition (2)	Condition (1)	Condition (2)
FP085	483968	752199	3	4	10	0.1	1.1	76.33	6.96
FP087	483373	749538	2	4	10	6.3	7.3	1.82	1.57
FP088	483243	749543	2	4	10	5.4	6.4	2.13	1.78
FP089	483868	752984	3	4	10	0.9	1.9	8.50	4.03
FP090	483308	753474	3	4	10	2.7	3.7	2.83	2.07
FP091	483268	753600	2	4	10	1.9	2.9	6.04	3.95
FP092	483466	753037	3	4	10	1.5	2.5	5.10	3.06
FP093	483478	752843	2	4	10	1.7	2.7	6.75	4.25
FP094	483596	752851	2	4	10	3.6	4.6	3.19	2.49
FP095	483822	752903	6	10	10	1.6	2.6	6.01	3.70
FP096	484018	752993	10	10	10	1.1	2.1	5.32	2.78
FP097	483727	752953	3	4	10	2.6	3.6	7.94	2.13
FP098	484126	752605	4	4	10	0.9	1.9	6.39	3.03
FP099	483200	752804	4	4	10	0.3	1.3	18.16	4.42
FP100	483063	752773	3	4	10	1.8	2.8	4.75	2.73
FP101	482865	752724	20	10	10	0.4	1.4	7.78	2.23
FP102	482731	752691	12	10	10	0.6	1.6	8.39	3.07
FP103	482688	752805	12	10	10	0.7	1.7	7.07	2.89
FP104	482962	752438	25	10	10	0.1	1.1	36.11	2.37
FP105	482728	752397	30	10	10	0.3	1.3	7.70	1.78
FP106	482604	752532	25	10	10	0.5	1.5	5.22	1.74
FP107	482586	752733	15	10	10	0.8	1.8	5.06	2.22
FP108	482650	752279	25	10	10	0.5	1.5	5.22	1.74
FP109	482694	752519	20	10	10	0.7	1.7	4.44	1.83
FP110	482763	752295	15	10	10	0.6	1.6	6.67	2.50
FP111	482792	752193	15	10	10	0.6	1.6	6.67	2.50
FP112	482724	752058	20	10	10	0.5	1.5	6.22	2.07
FP113	482941	752154	10	10	10	0.9	1.9	6.50	3.08
FP114	483085	752058	15	10	10	0.7	1.7	5.71	2.35
FP115	483072	752202	20	10	10	0.1	1.1	31.11	2.83
FP116	483010	752312	12	10	10	0.3	1.3	16.39	3.78
FP117	483130	752373	15	10	10	0.3	1.3	13.33	3.08
FP118	483003	751994	12	10	10	0.5	1.5	9.83	3.28
FP119	482916	752555	25	10	10	0.1	1.1	36.11	2.37
FP120	482795	752518	15	10	10	0.6	1.6	6.67	2.50
FP121	482888	752640	15	10	10	0.5	1.5	8.00	2.67
FP122	482798	752829	20	10	10	0.6	1.6	5.19	1.94
FP123	482942	752946	10	10	10	0.9	1.9	6.50	3.08
FP124	483176	752901	7	10	10	0.2	1.2	41.34	6.89
FP125	483289	752919	3	4	10	1.9	2.9	4.03	2.64
FP126	483364	753020	2	4	10	0.7	1.7	16.38	6.75
FP127	483358	753120	3	4	10	1.8	2.8	4.75	2.73
FP128	483317	753253	2	4	10	1.9	2.9	6.04	3.95
FP129	483120	751956	5	4	10	0.5	1.5	9.23	3.07
FP130	483246	751964	4	4	10	0.7	1.7	8.21	3.38
FP131	483054	751861	3	4	10	0.2	1.2	38.27	6.38
FP132	482763	751950	12	10	10	0.5	1.5	9.83	3.28
FP133	482881	751973	4	4	10	0.6	1.6	9.58	3.59
FP134	484017	753101	4	4	10	2.7	3.7	2.13	1.55
FP135	483995	753209	4	4	10	1.4	2.4	4.11	2.40
FP136	483788	753097	12	10	10	0.1	1.1	49.17	4.47
FP137	483790	753208	3	4	10	1.5	2.5	5.10	3.06
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FP139	483596	753194	5	4	10	2.0	3.0	2.30	1.54
FP140	484041	752449	3	4	10	1.8	2.8	4.25	2.73
FP141	484073	752853	5	4	10	0.8	1.8	5.76	2.56
FP142	483371	751034	20	10	10	0.1	1.1	31.11	2.83
FP143	483452	751091	22	10	10	0.4	1.4	7.20	2.06
FP144	483316	751270	10	10	10	0.1	1.1	58.48	5.32
FP145	483395	751192	25	10	10	0.1	1.1	26.11	2.37
FP146	483226	749738	10	10	10	0.3	1.3	19.49	4.50
FP147	483401	749882	5	4	10	0.6	1.6	7.68	2.88
FP148	483334	749959	4	4	10	0.2	1.2	38.27	4.79
FP149	483165	749810	10	10	10	0.2	1.2	26.74	4.87
FP150	483083	749630	13	10	10	0.5	1.5	9.13	3.54
FP151	483485	749281	6	10	10	1.5	2.5	6.41	3.85
FP152	483464	749601	2	4	10	0.5	1.5	22.94	7.65
FP153	482761	750070	4	4	10	1.2	2.2	4.79	2.61
FP154	482752	749901	3	4	10	0.8	1.8	9.57	4.25
FP155	482578	749902	10	10	10	0.3	1.3	19.49	4.50
FP156	482914	749879	6	10	10	0.4	1.4	24.05	6.87
FP157	482316	749230	12	10	10	0.1	1.1	49.17	4.47
FP158	482199	749210	5	4	10	0.9	1.9	5.42	2.49
FP159	483430	751499	18	10	10	0.2	1.2	17.01	2.84
FP160	483550	751180	28	10	10	0.2	1.2	12.06	2.01
FP161	483611	751019	10	10	10	0.5	1.5	11.70	3.50
FP162	483729	750339	20	10	10	0.4	1.4	7.78	2.22
RPS-00	483210	753495	1	4	10	3.3	4.3	7.05	5.39
RPS-01	483458	753128	5	4	10	1.3	2.3	3.68	2.05
RPS-02	483884	753096	4	4	10	0.9	1.9	6.39	3.03
RPS-03	483923	752753	2	4	10	4.0	5.0	7.90	2.32
RPS-04	483604	752756	2	4	10	4.3	5.3	7.70	2.18
RPS-05	483334	752835	2	4	10	0.2	1.2	57.34	9.56
RPS-06	483186	753106	2	4	10	1.4	2.4	8.18	4.78
RPS-07	482915	752814	15	10	10	0.5	1.5	8.00	2.67
RPS-08	482630	752838	13	10	10	0.3	1.3	15.21	3.51
RPS-09	482843	752410	10	10	10	0.3	1.3	21.66	4.60
RPS-10	482834	752052	22	10	10	0.8	1.8	3.84	1.65
RPS-11	483189	752065	9	10	10	0.8	1.8	8.09	3.60
RPS-12	483314	751665	23	10	10	0.3	1.3	9.27	2.14
RPS-13	483542	751363	20	10	10	0.4	1.4	7.78	2.22

Received

08 JAN 2024

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Galway County Council

Calculated FoS of Natural Peat Slopes for Derrycollare Peatland Rehabilitation - Undrained Analysis (Phase 2 and RPS Peat Probe Locations)									
Location ID	Easting	Northing	Slope	Undrained shear strength	Bulk unit weight of Peat	Peat Depth	Surcharge Equivalent Placed Fill Depth (m)	Condition (1)	Condition (2)
			β (deg)	c_u (kPa)	γ (kN/m ³)	(m)			
RPS-15	483306	749331	7	10	10	0.4	1.8	23.82	6.12
RPS-16	482707	749383	2	4	10	2.4	3.4	4.78	3.17
RPS-18	482277	749311	2	4	10	2.0	3.0	5.73	3.32
RPS-19	482143	749585	10	10	10	0.3	1.3	22.49	4.64
RPS-20	482509	750071	14	10	10	0.3	1.3	16.20	3.78
RPS-21	482815	750389	7	10	10	0.3	1.3	31.07	6.61
RPS-22	482465	749678	3	4	10	1.3	2.3	6.12	3.40
RPS-23	482846	749973	4	4	10	1.6	2.6	3.59	2.31
RPS-24	482950	749612	3	4	10	1.3	2.3	3.69	2.05
RPS-25	483249	749889	2	4	10	3.1	4.1	3.70	2.80
RPS-26	483406	750034	3	4	10	0.3	1.3	13.36	3.54
RPS-31	483471	752249	6	10	10	1.4	2.4	6.82	3.99
RPS-32	483623	752521	10	10	10	0.3	1.3	23.39	4.68
RPS-34	483910	752303	2	4	10	1.5	2.5	7.91	4.68
RPS-41	483469	750984	20	10	10	0.4	1.4	8.39	2.35

Notes:

- (1) Assuming a bulk unit weight for peat of 10kN/m³
- (2) Assuming a surcharge equivalent to fill depth of 1m of peat i.e. 10kPa.
- (3) Slope inclination (β) based on site readings and site contour plans.
- (4) A lower bound undrained shear strength, c_u for the peat of 40Pa (slopes < 6 degrees) and 10kPa (slopes > 6 degrees) were selected for the assessment. It should be noted that a c_u of 4/10kPa for the peat is considered a conservative value for the analysis and is not representative of all peat present across the site. In reality the peat has a significantly higher undrained strength.
- (5) Peat depths based on probes carried out by FT.
- (6) For load conditions see report text.
- (7) Surface slope angles used to determine the FoS for the RPS peat probe locations were derived using the DTM supplied by the Client.

Minimum = 1.78
 Maximum = 58.48
 Average = 17.01

Calculated FOS of Natural Peat Slopes for Derryciare Peatland Rehabilitation - Undrained Analysis (Phase 2 GPR Locations)

Distance along line	Line ID	Northing		Slope	Base of Peat	Undrained shear strength	Bulk unit weight of Peat	Peat Depth	Factor of Safety for Load Condition	
		Easting	Northing						Condition [1]	Condition [2]
12	G86	482984.2	749978.9	1	4	4	10	0.1	239.31	21.76
66	G81	484096.9	750099.9	3	4	4	10	0.2	44.85	7.47
384	G24	483306.3	749383.2	6	10	10	10	0.4	24.63	7.64
48	G25	483304.2	749420.9	6	10	10	10	0.4	25.29	7.73
162	G33	483009.3	750409.2	7	10	10	10	0.4	21.97	6.20
164	G68	484166.2	752712.8	1	4	4	10	0.4	47.93	13.69
384	G76	482906.0	752735.6	7	10	10	10	0.4	20.86	5.96
72	G86	482949.8	750018.6	7	10	10	10	0.4	21.14	6.04
436	G59	484056.5	752164.2	4	4	4	10	0.47	12.77	4.08
68	G19	482413.1	749123.7	8	10	10	10	0.5	14.10	4.70
170	G32	483229.9	749925.7	6	10	10	10	0.5	20.86	6.95
4	G40	483330.6	751040.1	4	4	4	10	0.5	11.51	3.84
36	G45	483350.9	751015.3	4	4	4	10	0.5	11.51	3.84
132	G45	483480.7	752808.0	5	4	4	10	0.5	9.41	3.14
100	G59	483726.8	752167.9	0	4	4	10	0.5	154.64	58.21
58	G61	483383.0	752097.8	4	4	4	10	0.5	10.50	3.50
114	G64	483383.8	752775.4	6	10	10	10	0.5	17.84	5.96
314	G70	483340.4	752488.9	8	4	4	10	0.5	11.93	3.98
34	G71	483385.2	752487.8	1	4	4	10	0.5	32.81	10.57
100	G72	483164.3	752030.6	3	4	4	10	0.5	14.70	4.90
186	G72	483080.0	752013.3	1	4	4	10	0.5	18.34	5.78
170	G74	482883.1	752080.8	1	4	4	10	0.5	86.55	28.85
130	G84	482823.8	752447.0	5	4	4	10	0.5	9.06	3.02
136	G84	482825.6	752441.4	4	4	4	10	0.5	14.70	4.90
388	G84	482911.6	752207.5	2	4	4	10	0.5	19.39	6.46
800	G84	482967.8	752013.5	1	4	4	10	0.5	17.39	5.33
92	G61	483329.2	752098.0	2	4	4	10	0.6	23.30	8.18
124	G61	483297.7	752044.6	2	4	4	10	0.6	24.86	8.13
118	G24	483149.4	749306.1	0	4	4	10	0.6	109.80	41.17
140	G24	483171.1	749309.5	3	4	4	10	0.6	13.68	5.33
56	G40	483359.2	752697.5	4	4	4	10	0.6	10.80	4.05
152	G45	483486.2	752769.0	5	4	4	10	0.6	7.84	2.94
196	G61	483239.1	752055.0	3	4	4	10	0.6	13.92	5.22
70	G64	483053.2	752767.7	8	10	10	10	0.6	12.54	4.70
178	G64	483138.3	752775.1	2	4	4	10	0.6	19.10	7.34
210	G64	483170.0	752766.2	1	4	4	10	0.6	61.72	21.90
24	G65	483227.7	752747.4	7	10	10	10	0.6	14.65	5.42
220	G67	483985.0	752518.9	3	4	4	10	0.6	13.92	5.22
210	G71	483121.6	752465.3	2	4	4	10	0.6	24.01	9.01
222	G72	483044.8	752006.0	5	4	4	10	0.6	7.84	2.94
380	G72	482911.9	752052.8	6	10	10	10	0.6	16.86	5.32
40	G74	482778.5	752065.1	1	4	4	10	0.6	72.12	27.01
104	G84	482815.4	752471.7	1	4	4	10	0.6	63.72	23.90
80	G15	482305.8	749309.5	2	4	4	10	0.6	16.43	6.76
246	G24	483272.3	749311.6	4	4	4	10	0.7	7.70	3.17
344	G24	483360.6	749368.8	6	10	10	10	0.7	13.59	5.60
70	G42	483253.5	753418.7	6	10	10	10	0.7	11.52	3.59
136	G44	483468.4	752978.6	3	4	4	10	0.7	31.83	10.53
16	G56	483087.3	752567.1	5	4	4	10	0.7	7.27	2.97
100	G58	483077.8	752390.2	4	4	4	10	0.7	8.09	3.33
152	G64	483144.4	752782.1	9	10	10	10	0.7	9.40	3.95
222	G64	483181.7	752763.4	1	4	4	10	0.7	54.62	22.49
162	G67	483928.5	752528.9	1	4	4	10	0.7	23.51	9.68
108	G72	483196.4	752028.9	3	4	4	10	0.7	10.50	4.32
358	G76	482880.4	752740.5	7	10	10	10	0.7	11.92	4.91
158	G84	482634.7	752421.4	3	4	4	10	0.7	10.33	4.25
260	G84	482870.1	752326.3	1	4	4	10	0.7	32.83	13.52
402	G84	482923.2	752194.7	6	10	10	10	0.7	14.14	5.82
80	G14	482245.7	749422.2	7	10	10	10	0.8	10.37	4.61
18	G25	483475.2	749417.3	7	10	10	10	0.8	10.30	4.58
32	G25	483488.4	749422.1	7	10	10	10	0.8	10.09	4.49
50	G45	483471.4	752888.6	3	4	4	10	0.8	8.64	3.44
68	G51	484111.6	753072.9	3	4	4	10	0.8	11.21	4.94
168	G65	483366.5	752717.8	3	4	4	10	0.8	47.79	16.34
206	G66	483327.9	752491.7	4	4	4	10	0.8	6.24	2.77
206	G66	483720.3	752514.0	8	10	10	10	0.8	11.50	5.11
204	G87	483969.5	752522.2	2	4	4	10	0.8	18.03	6.01
124	G77	482585.7	752478.2	4	4	4	10	0.8	7.30	3.25
38	G84	482792.7	752533.0	2	4	4	10	0.8	14.47	6.43
542	G84	482973.3	752066.0	7	10	10	10	0.8	10.95	4.87
12	G59	483639.9	752154.1	5	4	4	10	0.9	5.71	2.62
52	G59	483678.4	752160.4	2	4	4	10	0.9	16.29	7.63
126	G59	483752.4	752172.0	2	4	4	10	0.9	11.85	5.58
20	G19	482384.3	749167.9	8	10	10	10	0.9	8.07	3.82
318	G24	483331.5	749349.8	6	10	10	10	0.9	10.16	4.91
364	G24	483368.7	749375.2	6	10	10	10	0.9	10.95	5.18
178	G25	483631.0	749419.9	2	4	4	10	0.9	16.02	7.39
0	G48	483475.4	752845.1	0	4	4	10	0.9	127.84	60.32
136	G56	483675.2	752355.6	3	4	4	10	0.9	5.29	2.51
48	G71	483271.3	752481.1	1	4	4	10	0.9	18.28	6.66
306	G72	482928.1	752037.8	7	10	10	10	0.9	9.53	4.51
232	G84	482858.8	752351.9	2	4	4	10	0.9	12.74	6.04
348	G84	482903.3	752244.9	3	4	4	10	0.9	5.39	2.55
148	G59	483774.2	752175.4	2	4	4	10	1.0	10.99	5.38
74	G59	483701.1	752163.9	3	4	4	10	1.0	4.89	2.41
88	G1	482854.3	749769.1	3	4	4	10	1.0	8.83	4.41
248	G1	482753.9	749889.3	4	4	4	10	1.0	6.29	3.14
124	G14	482287.9	749384.4	3	4	4	10	1.0	8.65	4.32
324	G25	483759.9	749427.8	0	4	4	10	1.0	17.82	28.66
224	G61	483212.8	752050.4	5	4	4	10	1.0	4.87	2.44
88	G67	483841.7	752559.9	6	10	10	10	1.0	10.16	5.13

Distance along line	Calculated FoS of Natural Peat Slopes for Derryclare Peatland Rehabilitation - Undrained Analysis (Phase 2 GPR Locations)				Factor of Safety for Load Condition					
	Line ID	Easting	Northing	Slope	Base of Peat	Undrained shear strength	Bulk unit weight of Peat	Peat Depth	Surcharge Equivalent Placed Fill Depth (m)	Condition [1]
			β [deg]	c_u [kPa]	γ [kN/m ³]	[m]	[m]	[m]	[1]	[2]
112	G84	482818.3	752404.2	5	4	10	10	2.0	4.53	2.77
146	G84	482820.4	752432.1	7	4	10	10	2.0	7.23	3.62
578	G84	482908.2	752033.3	0	4	10	10	2.0	37.32	28.66
276	G24	483253.0	749306.3	4	4	10	1.1	2.1	4.90	2.57
70	G45	483473.9	752809.0	1	4	10	1.1	2.1	28.09	11.66
212	G45	483492.7	752729.6	2	4	10	1.1	2.1	9.58	5.02
22	G50	483739.8	752893.6	7	10	10	1.1	2.1	7.78	4.05
468	G59	484081.1	752169.3	2	4	10	1.1	2.1	18.11	6.81
190	G67	483871.5	752560.5	2	4	10	1.1	2.1	11.67	5.11
98	G77	482508.2	752453.6	6	10	10	1.1	2.1	8.38	4.54
270	G77	482565.3	752821.3	7	10	10	1.1	2.1	7.11	3.84
302	G11	482727.3	749935.9	7	10	10	1.2	2.2	9.12	3.66
348	G11	482710.0	749972.8	7	10	10	1.2	2.2	6.72	2.60
40	G15	482298.9	749344.0	6	10	10	1.2	2.2	8.84	2.10
72	G19	482414.7	749120.1	6	10	10	1.2	2.2	7.89	4.09
198	G32	483238.3	749917.1	6	10	10	1.2	2.2	5.87	3.20
328	G54	483719.2	752634.2	4	4	10	1.2	2.2	8.69	4.74
46	G56	483672.8	752579.2	6	10	10	1.2	2.2	6.01	3.28
454	G59	484087.7	752160.6	4	4	10	1.2	2.2	8.51	4.84
124	G65	483324.5	752728.1	5	4	10	1.2	2.2	5.00	2.73
20	G68	484083.7	752661.9	8	10	10	1.2	2.2	4.06	2.21
182	G70	483372.0	752490.4	3	4	10	1.2	2.2	5.85	3.19
112	G71	483213.5	752483.3	3	4	10	1.2	2.2	6.96	3.80
168	G71	483161.5	752470.9	3	10	10	1.2	2.2	8.92	4.86
240	G84	482862.3	752344.7	2	4	10	1.2	2.2	9.56	5.21
88	G24	483120.7	749313.3	2	4	10	1.3	2.3	7.99	4.52
298	G50	483975.8	752685.1	4	10	10	1.3	2.3	3.53	2.00
128	G51	484148.9	752064.7	8	10	10	1.3	2.3	5.82	3.29
14	G55	483729.4	752818.0	3	4	10	1.3	2.3	6.43	3.53
148	G58	483675.3	752343.0	3	4	10	1.3	2.3	2.66	2.07
508	G59	484113.2	752142.1	3	4	10	1.3	2.3	5.81	3.28
250	G65	483444.6	752694.4	6	10	10	1.3	2.3	8.00	4.52
134	G67	483904.2	752641.4	1	4	10	1.3	2.3	29.41	18.82
234	G70	483321.0	752488.4	8	10	10	1.3	2.3	5.79	3.27
96	G71	483228.2	752477.1	1	4	10	1.3	2.3	14.75	8.34
374	G76	482896.1	752737.5	7	10	10	1.3	2.3	6.42	3.63
34	G86	482877.9	749993.7	1	4	10	1.3	2.3	18.41	10.40
62	G21	483259.7	752479.5	6	10	10	1.4	2.4	7.25	4.18
102	G24	483134.3	749310.8	0	4	10	1.4	2.4	47.06	27.45
60	G40	483360.0	750985.5	4	4	10	1.4	2.4	4.63	2.70
90	G45	483477.0	752849.2	1	4	10	1.4	2.4	20.50	11.96
86	G65	483286.8	752732.8	1	4	10	1.4	2.4	11.75	6.86
132	G68	484166.1	752725.7	0	4	10	1.4	2.4	40.94	23.88
414	G72	482884.0	752072.2	2	4	10	1.4	2.4	10.80	6.01
38	G25	483494.3	749422.4	7	10	10	1.5	2.5	5.49	2.77
108	G25	483590.4	749415.0	3	4	10	1.5	2.5	4.63	2.78
20	G40	483340.7	751027.6	4	4	10	1.5	2.5	8.84	2.80
22	G45	483467.5	752016.5	3	4	10	1.5	2.5	4.61	2.76
120	G54	483710.6	752830.4	1	4	10	1.5	2.5	12.78	7.67
282	G54	483702.2	752671.0	1	4	10	1.5	2.5	15.37	9.19
86	G59	483712.9	752165.8	5	4	10	1.5	2.5	8.16	1.90
204	G59	483329.5	752184.2	2	4	10	1.5	2.5	7.72	4.63
522	G59	484128.7	752138.4	2	4	10	1.5	2.5	5.64	3.02
106	G61	483315.2	752098.5	2	4	10	1.5	2.5	9.61	5.77
188	G66	483705.4	752500.8	1	4	10	1.5	2.5	19.13	11.48
144	G68	484176.8	752719.8	7	10	10	1.5	2.5	5.43	1.55
148	G70	483401.4	752529.8	1	4	10	1.5	2.5	15.32	9.19
384	G84	482908.7	752229.6	3	4	10	1.5	2.5	3.14	1.94
416	G84	482928.3	752181.7	8	10	10	1.5	2.5	6.69	3.96
334	G11	482708.7	749961.8	8	10	10	1.6	2.6	4.57	2.78
110	G14	482261.7	749396.8	3	4	10	1.6	2.6	9.41	3.33
56	G53	483871.0	752225.9	6	10	10	1.6	2.6	6.24	3.24
164	G59	483790.0	752177.9	4	4	10	1.6	2.6	3.33	1.6
166	G64	483728.1	752779.3	2	4	10	1.6	2.6	7.24	4.45
240	G67	484003.5	752524.8	4	4	10	1.6	2.6	7.66	2.25
110	G70	483436.4	752516.9	4	4	10	1.6	2.6	3.56	2.19
66	G1	482808.2	749752.9	3	4	10	1.7	2.7	5.19	3.27
240	G1	482755.6	749684.1	5	4	10	1.7	2.7	2.88	1.81
180	G24	483209.4	749302.8	3	4	10	1.7	2.7	4.83	1.04
340	G42	483183.1	752976.7	3	4	10	1.7	2.7	4.54	3.11
156	G44	483463.0	752967.1	1	4	10	1.7	2.7	13.52	8.51
254	G53	483888.5	752065.0	6	10	10	1.7	2.7	5.84	3.74
312	G54	483710.2	752644.6	3	4	10	1.7	2.7	4.24	2.67
82	G56	483818.8	752563.7	0	4	10	1.7	2.7	67.81	42.45
188	G58	483865.3	752305.6	2	4	10	1.7	2.7	6.21	3.91
84	G64	483866.2	752772.6	6	10	10	1.7	2.7	4.43	2.79
104	G64	483800.3	7527166.3	6	10	10	1.7	2.7	5.25	3.30
62	G65	483265.3	752742.9	6	10	10	1.7	2.7	9.34	3.36
60	G66	483583.4	752485.3	4	4	10	1.7	2.7	3.72	2.34
80	G67	483853.1	752557.3	6	10	10	1.7	2.7	6.04	3.80
148	G67	483917.4	752536.9	8	10	10	1.7	2.7	4.02	2.53
74	G70	483460.8	752518.3	5	4	10	1.7	2.7	2.68	1.69
202	G72	483864.3	752010.0	7	10	10	1.7	2.7	4.78	1.01
22	G74	482781.7	752077.4	1	4	10	1.7	2.7	25.46	16.03
54	G86	482981.5	752005.1	1	4	10	1.7	2.7	14.08	8.46
98	G24	483130.8	749312.3	2	4	10	1.7	2.7	3.97	3.79
26	G25	483482.8	749420.0	7	10	10	1.8	2.8	4.58	2.94
234	G33	483854.1	750352.9	1	4	10	1.8	2.8	31.73	7.72
250	G33	483864.1	750340.5	1	4	10	1.8	2.8	11.73	7.22
58	G49	483531.4	752860.1	4	4	10	1.8	2.8	1.08	1.98
82	G49	483564.3	752868.8	2	4	10	1.8	2.8	5.58	3.46
110	G56	483688.1	752517.1	2	4	10	1.8	2.8	9.20	3.34

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Calculated FoS of Natural Peat Slopes for Derryciare Peatland Rehabilitation - Undrained Analysis (Phase 2 GPR Locations)											
Distance along line	Line ID	Easting	Northing	Base of Peat Slope	Undrained shear strength	Bulk unit weight of Peat	Peat Depth	Surcharge Equivalent Placed Fill Depth (m)	Factor of Safety for Load Condition		
									Condition (2)	Condition (1)	Condition (2)
				β (deg)	c_u (kPa)	γ (kN/m ³)	(m)				
204	G58	483660.3	752290.7	2	4	10	1.8	2.8	5.86	3.77	
224	G58	483657.0	752271.0	3	4	10	1.8	2.8	2.71	1.74	
184	G59	483809.7	752181.1	2	4	10	1.8	2.8	6.43	4.34	
10	G65	483214.2	752750.9	7	10	10	1.8	2.8	4.82	3.10	
592	G84	482994.6	752020.8	9	10	10	1.8	2.8	3.52	2.26	
100	G14	482256.4	749405.2	7	10	10	1.9	2.9	4.36	2.86	
158	G25	483611.5	749416.2	2	4	10	1.9	2.9	7.59	4.97	
0	G51	484040.3	753022.9	8	10	10	1.9	2.9	3.68	2.41	
188	G58	483670.8	752324.8	3	4	10	1.9	2.9	2.51	1.64	
120	G67	483890.8	752545.4	2	4	10	1.9	2.9	6.76	4.43	
240	G72	483026.8	752005.4	7	10	10	1.9	2.9	4.62	3.03	
208	G1	482775.7	749859.3	5	4	10	2.0	3.0	2.45	1.63	
160	G24	483191.0	749309.6	3	4	10	2.0	3.0	4.10	2.74	
308	G24	483323.7	749343.5	6	10	10	2.0	3.0	4.66	3.11	
126	G32	483260.8	749894.4	4	4	10	2.0	3.0	3.13	2.08	
192	G45	483489.5	752749.2	2	4	10	2.0	3.0	5.27	3.52	
180	G51	484198.7	753070.2	1	4	10	2.0	3.0	6.59	4.39	
80	G54	483711.7	752870.3	1	4	10	2.0	3.0	3.59	2.39	
80	G58	483678.6	752410.2	4	4	10	2.0	3.0	2.83	1.89	
260	G58	483654.2	752235.3	6	10	10	2.0	3.0	4.97	3.28	
280	G58	483653.7	752216.5	4	4	10	2.0	3.0	2.67	1.75	
158	G64	483120.3	752781.2	9	10	10	2.0	3.0	3.36	2.24	
236	G64	483195.4	752760.6	8	10	10	2.0	3.0	3.81	2.54	
34	G65	483237.7	752746.6	1	4	10	2.0	3.0	5.59	3.39	
196	G66	483713.2	752507.0	6	10	10	2.0	3.0	4.60	3.07	
132	G70	483415.4	752513.3	5	4	10	2.0	3.0	2.41	1.61	
100	G54	483712.3	752850.4	1	4	10	2.1	3.1	9.13	6.18	
32	G59	483659.6	752157.3	5	4	10	2.1	3.1	2.31	1.57	
222	G65	483417.6	752700.8	5	4	10	2.1	3.1	2.24	1.52	
162	G70	483390.2	752497.8	6	10	10	2.1	3.1	4.73	3.20	
128	G72	483136.8	752024.9	6	10	10	2.1	3.1	4.51	3.05	
330	G24	483341.4	749356.6	6	10	10	2.1	3.1	4.45	3.03	
270	G1	482743.2	749908.4	4	4	10	2.2	3.2	2.86	1.96	
298	G25	483734.3	749427.1	0	4	10	2.2	3.2	26.06	17.81	
112	G45	483481.1	752827.9	5	4	10	2.2	3.2	2.14	1.47	
312	G50	483989.0	752994.0	5	4	10	2.2	3.2	2.09	1.44	
160	G51	484180.2	753067.6	1	4	10	2.2	3.2	8.75	5.95	
58	G58	483679.1	752432.1	4	4	10	2.2	3.2	2.51	1.73	
0	G65	483205.0	752754.9	1	4	10	2.2	3.2	17.38	11.95	
18	G66	483544.4	752488.1	5	4	10	2.2	3.2	2.27	1.56	
126	G66	483649.1	752487.5	6	10	10	2.2	3.2	4.54	3.12	
112	G68	484147.0	752724.6	4	4	10	2.2	3.2	2.39	1.64	
120	G72	483144.7	752026.5	9	10	10	2.2	3.2	3.01	2.07	
564	G84	482981.5	752045.6	9	10	10	2.2	3.2	3.06	2.11	
216	G53	483914.4	753092.1	5	10	10	2.3	3.3	4.65	3.23	
26	G1	482898.2	749725.6	3	4	10	2.3	3.3	1.84	1.27	
36	G19	482400.8	749153.1	8	10	10	2.3	3.3	3.16	2.10	
30	G24	483064.2	749323.7	5	4	10	2.3	3.3	2.03	1.42	
324	G42	483186.5	753661.1	2	4	10	2.3	3.3	4.21	2.94	
42	G49	483516.0	752856.0	2	4	10	2.3	3.3	4.21	2.94	
140	G54	483709.7	752810.5	6	10	10	2.3	3.3	4.37	3.01	
548	G59	484149.0	752135.5	3	4	10	2.3	3.3	3.28	2.29	
254	G64	483212.6	752755.3	2	4	10	2.3	3.3	6.27	4.37	
208	G65	483404.6	752705.9	1	4	10	2.3	3.3	16.62	11.59	
254	G67	484015.9	752531.2	4	4	10	2.3	3.3	2.54	1.77	
2	G50	483720.6	752897.2	7	10	10	2.32	3.3	3.67	2.56	
108	G51	484131.1	753073.8	8	10	10	2.3	3.3	3.00	2.10	
62	G42	483256.0	753411.2	6	10	10	2.4	3.4	4.01	2.82	
46	G1	482883.2	749738.6	3	4	10	2.4	3.4	3.66	2.58	
20	G24	483054.2	749323.7	5	4	10	2.4	3.4	1.95	1.37	
172	G45	483487.2	752769.0	2	4	10	2.4	3.4	4.40	3.10	
22	G49	483496.6	752850.9	9	10	10	2.4	3.4	2.79	1.97	
242	G49	483711.6	752894.2	1	4	10	2.4	3.4	15.93	11.25	
54	G51	484085.9	753051.3	2	4	10	2.4	3.4	5.35	3.78	
38	G54	483721.4	752910.7	0	4	10	2.4	3.4	23.88	16.86	
536	G59	484137.1	752136.3	3	4	10	2.4	3.4	3.15	2.22	
188	G65	483385.5	752711.7	1	4	10	2.4	3.4	15.93	11.25	
52	G68	484101.0	752887.7	1	4	10	2.4	3.4	7.99	5.64	
244	G25	483685.5	749406.9	4	4	10	2.5	3.5	2.50	1.78	
44	G50	483761.1	752896.5	6	10	10	2.5	3.5	3.93	2.80	
32	G56	483672.2	752592.9	6	10	10	2.5	3.5	4.09	2.92	
38	G66	483561.9	752483.1	4	4	10	2.5	3.5	2.53	1.81	
196	G25	483646.3	749410.8	6	10	10	2.5	3.5	3.85	2.76	
176	G33	483618.3	750396.5	7	10	10	2.5	3.5	3.42	2.45	
288	G1	482735.7	749924.7	7	10	10	2.6	3.6	3.10	2.24	
216	G25	483660.8	749397.3	6	10	10	2.6	3.6	3.74	2.70	
176	G44	483464.8	752937.8	1	4	10	2.6	3.6	8.84	6.38	
202	G54	483697.4	752750.0	1	4	10	2.6	3.6	6.33	4.57	
268	G65	483462.4	752892.1	1	4	10	2.6	3.6	14.71	10.62	
168	G66	483688.6	752495.2	6	10	10	2.6	3.6	3.84	2.77	
330	G67	484057.9	752585.9	4	4	10	2.6	3.6	2.33	1.68	
140	G51	484160.3	753068.2	8	10	10	2.6	3.6	2.89	2.09	
226	G1	482784.1	749873.0	5	4	10	2.7	3.7	1.60	1.12	
288	G42	483193.1	753626.0	1	4	10	2.7	3.7	10.63	7.76	
112	G49	483583.7	752873.5	4	4	10	2.7	3.7	2.16	1.57	
240	G58	483656.4	752255.1	6	10	10	2.7	3.7	3.65	2.66	
228	G70	483326.7	752488.6	8	10	10	2.7	3.7	2.79	2.03	
182	G42	483225.3	753526.0	6	10	10	2.8	3.8	3.43	2.53	
308	G42	483188.4	753645.3	1	4	10	2.8	3.8	10.29	7.55	
54	G50	483771.0	752895.3	6	10	10	2.8	3.8	3.50	2.58	
266	G67	484027.5	752534.2	8	10	10	2.8	3.8	2.73	2.01	
126	G25	483580.3	749413.5	5	4	10	2.9	3.9	1.63	1.21	

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Galway County Council

Distance along line	Calculated FOS of Natural Peat Slopes for Derrycree Peatland Rehabilitation - Undrained Analysis (Phase 2 GPR Locations)										Factor of Safety for Load Condition	
	Line ID	Easting	Northing	Slope	Base of Peat	Undrained shear strength	c_u (kPa)	Bulk unit weight of Peat	Peat Depth	Surcharge Equivalent Peat Fill Depth (m)	Condition [1]	Condition [2]
240	G42	483210.9	753581.9	0	0	4	10	2.9	3.9	13.77	13.70	
2	G45	483465.6	752936.4	2	4	4	10	2.9	3.9	7.38	1.77	
70	G49	483453.0	752863.2	4	4	4	10	2.9	3.9	1.91	1.43	
222	G49	483269.1	752890.0	1	4	4	10	2.9	3.9	13.18	9.80	
42	G66	483081.4	752544.3	2	4	4	10	2.9	3.9	3.21	2.40	
276	G67	484036.5	752536.5	8	10	10	10	2.9	3.9	7.63	1.96	
292	G67	484048.6	752540.8	1	4	4	10	2.9	3.9	9.90	7.36	
30	G68	484006.6	752671.5	0	4	4	10	2.9	3.9	33.52	29.39	
154	G53	483927.9	753147.8	2	4	4	10	2.9	3.9	1.34	2.49	
68	G15	482298.0	749316.5	2	4	4	10	3.0	4.0	3.83	2.88	
140	G19	482418.9	749111.5	2	4	4	10	3.0	4.0	3.0	7.17	
142	G25	483509.4	749411.8	4	4	4	10	3.0	4.0	9.56	4.0	
136	G42	483232.4	753480.7	8	10	10	10	3.0	4.0	1.84	1.38	
0	G58	483682.9	752486.9	1	4	4	10	3.0	4.0	2.57	1.93	
310	G67	484050.9	752567.2	4	4	4	10	3.0	4.0	12.74	9.56	
200	G24	483228.6	749286.0	3	4	4	10	3.1	4.1	2.07	1.51	
206	G24	483234.6	749286.7	4	4	4	10	3.1	4.1	2.65	2.00	
138	G32	483252.4	749902.9	6	10	10	10	3.1	4.1	1.74	1.31	
222	G54	483696.8	752730.5	4	4	4	10	3.1	4.1	3.36	2.54	
252	G54	483701.6	752691.0	1	4	4	10	3.1	4.1	1.94	1.47	
366	G72	482922.4	752943.5	7	10	10	10	3.1	4.1	7.41	5.60	
60	G64	483713.9	752860.1	8	10	10	10	3.1	4.1	2.77	2.09	
10	G24	483044.3	749322.7	2	4	4	10	3.2	4.2	7.63	1.84	
148	G66	483670.6	752466.4	6	10	10	10	3.2	4.2	3.89	2.96	
220	G42	483217.7	753565.1	6	10	10	10	3.2	4.2	8.12	2.88	
268	G42	483197.8	753806.6	4	4	4	10	3.3	4.3	8.15	2.41	
34	G51	484066.8	753041.2	2	4	4	10	3.3	4.3	1.75	1.34	
38	G58	483684.1	752451.3	4	4	4	10	3.3	4.3	8.89	2.99	
90	G70	483454.1	752516.3	3	4	4	10	3.3	4.3	1.68	1.29	
228	G25	483672.1	749396.3	3	4	4	10	3.3	4.3	2.12	1.62	
40	G68	484091.9	752676.9	6	10	10	10	3.3	4.3	2.53	1.94	
60	G60	482657.3	750009.3	7	10	10	10	3.4	4.4	3.07	2.37	
260	G25	483696.8	749415.8	4	4	4	10	3.4	4.4	2.49	1.92	
146	G49	483617.4	752877.0	0	4	4	10	3.5	4.5	1.73	1.36	
0	G54	483726.4	752947.8	7	10	10	10	3.5	4.5	15.92	12.46	
50	G65	483253.5	752744.7	6	10	10	10	3.5	4.5	2.33	1.83	
242	G54	483700.7	752710.9	4	4	4	10	3.5	4.5	2.52	1.92	
166	G49	483637.2	752876.7	0	4	4	10	3.5	4.5	1.65	1.30	
72	G68	484115.9	752705.9	1	4	4	10	3.7	4.7	15.49	12.20	
18	G58	483683.3	752469.0	4	4	4	10	3.7	4.7	6.21	4.89	
60	G15	482293.7	749255.2	6	10	10	10	3.8	4.8	1.68	1.17	
14	G54	483726.7	752933.9	7	10	10	10	3.8	4.8	2.17	1.87	
182	G54	483702.3	752769.2	1	4	4	10	3.8	4.8	2.21	1.75	
92	G68	484130.8	752713.6	1	4	4	10	3.9	4.9	4.33	3.43	
124	G49	483595.6	752875.5	4	4	4	10	4.0	5.0	5.87	4.69	
196	G49	483656.9	752862.6	2	4	4	10	4.0	5.0	1.46	1.16	
236	G65	483431.2	752697.8	6	10	10	10	4.0	5.0	3.20	2.56	
156	G42	483230.5	753500.5	1	4	4	10	4.2	5.2	2.60	2.08	
160	G54	483706.0	752790.9	6	10	10	10	4.5	5.5	9.06	7.32	
202	G49	483672.5	752865.9	2	4	4	10	4.6	5.6	2.16	1.77	
14	G51	484051.3	753031.5	8	10	10	10	4.8	5.8	2.66	2.20	
64	G50	483781.0	752894.9	6	10	10	10	4.9	5.9	1.46	1.11	
278	G25	483716.5	749418.2	4	4	4	10	5.0	6.0	2.60	2.66	
										1.33	1.04	

Minimum = 1.46
Maximum = 239.31
Average = 11.99

NOTES:

- (1) Assuming a bulk unit weight for peat of 10kN/m³
- (2) Assuming a surcharge equivalent to fill depth of 1m of peat i.e. 10kPa.
- (3) Slope inclination (β) based on site readings and site contour plans.
- (4) A lower bound undrained shear strength, c_u for the peat of 4kPa (slopes < 6 degrees) and 10kPa (slopes > 6 degrees) were selected for the assessment. It should be noted that a c_u of 4/10kPa for the peat is considered a conservative value for the analyses and is not representative of all peat present across the site. In reality the peat has a significantly higher undrained strength.
- (5) Peat depths based on probes carried out by FT.
- (6) For load conditions see report text.





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