FEHILY TIMONEY

DESIGNING AND DELIVERING
A SUSTAINABLE FUTURE

APPENDIX 11

SOILS, GEOLOGY AND HYDROGEOLOGY

Appendix 11.1 – GII Ground Investigation Factual Report

Appendix 11.2 – Peat Stability and Geotechnical Assessment Report

Appendix 11.3 – Peat and Spoil Management Plan

Appendix 11.4 – Ground Penetration Radar Survey

APPENDIX 11.1

GII Ground Investigation Factual Report

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Ground Investigations Ireland

Derrynadarragh Wind Farm

Fehily Timoney and Company

Factual Ground Investigation Report

August 2025

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DOCUMENT CONTROL SHEET

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Client	Fehily Timoney and Company
Project No	14567-03-25
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Ground Investigations Ireland Ltd. present the results of the fieldworks and laboratory testing in accordance with the specification and related documents provided by or on behalf of the client The possibility of variation in the ground and/or groundwater conditions between or below exploratory locations or due to the investigation techniques employed must be taken into account when this report and the appendices inform designs or decisions where such variation may be considered relevant. Ground and/or groundwater conditions may vary due to seasonal, man-made or other activities not apparent during the fieldworks and no responsibility can be taken for such variation. The data presented and the recommendations included in this report and associated appendices are intended for the use of the client and the client's geotechnical representative only and any duty of care to others is excluded unless approved in writing.

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CONTENTS

APPENDICES

1.0 Preamble

On the instructions of Fehily Timoney and Company, a site investigation was carried out by Ground Investigations Ireland Ltd. (GII) in April 2025 at the site of the proposed wind farm located on the Kildare-Offaly border.

2.0 Overview

2.1. Background

It is proposed to construct a new wind farm with associated services, access roads and substation at the proposed site. At the time of the site investigation the site was greenfield and consisted of a mixture of agricultural land and peatland. The site is situated in the townlands of Cushina, Clonsast Lower and Derrynadarragh near Bracknagh, in County Offaly and the townlands of Aughrim and Derrylea near Monastervin in County Kildare.

2.2. Purpose and Scope

The purpose of the site investigation was to investigate subsurface conditions utilising a variety of investigative methods in accordance with the project specification. The scope of the work undertaken for this project included the following:

- Visit project site to observe existing conditions
- Carry out 12 No. Trial Pits to a maximum depth of 4.30m BGL
- Geotechnical and chemical laboratory testing
- Factual Report

3.0 Subsurface Exploration

3.1. General

During the ground investigation a programme of intrusive investigation specified by the Consulting Engineer was undertaken to determine the sub surface conditions at the proposed site. Regular sampling and in-situ testing were undertaken in the exploratory holes to facilitate the geotechnical descriptions and to enable laboratory testing to be carried out on the soil samples recovered during excavation and drilling.
The procedures used in this site investigation are in accordance with Eurocode 7 Part 2: Ground Investigation and testing (ISEN 1997 – 2:2007) and B.S. 5930:2015+A1:2020.

3.2. Trial Pits

The trial pits were excavated using a JCB 3CX excavator at the locations shown in the exploratory hole location plan in Appendix 1. The locations were checked using a CAT scan to minimise the potential for encountering services during the excavation. The trial pits were sampled, logged and photographed by a Geotechnical Engineer/Engineering Geologist prior to backfilling with arisings. Notes were made of any services, inclusions, pit stability, groundwater encountered, and the characteristics of the strata encountered and are presented on the trial pit logs which are provided in Appendix 2 of this Report.

3.3. Surveying

The exploratory hole locations have been recorded using a KQGeo M8 GNSS System which records the coordinates and elevation of the locations to Irish Transverse Mercator (ITM) as required by the project specification. The coordinates and elevations are provided on the exploratory hole logs in the appendices of this Report.

3.4. Laboratory Testing

Samples were selected from the exploratory holes for a range of geotechnical and chemical testing to assist in the classification of soils and to provide information for the proposed design.
Chemical testing, as required by the specification, including pH, total sulphur, water soluble sulphate, and acid soluble sulphate tests was carried out by Element Materials Technology Laboratory in the United Kingdom (UK).
Geotechnical testing consisting of moisture content, Atterberg limits, Particle Size Distribution (PSD) wet sieve and hydrometer tests were completed by Professional Soils Laboratory (PSL) in the UK.
The results of the laboratory testing are included in Appendix 3 of this Report.

4.0 Ground Conditions

4.1. General

The ground conditions encountered during the investigation are summarised below with reference to in-situ and laboratory test results. The full details of the strata encountered during the ground investigation are provided in the exploratory hole logs included in the appendices of this report.

The sequence of strata encountered was variable across the site but generally comprised;

- Peat
- Cohesive Deposits

TOPSOIL: Topsoil was encountered from ground level at TP08 and TP09 and was present to a maximum depth of 0.30m BGL.

PEAT: Peat was encountered from ground level at most exploratory holes and was present to a depth of 0.40m to 1.90m BGL. The peat was typically described as a *black/dark brown amorphous PEAT with roots* and was often grass capped at surface. The peat was also noted be *fibrous or pseudo-fibrous* at several locations.

COHESIVE DEPOSITS: A sequence of cohesive deposits was typically encountered beneath the topsoil or peat and generally consisted of a *very soft white slightly sandy clayey SILT* overlying a *very soft bluish grey slightly sandy silty CLAY* which grades into a *soft to firm interlaminated bluish grey silty CLAY and sandy SILT* at several locations. The secondary sand and gravel constituents varied across the site and with depth, with granular lenses occasionally present in the glacial till matrix. A *bluish grey slightly sandy gravelly CLAY with low cobble content* was also noted below the peat at TP10.

GRANULAR DEPOSITS: A granular deposit was encountered below the cohesive deposits at TP10 only and was described as bluish grey slightly *sandy subangular to rounded fine to coarse GRAVEL with low cobble content.* The secondary sand and fines constituents varied across the site and with depth, while low (<5%), medium (5%-20%) or high (20%-50%) cobble and boulder content may also be present across the stratum. It should be noted the trial pit where granular deposits or groundwater were encountered, experienced instability. This was described either as side wall spalling or as side wall collapse in the remarks section at the base of the trial pit logs.

4.2. Groundwater

Groundwater strikes are noted on the exploratory hole logs where they occurred. It should be noted that these exploratory holes did not remain open for sufficiently long periods of time to establish the hydrogeological regime and groundwater levels would be expected to vary with the tide, time of year, rainfall, nearby construction and other factors.

APPENDIX 1 - Figures

Site Location

Trial Pit

Client:

FEHILY TIMONEY

Project Code:

14567-03-25

Project Title:

Derrynadarragh Wind Farm

Drawing Title:

Figure 1 Site Location and Exploratory Holes

GROUND INVESTIGATIONS IRELAND
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0 145 290 435 580 725 m

Drawn By:	Date:
JG	02/05/2025

APPENDIX 2 – Trial Pit Records

Ground Investigations Ireland Ltd
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Site Derrynadarragh Wind Farm			**Trial Pit Number** TP01
Machine : JCB-3CX **Method :** Trial Pit	**Dimensions** L x W x D 3.40 x 1.00 x 4.10	**Ground Level (mOD)** 60.48	**Client** Fehily Timoney	**Job Number** 14567-03-25
	Location 659909.5 E 714994.1 N	**Dates** 03/04/2025	**Engineer**	**Sheet** 1/2

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.70)	Black amorphous PEAT with roots and grass		
				59.78	0.70	Very soft white slightly sandy clayey SILT		
					(0.60)			
				59.18	1.30	Very soft to soft bluish grey slightly sandy silty CLAY		▽1
1.50 1.50 1.50	HV 24kPa B D		seepage(1) at 1.40m.					
					(1.70)			
			seepage(2) at 3.00m.	57.48	3.00	Soft to firm thinly to thickly interlaminated bluish grey silty CLAY and sandy SILT		▽2
3.50 3.50	B D				(1.10)			

Plan

Remarks

Groundwater: First strike at 1.40m BGL. Second strike at 3.00m BGL
Trial pit unstable: Sidewalls spalling at 1.30m BGL
Trial pit complete at 4.10m BGL
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	JG	14567-03-25.TP01

Ground Investigations Ireland Ltd
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Site Derrynadarragh Wind Farm			**Trial Pit Number** TP01
Machine : JCB-3CX **Method :** Trial Pit	**Dimensions** L x W x D 3.40 x 1.00 x 4.10	**Ground Level (mOD)** 60.48	**Client** Fehily Timoney	**Job Number** 14567-03-25
	Location 659909.5 E 714994.1 N	**Dates** 03/04/2025	**Engineer**	**Sheet** 2/2

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
				56.38	4.10	Complete at 4.10m		

Plan

Remarks

Scale (approx)	Logged By	Figure No.
1:25	JG	14567-03-25.TP01

Ground Investigations Ireland Ltd
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Site Derrynadarragh Wind Farm			**Trial Pit Number** TP02
Machine : JCB-3CX **Method :** Trial Pit	**Dimensions** L x W x D 2.50 x 2.20 x 3.80	**Ground Level (mOD)** 62.05	**Client** Fehily Timoney	**Job Number** 14567-03-25
	Location 658905.9 E 716703.2 N	**Dates** 23/04/2025	**Engineer**	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.50	HV 16kPa		30,35/Av. 32.50			Brown fibrous PEAT with roots and grass		
0.50	B							
0.50	HV 21kPa		40,45/Av. 42.50					
0.50	D							
0.50	HV 18kPa				(1.90)			
1.90	B			60.15	1.90	Very soft white slightly sandy clayey SILT		
1.90	D				(0.20)			
				59.95	2.10	Very soft bluish grey sandy silty CLAY		
					(1.10)			
3.50	HV 15kPa			58.85	3.20	Soft bluish grey thinly to thickly interlaminated silty CLAY and sandy SILT		
3.50	B				(0.60)			
3.50	D							
			Water strike(1) at 3.80m.	58.25	3.80	Complete at 3.80m		▽1

Plan

Remarks

Groundwater encountered: Seepage at 3.80m BGL
Trial pit unstable: Spalling at 1.00m BGL
Trial pit complete at 3.80m BGL
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	JG	14567-03-25.TP02

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Site Derrynadarragh Wind Farm			**Trial Pit Number** TP03
Machine : JCB-3CX **Method :** Trial Pit	**Dimensions** L x W x D 2.80 x 1.00 x 4.20	**Ground Level (mOD)** 61.35	**Client** Fehily Timoney	**Job Number** 14567-03-25
	Location 659646.4 E 716552.9 N	**Dates** 04/04/2025	**Engineer**	**Sheet** 1/2

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.90)	Black amorphous PEAT with roots and grass		
0.50	HV 19kPa		35,40/Av. 37.50	60.45	0.90			
					(0.70)	Very soft brownish white slightly sandy clayey SILT		
1.50 1.50	B D			59.75	1.60			
					(1.40)	Very soft bluish grey slightly sandy silty CLAY		
				58.35	3.00			
3.50 3.50	B D				(1.20)	Soft to firm thinly to thickly interlaminated bluish grey silty CLAY and sandy SILT		

Plan

Remarks

Groundwater encountered: Seepage at 4.20m BGL
Trial pit unstable: Spalling at 1.40m BGL
Trial pit complete at 4.20m BGL
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	JG	14567-03-25.TP08

Ground Investigations Ireland Ltd
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Site Derrynadarragh Wind Farm			**Trial Pit Number** TP03
Machine : JCB-3CX **Method :** Trial Pit	**Dimensions** L x W x D 2.80 x 1.00 x 4.20	**Ground Level (mOD)** 61.35	**Client** Fehily Timoney	**Job Number** 14567-03-25
	Location 659646.4 E 716552.9 N	**Dates** 04/04/2025	**Engineer**	**Sheet** 2/2

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
			Water strike(1) at 4.20m.	57.15	4.20	Complete at 4.30m		▽1

Plan

Remarks

Scale (approx)	Logged By	Figure No.
1:25	JG	14567-03-25.TP08

Ground Investigations Ireland Ltd
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Site Derrynadarragh Wind Farm			**Trial Pit Number** TP04
Machine : JCB-3CX **Method :** Trial Pit	**Dimensions** L x W x D 2.80 x 1.00 x 4.20	**Ground Level (mOD)** 60.39	**Client** Fehily Timoney	**Job Number** 14567-03-25
	Location 659623.9 E 715347.8 N	**Dates** 03/04/2025	**Engineer**	**Sheet** 1/2

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.40)	Black amorphous PEAT with roots and grass		
				59.99	0.40			
0.50	HV 18kPa		20,17,17/Av. 18.00		(0.70)	Very soft white slightly sandy clayey SILT		▽1
			seepage(1) at 0.80m.					
1.00 1.00	B D			59.29	1.10			
					(1.70)	Very soft bluish grey slightly sandy silty CLAY		
				57.59	2.80			
3.00 3.00 3.00	HV 21kPa B D				(1.40)	Soft to firm thinly to thickly interlaminated bluish grey silty CLAY and sandy SILT		

Plan

Remarks

Groundwater encountered: Seepage at 0.80m BGL
Trial pit unstable: Sidewalls spalling at 1.10m BGL
Trial pit complete at 4.20m BGL
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	JG	14567-03-25.TP01

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Site Derrynadarragh Wind Farm			**Trial Pit Number** TP04
Machine : JCB-3CX **Method :** Trial Pit	**Dimensions** L x W x D 2.80 x 1.00 x 4.20	**Ground Level (mOD)** 60.39	**Client** Fehily Timoney	**Job Number** 14567-03-25
	Location 659623.9 E 715347.8 N	**Dates** 03/04/2025	**Engineer**	**Sheet** 2/2

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
				56.19	4.20	Complete at 4.20m		

Plan

Remarks

Scale (approx)	Logged By	Figure No.
1:25	JG	14567-03-25.TP01

Ground Investigations Ireland Ltd
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Site	Trial Pit Number
Derrynadarragh Wind Farm	TP05

Machine : JCB-3CX Method : Trial Pit	Dimensions L x W x D 2.00 x 1.00 x 4.30	Ground Level (mOD) 61.08	Client Fehily Timoney	Job Number 14567-03-25
	Location 659124.9 E 716051.4 N	Dates 04/04/2025	Engineer	Sheet 1/2

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.80)	Black amorphous PEAT with roots and grass		
0.50	HV 15kPa			60.28	0.80			
					(0.20)	Brown fibrous PEAT		
				60.08	1.00			
					(0.50)	Very soft white slightly sandy clayey SILT		
1.50 1.50	B D			59.58	1.50			
					(1.10)	Very soft bluish grey slightly sandy silty CLAY		
				58.48	2.60			
			fast ingress(1) at 2.90m.			Soft to firm thinly to thickly interlaminated bluish grey silty CLAY and sandy SILT		▽1
					(1.70)			
3.50 3.50	B D							

Plan

Remarks

No groundwater encountered
Trial pit stable
Trial pit complete at 4.30m BGL
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	JG	14567-03-25.TP05

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Site Derrynadarragh Wind Farm			**Trial Pit Number** TP05
Machine : JCB-3CX **Method :** Trial Pit	**Dimensions** L x W x D 2.00 x 1.00 x 4.30	**Ground Level (mOD)** 61.08	**Client** Fehily Timoney	**Job Number** 14567-03-25
	Location 659124.9 E 716051.4 N	**Dates** 04/04/2025	**Engineer**	**Sheet** 2/2

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
				56.78	4.30	Complete at 4.30m		

Plan

Remarks

Scale (approx)	Logged By	Figure No.
1:25	JG	14567-03-25.TP05

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Site Derrynadarragh Wind Farm			**Trial Pit Number** TP06
Machine : JCB-3CX **Method :** Trial Pit	**Dimensions** L x W x D 2.70 x 1.10 x 4.20	**Ground Level (mOD)** 61.95	**Client** Fehily Timoney	**Job Number** 14567-03-25
	Location 658391.1 E 715688.6 N	**Dates** 03/04/2025	**Engineer**	**Sheet** 1/2

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.50)	Black pseudo-fibrous PEAT with roots and grass		
0.40	HV 20kPa			61.45	0.50			
					(0.70)	Soft bluish grey sandy gravelly CLAY with low cobble content		
1.00 1.00	B D			60.75	1.20			
					(0.80)	Very soft bluish grey slightly sandy slightly gravelly silty CLAY with low cobble content		
				59.95	2.00			
					(2.20)	Very soft bluish grey slightly gravelly sandy silty CLAY		
			seepage(1) at 3.30m.					▽1
3.50 3.50	B D							

Plan

Remarks

Groundwater encountered: Seepage at 3.30m BGL
Trial pit unstable: Sidewalls spalling/collapsed at 2.00m BGL
Trial pit complete at 4.20m BGL
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	JG	14567-03-25.TP01

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Site Derrynadarragh Wind Farm			**Trial Pit Number** TP06
Machine : JCB-3CX **Method :** Trial Pit	**Dimensions** L x W x D 2.70 x 1.10 x 4.20	**Ground Level (mOD)** 61.95	**Client** Fehily Timoney	**Job Number** 14567-03-25
	Location 658391.1 E 715688.6 N	**Dates** 03/04/2025	**Engineer**	**Sheet** 2/2

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
				57.75	4.20	Complete at 4.20m		

Plan

Remarks

Scale (approx)	Logged By	Figure No.
1:25	JG	14567-03-25.TP01

Ground Investigations Ireland Ltd
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Site Derrynadarragh Wind Farm			**Trial Pit Number** TP07
Machine : JCB-3CX **Method :** Trial Pit	**Dimensions** L x W x D 3.00 x 1.00 x 4.10	**Ground Level (mOD)** 61.35	**Client** Fehily Timoney	**Job Number** 14567-03-25
	Location 659292.8 E 715526.8 N	**Dates** 03/04/2025	**Engineer**	**Sheet** 1/2

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.90)	Black amorphous PEAT with roots and grass		
0.50	HV 18kPa			60.45	0.90			
					(0.20)	Dark brown pseudofibrous PEAT with roots		
				60.25	1.10			
					(0.80)	Very soft white slightly sandy clayey SILT		
1.50	HV 16kPa		35,30/Av. 32.50	59.45	1.90			
					(0.80)	Very soft bluish grey sandy silty CLAY		
2.50 2.50	B D			58.65	2.70			
					(1.40)	Firm bluish grey sandy silty CLAY		
3.50 3.50	B D							

Plan

Remarks

No groundwater encountered
Trial pit stable
Trial pit complete at 4.10m BGL
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	JG	14567-03-25.TP01

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Site Derrynadarragh Wind Farm			**Trial Pit Number** TP07
Machine : JCB-3CX **Method :** Trial Pit	**Dimensions** L x W x D 3.00 x 1.00 x 4.10	**Ground Level (mOD)** 61.35	**Client** Fehily Timoney	**Job Number** 14567-03-25
	Location 659292.8 E 715526.8 N	**Dates** 03/04/2025	**Engineer**	**Sheet** 2/2

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
				57.25	4.10	Complete at 4.10m		

Plan

Remarks

Scale (approx)	Logged By	Figure No.
1:25	JG	14567-03-25.TP01

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Site Derrynadarragh Wind Farm			**Trial Pit Number** TP08
Machine : JCB-3CX **Method :** Trial Pit	**Dimensions** L x W x D 2.90 x 1.00 x 4.30	**Ground Level (mOD)** 59.88	**Client** Fehily Timoney	**Job Number** 14567-03-25
	Location 659685.9 E 715964.7 N	**Dates** 04/04/2025	**Engineer**	**Sheet** 1/2

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.30)	TOPSOIL: Brown slightly sandy slightly gravelly Clay		
				59.58	0.30			
					(0.10)	Soft white sandy silty CLAY		
				59.48	0.40			
0.50	HV 26kPa		50,55/Av. 52.50			Soft bluish grey slightly sandy slightly gravelly silty CLAY		
					(0.60)			
				58.88	1.00			
						Very soft bluish grey sandy silty CLAY		
1.50 1.50	B D							
					(1.50)			
				57.38	2.50			
						Soft thinly to thickly interlaminated bluish grey silty CLAY and sandy SILT		
					(1.80)			
3.50 3.50	B D		seepage(1) at 3.50m.					▽1

Plan

Remarks

Groundwater encountered: Seepage at 3.50m BGL
Trial pit stable
Trial pit complete at 4.30m BGL
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	JG	14567-03-25.TP08

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Site Derrynadarragh Wind Farm			**Trial Pit Number** TP08
Machine : JCB-3CX **Method :** Trial Pit	**Dimensions** L x W x D 2.90 x 1.00 x 4.30	**Ground Level (mOD)** 59.88	**Client** Fehily Timoney	**Job Number** 14567-03-25
	Location 659685.9 E 715964.7 N	**Dates** 04/04/2025	**Engineer**	**Sheet** 2/2

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
				55.58	4.30	Complete at 4.30m		

Plan

Remarks

Scale (approx)	Logged By	Figure No.
1:25	JG	14567-03-25.TP08

Ground Investigations Ireland Ltd
www.gii.ie

Site Derrynadarragh Wind Farm			**Trial Pit Number** TP09
Machine : JCB-3CX **Method :** Trial Pit	**Dimensions** L x W x D 2.90 x 1.00 x 4.20	**Ground Level (mOD)** 59.96	**Client** Fehily Timoney	**Job Number** 14567-03-25
	Location 660132.4 E 715726.2 N	**Dates** 04/04/2025	**Engineer**	**Sheet** 1/2

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.20)	TOPSOIL: dark brown organic Clay		
				59.76	0.20			
					(0.20)	Very soft white slightly sandy clayey SILT		
0.30	HV 16kPa		15,17/Av. 16.00	59.56	0.40			
					(0.60)	Soft bluish grey slightly sandy slightly gravelly silty CLAY		
				58.96	1.00			
1.50 1.50	B D		seepage(1) at 1.50m.		(1.00)	Very soft bluish grey slightly sandy silty CLAY		▽1
				57.96	2.00			
					(2.20)	Soft to firm thinly to thickly interlaminated bluish grey silty CLAY and sandy SILT		
3.50 3.50	B D							

Plan

Remarks

Groundwater encountered: Seepage at 1.50m BGL
Trial pit stable
Trial pit complete at 4.20m BGL
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	JG	14567-03-25.TP08

Ground Investigations Ireland Ltd
www.gii.ie

Site Derrynadarragh Wind Farm			**Trial Pit Number** TP09
Machine : JCB-3CX **Method :** Trial Pit	**Dimensions** L x W x D 2.90 x 1.00 x 4.20	**Ground Level (mOD)** 59.96	**Client** Fehily Timoney	**Job Number** 14567-03-25
	Location 660132.4 E 715726.2 N	**Dates** 04/04/2025	**Engineer**	**Sheet** 2/2

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
				55.76	4.20	Complete at 4.20m		

Plan

Remarks

Scale (approx)	Logged By	Figure No.
1:25	JG	14567-03-25.TP08

Ground Investigations Ireland Ltd
www.gii.ie

Site Derrynadarragh Wind Farm			**Trial Pit Number** TP10
Machine : JCB-3CX **Method :** Trial Pit	**Dimensions** L x W x D 2.50 x 1.00 x 3.30	**Ground Level (mOD)** 63.32	**Client** Fehily Timoney	**Job Number** 14567-03-25
	Location 658231.3 E 716286.2 N	**Dates** 03/04/2025	**Engineer**	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(1.40)	Black amorphous PEAT with roots and grass		
0.50	HV 15kPa			61.92	1.40	Brown fibrous PEAT		
					(0.40)			
				61.52	1.80	Very soft bluish grey slightly sandy gravelly CLAY with low cobble content		
					(1.00)			
2.50	B							
2.50	D							
			fast ingress(1) at 2.90m.	60.52	2.80	Bluish grey slightly sandy subangular to rounded fine to coarse GRAVEL with low cobble content. Visually assessed as loose.		▽1
3.00	B				(0.50)			
3.00	D							
				60.02	3.30	Complete at 3.30m		

Plan

Remarks

Groundwater encountered: Fast ingress at 2.90m BGL
Trial pit unstable: Sidewalls collapsed
Trial pit complete at 3.30m BGL
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	JG	14567-03-25.TP01

Ground Investigations Ireland Ltd
www.gii.ie

Site Derrynadarragh Wind Farm			**Trial Pit Number** TP11
Machine : JCB-3CX **Method :** Trial Pit	**Dimensions** L x W x D 2.80 x 1.20 x 3.50	**Ground Level (mOD)** 62.34	**Client** Fehily Timoney	**Job Number** 14567-03-25
	Location 658340.6 E 716158.3 N	**Dates** 03/04/2025	**Engineer**	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.60)	Black amorphous PEAT with roots and grass		
0.50	HV 18kPa			61.74	0.60			
					(1.20)	Very soft bluish grey slightly gravelly sandy silty CLAY with low cobble content		
1.50 1.50	B D			60.54	1.80			
					(1.70)	Soft to firm bluish grey slightly gravelly sandy silty CLAY with low cobble content		
3.00 3.00	B D			58.84	3.50			
						Complete at 3.50m		

Plan

Remarks

No groundwater encountered
Trial pit unstable: Sidewalls collapsing at 1.80m BGL
Trial pit complete at 3.50m BGL
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	JG	14567-03-25.TP01

Ground Investigations Ireland Ltd
www.gii.ie

Site Derrynadarragh Wind Farm			**Trial Pit Number** TP12
Machine : JCB-3CX **Method :** Trial Pit	**Dimensions** L x W x D 2.70 x 1.00 x 3.50	**Ground Level (mOD)** 61.91	**Client** Fehily Timoney	**Job Number** 14567-03-25
	Location 658430.9 E 716124.8 N	**Dates** 03/04/2025	**Engineer**	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
			seepage(1) at 0.90m.		(1.10)	Black/dark brown amorphous PEAT with roots and grass		▽1
				60.81	1.10			
1.50 1.50	B D				(1.90)	Very soft bluish grey slightly gravelly sandy silty CLAY with low cobble content		
3.00 3.00	B D			58.91	3.00			
					(0.50)	Firm bluish slightly gravelly grey sandy silty CLAY with low cobble content		
				58.41	3.50			
						Complete at 3.50m		

Plan

Remarks

Groundwater encountered: Seepage at 0.90m BGL
Trial pit unstable: Sidewalls collapsing at 0.90m BGL
Trial pit complete at 3.50m BGL
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	JG	14567-03-25.TP01

Derrynadarragh Wind Farm – Trial Pit Photographs

TP01

TP01

Derrynadarragh Wind Farm – Trial Pit Photographs

TP01

TP01

Derrynadarragh Wind Farm – Trial Pit Photographs

TP02

TP02

Derrynadarragh Wind Farm – Trial Pit Photographs

TP02

TP02

Derrynadarragh Wind Farm – Trial Pit Photographs

TP03

TP03

Derrynadarragh Wind Farm – Trial Pit Photographs

TP03

TP03

Derrynadarragh Wind Farm – Trial Pit Photographs

TP04

TP04

Derrynadarragh Wind Farm – Trial Pit Photographs

TP04

TP04

Derrynadarragh Wind Farm – Trial Pit Photographs

TP05

TP05

Derrynadarragh Wind Farm – Trial Pit Photographs

TP05

TP05

Derrynadarragh Wind Farm – Trial Pit Photographs

TP06

TP06

Derrynadarragh Wind Farm – Trial Pit Photographs

TP06

TP06

Derrynadarragh Wind Farm – Trial Pit Photographs

TP07

TP07

Derrynadarragh Wind Farm – Trial Pit Photographs

TP07

TP07

Derrynadarragh Wind Farm – Trial Pit Photographs

TP08

TP08

Derrynadarragh Wind Farm – Trial Pit Photographs

TP08

TP08

Derrynadarragh Wind Farm – Trial Pit Photographs

TP09

TP09

Derrynadarragh Wind Farm – Trial Pit Photographs

TP09

TP09

Derrynadarragh Wind Farm – Trial Pit Photographs

TP10

TP10

Derrynadarragh Wind Farm – Trial Pit Photographs

TP10

TP10

Derrynadarragh Wind Farm – Trial Pit Photographs

TP11

TP11

Derrynadarragh Wind Farm – Trial Pit Photographs

TP11

TP11

Derrynadarragh Wind Farm – Trial Pit Photographs

TP12

TP12

Derrynadarragh Wind Farm – Trial Pit Photographs

TP12

TP12

APPENDIX 3 – Laboratory Testing

Element Materials Technology
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Ground Investigations Ireland
Catherinestown House
Hazelhatch Road
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D22 K5P8

Attention :	James Cashen
Date :	27th May, 2025
Your reference :	14567-03-25
Our reference :	Test Report 25/7688 Batch 1
Location :	Derrynadarragh Wind Farm
Date samples received :	14th May, 2025
Status :	Final Report
Issue :	202505271252

Four samples were received for analysis on 14th May, 2025 of which four were scheduled for analysis. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.
All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

The greenhouse gas emissions generated (in Carbon – Co2e) to obtain the results in this report are estimated as:

Scope 1&2 emissions - 5.213 kg of CO2

Scope 1&2&3 emissions - 12.319 kg of CO2

Authorised By:

Bruce Leslie
Project Manager

Element Materials Technology

Client Name: Ground Investigations Ireland
Reference: 14567-03-25
Location: Derrynadarragh Wind Farm
Contact: James Cashen
EMT Job No: 25/7688

Report : Solid

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

EMT Sample No.	1	2	3	4							LOD/LOR	Units	Method No.
Sample ID	TP02	TP09	TP10	TP12									
Depth	1.90	1.50	2.50	1.50									
COC No / misc													
Containers	T	T	T	T									
Sample Date	13/05/2025	13/05/2025	13/05/2025	13/05/2025									
Sample Type	Soil	Soil	Soil	Soil									
Batch Number	1	1	1	1									
Date of Receipt	14/05/2025	14/05/2025	14/05/2025	14/05/2025									
Sulphur as S	0.48	0.03	0.31	0.04							<0.01	%	TM30/PM15
Total Sulphate as SO4 BRE	0.14	0.03	0.05	0.02							<0.01	%	TM50/PM29
Sulphate as SO4 (2:1 Ext) #	0.4008	0.0247	0.1125	0.0235							<0.0015	g/l	TM38/PM20
Organic Matter	2.0	0.8	1.7	0.3							<0.2	%	TM21/PM24

Please see attached notes for all abbreviations and acronyms

Element Materials Technology

Notification of Deviating Samples

Client Name: Ground Investigations Ireland
Reference: 14567-03-25
Location: Derrynadarragh Wind Farm
Contact: James Cashen

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Analysis	Reason
No deviating sample report results for job 25/7688						

Please note that only samples that are deviating are mentioned in this report. If no samples are listed it is because none were deviating. Only analyses which are accredited are recorded as deviating if set criteria are not met.
It is a requirement under ISO 17025 that we inform clients if samples are deviating i.e. outside what is expected. A deviating sample indicates that the sample 'may' be compromised but not necessarily will be compromised. The result is still accredited and our analytical reports will still show accreditation on the relevant analytes.

NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

EMT Job No.: 25/7688

SOILS and ASH

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

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

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

All samples will be discarded one month after the date of reporting, unless we are instructed to the contrary. Asbestos samples are retained for 6 months.

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

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

All analysis is reported on a dry weight basis unless stated otherwise. Limits of detection for analyses carried out on as received samples are not moisture content corrected. Results are not surrogate corrected. Samples are dried at 35°C ±5°C unless otherwise stated. Moisture content for CEN Leachate tests are dried at 105°C ±5°C. Ash samples are dried at 35°C ±5°C.

Where Mineral Oil is quoted, this refers to Total Aliphatics C10-C40.

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

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

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

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

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

WATERS

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

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

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

Where Mineral Oil is quoted, this refers to Total Aliphatics C10-C40.

STACK EMISSIONS

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation for Dioxins and Furans and Dioxin like PCBs has been performed on XAD-2 Resin, only samples which use this resin will be within our MCERTS scope.

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

DEVIATING SAMPLES

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

SURROGATES

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

DILUTIONS

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

BLANKS

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

NOTE

Data is only reported if the laboratory is confident that the data is a true reflection of the samples analysed. Data is only reported as accredited when all the requirements of our Quality System have been met. In certain circumstances where all the requirements of the Quality System have not been met, for instance if the associated AQC has failed, the reason is fully investigated and documented. The sample data is then evaluated alongside the other quality control checks performed during analysis to determine its suitability. Following this evaluation, provided the sample results have not been effected, the data is reported but accreditation is removed. It is a requirement of our Accreditation Body for data not reported as accredited to be considered indicative only, but this does not mean the data is not valid.
Where possible, and if requested, samples will be re-extracted and a revised report issued with accredited results. Please do not hesitate to contact the laboratory if further details are required of the circumstances which have led to the removal of accreditation.
Laboratory records are kept for a period of no less than 6 years.

REPORTS FROM THE SOUTH AFRICA LABORATORY

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

Measurement Uncertainty

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

Customer Provided Information

Sample ID and depth is information provided by the customer.

Age of Diesel

The age of release estimation is based on the nC17/pristane ratio only as prescribed by Christensen and Larsen (1993) and Kaplan, Galperin, Alimi et al., (1996).
Age estimation should be treated with caution as it can be influenced by site specific factors of which the laboratory are not aware.

Tentatively Identified Compounds (TICs)

Where Tentatively Identified Compounds (TICs) are reported, up to 10 Tentatively Identified Compounds will be listed where there is found to be a greater than 80% match with the NIST library. The reported concentration is determined semi-quantitively, with a matrix specific limit of detection. Note, other compounds may be present but are not reported.

ABBREVIATIONS and ACRONYMS USED

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

HWOL ACRONYMS AND OPERATORS USED

HS	Headspace Analysis.
EH	Extractable Hydrocarbons - i.e. everything extracted by the solvent.
CU	Clean-up - e.g. by florisil, silica gel.
1D	GC - Single coil gas chromatography.
Total	Aliphatics & Aromatics.
AL	Aliphatics only.
AR	Aromatics only.
2D	GC-GC - Double coil gas chromatography.
#1	EH_Total but with humics mathematically subtracted
#2	EU_Total but with fatty acids mathematically subtracted
_	Operator - underscore to separate acronyms (exception for +).
+	Operator to indicate cumulative e.g. EH+HS_Total or EH_CU+HS_Total
MS	Mass Spectrometry.

EMT Job No: 25/7688

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/SANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM21	Modified BS 7755-3:1995, ISO10694:1995 Determination of Total Organic Carbon or Total Carbon by combustion in an Eltra TOC furnace/analyser in the presence of oxygen. The CO2 generated is quantified using infra-red detection. Organic Matter (SOM) calculated as per EA MCERTS Chemical Testing of Soil.	PM24	Preparation of Soil and Marine Sediment Samples for Total Organic Carbon.			AD	Yes
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma-Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP 6010B, Rev.2, Dec.1996; Modified EPA Method 3050B, Rev.2, Dec.1996	PM15	Acid digestion of dried and ground solid samples using Aqua Regia refluxed at 112.5 degrees Celsius. Samples containing asbestos are not dried and ground.			AD	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993) - All anions comparable to BS ISO 15923-1: 2013I	PM20	Extraction of dried and ground or as received samples with deionised water in a 2:1 water to solid ratio using a reciprocal shaker for all analytes except hexavalent chromium. Extraction of as received sample using 10:1 ratio of 0.2M sodium hydroxide to soil for hexavalent chromium using a reciprocal shaker.	Yes		AD	Yes
TM50	Acid soluble sulphate (Total Sulphate) analysed by ICP-OES	PM29	A hot hydrochloric acid digest is performed on a dried and ground sample, and the resulting liquor is analysed.			AD	Yes

LABORATORY REPORT

Contract Number: PSL25/3948

Report Date: 08 August 2025

Client's Reference: 14567-03-25

Client Name: Ground Investigations Ireland Ltd
Catherinestown House
Hazelhatch Road
Newcastle
Co Dublin
D22 YD52

For the attention of: James Cashen

Contract Title: Derrynadarragh Wind Farm

Date Received: 28/5/2025
Date Commenced: 28/5/2025
Date Completed: 8/8/2025

Notes: Opinions and Interpretations are outside the UKAS Accreditation

A copy of the Laboratory Schedule of accredited tests as issued by UKAS is attached to this report. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced other than in full, without the prior written approval of the laboratory.

Checked and Approved Signatories:

A Watkins (Managing Director)	R Berriman (Associate Director)	S Royle (Laboratory Manager)
L Knight (Assistant Laboratory Manager)	S Eyre (Senior Technician)	T Watkins (Senior Technician)

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awatkins@prosoils.co.uk

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Description of Sample
TP01		B	1.50		Grey slightly sandy CLAY.
TP02		B	1.90		Grey slightly sandy CLAY.
TP03		B	3.50		Grey slightly sandy CLAY.
TP04		B	1.00		Light brown slightly sandy organic CLAY.
TP05		B	3.50		Grey slightly sandy CLAY.
TP06		B	1.00		Brown slightly clayey very sandy GRAVEL.
TP07		B	3.50		Brown slightly sandy slightly gravelly CLAY.
TP08		B	1.50		Grey slightly sandy CLAY.
TP09		B	3.50		Grey slightly sandy CLAY.
TP10		B	2.50		Grey slightly sandy gravelly CLAY.

UKAS TESTING 4043

PSL PROFESSIONAL SOILS LABORATORY A PHENNA GROUP COMPANY

Derrynadarragh Wind Farm

Contract No:

PSL25/3948

Client Ref:

14567-03-25

SUMMARY OF SOIL CLASSIFICATION TESTS

BS 1377 - Part 2 : 2022 in accordance with BS EN ISO 17892 (as below)

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Water Content %	Linear Shrinkage	Particle Density Mg/m^3	Liquid Limit %	Plastic Limit %	Plasticity Index %	Passing 0.425mm %	Remarks
TP01		B	1.50		23.5			44	23	21	100	Medium Plasticity CIM
TP02		B	1.90		26.0			41	22	19	100	Medium Plasticity CIM
TP03		B	3.50		25.6			41	21	20	100	Medium Plasticity CIM
TP04		B	1.00		92.1			126	47	79	100	Organic Plasticity CIHO
TP05		B	3.50		24.6			43	24	19	100	Medium Plasticity CIM
TP06		B	1.00		15.8				NP			
TP07		B	3.50		7.2			33	18	15	97	Low Plasticity CIL
TP08		B	1.50		27.5			42	21	21	100	Medium Plasticity CIM
TP09		B	3.50		24.2			45	23	22	100	Medium Plasticity CIM
TP10		B	2.50		21.5			36	18	18	71	Medium Plasticity CIM

Water Content - BS 1377 - Part 2 : 2022 : Clause 4 in accordance with BS EN ISO 17892 - 1 : 2014 + A1 : 2022
Linear Shrinkage - BS 1377 - Part 2 : 2022 : Clause 7
Particle Density (Gas Jar method) - BS 1377 - Part 2 : 2022 : Clause 9
Liquid, Plastic Limit & Plasticity Index - BS 1377 - Part 2 : 2022 : Clause 5 & 6 in accordance with BS EN ISO 17892 - 12 : 2018 + A2 : 2022

SYMBOLS : NP = Non Plastic

UKAS TESTING 4043

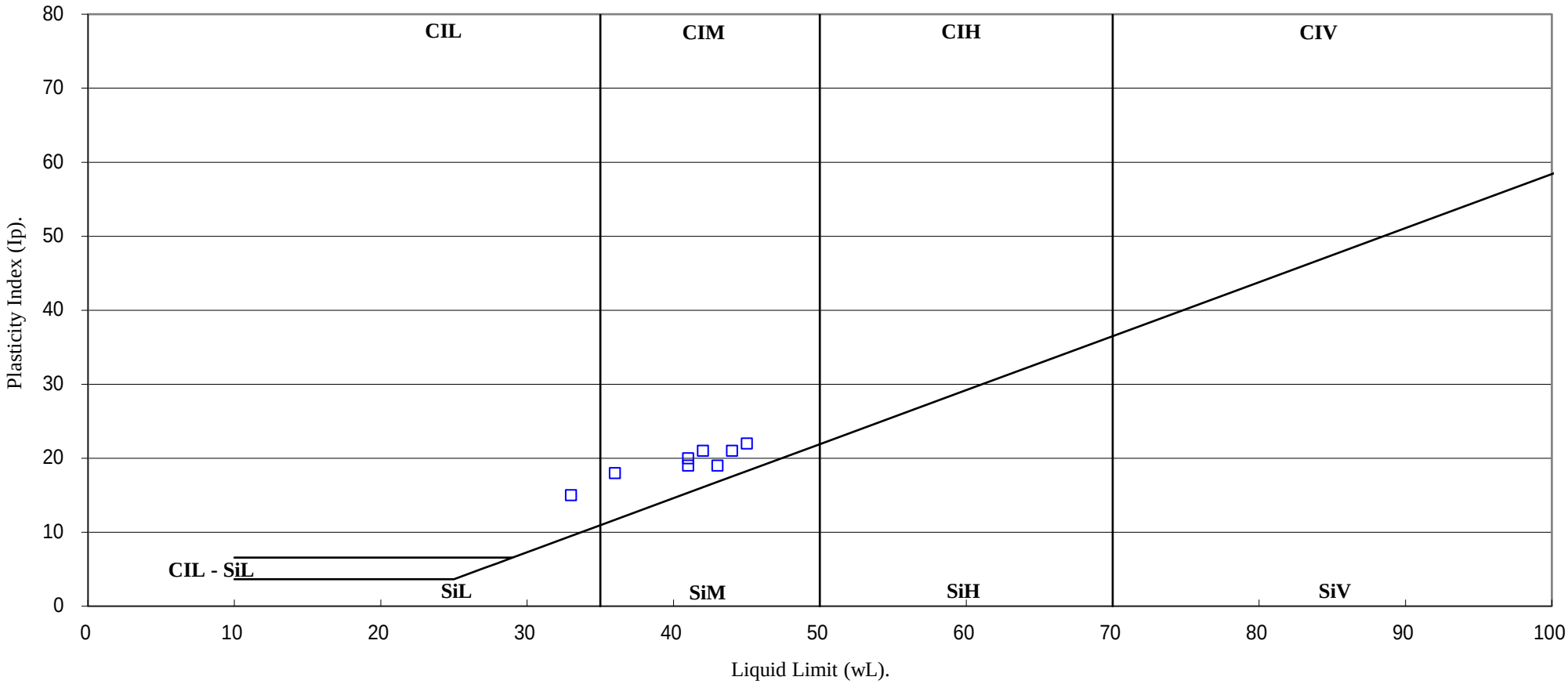
PSL PROFESSIONAL SOILS LABORATORY A PHENNA GROUP COMPANY

Derrynadarragh Wind Farm

Contract No:
PSL25/3948
Client Ref:
14567-03-25

PLASTICITY CHART

BS EN ISO 14688-2:2017 Clause 4.4



UKAS TESTING 4043 / PSL PROFESSIONAL SOILS LABORATORY A PHENNA GROUP COMPANY	**Derrynadarragh Wind Farm**	**Contract No:**
		PSL25/3948
		Client Ref:
		14567-03-25

PARTICLE SIZE DISTRIBUTION TEST

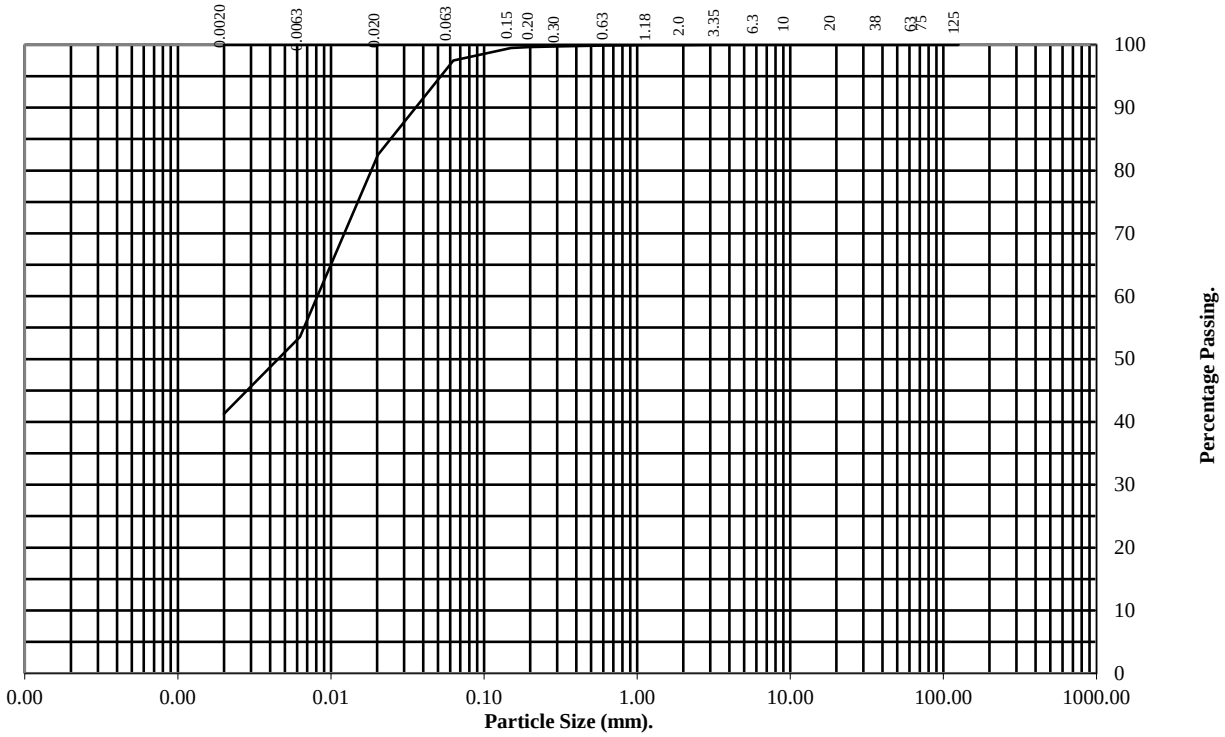
BS 1377 - Part 2 : 2022 : Clause 10 in accordance with BS EN ISO 17892 - 4 : 2016

Sieve Method, Clause 5.2 & Pipette Method, Clause 5.4

Hole Number: **TP01** **Top Depth (m):** **1.50**

Sample Number: **Base Depth (m):**

Sample Type: **B**



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	100
10	100
6.3	100
3.35	100
2	100
1.18	100
0.63	100
0.3	100
0.2	100
0.15	100
0.063	98

Particle Diameter	Percentage Passing
0.020	83
0.0063	54
0.0020	41
Particle Density - 2.65 Mg/m3 assumed	

Soil Fraction	Total Percentage
Cobbles	0
Gravel	0
Sand	2
Silt	57
Clay	41

Remarks:

See Summary of Soil Descriptions

UKAS TESTING 4043

PSL PROFESSIONAL SOILS LABORATORY A PHENNA GROUP COMPANY

Derrynadarragh Wind Farm

Contract No:
PSL25/3948
Client Ref:
14567-03-25

PARTICLE SIZE DISTRIBUTION TEST

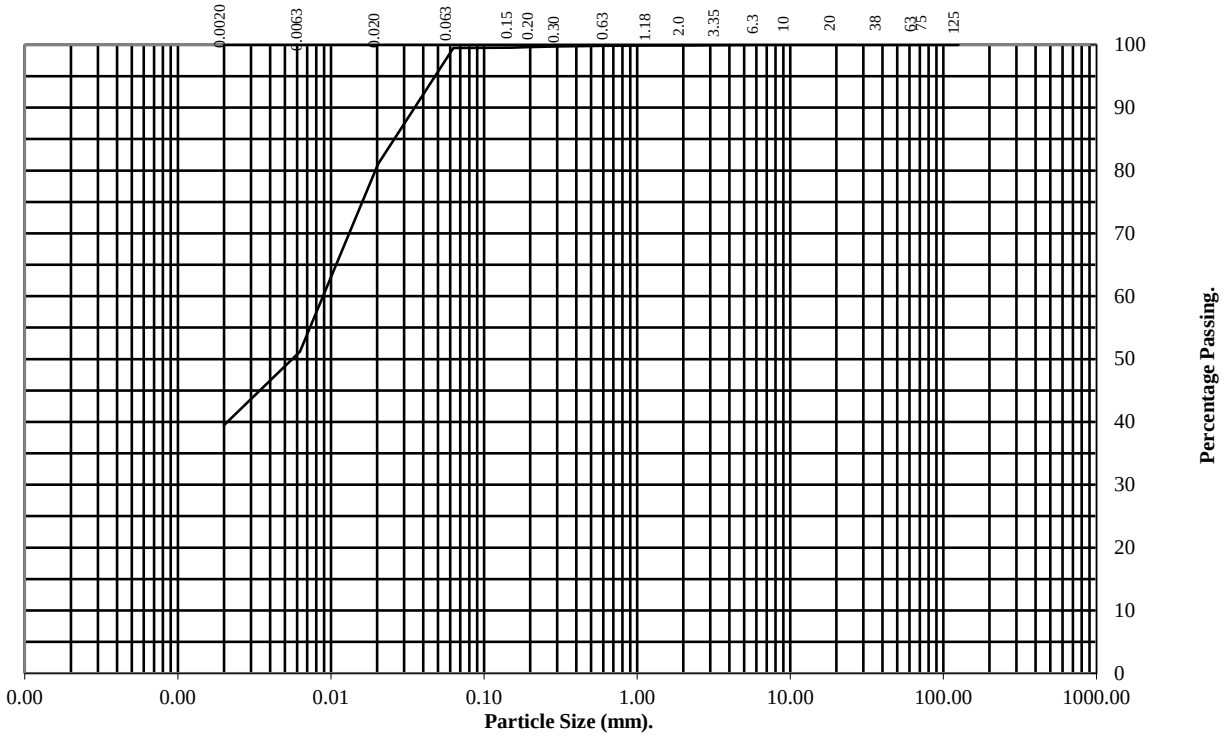
BS 1377 - Part 2 : 2022 : Clause 10 in accordance with BS EN ISO 17892 - 4 : 2016

Sieve Method, Clause 5.2 & Pipette Method, Clause 5.4

Hole Number: **TP02** **Top Depth (m):** **1.90**

Sample Number: **Base Depth (m):**

Sample Type: **B**



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	100
10	100
6.3	100
3.35	100
2	100
1.18	100
0.63	100
0.3	100
0.2	100
0.15	100
0.063	99

Particle Diameter	Percentage Passing
0.020	81
0.0063	51
0.0020	39
Particle Density - 2.65 Mg/m3 assumed	

Soil Fraction	Total Percentage
Cobbles	0
Gravel	0
Sand	1
Silt	60
Clay	39

Remarks:

See Summary of Soil Descriptions

UKAS TESTING 4043

PSL PROFESSIONAL SOILS LABORATORY A PHENNA GROUP COMPANY

Derrynadarragh Wind Farm

Contract No:
PSL25/3948
Client Ref:
14567-03-25

PARTICLE SIZE DISTRIBUTION TEST

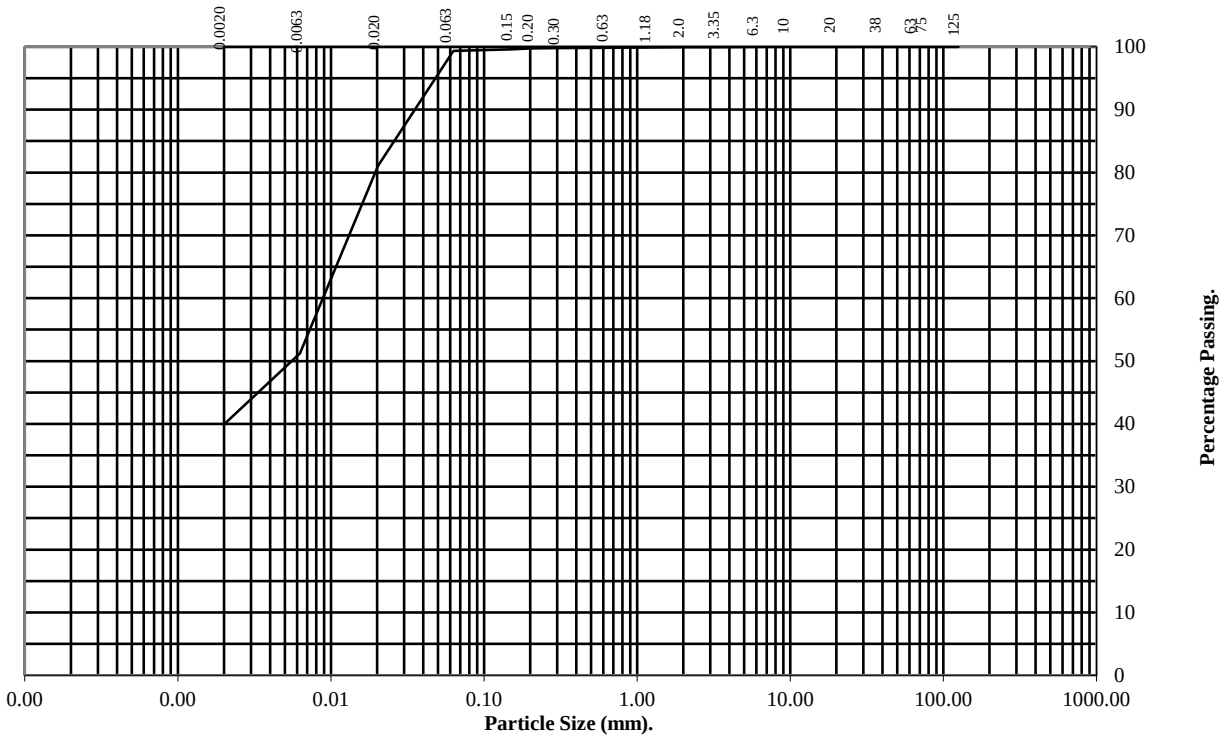
BS 1377 - Part 2 : 2022 : Clause 10 in accordance with BS EN ISO 17892 - 4 : 2016

Sieve Method, Clause 5.2 & Pipette Method, Clause 5.4

Hole Number: **TP03** **Top Depth (m):** **3.50**

Sample Number: **Base Depth (m):**

Sample Type: **B**



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	100
10	100
6.3	100
3.35	100
2	100
1.18	100
0.63	100
0.3	100
0.2	100
0.15	100
0.063	99

Particle Diameter	Percentage Passing
0.020	81
0.0063	51
0.0020	40
Particle Density - 2.65 Mg/m3 assumed	

Soil Fraction	Total Percentage
Cobbles	0
Gravel	0
Sand	1
Silt	59
Clay	40

Remarks:

See Summary of Soil Descriptions

UKAS TESTING 4043

PSL PROFESSIONAL SOILS LABORATORY A PHENNA GROUP COMPANY

Derrynadarragh Wind Farm

Contract No: PSL25/3948

Client Ref: 14567-03-25

PARTICLE SIZE DISTRIBUTION TEST

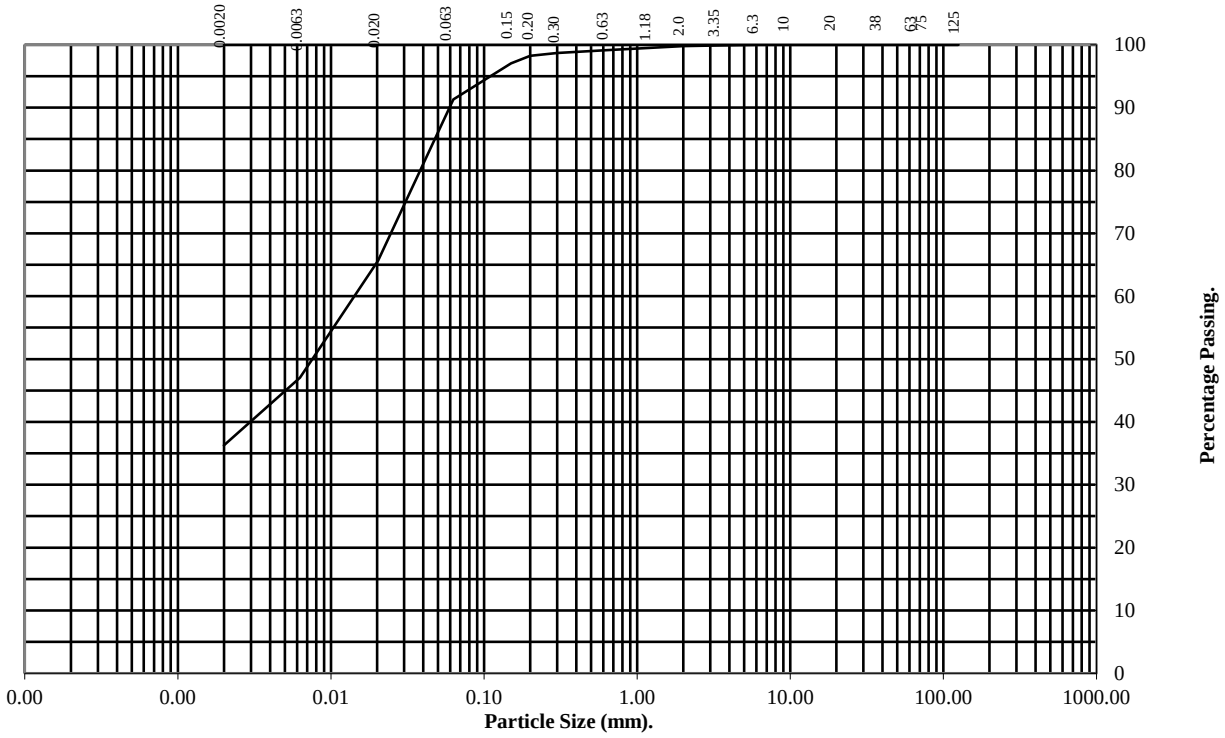
BS 1377 - Part 2 : 2022 : Clause 10 in accordance with BS EN ISO 17892 - 4 : 2016

Sieve Method, Clause 5.2 & Pipette Method, Clause 5.4

Hole Number: **TP04** **Top Depth (m):** **1.00**

Sample Number: **Base Depth (m):**

Sample Type: **B**



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	100
10	100
6.3	100
3.35	100
2	100
1.18	99
0.63	99
0.3	99
0.2	98
0.15	97
0.063	91

Particle Diameter	Percentage Passing
0.020	66
0.0063	47
0.0020	36
Particle Density - 2.65 Mg/m3 assumed	

Soil Fraction	Total Percentage
Cobbles	0
Gravel	0
Sand	9
Silt	55
Clay	36

Remarks:

See Summary of Soil Descriptions

UKAS TESTING 4043

PSL PROFESSIONAL SOILS LABORATORY A PHENNA GROUP COMPANY

Derrynadarragh Wind Farm

Contract No:
PSL25/3948
Client Ref:
14567-03-25

PARTICLE SIZE DISTRIBUTION TEST

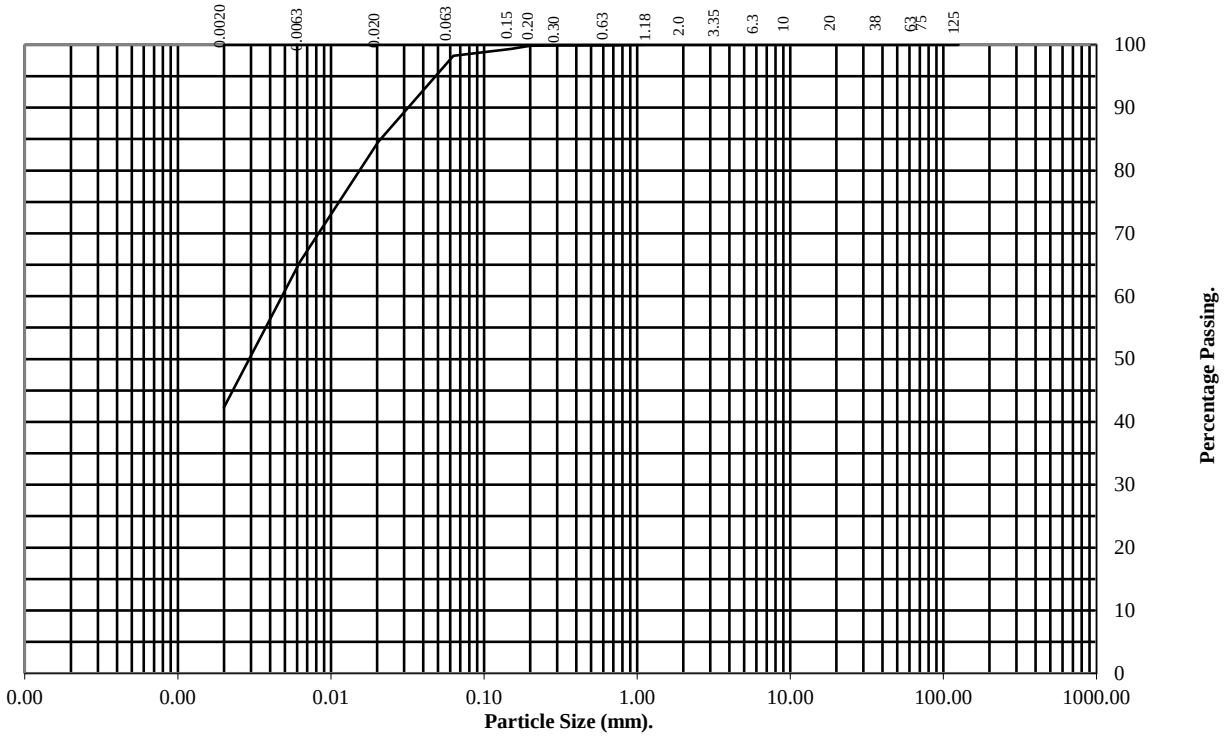
BS 1377 - Part 2 : 2022 : Clause 10 in accordance with BS EN ISO 17892 - 4 : 2016

Sieve Method, Clause 5.2 & Pipette Method, Clause 5.4

Hole Number: **TP05** **Top Depth (m):** **3.50**

Sample Number: **Base Depth (m):**

Sample Type: **B**



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	100
10	100
6.3	100
3.35	100
2	100
1.18	100
0.63	100
0.3	100
0.2	100
0.15	99
0.063	98

Particle Diameter	Percentage Passing
0.020	85
0.0063	65
0.0020	42
Particle Density - 2.65 Mg/m3 assumed	

Soil Fraction	Total Percentage
Cobbles	0
Gravel	0
Sand	2
Silt	56
Clay	42

Remarks:

See Summary of Soil Descriptions

UKAS TESTING 4043

PSL PROFESSIONAL SOILS LABORATORY A PHENNA GROUP COMPANY

Derrynadarragh Wind Farm

Contract No:
PSL25/3948
Client Ref:
14567-03-25

PARTICLE SIZE DISTRIBUTION TEST

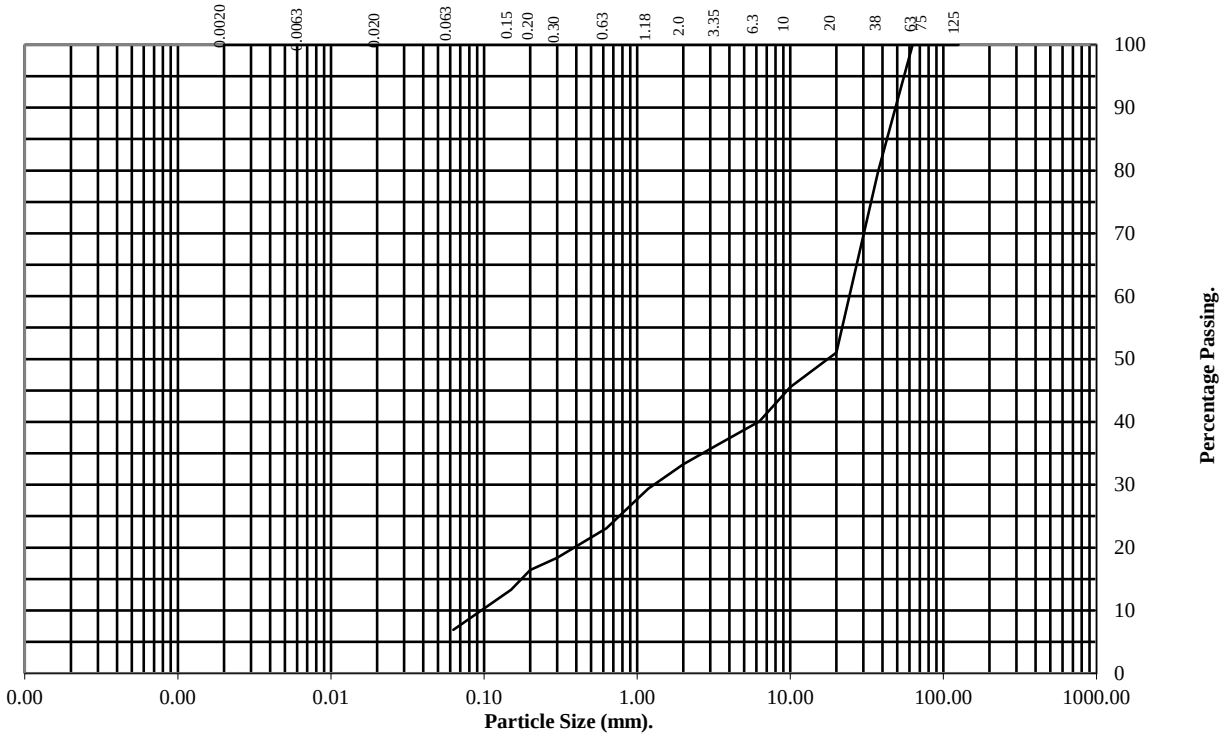
BS 1377 - Part 2 : 2022 : Clause 10 in accordance with BS EN ISO 17892 - 4 : 2016

Sieve Method, Clause 5.2

Hole Number: **TP06** **Top Depth (m):** **1.00**

Sample Number: **Base Depth (m):**

Sample Type: **B**



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	80
20	51
10	46
6.3	40
3.35	36
2	33
1.18	29
0.63	23
0.3	18
0.2	16
0.15	13
0.063	7

Soil Fraction	Total Percentage
Cobbles	0
Gravel	67
Sand	26
Silt/Clay	7

Remarks:

See Summary of Soil Descriptions

UKAS TESTING 4043

PSL PROFESSIONAL SOILS LABORATORY A PHENNA GROUP COMPANY

Derrynadarragh Wind Farm

Contract No:
PSL25/3948
Client Ref:
14567-03-25

PARTICLE SIZE DISTRIBUTION TEST

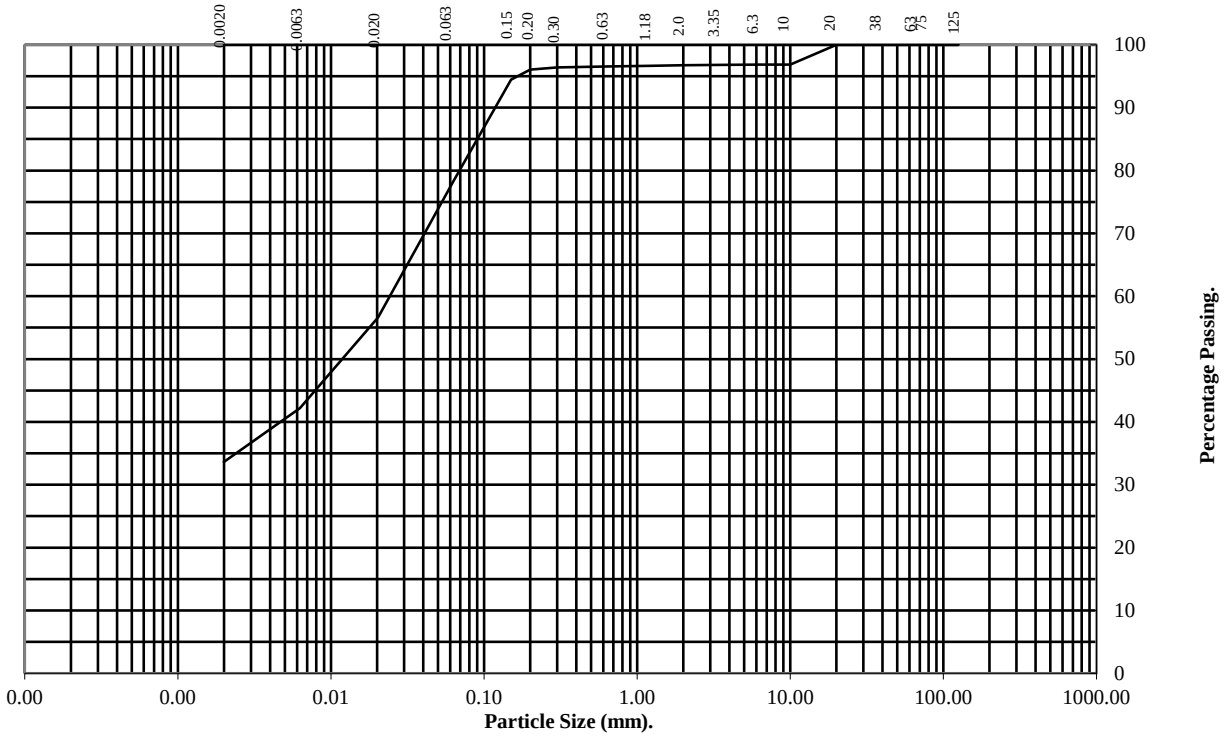
BS 1377 - Part 2 : 2022 : Clause 10 in accordance with BS EN ISO 17892 - 4 : 2016

Sieve Method, Clause 5.2 & Pipette Method, Clause 5.4

Hole Number: TP07 **Top Depth (m):** 3.50

Sample Number: **Base Depth (m):**

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	100
10	97
6.3	97
3.35	97
2	97
1.18	97
0.63	97
0.3	96
0.2	96
0.15	94
0.063	78

Particle Diameter	Percentage Passing
0.020	57
0.0063	42
0.0020	34
Particle Density - 2.65 Mg/m3 assumed	

Soil Fraction	Total Percentage
Cobbles	0
Gravel	3
Sand	19
Silt	44
Clay	34

Remarks:

See Summary of Soil Descriptions

UKAS TESTING 4043

PSL PROFESSIONAL SOILS LABORATORY A PHENNA GROUP COMPANY

Derrynadarragh Wind Farm

Contract No: PSL25/3948

Client Ref: 14567-03-25

PARTICLE SIZE DISTRIBUTION TEST

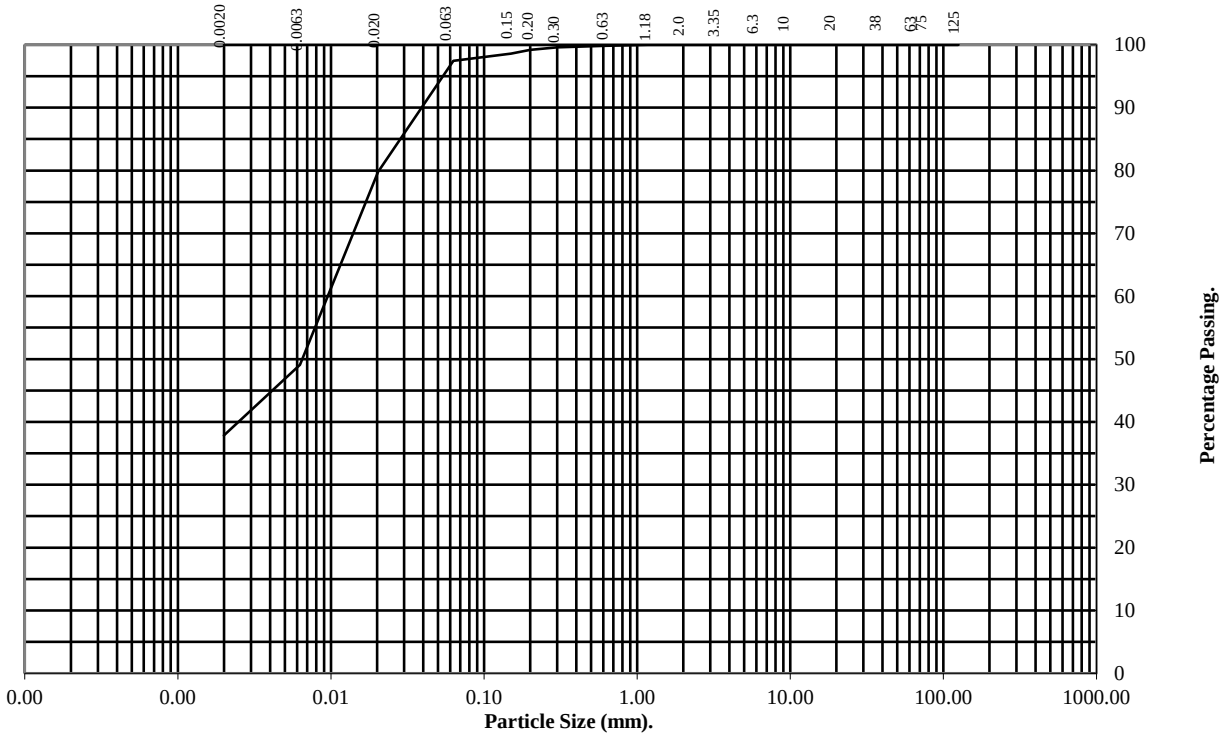
BS 1377 - Part 2 : 2022 : Clause 10 in accordance with BS EN ISO 17892 - 4 : 2016

Sieve Method, Clause 5.2 & Pipette Method, Clause 5.4

Hole Number: **TP08** **Top Depth (m):** **1.50**

Sample Number: **Base Depth (m):**

Sample Type: **B**



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	100
10	100
6.3	100
3.35	100
2	100
1.18	100
0.63	100
0.3	100
0.2	99
0.15	99
0.063	97

Particle Diameter	Percentage Passing
0.020	80
0.0063	49
0.0020	38
Particle Density - 2.65 Mg/m3 assumed	

Soil Fraction	Total Percentage
Cobbles	0
Gravel	0
Sand	3
Silt	59
Clay	38

Remarks:

See Summary of Soil Descriptions

UKAS TESTING 4043

PSL PROFESSIONAL SOILS LABORATORY A PHENNA GROUP COMPANY

Derrynadarragh Wind Farm

Contract No: **PSL25/3948**

Client Ref: **14567-03-25**

PARTICLE SIZE DISTRIBUTION TEST

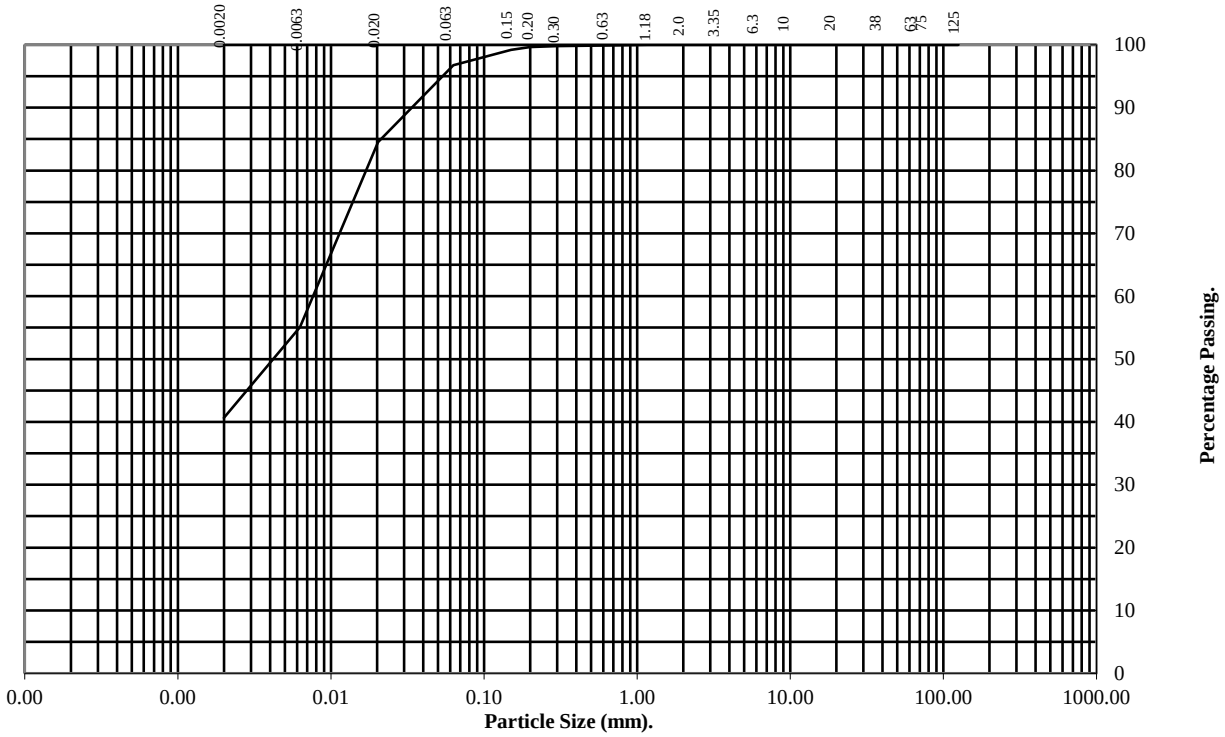
BS 1377 - Part 2 : 2022 : Clause 10 in accordance with BS EN ISO 17892 - 4 : 2016

Sieve Method, Clause 5.2 & Pipette Method, Clause 5.4

Hole Number: **TP09** **Top Depth (m):** **3.50**

Sample Number: **Base Depth (m):**

Sample Type: **B**



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	100
10	100
6.3	100
3.35	100
2	100
1.18	100
0.63	100
0.3	100
0.2	100
0.15	99
0.063	97

Particle Diameter	Percentage Passing
0.020	85
0.0063	55
0.0020	41
Particle Density - 2.65 Mg/m3 assumed	

Soil Fraction	Total Percentage
Cobbles	0
Gravel	0
Sand	3
Silt	56
Clay	41

Remarks:

See Summary of Soil Descriptions

PARTICLE SIZE DISTRIBUTION TEST

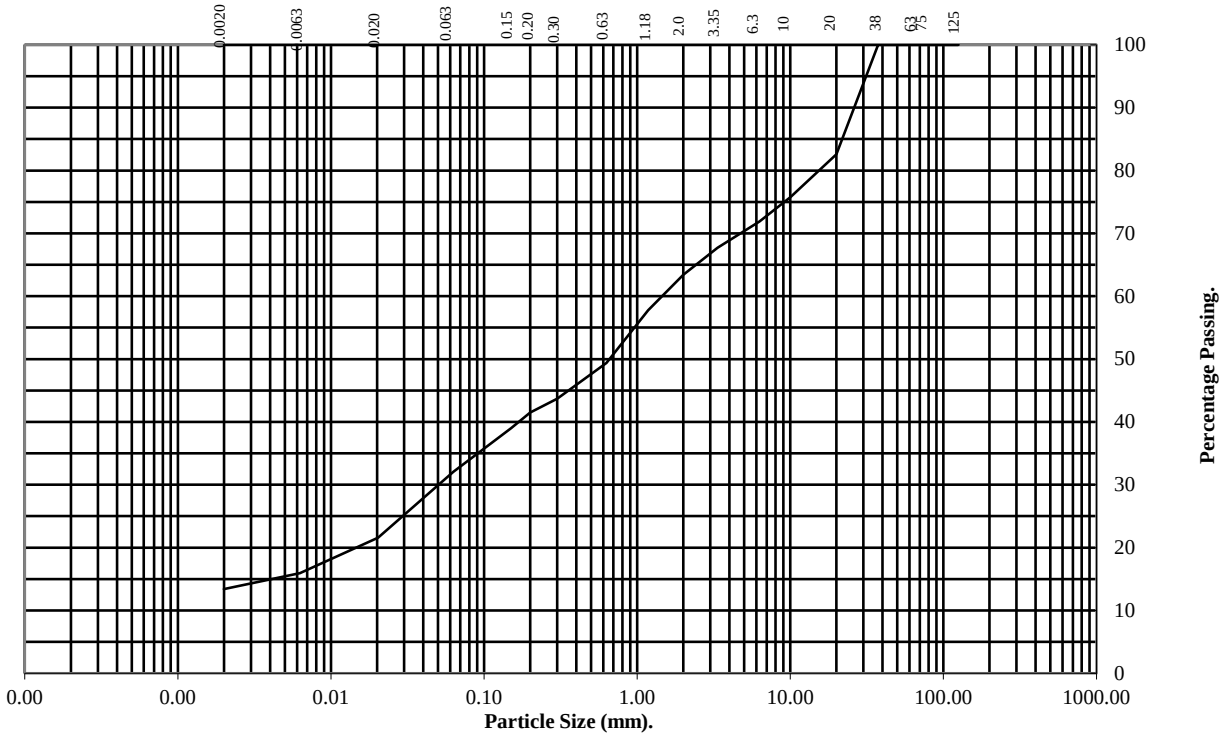
BS 1377 - Part 2 : 2022 : Clause 10 in accordance with BS EN ISO 17892 - 4 : 2016

Sieve Method, Clause 5.2 & Pipette Method, Clause 5.4

Hole Number: TP10 **Top Depth (m):** 2.50

Sample Number: **Base Depth (m):**

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	83
10	76
6.3	72
3.35	68
2	63
1.18	58
0.63	49
0.3	44
0.2	41
0.15	39
0.063	32

Particle Diameter	Percentage Passing
0.020	22
0.0063	16
0.0020	13
Particle Density - 2.65 Mg/m3 assumed	

Soil Fraction	Total Percentage
Cobbles	0
Gravel	37
Sand	31
Silt	19
Clay	13

Remarks:

See Summary of Soil Descriptions

UKAS TESTING 4043

PSL PROFESSIONAL SOILS LABORATORY A PHENNA GROUP COMPANY

Derrynadarragh Wind Farm

Contract No: PSL25/3948

Client Ref: 14567-03-25

APPENDIX 11.2

Peat Stability and Geotechnical Assessment Report

FEHILY TIMONEY

CONSULTANTS IN ENGINEERING, ENVIRONMENTAL SCIENCE & PLANNING

GEOTECHNICAL & PEAT STABILITY REPORT

DERRYNADARRAGH WIND FARM

Prepared for:

Dara Energy Limited

Dara Energy Limited

Date: **August 2025**

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GEOTECHNICAL & PEAT STABILITY ASSESSMENT REPORT
DERRYNADARRAGH WIND FARM

REVISION CONTROL TABLE, CLIENT, KEYWORDS AND ABSTRACT

User is responsible for Checking the Revision Status of This Document

Rev. No.	Description of Changes	Prepared by:	Checked by:	Approved by:	Date:
0	Final	EA	IH	TC	15/09/2025

Client: Dara Energy Ltd.

Keywords: Geotechnical, Peat Stability, Peat Failure, Risk Assessment

Abstract: Fehily Timoney and Company (FT) were engaged by Dara Energy Ltd. to undertake a geotechnical assessment of the proposed Derrynadarragh wind farm site with respect to peat stability. As part of the geotechnical assessment of the proposed development, FT completed a walkover survey at the site. The findings of the geotechnical and peat stability assessment showed that the site has an acceptable margin of safety and is suitable for the proposed wind farm development.

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1. NON-TECHNCIAL SUMMARY

Fehily Timoney and Company (FT) was engaged by Dara Energy Limited to undertake a geotechnical and peat stability assessment of the proposed Derrynadarragh wind farm site. In accordance with planning guidelines compiled by the Department of the Housing, Planning and Local Government (Draft Revised Wind Energy Development Guidelines, DoHPLG, 2019), where peat >0.5m in thickness is present on a proposed wind farm development, a peat stability assessment is required.

A site walkover, including intrusive peat depth probing, desk study, stability analysis and risk assessment was carried out to assess the susceptibility of the site to peat failure following the principles in Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Developments (PLHRAG, Scottish Government, 2017).

The findings, which involved analysis of approximately 354 locations, show that the site has an acceptable margin of safety and is suitable for the proposed wind farm project. The findings include recommendations and control measures for construction work in peat lands to ensure that all works adhere to an acceptable standard of safety.

The proposed wind farm comprises 9 no. wind turbines and associated infrastructure.

The site is relatively flat lying with drainage channels running typically northeast to southwest. The land uses and types within the proposed development site are a mixture of agricultural fields, mature forestry and cutaway peat.

Peat depth recorded during the site walkover and from the ground investigation ranged from 0.1 to 4.2m with an average peat depth of 1.0m. Approximately 94% of peat depth probes recorded peat depths of less than 2.0m. A number of localised readings were recorded where peat depths were 2.0 to 4.2m.

Slope inclinations at the main infrastructure locations are 2 degrees. The flat topography/nature of the terrain on site reflects the low risk of peat failure.

The purpose of the stability analysis was to determine the stability i.e. Factor of Safety (FoS), of the peat slopes. The FoS provides a direct measure of the degree of stability of a peat slope. A FoS of less than 1.0 indicates that a slope is unstable; a FoS of greater than 1.0 indicates a stable slope. An acceptable FoS for slopes is generally taken as a minimum of 1.3. The stability analysis for this project, which analysed the turbine locations and a grid across the site, resulted in FoS above the minimum acceptable value of 1.3 and hence the site has a satisfactory margin of safety.

The risk assessment uses the results of the stability analysis in combination with qualitative factors, which cannot be reasonably included in a stability calculation but nevertheless may affect the occurrence of peat instability, to assess the risk of peat failure at the site. The results of the risk assessment are given in Appendix B.

The findings of the peat assessment (which combines the FOS and the risk assessment), which involved analysis of 354 no. locations , showed that the proposed development areas have an acceptable margin of safety and that the site is suitable for the proposed wind farm development. Notwithstanding the above, the management of peat stability and appropriate construction practices will be inherent in the construction phase of the wind farm to ensure peat failures do not occur on site.

In summary, the Site has an acceptable margin of safety and is considered to be at **low** risk of peat failure providing appropriate mitigation measures and construction controls are implemented and is suitable for wind farm development.

2. INTRODUCTION

2.1 Fehily Timoney and Company

Fehily Timoney and Company (FT) is an Irish engineering, environmental science and planning consultancy with offices in Cork, Dublin and Carlow. The practice was established in 1990 and currently has 100 members of staff, including engineers, scientists, planners and technical support staff. FT deliver projects in Ireland and internationally in our core competency areas of Waste Management, Environment and Energy, Civils Infrastructure, Planning and GIS and Data Management.

FT have been involved in over 100 wind farm developments in both Ireland and the UK at various stages of development i.e. preliminary feasibility, planning, design, construction and operational stage and have established themselves as one of the leading engineering consultancies in peat stability assessment, geohazard mapping in peat land areas, investigation of peat failures and site assessment of peat.

2.2 Project Description

FT was engaged by Dara Energy Ltd. to undertake a geotechnical & peat stability assessment of the proposed Derrynadarragh wind farm Site.

The Site is located approximately 5km north-east of Portarlington, Co. Laois.

The Site comprises areas of forestry and agricultural fields with an area of cut peat in the southern part of the Site. The surrounding landscape is predominately flat with land-use comprising forestry, agricultural land and cutaway peatland.

The development comprises the construction of 9 no. wind turbines and all associated hard-standing areas, new site access roads and associated drainage, a construction compound and a substation.

The peat depth data was recorded by FT during May and September 2023 and an additional peat probing survey was carried out in January 2025. This data has been used in the assessment of peat stability for the Site.

2.3 Peat Stability Assessment Methodology

FT undertook the assessment following the principles in Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Developments (2nd edition, PLHRAG, 2017). The Peat Landslide Hazard and Risk Assessment Guide (PLHRAG) is used in this report as it provides best practice methods to identify, mitigate and manage peat slide hazards and associated risks in respect of consent applications for electricity generation projects.

The aforementioned best practice guide was produced following peat failures in the Shetland Islands, Scotland in September 2003 but more pertinently following the peat failure in October 2003, during the construction of a wind farm at Derrybrien, County Galway, Ireland.

This peat stability assessment has been undertaken taking into account peat failures that have occurred on wind farm sites located on peatlands (such as recent failures at Shass Mountain 2020, Co. Leitrim and Meenbog 2020, Co. Donegal). The lessons learned from both peat slide events have been incorporated into the design of the Proposed Project and the construction methodologies to be implemented. The Meenbog failure occurred during the construction of a section of floating road on sidelong ground/at a break in slope in an area of weak peat. While floating roads are proposed for the Proposed Wind Farm site, there are no breaks in slope or areas of significant sidelong ground present on the Site, which make a similar type of failure to Meenbog highly unlikely. It is important that the existing site drainage is maintained during construction to avoid a similar failure to that on Shass Mountain, which occurred following heavy rainfall; this is referenced in the Risk Assessments for the turbines/access roads. Please note, the Shass Mountain failure occurred in an area containing a deep peat layer (4-5m in depth), and the peat depths across the Site are typically less than 1.0m around the infrastructure of the Proposed Wind Farm, meaning that this type of failure is highly unlikely. It is also noted that there have been numerous wind farms successfully constructed on lowland bogland sites over the past 15 years without any issues relating to peat failure, such as Galway Wind Park and Arderroo Wind Farm (both Co. Galway).

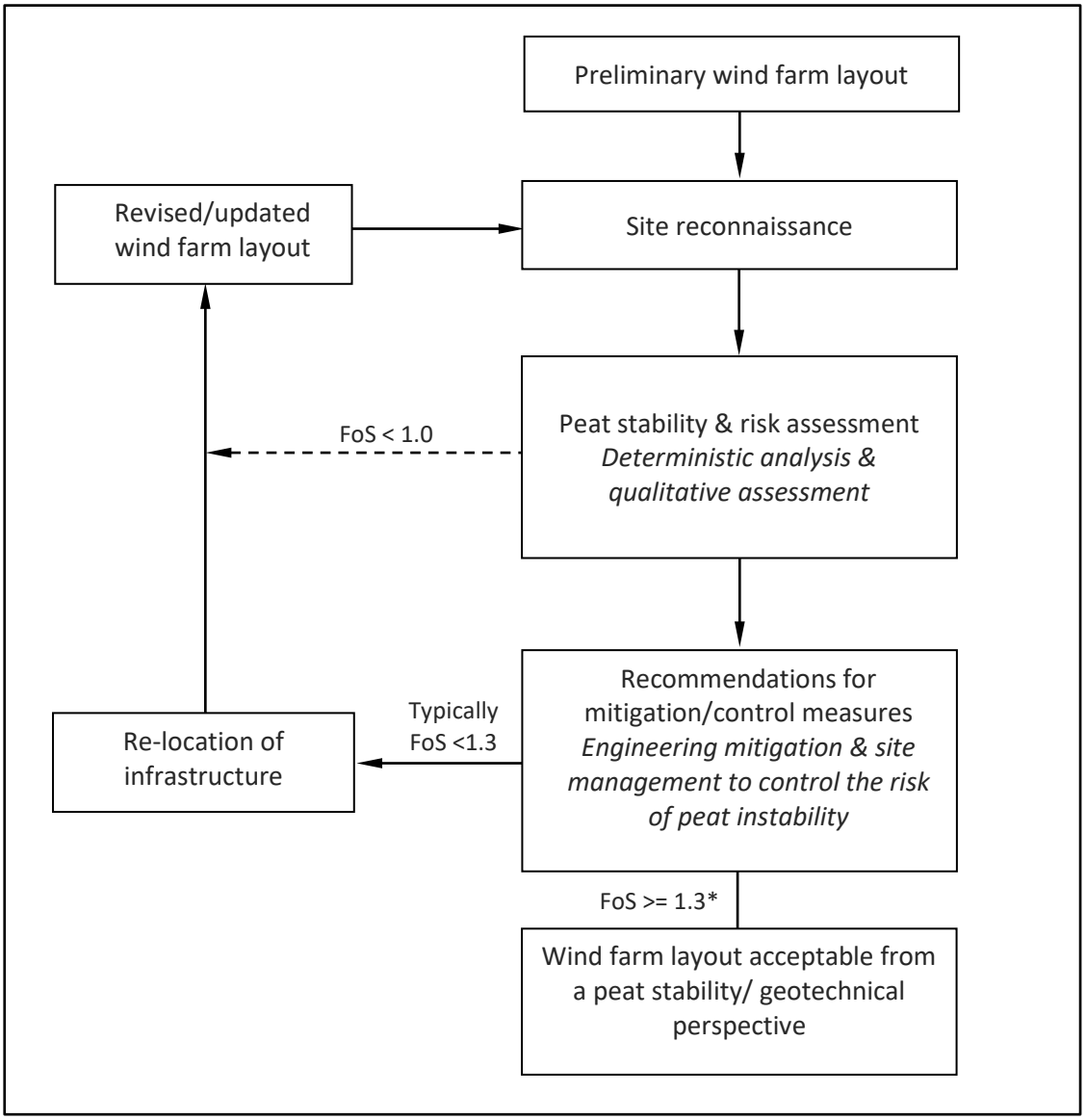
A constraints study was initially undertaken by the Environmental, Hydrogeological and Ecological members of the design team to determine the developable area on the Proposed Wind Farm site, prior to the site reconnaissance by engineering geologists/geotechnical engineers from FT. The extent and depth of ground investigation and peat stability analysis by FT have been undertaken in accordance with guidance within Eurocode 7 and PLHRAG (2nd Edition, Scottish Government, 2017) to investigate the ability of the Site to receive the Proposed Wind Farm infrastructure and to assess the peat slopes that have the potential to impact on the Site, as applicable. Sufficient peat depth data has been recorded during the site walkovers to enable the characterisation of the peat depth across the Site, with additional detail at infrastructure locations. The peat stability assessment is undertaken to identify peat slopes at risk from the Site, and to identify peat slopes that may pose a risk to the Site.

The geotechnical and peat stability assessment at the site included the following activities:

1. Desk study involving the review of publicly available soils and geology maps, records of historical peat failures, aerial photography.
2. Site reconnaissance including shear strength and peat depth measurements undertaken following a multidisciplinary constraints study (by the design team) to determine the proposed construction envelope within the Proposed Wind Farm site i.e. the area within the overall site where development is possible following multidisciplinary review and assessment of constraints (refer to Chapter 3 of the EIAR).
3. Peat stability assessment of the peat slopes on site using a deterministic and qualitative approach.
4. Peat contour depth plan – compiled based on the peat depth probes carried out across the site by FT (2023 and 2025).
5. Factor of safety plan – compiled for the short-term critical condition (undrained) for approximately 330 no. FoS points analysed along the proposed infrastructure envelope on site.
6. Construction buffer zone plan – identifies areas with an elevated or higher construction risk where mitigation/control measures will need to be implemented during construction to minimise the potential risks and ensure they are kept within an acceptable range.
7. A peat stability risk register was compiled to assess the potential design/construction risks at the infrastructure locations and determine adequate mitigation/control measures for each location to minimise the potential risks and ensure they are kept within an acceptable range, where necessary
8. Review of ground investigation carried out on the Site by GII in April 2025.

9. Commentary of founding details for other infrastructure elements such as access roads, crane hardstands, onsite substation, and temporary construction compound platforms and met mast foundation.

A flow diagram showing the general methodology for peat stability assessment is shown in Figure 2.1. The methodology illustrates the optimisation of the wind farm layout based on the findings from the site reconnaissance and stability analysis and subsequent feedback.



*An FoS of between 1.0 and 1.3 does not mean that a failure will occur, but that the area requires attention. Mitigation measures can be provided for areas with an FoS of between 1.0 and 1.3 to reduce the risk of failure.

Figure 2-1: Methodology for Peat Stability Assessment

As for all construction projects, a detailed engineering construction design must be carried out by the appointed construction stage designer prior to any construction work commencing on site. This must take account of the consented project details and any conditions imposed by that consent. This must include a detailed peat stability assessment to account for any changes in the environment which may have occurred in the time leading up to the commencement of construction and a peat and spoil management plan to allow for the most appropriate geotechnical and environmental led solutions to be developed for the management of peat and spoil.

2.4 Peat Failure Definition

Peat failure in this report refers to a significant mass movement of a body of peat that would have an adverse impact on the proposed wind farm development and the surrounding environment. Peat failure excludes localised movement of peat that would occur below an access road, creep movement or erosion type events.

The potential for peat failure at this Site is examined with respect to wind farm construction and associated activity.

2.5 Main Approaches to Assessing Peat Stability

The main approaches for assessing peat stability for wind farm developments include the following:

1. Geomorphological;
2. Qualitative (judgement);
3. Index/Probabilistic (probability);
4. Deterministic (factor of safety).

Approaches (1) to (3) listed above are considered subjective and do not provide a definitive indication of stability; in addition, a high level of judgement/experience is required which makes it difficult to relate the findings to real conditions. FT apply a more objective approach, the deterministic approach (as discussed in Section 2.6).

As part of FT's deterministic approach, a qualitative risk assessment is also carried out taking into account qualitative factors, which cannot necessarily be quantified, such as the presence of mechanically cut peat, quaking peat, bog pools, sub peat water flow, slope characteristics and numerous other factors. The qualitative factors used in the risk assessment are compiled based on FT's experience of assessments and construction in peat land sites and peat failures throughout Ireland and the UK. FT have been involved with in excess of 100 wind farm developments across Ireland and the UK at various stages of development, from preliminary feasibility stage through planning and from scheme development at tender design and detailed design stage, through to the construction and operational stages. This approach follows the guidelines for geotechnical risk management as given in Clayton (2001), as referenced in the best practice for Peat Landslide Hazard and Risk Assessment Guide (PLHRAG, 2017), and takes into account the approach of MacCulloch (2005).

The risk assessment uses the results of the deterministic approach in combination with qualitative factors, which cannot be reasonably included in a stability calculation but nevertheless may affect the occurrence of peat instability to assess the risk of instability on a peat land site.

2.6 Peat Stability Assessment – Deterministic Approach

The peat stability assessment is carried out across a wide area of peatland to determine the stability of peat slopes and to identify areas of peatland that are suitable for development; this allows the layout of infrastructure on a particular wind farm site to be optimised. The assessment provides a numerical value (factor of safety) of the stability of individual parcels of peatland. The findings of the assessment discriminate between areas of stable and unstable peat, and areas of marginal stability where restrictions may apply. This allows for the identification of the most suitable locations for turbines, access roads and infrastructure.

A deterministic assessment requires geotechnical information and site characteristics which are obtained from desk study and site walkover, e.g. properties of peat/soil/rock, slope geometry, depth of peat, underlying strata, groundwater, etc. An adverse combination of the factors listed above could potentially result in instability. Using the information above, a factor of safety is calculated for the stability of individual parcels of peatland on a site (as discussed in Section 7).

The factor of safety is a measure of the stability of a particular slope. For any slope, the degree of stability depends on the balance of forces between the weight of the soil/peat working downslope (destabilising force) and the inherent strength of the peat/soil (shear resistance) to resist the downslope weight, see Figure 2.2.

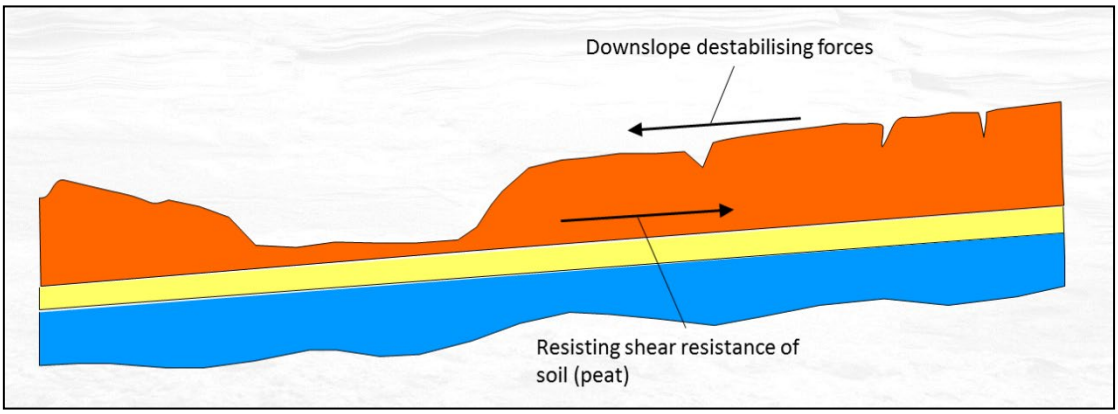


Figure 2-2: Peat Slope Showing Balance of Forces to Maintain Stability

The factor of safety provides a direct measure of the degree of stability of a slope and is the ratio of the shear resistance over the downslope destabilising force. Provided the available shear resistance is greater than the downslope destabilising force then the factor of safety will be greater than 1.0 and the slope will remain stable. If the factor of safety is less than 1.0 the slope is unstable and liable to fail. The acceptable range for factor of safety is typically from 1.3 to 1.4.

2.7 Applicability of the Factor of Safety (Deterministic) Approach for Peat Slopes

The factor of safety approach is a standard engineering approach in assessing slopes which is applied to many engineering materials, such as peat, soil, rock, etc.

The factor of safety approach is included in the Peat Landslide Hazard and Risk Assessments Best Practice Guide for Proposed Electricity Generation Developments (PLHRAG, 2017); see Section 5.3.1 of the guide. This guide provides best practice methods to identify, mitigate and manage peat slide hazards and associated risks in respect of consent applications for electricity generation projects.

Furthermore, the best practice guide notes that the results from the factor of safety approach 'has provided the most informative results' with respect to analysing peat stability (Section 5.3.1 of the guide).

The factor of safety approach in this report includes undrained (short-term stability) and drained (long-term stability) analyses. The undrained condition is the critical condition for the development. The purpose of the drained analysis is to identify the relative susceptibility of rainfall-induced failures at the site.

Notwithstanding the above, the stability analysis used by FT in this report also includes qualitative factors to determine the potential for peat stability i.e. the analysis used does not solely rely on the factor of safety approach.

The deterministic analysis is considered an acceptable engineering design approach. This concurs with the best practice guide referenced above.

2.8 Assessment of Intense Rainfall and Extreme Dry Events on the Peat Slope

The deterministic approach carried out by FT examines intense rainfall and extreme dry events. The deterministic approach includes an undrained (short-term stability) and drained (long-term stability) analysis to assess the factor of safety for the peat slopes against a peat failure.

The drained loading condition applies in the long-term. This condition examines the effect of the change in groundwater level as a result of rainfall on the existing stability of the natural peat slopes. For the drained analysis the level of the water table above the failure surface is required to calculate the factor of safety for the peat slope.

In order to represent varying water levels within the peat slopes, a sensitivity analysis is carried out which assesses varying water level in the peat slopes i.e. water levels ranging from 0 to 100% of the peat depth is conducted, where 0% equates to the peat been completely dry and 100% equates to the peat being fully saturated.

By carrying out such a sensitivity analysis with varying water level in the peat slopes, the effects of intense rainfall and extreme dry events are considered and analysed. The results of which are presented in Section 7 of this report.

3. DESK STUDY

3.1 Desk Study

The main relevant sources of interest with respect to the site include:

- Geological plans and Geological Survey of Ireland database;
- Ordnance survey plans;
- Literature review of peat failures.

The Geological Survey of Ireland online dataset viewer (GSI, 2023) and geological plans (GSI, 1999) for the site were used to verify the soil and bedrock conditions.

The Ordnance Survey plans were reviewed to determine if any notable features or areas of particular interest (from a geotechnical point of view) are present on the site.

The desk study also includes a review of both published literature and GSI online dataset viewer (GSI, 2023) on peat failures/landslides in the vicinity of the site.

3.2 Soils, Subsoil & Bedrock

A review of the Geological Survey of Ireland online database and published documents from GSI was carried out.

The Quaternary deposits within the site boundary predominantly comprise cut over raised peat. There are sections in the north and west of the site that are underlain by till derived from limestones. The eastern section of the site is underlain by Lake marl.

The Quaternary deposits within the site are shown in Figure 3.1.

In relation to bedrock, the GSI online 1:100,000 scale bedrock geology map shows that the site comprises:

- Lucan Formation – dark limestones and shale
- Ballyadams Formation – crinoidal wackestones/ packstone limestone

The site is predominantly underlain by the Lucan Formation with a section in the north of the site underlain by the Ballyadams Formation.

The bedrock geology of the site is shown in Figure 3.2.

No karst features were identified on the survey area. The nearest karst features are 10km to the north of the site, which is the Clonkeen Mushroom Rock.

There are no audited or unaudited geological heritage areas within the site boundary. The nearest area is Dunmurry Hill audited geological heritage site and is located approximately 10 km east of the site. The heritage site has been described by the GSI as comprising a forested hillside.

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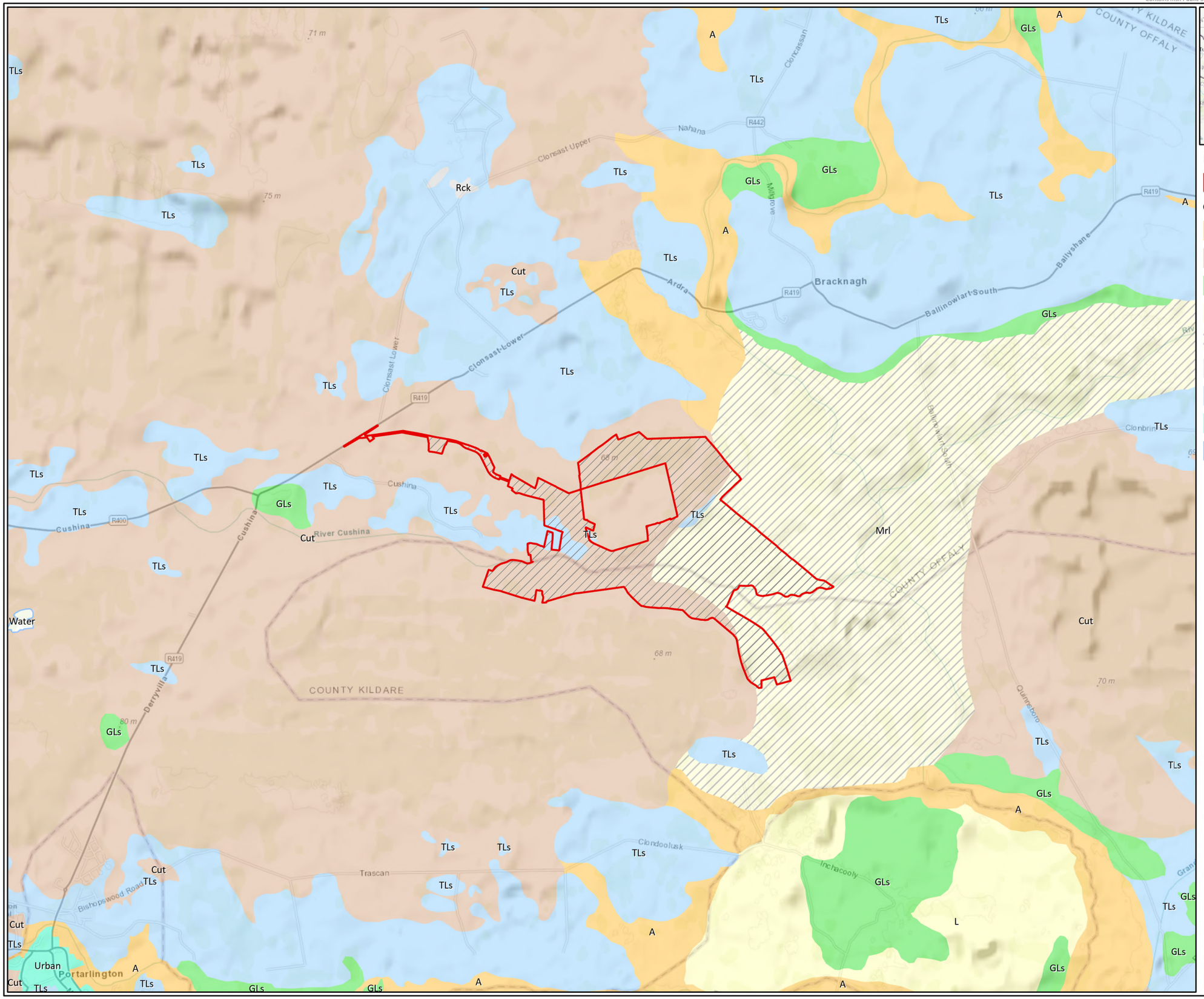

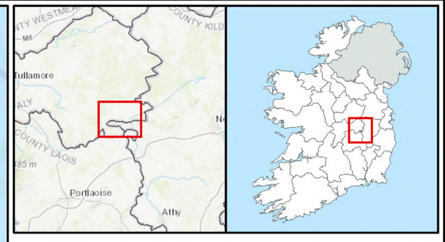

Legend

- Proposed Site Boundary

Quaternary Sediments

- A, Alluvium
- Cut, Cut over raised peat
- GLs, Gravels derived from Limestones
- L, Lacustrine sediments
- Mrl, Lake marl
- Rck, Bedrock outcrop or subcrop
- TLs, Till derived from limestones
- Urban
- Water

TITLE:	Quaternary Geology		
PROJECT:	Derrynadarragh Wind Farm		
FIGURE NO:	3.1		
CLIENT:	Dara Energy Ltd.		
SCALE:	1:30,000	**REVISION:**	0
DATE:	11/08/2025	**PAGE SIZE:**	A3

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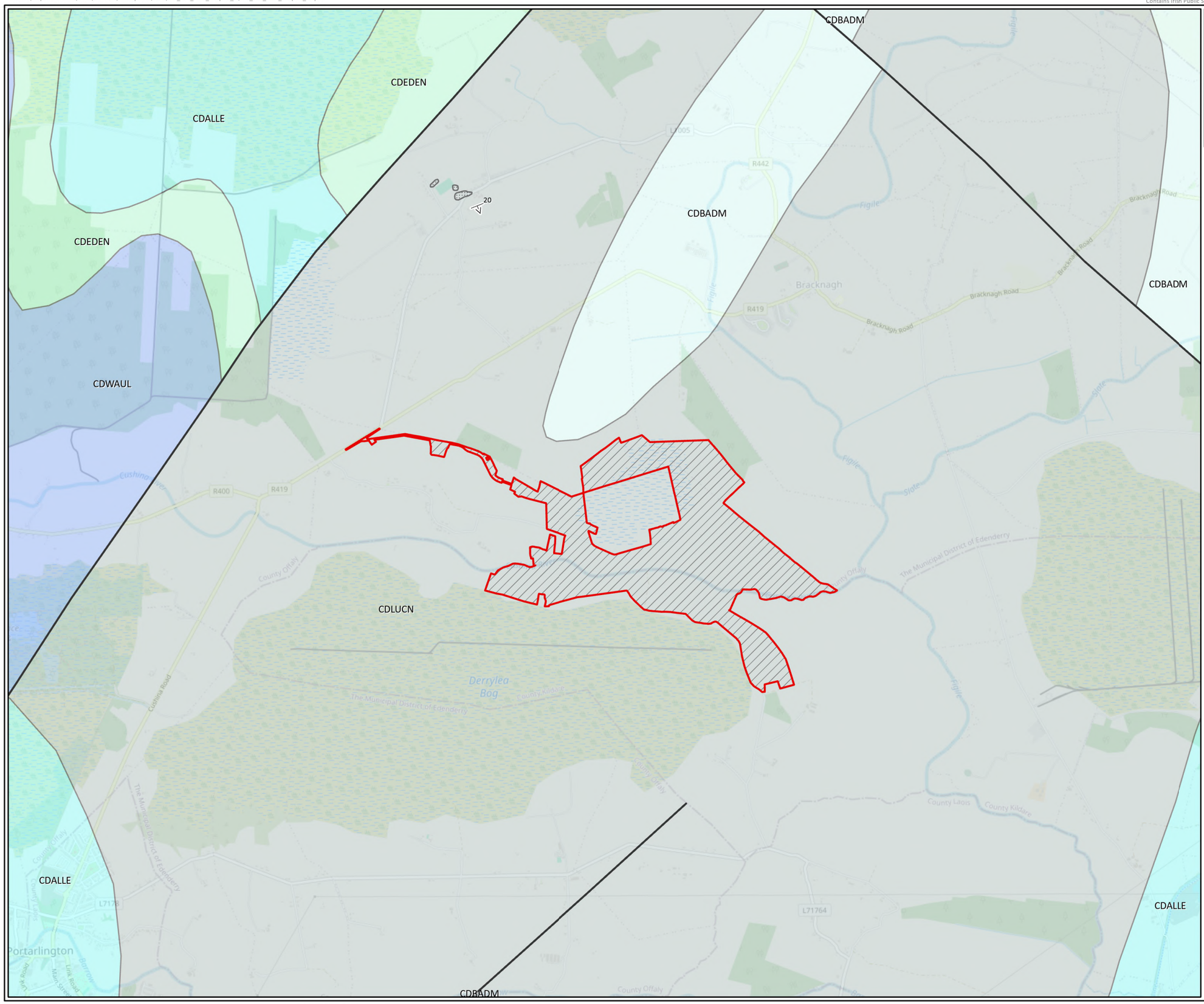
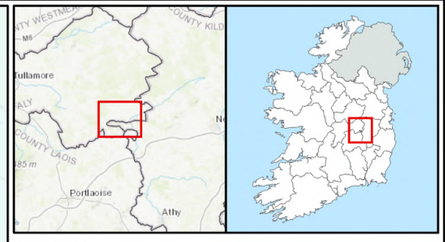
N W E S

0 0.25 0.5 1 Kilometers





Legend

- Proposed Site Boundary
- Strike and dip of bedding, right way up
- Fault
- Bedrock Outcrop

Bedrock Geology

- Allenwood Formation
- Ballyadams Formation
- Edenderry Oolite Member
- Lucan Formation
- Waulsortian Limestones

N W E S

0 0.5 1 2 Kilometers

TITLE:	Bedrock Geology		
PROJECT:	Derrynadarragh Wind Farm		
FIGURE NO:	3.2		
CLIENT:	Dara Energy Ltd.		
SCALE:	1:30,000	**REVISION:**	0
DATE:	11/08/2025	**PAGE SIZE:**	A3

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3.3 Previous Failures

There are no recorded peat failures within the Derrynadarragh wind farm site and there are no historical failures within 20km of the site (GSI, 2023).

The landslide susceptibility the site was classified by the GSI (2023) as low susceptibility, which is expected given the flat terrain present.

The presence, or otherwise, of relict peat failures or clustering of relict failures within an area is an indicator that particular site conditions exist that pre-dispose a site to failure or not as the case may be. Hence based on the historical data reviewed and the terrain and ground conditions present on site it can be concluded that site conditions in the area of the Derrynadarragh site have a limited potential of peat failure.

The landslide susceptibility across the site is displayed in Figure 3.3.

3.4 Environmental Considerations

According to the EPA online mapping, there are no licensed waste, industrial emission (IE), or integrated pollution control (IPC) facilities on or within the immediate environs of the site. The nearest facility is Deer Park Cross licensed facility, located in Portarlington, approximately 5 km southwest of the site.

Table 3.1 summarises the various types of contamination that could be present within and around the site boundary.

Table 3-1: Summary of Environmental Considerations

Potential Contamination Source	Location	Type of Contamination	Description
Agricultural land	All of site	Pesticides, herbicides, and fertilisers	The chemicals used in pesticides, herbicides, and fertilisers may be harmful to human, animal, and plant health. The chemicals may reside in the upper layers of the soil.
Agricultural land	All of site	Minor fuel spills and leaks	Risk of minor fuel spills and leaks over time from machinery resulting in contamination of the upper soils.
Local roads	Local unnamed roads through the site	Minor fuel spills and leaks	Risk of fuel leakages from vehicles travelling along these roads and other transport-related contamination could be present within the upper soils.

3.5 Borrow Pit Viability

According to the GSI Aggregate Potential Mapping, the crushed rock aggregate potential is classified as low to very low across the majority of the site with an area in the north classified as having high potential. This is displayed in Figure 3.4.

The viability of borrow pits is dependent on several factors and should be assessed through a site walkover and subsequent ground investigations to confirm the information of the desk study, as well as ground investigation and material testing to ensure the potential quality of the material.

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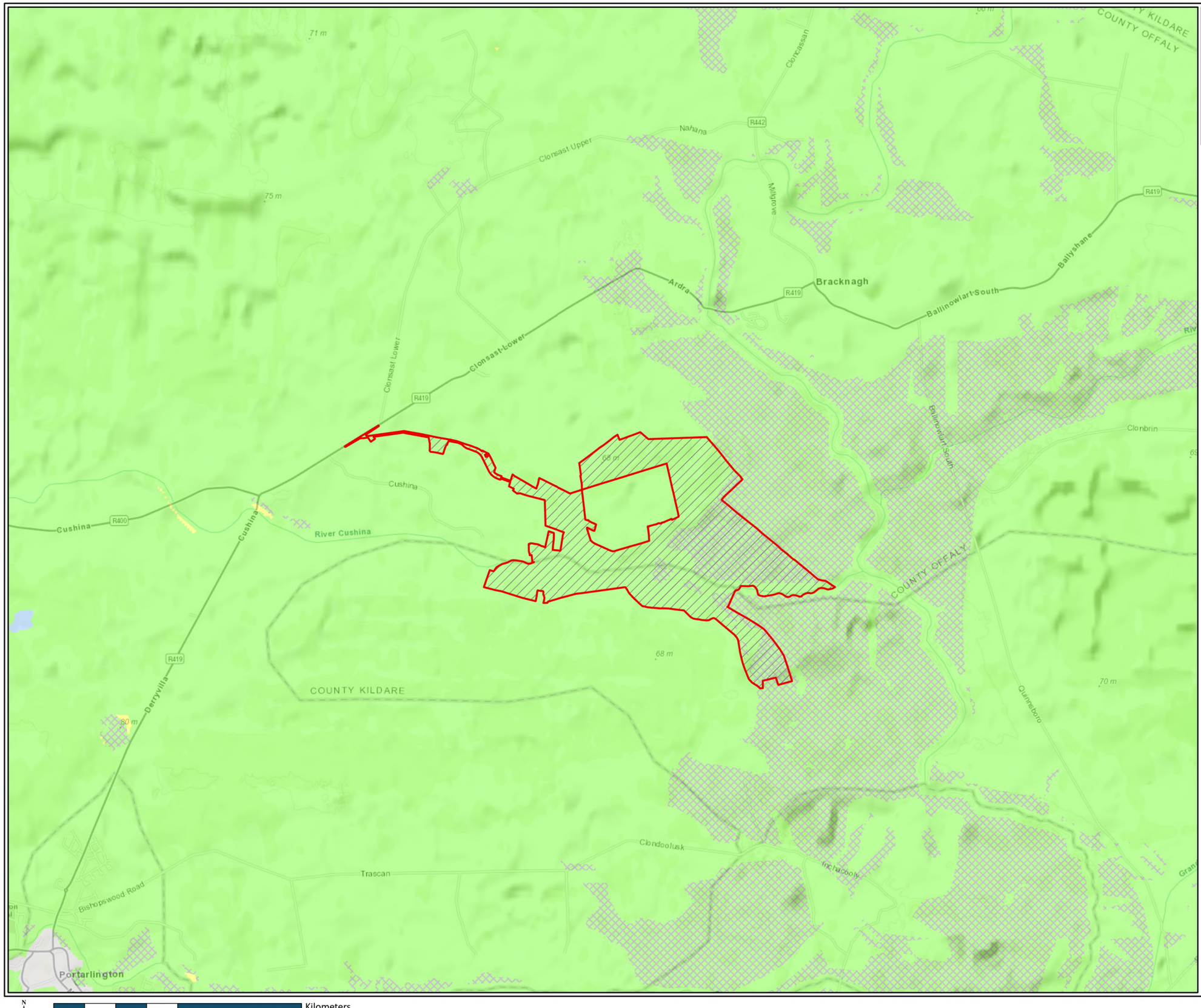

Legend

- Proposed Site Boundary

Landslide Susceptibility

- Low
- Low (inferred)
- Moderately Low
- Made
- Water

TITLE: Landslide Susceptibility and Previous Landslides			
PROJECT: Derrynadarragh Wind Farm			
FIGURE NO:	3.3		
CLIENT:	Dara Energy Ltd.		
SCALE:	1:30,000	**REVISION:**	0
DATE:	11/08/2025	**PAGE SIZE:**	A3

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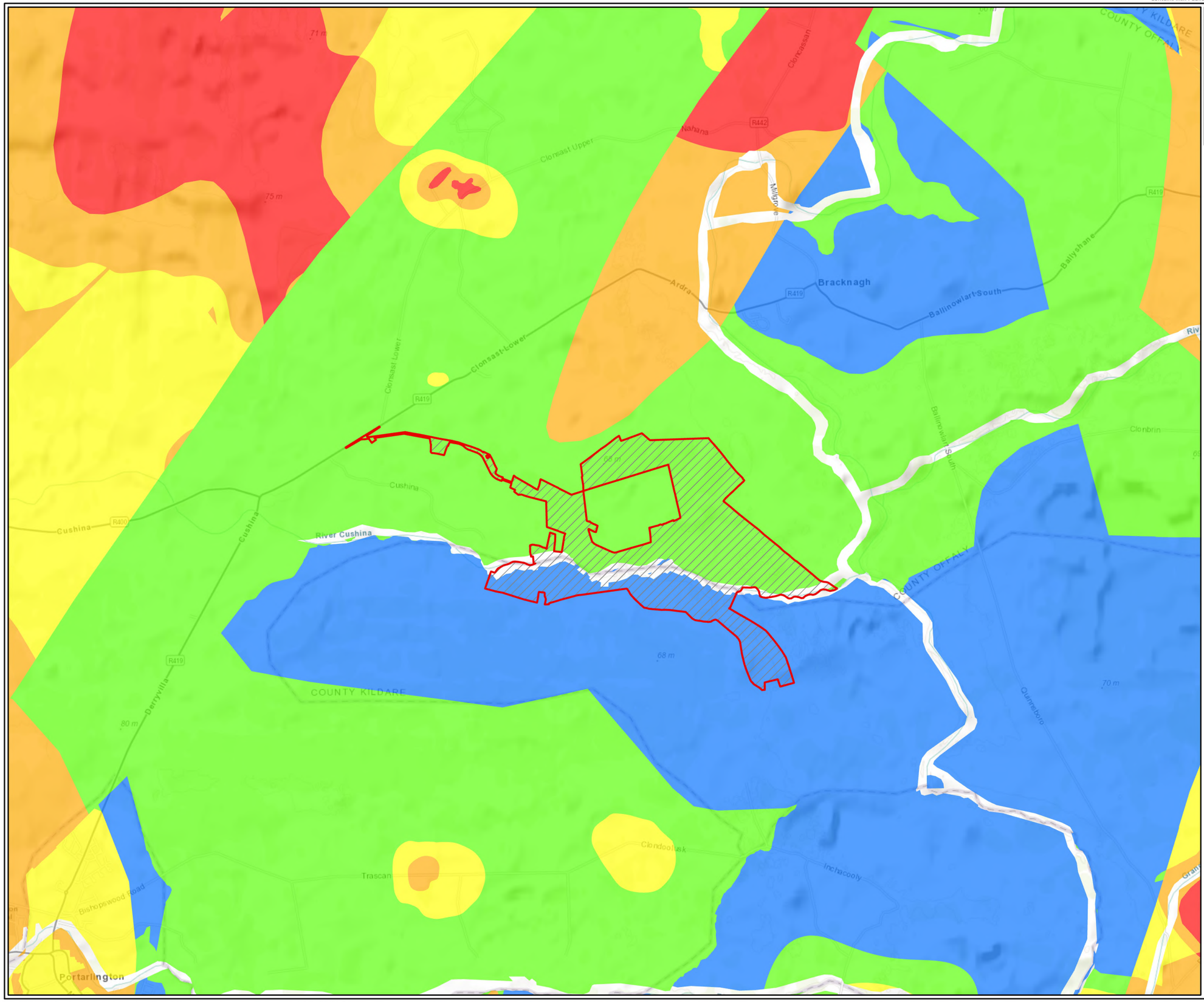

Legend

- Proposed Site Boundary

Crushed Rock Aggregate Potential

- Very High potential
- High potential
- Moderate potential
- Low potential
- Very Low potential

N W E S

0 0.5 1 2 Kilometers

TITLE: Crushed Rock Potential			
PROJECT: Derrynadarragh Wind Farm			
FIGURE NO:	3.4		
CLIENT:	Dara Energy Ltd.		
SCALE:	1:30,000	**REVISION:**	0
DATE:	11/08/2025	**PAGE SIZE:**	A3

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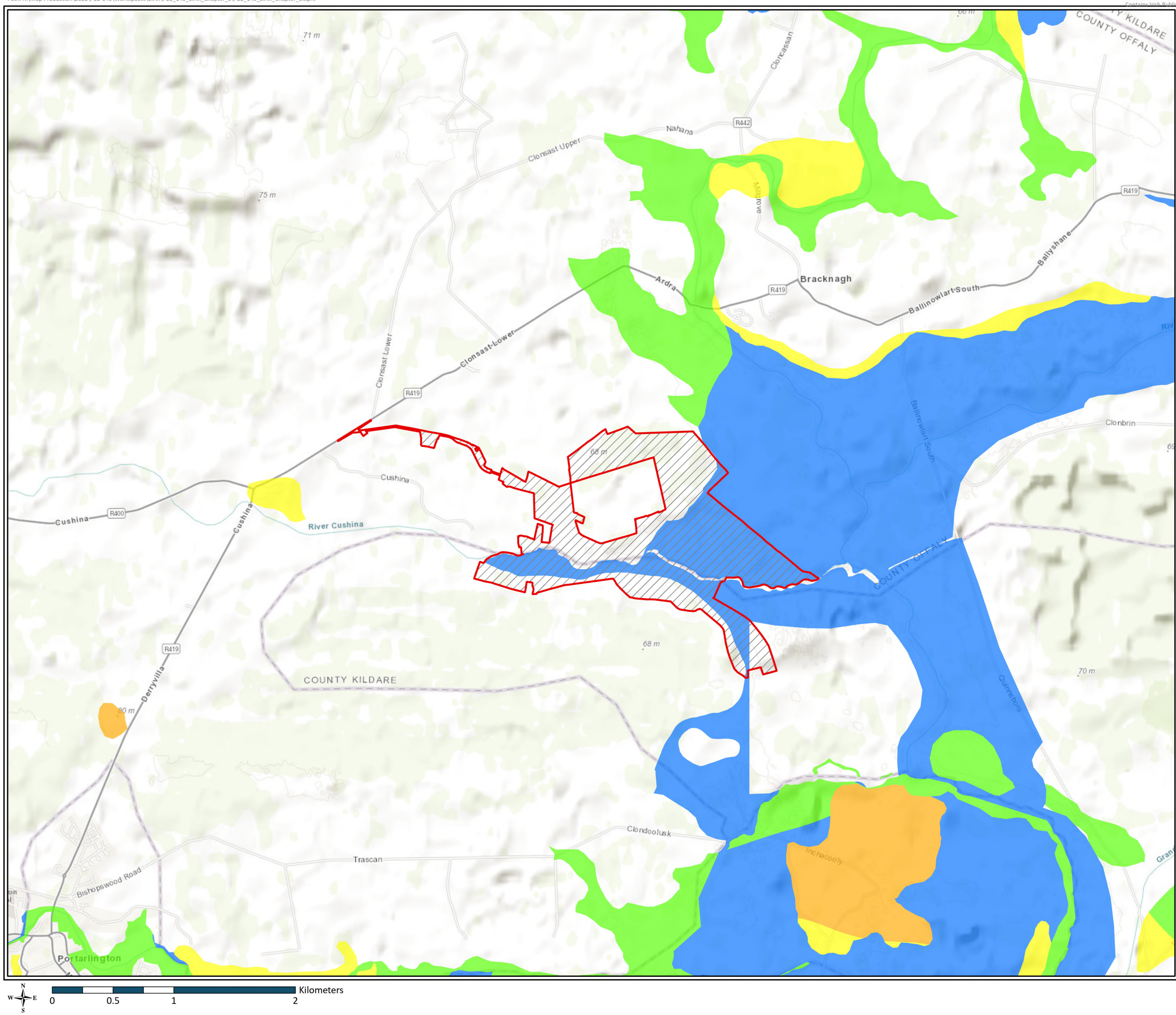

Legend

Proposed Site Boundary

Granular Aggregate Potential

- High potential
- Moderate potential
- Low potential
- Very Low potential

TITLE:	Granular Aggregate Potential
PROJECT:	Derrynadarragh Wind Farm
FIGURE NO:	3.5
CLIENT:	Dara Energy Ltd.
SCALE: 1:30,000	REVISION: 0
DATE: 11/08/2025	PAGE SIZE: A3

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4. FINDINGS OF SITE RECONNAISSANCE

4.1 Site Reconnaissance

As part of the assessment of potential peat failure at the Site, FT carried out a site reconnaissance in conjunction with the desk study review described in Section 3. This comprised walkover inspections of the site with recording of salient geomorphological features with respect to the wind farm development which included peat depth and preliminary assessment of peat strength. General photographs of the site are included at the end of the main text. The information gathered from these site visits provide sufficient information for a site-wide assessment of the extent, depth and strength of peat present at the Proposed Development.

The following salient geomorphological features were considered:

- 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;
- Slope inclination and break in slope.

The survey covered the proposed locations for the turbine bases and associated infrastructure.

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.

4.2 Findings of Site Reconnaissance

The site reconnaissance comprised a walkover inspection of the site during January and May 2023 with an additional visit in January 2025. Weather conditions for the site visit were dry and overcast during all visits.

The findings from the site walkover have been used to optimise the layout of the infrastructure on site.

The main findings of the site walkover of the wind farm site are as follows:

1. The site is typically covered in a layer of peat and is relatively flat. Peat depths vary across the site depending on mainly topography.
2. A total of approximately 354 no. peat depth probes were carried out on site. Peat depths recorded from peat probing across the site ranged from 0.1m to 4.2m with an average depth of 1.0m (Figure 4-1). Approximately 95 percent of peat depth probes recorded peat depths of less than 2.0m. A number of localised readings were recorded where peat depths were between 2.0 and 4.0m.
3. The peat depths recorded at the turbine locations varied from 0.4 to 3.0m with an average depth of 1.4m.
4. Slope angles at the turbine locations were 2 degrees. These slope angle readings were obtained using a combination of readings taken during the site reconnaissance by FT using handheld equipment, such as the Silva Clino Master which has an accuracy of +/- 0.25 degrees and from contour survey plans for the site.

5. The slope angle quoted typically reflects the slope within the footprint of each infrastructure location. The flat topography/nature of the terrain on site highlights the low risk of peat failure.
6. The Site will comprise both the upgrade of existing and the construction of new proposed access roads. The construction of new proposed access roads will be carried out predominantly using excavate and replace construction techniques. This will be used in short sections where the peat is <1m in thickness or is not present, which involves the removal and replacement of peat or soft ground where encountered, and replacement with granular fill. There is a small portion of access track where floated roads will be required.
7. No evidence of past failures or any significant signs of peat instability were noted on site.
8. A summary of the site walkover findings for the wind farm are as follows:
    a) The Site is typically covered in a layer of peat with typically flat terrain and open peatland. Peat depths recorded across the site ranged from 0.1 to 4.2m with an average depth of 1.0m.
    b) The results of the peat depth probing, shear strength testing of the peat and qualitative factors identified on site have been used in the stability and risk assessments, see Sections 6, 7 and 8 of this report for details.
    c) Based on the findings from the walkover survey, the Site is considered to have a low risk of peat failure.

In summary, based on the findings from the site reconnaissance, the proposed development footprint for the Site would be considered to have a low risk of peat instability.

LEGEND - PEAT DEPTH CONTOURS:

- ≥ 0 < 0.5
- ≥ 0.5 < 1
- ≥ 1 < 1.5
- ≥ 1.5 < 2
- ≥ 2 < 2.5
- ≥ 2.5 < 3
- ≥ 3 < 3.5
- ≥ 3.5 < 4
- ≥ 4 ≤ 4.2

LEGEND:

Planning Site Boundary

0m 100m 200m 300m 400m 500m 600m 700m 800m 900m 1000m

Scale 1:10000

PLAN

Scale 1:10000

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Rev.	Description	App By	Date
A	ISSUE FOR PLANNING	JH	08.09.25

PROJECT: DERRYNADARRAGH WIND FARM

CLIENT: Dara Energy Limited

SHEET: PEAT DEPTH CONTOUR PLAN

Date: 08.09.25	Project number: P22-145	Scale (@ A1-): 1:10000	
Drawn by: CS	Drawing Number: P22-145-INFO-0013		Rev: A
Checked by: LD			

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10 September 2025

5. GROUND INVESTIGATION

Ground investigations were carried out at the Site by GII under the supervision of FT in April 2025.

The ground investigation by GII comprised 12 no. trial pits along with laboratory testing. The trial pits were carried out at various locations across the Site to provide information on the ground conditions. The trial pit locations are displayed on a map within the GII Ground Investigation Factual Report, in Appendix 1 inChapter 11 of the main EIAR.

The laboratory testing included the following:

- Classification testing for overburden material

The trial pits logs, locations, photographs and associated laboratory testing are included within Appendix E of this report.

5.1 Summary of Ground Conditions

The ground conditions at the Site can be typically categorised into the following deposits:

Peat – Typically described as black/ dark brown amorphous peat with roots. Peat thicknesses from the trial pits ranged from 0.4 to 1.9m.

Cohesive Deposits – A very soft white slightly sandy clayey SILT overlying a very soft bluish grey slightly sandy silty CLAY which grades into a soft to firm interlaminated bluish grey silty CLAY and sandy SILT at several locations. The secondary sand and gravel constituents varied across the site and with depth, with granular lenses occasionally present in the glacial till matrix. A bluish grey slightly sandy gravelly CLAY with low cobble content was also noted below the peat at TP10.

Granular Deposits – A granular deposit was encountered below the cohesive deposits at TP10 only and was described as bluish grey slightly sandy subangular to rounded fine to coarse GRAVEL with low cobble content.

Groundwater was noted during the excavation of nine of the trial pits. Groundwater was recorded at depth of between 0.8 and 4.2m bgl, with flow ranging from slow to rapid.

5.2 Summary of Laboratory Testing

Following completion of intrusive site investigations by GII, laboratory testing was scheduled by FT and undertaken by GII. Soil testing was carried out in accordance with BS1377 (1990) - Methods of Test for Soils for Civil Engineering Purposes in GII's Materials Laboratory, accredited in accordance with the Irish National Accreditation Board (INAB).

Laboratory testing comprising moisture content, Atterberg limit tests and particle size distribution (PSD) testing was undertaken on samples from the trial pits. Based on the results of the PSD tests, the descriptions on the final trial pit logs have been updated.

Atterberg limit tests carried out on the samples classify the material as Clay of low plasticity, or non-plastic (Silt).

Laboratory results are included in Appendix 2 of the IDL Ground Investigation Factual Report.

6. PEAT DEPTHS, STRENGTH & SLOPE AT PROPOSED INFRASTRUCTURE LOCATIONS

As part of the site walkover, peat depth, in-situ peat strength and slope angles were recorded at various locations across the Site.

6.1 Peat Depth

Peat depth probes were carried out at/near to proposed turbine locations and access roads and other main infrastructure elements. At turbine locations up to 5 probes were carried out around the turbine location, and an average peat depth was calculated.

6.2 Peat Strength

The strength testing was carried out in-situ using a Geonor H-60 Hand-Field Vane Tester. From FT's experience hand vanes give indicative results for in-situ strength of peat and would be considered best practice for the field assessment of peat strength.

6.3 Slope Angle

The slope angles at each of the main infrastructure locations were obtained using a combination of readings taken during the site reconnaissance by FT using handheld equipment, such as the Silva Clino Master and from contour survey plans for site.

The slope angle quoted typically reflects the slope within the footprint of each infrastructure location. It should be noted that slope angles derived from contour survey plans would be considered approximate, as such surveys are dependent on the density of survey data and do not always reflect local variations in ground topography. Slope angles recorded during the site reconnaissance by FT using handheld equipment would generally be deemed more accurate and representative of local topography.

6.4 Summary of Findings

Based on the peat depths recorded across the Site by FT, the peat varied in depth from 0.1 to 4.2m with an average depth of 1.0m. All peat depth probes carried out on site have been utilised to produce a peat depth contour plan for the site (Figure 4.1).

A summary of the peat depths at the proposed infrastructure locations is given in Table 6.1. The data presented in Table 6.1 is used in the peat stability assessment of the site.

Table 6-1: Peat Depth & Slope Angle at Proposed Infrastructure Locations

Infrastructure Element	Easting	Northing	Peat Depth (m)	Slope (o) Note 1
T01	659937	714994	0.5 – 0.8	2
T02	658662	716607	2 – 2.5	2
T03	659623	716518	0.4 – 0.6	2
T04	659622	715347	1 – 1.6	2
T05	659128	716060	2.4 – 3.1	2
T06	658384	715670	0.4 – 0.9	2
T07	659268	715518	0.2 – 0.4	2
T08	659680	715968	0.2 – 0.3	2
T09	660136	715709	0.1 – 0.3	2
Construction Compound	658226	716272	0.8 – 1.2	3
On-Site Substation	658367	716134	0.2 – 0.5	2

Note (1) Based on probe results from the site walkovers. The range of peat depths for the infrastructure locations are typically based on a 10m grid carried out around the infrastructure element, where accessible.

Note (2) The slope angles at each of the main infrastructure locations were obtained using a combination of readings taken during the site reconnaissance by FT using handheld equipment, such as the Silva Clino Master (which has an accuracy of +/- 0.25 degrees) and from contour survey plans for site. The slope angle quoted typically reflects the slope within the footprint of each infrastructure location.

Note (3) The data presented in the Table above is used in the peat stability assessment of the site.

In addition to probing, in-situ shear vane testing was carried out as part of the ground investigation. Strength testing was carried out at selected locations across the site to provide representative coverage of indicative peat strengths. The results of the vane testing with depth are presented in Figure 6.1.

The hand vane results indicate undrained shear strengths in the range 25 to 65kPa, with an average value of about 46kPa. The strengths recorded would be typical of well drained peat as is present on the Site.

Peat strength at sites of known peat failures (assuming undrained loading failure) are generally very low, for example the undrained shear strength at the Derrybrien failure (AGEC, 2004) as derived from back-analysis, was estimated at 2.5kPa. The recorded undrained strength on the Site is significantly greater than the lower bound values for Derrybrien indicating that there is no close correlation to the peat conditions at the Derrybrien site and that there is significantly less likelihood of failure on the Site.

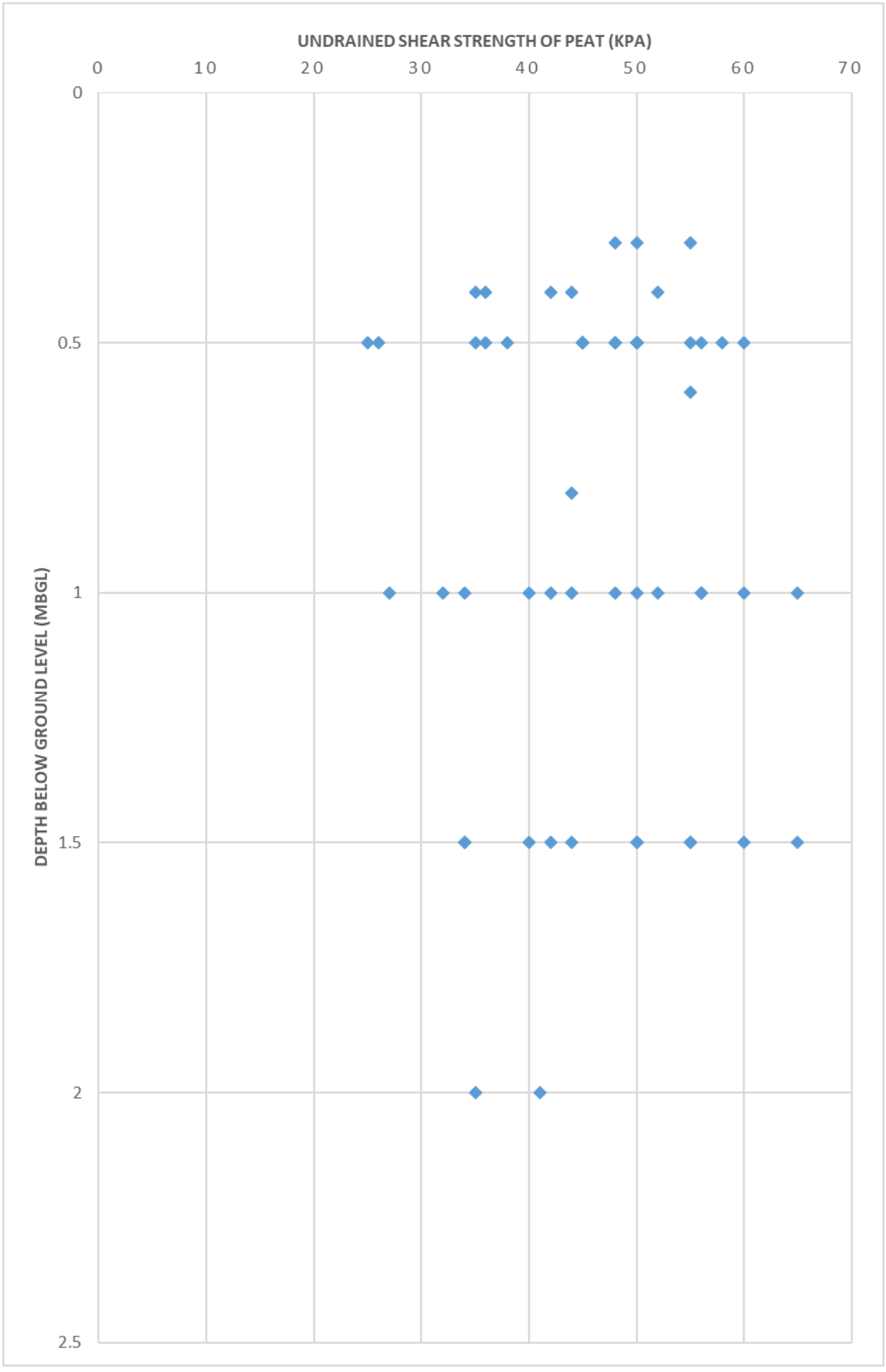

Figure 6-6-1: Undrained Shear Strength (c_u) Profile for Peat with Depth

7. PEAT STABILITY ASSESSMENTS

The peat stability assessment includes an assessment of the stability of the natural peat slopes for individual parcels across the site including at the turbine locations and along the proposed access roads. The assessment also analyses the stability of the natural peat slopes with a surcharge loading of 10kPa, equivalent to placing 1m of stockpiled peat on the surface of the peat slope.

7.1 Methodology for Peat Stability Assessment

Stability of a peat slope is dependent on several factors working in combination. The main factors that influence peat stability are slope angle, shear strength of peat, depth of peat, pore water pressure and loading conditions.

An adverse combination of factors could potentially result in peat sliding. An adverse condition of one of the above-mentioned factors alone is unlikely to result in peat failure. The infinite slope model (Skempton and DeLory, 1957) is used to combine these factors to determine a factor of safety for peat sliding. This model is based on a translational slide, which is a reasonable representation of the dominant mode of movement for peat failures.

To assess the factor of safety for a peat slide, an undrained (short-term stability) and drained (long-term stability) analysis has been undertaken to determine the stability of the peat slopes on site.

1. The undrained loading condition applies in the short-term during construction and until construction induced pore water pressures dissipate.
2. The drained loading condition applies in the long-term. The condition examines the effect of the change in groundwater level as a result of rainfall on the existing stability of the natural peat slopes.

Undrained shear strength values (cu) for peat are used for the total stress analysis. Based on the findings of the 2003 Derrybrien failure and other failures in peat, undrained loading during construction was found to be the critical failure mechanism.

A drained analysis requires effective cohesion (c') and effective friction angle (ø') values for the calculations. These values can be difficult to obtain because of disturbance experienced when sampling peat and the difficulties in interpreting test results due to the excessive strain induced within the peat. To determine suitable drained strength values a review of published information on peat was carried out. Table 7.1 shows a summary of the published information on peat together with drained strength values.

From Table 7.1 the values for c' ranged from 1.1 to 8.74kPa and ø' ranged from 21.6 to 43°. The average c' and ø' values are 4.5kPa and 30° respectively. Based on the above, it was considered to adopt a conservative approach and to use design values below the averages. For design the following general drained strength values have been used for the site:

c' = 4kPa

ø' = 25°

Table 7-7-1: List of Effective Cohesion and Friction Angle Values for Peat

Reference	Cohesion, c' (kPa)	Friction Angle, ø' (degs)	Testing Apparatus/ Comments
Hanrahan et al (1967)	5 to 7	36 to 43	From triaxial apparatus
Rowe and Mylleville (1996)	2.5	28	From simple shear apparatus
Landva (1980)	2 to 4	27.1 to 32.5	Mainly ring shear apparatus for normal stress greater than 13kPa
	5 to 6	-	At zero normal stress
Carling (1986)	6.5	0	-
Farrell and Hebib (1998)	0	38	From ring shear and shear box apparatus. Results are not considered representative.
	0.61	31	From direct simple shear (DSS) apparatus. Result considered too low therefore DSS not considered appropriate
Rowe, Maclean and Soderman (1984)	1.1	26	From simple shear apparatus
	3	27	From DSS apparatus
McGreever and Farrell (1988)	6	38	From triaxial apparatus using soil with 20% organic content
	6	31	From shear box apparatus using soil with 20% organic content
Hungr and Evans (1985)	3.3	-	Back-analysed from failure
Dykes and Kirk (2006)	3.2	30.4	Test within acrotelm
Dykes and Kirk (2006)	4	28.8	Test within catotelm
Warburton et al (2003)	5	23.9	Test in basal peat
Warburton et al (2003)	8.74	21.6	Test using fibrous peat
Hendry et al (2012)	0	31	Remoulded test specimen
Komatsu et al (2011)	8	34	Remoulded test specimen
Zwanenburg et al (2012)	2.3	32.3	From DSS apparatus
Den Haan & Grognet (2014)	-	37.4	From large DSS apparatus
O'Kelly & Zhang (2013)	0	28.9 to 30.3	Tests carried out on reconstituted, undisturbed and blended peat samples.

7.2 Analysis to Determine Factor of Safety (Deterministic Approach)

The purpose of the analysis was to determine the Factor of Safety (FoS) of the peat slopes using infinite slope analysis. The analysis was carried out at the turbine locations, along the proposed access roads and at various locations across the site.

The FoS provides a direct measure of the degree of stability of the slope. A FoS of less than unity (1.0) indicates that a slope is unstable, a FoS of greater than unity indicates a stable slope.

The acceptable safe range for FoS typically ranges from 1.3 to 1.4. The previous code of practice for earthworks BS 6031:1981 (BSI, 1981), provided advice on design of earthworks slopes. It stated that for a first-time failure with a good standard of site investigation the design FoS should be greater than 1.3.

As a general guide the FoS limits for peat slopes in this report are summarised in Table 7.2.

Table 7-7-2: Factor of Safety Limits for Slopes

Factor of Safety (FoS)	Degree of Stability
Less than 1.0	Unstable (red)
Between 1.0 and 1.3	Marginally stable (yellow)
1.3 or greater	Acceptable (green)

Eurocode 7 (EC7) (IS EN 1997-1:2005) now serves as the reference document and the basis for design geotechnical engineering works. The design philosophy used in EC7 applies partial factors to soil parameters, actions and resistances. Unlike the traditional approach, EC7 does not provide a direct measure of stability since global Factors of Safety are not used.

As such, and in order to provide a direct measure of the level of safety on a site, EC7 partial factors have not been used in this stability assessment. The results are given in terms of FoS.

A lower bound undrained shear strength, c_u for the peat of 8kPa was selected for the assessment based on the cu values recorded at the site. It should be noted that a c_u of 8kPa 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 generally has a higher undrained strength.

The formula used to determine the factor of safety for the undrained condition in the peat (Bromhead, 1986) is as follows:

$$F = \frac{c_u}{\gamma z \sin\alpha \cos\alpha}$$

Where:

F = Factor of Safety

c_u = Undrained strength

γ = Bulk unit weight of material

z = Depth to failure plane assumed as depth of peat

α = Slope angle

The formula used to determine the factor of safety for the drained condition in the peat (Bromhead, 1986) is as follows:

$$F = \frac{c' + (\gamma z - \gamma_w h_w)\cos^2 \alpha \tan \phi'}{\gamma z \sin \alpha \cos \alpha}$$

Where:

F = Factor of Safety

c' = Effective cohesion

γ = Bulk unit weight of material

z = Depth to failure plane assumed as depth of peat

γ_w = Unit weight of water

h_w = Height of water table above failure plane

α = Slope angle

ϕ' = Effective friction angle

For the drained analysis the level of the water table above the failure surface is required to calculate the factor of safety for the slope. Since the water level in blanket peat can be variable and can be recharged by rainfall, it is not feasible to establish its precise location throughout the site. Therefore, a sensitivity analysis using water level ranging between 0% and 100% of the peat depth was conducted, where 0% equates to the peat being completely dry and 100% equates to the peat been fully saturated.

The following general assumptions were used in the analysis of peat slopes at each location:

1. Peat depths are based on the maximum peat depth recorded at each location from the walkover surveys.
2. The slope angles used in the peat stability assessment were obtained using a combination of readings taken during the site reconnaissance by FT using handheld equipment and from contour survey plans for site. It should be noted that slope angles derived from contour survey plans would be considered approximate, as such surveys are dependent on the density of survey data and do not always reflect local variations in ground topography.
3. Slope angle at base of sliding assumed to be parallel to ground surface.

A lower bound undrained shear strength, c_u for the peat of 6kPa was selected for the assessment. The lowest recorded value on the Derrynadarragh wind farm site during the site walkover was 25kPa. It should be noted that a c_u of 6kPa 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 as a result of the extensive drainage & extraction works which have been carried out on site.

For the stability analysis two load conditions were examined, namely:

Condition (1): no surcharge loading;

Condition (2): surcharge of 10 kPa, equivalent to 1m of stockpiled peat assumed as a worst case.

7.3 Results of Analysis

7.3.1 Undrained Analysis for the Peat

The results of the undrained analysis for the natural peat slopes are presented in Appendix C. The undrained analysis for load condition 2 is considered the most critical load case as most peat failures occur in the short term upon loading of the peat surface. The results from the main infrastructure locations are summarised in Table 7.3.

The calculated FoS for load condition 1 is in excess of 1.30 for each of the locations (approx. 354 no. locations) analysed with a range of FoS of 4.10 to 172.03, indicating a low risk of peat instability.

The calculated FoS for load condition 2 is in excess of 1.30 for each of the locations (approx. 354 no. locations) analysed with a range of FoS of 3.08 to 15.64, indicating a low risk of peat instability.

Table 7-7-3: Factor of Safety Results for Infrastructure Locations (Undrained Condition)

Turbine No./Waypoint	Easting	Northing	Factor of Safety for Load Condition	
			Condition (1)	Condition (2)
T01	659937	714994	**21.50**	**9.56**
T02	658662	716607	**7.48**	**5.21**
T03	659623	716518	**34.41**	**11.47**
T04	659622	715347	**10.75**	**6.62**
T05	659128	716060	**5.73**	**4.30**
T06	658384	715670	**19.11**	**9.05**
T07	659268	715518	**43.01**	**12.29**
T08	659680	715968	**71.68**	**13.87**
T09	660136	715709	**95.57**	**14.58**
Construction Compound	658226	716272	**9.57**	**5.22**
Substation	658367	716134	**34.41**	**11.47**

LEGEND - FACTOR OF SAFETY:

0 < 1.0	
≥ 1.0 < 1.3	
≥ 1.3	

Increasing Stability

No Peat Recorded
At This Location

LEGEND:

Planning Site Boundary

0m 100m 200m 300m 400m 500m 600m 700m 800m 900m 1000m

Scale 1:10000

PLAN

Scale 1:10000

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Rev.	Description	App By	Date
A	ISSUE FOR PLANNING	JH	08.09.25

PROJECT
DERRYNADARRAGH WIND FARM

CLIENT
Dara Energy Limited

SHEET
FACTOR OF SAFETY PLAN

Date 08.09.25	Project number P22-145	Scale (@ A1-) 1:10000	
Drawn by CS	Drawing Number P22-145-INFO-0014		Rev A
Checked by LD			

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7.3.2 Drained Analysis for the Peat

The results of the drained analysis for the peat are presented in Appendix C. The results from the main infrastructure locations are summarised in Table 7.4. As stated previously, the drained loading condition examines the effect of rainfall and water on the existing stability of the natural peat slopes.

The calculated FoS for load condition 1 is in excess of 1.30 for each of the locations (approx. 354 no. locations) analysed with a range of FoS of 4.99 to 128.04, indicating a low risk of peat instability.

The calculated FoS for load condition 2 is in excess of 1.30 for each of the locations (approx. 354 no. locations) analysed with a range of FoS of 7.52 to 61.94, indicating a low risk of peat instability.

Table 7-7-4: Factor of Safety Results for Infrastructure Locations (Drained Conditions)

Turbine No./Waypoint	Easting	Northing	Factor of Safety for Load Condition	
			Condition (1)	Condition (2)
T01	659937	714994	**27.69**	**19.72**
T02	658662	716607	**18.34**	**16.83**
T03	659623	716518	**36.29**	**21.00**
T04	659622	715347	**20.52**	**17.76**
T05	659128	716060	**3.82**	**6.21**
T06	658384	715670	**12.74**	**13.06**
T07	659268	715518	**28.67**	**17.73**
T08	659680	715968	**61.75**	**23.22**
T09	660136	715709	**78.30**	**24.31**
Construction Compound	658226	716272	**15.68**	**12.79**
Substation	658367	716134	**46.13**	**30.83**

8. PEAT STABILITY RISK ASSESSMENT

A peat stability risk assessment was carried out for the main infrastructure elements on the Site. This approach takes into account guidelines for geotechnical/peat stability risk assessments as given in PLHRAG (2017) and MacCulloch (2005).

The risk assessment uses the results of the stability analysis (deterministic approach) in combination with qualitative factors, which cannot be reasonably included in a stability calculation but nevertheless may affect the occurrence of peat instability, to assess the risk for each infrastructure element.

For each of the main infrastructure elements, a risk rating (product of probability and impact) is calculated and rated as shown in Table 8.1. Where a subsection is rated 'Medium' or 'High', control measures are required to reduce the risk to at least a 'Low' risk rating. Where a subsection is rated 'Low' or 'Negligible', only routine control measures are required.

Table 8-8-1: Risk Rating Legend

17 to 25	High: avoid works in area or significant control measures required
11 to 16	Medium: notable control measures required
5 to 10	Low: only routine control measures required
1 to 4	Negligible: none or only routine control measures required

A full methodology for the peat stability risk assessment is given in Appendix D.

8.1 Summary of Risk Assessment Results

The results of the peat stability risk assessment for potential peat failure at the main infrastructure elements is presented as a Geotechnical Risk Register in Appendix B and summarised in Table 8.2.

The risk rating for each infrastructure element at the Derrynadarragh wind farm is designated trivial following some mitigation/control measures being implemented. Sections of access roads to the nearest infrastructure element will be subject to the same mitigation/control measures that apply to the nearest infrastructure element.

Details of the required mitigation/control measures can be found in the Geotechnical Risk Register for each infrastructure element (Appendix B).

Table 8-8-2: Summary of Peat Stability Risk Register

Infrastructure	Pre- General Control Measure Implementation Risk Rating	Pre- General Control Measure Implementation Risk Rating Category	Specific Control Measures Required	Post- General Control Measure Implementation Risk Rating	Post- General Control Measure Implementation Risk Rating Category
T01	Negligible	1 to 4	No	Negligible	1 to 4
T02	Negligible	1 to 4	No	Negligible	1 to 4
T03	Negligible	1 to 4	No	Negligible	1 to 4
T04	Negligible	1 to 4	No	Negligible	1 to 4
T05	Negligible	1 to 4	No	Negligible	1 to 4
T06	Negligible	1 to 4	No	Negligible	1 to 4
T07	Negligible	1 to 4	No	Negligible	1 to 4
T08	Negligible	1 to 4	No	Negligible	1 to 4
T09	Negligible	1 to 4	No	Negligible	1 to 4
Construction Compound	Negligible	1 to 4	No	Negligible	1 to 4
Substation	Negligible	1 to 4	No	Negligible	1 to 4

9. INDICTATIVE FOUNDATION TYPE AND FOUNDATION DEPTH FOR TURBINES

9.1 Summary

Based on a review of the site walkover information for site, a preliminary assessment of the likely foundation type and founding depths for each turbine location was carried out, where possible. A summary of this assessment is provided in Table 9-1:

Table 9-9-1: Summary of Indicative Turbine Foundation Type and Founding Depths

Turbine No.	Proposed Turbine Foundation Type	Relevant GI	Proposed founding depth (m bgl)	Ground Conditions
T01	Piled foundation	TP1	-	Peat overlying soft to firm Clay/ Silt.
T02	Piled foundation	TP2	-	Peat overlying soft to firm Clay/ Silt.
T03	Piled foundation	TP3	-	Peat overlying soft to firm Clay/ Silt.
T04	Piled foundation	TP4	-	Peat overlying soft to firm Clay/ Silt.
T05	Piled foundation	TP5	-	Peat overlying soft to firm Clay/ Silt.
T06	Piled foundation	TP6	-	Peat overlying soft to firm Clay/ Silt.
T07	Piled foundation	TP7	-	Peat overlying soft to firm Clay/ Silt.
T08	Piled foundation	TP8	-	Soft to firm Clay/ Silt
T09	Piled foundation	TP9	-	Soft to firm Clay/ Silt

It should be noted that confirmatory ground investigation should be carried out prior to construction at each turbine location in the form of a borehole with in-situ SPT testing at 1m intervals in the overburden and follow-on rotary core through bedrock to confirm the foundation types and founding stratums indicated in Table 9-1. It is likely that following the completion of further ground investigation prior to construction that a number of the turbine bases will be deemed suitable for gravity type foundations.

For gravity type turbine foundations, where the depth of excavation exceeds the required founding depth for the proposed turbine base, up-fill material consisting of granular fill (6N) shall be used to backfill the excavation to the required founding depth.

For the piled turbine foundations, a typical piling type and configuration could be up to 16 no. 900-1200mm rotary bored piles.

10. SUMMARY AND RECOMMENDATIONS

10.1 Summary

The following summary is given.

FT was engaged by Dara Energy Limited to undertake a geotechnical and peat stability assessment of the proposed Derrynadarragh wind farm site.

The findings of the peat assessment showed that the Site has an acceptable margin of safety and is suitable for the proposed wind farm development. The findings include recommendations and control measures for construction work in peat lands to ensure that all works adhere to an acceptable standard of safety.

The site is relatively flat lying with drainage channels running typically northeast to southwest. The land uses and types within the proposed development site are a mixture of agricultural fields, mature forestry, bare cutover and cutaway peat.

Peat depth recorded during the site walkover and from the ground investigation ranged from 0.1 to 4.2m with an average peat depth of 1.0m. Approximately 94 percent of peat depth probes recorded peat depths of less than 2.0m. A number of localised readings were recorded where peat depths were 2.0 to 4.1m.

Slope inclinations at the main infrastructure locations were 2 degrees.

An analysis of peat sliding was carried out at the main infrastructure locations across site for both the undrained and drained conditions. The purpose of the analysis was to determine the Factor of Safety (FoS) of the peat slopes.

An undrained analysis was carried out, which applies in the short-term during construction. For the undrained condition, the calculated FoS for load conditions (1) and (2) for the locations analysed, showed that all locations have an acceptable FoS of greater than 1.3, indicating a low risk of peat failure. The undrained analysis would be considered the most critical condition for the peat slopes.

A drained analysis was also carried out, which examined the effect of in particular, rainfall on the existing stability of the natural peat slopes on site. For the drained condition, the calculated FoS for load conditions (1) & (2) for the locations analysed, showed that all locations analysed have an acceptable FoS of greater than 1.3.

The peat stability risk assessment at each infrastructure location identified a number of mitigation/control measures to reduce the potential risk of peat failure. Sections of access roads to the nearest infrastructure element should be subject to the same mitigation/control measures that apply to the nearest infrastructure element. See Appendix B for details of the required mitigation/control measures for each infrastructure element.

In summary, the findings of the peat assessment showed that the Site has an acceptable margin of safety, is suitable for the proposed wind farm development and is considered to be at low risk of peat failure. The findings include recommendations and control measures for construction work in peat lands to ensure that all works adhere to an acceptable standard of safety.

10.2 Recommendations

The following recommendations are given.

Notwithstanding that the site has an acceptable margin of safety a number of mitigation/control measures are given to ensure that all works adhere to an acceptable standard of safety for work in peatlands. Mitigation/control measures identified for each of the infrastructure elements in the risk assessment will be taken into account and implemented throughout design and construction works (Appendix B).

Figure 4-2 shows areas which have an elevated or higher construction risk due to the terrain and features encountered during the site reconnaissance i.e. presence of relatively deep peat. Figure 7-1 shows the results of the factor of safety (FoS) analysis for the peat slopes on site for the most critical load condition.

To minimise the risk of construction activity causing potential peat instability the Construction Method Statements (CMSs) for the project will take into account, but not be limited, to the recommendations above. This will ensure that best practice guidance regarding the management of peat stability will be inherent in the construction phase.

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APPENDIX A

Photos from Site Walkover

Photo 1: **Example of the agricultural land present across the site**

Photo 2: **Flat open agricultural field with shallow peat**

Photo 3: Mature forestry in northern area of the site

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APPENDIX B

Peat Stability Risk Registers

Derrynadarragh Wind Farm - Peat Stability Risk Register (Rev 0)

Location:	**Turbine T01**

Grid Reference (Eastings, Northings):	659937	714994
Distance to Watercourse (m)	**50 - 100**	
Min & Max Measured Peat Depth (m):	**0.5 - 0.8**	
Specific Control Required:	**No**	

		Pre-Control Measure Implementation						Post-Control Measure Implementation			
Ref.	Contributory/Qualitative Factors to Potential Peat Failure	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating	Control Required	Control measures to be implemented during construction	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating
1	FOS = 21.50 (u), 27.69 (d)	1	3	3	Negligible	No	See Below	1	3	3	Negligible
2	Evidence of sub peat water flow	1	3	3	Negligible	No		1	3	3	Negligible
3	Evidence of surface water flow	1	3	3	Negligible	No		1	3	3	Negligible
4	Evidence of previous failures/slips	0	3	0	Not Applicable	No		0	3	0	Not Applicable
5	Type of vegetation	2	3	6	Low	No		2	3	6	Low
6	General slope characteristics upslope/downslope from infrastructure location	1	3	3	Negligible	No		1	3	3	Negligible
7	Evidence of very soft/soft clay at base of peat	0	3	0	Not Applicable	No		0	3	0	Not Applicable
8	Evidence of mechanically cut peat	0	3	0	Not Applicable	No		0	3	0	Not Applicable
9	Evidence of quaking or buoyant peat	0	3	0	Not Applicable	No		0	3	0	Not Applicable
10	Evidence of bog pools	0	3	0	Not Applicable	No		0	3	0	Not Applicable
11	Other	0	3	0	Not Applicable	No		0	3	0	Not Applicable

	General Control Measures to be Implemented Prior to/and During Construction for **Turbine T01**
i	Maintain hydrology of area as far as possible;
ii	Use of experienced geotechnical staff for site investigation;
iii	Use of experienced contractors and trained operators to carry out the work;
iv	Detailed ground investigation to determine peat, mineral soil and bedrock condition and properties.
v	Inspection & approval of turbine base sub-formation by a competent person where a gravity type foundation base is constructed.

Note

(1) FOS abbreviations are: u: FOS for undrained analysis, d: FOS for drained analysis.
(2) Probability assessed as per Table A and B of Appendix D.
(3) Impact based on distance of infrastructure element to nearest watercourse.

Derrynadarragh Wind Farm - Peat Stability Risk Register (Rev 0)

Location:	**Turbine T02**	
Grid Reference (Eastings, Northings):	658662	716607
Distance to Watercourse (m)	**> 150**	
Min & Max Measured Peat Depth (m):	**2 - 2.5**	
Specific Control Required:	**No**	

		Pre-Control Measure Implementation						Post-Control Measure Implementation			
Ref.	Contributory/Qualitative Factors to Potential Peat Failure	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating	Control Required	Control measures to be implemented during construction	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating
1	FOS = 7.48 (u), 18.34 (d)	1	1	1	Negligible	No		1	1	1	Negligible
2	Evidence of sub peat water flow	1	1	1	Negligible	No		1	1	1	Negligible
3	Evidence of surface water flow	1	1	1	Negligible	No		3	1	3	Negligible
4	Evidence of previous failures/slips	0	1	0	Not Applicable	No		0	1	0	Not Applicable
5	Type of vegetation	2	1	2	Negligible	No		2	1	2	Negligible
6	General slope characteristics upslope/downslope from infrastructure location	1	1	1	Negligible	No	See Below	3	1	3	Negligible
7	Evidence of very soft/soft clay at base of peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
8	Evidence of mechanically cut peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
9	Evidence of quaking or buoyant peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
10	Evidence of bog pools	0	1	0	Not Applicable	No		0	1	0	Not Applicable
11	Other	0	1	0	Not Applicable	No		0	1	0	Not Applicable

	General Control Measures to be Implemented Prior to/and During Construction for **Turbine T02**
i	Due to relatively deep peat at this turbine location, additional construction measures such as the following may be required: - excavation side walls to be supported (e.g. boulders, sheet piles) or excavation faces battered to a shallow angle - temporary works designer may be required to provide excavation support design -daily detailed inspection of excavation faces -potential for greater water inflow into excavation requiring removal of water using pumping -increased exclusion zone around excavation to avoid accidental loading of crest of slope
ii	Maintain hydrology of area as far as possible;
iii	Use of experienced geotechnical staff for site investigation;
iv	Use of experienced contractors and trained operators to carry out the work;
v	Detailed ground investigation to determine peat, mineral soil and bedrock condition and properties.
vi	Inspection & approval of turbine base sub-formation by a competent person where a gravity type foundation base is constructed.

Note
(1) FOS abbreviations are: u: FOS for undrained analysis, d: FOS for drained analysis.
(2) Probability assessed as per Table A and B of Appendix D.
(3) Impact based on distance of infrastructure element to nearest watercourse.

Derrynadarragh Wind Farm - Peat Stability Risk Register (Rev 0)

Location:	**Turbine T03**

Grid Reference (Eastings, Northings):	659623	716518
Distance to Watercourse (m)	**> 150**	
Min & Max Measured Peat Depth (m):	**0.4 - 0.6**	
Specific Control Required:	**No**	

		Pre-Control Measure Implementation						Post-Control Measure Implementation			
Ref.	Contributory/Qualitative Factors to Potential Peat Failure	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating	Control Required	Control measures to be implemented during construction	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating
1	FOS = 34.41 (u), 36.29 (d)	1	1	1	Negligible	No		1	1	1	Negligible
2	Evidence of sub peat water flow	1	1	1	Negligible	No		1	1	1	Negligible
3	Evidence of surface water flow	1	1	1	Negligible	No		3	1	3	Negligible
4	Evidence of previous failures/slips	0	1	0	Not Applicable	No		0	1	0	Not Applicable
5	Type of vegetation	2	1	2	Negligible	No		2	1	2	Negligible
6	General slope characteristics upslope/downslope from infrastructure location	1	1	1	Negligible	No	See Below	2	1	2	Negligible
7	Evidence of very soft/soft clay at base of peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
8	Evidence of mechanically cut peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
9	Evidence of quaking or buoyant peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
10	Evidence of bog pools	0	1	0	Not Applicable	No		0	1	0	Not Applicable
11	Other	0	1	0	Not Applicable	No		0	1	0	Not Applicable

	General Control Measures to be Implemented Prior to/and During Construction for **Turbine T03**
i	Maintain hydrology of area as far as possible;
ii	Use of experienced geotechnical staff for site investigation;
iii	Use of experienced contractors and trained operators to carry out the work;
iv	Detailed ground investigation to determine peat, mineral soil and bedrock condition and properties.
v	Inspection & approval of turbine base sub-formation by a competent person where a gravity type foundation base is constructed.

Note

(1) FOS abbreviations are: u: FOS for undrained analysis, d: FOS for drained analysis.
(2) Probability assessed as per Table A and B of Appendix D.
(3) Impact based on distance of infrastructure element to nearest watercourse.

Derrynadarragh Wind Farm - Peat Stability Risk Register (Rev 0)

Location:	Turbine T04

Grid Reference (Eastings, Northings):	659622	715347
Distance to Watercourse (m)	**> 150**	
Min & Max Measured Peat Depth (m):	**1 - 1.6**	
Specific Control Required:	**No**	

		Pre-Control Measure Implementation						Post-Control Measure Implementation			
Ref.	Contributory/Qualitative Factors to Potential Peat Failure	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating	Control Required	Control measures to be implemented during construction	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating
1	FOS = 10.75 (u), 20.52 (d)	1	1	1	Negligible	No	See Below	1	1	1	Negligible
2	Evidence of sub peat water flow	1	1	1	Negligible	No		1	1	1	Negligible
3	Evidence of surface water flow	1	1	1	Negligible	No		2	1	2	Negligible
4	Evidence of previous failures/slips	0	1	0	Not Applicable	No		0	1	0	Not Applicable
5	Type of vegetation	2	1	2	Negligible	No		2	1	2	Negligible
6	General slope characteristics upslope/downslope from infrastructure location	1	1	1	Negligible	No		3	1	3	Negligible
7	Evidence of very soft/soft clay at base of peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
8	Evidence of mechanically cut peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
9	Evidence of quaking or buoyant peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
10	Evidence of bog pools	0	1	0	Not Applicable	No		0	1	0	Not Applicable
11	Other	0	1	0	Not Applicable	No		2	1	2	Negligible

	General Control Measures to be Implemented Prior to/and During Construction for **Turbine T04**
i	Due to relatively deep peat at this turbine location, additional construction measures such as the following may be required: - excavation side walls to be supported (e.g. boulders, sheet piles) or excavation faces battered to a shallow angle - temporary works designer may be required to provide excavation support design -daily detailed inspection of excavation faces -potential for greater water inflow into excavation requiring removal of water using pumping -increased exclusion zone around excavation to avoid accidental loading of crest of slope
ii	Maintain hydrology of area as far as possible;
iii	Use of experienced geotechnical staff for site investigation;
iv	Use of experienced contractors and trained operators to carry out the work;
v	Detailed ground investigation to determine peat, mineral soil and bedrock condition and properties.
vi	Inspection & approval of turbine base sub-formation by a competent person where a gravity type foundation base is constructed.

Note

(1) FOS abbreviations are: u: FOS for undrained analysis, d: FOS for drained analysis.
(2) Probability assessed as per Table A and B of Appendix D.
(3) Impact based on distance of infrastructure element to nearest watercourse.

Derrynadarragh Wind Farm - Peat Stability Risk Register (Rev 0)

Location:	**Turbine T05**	
Grid Reference (Eastings, Northings):	659128	716060
Distance to Watercourse (m)	**> 150**	
Min & Max Measured Peat Depth (m):	**2.5 - 3.1**	
Specific Control Required:	**No**	

		Pre-Control Measure Implementation						Post-Control Measure Implementation			
Ref.	Contributory/Qualitative Factors to Potential Peat Failure	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating	Control Required	Control measures to be implemented during construction	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating
1	FOS = 5.73 (u), 3.82 (d)	1	1	1	Negligible	No	See Below	1	1	1	Negligible
2	Evidence of sub peat water flow	1	1	1	Negligible	No		1	1	1	Negligible
3	Evidence of surface water flow	1	1	1	Negligible	No		2	1	2	Negligible
4	Evidence of previous failures/slips	0	1	0	Not Applicable	No		0	1	0	Not Applicable
5	Type of vegetation	2	1	2	Negligible	No		2	1	2	Negligible
6	General slope characteristics upslope/downslope from infrastructure location	1	1	1	Negligible	No		2	1	2	Negligible
7	Evidence of very soft/soft clay at base of peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
8	Evidence of mechanically cut peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
9	Evidence of quaking or buoyant peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
10	Evidence of bog pools	0	1	0	Not Applicable	No		0	1	0	Not Applicable
11	Other	1	1	1	Negligible	No		2	1	2	Negligible

	General Control Measures to be Implemented Prior to/and During Construction for **Turbine T05**
i	Due to relatively deep peat at this turbine location, additional construction measures such as the following may be required: - excavation side walls to be supported (e.g. boulders, sheet piles) or excavation faces battered to a shallow angle - temporary works designer may be required to provide excavation support design -daily detailed inspection of excavation faces -potential for greater water inflow into excavation requiring removal of water using pumping -increased exclusion zone around excavation to avoid accidental loading of crest of slope
ii	Maintain hydrology of area as far as possible;
iii	Use of experienced geotechnical staff for site investigation;
iv	Use of experienced contractors and trained operators to carry out the work;
v	Detailed ground investigation to determine peat, mineral soil and bedrock condition and properties.
vi	Inspection & approval of turbine base sub-formation by a competent person where a gravity type foundation base is constructed.

Note
(1) FOS abbreviations are: u: FOS for undrained analysis, d: FOS for drained analysis.
(2) Probability assessed as per Table A and B of Appendix D.
(3) Impact based on distance of infrastructure element to nearest watercourse.

Derrynadarragh Wind Farm - Peat Stability Risk Register (Rev 0)

Location:	**Turbine T06**	
Grid Reference (Eastings, Northings):	658384	715670
Distance to Watercourse (m)	**> 150**	
Min & Max Measured Peat Depth (m):	**0.4 - 0.9**	
Specific Control Required:	**No**	

		Pre-Control Measure Implementation						Post-Control Measure Implementation			
Ref.	Contributory/Qualitative Factors to Potential Peat Failure	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating	Control Required	Control measures to be implemented during construction	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating
1	FOS = 19.11 (u), 12.74 (d)	1	1	1	Negligible	No		1	1	1	Negligible
2	Evidence of sub peat water flow	1	1	1	Negligible	No		1	1	1	Negligible
3	Evidence of surface water flow	1	1	1	Negligible	No		3	1	3	Negligible
4	Evidence of previous failures/slips	0	1	0	Not Applicable	No		0	1	0	Not Applicable
5	Type of vegetation	2	1	2	Negligible	No		2	1	2	Negligible
6	General slope characteristics upslope/downslope from infrastructure location	1	1	1	Negligible	No	See Below	2	1	2	Negligible
7	Evidence of very soft/soft clay at base of peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
8	Evidence of mechanically cut peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
9	Evidence of quaking or buoyant peat	1	1	1	Negligible	No		0	1	0	Not Applicable
10	Evidence of bog pools	0	1	0	Not Applicable	No		0	1	0	Not Applicable
11	Other	0	1	0	Not Applicable	No		0	1	0	Not Applicable

	General Control Measures to be Implemented Prior to/and During Construction for **Turbine T06**
i	Maintain hydrology of area as far as possible;
ii	Use of experienced geotechnical staff for site investigation;
iii	Use of experienced contractors and trained operators to carry out the work;
iv	Detailed ground investigation to determine peat, mineral soil and bedrock condition and properties.
v	Inspection & approval of turbine base sub-formation by a competent person where a gravity type foundation base is constructed.

Note
(1) FOS abbreviations are: u: FOS for undrained analysis, d: FOS for drained analysis.
(2) Probability assessed as per Table A and B of Appendix D.
(3) Impact based on distance of infrastructure element to nearest watercourse.

Derrynadarragh Wind Farm - Peat Stability Risk Register (Rev 0)

Location:	**Turbine T07**	
Grid Reference (Eastings, Northings):	659268	715518
Distance to Watercourse (m)	**> 150**	
Min & Max Measured Peat Depth (m):	**0.2 - 0.4**	
Specific Control Required:	**No**	

		Pre-Control Measure Implementation						Post-Control Measure Implementation			
Ref.	Contributory/Qualitative Factors to Potential Peat Failure	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating	Control Required	Control measures to be implemented during construction	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating
1	FOS = 43.01 (u), 28.67 (d)	1	1	1	Negligible	No	See Below	1	1	1	Negligible
2	Evidence of sub peat water flow	1	1	1	Negligible	No		1	1	1	Negligible
3	Evidence of surface water flow	1	1	1	Negligible	No		2	1	2	Negligible
4	Evidence of previous failures/slips	0	1	0	Not Applicable	No		0	1	0	Not Applicable
5	Type of vegetation	1	1	1	Negligible	No		2	1	2	Negligible
6	General slope characteristics upslope/downslope from infrastructure location	1	1	1	Negligible	No		2	1	2	Negligible
7	Evidence of very soft/soft clay at base of peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
8	Evidence of mechanically cut peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
9	Evidence of quaking or buoyant peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
10	Evidence of bog pools	0	1	0	Not Applicable	No		0	1	0	Not Applicable
11	Relatively deep peat	3	1	3	Negligible	No		2	1	2	Negligible

	General Control Measures to be Implemented Prior to/and During Construction for **Turbine T07**
i	Maintain hydrology of area as far as possible;
ii	Use of experienced geotechnical staff for site investigation;
iii	Use of experienced contractors and trained operators to carry out the work;
iv	Detailed ground investigation to determine peat, mineral soil and bedrock condition and properties.
v	Inspection & approval of turbine base sub-formation by a competent person where a gravity type foundation base is constructed.

Note

(1) FOS abbreviations are: u: FOS for undrained analysis, d: FOS for drained analysis.
(2) Probability assessed as per Table A and B of Appendix D.
(3) Impact based on distance of infrastructure element to nearest watercourse.

Derrynadarragh Wind Farm - Peat Stability Risk Register (Rev 0)

Location:	**Turbine T08**

Grid Reference (Eastings, Northings):	659680	715968
Distance to Watercourse (m)	**> 150**	
Min & Max Measured Peat Depth (m):	**0.2 - 0.3**	
Specific Control Required:	**No**	

		Pre-Control Measure Implementation						Post-Control Measure Implementation			
Ref.	Contributory/Qualitative Factors to Potential Peat Failure	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating	Control Required	Control measures to be implemented during construction	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating
1	FOS = 43.01 (u), 28.67 (d)	1	1	1	Negligible	No	See Below	1	1	1	Negligible
2	Evidence of sub peat water flow	1	1	1	Negligible	No		1	1	1	Negligible
3	Evidence of surface water flow	1	1	1	Negligible	No		2	1	2	Negligible
4	Evidence of previous failures/slips	0	1	0	Not Applicable	No		0	1	0	Not Applicable
5	Type of vegetation	1	1	1	Negligible	No		2	1	2	Negligible
6	General slope characteristics upslope/downslope from infrastructure location	1	1	1	Negligible	No		2	1	2	Negligible
7	Evidence of very soft/soft clay at base of peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
8	Evidence of mechanically cut peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
9	Evidence of quaking or buoyant peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
10	Evidence of bog pools	0	1	0	Not Applicable	No		0	1	0	Not Applicable
11	Relatively deep peat	3	1	3	Negligible	No		2	1	2	Negligible

	General Control Measures to be Implemented Prior to/and During Construction for **Turbine T08**
i	Maintain hydrology of area as far as possible;
ii	Use of experienced geotechnical staff for site investigation;
iii	Use of experienced contractors and trained operators to carry out the work;
iv	Detailed ground investigation to determine peat, mineral soil and bedrock condition and properties.
v	Inspection & approval of turbine base sub-formation by a competent person where a gravity type foundation base is constructed.

Note

(1) FOS abbreviations are: u: FOS for undrained analysis, d: FOS for drained analysis.
(2) Probability assessed as per Table A and B of Appendix D.
(3) Impact based on distance of infrastructure element to nearest watercourse.

Derrynadarragh Wind Farm - Peat Stability Risk Register (Rev 0)

Location:	**Turbine T09**

Grid Reference (Eastings, Northings):	660136	715709
Distance to Watercourse (m)	**> 150**	
Min & Max Measured Peat Depth (m):	**0.1 - 0.3**	
Specific Control Required:	**No**	

		Pre-Control Measure Implementation						Post-Control Measure Implementation			
Ref.	Contributory/Qualitative Factors to Potential Peat Failure	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating	Control Required	Control measures to be implemented during construction	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating
1	FOS = 43.01 (u), 28.67 (d)	1	1	1	Negligible	No		1	1	1	Negligible
2	Evidence of sub peat water flow	1	1	1	Negligible	No		1	1	1	Negligible
3	Evidence of surface water flow	1	1	1	Negligible	No		2	1	2	Negligible
4	Evidence of previous failures/slips	0	1	0	Not Applicable	No		0	1	0	Not Applicable
5	Type of vegetation	1	1	1	Negligible	No		2	1	2	Negligible
6	General slope characteristics upslope/downslope from infrastructure location	1	1	1	Negligible	No	See Below	2	1	2	Negligible
7	Evidence of very soft/soft clay at base of peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
8	Evidence of mechanically cut peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
9	Evidence of quaking or buoyant peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
10	Evidence of bog pools	0	1	0	Not Applicable	No		0	1	0	Not Applicable
11	Relatively deep peat	3	1	3	Negligible	No		2	1	2	Negligible

	General Control Measures to be Implemented Prior to/and During Construction for **Turbine T09**
i	Maintain hydrology of area as far as possible;
ii	Use of experienced geotechnical staff for site investigation;
iii	Use of experienced contractors and trained operators to carry out the work;
iv	Detailed ground investigation to determine peat, mineral soil and bedrock condition and properties.
v	Inspection & approval of turbine base sub-formation by a competent person where a gravity type foundation base is constructed.

Note

(1) FOS abbreviations are: u: FOS for undrained analysis, d: FOS for drained analysis.
(2) Probability assessed as per Table A and B of Appendix D.
(3) Impact based on distance of infrastructure element to nearest watercourse.

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APPENDIX C

Calculated FOS for Peat Slopes on Site

Infinite Slope Analysis

Assumptions as follows:

(1) Undrained analysis assumed to give worst case, using infinite slope:

Infinite slope analysis (undrained)

$FoS = Cu/[\gamma.z.\sin \beta \cos \beta]$

where,
β = slope angle
Cu = undrained strength
z = depth of sliding layer
γ = bulk unit weight

Calculated FoS of Natural Peat Slopes for Derrynadarragh Wind Farm - Drained Analysis

Turbine No./Waypoint	Slope	Design c'	Bulk unit weight of Peat	Unit weight of Water	Depth of In situ Peat	Friction Angle	Surcharge Equivalent Placed Fill	Equivalent Total Depth of Peat (m)	Factor of Safety for Load Condition	
	α (deg)	c' (kPa)	γ (kN/m^3)	γ_w (kN/m^3)	(m)	ø' (deg)	Condition (2)	Condition (2)	Condition (1)	Condition (2)
									100% Water	100% Water
T01	2	4	10.0	10.0	0.6	25	1.0	1.6	**31.27**	**20.35**
T02	2	4	10.0	10.0	2.2	25	1.0	3.2	**18.52**	**16.91**
T03	2	4	10.0	10.0	0.5	25	1.0	1.5	**37.25**	**21.10**
T04	2	4	10.0	10.0	1.4	25	1.0	2.4	**21.79**	**18.21**
T05	2	4	10.0	10.0	2.3	25	1.0	3.3	**4.99**	**7.52**
T06	2	4	10.0	10.0	0.6	25	1.0	1.6	**19.11**	**15.51**
T07	2	4	10.0	10.0	0.3	25	1.0	1.3	**40.96**	**19.39**
T08	2	4	10.0	10.0	0.2	26	1.0	1.2	**61.75**	**23.22**
T09	2	4	10.0	10.0	0.2	27	1.0	1.2	**78.30**	**24.31**
1	2	4	10.0	10.0	0.8	25	1.0	1.8	**14.34**	**13.79**
2	2	4	10.0	10.0	0.4	25	1.0	1.4	**28.67**	**17.73**
3	2	4	10.0	10.0	0.6	25	1.0	1.6	**19.11**	**15.51**
4	3	4	10.0	10.0	1	25	1.0	2.0	**7.65**	**8.28**
5	2	4	10.0	10.0	0.3	25	1.0	1.3	**38.23**	**19.09**
6	2	4	10.0	10.0	0.2	25	1.0	1.2	**57.34**	**20.68**
7	2	4	10.0	10.0	0.4	25	1.0	1.4	**28.67**	**17.73**
8	3	4	10.0	10.0	1.2	25	1.0	2.2	**6.38**	**7.52**
9	3	4	10.0	10.0	1	25	1.0	2.0	**7.65**	**8.28**
10	2	4	10.0	10.0	0.4	25	1.0	1.4	**28.67**	**17.73**
11	2	4	10.0	10.0	0.2	25	1.0	1.2	**57.34**	**20.68**
12	3	4	10.0	10.0	0.3	25	1.0	1.3	**25.51**	**12.73**
13	2	4	10.0	10.0	2.2	25	1.0	3.2	**5.21**	**7.76**
14	2	4	10.0	10.0	0.2	25	1.0	1.2	**57.34**	**20.68**
15	2	4	10.0	10.0	0.1	25	1.0	1.1	**114.68**	**22.57**
16	2	4	10.0	10.0	0.2	25	1.0	1.2	**57.34**	**20.68**
17	2	4	10.0	10.0	0.3	25	1.0	1.3	**38.23**	**19.09**
18	2	4	10.0	10.0	2	25	1.0	3.0	**5.73**	**8.27**
19	2	4	10.0	10.0	1.8	25	1.0	2.8	**6.37**	**8.86**
20	2	4	10.0	10.0	0.4	25	1.0	1.4	**28.67**	**17.73**
21	2	4	10.0	10.0	0.2	25	1.0	1.2	**57.34**	**20.68**
22	2	4	10.0	10.0	0.1	25	1.0	1.1	**114.68**	**22.57**
23	2	4	10.0	10.0	0.1	25	1.0	1.1	**114.68**	**22.57**
24	2	4	10.0	10.0	0.3	25	1.0	1.3	**38.23**	**19.09**
25	2	4	10.0	10.0	0.2	25	1.0	1.2	**57.34**	**20.68**
26	2	4	10.0	10.0	0.8	25	1.0	1.8	**14.34**	**13.79**
27	2	4	10.0	10.0	0.5	25	1.0	1.5	**22.94**	**16.55**
28	2	4	10.0	10.0	0.3	25	1.0	1.3	**38.23**	**19.09**
29	2	4	10.0	10.0	0.3	25	1.0	1.3	**51.58**	**22.18**
30	2	4	10.0	10.0	0.2	25	1.0	1.2	**70.70**	**22.91**
31	2	4	10.0	10.0	0.2	25	1.0	1.2	**70.70**	**22.91**
32	2	4	10.0	10.0	0.2	25	1.0	1.2	**70.70**	**22.91**
33	2	4	10.0	10.0	0.3	25	1.0	1.3	**51.58**	**22.18**
34	2	4	10.0	10.0	0.2	25	1.0	1.2	**70.70**	**22.91**
35	2	4	10.0	10.0	0.3	25	1.0	1.3	**51.58**	**22.18**
36	2	4	10.0	10.0	1.2	25	1.0	2.2	**22.91**	**18.57**
37	2	4	10.0	10.0	2	25	1.0	3.0	**19.09**	**17.18**
38	2	4	10.0	10.0	0.8	25	1.0	1.8	**27.69**	**19.72**
39	2	4	10.0	10.0	1.2	25	1.0	2.2	**22.91**	**18.57**
40	3	4	10.0	10.0	0.2	25	1.0	1.2	**47.16**	**15.28**
41	3	4	10.0	10.0	0.1	25	1.0	1.1	**85.43**	**15.86**
42	2	4	10.0	10.0	0.2	25	1.0	1.2	**70.70**	**22.91**
43	2	4	10.0	10.0	0.3	25	1.0	1.3	**51.58**	**22.18**
44	2	4	10.0	10.0	0.4	25	1.0	1.4	**42.02**	**21.55**
45	3	4	10.0	10.0	1	25	1.0	2.0	**16.55**	**12.72**
46	3	4	10.0	10.0	1.2	25	1.0	2.2	**15.28**	**12.38**
47	2	4	10.0	10.0	0.8	25	1.0	1.8	**27.69**	**19.72**
48	2	4	10.0	10.0	0.9	25	1.0	1.9	**26.10**	**19.39**
49	3	4	10.0	10.0	0.2	25	1.0	1.2	**47.16**	**15.28**
50	3	4	10.0	10.0	0.1	25	1.0	1.1	**85.43**	**15.86**
51	3	4	10.0	10.0	0.2	25	1.0	1.2	**47.16**	**15.28**
52	2	4	10.0	10.0	0.8	25	1.0	1.8	**27.69**	**19.72**
53	2	4	10.0	10.0	0.4	25	1.0	1.4	**42.02**	**21.55**
54	2	4	10.0	10.0	0.3	25	1.0	1.3	**51.58**	**22.18**
55	3	4	10.0	10.0	1.8	25	1.0	2.8	**13.15**	**11.63**
56	3	4	10.0	10.0	2	25	1.0	3.0	**12.72**	**11.45**
57	2	4	10.0	10.0	3.2	25	1.0	4.2	**16.94**	**16.08**
58	4	4	10.0	10.0	0.2	25	1.0	1.2	**35.41**	**11.46**
59	3	4	10.0	10.0	0.1	25	1.0	1.1	**85.43**	**15.86**
60	2	4	10.0	10.0	0.2	25	1.0	1.2	**70.70**	**22.91**
61	2	4	10.0	10.0	0.2	25	1.0	1.2	**70.70**	**22.91**
62	2	4	10.0	10.0	0.2	25	1.0	1.2	**70.70**	**22.91**
63	2	4	10.0	10.0	0.3	25	1.0	1.3	**51.58**	**22.18**
64	2	4	10.0	10.0	0.3	25	1.0	1.3	**51.58**	**22.18**
65	2	4	10.0	10.0	2.5	25	1.0	3.5	**17.94**	**16.63**
66	2	4	10.0	10.0	1.4	25	1.0	2.4	**21.55**	**18.13**
67	2	4	10.0	10.0	2.2	25	1.0	3.2	**18.57**	**16.94**
68	3	4	10.0	10.0	1.2	25	1.0	2.2	**15.28**	**12.38**
69	3	4	10.0	10.0	0.1	25	1.0	1.1	**85.43**	**15.86**
70	3	4	10.0	10.0	0.2	25	1.0	1.2	**47.16**	**15.28**
71	2	4	10.0	10.0	0.1	25	1.0	1.1	**128.04**	**23.78**
72	3	4	10.0	10.0	0.3	25	1.0	1.3	**34.41**	**14.78**
73	3	4	10.0	10.0	0.4	25	1.0	1.4	**28.03**	**14.36**
74	3	4	10.0	10.0	0.2	25	1.0	1.2	**47.16**	**15.28**
75	3	4	10.0	10.0	0.4	25	1.0	1.4	**28.03**	**14.36**
76	2	4	10.0	10.0	0.4	25	1.0	1.4	**42.02**	**21.55**
77	2	4	10.0	10.0	0.4	25	1.0	1.4	**42.02**	**21.55**
78	3	4	10.0	10.0	2.5	25	1.0	3.5	**11.96**	**11.08**
79	2	4	10.0	10.0	2.2	25	1.0	3.2	**18.57**	**16.94**

Calculated FoS of Natural Peat Slopes for Derrynadarragh Wind Farm - Drained Analysis

Turbine No./Waypoint	Slope	Design c'	Bulk unit weight of Peat	Unit weight of Water	Depth of In situ Peat	Friction Angle	Surcharge Equivalent Placed Fill	Equivalent Total Depth of Peat (m)	Factor of Safety for Load Condition	
	α (deg)	c' (kPa)	γ (kN/m^3)	γ_w (kN/m^3)	(m)	ø' (deg)	Condition (2)	Condition (2)	Condition (1)	Condition (2)
									100% Water	100% Water
80	2	4	10.0	10.0	2.4	25	1.0	3.4	**18.13**	**16.73**
81	3	4	10.0	10.0	0.2	25	1.0	1.2	**47.16**	**15.28**
82	2	4	10.0	10.0	0.3	25	1.0	1.3	**51.58**	**22.18**
83	2	4	10.0	10.0	0.1	25	1.0	1.1	**128.04**	**23.78**
84	2	4	10.0	10.0	2	25	1.0	3.0	**19.09**	**17.18**
85	2	4	10.0	10.0	2.2	25	1.0	3.2	**18.57**	**16.94**
86	2	4	10.0	10.0	0.4	25	1.0	1.4	**42.02**	**21.55**
87	2	4	10.0	10.0	0.4	25	1.0	1.4	**42.02**	**21.55**
88	3	4	10.0	10.0	2.5	25	1.0	3.5	**11.96**	**11.08**
89	2	4	10.0	10.0	2	25	1.0	3.0	**19.09**	**17.18**
90	2	4	10.0	10.0	2	25	1.0	3.0	**19.09**	**17.18**
91	3	4	10.0	10.0	0.1	25	1.0	1.1	**85.43**	**15.86**
92	3	4	10.0	10.0	0.1	25	1.0	1.1	**85.43**	**15.86**
93	2	4	10.0	10.0	0.5	25	1.0	1.5	**36.29**	**21.00**
94	2	4	10.0	10.0	1.6	25	1.0	2.6	**20.52**	**17.76**
95	2	4	10.0	10.0	2.3	25	1.0	3.3	**18.34**	**16.83**
96	2	4	10.0	10.0	2.5	25	1.0	3.5	**17.94**	**16.63**
97	2	4	10.0	10.0	0.4	25	1.0	1.4	**42.02**	**21.55**
98	2	4	10.0	10.0	2.2	25	1.0	3.2	**18.57**	**16.94**
99	2	4	10.0	10.0	2	25	1.0	3.0	**19.09**	**17.18**
100	2	4	10.0	10.0	2.5	25	1.0	3.5	**17.94**	**16.63**
101	2	4	10.0	10.0	0.3	25	1.0	1.3	**51.58**	**22.18**
102	2	4	10.0	10.0	0.9	25	1.0	1.9	**26.10**	**19.39**
103	2	4	10.0	10.0	0.6	25	1.0	1.6	**32.47**	**20.52**
104	2	4	10.0	10.0	0.1	25	1.0	1.1	**128.04**	**23.78**
105	3	4	10.0	10.0	1.2	25	1.0	2.2	**15.28**	**12.38**
106	2	4	10.0	10.0	1.8	25	1.0	2.8	**19.72**	**17.45**
107	3	4	10.0	10.0	1.8	25	1.0	2.8	**13.15**	**11.63**
108	2	4	10.0	10.0	4.2	25	1.0	5.2	**16.08**	**15.56**
109	3	4	10.0	10.0	2.1	25	1.0	3.1	**12.54**	**11.37**
110	3	4	10.0	10.0	1.8	25	1.0	2.8	**13.15**	**11.63**
111	3	4	10.0	10.0	2	25	1.0	3.0	**12.72**	**11.45**
112	2	4	10.0	10.0	2.5	25	1.0	3.5	**17.94**	**16.63**
113	3	4	10.0	10.0	0.2	25	1.0	1.2	**47.16**	**15.28**
114	3	4	10.0	10.0	0.4	25	1.0	1.4	**28.03**	**14.36**
115	2	4	10.0	10.0	0.2	25	1.0	1.2	**70.70**	**22.91**
116	2	4	10.0	10.0	0.6	25	1.0	1.6	**32.47**	**20.52**
117	2	4	10.0	10.0	0.3	25	1.0	1.3	**51.58**	**22.18**
118	2	4	10.0	10.0	2	25	1.0	3.0	**19.09**	**17.18**
119	2	4	10.0	10.0	2.3	25	1.0	3.3	**18.34**	**16.83**
120	2	4	10.0	10.0	2.6	25	1.0	3.6	**17.76**	**16.54**
121	2	4	10.0	10.0	1.6	25	1.0	2.6	**20.52**	**17.76**
122	2	4	10.0	10.0	2	25	1.0	3.0	**19.09**	**17.18**
123	3	4	10.0	10.0	2.2	25	1.0	3.2	**12.38**	**11.29**
124	3	4	10.0	10.0	2	25	1.0	3.0	**12.72**	**11.45**
125	3	4	10.0	10.0	1.2	25	1.0	2.2	**15.28**	**12.38**
126	2	4	10.0	10.0	3.5	25	1.0	4.5	**16.63**	**15.90**
127	2	4	10.0	10.0	0.1	25	1.0	1.1	**128.04**	**23.78**
128	2	4	10.0	10.0	0.1	25	1.0	1.1	**128.04**	**23.78**
129	3	4	10.0	10.0	0.8	25	1.0	1.8	**18.46**	**13.15**
130	2	4	10.0	10.0	0.6	25	1.0	1.6	**32.47**	**20.52**
131	3	4	10.0	10.0	0.8	25	1.0	1.8	**18.46**	**13.15**
132	2	4	10.0	10.0	2.2	25	1.0	3.2	**18.57**	**16.94**
133	2	4	10.0	10.0	2.2	25	1.0	3.2	**18.57**	**16.94**
134	3	4	10.0	10.0	2.6	25	1.0	3.6	**11.84**	**11.02**
135	2	4	10.0	10.0	1.2	25	1.0	2.2	**22.91**	**18.57**
136	2	4	10.0	10.0	2.5	25	1.0	3.5	**17.94**	**16.63**
137	2	4	10.0	10.0	2	25	1.0	3.0	**19.09**	**17.18**
138	2	4	10.0	10.0	1.8	25	1.0	2.8	**19.72**	**17.45**
139	3	4	10.0	10.0	2.2	25	1.0	3.2	**12.38**	**11.29**
140	2	4	10.0	10.0	0.5	25	1.0	1.5	**36.29**	**21.00**
141	2	4	10.0	10.0	1.4	25	1.0	2.4	**21.55**	**18.13**
142	2	4	10.0	10.0	1.2	25	1.0	2.2	**22.91**	**18.57**
143	2	4	10.0	10.0	0.3	25	1.0	1.3	**51.58**	**22.18**
144	2	4	10.0	10.0	0.4	25	1.0	1.4	**42.02**	**21.55**
145	2	4	10.0	10.0	1.2	25	1.0	2.2	**22.91**	**18.57**
146	2	4	10.0	10.0	1	25	1.0	2.0	**24.82**	**19.09**
147	2	4	10.0	10.0	0.8	25	1.0	1.8	**27.69**	**19.72**
148	2	4	10.0	10.0	0.6	25	1.0	1.6	**32.47**	**20.52**
149	2	4	10.0	10.0	0.6	25	1.0	1.6	**32.47**	**20.52**
150	3	4	10.0	10.0	0.5	25	1.0	1.5	**24.20**	**14.00**
151	3	4	10.0	10.0	2.5	25	1.0	3.5	**11.96**	**11.08**
152	2	4	10.0	10.0	2.8	25	1.0	3.8	**17.45**	**16.37**
153	2	4	10.0	10.0	2.6	25	1.0	3.6	**17.76**	**16.54**
154	2	4	10.0	10.0	3	25	1.0	4.0	**17.18**	**16.22**
155	3	4	10.0	10.0	1.9	25	1.0	2.9	**12.93**	**11.54**
156	2	4	10.0	10.0	2	25	1.0	3.0	**19.09**	**17.18**
157	3	4	10.0	10.0	1.8	25	1.0	2.8	**13.15**	**11.63**
158	2	4	10.0	10.0	0.2	25	1.0	1.2	**70.70**	**22.91**
159	2	4	10.0	10.0	1.2	25	1.0	2.2	**22.91**	**18.57**
160	3	4	10.0	10.0	1	25	1.0	2.0	**16.55**	**12.72**
161	3	4	10.0	10.0	0.4	25	1.0	1.4	**28.03**	**14.36**
162	2	4	10.0	10.0	0.2	25	1.0	1.2	**70.70**	**22.91**
163	2	4	10.0	10.0	0.4	25	1.0	1.4	**42.02**	**21.55**
164	3	4	10.0	10.0	0.3	25	1.0	1.3	**34.41**	**14.78**
165	3	4	10.0	10.0	0.2	25	1.0	1.2	**47.16**	**15.28**
166	2	4	10.0	10.0	0.9	25	1.0	1.9	**26.10**	**19.39**
167	2	4	10.0	10.0	0.8	25	1.0	1.8	**27.69**	**19.72**
168	2	4	10.0	10.0	0.1	25	1.0	1.1	**128.04**	**23.78**

Calculated FoS of Natural Peat Slopes for Derrynadarragh Wind Farm - Drained Analysis

Turbine No./Waypoint	Slope	Design c'	Bulk unit weight of Peat	Unit weight of Water	Depth of In situ Peat	Friction Angle	Surcharge Equivalent Placed Fill	Equivalent Total Depth of Peat (m)	Factor of Safety for Load Condition	
	α (deg)	c' (kPa)	γ (kN/m^3)	γ_w (kN/m^3)	(m)	ø' (deg)	Condition (2)	Condition (2)	Condition (1)	Condition (2)
									100% Water	100% Water
169	2	4	10.0	10.0	0.9	25	1.0	1.9	**26.10**	**19.39**
170	2	4	10.0	10.0	2.6	25	1.0	3.6	**17.76**	**16.54**
171	2	4	10.0	10.0	3	25	1.0	4.0	**17.18**	**16.22**
172	2	4	10.0	10.0	1.8	25	1.0	2.8	**19.72**	**17.45**
173	2	4	10.0	10.0	1.8	25	1.0	2.8	**19.72**	**17.45**
174	2	4	10.0	10.0	1.5	25	1.0	2.5	**21.00**	**17.94**
175	2	4	10.0	10.0	0.6	25	1.0	1.6	**32.47**	**20.52**
176	2	4	10.0	10.0	0.5	25	1.0	1.5	**36.29**	**21.00**
177	2	4	10.0	10.0	2	25	1.0	3.0	**19.09**	**17.18**
178	2	4	10.0	10.0	0.5	25	1.0	1.5	**36.29**	**21.00**
179	2	4	10.0	10.0	0.2	25	1.0	1.2	**70.70**	**22.91**
180	2	4	10.0	10.0	0.2	25	1.0	1.2	**70.70**	**22.91**
181	2	4	10.0	10.0	0.2	25	1.0	1.2	**70.70**	**22.91**
182	2	4	10.0	10.0	0.2	25	1.0	1.2	**70.70**	**22.91**
183	2	4	10.0	10.0	0.3	25	1.0	1.3	**51.58**	**22.18**
184	2	4	10.0	10.0	0.1	25	1.0	1.1	**128.04**	**23.78**
185	2	4	10.0	10.0	0.2	25	1.0	1.2	**70.70**	**22.91**
186	2	4	10.0	10.0	0.2	25	1.0	1.2	**70.70**	**22.91**
187	2	4	10.0	10.0	0.3	25	1.0	1.3	**51.58**	**22.18**
188	2	4	10.0	10.0	0.3	25	1.0	1.3	**51.58**	**22.18**
189	2	4	10.0	10.0	1.8	25	1.0	2.8	**19.72**	**17.45**
190	2	4	10.0	10.0	0.5	25	1.0	1.5	**36.29**	**21.00**
191	3	4	10.0	10.0	0.9	25	1.0	1.9	**17.40**	**12.93**
192	3	4	10.0	10.0	0.4	25	1.0	1.4	**28.03**	**14.36**
193	2	4	10.0	10.0	0.2	25	1.0	1.2	**70.70**	**22.91**
194	2	4	10.0	10.0	0.2	25	1.0	1.2	**70.70**	**22.91**
195	2	4	10.0	10.0	0.2	25	1.0	1.2	**70.70**	**22.91**
196	2	4	10.0	10.0	0.1	25	1.0	1.1	**128.04**	**23.78**
197	2	4	10.0	10.0	0.2	25	1.0	1.2	**70.70**	**22.91**
198	2	4	10.0	10.0	0.3	25	1.0	1.3	**51.58**	**22.18**
199	2	4	10.0	10.0	0.3	25	1.0	1.3	**51.58**	**22.18**
200	3	4	10.0	10.0	0.4	25	1.0	1.4	**28.03**	**14.36**
201	2	4	10.0	10.0	1	25	1.0	2.0	**24.82**	**19.09**
202	2	4	10.0	10.0	1.1	25	1.0	2.1	**23.78**	**18.81**
203	2	4	10.0	10.0	2.4	25	1.0	3.4	**18.13**	**16.73**
204	2	4	10.0	10.0	3.4	25	1.0	4.4	**16.73**	**15.96**
205	2	4	10.0	10.0	3.2	25	1.0	4.2	**16.94**	**16.08**
206	2	4	10.0	10.0	1.5	25	1.0	2.5	**21.00**	**17.94**
207	2	4	10.0	10.0	3.8	25	1.0	4.8	**16.37**	**15.74**
208	2	4	10.0	10.0	4	25	1.0	5.0	**16.22**	**15.65**
209	2	4	10.0	10.0	0.6	25	1.0	1.6	**32.47**	**20.52**
210	2	4	10.0	10.0	0.4	25	1.0	1.4	**42.02**	**21.55**
211	3	4	10.0	10.0	0.4	25	1.0	1.4	**28.03**	**14.36**
212	2	4	10.0	10.0	0.3	25	1.0	1.3	**51.58**	**22.18**
213	2	4	10.0	10.0	0.1	25	1.0	1.1	**128.04**	**23.78**
214	2	4	10.0	10.0	0.2	25	1.0	1.2	**70.70**	**22.91**
215	2	4	10.0	10.0	0.2	25	1.0	1.2	**70.70**	**22.91**
216	3	4	10.0	10.0	0.5	25	1.0	1.5	**24.20**	**14.00**
217	2	4	10.0	10.0	0.9	25	1.0	1.9	**26.10**	**19.39**
218	2	4	10.0	10.0	1	25	1.0	2.0	**24.82**	**19.09**
219	2	4	10.0	10.0	3.2	25	1.0	4.2	**16.94**	**16.08**
220	2	4	10.0	10.0	3.2	25	1.0	4.2	**16.94**	**16.08**
221	2	4	10.0	10.0	1.6	25	1.0	2.6	**20.52**	**17.76**
222	2	4	10.0	10.0	4	25	1.0	5.0	**16.22**	**15.65**
223	2	4	10.0	10.0	0.4	25	1.0	1.4	**42.02**	**21.55**
224	2	4	10.0	10.0	0.3	25	1.0	1.3	**51.58**	**22.18**
225	2	4	10.0	10.0	0.4	25	1.0	1.4	**42.02**	**21.55**
226	2	4	10.0	10.0	0.1	25	1.0	1.1	**128.04**	**23.78**
227	2	4	10.0	10.0	0.2	25	1.0	1.2	**70.70**	**22.91**
228	2	4	10.0	10.0	0.8	25	1.0	1.8	**27.69**	**19.72**
229	2	4	10.0	10.0	1.1	25	1.0	2.1	**23.78**	**18.81**
230	2	4	10.0	10.0	1	25	1.0	2.0	**24.82**	**19.09**
231	3	4	10.0	10.0	1.5	25	1.0	2.5	**14.00**	**11.96**
232	2	4	10.0	10.0	0.5	25	1.0	1.5	**36.29**	**21.00**
234	2	4	10.0	10.0	0.3	25	1.0	1.3	**51.58**	**22.18**
235	2	4	10.0	10.0	0.3	25	1.0	1.3	**51.58**	**22.18**
236	2	4	10.0	10.0	0.4	25	1.0	1.4	**42.02**	**21.55**
237	2	4	10.0	10.0	0.2	25	1.0	1.2	**70.70**	**22.91**
238	2	4	10.0	10.0	0.2	25	1.0	1.2	**70.70**	**22.91**
239	2	4	10.0	10.0	0.6	25	1.0	1.6	**32.47**	**20.52**
240	2	4	10.0	10.0	1	25	1.0	2.0	**24.82**	**19.09**
241	3	4	10.0	10.0	1.2	25	1.0	2.2	**15.28**	**12.38**
242	2	4	10.0	10.0	1.5	25	1.0	2.5	**21.00**	**17.94**
243	2	4	10.0	10.0	2	25	1.0	3.0	**19.09**	**17.18**
244	3	4	10.0	10.0	1.5	25	1.0	2.5	**14.00**	**11.96**
249	2	4	10.0	10.0	0.2	25	1.0	1.2	**70.70**	**22.91**
250	2	4	10.0	10.0	0.1	25	1.0	1.1	**128.04**	**23.78**
251	2	4	10.0	10.0	0.1	25	1.0	1.1	**128.04**	**23.78**
252	2	4	10.0	10.0	0.2	25	1.0	1.2	**70.70**	**22.91**
253	3	4	10.0	10.0	0.8	25	1.0	1.8	**18.46**	**13.15**
254	2	4	10.0	10.0	1.4	25	1.0	2.4	**21.55**	**18.13**
255	2	4	10.0	10.0	1.3	25	1.0	2.3	**22.18**	**18.34**
256	2	4	10.0	10.0	1.5	25	1.0	2.5	**21.00**	**17.94**
265	2	4	10.0	10.0	0.2	25	1.0	1.2	**70.70**	**22.91**

Calculated FoS of Natural Peat Slopes for Derrynadarragh Wind Farm - Drained Analysis

Turbine No./Waypoint	Slope	Design c'	Bulk unit weight of Peat	Unit weight of Water	Depth of In situ Peat	Friction Angle	Surcharge Equivalent Placed Fill	Equivalent Total Depth of Peat (m)	Factor of Safety for Load Condition	
	α (deg)	c' (kPa)	γ (kN/m^3)	γ_w (kN/m^3)	(m)	ø' (deg)	Condition (2)	Condition (2)	Condition (1)	Condition (2)
									100% Water	100% Water
266	2	4	10.0	10.0	0.1	25	1.0	1.1	**128.04**	**23.78**
267	2	4	10.0	10.0	0.2	25	1.0	1.2	**70.70**	**22.91**
268	2	4	10.0	10.0	0.2	25	1.0	1.2	**70.70**	**22.91**
269	2	4	10.0	10.0	1.2	25	1.0	2.2	**22.91**	**18.57**
270	2	4	10.0	10.0	2.5	25	1.0	3.5	**17.94**	**16.63**
271	2	4	10.0	10.0	2.5	25	1.0	3.5	**17.94**	**16.63**
281	3	4	10.0	10.0	0.1	25	1.0	1.1	**85.43**	**15.86**
282	3	4	10.0	10.0	0.2	25	1.0	1.2	**47.16**	**15.28**
283	2	4	10.0	10.0	0.1	25	1.0	1.1	**128.04**	**23.78**
292	3	4	10.0	10.0	0.1	25	1.0	1.1	**85.43**	**15.86**
293	2	4	10.0	10.0	0.1	25	1.0	1.1	**128.04**	**23.78**
302	3	4	10.0	10.0	0.2	25	1.0	1.2	**47.16**	**15.28**
318	2	4	10.0	10.0	2.5	25	1.0	3.5	**17.94**	**16.63**
319	2	4	10.0	10.0	2	25	1.0	3.0	**19.09**	**17.18**
320	2	4	10.0	10.0	0.3	25	1.0	1.3	**51.58**	**22.18**
321	2	4	10.0	10.0	0.3	25	1.0	1.3	**51.58**	**22.18**
TC01	3	4	10.0	10.0	1.2	26	1.0	2.2	**15.68**	**12.79**
TC02	2	4	10.0	10.0	0.8	27	1.0	1.8	**28.93**	**20.96**
TC03	2	4	10.0	10.0	1	28	1.0	2.0	**26.69**	**20.96**
AT01	2	4	10.0	10.0	0.2	29	1.0	1.2	**73.22**	**25.43**
AT02	2	4	10.0	10.0	1.2	30	1.0	2.2	**26.09**	**21.75**
AT03	3	4	10.0	10.0	2	31	1.0	3.0	**15.29**	**14.02**
AT04	2	4	10.0	10.0	1.4	32	1.0	2.4	**26.09**	**22.67**
AT05	2	4	10.0	10.0	0.5	33	1.0	1.5	**41.53**	**26.24**
AT06	2	4	10.0	10.0	0.6	34	1.0	1.6	**38.43**	**26.48**
AT07	2	4	10.0	10.0	0.3	35	1.0	1.3	**58.28**	**28.87**
SS01	2	4	10.0	10.0	0.2	36	1.0	1.2	**78.15**	**30.36**
SS02	2	4	10.0	10.0	0.2	37	1.0	1.2	**78.92**	**31.14**
SS03	2	4	10.0	10.0	0.4	38	1.0	1.4	**51.04**	**30.56**
SS04	2	4	10.0	10.0	0.5	39	1.0	1.5	**46.13**	**30.83**
SS05	2	4	10.0	10.0	0.3	40	1.0	1.3	**62.26**	**32.85**
AT08	3	4	10.0	10.0	0.2	41	1.0	1.2	**54.85**	**22.96**
AT09	2	4	10.0	10.0	0.3	42	1.0	1.3	**64.01**	**34.61**
AT10	3	4	10.0	10.0	0.3	43	1.0	1.3	**43.30**	**23.68**
AT11	2	4	10.0	10.0	1.5	44	1.0	2.5	**35.30**	**32.24**
AT12	3	4	10.0	10.0	1.4	45	1.0	2.4	**24.55**	**22.27**
AT13	3	4	10.0	10.0	2	46	1.0	3.0	**23.59**	**22.31**
AT14	2	4	10.0	10.0	1.5	47	1.0	2.5	**38.35**	**35.30**
AT15	2	4	10.0	10.0	0.5	48	1.0	1.5	**54.74**	**39.45**
AT16	2	4	10.0	10.0	0.3	49	1.0	1.3	**71.17**	**41.76**
AT17	2	4	10.0	10.0	0.3	50	1.0	1.3	**72.36**	**42.95**
T05-A	2	4	10.0	10.0	2.2	51	1.0	3.2	**40.58**	**38.95**
T05-B	2	4	10.0	10.0	2.4	52	1.0	3.4	**41.43**	**40.03**
T05-C	2	4	10.0	10.0	2	53	1.0	3.0	**43.74**	**41.82**
T05-D	3	4	10.0	10.0	2.1	54	1.0	3.1	**29.91**	**28.73**
T05-E	4	4	10.0	10.0	1.8	55	1.0	2.8	**23.62**	**22.48**
T05-F	3	4	10.0	10.0	1.6	56	1.0	2.6	**33.07**	**31.23**
T05-G	3	4	10.0	10.0	2	57	1.0	3.0	**33.21**	**31.93**
T05-H	2	4	10.0	10.0	1.4	58	1.0	2.4	**54.02**	**50.61**
T05-I	2	4	10.0	10.0	1.5	59	1.0	2.5	**55.30**	**52.25**
T05-J	2	4	10.0	10.0	1.2	60	1.0	2.2	**59.16**	**54.81**
T05	2	4	10.0	10.0	2	61	1.0	3.0	**57.40**	**55.48**
SS2-1	2	4	10.0	10.0	0.8	62	1.0	1.8	**68.19**	**60.23**
SS2-2	2	4	10.0	10.0	1	63	1.0	2.0	**67.67**	**61.94**
SS2-3	3	4	10.0	10.0	0.6	64	1.0	1.6	**51.88**	**43.91**
SS2-4	3	4	10.0	10.0	1.1	65	1.0	2.1	**47.88**	**44.56**
SS2-5	3	4	10.0	10.0	0.8	66	1.0	1.8	**52.42**	**47.11**
							Minimum =		**4.99**	**7.52**
							Maximum =		**128.04**	**61.94**
							Average =		**41.74**	**20.33**

Notes:

(1) Assuming a bulk unit weight of peat of 10 (kN/m^3)

(2) Assuming a surcharge equivalent to fill depth of 1.0m.

(3) Slope inclination (β) based on site readings and contour survey plans of site.

(4) FoS is based on slope inclination and shear test results obtained from published data.

(5) Peat depths based on probes carried out by FT.

(6) For load conditions see Report text.

(7) Minimum acceptable factor of safety required of 1.3 for first-time failures based on BS: 6031:1981 Code of practice for Earthworks.

Calculated FoS of Natural Peat Slopes for Derrynadarragh Wind Farm - Undrained Analysis

Turbine No./Waypoint	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)
T01	659937	714994	2	6	10	0.6	1.6	**26.88**	**10.49**
T02	658662	716607	2	6	10	2.2	3.2	**7.75**	**5.34**
T03	659623	716518	2	6	10	0.5	1.5	**35.84**	**11.62**
T04	659622	715347	2	6	10	1.4	2.4	**12.65**	**7.29**
T05	659128	716060	2	6	10	2.3	3.3	**7.48**	**5.21**
T06	658384	715670	2	6	10	0.6	1.6	**28.67**	**10.75**
T07	659268	715518	2	6	10	0.3	1.3	**61.44**	**13.44**
T08	659680	715968	2	6	10	0.2	1.2	**71.68**	**13.87**
T09	660136	715709	2	6	10	0.2	1.2	**95.57**	**14.58**
1	657495	716774	2	6	10	0.8	1.8	**21.50**	**9.56**
2	657791	715771	2	6	10	0.4	1.4	**43.01**	**12.29**
3	657791	715671	2	6	10	0.6	1.6	**28.67**	**10.75**
4	657891	716471	3	6	10	1	2.0	**11.48**	**5.74**
5	657891	715771	2	6	10	0.3	1.3	**57.34**	**13.23**
6	657891	715671	2	6	10	0.2	1.2	**86.01**	**14.34**
7	657891	715571	2	6	10	0.4	1.4	**43.01**	**12.29**
8	657991	716471	3	6	10	1.2	2.2	**9.57**	**5.22**
9	657991	716371	3	6	10	1	2.0	**11.48**	**5.74**
10	657991	715771	2	6	10	0.4	1.4	**43.01**	**12.29**
11	657991	715671	2	6	10	0.2	1.2	**86.01**	**14.34**
12	657991	715571	3	6	10	0.3	1.3	**38.27**	**8.83**
13	658091	716371	2	6	10	2.2	3.2	**7.82**	**5.38**
14	658091	715871	2	6	10	0.2	1.2	**86.01**	**14.34**
15	658091	715771	2	6	10	0.1	1.1	**172.03**	**15.64**
16	658091	715671	2	6	10	0.2	1.2	**86.01**	**14.34**
17	658091	715571	2	6	10	0.3	1.3	**57.34**	**13.23**
18	658191	716371	2	6	10	2	3.0	**8.60**	**5.73**
19	658191	716271	2	6	10	1.8	2.8	**9.56**	**6.14**
20	658191	716171	2	6	10	0.4	1.4	**43.01**	**12.29**
21	658191	715971	2	6	10	0.2	1.2	**86.01**	**14.34**
22	658191	715871	2	6	10	0.1	1.1	**172.03**	**15.64**
23	658191	715771	2	6	10	0.1	1.1	**172.03**	**15.64**
24	658191	715671	2	6	10	0.3	1.3	**57.34**	**13.23**
25	658191	715571	2	6	10	0.2	1.2	**86.01**	**14.34**
26	658291	716371	2	6	10	0.8	1.8	**21.50**	**9.56**
27	658291	716271	2	6	10	0.5	1.5	**34.41**	**11.47**
28	658291	716171	2	6	10	0.3	1.3	**57.34**	**13.23**
29	658291	716071	2	6	10	0.3	1.3	**57.34**	**13.23**
30	658291	715871	2	6	10	0.2	1.2	**86.01**	**14.34**
31	658291	715771	2	6	10	0.2	1.2	**86.01**	**14.34**
32	658291	715671	2	6	10	0.2	1.2	**86.01**	**14.34**
33	658291	715571	2	6	10	0.3	1.3	**57.34**	**13.23**
34	658360	717494	2	6	10	0.2	1.2	**86.01**	**14.34**
35	658391	717271	2	6	10	0.3	1.3	**57.34**	**13.23**
36	658391	716371	2	6	10	1.2	2.2	**14.34**	**7.82**
37	658391	716271	2	6	10	2	3.0	**8.60**	**5.73**
38	658391	716171	2	6	10	0.8	1.8	**21.50**	**9.56**
39	658391	716071	2	6	10	1.2	2.2	**14.34**	**7.82**
40	658391	715971	3	6	10	0.2	1.2	**57.40**	**9.57**
41	658391	715871	3	6	10	0.1	1.1	**114.80**	**10.44**
42	658391	715771	2	6	10	0.2	1.2	**86.01**	**14.34**
43	658391	715671	2	6	10	0.3	1.3	**57.34**	**13.23**
44	658391	715571	2	6	10	0.4	1.4	**43.01**	**12.29**
45	658491	716571	3	6	10	1	2.0	**11.48**	**5.74**
46	658491	716471	3	6	10	1.2	2.2	**9.57**	**5.22**
47	658486	716171	2	6	10	0.8	1.8	**21.50**	**9.56**
48	658491	716071	2	6	10	0.9	1.9	**19.11**	**9.05**
49	658491	715971	3	6	10	0.2	1.2	**57.40**	**9.57**
50	658491	715871	3	6	10	0.1	1.1	**114.80**	**10.44**
51	658491	715771	3	6	10	0.2	1.2	**57.40**	**9.57**
52	658491	715671	2	6	10	0.8	1.8	**21.50**	**9.56**
53	658591	717271	2	6	10	0.4	1.4	**43.01**	**12.29**
54	658591	717171	2	6	10	0.3	1.3	**57.34**	**13.23**
55	658591	716671	3	6	10	1.8	2.8	**6.38**	**4.10**
56	658591	716571	3	6	10	2	3.0	**5.74**	**3.83**
57	658591	716471	2	6	10	3.2	4.2	**5.38**	**4.10**
58	658591	715871	4	6	10	0.2	1.2	**43.11**	**7.19**
59	658591	715771	3	6	10	0.1	1.1	**114.80**	**10.44**
60	658591	715671	2	6	10	0.2	1.2	**86.01**	**14.34**
61	658691	717371	2	6	10	0.2	1.2	**86.01**	**14.34**
62	658691	717271	2	6	10	0.2	1.2	**86.01**	**14.34**
63	658691	717171	2	6	10	0.3	1.3	**57.34**	**13.23**
64	658691	717071	2	6	10	0.3	1.3	**57.34**	**13.23**
65	658691	716971	2	6	10	2.5	3.5	**6.88**	**4.92**
66	658691	716771	2	6	10	1.4	2.4	**12.29**	**7.17**
67	658691	716671	2	6	10	2.2	3.2	**7.82**	**5.38**
68	658691	716571	3	6	10	1.2	2.2	**9.57**	**5.22**
69	658691	715871	3	6	10	0.1	1.1	**114.80**	**10.44**
70	658691	715771	3	6	10	0.2	1.2	**57.40**	**9.57**
71	658691	715671	2	6	10	0.1	1.1	**172.03**	**15.64**
72	658791	717371	3	6	10	0.3	1.3	**38.27**	**8.83**
73	658791	717271	3	6	10	0.4	1.4	**28.70**	**8.20**
74	658791	717171	3	6	10	0.2	1.2	**57.40**	**9.57**
75	658791	717071	3	6	10	0.4	1.4	**28.70**	**8.20**
76	658791	716971	2	6	10	0.4	1.4	**43.01**	**12.29**
77	658791	716871	2	6	10	0.4	1.4	**43.01**	**12.29**
78	658791	716771	3	6	10	2.5	3.5	**4.59**	**3.28**
79	658791	716671	2	6	10	2.2	3.2	**7.82**	**5.38**
80	658791	716571	2	6	10	2.4	3.4	**7.17**	**5.06**
81	658791	715871	3	6	10	0.2	1.2	**57.40**	**9.57**
82	658791	715771	2	6	10	0.3	1.3	**57.34**	**13.23**
83	658791	715671	2	6	10	0.1	1.1	**172.03**	**15.64**
84	658791	715471	2	6	10	2	3.0	**8.60**	**5.73**
85	658791	715371	2	6	10	2.2	3.2	**7.82**	**5.38**

Calculated FoS of Natural Peat Slopes for Derrynadarragh Wind Farm - Undrained Analysis

Turbine No./Waypoint	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)
86	658887	716971	2	6	10	0.4	1.4	**43.01**	**12.29**
87	658891	716871	2	6	10	0.4	1.4	**43.01**	**12.29**
88	658891	716771	3	6	10	2.5	3.5	**4.59**	**3.28**
89	658891	716671	2	6	10	2	3.0	**8.60**	**5.73**
90	658891	716571	2	6	10	2	3.0	**8.60**	**5.73**
91	658891	715871	3	6	10	0.1	1.1	**114.80**	**10.44**
92	658891	715771	3	6	10	0.1	1.1	**114.80**	**10.44**
93	658891	715671	2	6	10	0.5	1.5	**34.41**	**11.47**
94	658891	715571	2	6	10	1.6	2.6	**10.75**	**6.62**
95	658891	715471	2	6	10	2.3	3.3	**7.48**	**5.21**
96	658891	715371	2	6	10	2.5	3.5	**6.88**	**4.92**
97	658991	716871	2	6	10	0.4	1.4	**43.01**	**12.29**
98	658991	716771	2	6	10	2.2	3.2	**7.82**	**5.38**
99	658991	716671	2	6	10	2	3.0	**8.60**	**5.73**
100	658991	716571	2	6	10	2.5	3.5	**6.88**	**4.92**
101	658991	715971	2	6	10	0.3	1.3	**57.34**	**13.23**
102	658991	715871	2	6	10	0.9	1.9	**19.11**	**9.05**
103	658991	715771	2	6	10	0.6	1.6	**28.67**	**10.75**
104	658991	715671	2	6	10	0.1	1.1	**172.03**	**15.64**
105	658991	715571	3	6	10	1.2	2.2	**9.57**	**5.22**
106	658991	715471	2	6	10	1.8	2.8	**9.56**	**6.14**
107	658991	715371	3	6	10	1.8	2.8	**6.38**	**4.10**
108	658991	715271	2	6	10	4.2	5.2	**4.10**	**3.31**
109	659091	716871	3	6	10	2.1	3.1	**5.47**	**3.70**
110	659091	716771	3	6	10	1.8	2.8	**6.38**	**4.10**
111	659091	716671	3	6	10	2	3.0	**5.74**	**3.83**
112	659091	716071	2	6	10	2.5	3.5	**6.88**	**4.92**
113	659091	715971	3	6	10	0.2	1.2	**57.40**	**9.57**
114	659091	715871	3	6	10	0.4	1.4	**28.70**	**8.20**
115	659091	715771	2	6	10	0.2	1.2	**86.01**	**14.34**
116	659091	715671	2	6	10	0.6	1.6	**28.67**	**10.75**
117	659091	715571	2	6	10	0.3	1.3	**57.34**	**13.23**
118	659091	715471	2	6	10	2	3.0	**8.60**	**5.73**
119	659091	715371	2	6	10	2.3	3.3	**7.48**	**5.21**
120	659091	715271	2	6	10	2.6	3.6	**6.62**	**4.78**
121	659191	716871	2	6	10	1.6	2.6	**10.75**	**6.62**
122	659191	716771	2	6	10	2	3.0	**8.60**	**5.73**
123	659191	716671	3	6	10	2.2	3.2	**5.22**	**3.59**
124	659191	716571	3	6	10	2	3.0	**5.74**	**3.83**
125	659191	716471	3	6	10	1.2	2.2	**9.57**	**5.22**
126	659191	716071	2	6	10	3.5	4.5	**4.92**	**3.82**
127	659191	715971	2	6	10	0.1	1.1	**172.03**	**15.64**
128	659191	715871	2	6	10	0.1	1.1	**172.03**	**15.64**
129	659191	715771	3	6	10	0.8	1.8	**14.35**	**6.38**
130	659191	715671	2	6	10	0.6	1.6	**28.67**	**10.75**
131	659191	715571	3	6	10	0.8	1.8	**14.35**	**6.38**
132	659191	715471	2	6	10	2.2	3.2	**7.82**	**5.38**
133	659191	715371	2	6	10	2.2	3.2	**7.82**	**5.38**
134	659191	715271	3	6	10	2.6	3.6	**4.42**	**3.19**
135	659301	716958	2	6	10	1.2	2.2	**14.34**	**7.82**
136	659291	716871	2	6	10	2.5	3.5	**6.88**	**4.92**
137	659291	716771	2	6	10	2	3.0	**8.60**	**5.73**
138	659291	716671	2	6	10	1.8	2.8	**9.56**	**6.14**
139	659291	716571	3	6	10	2.2	3.2	**5.22**	**3.59**
140	659291	716471	2	6	10	0.5	1.5	**34.41**	**11.47**
141	659291	716371	2	6	10	1.4	2.4	**12.29**	**7.17**
142	659291	716271	2	6	10	1.2	2.2	**14.34**	**7.82**
143	659291	716171	2	6	10	0.3	1.3	**57.34**	**13.23**
144	659291	716071	2	6	10	0.4	1.4	**43.01**	**12.29**
145	659291	715971	2	6	10	1.2	2.2	**14.34**	**7.82**
146	659291	715871	2	6	10	1	2.0	**17.20**	**8.60**
147	659291	715771	2	6	10	0.8	1.8	**21.50**	**9.56**
148	659291	715671	2	6	10	0.6	1.6	**28.67**	**10.75**
149	659291	715571	2	6	10	0.6	1.6	**28.67**	**10.75**
150	659291	715471	3	6	10	0.5	1.5	**22.96**	**7.65**
151	659291	715371	3	6	10	2.5	3.5	**4.59**	**3.28**
152	659291	715271	2	6	10	2.8	3.8	**6.14**	**4.53**
153	659291	715171	2	6	10	2.6	3.6	**6.62**	**4.78**
154	659391	716871	2	6	10	3	4.0	**5.73**	**4.30**
155	659391	716771	3	6	10	1.9	2.9	**6.04**	**3.96**
156	659391	716671	2	6	10	2	3.0	**8.60**	**5.73**
157	659391	716571	3	6	10	1.8	2.8	**6.38**	**4.10**
158	659391	716471	2	6	10	0.2	1.2	**86.01**	**14.34**
159	659391	716371	2	6	10	1.2	2.2	**14.34**	**7.82**
160	659391	716271	3	6	10	1	2.0	**11.48**	**5.74**
161	659391	716171	3	6	10	0.4	1.4	**28.70**	**8.20**
162	659391	716071	2	6	10	0.2	1.2	**86.01**	**14.34**
163	659391	715971	2	6	10	0.4	1.4	**43.01**	**12.29**
164	659391	715871	3	6	10	0.3	1.3	**38.27**	**8.83**
165	659391	715771	3	6	10	0.2	1.2	**57.40**	**9.57**
166	659391	715671	2	6	10	0.9	1.9	**19.11**	**9.05**
167	659391	715571	2	6	10	0.8	1.8	**21.50**	**9.56**
168	659391	715471	2	6	10	0.1	1.1	**172.03**	**15.64**
169	659391	715371	2	6	10	0.9	1.9	**19.11**	**9.05**
170	659391	715271	2	6	10	2.6	3.6	**6.62**	**4.78**
171	659391	715171	2	6	10	3	4.0	**5.73**	**4.30**
172	659491	716771	2	6	10	1.8	2.8	**9.56**	**6.14**
173	659491	716671	2	6	10	1.8	2.8	**9.56**	**6.14**
174	659491	716571	2	6	10	1.5	2.5	**11.47**	**6.88**
175	659491	716471	2	6	10	0.6	1.6	**28.67**	**10.75**
176	659491	716371	2	6	10	0.5	1.5	**34.41**	**11.47**
177	659491	716271	2	6	10	2	3.0	**8.60**	**5.73**
178	659491	716171	2	6	10	0.5	1.5	**34.41**	**11.47**
179	659491	716071	2	6	10	0.2	1.2	**86.01**	**14.34**
180	659491	715971	2	6	10	0.2	1.2	**86.01**	**14.34**

Calculated FoS of Natural Peat Slopes for Derrynadarragh Wind Farm - Undrained Analysis

Turbine No./Waypoint	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)
181	659491	715871	2	6	10	0.2	1.2	**86.01**	**14.34**
182	659491	715771	2	6	10	0.2	1.2	**86.01**	**14.34**
183	659491	715671	2	6	10	0.3	1.3	**57.34**	**13.23**
184	659491	715571	2	6	10	0.1	1.1	**172.03**	**15.64**
185	659491	715471	2	6	10	0.2	1.2	**86.01**	**14.34**
186	659491	715371	2	6	10	0.2	1.2	**86.01**	**14.34**
187	659491	715271	2	6	10	0.3	1.3	**57.34**	**13.23**
188	659491	715171	2	6	10	0.3	1.3	**57.34**	**13.23**
189	659591	716671	2	6	10	1.8	2.8	**9.56**	**6.14**
190	659591	716571	2	6	10	0.5	1.5	**34.41**	**11.47**
191	659591	716471	3	6	10	0.9	1.9	**12.76**	**6.04**
192	659591	716371	3	6	10	0.4	1.4	**28.70**	**8.20**
193	659591	716271	2	6	10	0.2	1.2	**86.01**	**14.34**
194	659591	716171	2	6	10	0.2	1.2	**86.01**	**14.34**
195	659591	716071	2	6	10	0.2	1.2	**86.01**	**14.34**
196	659591	715971	2	6	10	0.1	1.1	**172.03**	**15.64**
197	659591	715871	2	6	10	0.2	1.2	**86.01**	**14.34**
198	659591	715771	2	6	10	0.3	1.3	**57.34**	**13.23**
199	659591	715671	2	6	10	0.3	1.3	**57.34**	**13.23**
200	659591	715571	3	6	10	0.4	1.4	**28.70**	**8.20**
201	659591	715471	2	6	10	1	2.0	**17.20**	**8.60**
202	659591	715371	2	6	10	1.1	2.1	**15.64**	**8.19**
203	659591	715271	2	6	10	2.4	3.4	**7.17**	**5.06**
204	659591	715171	2	6	10	3.4	4.4	**5.06**	**3.91**
205	659591	715071	2	6	10	3.2	4.2	**5.38**	**4.10**
206	659591	714971	2	6	10	1.5	2.5	**11.47**	**6.88**
207	659591	714871	2	6	10	3.8	4.8	**4.53**	**3.58**
208	659595	714781	2	6	10	4	5.0	**4.30**	**3.44**
209	659691	716471	2	6	10	0.6	1.6	**28.67**	**10.75**
210	659691	716171	2	6	10	0.4	1.4	**43.01**	**12.29**
211	659691	716071	3	6	10	0.4	1.4	**28.70**	**8.20**
212	659691	715971	2	6	10	0.3	1.3	**57.34**	**13.23**
213	659691	715871	2	6	10	0.1	1.1	**172.03**	**15.64**
214	659691	715771	2	6	10	0.2	1.2	**86.01**	**14.34**
215	659691	715671	2	6	10	0.2	1.2	**86.01**	**14.34**
216	659691	715571	3	6	10	0.5	1.5	**22.96**	**7.65**
217	659691	715371	2	6	10	0.9	1.9	**19.11**	**9.05**
218	659691	715271	2	6	10	1	2.0	**17.20**	**8.60**
219	659691	715171	2	6	10	3.2	4.2	**5.38**	**4.10**
220	659691	715071	2	6	10	3.2	4.2	**5.38**	**4.10**
221	659691	714971	2	6	10	1.6	2.6	**10.75**	**6.62**
222	659691	714871	2	6	10	4	5.0	**4.30**	**3.44**
223	659791	716071	2	6	10	0.4	1.4	**43.01**	**12.29**
224	659791	715971	2	6	10	0.3	1.3	**57.34**	**13.23**
225	659791	715871	2	6	10	0.4	1.4	**43.01**	**12.29**
226	659791	715771	2	6	10	0.1	1.1	**172.03**	**15.64**
227	659791	715671	2	6	10	0.2	1.2	**86.01**	**14.34**
228	659791	715271	2	6	10	0.8	1.8	**21.50**	**9.56**
229	659791	715171	2	6	10	1.1	2.1	**15.64**	**8.19**
230	659791	715071	2	6	10	1	2.0	**17.20**	**8.60**
231	659791	714971	3	6	10	1.5	2.5	**7.65**	**4.59**
232	659791	714871	2	6	10	0.5	1.5	**34.41**	**11.47**
234	659881	716071	2	6	10	0.3	1.3	**57.34**	**13.23**
235	659891	715971	2	6	10	0.3	1.3	**57.34**	**13.23**
236	659891	715871	2	6	10	0.4	1.4	**43.01**	**12.29**
237	659891	715771	2	6	10	0.2	1.2	**86.01**	**14.34**
238	659891	715671	2	6	10	0.2	1.2	**86.01**	**14.34**
239	659891	715571	2	6	10	0.6	1.6	**28.67**	**10.75**
240	659891	715271	2	6	10	1	2.0	**17.20**	**8.60**
241	659891	715171	3	6	10	1.2	2.2	**9.57**	**5.22**
242	659891	715071	2	6	10	1.5	2.5	**11.47**	**6.88**
243	659891	714971	2	6	10	2	3.0	**8.60**	**5.73**
244	659891	714871	3	6	10	1.5	2.5	**7.65**	**4.59**
249	659991	715971	2	6	10	0.2	1.2	**86.01**	**14.34**
250	659991	715871	2	6	10	0.1	1.1	**172.03**	**15.64**
251	659991	715771	2	6	10	0.1	1.1	**172.03**	**15.64**
252	659991	715671	2	6	10	0.2	1.2	**86.01**	**14.34**
253	659991	715571	3	6	10	0.8	1.8	**14.35**	**6.38**
254	659991	715171	2	6	10	1.4	2.4	**12.29**	**7.17**
255	659991	715071	2	6	10	1.3	2.3	**13.23**	**7.48**
256	659991	714971	2	6	10	1.5	2.5	**11.47**	**6.88**
265	660091	715871	2	6	10	0.2	1.2	**86.01**	**14.34**
266	660091	715771	2	6	10	0.1	1.1	**172.03**	**15.64**
267	660091	715671	2	6	10	0.2	1.2	**86.01**	**14.34**
268	660091	715571	2	6	10	0.2	1.2	**86.01**	**14.34**
269	660084	715065	2	6	10	1.2	2.2	**14.34**	**7.82**
270	660091	714971	2	6	10	2.5	3.5	**6.88**	**4.92**
271	660091	714871	2	6	10	2.5	3.5	**6.88**	**4.92**
281	660191	715771	3	6	10	0.1	1.1	**114.80**	**10.44**
282	660191	715671	3	6	10	0.2	1.2	**57.40**	**9.57**
283	660191	715571	2	6	10	0.1	1.1	**172.03**	**15.64**
292	660291	715671	3	6	10	0.1	1.1	**114.80**	**10.44**
293	660291	715571	2	6	10	0.1	1.1	**172.03**	**15.64**
302	660388	715652	3	6	10	0.2	1.2	**57.40**	**9.57**
318	656943	716889	2	6	10	2.5	3.5	**6.88**	**4.92**
319	657224	716836	2	6	10	2	3.0	**8.60**	**5.73**
320	657681	716657	2	6	10	0.3	1.3	**57.34**	**13.23**
321	658351	717678	2	6	10	0.3	1.3	**57.34**	**13.23**
TC01	658247.00	716337.00	3	6	10	1.2	2.2	**9.57**	**5.22**
TC02	658242.00	716285.00	2	6	10	0.8	1.8	**21.50**	**9.56**
TC03	658263.00	716233.00	2	6	10	1	2.0	**17.20**	**8.60**
AT01	656727.00	716819.00	2	6	10	0.2	1.2	**86.01**	**14.34**
AT02	656838.00	716833.00	2	6	10	1.2	2.2	**14.34**	**7.82**
AT03	657030.00	716858.00	3	6	10	2	3.0	**5.74**	**3.83**
AT04	657159.00	716833.00	2	6	10	1.4	2.4	**12.29**	**7.17**

Calculated FoS of Natural Peat Slopes for Derrynadarragh Wind Farm - Undrained Analysis

Turbine No./Waypoint	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)
AT05	657276.00	716810.00	2	6	10	0.5	1.5	**34.41**	**11.47**
AT06	657393.00	716789.00	2	6	10	0.6	1.6	**28.67**	**10.75**
AT07	657580.00	716729.00	2	6	10	0.3	1.3	**57.34**	**13.23**
SS01	658287.00	716116.00	2	6	10	0.2	1.2	**86.01**	**14.34**
SS02	658356.00	716082.00	2	6	10	0.2	1.2	**86.01**	**14.34**
SS03	658324.00	716194.00	2	6	10	0.4	1.4	**43.01**	**12.29**
SS04	658401.00	716149.00	2	6	10	0.5	1.5	**34.41**	**11.47**
SS05	658346.00	716151.00	2	6	10	0.3	1.3	**57.34**	**13.23**
AT08	659312.00	716031.00	3	6	10	0.2	1.2	**57.40**	**9.57**
AT09	659666.00	715903.00	2	6	10	0.3	1.3	**57.34**	**13.23**
AT10	660118.00	715742.00	3	6	10	0.3	1.3	**38.27**	**8.83**
AT11	659714.00	715025.00	2	6	10	1.5	2.5	**11.47**	**6.88**
AT12	659500.00	715329.00	3	6	10	1.4	2.4	**8.20**	**4.78**
AT13	659181.00	715495.00	3	6	10	2	3.0	**5.74**	**3.83**
AT14	658854.00	715602.00	2	6	10	1.5	2.5	**11.47**	**6.88**
AT15	658768.00	715626.00	2	6	10	0.5	1.5	**34.41**	**11.47**
AT16	658606.00	715631.00	2	6	10	0.3	1.3	**57.34**	**13.23**
AT17	658373.00	715667.00	2	6	10	0.3	1.3	**57.34**	**13.23**
T05-A	659019.00	716111.00	2	6	10	2.2	3.2	**7.82**	**5.38**
T05-B	659088.00	716140.00	2	6	10	2.4	3.4	**7.17**	**5.06**
T05-C	659164.00	716167.00	2	6	10	2	3.0	**8.60**	**5.73**
T05-D	659018.00	716061.00	3	6	10	2.1	3.1	**5.47**	**3.70**
T05-E	659132.00	716095.00	4	6	10	1.8	2.8	**4.79**	**3.08**
T05-F	659205.00	716132.00	3	6	10	1.6	2.6	**7.18**	**4.42**
T05-G	659031.00	716011.00	3	6	10	2	3.0	**5.74**	**3.83**
T05-H	659097.00	716036.00	2	6	10	1.4	2.4	**12.29**	**7.17**
T05-I	659167.00	716041.00	2	6	10	1.5	2.5	**11.47**	**6.88**
T05-J	659215.00	716097.00	2	6	10	1.2	2.2	**14.34**	**7.82**
T05	659129.00	716059.00	2	6	10	2	3.0	**8.60**	**5.73**
SS2-1	659947.00	714600.00	2	6	10	0.8	1.8	**21.50**	**9.56**
SS2-2	660078.00	714538.00	2	6	10	1	2.0	**17.20**	**8.60**
SS2-3	659979.00	714543.00	3	6	10	0.6	1.6	**19.13**	**7.18**
SS2-4	659921.00	714537.00	3	6	10	1.1	2.1	**10.44**	**5.47**
SS2-5	660041.00	714465.00	3	6	10	0.8	1.8	**14.35**	**6.38**
							Minimum =	**4.10**	**3.08**
							Maximum =	**172.03**	**15.64**
							Average =	**42.83**	**9.42**

Notes:

(1) Assuming a bulk unit weight for peat of 10kN/m^3

(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, cu for the peat of 6kPa was selected for the assessment. It should be noted that a cu of 6kPa 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.

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APPENDIX D

Methodology for Peat Stability Risk Assessment

Methodology for Peat Stability Risk Assessment

A peat stability risk assessment was carried out for each of the main infrastructure elements at the proposed wind farm development. This approach takes into account guidelines for geotechnical/peat stability risk assessments as given in PLHRAG (2nd Edition, 2017) and MacCulloch (2005). The degree of risk is determined as a Risk Rating (R), which is the product of probability (P) and impact (I). How these factors are determined and applied in the analysis is described below.

The main approaches for assessing peat stability include the following:

a) Geomorphological
b) Qualitative (judgement)
c) Index/Probabilistic (probability)
d) Deterministic (factor of safety)

Approaches a) to c) listed above would be considered subjective and do not provide a definitive indication of stability; in addition, a high level of judgement/experience is required which makes it difficult to relate the findings to real conditions. FT apply a more objective approach, the deterministic approach. As part of FT's deterministic approach, a qualitative risk assessment is also carried out taking into account qualitative factors, which cannot necessarily be quantified.

Probability

The likelihood of a peat failure occurring was assessed based on the results of both the quantitative results of stability calculations (deterministic approach using factors of safety) and the assessment of the severity of several qualitative factors which cannot be reasonably included in a stability calculation but nevertheless may affect the occurrence of peat instability.

The qualitative factors used in the risk assessment are outlined in Table A and have been compiled based on FT's experience of assessments and construction in peat land sites and peat failures throughout Ireland and the UK.

Table A: Qualitative Factors used to Assess Potential for Peat Failure

Qualitative Factor	Type of Feature/Indicator for each Qualitative Factor [1]	Explanation/Description of Qualitative Factor
Evidence of sub peat water flow	No	Based on site walkover observations. Sub peat water flow generally occurs in the form of natural piping at the base of peat. Where there is a constriction or blockage in natural pipes a build-up of water can occur at the base of the peat causing a reduction in effective stress at the base of the peat resulting in failure; this is particularly critical during periods of intense rainfall.
	Possibly	
	Probably	
	Yes	
	Dry	

Qualitative Factor	Type of Feature/Indicator for each Qualitative Factor [1]	Explanation/Description of Qualitative Factor
Evidence of surface water flow	Localised/Flowing in drains	Based on site walkover observations. The presence of surface water flow indicates if peat in an area is well drained or saturated and if any additional loading from the ponding of surface water onto the peat is likely.
	Ponded in drains	
	Springs/surface water	
Evidence of previous failures/slips	No	Based on site walkover observations. The presence of clustering of relict failures may indicate that particular pre-existing site conditions predispose a site to failure.
	In general area	
	On site	
	Within 500m of location	
Type of vegetation	Grass/Crops	Based on site walkover observations. The type of vegetation present indicates if peat in an area is well drained, saturated, etc. Vegetation that indicates wetter ground may also indicate softer underlying peat deposits.
	Improved Grass/Dry Heather	
	Wet Grassland/Juncus (Rushes)	
	Wetlands Sphagnum (Peat moss)	
General slope characteristics upslope/downslope from infrastructure location	Concave	Based on site walkover observations. Slope morphology in the area of the infrastructure location is an important factor. A number of recorded peat failures have occurred in close proximity to a convex break in slope.
	Planar to concave	
	Planar to convex	
	Convex	
Evidence of very soft/soft clay at base of peat	No	Based on inspection of exposures in general area from site walkover. Several reported peat failures identify the presence of a weak layer at the base of the peat along which shear failure has occurred.
	Yes	
Evidence of mechanically cut peat	No	Based on site walkover observations. Mechanically cut peat typically cut using a 'sausage' machine to extract peat for harvesting. Areas which have been cut in this manner have been linked to peat instability. The mechanical cuts can notably reduce the intrinsic strength of the peat and also allow ingress of rainfall/surface water.
	Yes	
Evidence of quaking or buoyant peat	No	Based on site walkover observations. Quaking/buoyant peat is indicative of highly

Qualitative Factor	Type of Feature/Indicator for each Qualitative Factor [1]	Explanation/Description of Qualitative Factor
	Yes	saturated peat, which would generally be considered to have a low strength. Quaking peat is a feature on sites that have been previously linked with peat instability.
Evidence of bog pools	No	Based on site walkover observations. Bog pools are generally an indicator of areas of weak, saturated peat. Commonly where there are open areas of water within peat these can be interconnected, with the result that there may be sub-surface bodies of water. The presence of bog pools has been previously linked with peat instability.
	Yes	
Other	Varies	In addition to the above features/ indicators and based on site recordings the following are some of the features which may be identified: Excessively deep peat, weak peat, overly steep slope angles, etc.

Note (1) The list of features/indicators for each qualitative factor are given in increasing order of probability of leading to peat instability/failure.

It should be noted that the presence of one of the qualitative factors alone from Table A is unlikely to lead to peat instability/failure. Peat instability/failure at a site is generally the combination of a number of these factors occurring at the same time at a particular location. The probability rating assigned to the quantitative and qualitative factors is judged on a 5-point scale from 1 (indicating negligible or no probability of failure) to 5 (indicating a very likely failure), as outlined in Table B:

Table B: Probability Scale

Scale	Factor of Safety	Probability
1	1.30 or greater	Negligible/None
2	1.29 to 1.20	Unlikely
3	1.19 to 1.11	Likely
4	1.01 to 1.10	Probable
5	≤1.0	Very Likely

Scale	Likelihood of Qualitative Factor leading to Peat Failure	Probability of Failure
1	Negligible/None	Least
2	Unlikely	
3	Probable	
4	Likely	
5	Very Likely	Greatest

Impact

The severity of the risk is also assessed qualitatively in terms of impact. The impact of a peat failure on the environment within and beyond the immediate wind farm site is assessed based on the potential travel distance of a peat failure. Where a peat failure enters a watercourse, it can travel a considerable distance downstream. Therefore, the proximity of a potential peat failure to a drainage course is a significant indicator of the likely potential impact.

The risk is determined based on the combination of hazard and impact. A qualitative scale has been derived for the impact of the hazard based on distance of infrastructure element to a watercourse (Table C).

The location of watercourses is based on topographic maps and supplemented by site observations from walkover survey. Note that not all watercourses are shown on maps.

Table C: Impact Scale

Scale	Criteria	Impact
1	Proposed infrastructure element greater than 150m of watercourse	Negligible/None
2	Proposed infrastructure element within 150 to 101m of watercourse	Low
3	Proposed infrastructure element within 100 to 51m of watercourse	Medium
4	Proposed infrastructure element within 50 m of watercourse	High
5	Proposed infrastructure element within 50 m of watercourse, in an environmentally sensitive area	Extremely High

Risk Rating

The degree of risk is determined as the product of probability (P) and impact (I), which gives the Risk Rating (R) as follows:

The Risk Rating is calculated from: $R = P \times I$

Due to the 5-point scales used to assess Probability and Impact, the Risk Rating can range from 1 to 25 as shown in Table D.

Table D: Qualitative Risk Rating

	Probability					
Impact		1	2	3	4	5
	5	5	10	15	20	25
	4	4	8	12	16	20
	3	3	6	9	12	15
	2	2	4	6	8	10
	1	1	2	3	4	5

Risk Rating & Control Measures	
17 to 25	High: avoid working in area or significant control measures required
11 to 16	Medium: notable control measures required
5 to 10	Low: only routine control measures required
1 to 4	Negligible: none or only routine control measures required

The risk rating is calculated individually for each contributory factor. Control measures are required to reduce the risk to at least a 'Low' risk rating. The control measures in response to the qualitative risk ratings are included in the peat stability risk registers for each main infrastructure element in Appendix B.

The risk rating is calculated individually for each contributory factor. Control measures are required to reduce the risk to at least a 'Low' risk rating.

FEHILY TIMONEY

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APPENDIX 11.3

Peat and Spoil Management Plan

FEHILY TIMONEY

DESIGNING AND DELIVERING
A SUSTAINABLE FUTURE

ENVIRONMENTAL IMPACT ASSESSMENT REPORT (EIAR) FOR THE PROPOSED DERRYNADARRAGH WIND FARM, CO. KILDARE, OFFALY & LAOIS

Volume III – Appendices

Appendix 11.3 – Peat and Spoil Management Plan

Prepared for:
Dara Energy Limited

Dara Energy Limited

Date: **January 2026**

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1. INTRODUCTION

1.1 Fehily Timoney and Company

Fehily Timoney and Company (FT) is an Irish engineering, environmental science and planning consultancy with offices in Cork, Dublin and Carlow. The practice was established in 1990 and currently has c.100 members of staff, including engineers, scientists, planners and technical support staff. We deliver projects in Ireland and internationally in our core competency areas of Waste Management, Environment and Energy, Civils Infrastructure, Planning and GIS and Data Management.

This Report was written by Emily Archer (FT Senior Project Geotechnical Engineer, MSc Applied Environmental Geoscience) and Ian Higgins (FT Principal Geotechnical Engineer, MSc in Geotechnical Engineering). Emily is a Senior Project Engineer with Fehily Timoney and has 6 years' experience in geotechnical engineering. Ian is a Technical Director with Fehily Timoney and has 25 years' experience in geotechnical engineering.

1.2 Project Description

Fehily Timoney and Company (FT) were engaged by Dara Energy Ltd. in November 2022 to compile a Peat and Spoil Management Plan for the Proposed Development.

A detailed description of the project assessed within the main EIAR is provided in Chapter 2 and is comprised of three main elements:

- The 'Proposed Wind Farm' (also referred to in this EIAR as the '**Site'**);
- The 'Proposed Grid Connection' (also referred to in this EIAR as the **'GC'**);
- The 'Turbine Delivery Route' (also referred to in this EIAR as the **'TDR'**);

The Development includes 9 no. wind turbines – 4 no. turbines will have a tip height of 186m above existing ground level with a hub height of 105m and rotor diameter of 162m, and 5 no. turbines will have a tip height of 187m above existing ground level with a hub heigh of 106m and rotor diameter of 162m. With an underground cable connecting the 9 no. turbine wind farm development to the on-site substation, internal access tracks, hard standings, internal electrical and communications cabling, temporary construction compound, drainage infrastructure and all associated works related to the construction of the proposed wind farm.

1.3 Purpose

The purpose of this report is to provide a peat and spoil management plan with particular reference to peat stability for the construction phase of the Proposed Development. Such peat and spoil management measures have been successfully implemented on numerous wind farms over the past 15 years.

This peat and spoil management plan also includes a monitoring programme which will be implemented during the construction phase of the Proposed Development and a contingency plan should peat instability/failure occur at the Site.

As for all construction projects, a detailed engineering construction design will be carried out by the appointed construction stage designer prior to any construction work commencing on site. This will take account of the consented project details and any conditions imposed by that consent.

This will include a detailed peat stability assessment to account for any changes in the environment which may have occurred in the time leading up to the commencement of construction and a peat and spoil management plan to allow for the most appropriate geotechnical and environmental led solutions to be developed for the management of peat and spoil.

As work is carried out on site the contents of the peat and spoil management plan and peat stability monitoring programme will be implemented in full and updated (if required to comply with any planning conditions or requirements of the planning authority) in the Construction & Environmental Management Plan (CEMP) for the construction phase.

This peat and spoil management plan contains some drainage guidelines for construction works and for management of peat on site. It should be noted that the control of water quality and drainage measures for the Proposed Wind Farm site is outlined in detail in Chapter 4: Description of the Proposed Development, and Chapter 9: Water, of the Environmental Impact Assessment Report (EIAR).

1.4 Peat Instability Definition

Peat instability in this report is defined as a mass movement of a body of peat that would have a significant adverse impact on the surrounding environment. Peat instability excludes localised movement of peat that would occur below a floating access road, creep movement or localised erosion type events.

Adherence to the peat and spoil management plan will reasonably minimise the potential for all such peat movements. However, it is noted that due to the soft ground nature of the peat terrain identified at the Proposed Wind Farm site it is not possible to completely avoid localised peat movement.

1.5 Site Investigation

As part of the design process for the Proposed Development, intrusive site investigations were undertaken across the Site, to provide detail and clarity on the nature and extent of sublayers and bedrock as a means of characterising the Proposed Wind Farm site. This assisted in providing additional information on the most suitable location for turbines and associated infrastructure.

Geotechnical ground investigations (i.e. trial pitting) were undertaken in April 2025, under the supervision of Fehily Timoney & Company (FT). The combined geological and hydrological dataset collected from the geotechnical ground investigations and from ground truthing site walkovers completed by FT, have been used in the preparation of the EIAR Chapters.

The objectives of the intrusive site investigations included mapping the subsoil lithology for all proposed turbines and other identified locations and assessing the underlying bedrock. This data was used to inform the final layout of the Site.

In summary, a total of 12 no. trial pits, supervised by FT, were carried out at proposed turbine locations and at other identified locations to investigate the underlying mineral soil lithology and subsoil/bedrock interface.

The complete geotechnical ground investigations were carried out in accordance with IS EN 1997-2 and BS5930:2015+A1:2020 Code of Practice for Ground Investigations with precedence given to IS EN 1997-2 where applicable.

As part of the assessment of potential peat failure at the Proposed Development site, FT carried out a site reconnaissance in conjunction with a desk study review. This comprised walkover inspections of the Site, with recording of salient geomorphological features which included peat depth assessments across the Site and a preliminary assessment of peat strength at the Site.

The peat depth data was recorded by FT during May and September 2023 and an additional peat probing survey was carried out in January 2025.

1.6 Relevant Guidance

The relevant guidance used and referred to throughout this report includes;

- Good Practice during Windfarm Construction (Scottish Renewables, SNH, SEPA & Forestry Commission Scotland, 5th Edition 2024);
- Guidance on Developments on Peatland: Site Surveys (Scottish Government, Scottish Natural Heritage and SEPA, 2017;
- Munro, R, 2004. Dealing with bearing capacity problems on low volume roads constructed on peat. Roadex II Northern Periphery;
- Scottish Natural Heritage/Forestry Commission Scotland, 2010. Floating Roads on Peat;
- Scottish Natural Heritage, 2015. Constructed Tracks in the Scottish Uplands. Scottish Natural Heritage.

2. CONSTRUCTION ACTIVITIES COVERED BY PEAT AND SPOIL MANAGEMENT PLAN

2.1 Construction Activities

For the construction phase of the Proposed Development the activities that will generate peat and spoil are as follows:

(1) Upgrade of existing access tracks (excavate and replace) including temporary widening of local road to facilitate deliver of turbine components

(2) Construction of new excavated roads through peat

(3) Construction of floating roads over peat (will not generate peat and spoil but the methodology for construction is included for completeness)

(4) Excavation and placement of arisings

(5) Excavations in peat for turbine bases, hardstands and other infrastructure foundations

(6) Excavations in peat for underground cables

Peat and spoil management of the above construction activities are covered individually in this report.

2.2 Road Construction Types

To provide access within the Proposed Wind Farm site and to connect the wind turbines and associated infrastructure, and to facilitate the Proposed Grid Connection existing tracks will need to be upgraded and new access roads will need to be constructed. The road construction design has taken the following key factors into account:

(1) Buildability considerations

(2) Maximising use of existing infrastructure

(3) Minimising excavation arisings

(4) Serviceability requirements for construction and wind turbine delivery and maintenance vehicles

(5) Requirement to minimise disruption to peat hydrology

Whilst the above key factors are used to determine the proposed road design, the actual construction technique employed for a particular length of road will be determined by the prevailing ground conditions encountered during confirmatory investigations along that length of road.

The proposed road construction techniques to be considered are given in Table 2-1.

It should be noted that this report does not include a detailed design for the access roads associated with the Proposed Wind Farm and Proposed Grid Connection underground cabling route. This report includes the most suitable type of road construction envisaged for each section of access road based on the ground/site conditions recorded during the site walkovers and intrusive site investigation works. Where floating roads are proposed in this report, a proposed methodology is presented however a detailed design will be carried out prior to construction commencing on site. These measures are based on available guidance, including 'Constructed

Tracks in the Scottish Uplands (Scottish Natural Heritage, 2nd Edition , 2015), Floating Roads on Peat (Scottish Natural Heritage/Forestry Commission Scotland, 2010) and 'Dealing with Bearing Capacity Problems on Low Volume Roads Constructed on Peat (ROADEX II, 2004).

Table 2.1: General Road Construction Techniques

Construction Method	Site Conditions			Approximate Length of Road (km)	Comment
	Construction Type	Peat Depth (m)	Slope Inclination (degs)		
Upgrade of existing access roads	Type A	-	Varies	0.55	Upgrade existing excavated access roads to the required width and finished with a layer of selected granular fill – Drawing P22-145-INFO-0010
Construction of new excavated roads	Type B	Proposed where less than 1.5m	Varies	7.26	New access road construction technique envisaged for various locations on site – Drawing P22-145-INFO-0011
Construction of new floating roads over peat	Type C	>1.5	<3	2.1	New access road construction technique envisaged for various locations on site – Drawing P22-145-INFO-0012

Further details on access road construction types A to C are given in Sections 3, 4 and 5 of this report.

3. UPGRADE OF EXISTING ACCESS ROADS – TYPE A

A small portion of access roads requiring upgrade are present across the Site and have been in operation for a significant number of years. The existing access roads were constructed using both floating and excavate and replace construction techniques. Based on the site walkover carried out by FT the existing access roads were noted as being in relatively good condition. Upgrade works will involve both widening and resurfacing of the existing access road. The proposed locations for upgrade of the existing access roads on site are shown in Drawing P22-145-INFO-0022 and details are shown in Drawing P22-145-INFO-0010.

3.1 Upgrading Existing Access Tracks Construction Methodology

This methodology includes procedures that will be included in the construction methodology to minimise any adverse impact on peat stability. The methodology is not intended to cover all aspects of construction such as drainage and environmental considerations, which are described and assessed within the main EIAR.

(1) Access road construction will be to the line and level requirements as per design.

(2) For upgrading of existing excavated access roads (Type A) the following guidelines will be implemented in full:

  (a) Excavation of the widened section of access road will take place to a competent stratum beneath the peat (as agreed with the designer) and backfilled with suitable granular fill.

  (b) Benching of the excavation may be required between the existing section of access road and the widened section of access road where the depth of excavation required exceeds 500mm.

  (c) The surface of the existing access road will be overlaid with up to 500mm of selected granular fill.

  (d) Access roads will be finished with a layer of capping across the full width of the track.

  (e) A layer of geogrid/geotextile may be required at the surface of the existing access road and at the base of the widened section of access road (to be confirmed by the designer).

  (f) For excavations in peat, side slopes will be not greater than 1 (v): 3 (h). This slope inclination will be reviewed during construction. Where areas of weaker peat are encountered then slacker slopes will be required to ensure stability.

(3) The finished road width will have a running width of 5m, with wider sections on bends and corners.

(4) On side long sloping ground any road widening works required will be done on the upslope side of the existing access road, where possible.

(5) At transitions between new floating and existing excavated roads a length of about 10 to 20m will have all peat excavated and replaced with suitable fill. The surface of this fill will be graded to accommodate wind turbine construction and delivery traffic.

4. CONSTRUCTION OF NEW EXCAVATED ROADS THROUGH PEAT – TYPE B

The excavation of peat and spoil and founding of access roads on competent stratum below the base of peat for new access roads will be carried out at various locations within the Site. The proposed locations for new excavated access roads within the Site are shown in drawing P22-145-INFO-0022 and details are shown in drawing P22-145-INFO-0011.

Excavate and replace type access roads are the conventional method for construction of access roads on peatland sites and the preferred construction technique in shallow peat provided sufficient placement/reinstatement capacity is available on site for the excavated peat.

4.1 Excavated Road Construction Methodology

This methodology includes procedures that will be included in the construction to minimise any adverse impact on peat stability. The methodology is not intended to cover all aspects of construction such as drainage and environmental considerations, which are assessed within the main EIAR.

(1) Prior to commencing the construction of the excavated roads movement monitoring posts will be installed in areas where the peat depth is greater than 2.0m.

(2) Interceptor drains will be installed upslope of the access road alignment to divert any surface water away from the construction area.

(3) Excavation of roads will be to the line and level given in the design requirements. Excavation will take place to a competent stratum beneath the peat.

(4) Road construction will be carried out in sections of up to 50m lengths i.e., no more than 50m of access road will be excavated without replacement with stone fill.

(5) Excavation of materials with respect to control of peat stability:

  (a) Where Acrotelm (the upper 0.3 to 0.4m of the peat layer) is required for landscaping, it will be stripped and temporarily stockpiled for re-use as required. Acrotelm stripping will be undertaken prior to main excavations.

  (b) Where possible, the acrotelm will be placed with the vegetation part of the sod facing the right way up to encourage growth of plants and vegetation.

  (c) All catotelm peat (peat below about 0.3 to 0.4m depth) will be transported immediately on excavation, where possible, to the designated peat and spoil management areas.

(6) Once excavated, non-catotelm peat will be temporarily stored in localised areas adjacent to excavations for roads and hardstands before being placed into the permanent Peat and Spoil Management areas. All temporary peat and spoil management areas will be upslope of founded roads/hardstands and will be inspected by the Project Geotechnical Engineer before material is stored in the area.

(7) Excavation side slopes in peat will be not greater than 1 (v): 3 (h). This slope inclination will be reviewed during construction. Where areas of weaker peat are encountered then slacker slopes will be required. Battering of the side slopes of the excavations will be carried out as the excavation progresses.

(8) End-tipping of stone onto the road during the construction/upgrading of the access road will be carefully monitored to ensure that excessive impact loading, which may adversely affect the adjacent peat, is limited.

(9) The excavated access road will be constructed with an average depth of 750mm of selected granular fill. Granular fill will be placed and compacted in layers in accordance with the TII Specification for Road Works.

(10) Access roads will be finished with a layer of capping across the full width of the road.

(11) A layer of geogrid/geotextile may be required at the surface of the competent stratum where cohesive material is present to prevent mixing of the underlying material with the granular fill.

(12) At transitions between floating and excavated roads a length of road of about 10m will have all peat excavated and replaced with suitable fill. The surface of this fill will be graded so that the road surface transitions smoothly from floating to excavated road.

(13) Where slopes of greater than 5 degrees are encountered along with relatively deep peat (i.e., greater than 2m) and where it is proposed to construct the access road perpendicular to the slope contours it is best practice to start construction at the bottom of the slope and work towards the top, where possible. This method avoids any unnecessary loading to the adjacent peat and greatly reduces any risk of peat instability.

(14) The construction and upgrading of access roads in areas of deep peat (greater than 2m) will be inspected on a routine basis (by the Site manager/Ecological Clerk of Works/Project Geotechnical Engineer) during the works, particularly before/following trafficking by heavy vehicular loads.

5. CONSTRUCTION OF NEW FLOATED ROADS OVER PEAT – TYPE C

The use of new floated access tracks will be limited on site to areas of flatter terrain, i.e., less than a 3 degree slope. The proposed locations for floating roads across the Site are shown in drawing P22-145-INFO-0022 and details shown in drawing P22-145-INFO-0012. Floating roads are not proposed on areas of sidelong ground.

A confirmatory stability analysis will be carried out by the designer where it is proposed to install floating access roads over the peat prior to any construction work commencing on site.

Floating roads minimise impact on the peat, particularly peat hydrology. As there is no excavation required no peat arisings are generated. However, where the underlying peat has insufficient bearing capacity or due to topographic restrictions an excavate and replace type access road will be more suitable (see Section 6), although this is not anticipated at the location of the proposed floated roads.

5.1 Floating Road Construction Methodology

This methodology includes procedures that will be included in the construction to minimise any adverse impact on peat stability. The methodology is not intended to cover all aspects of construction such as drainage and environmental considerations, which are assessed within the main EIAR.

Note: Details of geogrid arrangement will be provided by the specialist geogrid provider/designer.

(1) Prior to commencing floating road construction movement monitoring posts will be installed in areas where the peat depth is greater than 2m.

(2) Base geogrid will be laid directly onto the existing peat surface along the line of the road in accordance with geogrid provider's requirements.

(3) Construction of road will be in accordance with appropriate design from the designer.

(4) The make-up of the new floated access road is up to 1,000mm of selected granular fill with 2 no. layers of geogrid with possibly the inclusion of a geotextile separator (drawing P22-145-INFO-0012).

(5) Granular fill will be placed and compacted in layers in accordance with the TII Specification for Road Works.

(6) Following the detailed design of the floated access roads it may be deemed necessary to include pressure berms either side of the access road in some of the deeper peat areas. The inclusion of a 2 to 5m wide pressure berm (typically 0.5m in height) either side of the access road will reduce the likelihood of potential bearing failures beneath the access road.

(7) The finished road width will be a minimum of 5m, with wider sections on bends and corners.

(8) Stone delivered to the floating road construction will be end-tipped onto the constructed floating road. Direct tipping of stone onto the peat will be avoided.

(9) To avoid excessive impact loading on the peat due to concentrated end-tipping all stone delivered to the floating road will be tipped over at least a 10m length of constructed floating road.

(10) Where it is not possible to end-tip over a 10m length of constructed floating road then dumpers delivering stone to the floating road will carry a reduced stone load (not greater than half full) until such time as end-tipping can be carried out over a 10m length of constructed floating road.

(11) Following end-tipping suitable machinery will be employed to spread and place the tipped stone over the base geogrid along the line of the road.

(12) A final surface layer will be placed over the full width of the floating road, as per design requirements, to provide a road profile and graded to accommodate wind turbine construction and delivery traffic.

6. GENERAL CONSTRUCTION GUIDELINES FOR ACCESS ROADS

The following general construction guidelines will be implemented for the access roads on site.

(1) Where an open ditch is present alongside an existing/proposed floating access track, the ditch will need to be filled prior to upgrading/constructing the access track. The ditch will be filled with suitable drainage stone. As applicable, a perforated pipe will be laid into a ditch prior to filling so as to maintain water flow within the ditch.

(2) Where existing drainage crosses the road then it will be necessary to ensure that this drainage is not affected by settlement of the upgraded access road. Cross drains comprising flexible perforated pipes within a permeable stone fill surround will be used to maintain the existing drainage.

(3) No excavations (e.g., drainage, peat cuttings) will be carried out within 5m distance of a completed floated access road edge, or at a distance determined following site inspection. The presence of excavations can destabilise the road. Temporary excavations will be excavated in short lengths and backfilled as soon as practicable.

(4) Floating roads will not be constructed on areas of sidelong ground.

(5) No stockpiling of materials will take place on or adjacent to floated access roads so as to avoid bearing failure of the underlying peat.

(6) End-tipping of stone onto the road during the construction/upgrading of the access road will be carefully monitored to ensure that excessive impact loading, which may adversely affect the underlying peat, is limited.

(7) Due to the nature of floating road construction, it will be necessary to monitor the settlement/movement of the road. Survey points will be located along the road at 10m intervals in areas of deep peat (greater than 2m). These survey points will be surveyed on a weekly basis, and more frequently when construction activities are ongoing in the area.

(8) The construction and upgrading of access roads in areas of deep peat (greater than 2m) will be inspected on a routine basis during the works, particularly before/following trafficking by heavy vehicular loads.

(9) In the event of excessive vertical displacement of the road during/following construction then mitigation measures will be required to ensure the stability of the road. This will include:

  (a) Introduction of pressure berms either side of the road (that are 2 to 5m wide by 0.5m deep stone layer).

  (b) Where peat is relatively shallow then excavate peat and replace with suitable fill.

  (c) Slowing the rate of construction.

(10) Settlement of a floated access road is expected and will likely be in the order of several 100mm in the deeper peat areas; as such it will be necessary to re-level the road at convenient intervals during the works. The magnitude and extent of settlement is likely to be greater in areas of deeper peat with the rate of settlement reducing over time. Prior to completion of the works, the road will be re-levelled using crushed stone.

7. EXCAVATION AND STORAGE OF PEAT AND SPOIL

7.1 Excavation and Storage of Arisings Methodology

This methodology includes procedures that will be included in the construction to minimise any adverse impact on peat stability. The methodology is not intended to cover all aspects of construction such as drainage and environmental considerations, which are assessed in within the main EIAR.

(1) Excavated peat and spoil will be transported immediately to one of the designated peat and spoil management areas, unless it is the acrotelm as this will be temporarily stockpiled and re-used for landscaping purposes.

(2) Further details on the placement of excavated material to designated peat and spoil management areas close to turbines are given in Section 7.4.

(3) Some of the peat, in particular the acrotelm (upper layer of the peat), excavated during construction will be temporarily stored locally and used for landscaping purposes.

7.2 Summary of Peat and Spoil Volumes on the Proposed Wind Farm site

A summary of the excavated peat and spoil volumes calculated for the Site is given in Table 7-1.

Table 7.1: Summary of Excavated Peat and Spoil Volumes on Site

Infrastructure Element [1]	Proposed Dimensions	Peat Volume (m^3) [2]	Spoil (non-peat) Volume (m^3) [2]	Comment
9 no. Turbines and Hardstands	27m diameter excavation footprint (25m wide base with 1m of working space around the perimeter of the base) for turbine foundation with 80 x 33.5m hardstand area.	30,449	18,921	Hardstanding area and foundation footprint
Access Roads	Assumed 5m running surface with 6m wide development footprint.	13,776	9,184	
Substation	Hardstanding area of 140 x 85m.	2,881	2,881	
Temporary Construction Compounds (x3)	Footprint of 40 x 45 for TCC1 and 70 x 40m for both TCC2 and TCC3.	5,244	6,417	
Turbine Delivery Route	Dimensions are variable across the TDR for accommodation works. Peat will be extracted down to suitable bearing stratum.	3,100		
GCR	The route will run through 9.1 km of existing public road, 0.3km in existing tracks and 2km in new access tracks on the wind farm site. The trench will be 1.35m deep and 0.60m wide along with 15 joint bays of 6.5mx 2.5m wide. Peat will be extracted down to suitable bearing stratum.	3,450		The Peat depths along the GCR road and tracks were determined following a Ground penetration radar survey of the Grid Connection Route.
	Total =	**58,900**	**37,403**	**Total peat and spoil = 96,303m3**

Note 1 – A bulking factor of 15 and 10% has been applied to the excavated peat and non-peat soils respectively. This allows for expected increase in volume upon excavation and to allow for a variation in ground conditions across the Site.
Note 2 – Soil volumes given in this table are indicative and for information purposes only, and subject to detailed estimates

7.3 Summary of Peat and Spoil Management Areas on the Proposed Wind Farm site

A summary of the potential peat and spoil management areas at the Site is given in Table 7-2.

Table 7.2: Summary of Peat and Spoil Management Areas on the Proposed Wind Farm site

Location (1)	Peat and Spoil Volume (m^3)	Comment
Peat placement within proposed peat and spoil management areas	92,830	Up to 1.25m in height across specific areas shown in Drawing P22-145-INFO-0022. See Section 7.5 of the report and Drawings P22-145-INFO-0015 to P22-145-INFO-0021 for further details.
Landscaping (2)	13,500	1,500m^3 assessed at 9 no. turbine locations
Total =	**106,330m^3**	

Note (1) The location of the proposed peat/spoil storage areas at the Proposed Wind Farm site are shown on Drawing P22-145-INFO-0022.

Note (2) Some of the acrotelm (upper layer of the peat) excavated during construction will be used for landscaping purposes.

7.4 Summary of Management and Reuse of Excavated Peat and Spoil

The Proposed Development will be developed in phases, to allow for the development and backfill of the peat and spoil storage areas. An outline of the proposed Phasing is provided below:

(1) Peat and spoil excavated from turbines will be transported to the adjacent peat and spoil storage areas, peat will be used to create pressure berms on both sides of the floating roads or used for landscaping around the hardstands.

(2) Shallow Peat/Topsoil removed will be temporarily stockpiled locally and used to cover the peat/spoil storage areas, as well as any landscaping areas.

(3) Spoil excavated from the substation platform will either be landscaped around the platform or transported to the peat and spoil storage areas.

(4) A small volume (c. 350m^3 per base) of spoil will be reused at each turbine base as ballast backfill.

7.5 Designated Peat and Spoil Management Areas

The following commitments for the placement of peat within peat and spoil management areas will be implemented during construction. These areas have been selected based on a combination of the depth of peat, the recorded peat strength in the area and the slope angle.

(1) Excavated peat will be placed/spread across the 7 no. areas within the Proposed Wind Farm site. These locations are shown in Drawing P22-145-INFO-0022.

(2) The peat placed within the peat and spoil management areas shown on Drawing P22-145-INFO-0022 will be restricted to a maximum height of 1.25m. Weak/liquified peat will be stored in the centre of the peat management areas with firmer/drier peat placed around the outside.

(3) The placement of excavated peat will be avoided without first establishing the adequacy of the ground to support the load. The placement of peat and spoil within the peat and spoil management areas will require the use of long reach excavators, low ground pressure machinery and possibly bog mats in particular for drainage works.

(4) It will be ensured that the surface of the placed peat will be shaped to allow efficient run-off of surface water. Shaping of the surface of the peat will be carried out as placement of peat within the peat and spoil management area progresses. This will reduce the likelihood of debris run-off and reduce the risk of instability of the placed peat.

(5) Finished/shaped side slopes in the placed peat will be not greater than 1 (v): 4 (h). This slope inclination will be reviewed during construction, as appropriate.

(6) Where available, the acrotelm will be placed on the finished surface with the vegetation part of the sod facing the right way up to encourage growth of plants and vegetation at the surface of the placed peat and spoil within the peat and spoil management areas.

(7) Movement monitoring instrumentation will be placed around the areas where peat has been placed. The locations where monitoring is required will be identified by the Project Geotechnical Engineer on site.

(8) Supervision by the Project Geotechnical Engineer will be carried out for the works.

(9) An interceptor drain will be installed upslope of the designated peat and spoil management areas to divert any surface water away from these areas. This will help ensure stability of the placed peat and reduce the likelihood of debris run-off.

(10) All of the above mentioned general guidelines and requirements will be undertaken by the Contractor during construction.

7.6 Summary of Stone Volume Requirements

Table 7.3 below summarises the stone volume requirement for the Proposed Development, excluding the final blinding layer, all of which will come from an external source.

Table 7.3: Summary of Stone Volume Requirements

Infrastructure Element (1)	Typical Dimensions	Stone Volume (m3) (2)	Comment
9 no. Turbines and Hardstands	27m diameter excavation footprint (25m wide base with 1m of working space around the perimeter of the base) for turbine foundation with 80 x 33.5m hardstand area.	28,826	Hardstanding area and foundation footprint. Allowance included for mini-crane pads and blade finger hardstands associated with the main hardstand, plus allowance for side slopes in areas of fill.
Access Roads	Assumed 5m running surface with 6m wide development footprint.	52,305	Allowance includes for widening on bends, at junctions, laybys, and tie-ins to hardstands.
Substation	Hardstanding area of 140 x 85m.	9,185	
Temporary Construction Compounds (x2)	Footprint of 40 x 45 for TCC1 and 70 x 40m for both TCC2 and TCC3.	8,140	-
Turbine Delivery Route	Dimensions are variable across the TDR for accommodation works. Material to be placed as load bearing surfaces at several TDR nodes.	12,800	
GCR	As per Trench details for 11.15km CL808.	4,000	
	Total =	**115,256**	

Note 1 – A contingency factor of 10% stone volumes to allow for a variation in ground conditions across the Site.
Note 2 – Stone volumes given in this table are indicative and for information purposes only, and subject to detailed estimates.

8. EXCAVATIONS IN PEAT FOR TURBINE BASES, HARDSTANDINGS AND INFRASTRUCTURE FOUNDATIONS

The turbine bases will be founded on competent founding strata which will require excavation through peat and soft overburden. Some turbine foundations will require a piled solution following confirmatory ground investigations by the Contractor.

Similarly, crane hardstandings, construction compound, and substation platforms will be founded on competent mineral soil and/or rock which will require excavation through peat and spoil.

8.1 Methodology

This methodology includes procedures that will be included in the construction to minimise any adverse impact on peat stability. The methodology is not intended to cover all aspects of construction such as drainage and environmental considerations, which are assessed within the main EIAR.

(1) With respect to placement of arisings from excavations the commitments given in Section 7 will be followed.

(2) All excavations within peat will be adequately supported or peat slopes will be battered to a safe slope inclination typically of 1 (v): 3 (h). This slope inclination will be reviewed during construction, as appropriate. Where areas of weaker peat are encountered then slacker slopes will be provided.

(3) Excavations will be kept reasonably free from water at all times. Water will be prevented from being impounded within excavations by either using drainage channels cut into the excavation face or by pumping.

(4) Where water is channelled or pumped from an excavation then this water will be fed into an established watercourse or drainage ditch following suitable treatment, as described within the main EIAR.

9. EXCAVATIONS FOR UNDERGROUND CABLES

A connection between the Site and the national electricity grid will be necessary to export electricity. The Proposed Grid Connection construction methodology, including proposals for water crossings on the underground cabling routes is described in within the main EIAR.

It is proposed to excavate the trenches for the underground cable at a uniform level within the footprint of the access roads. The Proposed Grid Connection will encounter localised areas of shallow peat (<0.5m) and till derived from limestones, as per GSI mapping (gsi.ie) and walkover surveys, and will be constructed on solid ground to EirGrid specifications.

9.1 Methodology

This methodology includes procedures that will be included in the construction to minimise any adverse impact on peat stability. The methodology is not intended to cover all aspects of construction such as drainage and environmental considerations, which are assessed within the main EIAR.

(1) With respect to placement of arisings from excavations the guidelines given in Section 7 will be followed.

(2) All excavations within peat will be adequately supported or peat slopes will be battered to a safe slope inclination typically of 1 (v): 3 (h). This slope inclination will be reviewed during construction, as appropriate. Where areas of weaker peat are encountered then slacker slopes will be required.

(3) Similarly, all excavations within non-peat overburden for the cable trench will be adequately supported or battered to a safe slope inclination typically of 1 (v): 1.5 or 2 (h). This slope inclination will be reviewed during construction, as appropriate.

(4) Excavations will be kept reasonably free from water at all times.

(5) Any overburden excavated from the cable trench will be transported to the peat/spoil storage areas for storage. Any pavement materials containing tar will be transported to an authorised waste facility.

10. GENERAL MEASURES FOR GOOD CONSTRUCTION PRACTICE

To minimise the risk of construction activity causing potential peat instability the Construction Method Statements (CMS) for the Proposed Development will also implement (as a minimum), the general measures below together with the specific measures above.

(1) Uncontrolled concentrated water discharge onto peat slopes identified as being unsuitable for such discharge will be avoided. All water discharged from excavations during work will be piped over areas specifically assessed as being unsuitable and hence directly into suitable drainage lines.

(2) All excavations will be suitably supported to prevent collapse and development of tension cracks.

(3) Avoidance of placing fill and excavations in the vicinity of steeper peat slopes, that is at the crest or toe of the slope.

(4) Installation and regular monitoring of geotechnical instrumentation during construction in areas of possible poor ground, such as deeper peat deposits (see Section 11).

(5) Site reporting procedures will be implemented to ensure that working practices are suitable for the encountered ground conditions. Ground conditions will be assessed by a suitably experienced geotechnical engineer.

(6) Regular briefing of all site staff (e.g., toolbox talks) to provide feedback on construction and ground performance and to promote reporting of any observed change in ground conditions.

(7) Routine inspection of the Proposed Wind Farm site and Proposed Grid Connection by the Contractor and Project Geotechnical Engineer will be undertaken and will include an assessment of ground stability conditions (e.g., cracking, excessive floating road settlement, disrupted surface, closed-up drains) and drainage conditions (e.g., blocked drains, absence of water in previously flowing drains, springs, etc).

11. INSTRUMENTATION

11.1 Movement Monitoring Posts

To monitor possible peat movements, it is proposed to install sighting posts upslope and downslope of the access roads at staggered intervals at locations where the peat depth is greater than 2m. Additional monitoring locations will be provided at infrastructure locations with deeper peat deposits and at peat and spoil management areas. Details of sighting posts are given below.

(1) A line of sighting posts will comprise:

(a) A line of wooden stakes (proposed to be 1 to 1.5m long) placed vertically into the peat to form a straight line.

(b) The sighting line will comprise 6 no. posts at 5m centres that is a line some 25m long.

(c) A string line will be attached to the first and last posts and all intervening posts will be adjusted so they are just touching the string line.

(2) Lines of sighting posts will be placed across the existing slope about 5m away from the area to be worked. It is recommended that the posts are located along the road at 5m intervals in areas of deep peat (say greater than 2.0m). Where there are relatively steeper slopes or softer ground a sighting line will be placed down the slope, or at any location where monitoring is deemed useful by the Project Geotechnical Engineer.

(3) Each line of sighting posts will be uniquely referenced with each post in the line given a reference. The post reference will be marked on each post (e.g., reference 1-1, 1-2, 1-3, 1-4, 1-5, 1-6 for posts in line 1).

(4) The sighting lines will be monitored at the beginning of each working day, and during the day were considered appropriate (e.g., when working activity is concentrated at a specific location).

(5) Monitoring of the posts will comprise sighting along the line and recording any relative movement of posts from the string line.

(6) Where increased movements are recorded the frequency of monitoring will be increased.

(7) A monitoring record will be kept of the date, time and relative movement of each post, if any. This record will be updated and stored as a spreadsheet.

12. CONTINGENCY MEASURES

12.1 Excessive Movement

Where there is excessive movement or continuing peat movement recorded at a monitoring location or identified at any location within the Proposed Wind Farm site but no apparent signs of distress to the peat (e.g., cracking, surface rippling) then the following will be carried out.

(1) All activities (if any) will cease within the affected area.

(2) Increased monitoring at the location will be carried out. The area will be monitored, as appropriate, until such time as movements have ceased.

(3) Re-commencement of activities will only start following a cessation of movement and agreement with all parties (Contractor/Engineer/Designer).

12.2 Onset of Peat Slide

In the unlikely event where there is the onset or actual detachment of peat (e.g., cracking, surface rippling) then the following will be carried out.

(1) On alert of a peat slide incident, all activities (if any) in the area will cease and all available resources will be diverted to assist in the required mitigation procedures.

(2) Action will be taken to prevent a peat slide reaching any watercourse. This will take the form of the construction of check barrages on land. Due to the terrain and the inability to predict locations it may not be possible to implement any on-land prevention measures, in this case a watercourse check barrage will be implemented.

(3) All relevant authorities will be notified if a peat slide event occurs on site.

(4) For localised peat slides that do not represent a risk to a watercourse and have essentially come to rest the area will be stabilised initially by rock infill, if required. The failed area and surrounding area will then be assessed by the engineering staff and stabilisation procedures implemented. The area will be monitored, as appropriate, until such time as movements have ceased.

12.3 Check Barrages

Whilst it is not anticipated from the analysis undertaken that a peat slide will occur on site, as a contingency a check barrage procedure is included below.

The check barrage procedure deals with preventing a peat slide from moving downstream within a watercourse.

The most effective method of preventing excessive peat slide debris from travelling downstream in a watercourse is the use of a check barrage. A check barrage comprises the placement of rock fill across a watercourse. The check barrage is a highly permeable construction that will allow the passage of water but will prevent peat debris from passing through. Rock fill will comprise well-graded coarse rock pieces from about 300mm up to 1000mm.

The rock fill for the check barrage will be sourced from local quarries.

The size of the barrage will vary depending on the scale of the peat debris to be contained and the geometry of the watercourse at the barrage location. In general, due to the low speed of a peat slide there is generally little impact force and most of the lateral load is due to fluid pressure on the upslope face of the barrage.

The check barrage will fill the entire channel width of the watercourse up to a height of 3 to 4m with a crest width of at least 2m and side slopes of about 45 degrees depending on the geometry of the barrage location.

The check barrage procedure is as follows:

(1) Access to the check barrage location will be along the existing access roads on the Proposed Wind Farm site and/or along public roads, where possible. When it is necessary to form the barrage then rock fill will be placed across the watercourse to effectively block the passage of peat debris.

(2) Operatives employed to carry out the construction of the check barrage will be inducted by means of a briefing by on-site supervisors as to the proposed location of the check barrage.

(3) The check barrage provides containment for peat debris in the highly unlikely event of a major peat slide. Further remedial measures, should they be required, will be assessed by the Contractor and the Project Geotechnical Engineer and carried out as soon as physically possible when the location and extent of the failure is established.

(4) Where a barrage was constructed as a precaution and no peat debris reached the watercourse then the barrage will be removed as soon as any measures to prevent further peat sliding is agreed with all parties (Contractor/Engineer/Designer).

13. REFERENCES

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DRAWINGS

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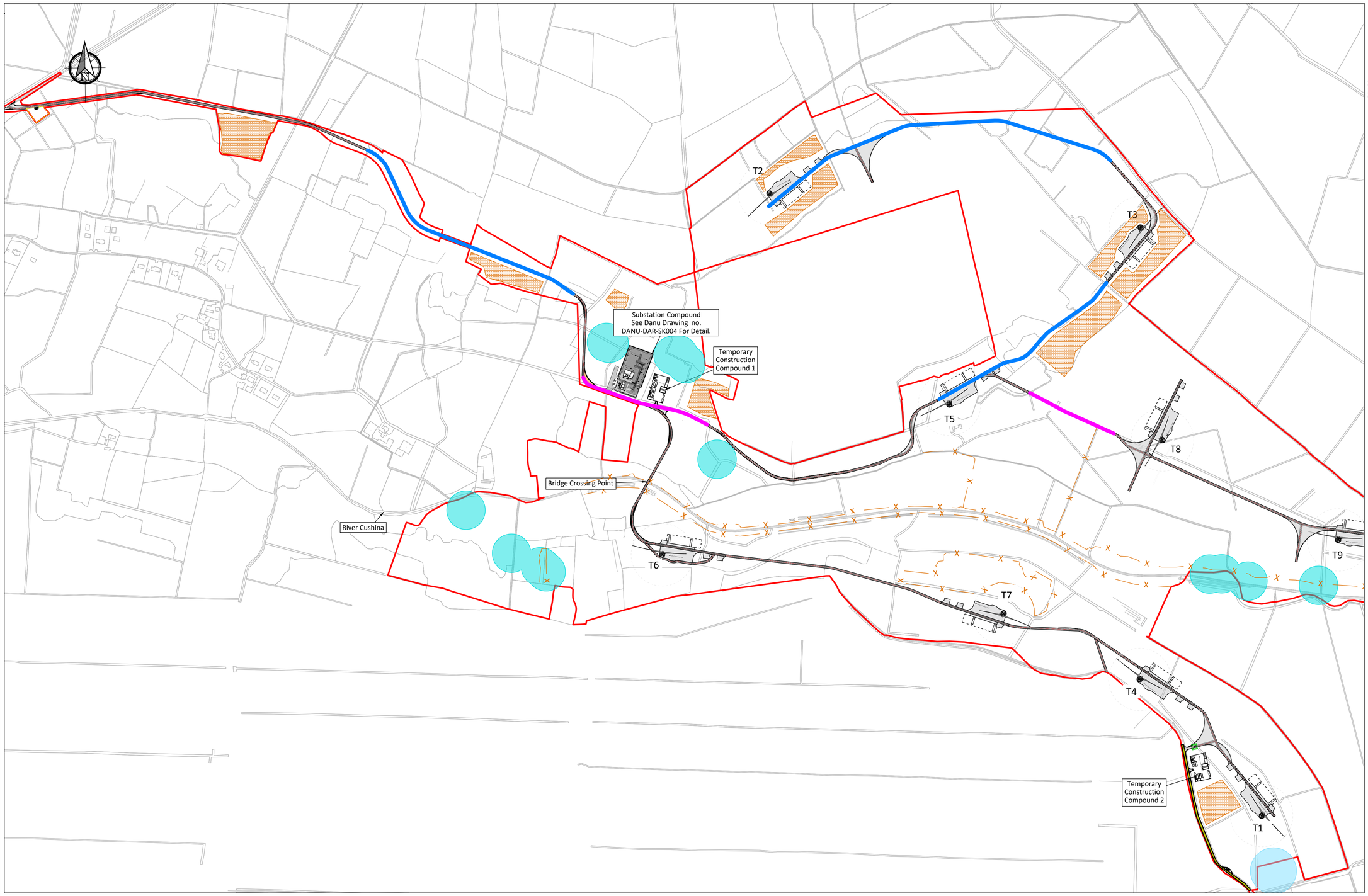
DRAWINGS



LEGEND:

- Planning Site Boundary
- Turbine
- Proposed Site Access Road
- Temporary Widenings
- Existing Road to be upgraded
- 64.00 Existing Ground Contour
- Proposed Peat Storage Areas
- Proposed Habitat Fence

ROAD TYPE LEGEND:

- New Floated Access Road
- Upgrade of Existing Access Track

PLAN

Scale 1:5000

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Rev.	Description	App By	Date
A	ISSUE FOR PLANNING	JH	23.04.25

PROJECT
DERRYNADARRAGH WIND FARM

CLIENT
Dara Energy Limited

SHEET
PEAT AND SPOIL MANAGEMENT AREAS
ROAD CONSTRUCTION TYPES PLAN

Date 23.04.25	Project number P22-145	Scale (@ A1-) 1:5000
Drawn by CS	Drawing Number P22-145-INFO-0022	Rev A
Checked by LD		

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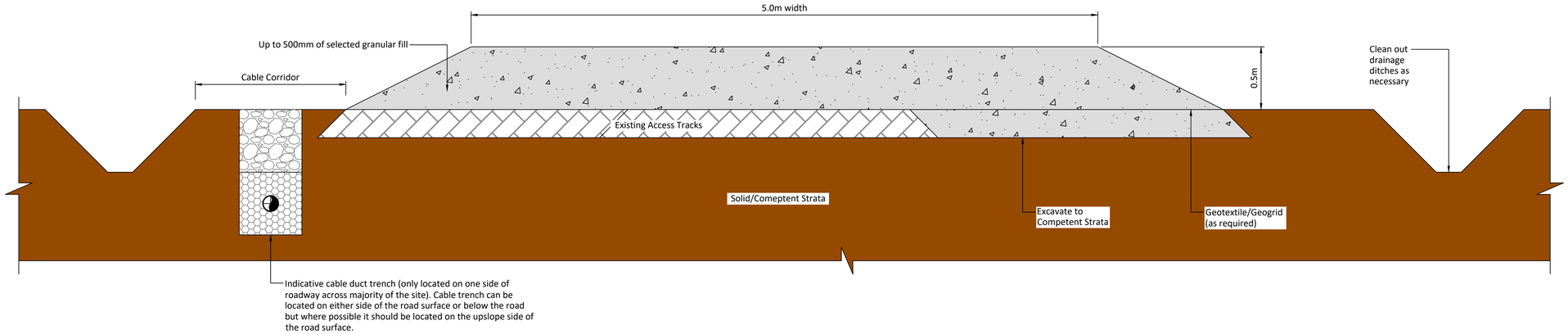
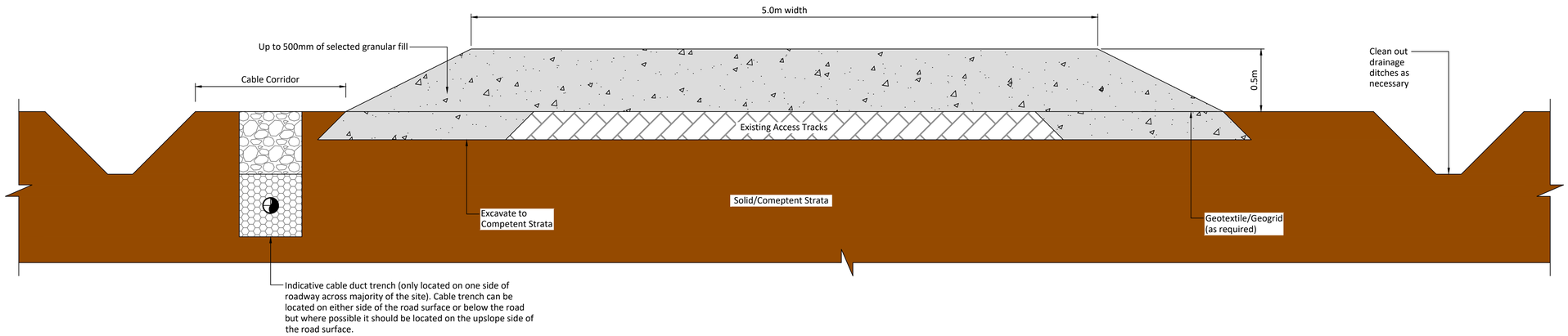
10 September 2025





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Rev.	Description	App By	Date
A	ISSUE FOR PLANNING	JH	25.08.25

PROJECT
DERRYNADARRAGH WIND FARM

CLIENT
Dara Energy Limited

SHEET
PEAT & SPOIL MANAGEMENT AREAS- TYPE A - UPGRADE OF EXISTING EXCAVATED ACCESS ROAD

Date 25.08.25	Project number P22-145	Scale (@ A1-) 1:0	
Drawn by CS	Drawing Number P22-145-INFO-0010		Rev A
Checked by EA			

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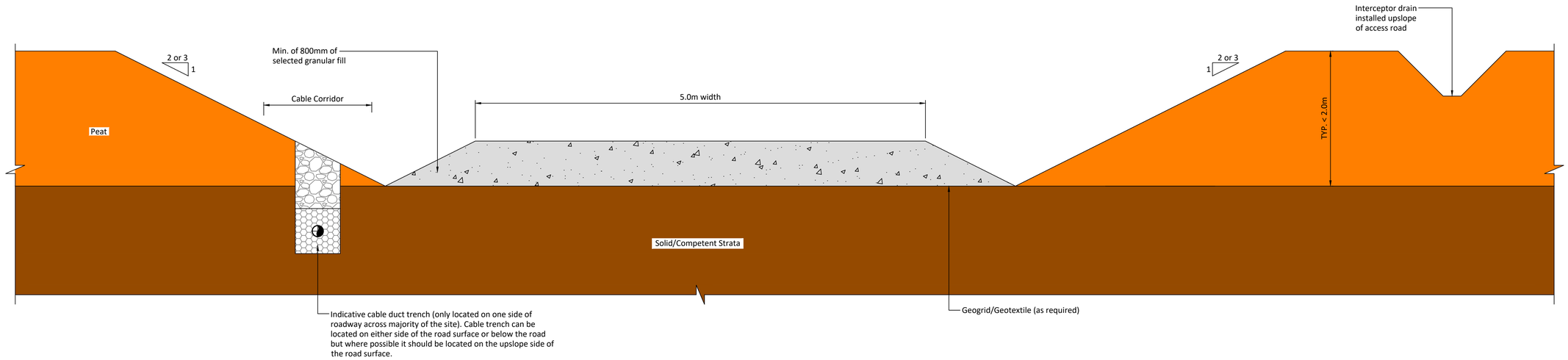
10 September 2025



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Rev.	Description	App By	Date
A	ISSUE FOR PLANNING	JH	25.08.25

PROJECT
DERRYNADARRAGH WIND FARM

CLIENT
Dara Energy Limited

SHEET
PEAT & SPOIL MANAGEMENT AREAS- TYPE B - NEW EXCAVATE AND REPLACE ACCESS ROAD

Date 25.08.25	Project number P22-145	Scale (@ A1-) 1:0	
Drawn by CS	Drawing Number P22-145-INFO-0011		Rev A
Checked by EA			

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10 September 2025

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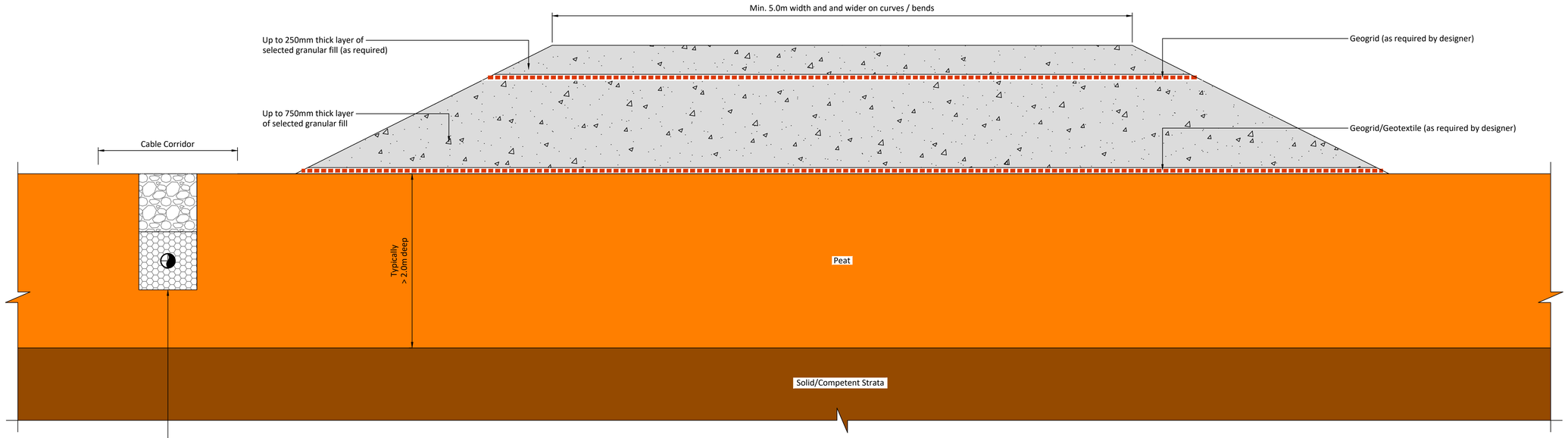

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Rev.	Description	App By	Date
A	ISSUE FOR PLANNING	JH	25.08.25

PROJECT
DERRYNADARRAGH WIND FARM

CLIENT
Dara Energy Limited

SHEET
PEAT & SPOIL MANAGEMENT AREAS- TYPE C - NEW FLOATED ACCESS TRACK

Date 25.08.25	Project number P22-145	Scale (@ A1-) 1:0	
Drawn by CS	Drawing Number P22-145-INFO-0012		Rev A
Checked by EA			

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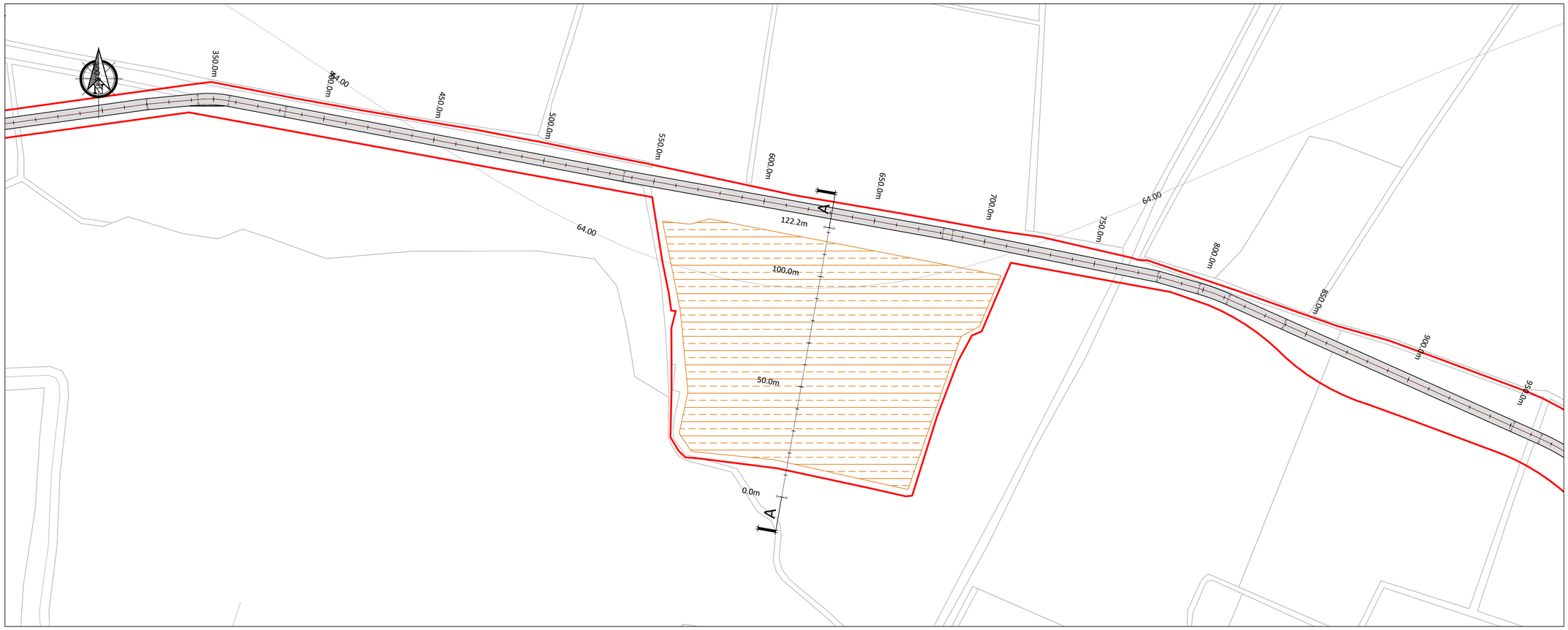
10 September 2025



PLAN

Scale 1:1000

LEGEND:

- Planning Site Boundary
- Turbine
- Proposed Site Access Road
- Temporary Widenings
- Existing Road to be upgraded
- 64.00 Existing Ground Contour
- Proposed Peat Storage Areas
- x x Proposed Habitat Fence

Construction Notes Peat Deposition Areas:

(1) An interceptor drain will also be installed upslope of the peat deposition areas.

(2) A silting pond will be required at the lower side of the peat deposition areas.

(3) It is important that the surface of the stored peat be shaped to allow efficient run-off of water from the stored spoil.

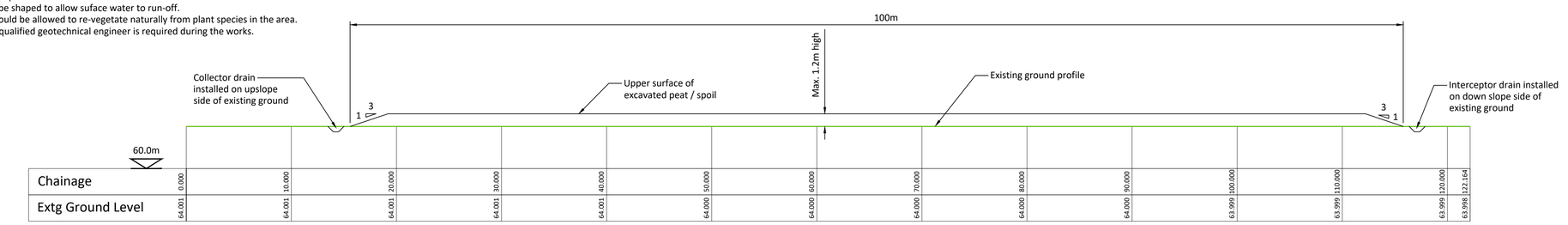
(4) Supervision by a geotechnical engineer or appropriately competent person is recommended for the construction of the peat deposition area.

(5) All the above-mentioned general guidelines and requirements will be implemented during construction.

(6) Further guidelines on the construction of the peat storage area are included within Section 5.4 of the Peat & Spoil Management Plan.

Construction Notes:

1) Spoil heap may consist of peat and overburden from local excavations.
2) Stored material should be shaped to allow suface water to run-off.
3) Placed / spread spoil should be allowed to re-vegetate naturally from plant species in the area.
4) Supervision by suitably qualified geotechnical engineer is required during the works.



SECTION A-A

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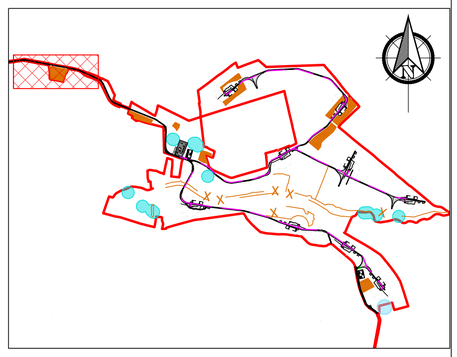

KEY PLAN

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Rev.	Description	App By	Date
A	ISSUE FOR PLANNING	JH	09.09.25

PROJECT: DERRYNADARRAGH WIND FARM

CLIENT: Dara Energy Limited

SHEET: PEAT AND SPOIL MANAGEMENT AREAS PLAN AND SECTION (SHEET 1 OF 7)

Date 09.09.25	Project number P22-145	Scale (@ A1-) 1:1000	
Drawn by CS	Drawing Number P22-145-INFO-0015		Rev A
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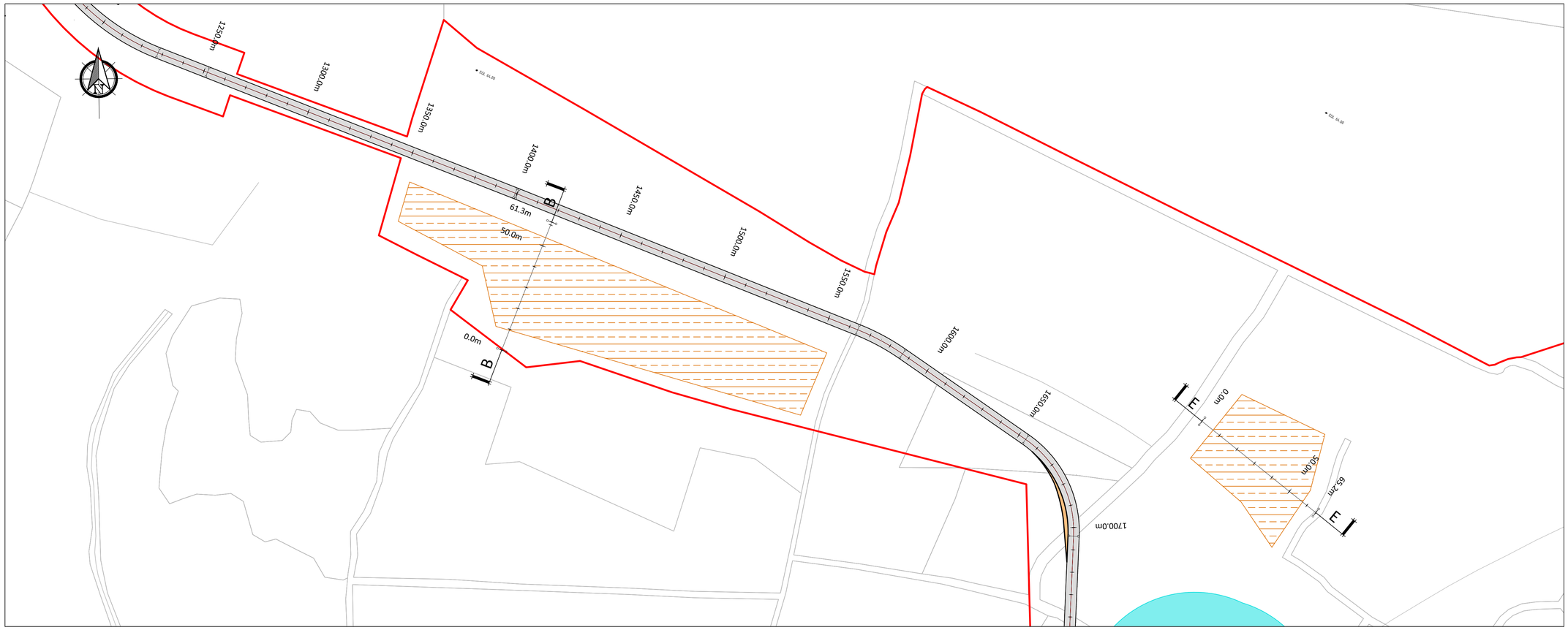
9 September 2025



PLAN

Scale 1:1000

LEGEND:

- Planning Site Boundary
- Turbine
- Proposed Site Access Road
- Temporary Widenings
- Existing Road to be upgraded
- 64.00 Existing Ground Contour
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- Proposed Habitat Fence

Construction Notes Peat Deposition Areas:

(1) An interceptor drain will also be installed upslope of the peat deposition areas.

(2) A silting pond will be required at the lower side of the peat deposition areas.

(3) It is important that the surface of the stored peat be shaped to allow efficient run-off of water from the stored spoil.

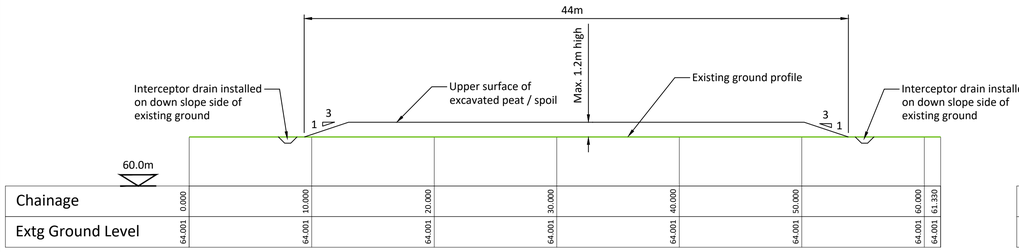
(4) Supervision by a geotechnical engineer or appropriately competent person is recommended for the construction of the peat deposition area.

(5) All the above-mentioned general guidelines and requirements will be implemented during construction.

(6) Further guidelines on the construction of the peat storage area are included within Section 5.4 of the Peat & Spoil Management Plan.

Construction Notes:

1) Spoil heap may consist of peat and overburden from local excavations.
2) Stored material should be shaped to allow suface water to run-off.
3) Placed / spread spoil should be allowed to re-vegetate naturally from plant species in the area.
4) Supervision by suitably qualified geotechnical engineer is required during the works.



SECTION B-B

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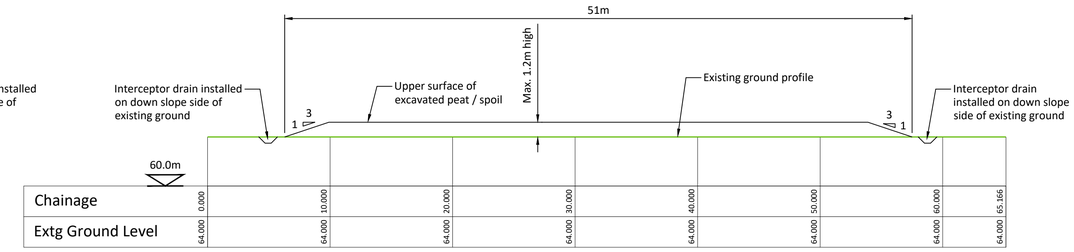

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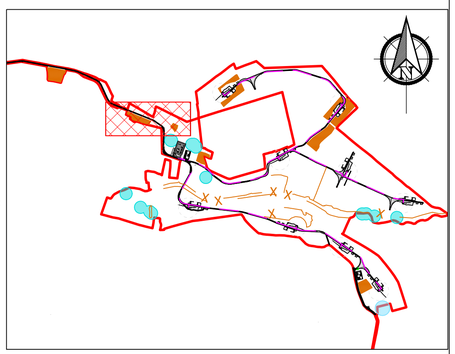

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Rev.	Description	App By	Date
A	ISSUE FOR PLANNING	JH	09.09.25

PROJECT: DERRYNADARRAGH WIND FARM

CLIENT: Dara Energy Limited

SHEET: PEAT AND SPOIL MANAGEMENT AREAS PLAN AND SECTION (SHEET 2 OF 7)

Date 09.09.25	Project number P22-145	Scale (@ A1-) 1:1000	
Drawn by CS	Drawing Number P22-145-INFO-0016		Rev A
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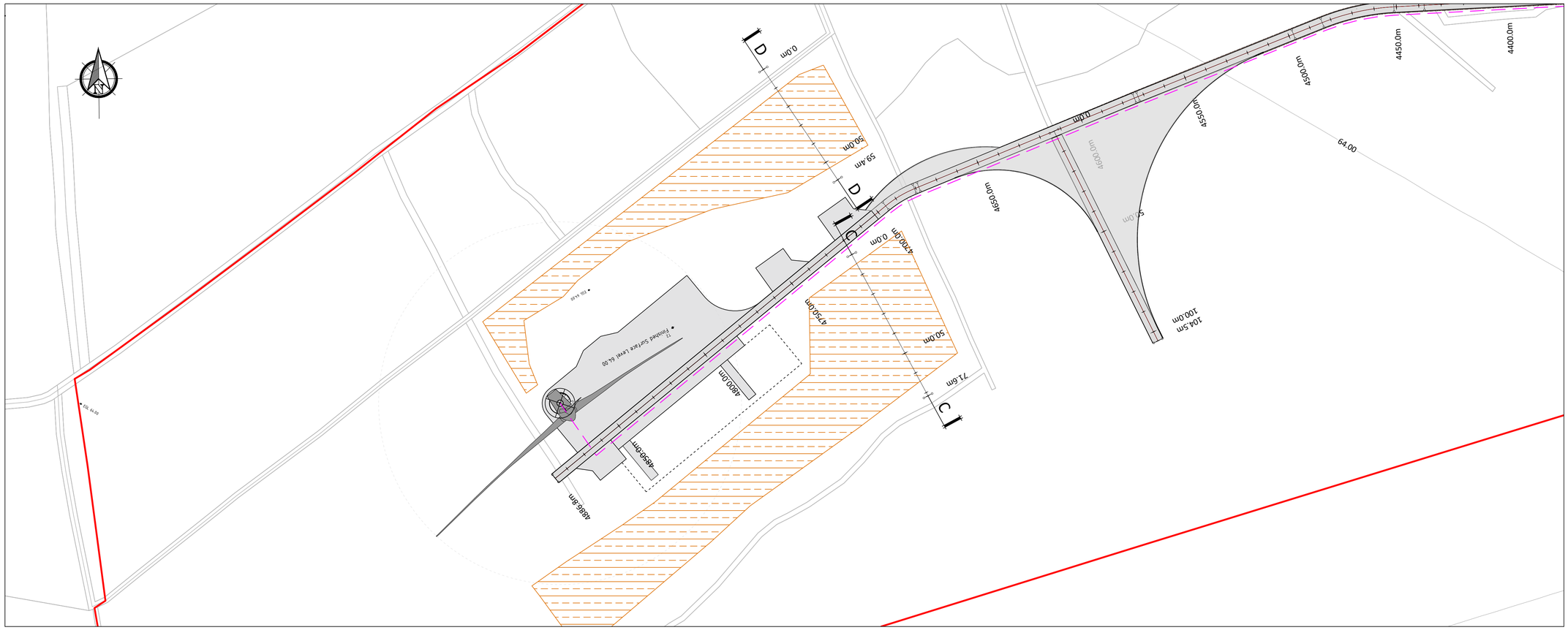
9 September 2025



PLAN

Scale 1:1000

LEGEND:

- Planning Site Boundary
- Turbine
- Proposed Site Access Road
- Temporary Widenings
- Existing Road to be upgraded
- 64.00 Existing Ground Contour
- Proposed Peat Storage Areas
- x x Proposed Habitat Fence

Construction Notes Peat Deposition Areas:

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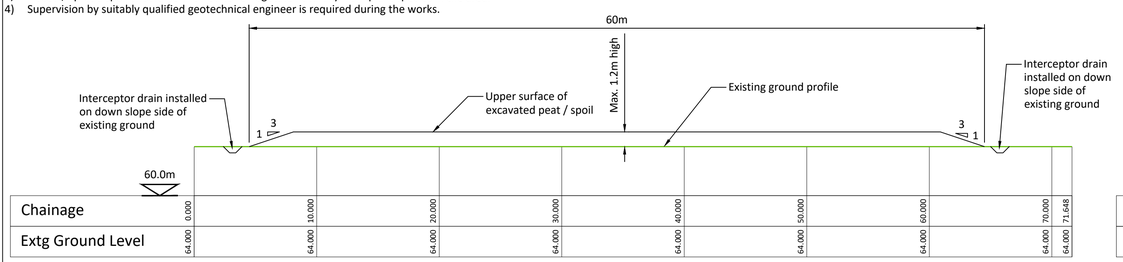

SECTION C-C

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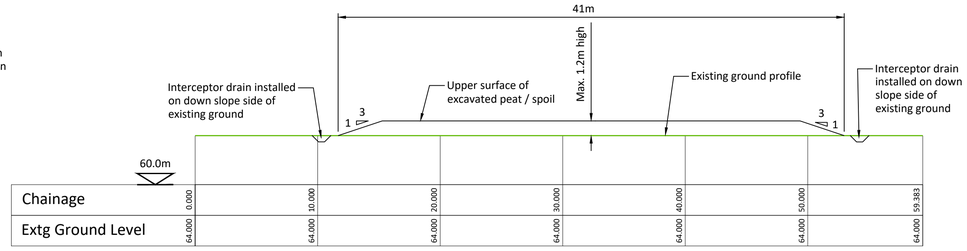

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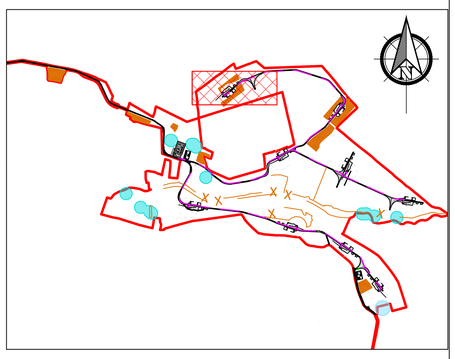

KEY PLAN

FEHILY TIMONEY

Cork | Dublin | Carlow

www.fehilytimoney.ie

Rev.	Description	App By	Date
A	ISSUE FOR PLANNING	JH	09.09.25

PROJECT: DERRYNADARRAGH WIND FARM

CLIENT: Dara Energy Limited

SHEET: PEAT AND SPOIL MANAGEMENT AREAS PLAN AND SECTION (SHEET 3 OF 7)

Date: 09.09.25	Project number: P22-145	Scale (@ A1-): 1:1000	
Drawn by: CS	Drawing Number: P22-145-INFO-0017		Rev: A
Checked by: EA			

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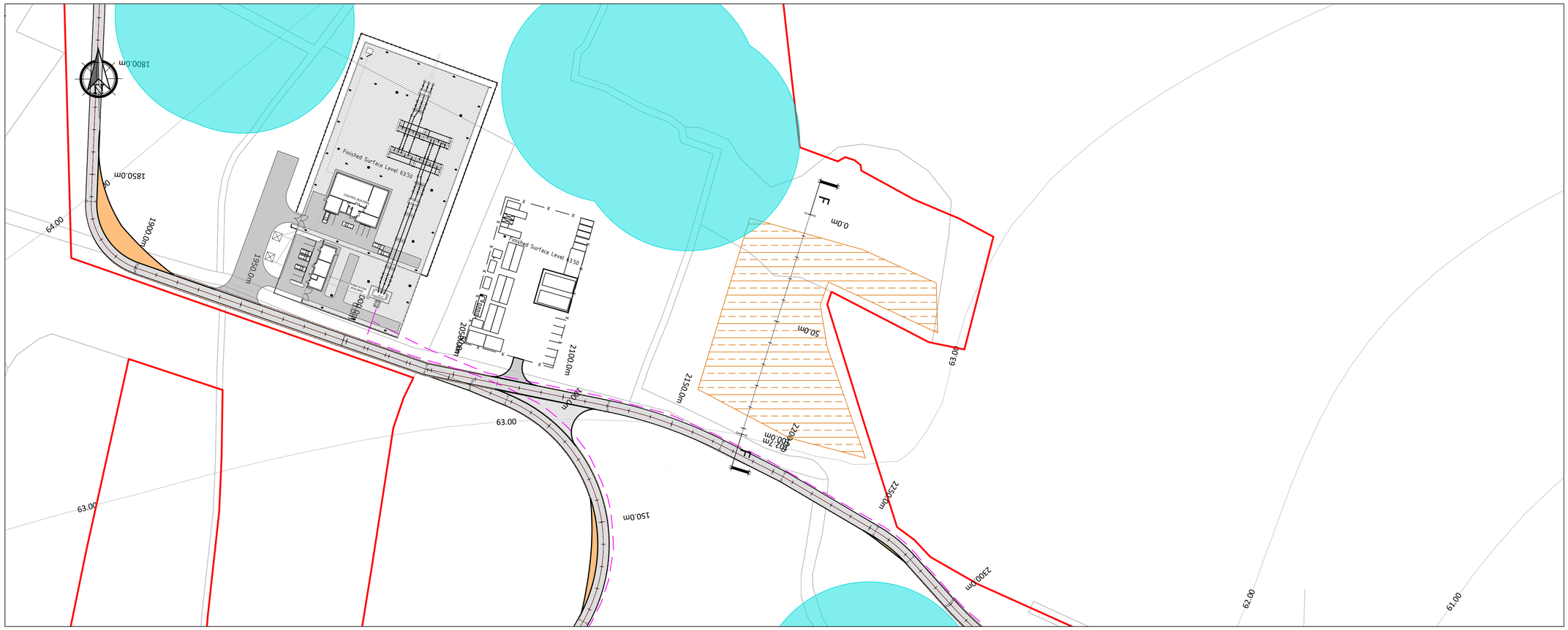
9 September 2025



PLAN

Scale 1:1000

LEGEND:

- Planning Site Boundary
- Turbine
- Proposed Site Access Road
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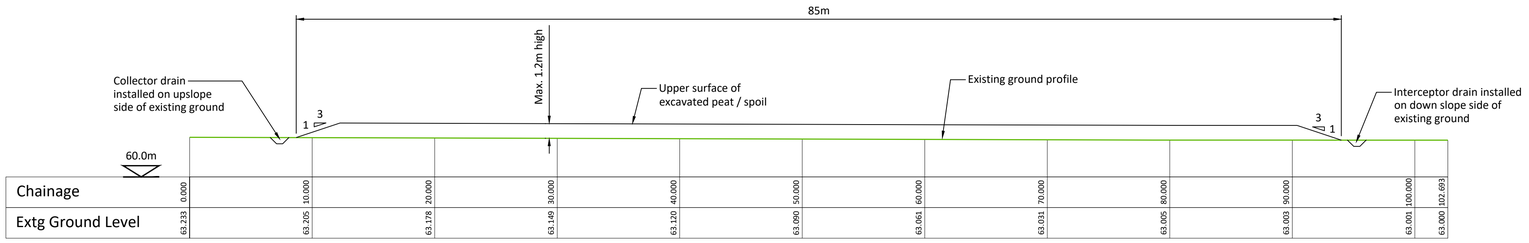
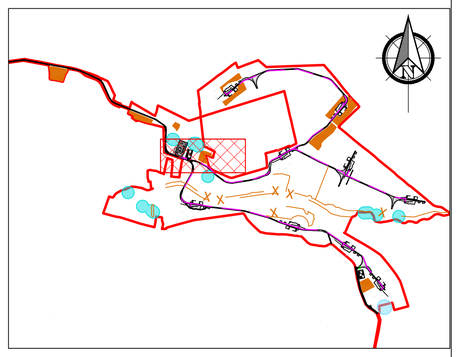


Chainage	0.000	10.000	20.000	30.000	40.000	50.000	60.000	70.000	80.000	90.000	100.000	102.693
Extg Ground Level	63.233	63.205	63.178	63.149	63.120	63.090	63.061	63.031	63.005	63.003	63.001	63.000

SECTION F-F

Scale 1:250



KEY PLAN

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Rev.	Description	App By	Date
A	ISSUE FOR PLANNING	JH	09.09.25

PROJECT: DERRYNADARRAGH WIND FARM

CLIENT: Dara Energy Limited

SHEET: PEAT AND SPOIL MANAGEMENT AREAS PLAN AND SECTION (SHEET 4 OF 7)

Date 09.09.25	Project number P22-145	Scale (@ A1-) 1:1000	
Drawn by CS	Drawing Number P22-145-INFO-0018		Rev A
Checked by EA			

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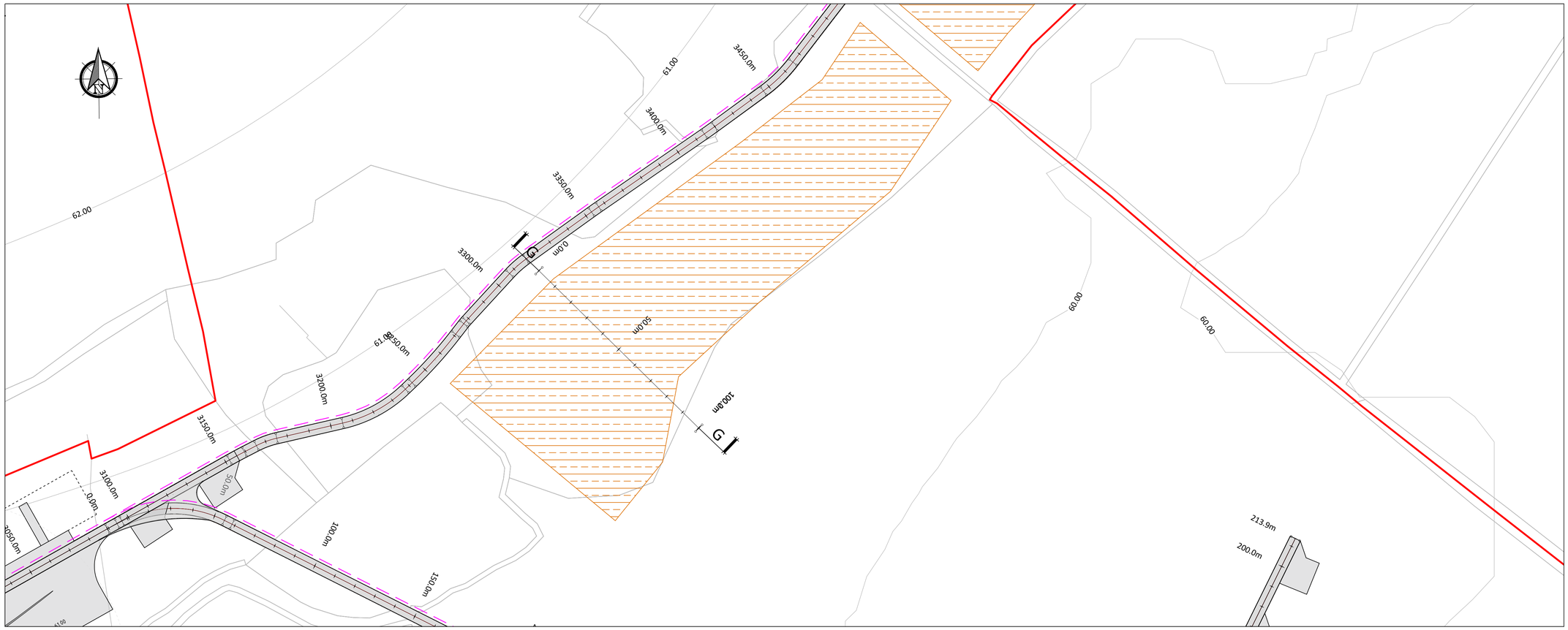
9 September 2025



PLAN

Scale 1:1000

LEGEND:

- Planning Site Boundary
- Turbine
- Proposed Site Access Road
- Temporary Widenings
- Existing Road to be upgraded
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- Proposed Habitat Fence

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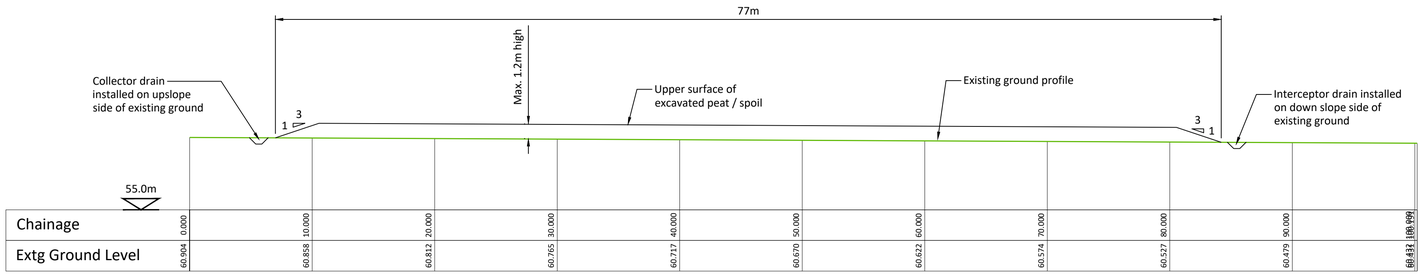
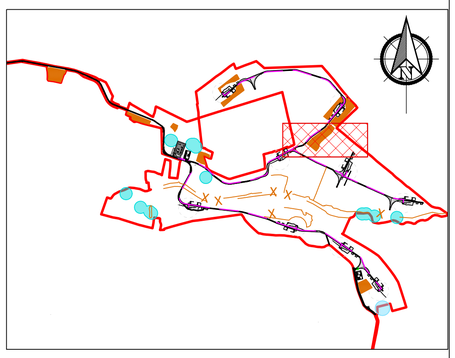


Chainage	0.000	10.000	20.000	30.000	40.000	50.000	60.000	70.000	80.000	90.000	100.000
Extg Ground Level	60.904	60.858	60.812	60.765	60.717	60.670	60.622	60.574	60.527	60.479	60.431

SECTION G-G

Scale 1:250



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Rev.	Description	App By	Date
A	ISSUE FOR PLANNING	JH	09.09.25

PROJECT: DERRYNADARRAGH WIND FARM

CLIENT: Dara Energy Limited

SHEET: PEAT AND SPOIL MANAGEMENT AREAS PLAN AND SECTION (SHEET 5 OF 7)

Date: 09.09.25	Project number: P22-145	Scale (@ A1-): 1:1000	
Drawn by: CS	Drawing Number: P22-145-INFO-0019		Rev: A
Checked by: EA			

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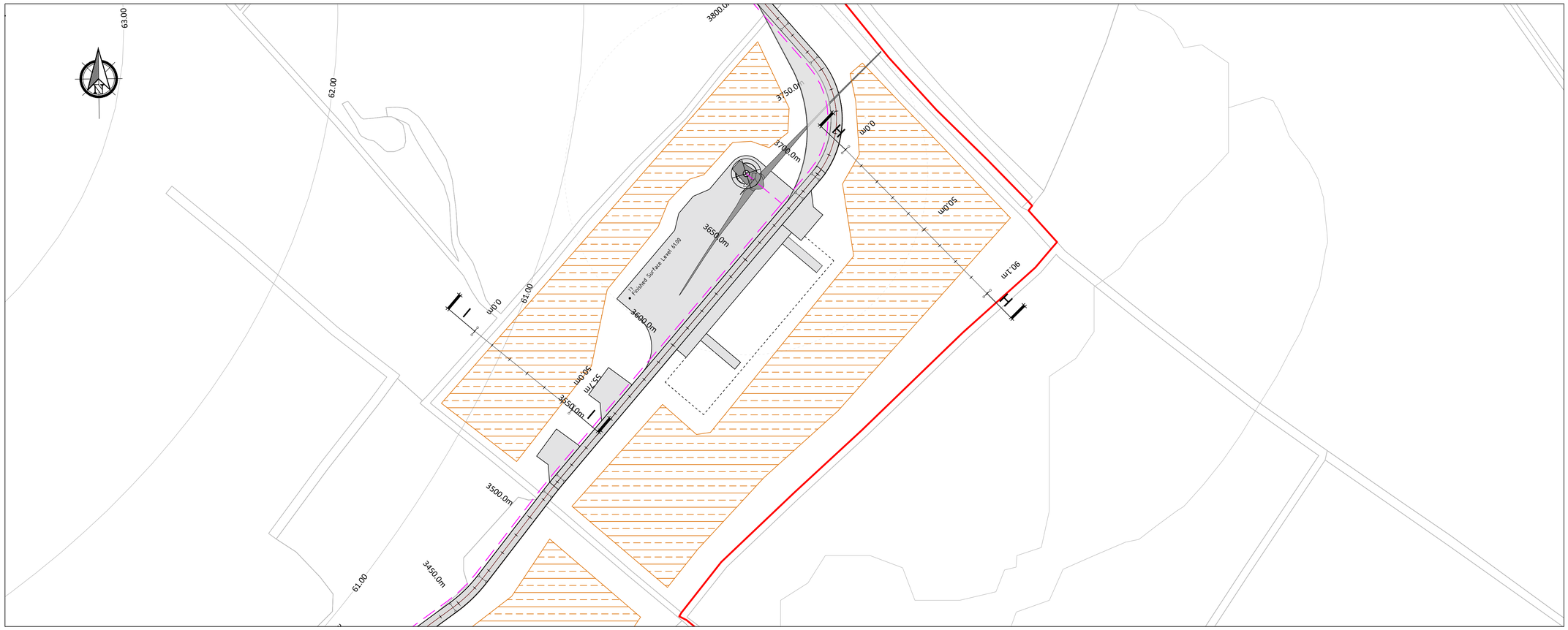
9 September 2025



PLAN

Scale 1:1000

LEGEND:

- Planning Site Boundary
- Turbine
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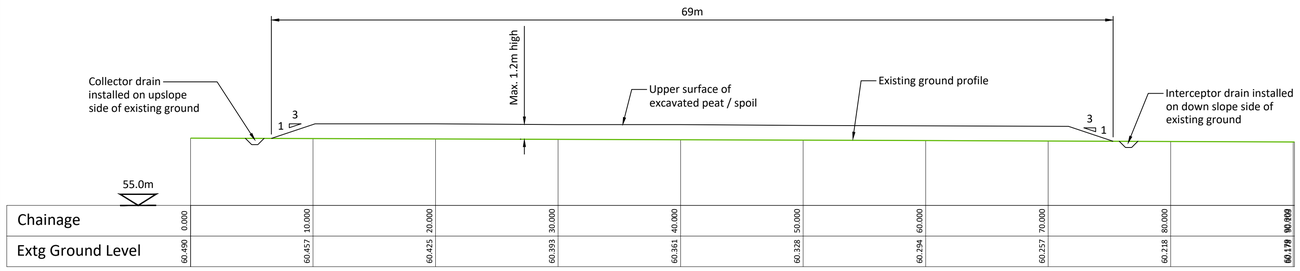
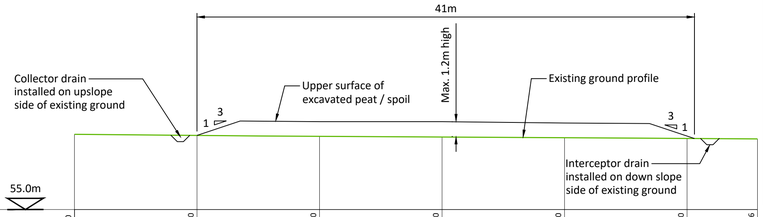


Chainage	0.000	10.000	20.000	30.000	40.000	50.000	60.000	70.000	80.000	90.809
Extg Ground Level	60.490	60.457	60.425	60.393	60.361	60.328	60.294	60.257	60.218	60.178

SECTION H-H

Scale 1:250



Chainage	0.000	10.000	20.000	30.000	40.000	50.000	55.746
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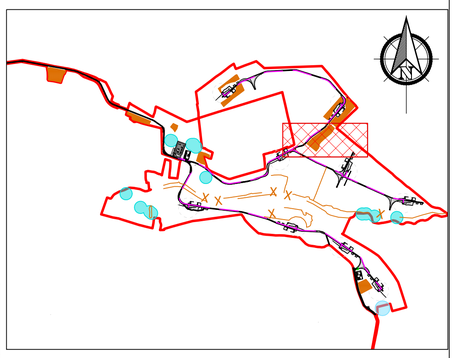
SECTION I-I

Scale 1:250



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Rev.	Description	App By	Date
A	ISSUE FOR PLANNING	JH	09.09.25

PROJECT: **DERRYNADARRAGH WIND FARM**

CLIENT: Dara Energy Limited

SHEET: **PEAT AND SPOIL MANAGEMENT AREAS PLAN AND SECTION (SHEET 6 OF 7)**

Date: 09.09.25	Project number: P22-145	Scale (@ A1-): 1:1000	
Drawn by: CS	Drawing Number: P22-145-INFO-0020		Rev: A
Checked by: EA			

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9 September 2025

PLAN

Scale 1:1000

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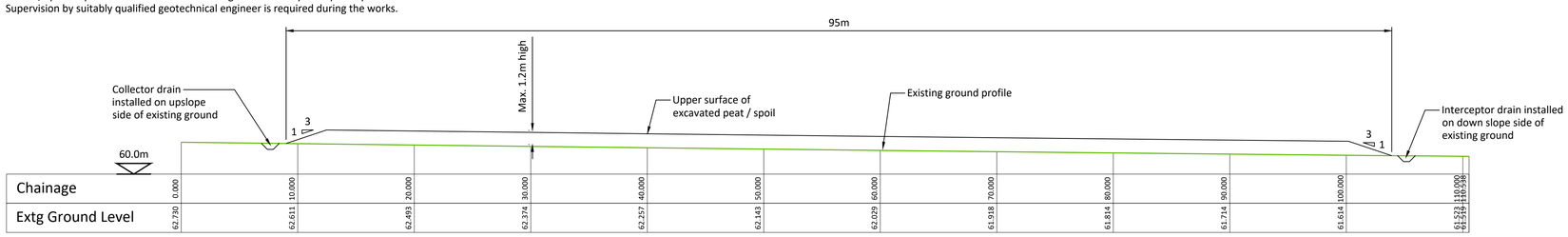

SECTION J-J

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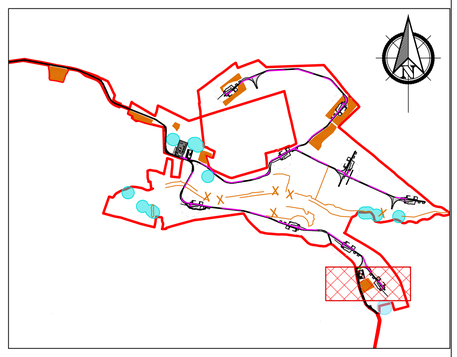

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Rev.	Description	App By	Date
A	ISSUE FOR PLANNING	JH	09.09.25

PROJECT: **DERRYNADARRAGH WIND FARM**

CLIENT: Dara Energy Limited

SHEET: **PEAT AND SPOIL MANAGEMENT AREAS PLAN AND SECTION (SHEET 7 OF 7)**

Date: 09.09.25	Project number: P22-145	Scale (@ A1-): 1:1000
Drawn by: CS	Drawing Number: P22-145-INFO-0021	Rev: A
Checked by: EA		

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9 September 2025

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Appendix 11.4

Ground Penetration Radar Survey

AGP25024_01

Report

on the

Geophysical Investigation

At

Kildare-Laois Cable Route

for

Inis Onshore Wind Limited

07TH March 2025

APEX Geophysics Limited
Unit 6, Knockmullen Business Park
Gorey
Co. Wexford

T: 0402 21842
F: 0402 21843
E: info@apexgeophysics.ie
W: www.apexgeophysics.com

PRIVATE AND CONFIDENTIAL

THE FINDINGS OF THIS REPORT ARE THE RESULT OF A GEOPHYSICAL SURVEY USING NON-INVASIVE SURVEY TECHNIQUES CARRIED OUT AT THE GROUND SURFACE. INTERPRETATIONS CONTAINED IN THIS REPORT ARE DERIVED FROM A KNOWLEDGE OF THE GROUND CONDITIONS, THE GEOPHYSICAL RESPONSES OF GROUND MATERIALS AND THE EXPERIENCE OF THE AUTHOR. APEX GEOPHYSICS LTD. HAS PREPARED THIS REPORT IN LINE WITH BEST CURRENT PRACTICE AND WITH ALL REASONABLE SKILL, CARE AND DILIGENCE IN CONSIDERATION OF THE LIMITS IMPOSED BY THE SURVEY TECHNIQUES USED AND THE RESOURCES DEVOTED TO IT BY AGREEMENT WITH THE CLIENT. THE INTERPRETATIVE BASIS OF THE CONCLUSIONS CONTAINED IN THIS REPORT SHOULD BE TAKEN INTO ACCOUNT IN ANY FUTURE USE OF THIS REPORT.

PROJECT NUMBER	AGP25024		
AUTHOR	**CHECKED**	**REPORT STATUS**	**DATE**
IAN SHARKEY (DIP MIN ENG)	TONY LOMBARD MSC (GEOPHYSICS)	V.01	07TH MARCH 2025

CONTENTS

1. EXECUTIVE SUMMARY

APEX Geophysics Limited was requested by Inis Onshore Wind Limited to carry out a geophysical investigation along a section of proposed cable route along local roads in Counties Kildare & Laois, using Ground Penetrating Radar (GPR).

The objective of the investigation was to provide information on the possible presence of peat below the road pavement along the cable route.

The Geological Survey of Ireland (GSI) soils map for the area indicates the area of investigation is underlain by soils including cut over raised peat, lake marl, alluvium, lacustrine sediments, gravels derived from limestones and till derived from limestones. Bedrock outcrop or subcrop is indicated towards the southwest of the area of investigation. The GSI bedrock map for the area indicates the area of investigation is underlain by limestones of the Lucan and Ballyadams Formations.

The geophysical investigation was carried out over one session on the 14th of February 2025 and involved the acquisition of 9,572 m of GPR data along local and regional roads from Derrylea Peat bog in the north to Portarlington in the southwest using GPR antenna frequencies ranging between 1600 MHz and 100 MHz to resolve shallow and deep planar reflections associated with the pavement construction and subgrade.

Seven Soft Ground Probes (SGP) were carried out as part of the investigation in accessible land adjacent to the road to confirm the presence and thickness of peat. Soft ground was encountered from 0.5 m to 2.5 m below ground level (bgl). The results were correlated with reflections from the GPR data interpreted as the base of the peat layer.

These data were combined and analysed to produce the following interpreted 2D sections:

- SECTION AA' (0 m – 2,287 m)
- SECTION BB' (0 m – 7,285 m)

The findings of the investigation are presented as 2D longitudinal sections in APPENDIX A: Drawings AGP25024_02 – AGP25024_09.

Longitudinal sections of interpreted layers have been presented with a flat datum (100 X vertical exaggeration). Material type and appropriate GPR velocity are assigned to planar reflections identified in the investigation, based on information available at the time of survey such as site observations, soft ground probes and GSI soils and bedrock distribution maps.

Four areas of Peat underlying the road construction have been interpreted on the GPR sections. The locations are shown as a contour plot overlain on the location plan in addition to the 2D section. Depth and thickness estimates associated with interpreted layers are summarized in APPENDIX B: Pavement construction summary tables.

Locations can be provided on request for direct investigation to confirm the geophysical interpretation. In-situ material thickness measurements may be used for calibration of the GPR signal and to refine the GPR wave velocity used in calculation of material thickness.

The findings from this investigation should be reviewed upon completion of any intrusive investigations.

2. INTRODUCTION

APEX Geophysics Limited was requested by Inis Onshore Wind Limited to carry out a geophysical investigation along a section of proposed cable route along local roads in Counties Kildare & Laois, using Ground Penetrating Radar (GPR).

2.1 Survey Objectives

The objective of the investigation was to provide information on the possible presence of peat below the road along the cable route.

2.2 Site Background

The section of cable route under investigation is 9,572 m in length and is divided into two sections AA' and BB' for the purposes of reporting. (Figure 2.1).

Section AA' starts at Derrylea Peat Bog in the north at chainage 0 m and terminates at local road L71764 in the south at chainage 2,287 m and comprises unpaved gravel roads and paved local road.

Section BB' starts in the west at chainage 0 m and runs south and west towards Portarlington for a distance of 7,285 m along local and regional roads L71764, L71765, L7176, L71761, R424 and R420.

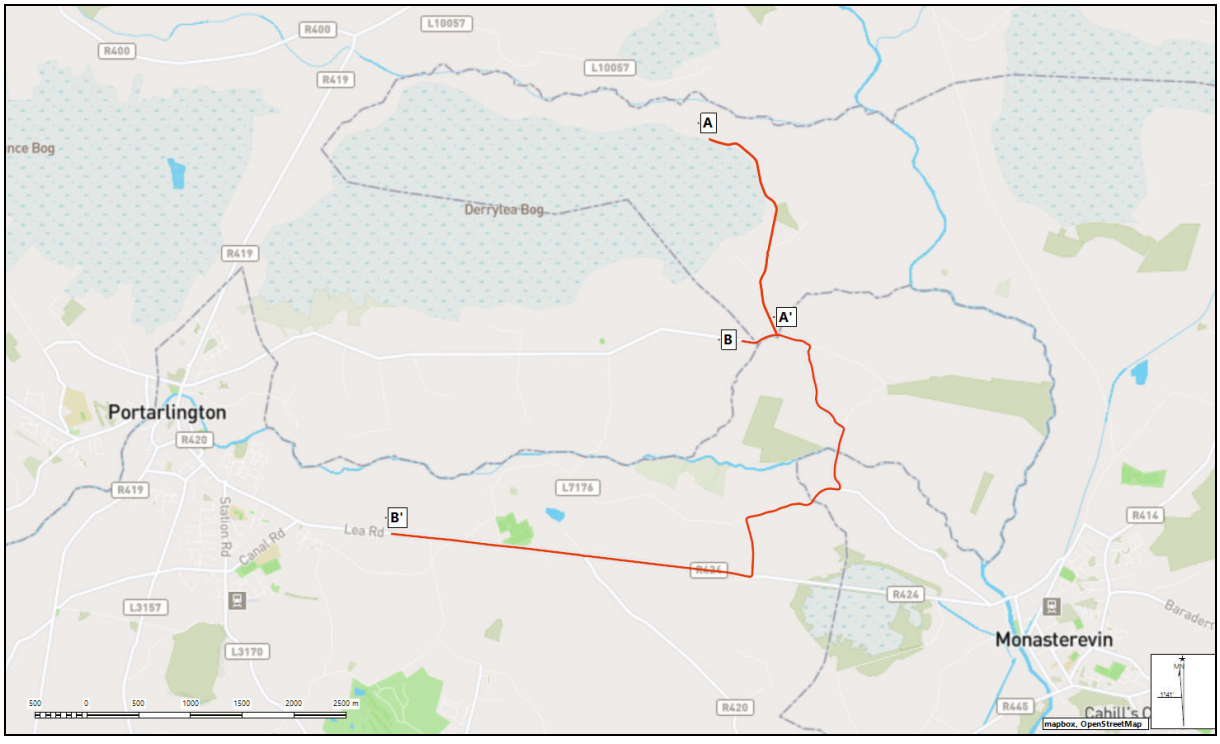

Figure 2.1: Site Investigation Location map (Geophysical investigation locations shown in red).

2.3 Soils

The Geological Survey of Ireland (GSI) soils map for the area (Figure 2.2) indicates cut over raised peat, lake marl, alluvium, lacustrine sediments, gravels derived from limestones and till derived from limestones. Bedrock outcrop or subcrop is indicated towards the southwest of the area of investigation.

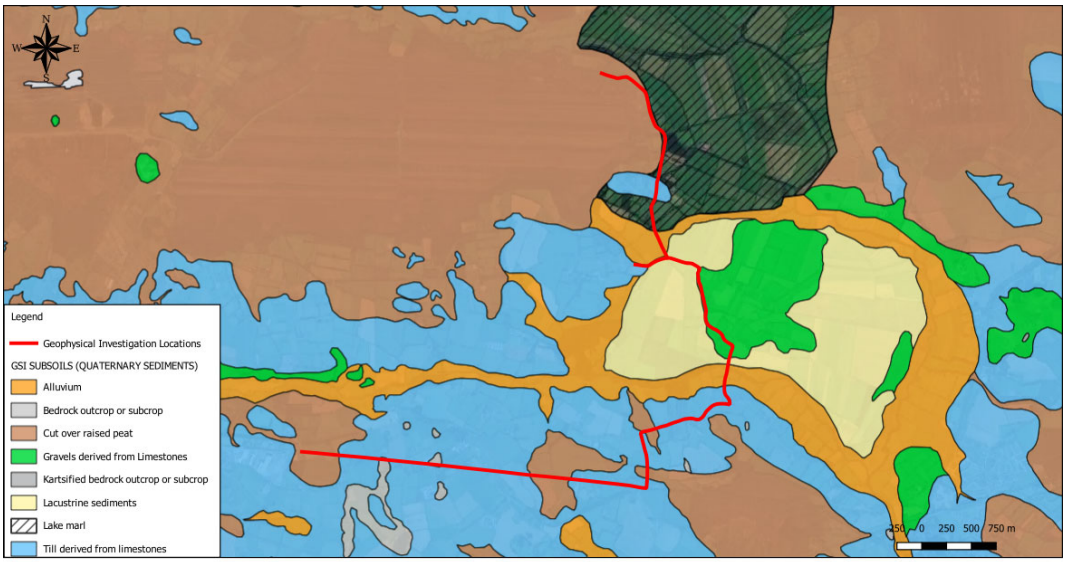

Figure 2.2: GSI Soils map (Geophysical investigation location shown in red).

2.4 Geology

The GSI 1:100k 2025 bedrock map for the area (Figure 2.3) indicates the area of investigation is underlain by limestones of the Lucan and Ballyadams Formations. A fault is shown to the southwest of the area of investigation. (GSI 1:100,000 Bedrock Map 2025).

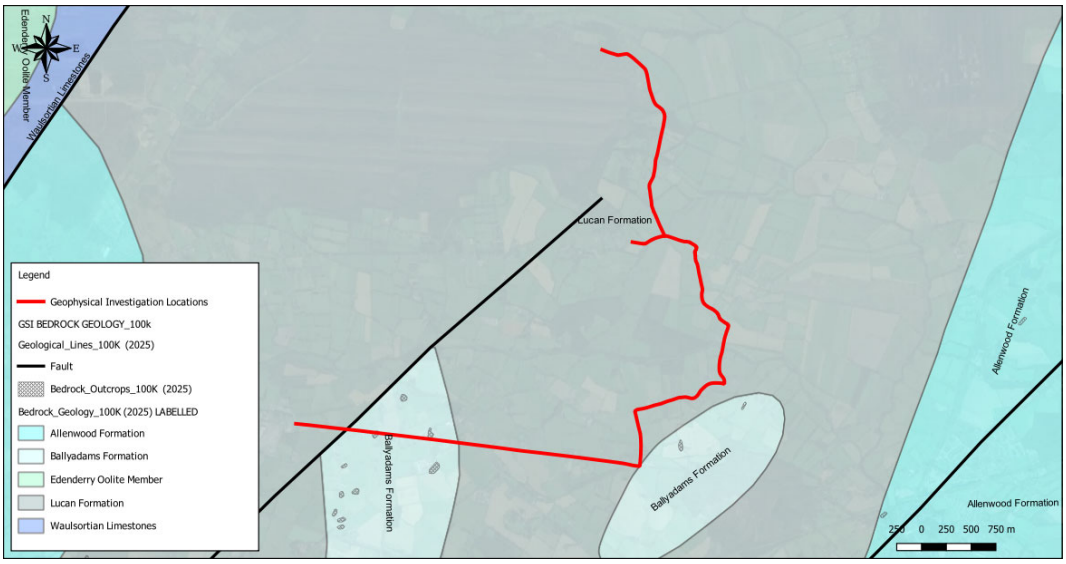

Figure 2.3: Bedrock Geology map (Geophysical investigation location shown in red).

2.5 Direct Investigation Data

Seven Soft Ground Probes (SGP) were carried out as part of the investigation in accessible land adjacent to the road to confirm the presence and thickness of peat. Soft ground was encountered from 0.5 m to 2.5 m below ground level (bgl). The results were correlated with reflections from the GPR data interpreted as the base of the peat layer.

No other intrusive investigation data was available at the time of producing this report. Where additional intrusive data becomes available the findings from the geophysical investigation should be reviewed accordingly.

2.6 Survey Rationale

Ground Penetrating Radar (GPR) works by sending radio waves into the ground and measuring the time of the reflected wave. Reflections occur where different material properties exist.

Pavement construction materials are generally well controlled and provide an effective target for the GPR technique. GPR has been used extensively in the determination of pavement construction detail as it provides continuous layer information which can be correlated to more intrusive core data.

GPR has also been used extensively in the determination of peat thickness in both raised bog as well as upland blanket bog and has been proved to be extremely accurate. Where peat has a high inorganic content (organic soil rather than pure peat) the penetration is reduced, and the peat base may not be fully resolved. Where a conductive material such as clay or ash overlies the peat, the signal will be attenuated and the base of the peat layer may not be resolved.

The base of the peat is normally underlain by materials with significantly different properties to the peat itself. This in turn produces a strong signal from the base of the peat enabling accurate thickness measurements to be made.

Further information on the detailed methodology of each geophysical method employed in this investigation is given in **APPENDIX C: DETAILED METHODOLOGY**.

As with all geophysical methods the results are based on indirect readings of the subsurface properties. The effectiveness *of the proposed approach will be affected by variations in the ground properties.*

3. RESULTS

The geophysical investigation was carried out over one session on the 14th of February 2025 and involved the acquisition of 9,572 m of GPR data along local and regional roads from Derrylea Peat bog in the north to Portarlington in the southwest using GPR antenna frequencies ranging between 1600 MHz and 100 MHz to resolve shallow and deep planar reflections associated with the pavement construction and subgrade.

These data were combined and analysed to produce the following interpreted 2D sections:

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The sections are presented as a series of drawings in APPENDIX A: Drawings AGP25024_02 – AGP25024_09. Longitudinal sections of interpreted layers have been presented with a flat datum (100 X vertical exaggeration). Material type and appropriate GPR velocity are assigned to planar reflections identified in the survey based on information available at the time of survey such as site observations, soft ground probes and GSI soils and bedrock distribution maps.

The following information is displayed in the drawings:

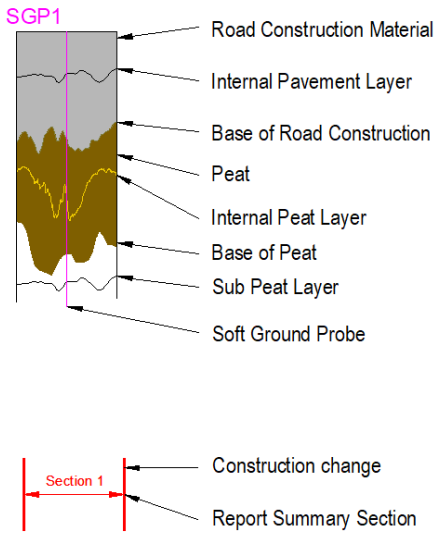


Figure 3.1: Drawing Legend.

Four areas of possible Peat underlying the road construction have been interpreted on the GPR sections. The locations are shown as a contour plot overlain on the location plan in addition to the 2D section. Depth and thickness estimates associated with interpreted layers are summarized in APPENDIX B: Pavement construction summary charts.

3.1 Data Quality

In general the data quality recorded along the sections was good and resolved a high amplitude planar reflection from the base of the peat material as shown in Figure 3.2.

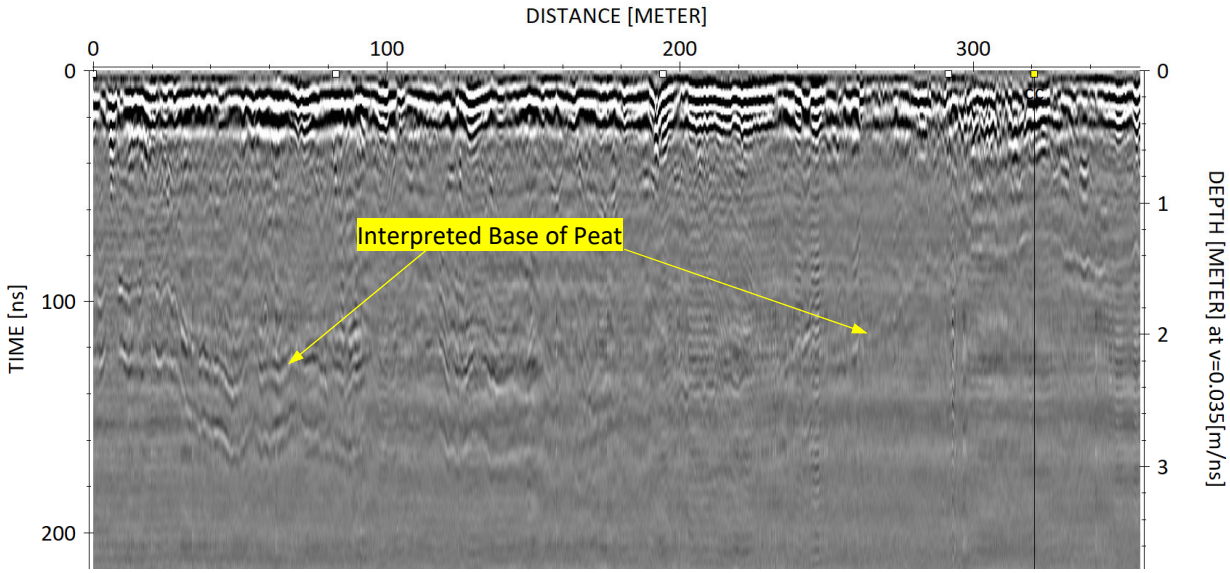


Figure 3.2: Planar reflection from base of peat material and GPR signal attenuation at Section A.

4. RECOMMENDATIONS

Locations can be provided on request for direct investigation to confirm the geophysical interpretation. In-situ material thickness measurements may be used for calibration of the GPR signal and to refine the GPR wave velocity used in calculation of material thickness.

The findings from this investigation should be reviewed upon completion of any intrusive investigations.

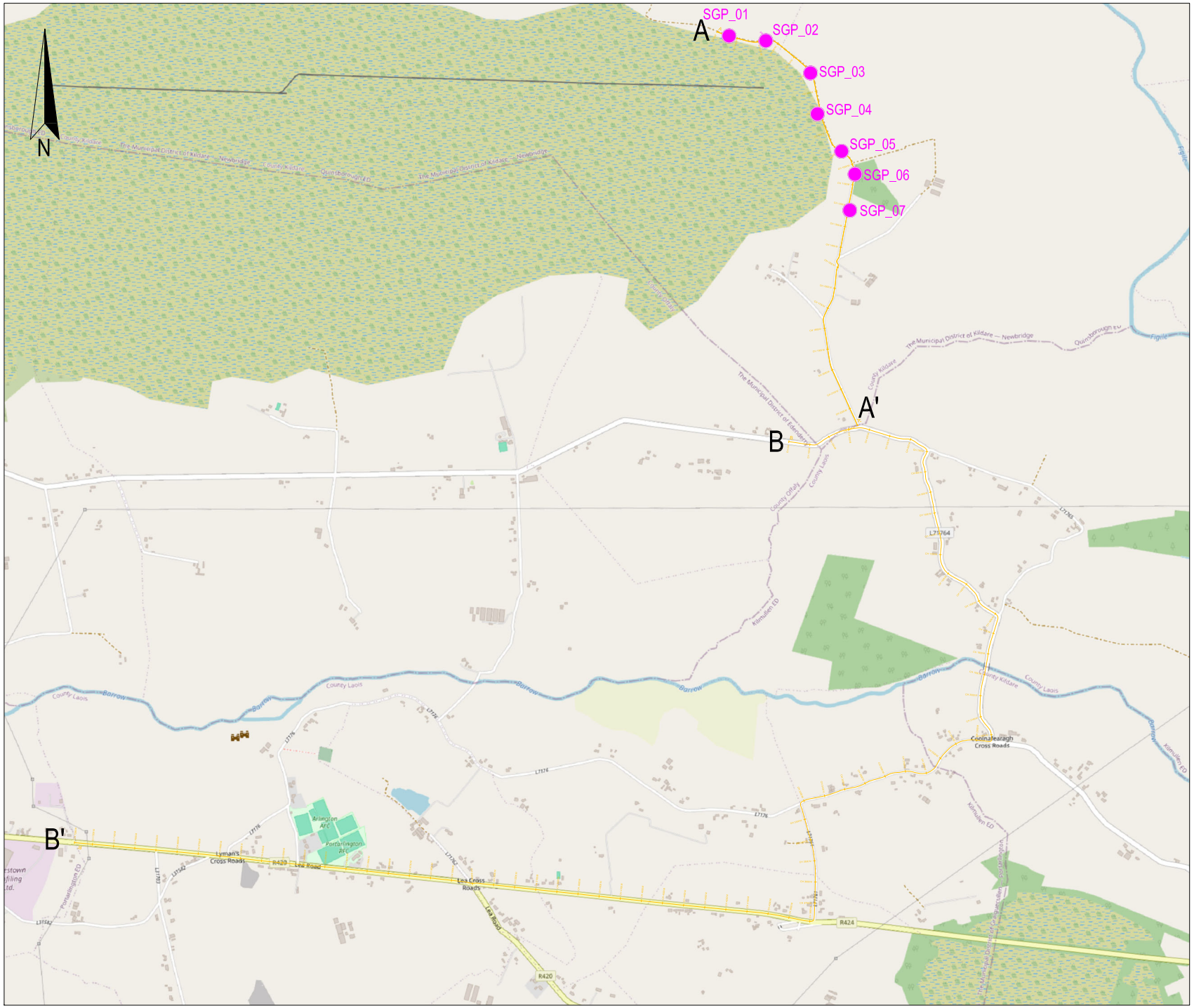
APPENDIX A: DRAWINGS

The data derived from the investigation has been presented in the following drawings:

AGP25024_01	**Geophysical Investigation Locations**	1:25,000 @ A4
AGP25024_02	**GPR Section AA' (Chainage: 0 - 1300 m)**	
FIGURE 1: Geophysical Investigation Locations Overlain on Aerial Photo.		1:4000 @ A3
FIGURE 2: GPR Interpretation - Flat Datum		Hz - 1:4000, Vt. 1:40 @ A3
AGP25024_03	**GPR Section AA' (Chainage: 1300 - 2287 m)**	
FIGURE 1: Geophysical Investigation Locations Overlain on Aerial Photo.		1:4000 @ A3
FIGURE 2: GPR Interpretation - Flat Datum		Hz - 1:4000, Vt. 1:40 @ A3
AGP25024_04	**GPR Section BB' (Chainage: 0 - 1300 m)**	
FIGURE 1: Geophysical Investigation Locations Overlain on Aerial Photo.		1:4000 @ A3
FIGURE 2: GPR Interpretation - Flat Datum		Hz - 1:4000, Vt. 1:40 @ A3
AGP25024_05	**GPR Section BB' (Chainage: 1300 - 2600 m)**	
FIGURE 1: Geophysical Investigation Locations Overlain on Aerial Photo.		1:4000 @ A3
FIGURE 2: GPR Interpretation - Flat Datum		Hz - 1:4000, Vt. 1:40 @ A3
AGP25024_06	**GPR Section BB' (Chainage: 2600 - 3900 m)**	
FIGURE 1: Geophysical Investigation Locations Overlain on Aerial Photo.		1:4000 @ A3
FIGURE 2: GPR Interpretation - Flat Datum		Hz - 1:4000, Vt. 1:40 @ A3
AGP25024_07	**GPR Section BB' (Chainage: 3900 - 5200 m)**	
FIGURE 1: Geophysical Investigation Locations Overlain on Aerial Photo.		1:4000 @ A3
FIGURE 2: GPR Interpretation - Flat Datum		Hz - 1:4000, Vt. 1:40 @ A3
AGP25024_08	**GPR Section BB' (Chainage: 5200 - 6500 m)**	
FIGURE 1: Geophysical Investigation Locations Overlain on Aerial Photo.		1:4000 @ A3
FIGURE 2: GPR Interpretation - Flat Datum		Hz - 1:4000, Vt. 1:40 @ A3
AGP25024_09	**GPR Section BB' (Chainage: 6500 - 7285 m)**	
FIGURE 1: Geophysical Investigation Locations Overlain on Aerial Photo.		1:4000 @ A3
FIGURE 2: GPR Interpretation - Flat Datum		Hz - 1:4000, Vt. 1:40 @ A3

GEOPHYSICAL LOCATIONS

SCALE 1:25,000



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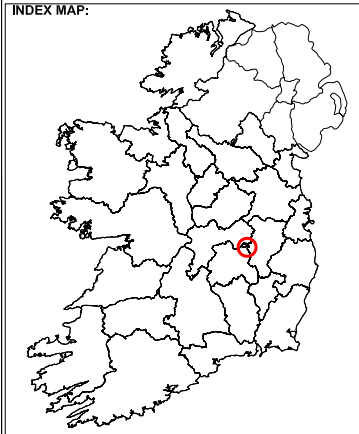

LEGEND:

Geophysical Investigation Locations annotated with chainage (m)

Soft Ground Probe

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FIGURE 1: GPR SECTION AA' (CHAINAGE: 0 - 1300 m) - GEOPHYSICAL INVESTIGATION LOCATIONS OVERLAIN ON AERIAL PHOTO

Scale 1:4000

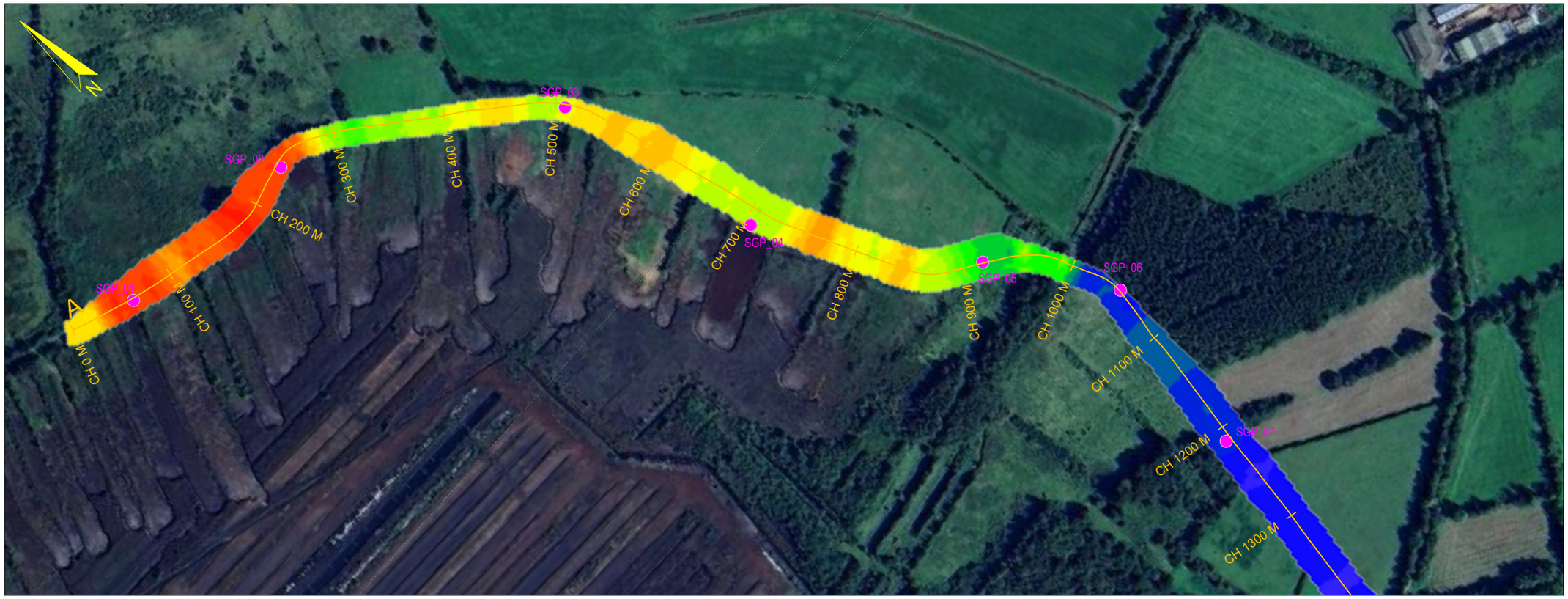
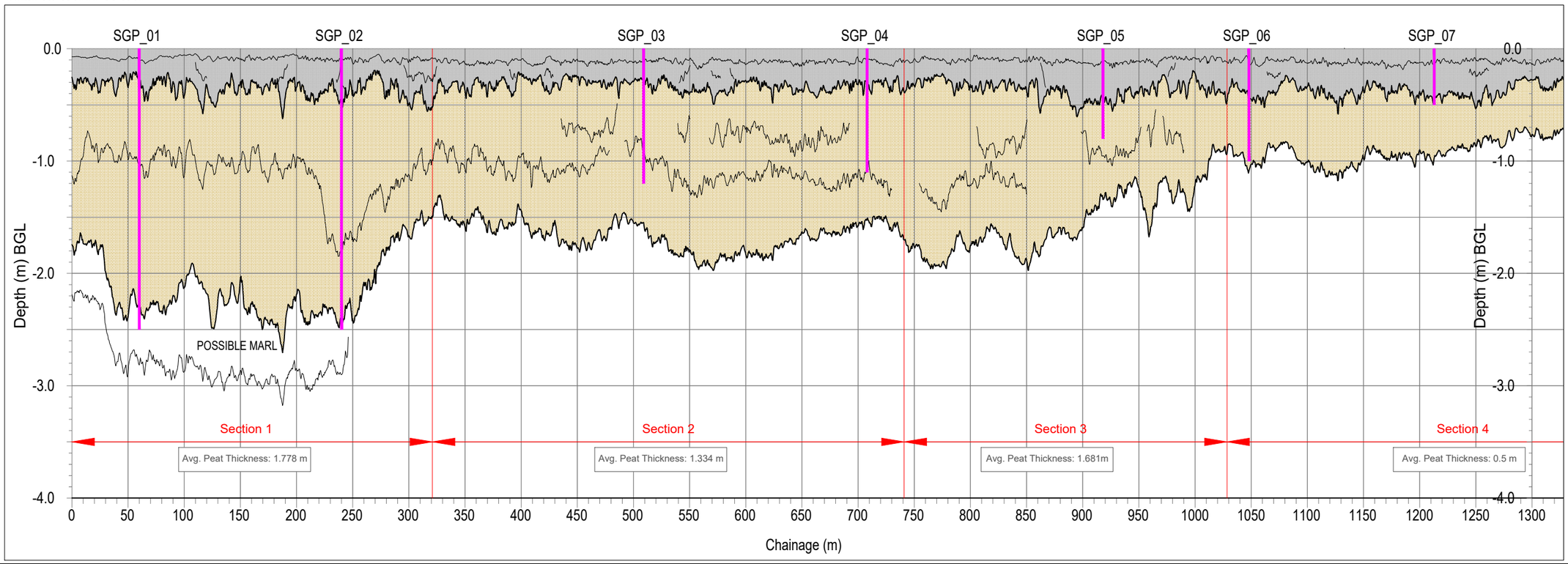


FIGURE 2: GPR SECTION AA' (CHAINAGE: 0 - 1300 m) - GPR INTERPRETATION - FLAT DATUM

Scale H: 1:4000 V: 1:40



INDEX MAP:

LEGEND:

Figure 1 key:

Geophysical Investigation Locations annotated with chainage (m)

Soft Ground Probe

PEAT Thickness (m)

2.2
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0

Figure 2 key:

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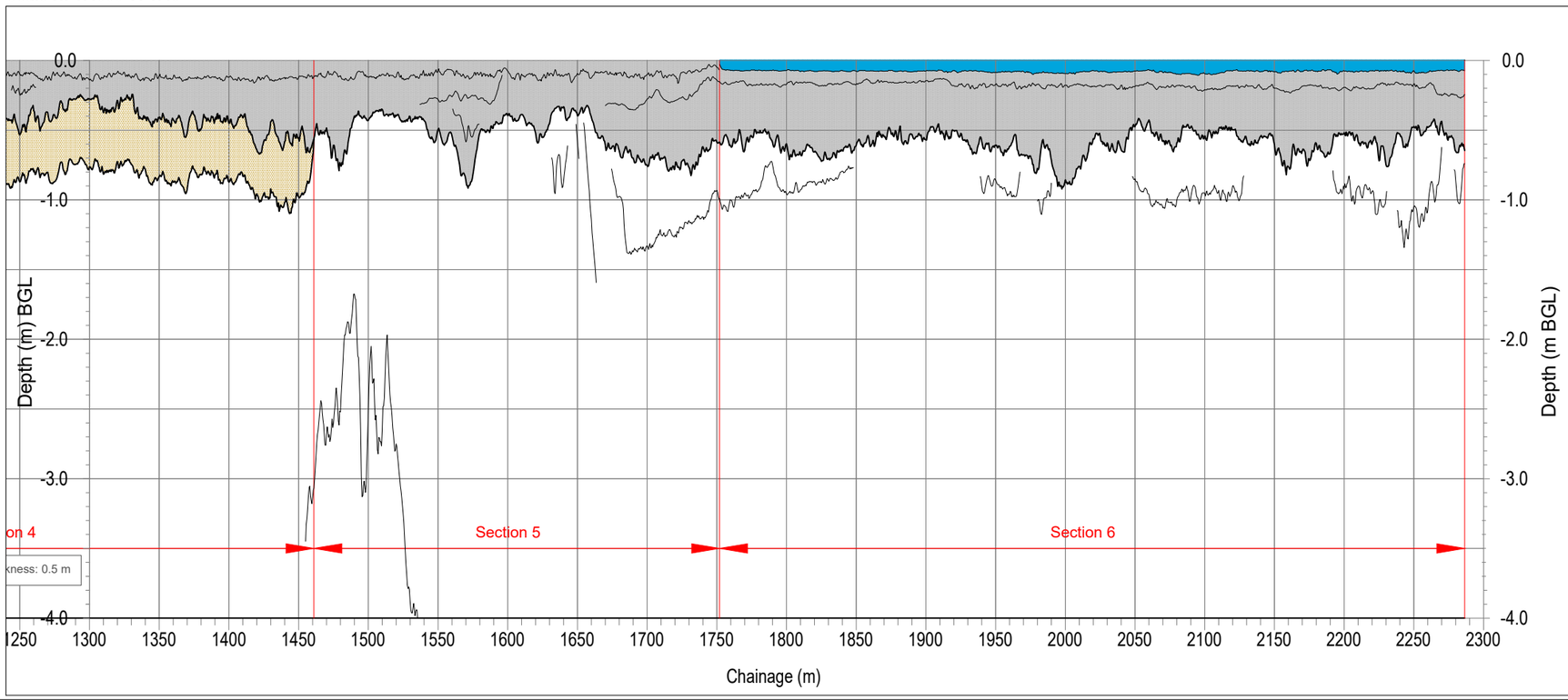
FIGURE 1: GPR SECTION AA' (CHAINAGE: 1300 - 2287 m) - GEOPHYSICAL INVESTIGATION LOCATIONS OVERLAIN ON AERIAL PHOTO

Scale 1:4000

FIGURE 2: GPR SECTION AA' (CHAINAGE: 1300 - 2287 m) - GPR INTERPRETATION - FLAT DATUM

Scale H: 1:4000 V: 1:40



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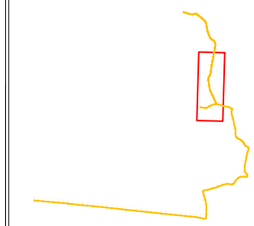
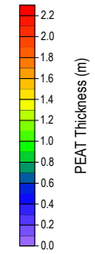


LEGEND:

Figure 1 key:

Geophysical Investigation Locations annotated with chainage (m)

Soft Ground Probe



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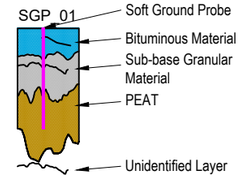

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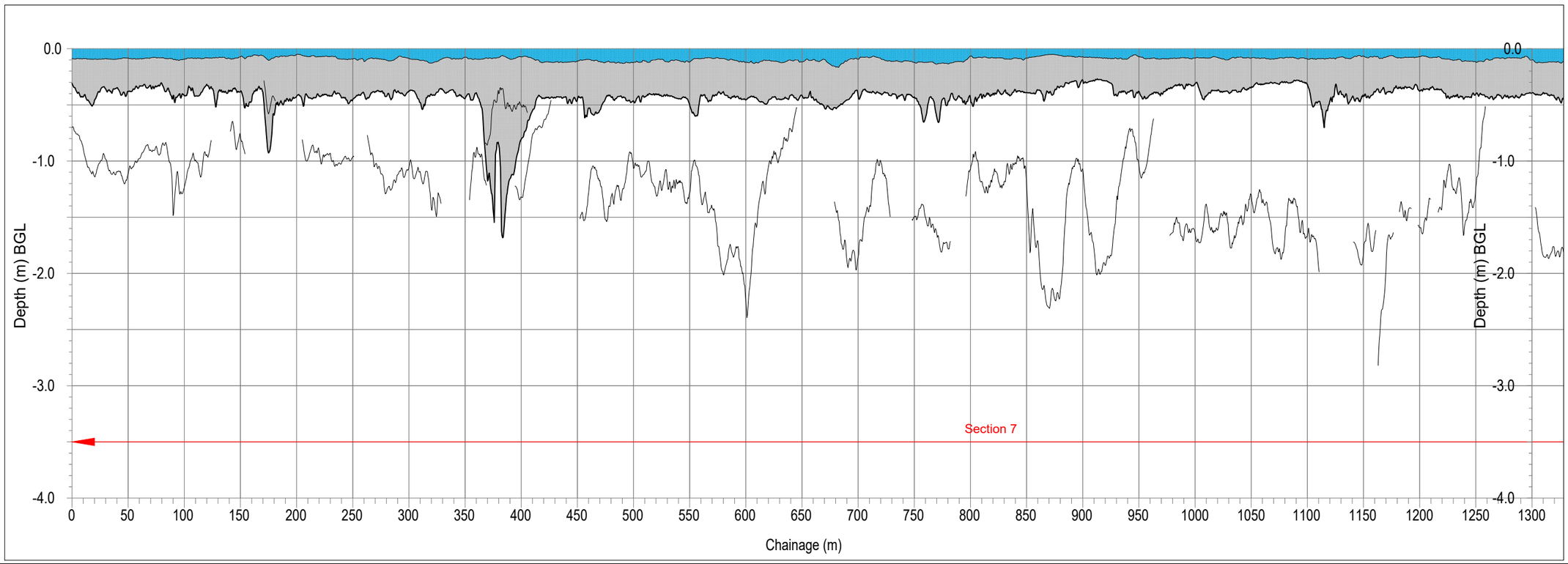
FIGURE 1: GPR SECTION BB' (CHAINAGE: 0 - 1300 m) - GEOPHYSICAL INVESTIGATION LOCATIONS OVERLAIN ON AERIAL PHOTO

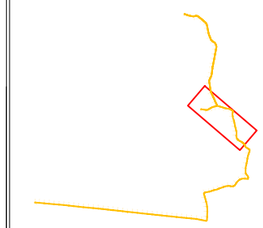
Scale 1:4000

FIGURE 2: GPR SECTION BB' (CHAINAGE: 0 - 1300 m) - GPR INTERPRETATION - FLAT DATUM

Scale H: 1:4000 V: 1:40



INDEX MAP:



LEGEND:

Figure 1 key:

Geophysical Investigation Locations annotated with chainage (m)

Soft Ground Probe

PEAT Thickness (m)

2.2
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0

Figure 2 key:

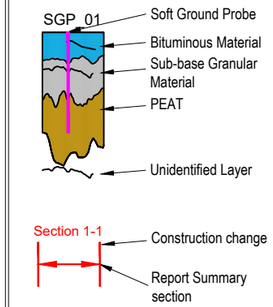


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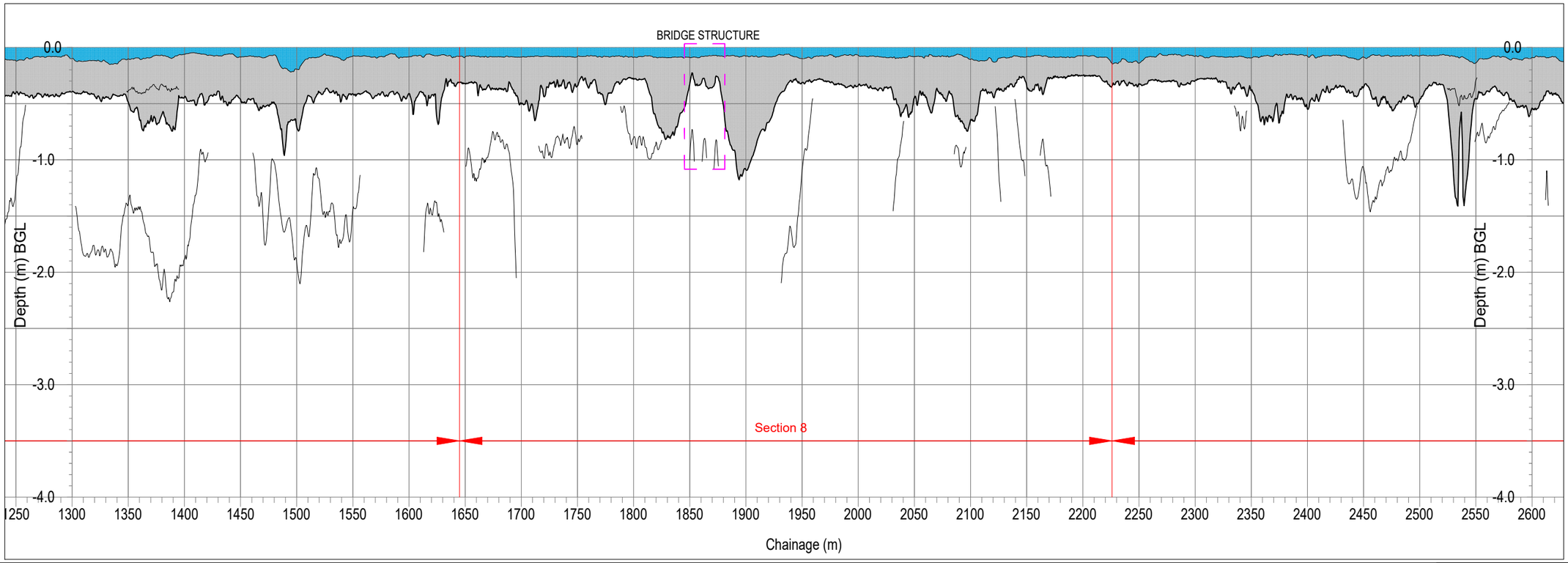
FIGURE 1: GPR SECTION BB' (CHAINAGE: 1300 - 2600 m) - GEOPHYSICAL INVESTIGATION LOCATIONS OVERLAIN ON AERIAL PHOTO

Scale 1:4000

FIGURE 2: GPR SECTION BB' (CHAINAGE: 1300 - 2600 m) - GPR INTERPRETATION - FLAT DATUM

Scale H: 1:4000 V: 1:40



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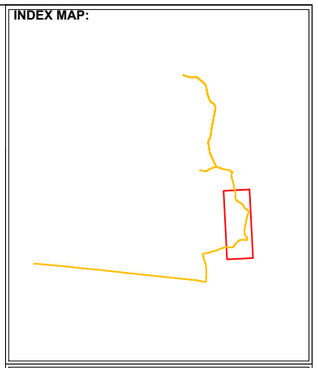

LEGEND:

Figure 1 key:

Geophysical Investigation Locations annotated with chainage (m)

Soft Ground Probe

PEAT Thickness (m)

2.2 2.0 1.8 1.6 1.4 1.2 1.0 0.8 0.6 0.4 0.2 0.0

Figure 2 key:

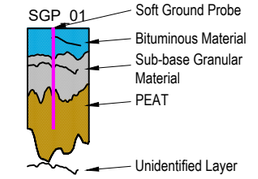

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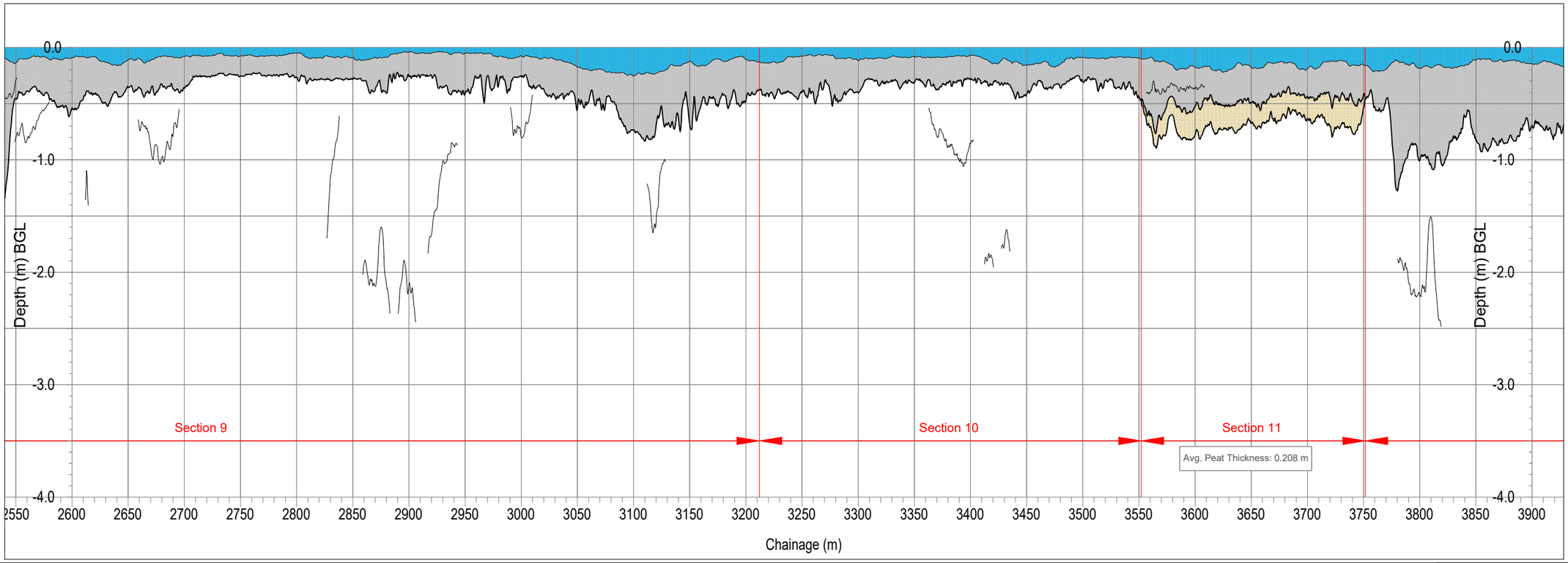
FIGURE 1: GPR SECTION BB' (CHAINAGE: 2600 - 3900 m) - GEOPHYSICAL INVESTIGATION LOCATIONS OVERLAIN ON AERIAL PHOTO

Scale 1:4000

FIGURE 2: GPR SECTION BB' (CHAINAGE: 2600 - 3900 m) - GPR INTERPRETATION - FLAT DATUM

Scale H: 1:4000 V: 1:40



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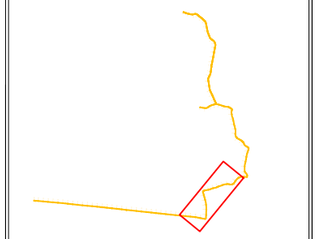

LEGEND:

Figure 1 key:

Geophysical Investigation Locations annotated with chainage (m)

Soft Ground Probe

PEAT Thickness (m)

2.2
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0

Figure 2 key:

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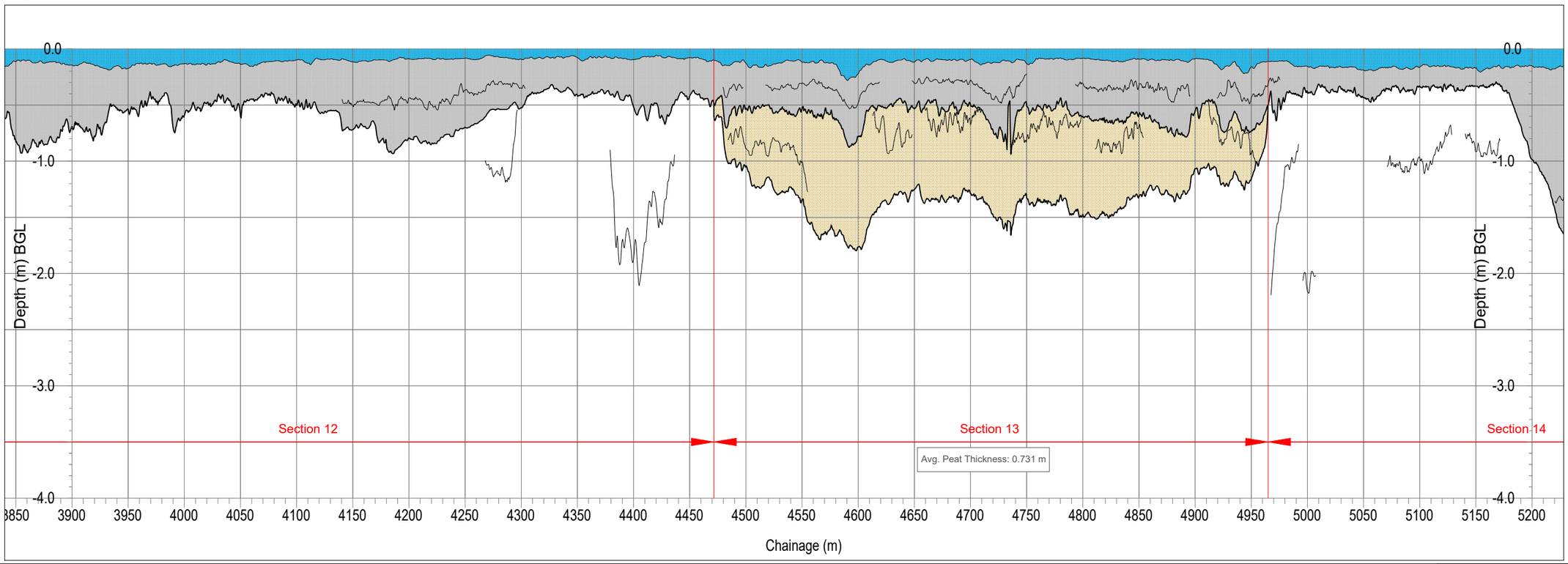
FIGURE 1: GPR SECTION BB' (CHAINAGE: 3900 - 5200 m) - GEOPHYSICAL INVESTIGATION LOCATIONS OVERLAIN ON AERIAL PHOTO

Scale 1:4000

FIGURE 2: GPR SECTION BB' (CHAINAGE: 3900 - 5200 m) - GPR INTERPRETATION - FLAT DATUM

Scale H: 1:4000 V: 1:40



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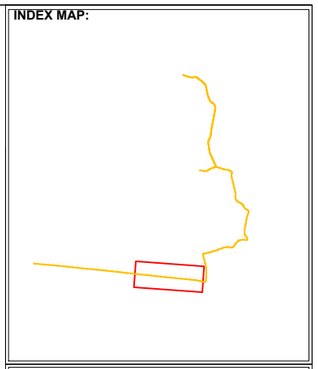

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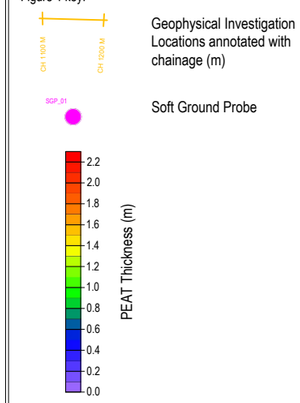

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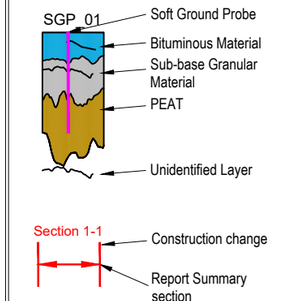

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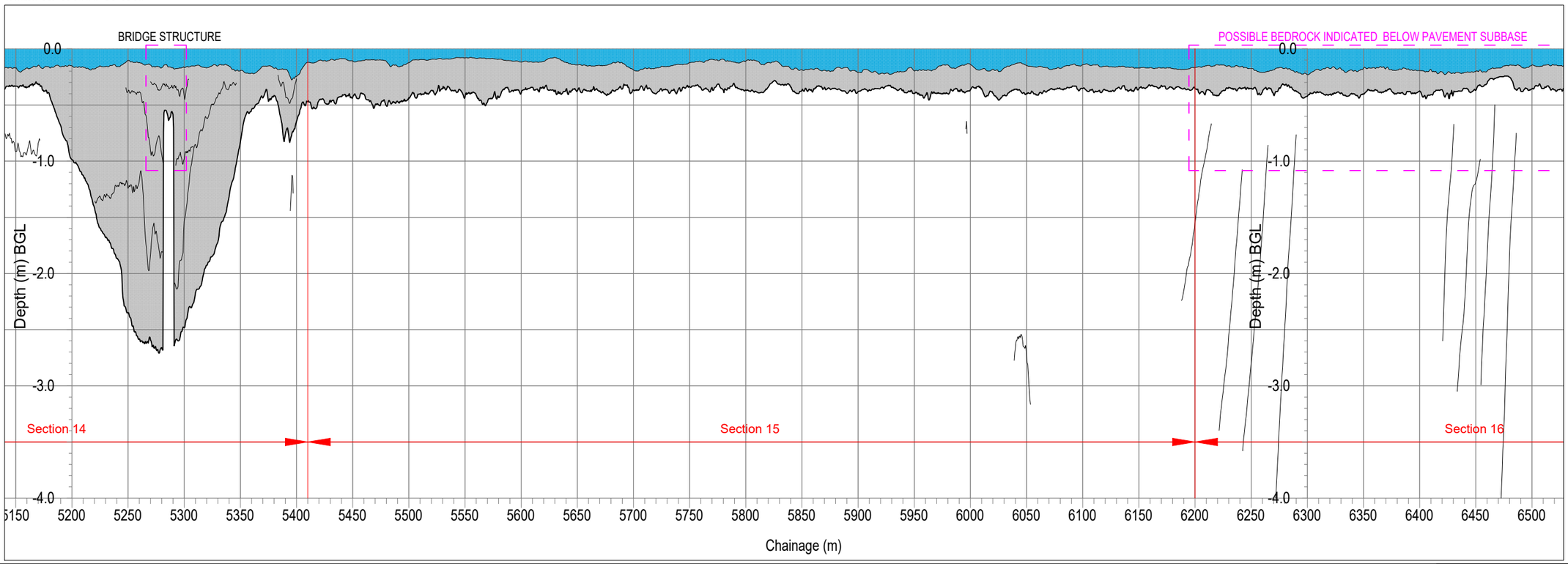
FIGURE 1: GPR SECTION BB' (CHAINAGE: 5200 - 6500 m) - GEOPHYSICAL INVESTIGATION LOCATIONS OVERLAIN ON AERIAL PHOTO

Scale 1:4000

FIGURE 2: GPR SECTION BB' (CHAINAGE: 5200 - 6500 m) - GPR INTERPRETATION - FLAT DATUM

Scale H: 1:4000 V: 1:40



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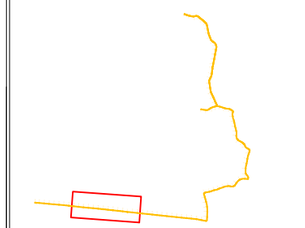

LEGEND:

Figure 1 key:

Geophysical Investigation Locations annotated with chainage (m)

Soft Ground Probe

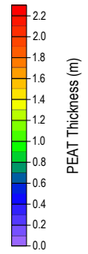

Figure 2 key:

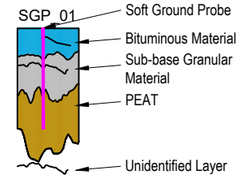

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FIGURE 1: GPR SECTION BB' (CHAINAGE: 6500 - 7285 m) - GEOPHYSICAL INVESTIGATION LOCATIONS OVERLAIN ON AERIAL PHOTO

Scale 1:4000

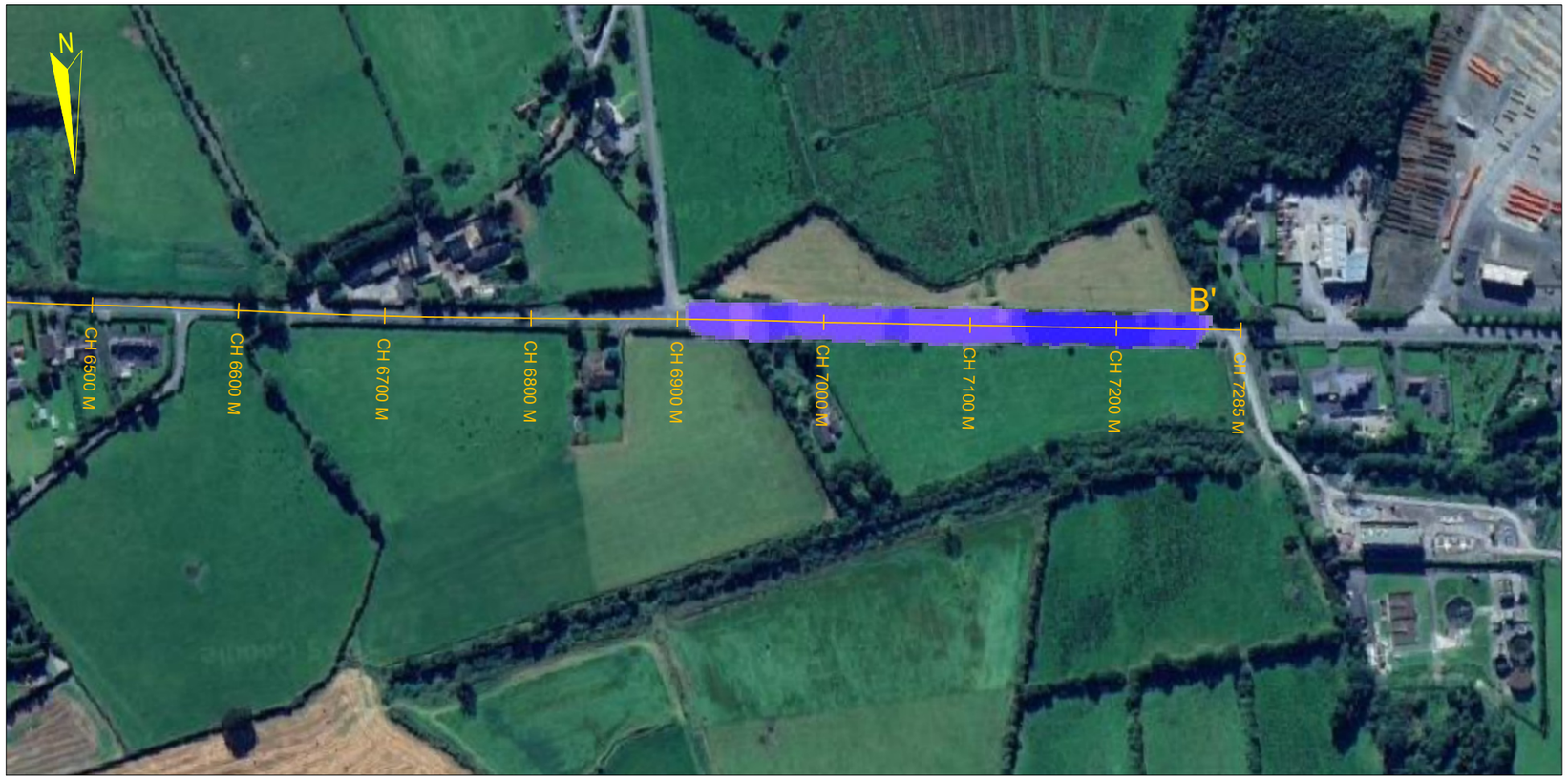
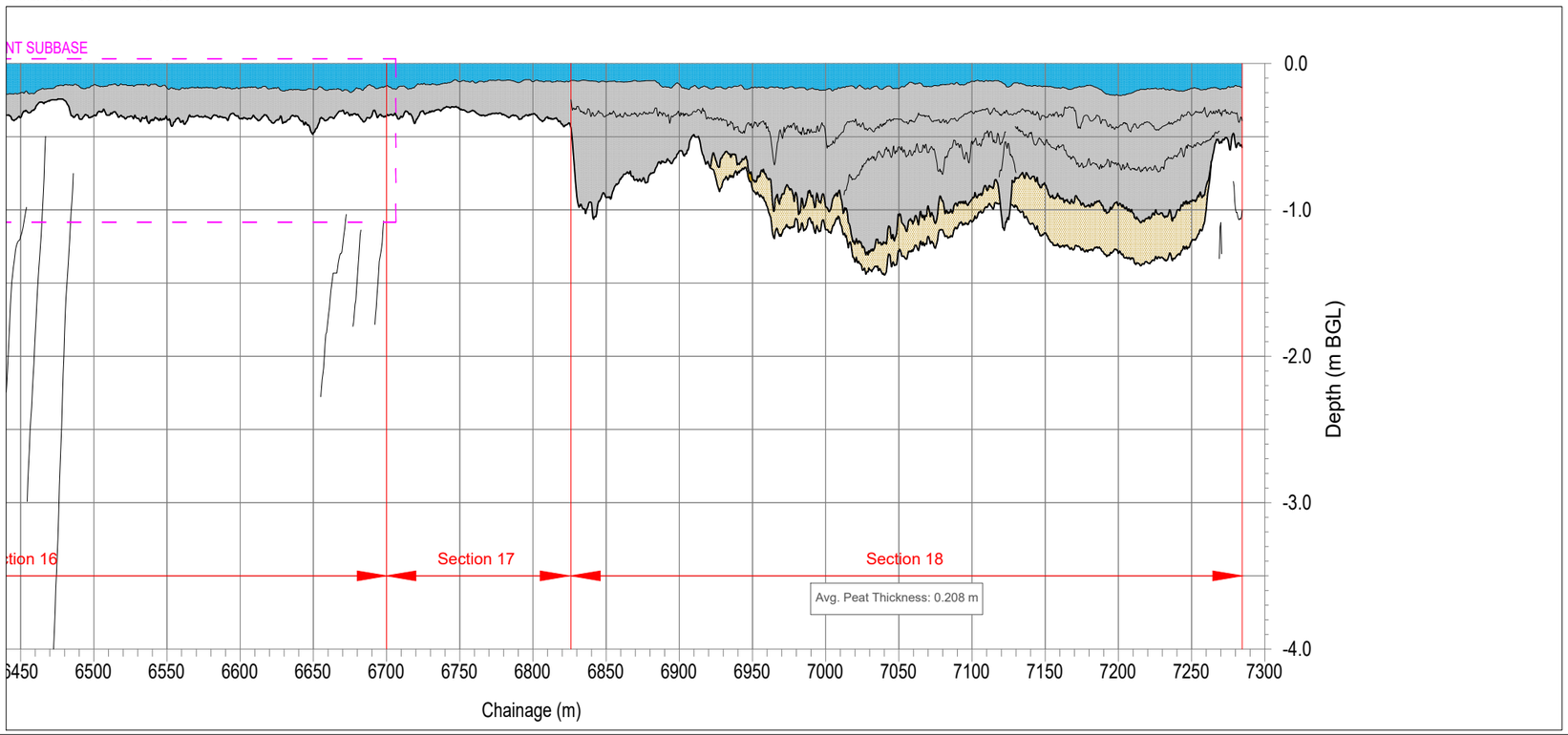
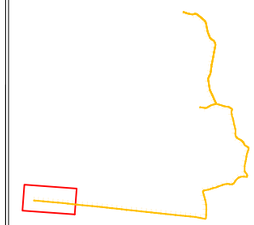


FIGURE 2: GPR SECTION BB' (CHAINAGE: 6500 - 7285 m) - GPR INTERPRETATION - FLAT DATUM

Scale H: 1:4000 V: 1:40



INDEX MAP:



LEGEND:

Figure 1 key:

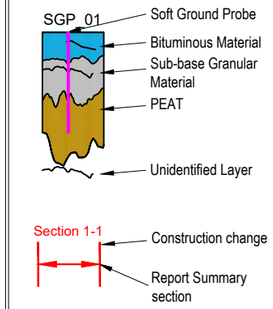
Geophysical Investigation Locations annotated with chainage (m)

Soft Ground Probe

PEAT Thickness (m)

2.2
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0

Figure 2 key:



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APPENDIX B: PAVEMENT CONSTRUCTION SUMMARY TABLES

Section AA'

CHAINAGE		COORDINATES		BITUMINOUS MATERIAL			SUBBASE MATERIAL			PEAT MATERIAL			
start (m)	end (m)	easting ITM	northing ITM	min. depth (m)	max. depth (m)	avg. depth (m)	min. depth (m)	max. depth (m)	avg. depth (m)	min. depth (m)	max. depth (m)	avg. depth (m)	avg. thickness (m)
	0	659279.67	715403.50										
0	321	659582.20	715335.46	-	-	-	0.194	0.624	0.353	1.438	2.706	2.130	1.778
321	741	659776.61	714986.40	-	-	-	0.208	0.522	0.328	1.302	1.975	1.662	1.334
741	1029	659927.05	714752.59	-	-	-	0.196	0.606	0.364	0.850	1.974	1.532	1.681
1029	1461	659846.39	714330.06	-	-	-	0.237	0.671	0.408	0.654	1.176	0.907	0.5
1461	1752	659781.00	714054.72	-	-	-	0.323	0.916	0.546	-	-	-	-
1752	2287	659940.97	713550.50	0.028	0.107	0.079	0.416	0.922	0.595	-	-	-	-

Section BB'

CHAINAGE		COORDINATES		BITUMINOUS MATERIAL			SUBBASE MATERIAL			PEAT MATERIAL			
start (m)	end (m)	easting ITM	northing ITM	min. depth (m)	max. depth (m)	avg. depth (m)	min. depth (m)	max. depth (m)	avg. depth (m)	min. depth (m)	max. depth (m)	avg. depth (m)	avg. thickness (m)
	0	659617.75	713473.46										
0	1645	660598.10	712622.97	0.047	0.219	0.091	0.268	1.683	0.444	-	-	-	-
1645	2226	660572.16	712067.20	0.059	0.145	0.083	0.226	1.178	0.426	-	-	-	-
2226	3212	659678.40	711777.34	0.038	0.255	0.099	0.223	1.412	0.409	-	-	-	-
3212	3552	659742.94	711448.20	0.062	0.178	0.102	0.25	0.523	0.348	-	-	-	-
3552	3752	659738.10	711248.86	0.088	0.222	0.159	0.347	0.767	0.486	0.500	0.897	0.694	0.208
3752	4472	659050.77	711298.09	0.056	0.217	0.114	0.318	1.278	0.609	-	-	-	-
4472	4965	658560.05	711350.29	0.081	0.282	0.120	0.414	0.939	0.591	0.569	1.797	1.322	0.731
4965	5410	658117.86	711394.43	0.103	0.277	0.163	0.294	2.71	0.909	-	-	-	-
5410	6200	657332.84	711480.33	0.076	0.228	0.143	0.282	0.535	0.381	-	-	-	-
6200	6700	656835.66	711533.14	0.139	0.232	0.176	0.242	0.485	0.371	-	-	-	-
6700	6826	656710.15	711544.13	0.111	0.176	0.131	0.293	0.438	0.351	-	-	-	-
6826	7285	656253.52	711585.41	0.114	0.219	0.157	0.438	1.308	0.888	0.622	1.445	1.154	0.208

APPENDIX C: DETAILED METHODOLOGY

An investigation using Ground Penetrating Radar (GPR) was commissioned to investigate the site.

4.1 Ground Penetrating Radar (GPR)

Ground penetrating radar is effective at determining the presence of layer detail within pavement construction by assessing the amplitude and phase of reflected signals from internal boundaries. The amount of reflected energy varies when there is a discontinuity caused by separation or the presence of a different material type. Changes in material type and/or the presence of discontinuities significantly alters the reflected energy.

GPR Pavement investigation is effective at resolving material boundaries (manmade or geological) but is limited in the determination of the exact nature of the boundaries. When combined with a targeted pavement coring/ trial pitting program any ambiguities on layer type can be resolved and an accurate longitudinal cross section can be generated.

4.2 Principles

Ground Penetrating Radar (GPR) is a reflective electro-magnetic technique that involves the transmission of high frequency radio waves (typically 100 to 1600MHz) into the ground and recording the subsequent reflections.

These pulses are transmitted with a high repetition rate as the antenna is moved along the ground and the reflected pulses build up a cross section (time series) of the sub-surface. Partial reflections of the electromagnetic pulse occur at the boundaries of materials with different dielectric properties.

By understanding the material types under investigation, specifically the electromagnetic pulse velocity, it is possible to convert the reflected time series to an accurate depth section, using:

Depth [m] = Velocity [m/ns] * Reflected Time * 0.5

The velocity and depth of penetration of the GPR signal depends on the electrical properties of the material with highly conductive materials showing a low penetration due to high absorption rates. Clay-rich and water saturated materials have a lower penetration than gravelly and dry soils. Signal penetration and resolution limits are also governed by the centre frequency of the transmitted electromagnetic pulse. High frequencies give good resolution and shallow penetration. Lower frequencies give lower resolution and deeper penetration.

The presence of metal such as in reinforced concrete will often act as a barrier to GPR signals (independent of frequency) and in such cases the resolution of deeper layers of subbase / subgrade may not be possible.

4.3 Data Collection

1600 MHz, 500 MHz, 250 MHz were collected across the specified pavement sections with supplementary 100 MHz data acquired along Section AA'. The use of these frequencies enables accurate resolution of the road construction layers, as well as providing good penetration into the deeper subbase and subgrade materials.

Data collection was controlled by an Electronic Distance Measuring (EDM) system linked to the hub of the survey vehicle. This enables a highly accurate, independent measuring system to be used to ensure data are collected at the specified intervals. Data were collected at 0.25 m centres along the road pavement.

Digital marks are placed on the data at predefined locations to determine the extents of the sections to be investigated.

4.4 Data Processing

GPR data was collected as continuous longitudinal profiles as described above. The processing and location of subsurface features was achieved by using a proprietary processing software (ReflexWin V.8.5)

The following processing was applied to the data prior to picking planar reflectors:

- Spatial relocation (data merge with surveyed positions)
- Temporal relocation (depth correction)
- Frequency band pass filtering
- Amplitude recovery gain (time dependant gain)
- Noise removal (background removal)

4.5 Calibration

The calculation of accurate thickness measurements relies on the correlation of GPR radio wave velocity to measured material thickness.

The velocity of the pavement construction materials and underlying peat material used in the calculation of material thickness detail was taken from published records and experience gained from previous investigations. The velocities used in the calculation of material thickness detail were.

- 0.10 m/ns Pavement Construction
- 0.035 m/ns Peat

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