M200 2hr	120	48.8	0.278	0.6	24.4	0.00000	0.000	0.0	244.2	0.0	0.0
M200 4hr	240	65.4	0.278	0.6	16.35	0.00000	0.000	0.0	488.4	0.0	0.0
M200 6hr	300	77.6	0.278	0.6	15.52	0.00000	0.000	0.0	732.5	0.0	0.0
M200 12hr	600	103.9	0.278	0.6	10.39	0.00000	0.000	0.0	1465.1	0.0	0.0
M200 24hr	1200	139.2	0.278	0.6	6.96	0.00000	0.000	0.0	2930.2	0.0	0.0
M200 48hr	2400	167.5	0.278	0.6	4.1875	0.00000	0.000	0.0	5860.4	0.0	0.0

Catchment			**SP28**	Area Excl Hardstand					water discharge rate (l/s)		
Clean water natural flow									33.91		l/s/ha
1 in 200 year return	**minutes**	**Rainfall (mm)**		**C**	**i (mm/hr)**	**A (km^2)**	**(m^3/s)**	**Volume (m^3)**	**Discharge (m^3/ha)**	**Discharge (m^3)**	**Residual Volume (m^3)**
M200 5min	5	12.4	0.278	0.78	148.8	0.00140	0.045	13.6	10.2	1.4	12.1
M200 10min	10	17.3	0.278	0.78	103.8	0.00140	0.032	18.9	20.3	2.8	16.1
M200 15min	15	20.3	0.278	0.78	81.2	0.00140	0.025	22.2	30.5	4.3	17.9
M200 30min	30	27.2	0.278	0.78	54.4	0.00140	0.017	29.7	61.0	8.5	21.2
M200 60min	60	36.5	0.278	0.78	36.5	0.00140	0.011	39.9	122.1	17.1	22.8
M200 2hr	120	48.8	0.278	0.78	24.4	0.00140	0.007	53.3	244.2	34.2	19.1
M200 4hr	240	65.4	0.278	0.78	16.35	0.00140	0.005	71.5	488.4	68.4	3.1
M200 6hr	300	77.6	0.278	0.78	15.52	0.00140	0.005	101.8	732.5	102.6	-0.8
M200 12hr	600	103.9	0.278	0.78	10.39	0.00140	0.003	136.3	1465.1	205.1	-68.9
M200 24hr	1200	139.2	0.278	0.78	6.96	0.00140	0.002	182.6	2930.2	410.2	-227.7
M200 48hr	2400	167.5	0.278	0.78	4.1875	0.00140	0.001	219.7	5860.4	820.5	-600.8

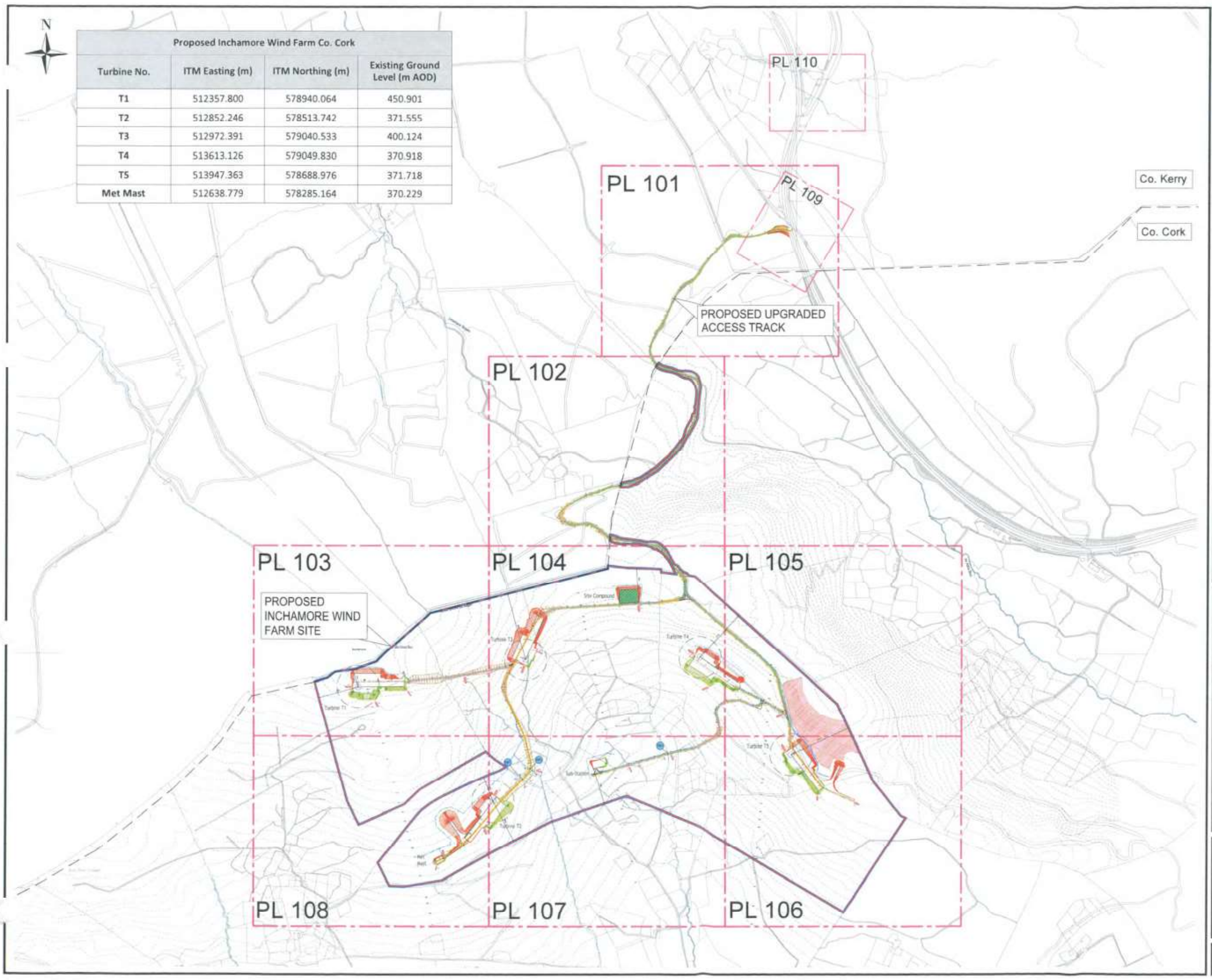
Catchment			**SP28**	Hardstand					water discharge rate (l/s)		
Clean water natural flow									33.91		l/s/ha
1 in 200 year return	**minutes**	**Rainfall (mm)**		**C**	**i (mm/hr)**	**A (km^2)**	**(m^3/s)**	**Volume (m^3)**	**Discharge (m^3/ha)**	**Discharge (m^3)**	**Residual Volume (m^3)**

6226 Inchamore WF

M200 5min	5	12.4	0.278	0.6	148.8	0.00000	0.000	0.0	10.2	0.0	0.0
M200 10min	10	17.3	0.278	0.6	103.8	0.00000	0.000	0.0	20.3	0.0	0.0
M200 15min	15	20.3	0.278	0.6	81.2	0.00000	0.000	0.0	30.5	0.0	0.0
M200 30min	30	27.2	0.278	0.6	54.4	0.00000	0.000	0.0	61.0	0.0	0.0
M200 60min	60	36.5	0.278	0.6	36.5	0.00000	0.000	0.0	122.1	0.0	0.0
M200 2hr	120	48.8	0.278	0.6	24.4	0.00000	0.000	0.0	244.2	0.0	0.0
M200 4hr	240	65.4	0.278	0.6	16.35	0.00000	0.000	0.0	488.4	0.0	0.0
M200 6hr	300	77.6	0.278	0.6	15.52	0.00000	0.000	0.0	732.5	0.0	0.0
M200 12hr	600	103.9	0.278	0.6	10.39	0.00000	0.000	0.0	1465.1	0.0	0.0
M200 24hr	1200	139.2	0.278	0.6	6.96	0.00000	0.000	0.0	2930.2	0.0	0.0
M200 48hr	2400	167.5	0.278	0.6	4.1875	0.00000	0.000	0.0	5860.4	0.0	0.0

APPENDIX D

DRAINAGE DRAWINGS



Proposed Inchamore Wind Farm Co. Cork			
Turbine No.	ITM Easting (m)	ITM Northing (m)	Existing Ground Level (m AOD)
T1	512357.800	578940.064	450.901
T2	512852.246	578513.742	371.555
T3	512972.391	579040.533	400.124
T4	513613.126	579049.830	370.918
T5	513947.363	578688.976	371.718
Met Mast	512638.779	578285.164	370.229

Legend

▬	Land where the Applicant has ownership of beneficial interest
▬	Planning Application Boundary
⊗	Proposed Wind Turbine
▭	Proposed Crane Hardstand
▬	Proposed Site Access Road
🟩	Existing Site Road to be upgraded
▨	Proposed Cut Area
▨	Proposed Filled Area
— · —	Dirty Water Drain
— · —	Clean Water Drain
— — —	Culvert
▨	Settlement Pond
→	Buffered Outlet
● WC1	Watercourse Crossing
—	Existing Watercourse
▨	Proposed Borrow Pit
△	Proposed Meteorological Mast
▨	Proposed Temporary Construction Compound
—	Contours of existing ground elevation
— —	County Border

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Client
Inchamore Wind DAC

Project
Proposed Wind Farm
at Inchamore, Coolea,
Co. Cork

Stage
Planning

Title
Site Layout Keyplan

Scales
1:12,500 @ A3

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Job No.	Drawing no.	Revision
6226	6226-PL-100	

The proposed development in Co. Kerry is displayed for information purposes only. A separate planning application will be submitted to Kerry County Council for these works.

Legend

🟦	Land where the Applicant has ownership of beneficial interest
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	Proposed Wind Turbine
	Proposed Crane Hardstand
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	Contours of existing ground elevation
— —	County Border

KEYPLAN

OS Sheets:
6229-A, 6229-B

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Client
Inchamore Wind DAC

Project
Proposed Wind Farm
at Inchamore, Coolea,
Co. Cork

Stage
Planning

Title
Site Layout Plan
Sheet 1 of 8

Scales
1:2,500 @ A3

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6226	6226-PL-101	

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Legend

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- - -	Contours of existing ground elevation
— —	County Border

KEYPLAN

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Client
Inchamore Wind DAC

Project
Proposed Wind Farm
at Inchamore, Coolea,
Co. Cork

Stage
Planning

Title
Site Layout Plan
Sheet 2 of 8

Scales
1:2,500 @ A3

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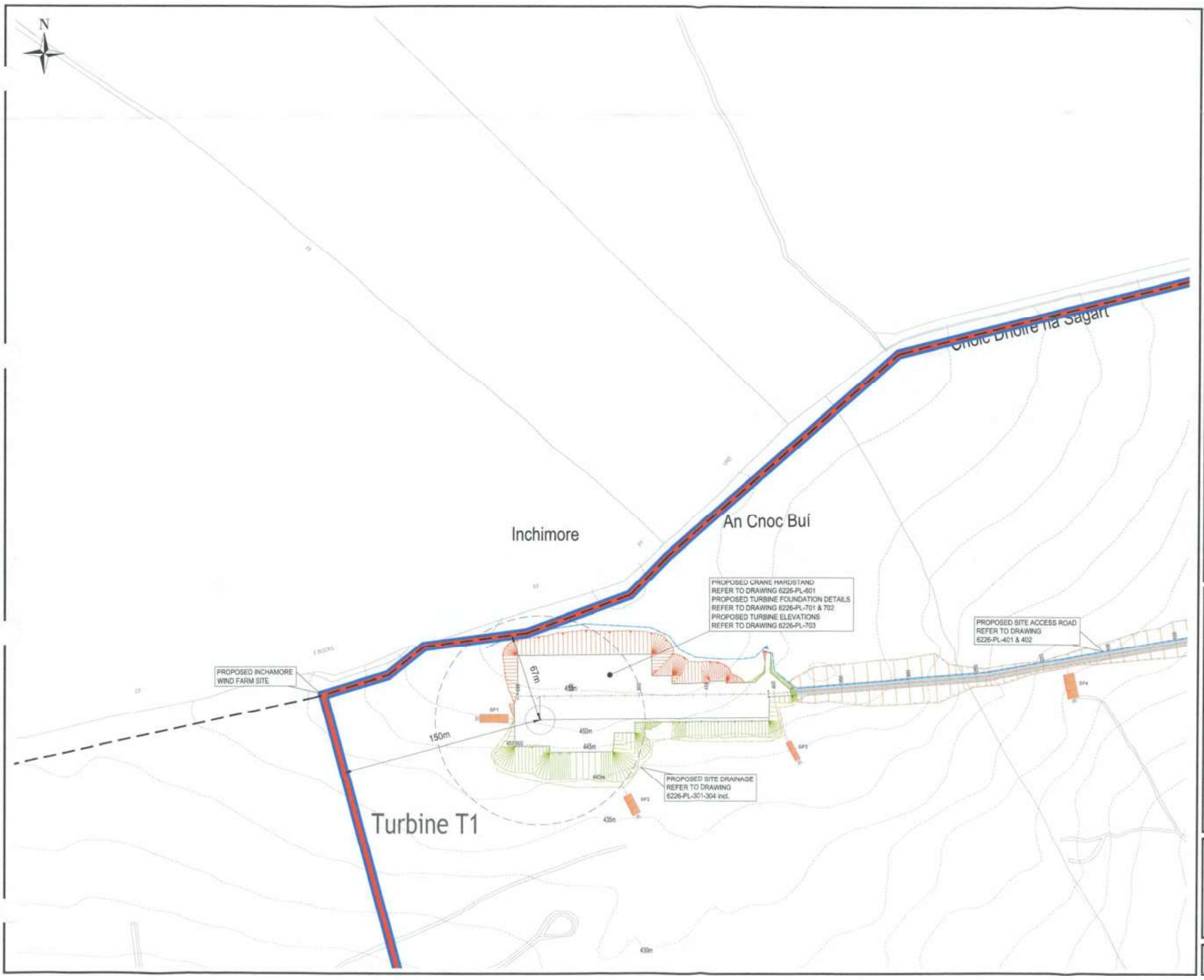

Legend

- Land where the Applicant has ownership of beneficial interest
- Planning Application Boundary
- Proposed Wind Turbine
- Proposed Crane Hardstand
- Proposed Site Access Road
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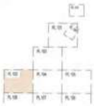
- Watercourse Crossing
- Existing Watercourse
- Proposed Borrow Pit
- Proposed Meteorological Mast
- Proposed Temporary Construction Compound
- Contours of existing ground elevation
- County Border

KEYPLAN



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Client
Inchamore Wind DAC

Project
Proposed Wind Farm
at Inchamore, Coolea,
Co. Cork

Stage
Planning

Title
Site Layout Plan
Sheet 3 of 8

Scales
1:2,500 @ A3

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Job No.	Drawing no.	Revision
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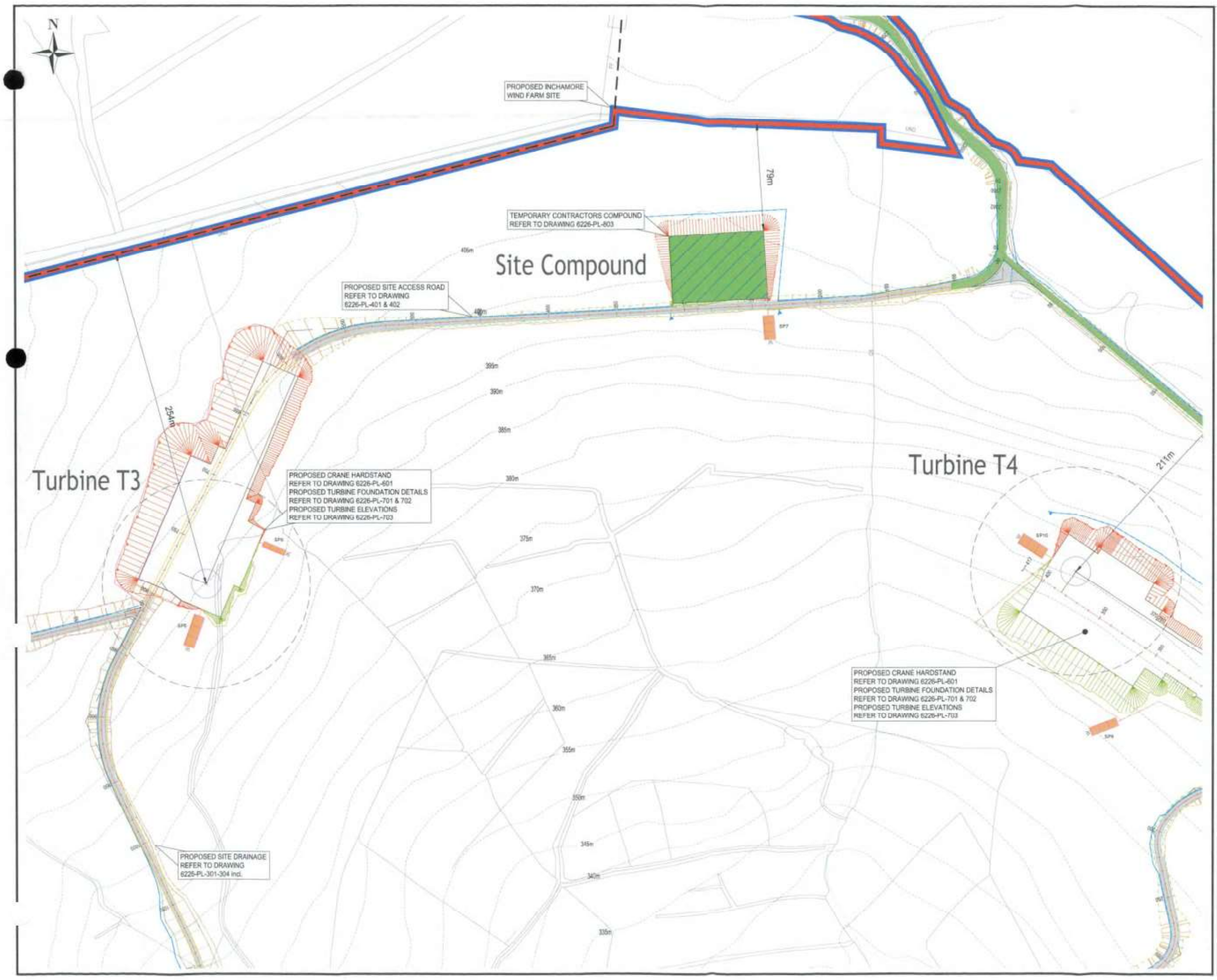

Legend

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⊙	Proposed Wind Turbine
	Proposed Crane Hardstand
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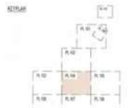
▨	Proposed Temporary Construction Compound
----	Contours of existing ground elevation
— —	County Border

KEYPLAN



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Client
Inchamore Wind DAC

Project
Proposed Wind Farm
at Inchamore, Coolea,
Co. Cork

Stage
Planning

Title
Site Layout Plan
Sheet 4 of 8

Scales
1:2,500 @ A3

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6226	6226-PL-104	

Legend

▬	Land where the Applicant has ownership of beneficial interest
▬	Planning Application Boundary
T1	Proposed Wind Turbine
	Proposed Crane Hardstand
▬	Proposed Site Access Road
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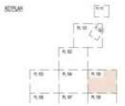

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Client
Inchamore Wind DAC

Project
Proposed Wind Farm
at Inchamore, Coolea,
Co. Cork

Stage
Planning

Title
Site Layout Plan
Sheet 5 of 8

Scales
1:2,500 @ A3

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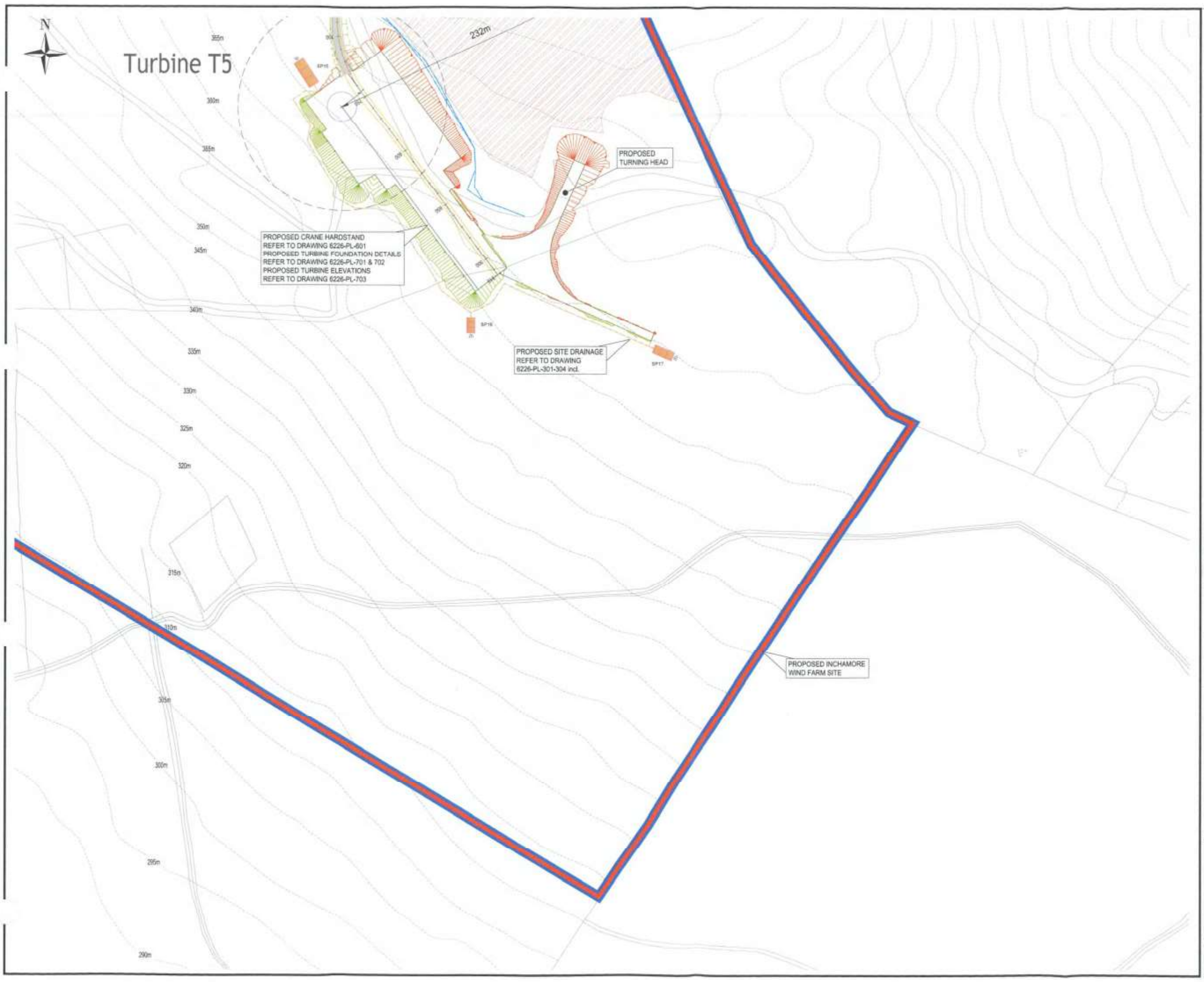

Legend

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KEYPLAN

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Stage
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Title
Site Layout Plan
Sheet 6 of 8

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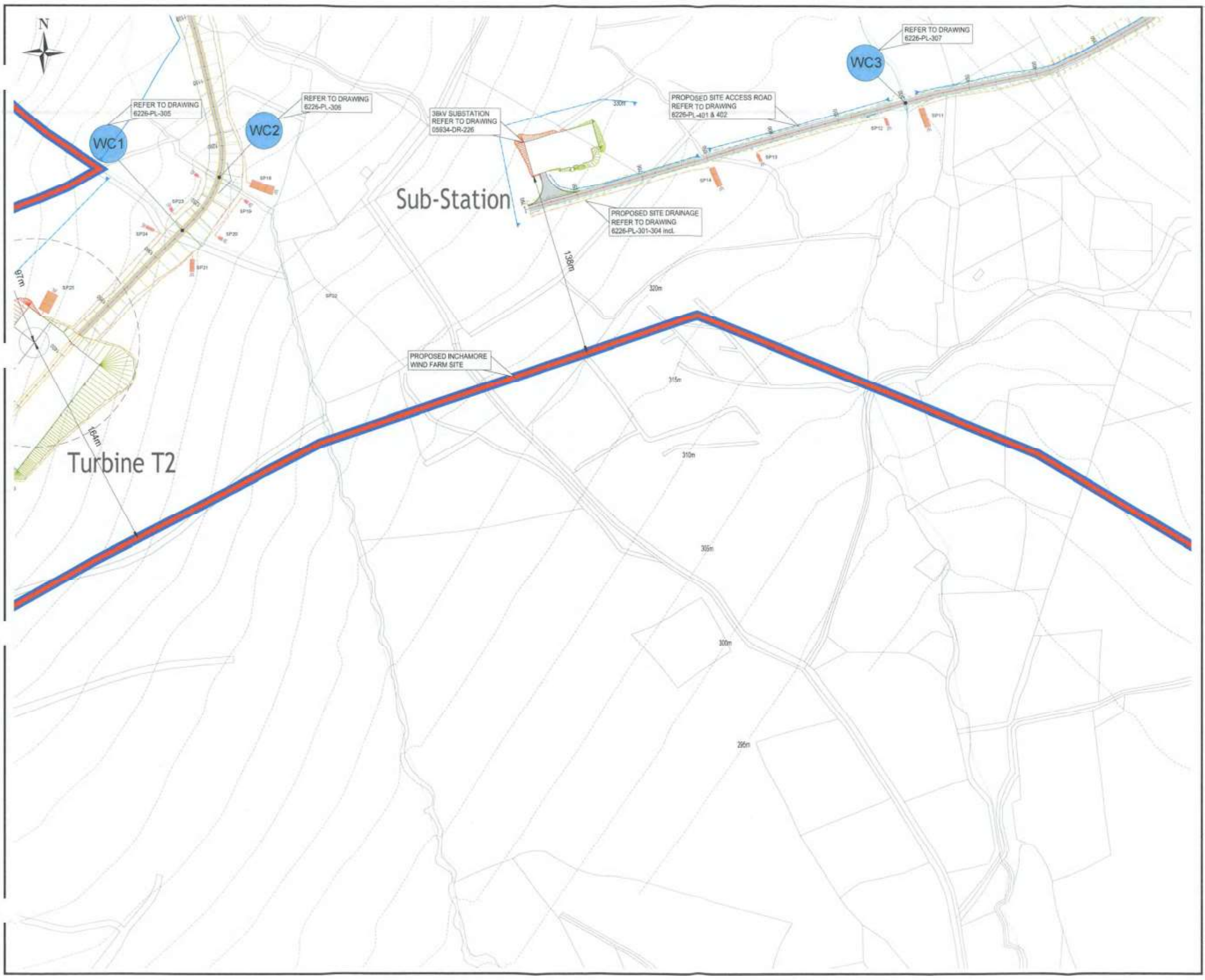

Legend

- Land where the Applicant has ownership of beneficial interest
- Planning Application Boundary
- Proposed Wind Turbine
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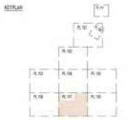
KEYPLAN



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Sheet 7 of 8

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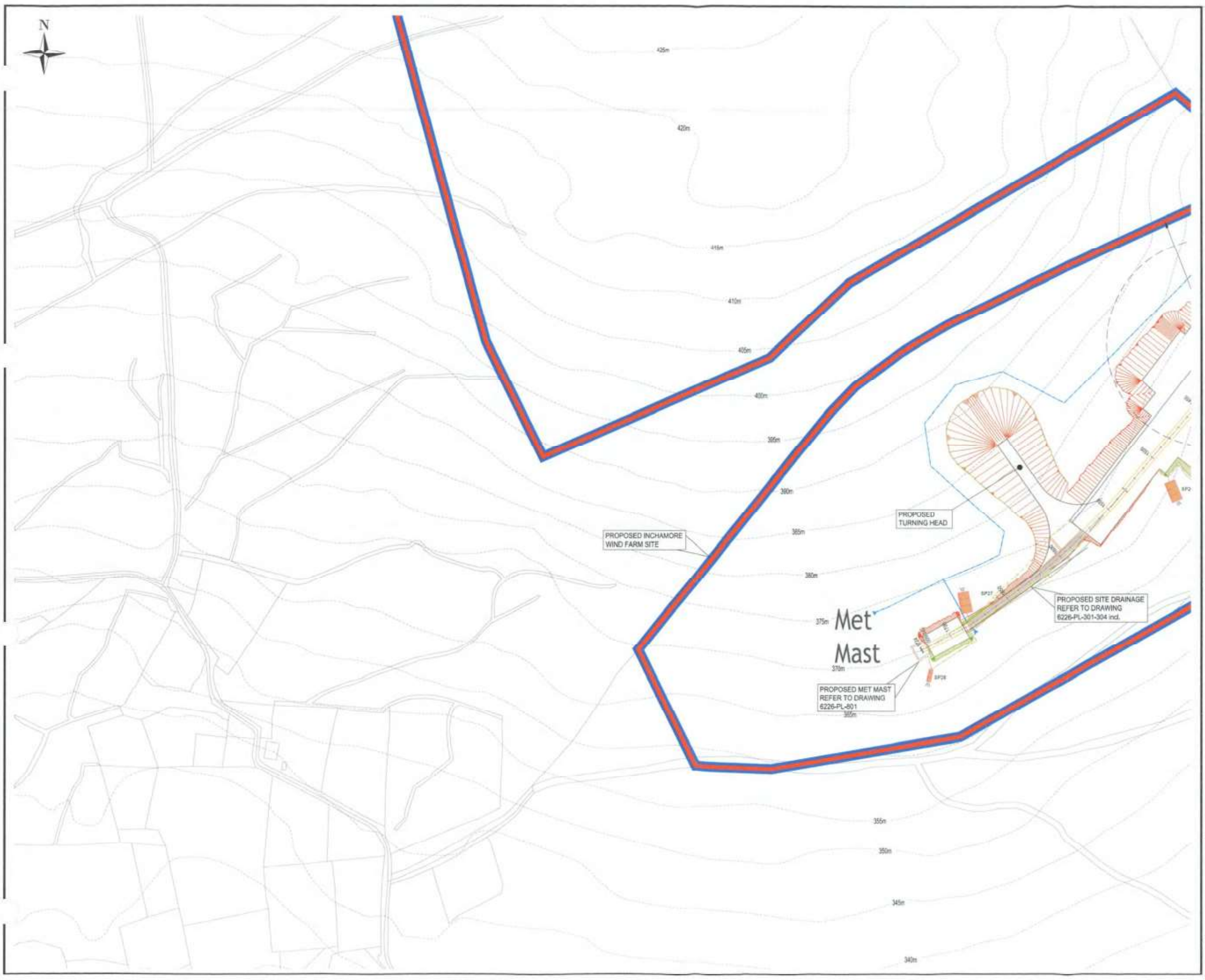

Legend

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KEYPLAN

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Inchamore Wind DAC

Project
Proposed Wind Farm
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Stage
Planning

Title
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Sheet 8 of 8

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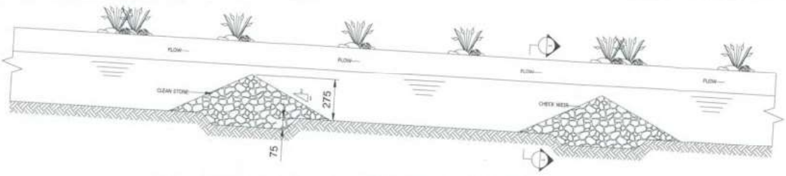
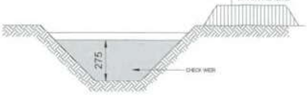
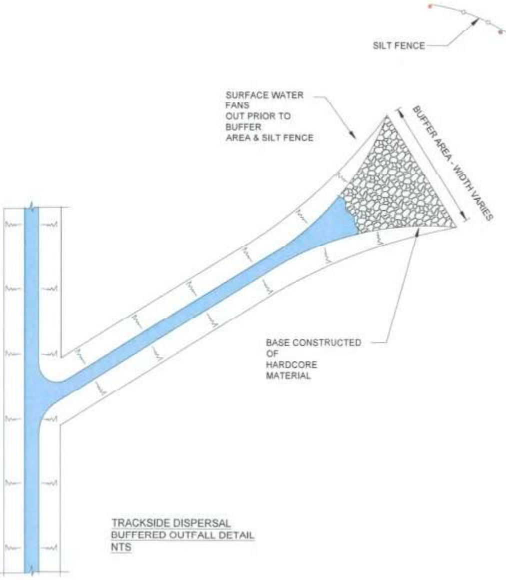


TYPICAL LONGITUDINAL SECTION THROUGH DRAINAGE WITH CHECK WEIRS
SCALE 1:25



SECTION 1-1
SCALE 1:25



TRACKSIDE DISPERSAL
BUFFERED OUTFALL DETAIL
NTS

DRAINAGE NOTES

1. GENERAL:
   DRAINAGE BUFFER ZONE WIDTHS SHALL BE A MINIMUM OF 50m.

2. CONSTRUCTION AND MAINTENANCE
   - ROADSIDE DRAIN SHOULD NOT INTERCEPT LARGE VOLUMES OF WATER FROM THE GROUND ABOVE.
   - ROADSIDE DRAINS LIKELY TO CARRY HIGH SEDIMENT LOADS AND MUST DISCHARGE INTO A BUFFER OF ADEQUATE WIDTH.
   - DRAINS ON THE UPPER SIDE OF THE ROAD MAY NEED CULVERTS TO THE LOWER SIDE.
   - PROPER MAINTENANCE PROVISIONS MUST BE PUT IN PLACE SO AS TO ENSURE THE PROPER FUNCTIONING OF THE DRAINAGE SYSTEM INCLUDING REGULAR INSPECTIONS, CLEANING AND REPAIRS WHERE NECESSARY.

4. DRAINS:
   - DRAINS SHALL BE DESIGNED AND CONSTRUCTED TO MITIGATE CHANNEL EROSION, E.G. BY INSTALLATION OF PERFORATED PIPE WITH DRAINAGE STONE SURROUND.
   DIVERTED RUNOFF FROM A DISTURBED AREA SHALL BE CONVEYED TO A SYSTEM OF STILLING PONDS AND BUFFERED OUTFALLS.
   - DIVERTED RUNOFF FROM AN UNDISTURBED AREA SHALL BE CONVEYED THROUGH A BUFFERED OUTFALL WITHIN AN UNDISTURBED STABILISED AREA AT NON-EROSIVE VELOCITIES.
   - ALL OBSTRUCTIONS WITHIN A DRAINAGE CHANNEL SHALL BE REMOVED AND DISPOSED OF, SO AS NOT TO INTERFERE WITH THE PROPER FUNCTION OF THE DRAINAGE SYSTEM.
   - CHECK DAMS SHALL BE CONSTRUCTED USING WELL GRADED 150mm DOWN ANGULAR GRAVEL PLACED OVER A GEO-TEXTILE LAYER. SEE DETAIL 1.
   - THE SPACING OF CHECK DAMS SHALL BE SUCH THAT THE PEAK OF THE DOWNSTREAM DAM IS NO LOWER THAN THE FOOT OF THE UPSTREAM DAM.
   - THE USE OF STRAW BALES WITHIN THE DRAINAGE SYSTEM SHOULD BE CONSIDERED ON A TEMPORARY BASIS DURING CONSTRUCTION AND MAINTENANCE WORK.
   - STRAW BALES SHOULD, HOWEVER, ONLY BE USED TO INTERCEPT SEDIMENT-LADEN RUNOFF FROM ALL DRAINAGE AREAS OF DISTURBED SOIL.
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no.	modifications	by	chkd	date

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Inchamore Wind DAC

Project
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at Inchamore, Coolea,
Co. Cork

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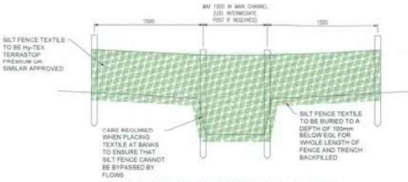
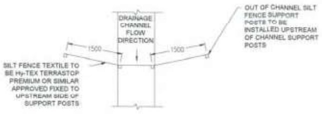
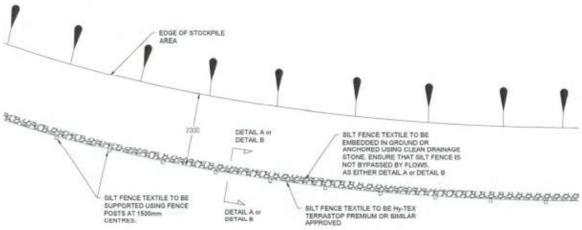
6226	PL-301	2.11	



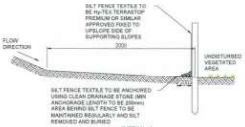
TYPICAL ELEVATION ON SILT FENCE AT DRAINAGE CHANNEL
SCALE 1:50



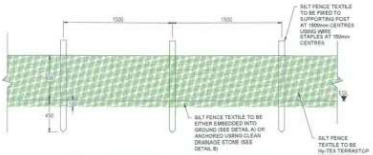
TYPICAL PLAN ON SILT FENCE AT DRAINAGE CHANNEL
SCALE 1:100



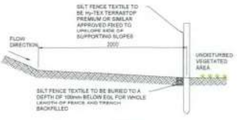
TYPICAL PLAN ON SILT FENCE AT STOCKPILE AREAS
SCALE 1:100



DETAIL A
SCALE 1:50



TYPICAL ELEVATION ON SILT FENCE AT STOCKPILE AREAS
SCALE 1:50



DETAIL B
SCALE 1:50

DRAINAGE NOTES

1. GENERAL:
   DRAINAGE BUFFER ZONE WIDTHS SHALL BE A MINIMUM OF 50m.

2. CONSTRUCTION AND MAINTENANCE
   - ROADSIDE DRAIN SHOULD NOT INTERCEPT LARGE VOLUMES OF WATER FROM THE GROUND ABOVE.
   - ROADSIDE DRAINS LIKELY TO CARRY HIGH SEDIMENT LOADS AND MUST DISCHARGE INTO A BUFFER OF ADEQUATE WIDTH.
   - DRAINS ON THE UPPER SIDE OF THE ROAD MAY NEED CULVERTS TO THE LOWER SIDE.
   - PROPER MAINTENANCE PROVISIONS MUST BE PUT IN PLACE SO AS TO ENSURE THE PROPER FUNCTIONING OF THE DRAINAGE SYSTEM INCLUDING REGULAR INSPECTIONS, CLEANING AND REPAIRS WHERE NECESSARY.

3. DRAINS:
   - DRAINS SHALL BE DESIGNED AND CONSTRUCTED TO MITIGATE CHANNEL EROSION, E.G. BY INSTALLATION OF PERFORATED PIPE WITH DRAINAGE STONE SURROUND.
   - DIVERTED RUNOFF FROM A DISTURBED AREA SHALL BE CONVEYED TO A SYSTEM OF STILLING PONDS AND BUFFERED OUTFALLS.
   - DIVERTED RUNOFF FROM AN UNDISTURBED AREA SHALL BE CONVEYED THROUGH A BUFFERED OUTFALL WITHIN AN UNDISTURBED STABILISED AREA AT NON-EROSIVE VELOCITIES.
   - ALL OBSTRUCTIONS WITHIN A DRAINAGE CHANNEL SHALL BE REMOVED AND DISPOSED OF, SO AS NOT TO INTERFERE WITH THE PROPER FUNCTION OF THE DRAINAGE SYSTEM.
   - CHECK DAMS SHALL BE CONSTRUCTED USING WELL GRADED 150mm DOWN ANGULAR GRAVEL PLACED OVER A GEO-TEXTILE LAYER. SEE DETAIL 1.
   - THE SPACING OF CHECK DAMS SHALL BE SUCH THAT THE PEAK OF THE DOWNSTREAM DAM IS NO LOWER THAN THE FOOT OF THE UPSTREAM DAM.
   - THE USE OF STRAW BALES WITHIN THE DRAINAGE SYSTEM SHOULD BE CONSIDERED ON A TEMPORARY BASIS DURING CONSTRUCTION AND MAINTENANCE WORK.
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Scales
As Noted @ A3

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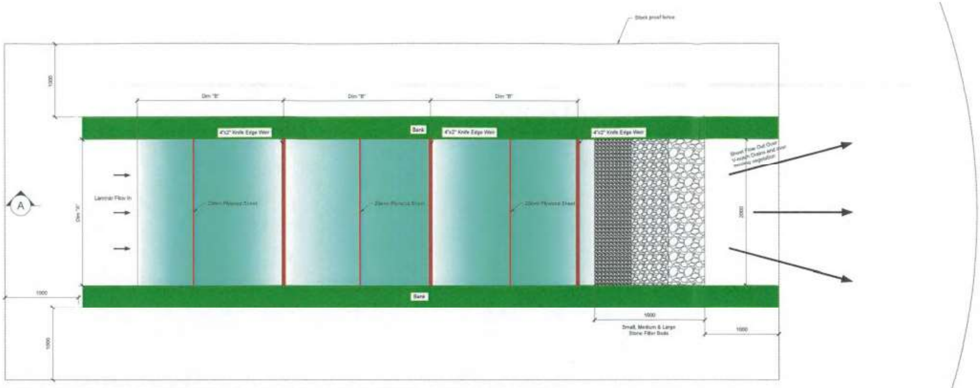
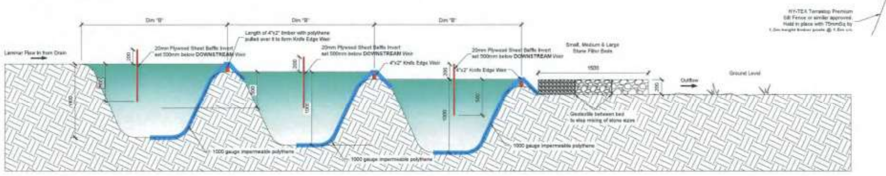
6226	PL-302	2.12	

Note:
Please refer to EIAR Appendix 2.1, Management Plan 3: Surface Water Management Plan for the details of each proposed stilling pond.



PLAN VIEW OF SETTLEMENT PONDS (WITH DISCHARGE TO DRAINS WHERE APPLICABLE)

SCALE: 1:50



SECTION

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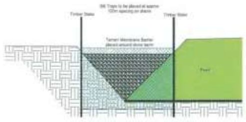
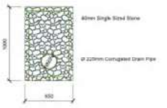


SEDIMENT FENCE DETAIL

SCALE 1:50



PERMANENT PERIPHERAL LAND DRAIN

SCALE 1:50

TEMPORARY "V" DITCH DRAIN PROFILE

SCALE 1:50

COMPLETED SETTLEMENT POND SYSTEM

SCALE: NTS

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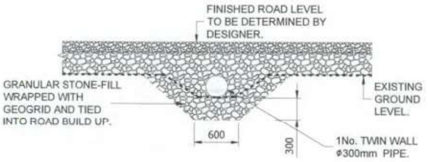
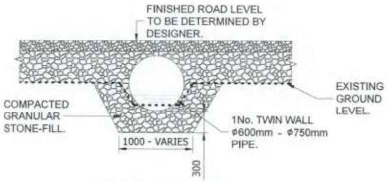
6226	PL-303	2.13	



TYPE 1 CULVERT

SCALE 1:50



TYPE 2 CULVERT

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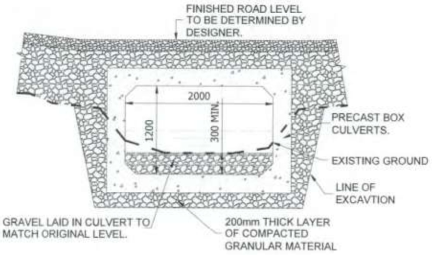

TYPE 3 CULVERT

SCALE 1:50

NOTE:

CULVERTS ARE TO BE OF ADEQUATE SIZE TO CARRY PEAK FLOWS CORRESPONDING TO A 1 IN 100 YEAR STORM EVENT, WITH A MINIMUM DIAMETER OF 900mm. THEY SHOULD BE INSTALLED TO CONFORM WHEREVER POSSIBLE TO THE NATURAL SLOPE AND ALIGNMENT OF THE STREAM OR DRAINAGE LINE. CULVERTS GREATER THAN 1m DIAMETER SHOULD BE BURIED TO A MINIMUM DEPTH OF 300mm BELOW THE STREAMBED AND THE ORIGINAL BED MATERIAL PLACED IN THE BOTTOM OF THE CULVERT.

1. FORMATION LEVEL TO BE DETERMINED BY THE CIVIL WORKS DESIGNER. REFER TO SITE INVESTIGATIONS REPORT.

2. SUB BASE MATERIAL TO CONFORM TO THE FOLLOWING:

   IMPORTED MATERIAL
   TO CONFORM TO TYPE 6F1 IN ACCORDANCE WITH TABLE 6/2 OF THE NRA SPECIFICATION FOR ROAD WORKS.

   SITE WON MATERIAL
   ROCK WON IN EXCAVATION OF TURBINES MUST BE CRUSHED AND GRADED ON SITE. THE MAXIMUM SIZE OF AGGREGATE TO BE 125mm. THE AGGREGATE GRADING TO BE AGREED WITH THE ENGINEER.

3. SURFACE LAYER TO BE CLAUSE 804. THIS LAYER MAY BE APPLIED IMMEDIATELY BEFORE TURBINE DELIVERY.

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6226	PL-304	2.14	

MANAGEMENT PLAN 4 –

PEAT AND SPOIL MANAGEMENT PLAN

INCHAMORE WIND DAC

INCHAMORE WIND FARM

CO. CORK

CONSTUCTION ENVIRONMENTAL MANAGEMENT PLAN

(CEMP)

MANAGEMENT PLAN 4

PEAT AND SPOIL MANAGEMENT PLAN

MAY 2023

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DOCUMENT APPROVAL

PROJECT	Inchamore Wind Farm	
CLIENT / JOB NO	Inchamore Wind DAC	6226
DOCUMENT TITLE	Construction Environmental Management Plan (CEMP) Peat and Spoil Management Plan	

	Prepared by	**Reviewed/Approved by**
Document Final	Name Shirley Bradley	Name David Kiely
Date May 2023	Signature Shirley Bradley	Signature David Kiely

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CONTENTS

1 INTRODUCTION

1.1 General

The plan provides an assessment of the issue of handling surplus excavated material at the proposed Inchamore Wind Farm. The measures outlined in the plan will be monitored by the appointed Ecological Clerk of Works and will be discussed with the Contractor before works commence. This plan should be read in conjunction with the Construction Environmental Management Plan (CEMP) and Management Plans.

1.2 Site Investigations

Minerex Environmental Ltd (RSK Group) has been commissioned by Jennings O'Donovan & Partners on behalf of FuturEnergy Ireland and SSE Renewables (the Developer/s) to assess the geological site characteristics in relation to the planning application for Inchamore Wind Farm, Co. Cork (the Project). The Site Investigations Report (**Appendix A**) assesses ground conditions in terms of peat and slope stability risk, subsoil and geological characterisation and classification.

The Site Investigations works were completed in June 2021 of which the scope of works included:

- Peat depth probing, 150 No. sampling locations.
- Trial pits, 16 No.
- Sub-soil sampling and Particle Size Distribution analysis, 4 No.
- Drilling – Rotary Core, 1 No.
- Drill core sample analysis. Point Load (PL) and Unconfined Compression Test (UCS).

1.3 General Aims and Principals of the Peat and Spoil Management Plan

The purpose of this Peat and Spoil Management Plan is:

- safety in relation to potential peat slippage risk;
- reduction in bare soil exposure and release of sediment;
- to make sure that the landscape is not adversely impacted as a result of the Development; and
- to make sure that good site management practices are carried out.

Any reinstatement and reprofiling proposals will consider and mitigate against all identified significant risks to environmental receptors.

Topsoil and surface vegetation excavated during the construction of the wind farm infrastructure will be used to finish reinstated surfaces around Turbine Foundations and Turbine Hardstands. Reinstatement and reprofiling of, and around, infrastructure will be carried out during the construction phase.

Landscaping will allow for sympathetic restoration of the ground surface and ground profile to reduce the visual impact of new infrastructure, facilitate vegetation regrowth and reduce scour and erosion of bare surfaces prior to vegetation establishment. Reinstatement will be undertaken as work progresses. This work will be completed only by experienced personnel under guidance from the appointed Ecological Clerk of Works, and they will conduct regular inspections of the work to ensure it is completed in an appropriate manner.

All areas subjected to reinstatement will be fenced with stock-proof fencing to prevent livestock disturbance until vegetation has become established.

Excavated material is used in several ways:

- Excavated rock is used for Site Access Roads and Turbine Hardstands.
- Excavated sub-soil material will be used as fill material where suitable (e.g., back filling around and on top of Turbine Foundations) with any other sub-soil material to be placed in shallow deposition areas around the WTG foundations (always avoiding sensitive habitats).
- Excavated topsoil will be used to vegetate edges of Turbine Hardstands and Turbine Foundations.
- All surplus material will be used to reinstate the proposed borrow pits.

1.4 Management of Excavated Material

The excess excavated material will be permanently stored in the borrow pit. Excavated materials during the construction phase required for reinstatement, shall in the first instance be stored on site, in an environmentally safe manner that will not result in the pollution of waters, until it is required for re-use.

A buffer of 25 m from watercourses will be implemented for storage areas of excavated materials to be re-used for reinstatement works.

Excavated material will not be stored adjacent to slopes (>15 degrees gradient). This will be subject to evaluation and approval by the Civil Contractors' geotechnical engineer and will accommodate the Site stockpiling requirements based on earthwork calculations.

The locations chosen for temporary storage are based on gradient, geotechnical data and ground stability assessment, habitat type, and the adequacy of the ground to support the surcharge material. The Civil Contractor will be responsible for ensuring that the removal and storage of excavated material is done in accordance with the requirements of this management plan. The temporary storage area and the vegetative material will be inspected regularly from an ecological perspective.

1.5 Reinstatement

Reinstatement works will commence at an early stage of the construction works. Such reinstatement will occur following the completion of individual sections of work such as the completion of for example a Turbine Foundation or Turbine Hardstand. Reinstatement will include grading of any slopes left by the construction works, followed by the careful placement of topsoil which had been previously excavated from this area and temporarily stored on site.

Peat material excavated will be reused as backfill in areas previously excavated and/or for reinstatement works elsewhere on the Site. To facilitate this the acrotelm (living layer) and the catotelm (lower layer) will be treated as two separate materials. Catotelm peat will be used to backfill, for example, around Turbine Foundation pads once established. Acrotelm peat will be used as a dressing on top of deposited catotelm peat in order to promote and re-establish flora and ensure the acrotelm layer becomes relatively cohesive in terms of localised peat stability (vegetated) and also reduces sediment release.

Natural revegetation is the preferred method of recovery. However, if required, bare material and/or reinstated soil can be secured using vegetation blankets such as Greenfix Embankment Mat2, Geojute2 or similar approved product. An appropriately pre-seeded Coir-Mesh2 would also be suitable. This may be required in patches where excavation works have excessively impacted on the ability of vegetation to recover.

2 ESTIMATED EXCAVATION QUANTITIES

The environs of the Site are characterised by relatively complex (hilly) topography with associated elevations ranging between c. 350 to 460 metres above datum (m AOD) throughout the Development. Geotechnical drawings prepared by Minerex Environmental Limited were used in conjunction with the peat depth probes and geotechnical trial pit logs as seen in **Appendix I – Site Investigations Report** to calculate the spoil volumes generated by the Development, as can be seen in **Tables 2.1** to **2.6**.

2.1 Road Construction

The minimum useful road width required for delivery of turbine components is 4.5 m. **Table 2.1** tabulates the volumes of topsoil and sub-soil to be excavated for the Site access roads.

Table 2.1 **Estimated Excavation for Road Construction**

Road Section	Length (m)	Width (m)	Area (m^2)	Relevant Trial Pits	Average Peat Depth (m)	Depth to firm Sub-soil/Rock (m)	Depth of Sub soil to be excavated (m)	Total Volume to be excavated (m^3)	Vol of peat to be excavated (m^3)	Vol of soil to be excavated (m^3)	Vol of rock to be excavated (m^3)
Upgraded Site Access Road	3,102	2.00	6,203	N/A	0.60	0.70	0.10	4,342	3,722	620	-
New Site Access Road	3,555	4.50	15,998	N/A	0.60	0.70	0.10	11,199	9,599	1,600	-
Off-site Road Upgrade Nodes	-	-	1,118	N/A	-	0.30	0.30	335	-	335	-
Totals	**6,657**	**6.50**	**23,319**	N/A	**1.20**	**1.70**	**0.50**	**15,876**	**13,321**	**2,556**	-

Trial Pit data is available in the Site Investigation Report (**Appendix A**). Average peat depth from this data was calculated to be 0.6 m. Excavation for roads is required to 0.6 m only. From this, the volume of peat, soil and rock to be extracted was extrapolated and can be seen in **Table 2.1**.

2.2 Wind Turbine Foundations

The depth of excavation required for each wind turbine foundation will vary depending on peat depths. The diameter of the gravity Turbine Foundations will range from 22 m to 25.5 m. Each Turbine Foundation excavation will be 2.8 m to 3.2 m deep. **Tables 2.2a (i and ii) and b (i and ii)** provide a breakdown of the estimated total excavation volume for the Turbine Foundations.

Table 2.2a (i) Estimated Excavation for WTG Foundations (22 m Diameter and 2.8 m)

22 m diameter										
Turbine No.	Area of Foundation Excavation (m^2)	Foundation Depth (m)	Max Peat Depth (m)	Mineral Soil (m)	Depth to suitable formation (m)	Rock depth (m)	Total Excavation (m^3)	Total Peat (m^3)	Total Soil (m^3)	Total Rock (m^3)
T1	380.00	2.80	1.40	0.10	1.50	1.30	1,064	532	38	494
T2	380.00	2.80	0.30	0.70	1.00	1.80	1,064	114	266	684
T3	380.00	2.80	0.20	2.40	2.60	0.20	1,064	76	912	76
T4	380.00	2.80	0.40	2.40	2.80	0.00	1,064	152	912	0
T5	380.00	2.80	0.70	0.30	1.00	1.80	1,064	266	114	684
Met Mast	100.0	1.0	0.3	0.7	1.0	0.0	100.0	30.0	70.0	0.0
Totals							5,420	1,170	2,312	1,938

Table 2.2a (ii) Estimated Excavation for WTG Foundations (22 m Diameter and 3.2 m depth)

22 m diameter										
Turbine No.	Area of Foundation Excavation (m^2)	Foundation Depth (m)	Max Peat Depth (m)	Mineral Soil (m)	Depth to suitable formation (m)	Rock depth (m)	Total Excavation (m^3)	Total Peat (m^3)	Total Soil (m^3)	Total Rock (m^3)
T1	380.00	3.20	1.40	0.10	1.50	1.70	1,216	532	38	646
T2	380.00	3.20	0.30	0.70	1.00	2.20	1,216	114	266	836
T3	380.00	3.20	0.20	2.40	2.60	0.60	1,216	76	912	228
T4	380.00	3.20	0.40	2.45	2.85	0.35	1,216	152	931	133
T5	380.00	3.20	0.70	0.30	1.00	2.20	1,216	266	114	836
Met Mast	100.0	1.0	0.3	0.7	1.0	0.0	100.0	30.0	70.0	0.0
Totals							6,180	1,170	2,331	2,679

Table 2.2b (i) Estimated Excavation for WTG Foundations (25.5 m Diameter and 2.8 m depth)

25.5 m diameter										
Turbine No.	Area of Foundation Excavation (m^2)	Foundation Depth (m)	Max Peat Depth (m)	Mineral Soil (m)	Depth to suitable formation (m)	Rock depth (m)	Total Excavation (m^3)	Total Peat (m^3)	Total Soil (m^3)	Total Rock (m^3)
T1	511	2.80	1.40	0.10	1.50	1.30	1,430	715	51	664
T2	511	2.80	0.30	0.70	1.00	1.80	1,430	153	357	919
T3	511	2.80	0.20	2.40	2.60	0.20	1,430	102	1,226	102
T4	511	2.80	0.40	2.40	2.80	0.00	1,430	204	1,226	0
T5	511	2.80	0.70	0.30	1.00	1.80	1,430	357	153	919
Met Mast	100.0	1.0	0.3	0.7	1.0	0.0	100.0	30.0	70.0	0.0
Totals							7,250	1,562	3,083	2,605

Table 2.2b (ii) Estimated Excavation for WTG Foundations (25.5 m Diameter and 3.2 m depth)

25.5 m diameter										
Turbine No.	Area of Foundation Excavation (m^2)	Foundation Depth (m)	Max Peat Depth (m)	Mineral Soil (m)	Depth to suitable formation (m)	Rock depth (m)	Total Excavation (m^3)	Total Peat (m^3)	Total Soil (m^3)	Total Rock (m^3)
T1	511	3.20	1.40	0.10	1.50	1.70	1,634	715	51	868
T2	511	3.20	0.30	0.70	1.00	2.20	1,634	153	357	1,124
T3	511	3.20	0.20	2.40	2.60	0.60	1,634	102	1,226	306
T4	511	3.20	0.40	2.45	2.85	0.35	1,634	204	1,251	179
T5	511	3.20	0.70	0.30	1.00	2.20	1,634	357	153	1,124
Met Mast	100.0	1.0	0.3	0.7	1.0	0.0	100.0	30.0	70.0	0.0
Totals							8,271	1,562	3,109	3,601

2.3 Turbine Hardstands

The depth of excavation required for each crane hardstand will vary and has been calculated below. The total Turbine Hardstands area will be 4,740 m^2 and includes the main crane hardstand (2,770 m^2), the component set down area (1,290 m^2), the assist crane hardstands (290m^2) and the vehicle parking (390m^2). **Table 2.3** provides a breakdown of the estimated total excavation volume for the Turbine Hardstands.

Table 2.3 Estimated Excavation from Turbine Hardstands

Hardstand No	Area (m^2)	Depth to suitable formation (m)	Max Peat Depth (m)	Mineral Soil (m)	Total Excavation (m^3)	Total Peat (m^3)	Total Soil (m^3)	Total Rock (m^3)
1	4,740.00	1.40	1.40	0.0	6,636	6,636	0	0
2	4,740.00	1.00	0.30	0.7	4,740	1,422	3,318	0
3	4,740.00	2.60	0.20	2.4	12,324	948	11,376	0
4	4,740.00	2.85	0.40	2.5	13,509	1,896	11,613	0
5	4,740.00	1.00	0.70	0.3	4,740	3,318	1,422	0
Totals					**41,949**	**14,220**	**27,729**	**0**

2.5 Electrical Sub-Station and Site Compound

Table 2.4a Dimensions of Sub-Station and Site Compound

Description	Length	Width	No.	Area (m^2)
Electrical Substation	-	-	1	1,314
Site Compound	70	52	1	3,640
Total				**4,954**

Table 2.4b Estimated Excavation from Sub-Stations and Site Compounds

Infrastructure	Area (m^2)	Depth to Formation (m)	Average Peat Depth (m)	Mineral Soil (m)	Relevant Trial Pits/Bore Holes	Total Excavation (m^3)	Total Peat (m^3)	Total Soil (m^3)	Total Rock (m^3)
Electrical Substation	1,314	2.0	0.5	1.5	TP010	2,627	657	1,970	0
Site Compound	3,640	2.0	0.2	1.8	TP006	7,280	728	6,552	0
Total						**9,907**	**1,385**	**8,522**	**0**

2.6 Grid Connection

The Inchamore Wind Farm 38kV substation will be connected to the existing Ballyvouskill 220 kV substation via underground cabling (UGC). The UGC route is approximately 19.9 km in length and traverses in an east to south easterly direction from the existing Ballyvouskill 220 kV substation to the Inchamore Wind Farm substation location utilising existing access tracks (1.3 km) and third-party lands (18.6 km) through the townlands of Inchamore, Derryreag, Derreenaling, Cummeenavrick, Glashacormick, Clydaghroe, Cummeennabuddoge and Caherdowney.

The underground cable route initially begins within the townland of Caherdowney, Co. Cork where from Ballyvouskil 220 kV substation compound, the UGC departs the substation on the north western boundary, converging onto a permanent access track to be constructed as part of this development within agricultural lands and traverses on an upward trajectory for approximately 950 m prior to entering into forested plantations propertied by Coillte.

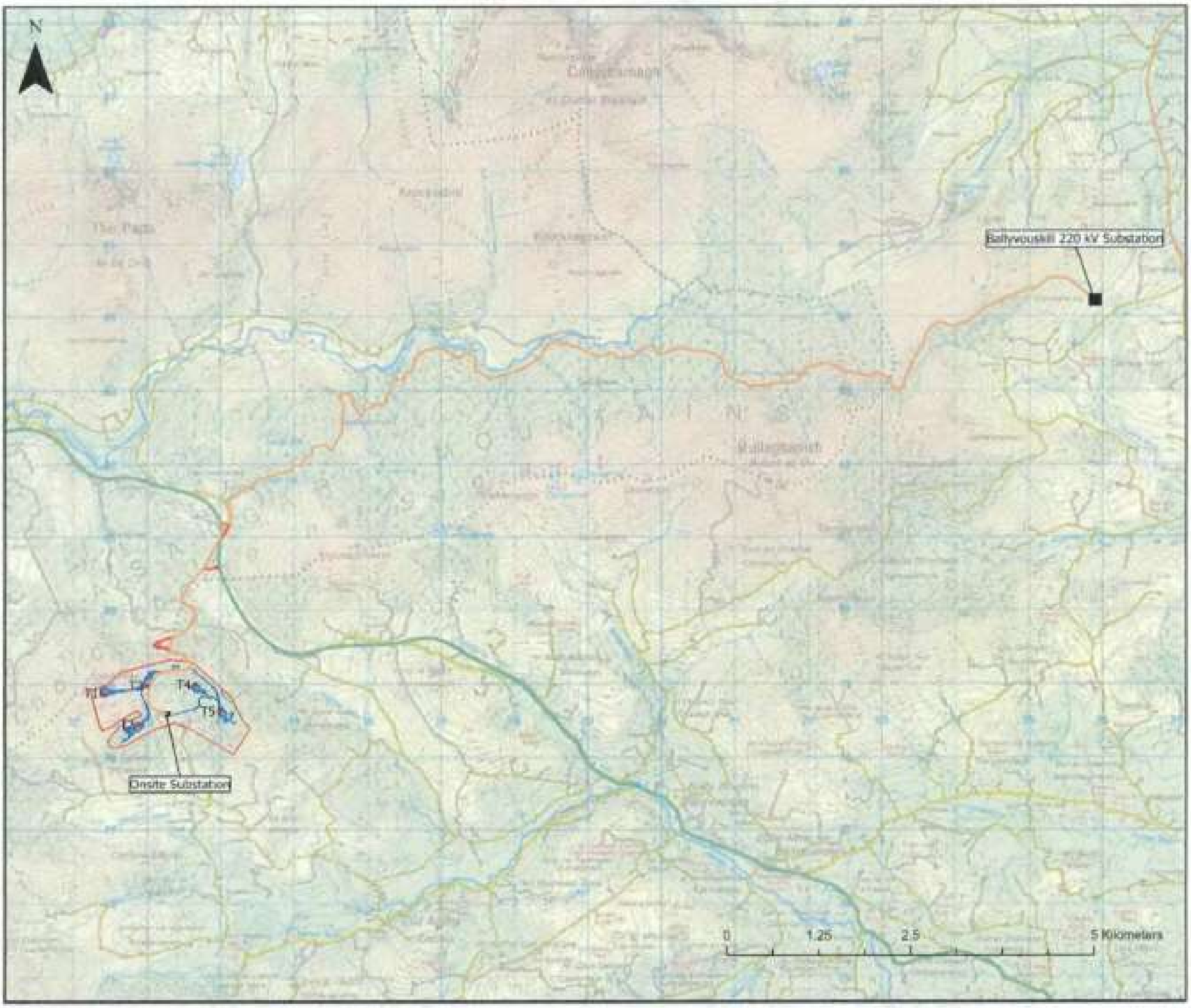

Figure 2.1 Inchamore Wind Farm Grid Connection Route

The cable network will be installed in trenches approximately 0.6 m wide by 1.3 m in depth. There will be 18 No. pre-cast concrete jointing bays measuring 6 m by 2.5 m buried approximately 2 m deep along the grid connection route and at varying intervals from c. 500-820 m intervals (See **EIAR Appendix 2.4**).

Excavated material from the installation of the Grid Connection Route will be used to backfill the trenches once the cable has been laid. Any surplus material will be disposed of at a licensed facility according to **Management Plan 5: Waste Management Plan** due to the presence of bituminous material and hydrocarbons.

In addition, **Table 2.5** provides a breakdown of the estimated total excavation volume for the Grid Connection Route.

Table 2.5 Estimated Excavation from Grid Connection

Description	Length (m)	Width (m)	Depth (m)	No.	Area (m^2)	Depth to Bedrock (m)	Depth of Rock (m)	Peat Depth (m)	Depth (m)	Mineral Soil Depth	Volume of Excavation (m^3)	Volume of Peat	Volume of Soil Extraction	Volume of Rock
Internal Cabling	4,743.00	0.45	1.00	1	2,134.35	1.40	0.00	0.00	1.00	1.00	2,134	0	2,134	0
110kV Cable Trench	4,743.00	0.60	1.34	1	2,845.80	1.40	0.00	0.00	1.34	1.34	3,813	0	3,813	0
Joint Bays	6.00	2.50	2.00	18	270.00	1.40	1.10	0.00	2.00	2.00	837	0	540	297
Link Box	2.00	1.25	1.00	18	45.00	1.40	0.00	0.00	1.00	1.00	45	0	45	0
Comms Box	1.00	1.03	1.29	18	18.54	1.40	0.00	0.00	1.29	1.29	24	0	24	0
Totals											6,854	0	6,557	297

2.7 Drainage

There are 28 No. stilling ponds at the Site with a combined area of 2,280 m^2 and a combined volume of 2,280 m^3. Please see **CEMP 3: Surface Water Management Plan** of the CEMP for further details of drainage for the Project.

2.8 Total Estimated Excavation Volume Summary

As detailed in Sections 2.1 to 2.5, the total estimated excavation volume is 84,116 m^3, of which 31,856 m^3 is peat soil and 50,271 m^3 is mineral subsoil. These quantities are detailed in **Table 2.6**.

Table 2.6 Summary of Estimated Excavation Quantities (m^3)

**All excavated materials will be disposed of at a licensed facility*

Excavated Material Type	Excavated Material Volume (m^3)	Proposed Re-Use Volume	Comments
Roads	15,876	13,321 m^3 peat 2,556 m^3 subsoil	Peat and subsoil material will be used to reinstate the onsite borrow pits.
Turbine Foundations	7,250	1,562 m^3 peat	Peat will be used as backfill to foundations. Any surplus will be used to reinstate the borrow pits after extraction.
		3,083 m^3 subsoil	Subsoil will be deposited locally adjacent to Turbine Bases. 144 m^3 will be used as berms around Turbines. Any surplus will be used to reinstate the borrow pits after extraction.
		2,605 m^3 rock	Rock will be crushed and used as hardcore in Site Access Tracks and Turbine Hardstands.
Turbine Hardstands	41,949	14,220 m^3 peat 27,729 m^3 subsoil	Peat and subsoil are to be deposited locally at hardstand edges. 360 m^3 will be used as berms around Turbine Hardstands. Any outstanding peat will be air dried and used to fill borrow pits.
Electrical Sub-Stations & temporary Compounds.	9,907	1,385 m^3 peat	Peat is to be temporally stored and re-used to reinstate the Temporary Compound Areas.

Excavated Material Type	Excavated Material Volume (m^3)	Proposed Re-Use Volume		Comments
		8,522 0	m^3 subsoil m^3 rock	Subsoil will be dried and used to reinstate the borrow pits after extraction
Grid Connection*	6,854	0 6,557 297	m^3 peat m^3 subsoil m^3 rock	To be disposed of at a licensed facility (LoW 17 05 03*, 17 05 04) Please see Waste Managament Plan for more details
Drainage	2,280	2,280	m^3 peat	Peat is to be temporally stored and re-used to reinstate the Temporary Compound Areas.

As the excavated materials arising from the construction of the Grid Connection Route will be disposed of at a licensed facility, and rock won onsite will be used before using the on-site borrow pit, 77,262 m^3 of peat and soil will need to be re-used within the Site as per **Table 2.6**.

3 RE-USE OF EXCAVATED MATERIAL

3.1 Road Construction

The total length of new Site Access Roads is 3,102 m, however there are also 3,555 m of existing tracks being utilised as part of the Development.

Roadside berms will not be used on-site.

All additional excavated material will be used to reinstate the onsite borrow pit.

3.2 Turbine and Met Mast Foundation Excavations

The concrete foundation of each turbine will be between 22 m and 25.5 m in diameter. A volume of 124 m^3 (69 m length x 0.6 m width x 0.6 m depth) to 144 m^3 (80 m length x 0.6 m width x 0.6 m depth) of excavated subsoil material will be used as backfill to the perimeter of the turbine foundations. The remaining 2,939 m^3 excavated subsoil material will be used to reinstate the onsite borrow pit.

A volume of 2,605 m^3 of rock will be crushed and used as hardcore in Site Access Roads and Turbine Hardstands.

All additional excavated material will be used to reinstate the onsite borrow pits.

3.3 Storage Areas to the perimeter of Hardstands

Peat and subsoil will be used in landscaping and remediation around turbines and hardstands. The balance of soil excavated for the hardstands will be placed along the hardstand edges. The total calculated volume of excavated material at these locations is 41,949 m^3, of which 14,220 m^3 is peat soil and 27,729 m^3 is mineral subsoil. The landscaping berms around the perimeter of the Turbine Hardstands will measure 0.6 m in height and 0.6 m in width. It is estimated that 360 m^3 of excavated material will be used in berms around the perimeter of the Turbine Hardstands. However, it must be noted that while all peat soils will be entirely removed from the Turbine Hardstand areas, the final volumes of subsoils will depend on the results of plate bearing tests.

3.4 Grid Connection

The total volumes to be excavated for the Grid Connection Route is estimated at 6,854 m^3. This material will be used to backfill the trenches once the cable has been laid. Any surplus material will be disposed of at a licensed facility according to **Management Plan 5: Waste Management Plan** due to the presence of bituminous material and hydrocarbons.

3.5 Bedrock

Rock encountered in the excavations such as cobbles or boulders will be crushed and used for hardcore in the Site Access Roads and Turbine Hardstands. When this resource has been used up, the onsite borrow pits will be used to provide rock. The onsite borrow pit will provide 50,276 m^3 excavated material to provide for the Site Access Roads, Turbine Hardstands, upfill to foundations and temporary compounds. However, a volume of 5,070 m^3 of imported stone will be imported as a finish to these elements of infrastructure.

Table 3.1a Rock required from Borrow Pit

Volume of imported rock required (m^3)	Rock required for Road Construction / Upgrade (m^3)	Rock required for Turbine Hardstand Construction (m^3)	Total Rock required for Construction (m^3)	Volume of Rock to be Extracted from Excavations (m^3)	Rock required from Borrow Pit (m^3)
5,070	13,741	39,105	52,846	2,902	49,945

Table 3.1b Volume of Rock to be Extracted from Borrow Pits

Length (m)	Width (m)	Area (m^2)	Depth (m)	Volume to be extracted from Borrow Pits (m^3)
-	-	38,674	1.30	50,276
Total Volume of Rock to be Extracted from Borrow Pits				***50,276***

Table 3.1c Volume of Excavated Material to be Re-used On-Site

Total Volume (m^3) of Excavated Material to be stored	Volume of Borrow Pits (m^3)	Volume used to top borrow pits (m3)	Total Volume of material to be stored in Borrow Pits (m^3)	Volume to be used in berms (Turbine Foundations and Hardstands) (m^3)
77,262	***50,276***	***30,939***	***81,215***	***504***

The borrow pit will provide 50,276 m^3 of material to be used on-site. It also has the capacity to be filled to 81,215 m^3 and to be topped by up to 0.7 m (30,939 m^3). The total volume of fill to reinstate the borrow pit will be 81,215 m^3. A volume of 504 m^3 will be reused in berms around Turbine Foundations and Turbine Hardstands. See **Table 3.2b** for detailed volumes.

One borrow pit will be constructed as part of the Project. It will be located west of T5 and covers an area of 38,674 m^2. The borrow pit will provide 50,276 m^3 of excavated material to provide fill for the roads, hardstands, upfill to foundations and the temporary compound. The borrow pit will be excavated only as required. Where rock and fill material are available from the excavation of Turbine Foundations, this material will be used first. The use of an on-site borrow pit will reduce the need to transport material to the Site.

Once the required rock has been extracted from the borrow pit, it will be reinstated using any surplus inert material from the Site and made secure using permanent stock proof fencing. The method for restoration of the borrow pit is to encourage stabilisation and early establishment of vegetation cover, where available, vegetative sods/turves or other topsoil in keeping with the surrounding vegetation type will be used to provide a dressing for the final surface. There is no intention to implement improved habitats in the vicinity of the proposed borrow pit, but a habitat enhancement area will be established as part of the Project to the immediate west of the Site. The borrow pit will be reinstated with excavated material from the Site and will be capped to a level of 0.8 m above the existing ground level.

3.6 Summary of Re-Use of Excavated Material

All of the excavated material can be re-used on Site. **Table 3.2a and b** provides a summary of the re-use methods.

Table 3.2a Summary of Estimated Excavation Quantities (m^3)

Excavated Material Type	Excavated Material Volume (m^3)	Proposed Re-Use Volume		Comments
Roads	15,876	13,321	m^3 peat	Peat and subsoil will reinstate the onsite borrow pit.
		2,556	m^3 subsoil	
Turbine Foundations	7,250	1,562	m^3 peat	Peat will be used as backfill to foundations. Any surplus will be used to reinstate the borrow pit after extraction.
		3,083	m^3 subsoil	Subsoil will be deposited locally adjacent to Turbine Bases. 144 m^3 will be used as berms around Turbines. Any surplus will be used to reinstate the borrow pits after extraction.
		2,605	m^3 rock	Rock will be crushed and used as hardcore in Site Access Tracks and Turbine Hardstands.
Turbine Hardstands	41,949	14,220	m^3 peat	Peat and subsoil are to be deposited locally at hardstand edges. 360 m^3 will be used as berms around Turbine Hardstands. Any outstanding peat will be naturally air dried and used to fill borrow pits.
		27,729	m^3 subsoil	
Electrical Sub-Stations & temporary Compounds.	9,907	1,385	m^3 peat	Peat is to be temporally stored and re-used to reinstate the Temporary Compound Areas.
		8,522	m^3 subsoil	Subsoil will be dried naturally with air and used to reinstate the borrow pits after extraction
		0	m^3 rock	Rock will be crushed and used as hardcore in Site Access Tracks and Crane Hardstands.
Grid Connection*	6,854	0	m^3 peat	Subsoil and rock will be used to backfill tranches as part of the Grid Connection Route construction. The remaining material is to be disposed of at a licensed facility (LoW 17 05 03*, 17 05 04)
		6,557	m^3 subsoil	

Excavated Material Type	Excavated Material Volume (m^3)	Proposed Re-Use Volume		Comments
		297	m^3 rock	Please see Waste Management Plan for more details.
Drainage	2,280	2,280	m^3 peat	Peat is to be temporally stored and re-used to reinstate the Temporary Compound Areas.

Table 3.2b Summary of berms (m^3)

Total Turbine Foundation Volume (m^3)	Total Turbine Hardstand Volume (m^3)	Roadside berms (m^3)	Total Volume of Berms (m^3)
144	360	0	504

4 RECOMMENDATION

Based on the available information, Jennings O'Donovan make the following recommendations:

- The estimated potential total volume of excavated material is 77,262 m³.
- Excavated material along the Grid Connection Route will be used to backfill the trenches once the cable has been laid. Any surplus material will be disposed of at a licensed facility according to **Management Plan 5: Waste Management Plan** due to the presence of bituminous material and hydrocarbons. All other excavated material can be re-used on the Site.
- A minimum of 5,070 m³ of imported stone is required for finishing of road construction/upgrade and Turbine Hardstands if the rock onsite is determined to be insufficient quality.

APPENDIX A

Site Investigations Report

Prepared for;

Jennings O'Donovan

Inchamore Windfarm (IWF)

Site Investigation Report & Peat & Subsoil Stability Risk Assessment

603679 IWF EIAR App. 8.1 SI & PSSRA (02)

MARCH 2023

RSK GENERAL NOTES

Project No.: 603679 (02)

Title: Site Investigation & Peat & Subsoil Stability Risk Assessment Report

Client: Jennings O'Donovan

Date: 03/04/2023

Office: RSK Dublin

Status: (03) FINAL

Author	Lissa Colleen McClung	**Technical reviewer**	Sven Klinkenbergh
Signature		Signature	
Date:	03/04/2023	Date:	26/04/2023

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SI Appendix B	Peat Depth & Subsoil Databases
SI Appendix C	Trial Pit & Borehole Locations
SI Appendix D	Trial Pit Logs
SI Appendix E	Trial Pit and Site Photos
SI Appendix F	Borehole Logs & Bedrock Core Testing Laboratory Certificates
SI Appendix G	Subsoil Testing - Laboratory Certificates
SI Appendix H	Register of Geo-Hazards
SI Appendix I	Peat and Subsoil Stability Risk Assessment

1. Introduction

1.1 Background

RSK Ireland was commissioned by Jennings O'Donovan & Partners (JOD, the Client) on behalf of Inchamore Wind DAC (the Developer/s) to assess the geological site characteristics in relation to the planning application for the Inchamore Wind Farm (IWF, the Development) in Co. Cork.

1.2 Purpose

Site Investigation for the purposes of assessing ground conditions at EIA design phase of a proposed wind farm development, Inchamore Wind Farm, Co. Cork. Assessing ground conditions in terms of peat and slope stability risk, subsoil and geological characterisation and classification.

1.3 Scope of Works – Tender

The scope of works was initially specified by the Developer at tender phase. The scope of works for ground investigations at tender included the following works;

- Peat probing (50 m grid), 50 ha
- Trial pits, 35 no.
- Number of groundwater monitoring wells, 4 no.
- SI report with detailed findings, records and interpretation

Provisional works included;

- Gouge auger samples
- Boreholes up to 15 m, 5 no.
- Ground penetrating radar surveys (5 days)

In consultation with the Client and Developer the scope of works was adapted to the site based on observations made by desk study and initial site walk overs and assessments. The actual completed scope of works is detailed in **Section 2**.

This work has been carried out in unison with the EIAR for the Project. Therefore, this report will be appended to **EIAR Chapter 8 - Soils & Geology** as part of the planning application for the Project. The EIAR tender scope includes for a stand-alone Peat Stability Report as well as stand alone Site Investigation report, however the two will be merged in this Site Investigation report. This is done with a view streamlining the site geological assessment.

Further to the above, the geological or environmental setting of the site will be described in detail in **EIAR Chapter 8 – Soil & Geology** with appended maps and graphics for reference. This report will refer and summarise the EIAR chapter/s to avoid duplication of information or graphics. This report will also reference **EIAR Chapter 9 – Hydrology & Hydrogeology** in relation to groundwater.

1.4 Statement of Authority

RSK (Ireland) Ltd. (RSK), part of RSK Group, is a consultancy providing environmental services in the hydrological, hydrogeological and other environmental disciplines. The company and group provide consultancy to clients in both the public & private sectors. More information can be found at www.rskgroup.com. The principal members of the RSK EIA team involved in this assessment include the following persons;

- Sven Klinkenbergh – B.Sc. (Environmental Science), P.G.Dip. (Environmental Protection) – Associate, Project Manager and EIA Lead Author with c. 10 years industry experience in the preparation of hydrological, hydrogeological and geological reports..
- Project Scientist: Lissa Colleen McClung - B.Sc. (Hons.) Environmental Studies, M.Sc. (Hons.) Environmental Science. Current Role: Graduate Project Scientist
- Project Scientist: Mairéad Duffy – B.Sc. (Environmental Science), M.Sc. (Climate Change). Current Role: Graduate Project Scientist

2. Site Investigation Works & Methods

2.1 Scope of Works – Completed

The completed scope of works included;

- Peat depth probing, approx. 150 no. sampling locations.
- Trial pits, 16 no.
- Sub-soil sampling and Particle Size Distribution analysis, 4 no.
- Drilling – Rotary Core, 1 no.
- Drill core sample analysis. Point Load (PL) and Unconfined Compression Test (UCS).

2.2 Peat & Slope Stability Risk Assessment Methodology

2.2.1 Key assessment principals

The site assessment is carried out following key principals in line with relevant guidance, namely;

- BS 5930:2015+A1:2020 Code of Practice for Site Investigations.
- Scottish Government (2017) Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Developments

Some key insights to application and interpretation are provided from numerous documents, in particular;

- N. Boylan, P. Jennings & M. Long (2008) Peat slope failure in Ireland. Quarterly Journal of Engineering Geology and Hydrogeolog.

2.2.1.1 BS 5930 – Code of Practice for Site Investigations

This document explains the important steps to be taken in preparing for, scoping, and executing site investigations of various nature. The standard covers the following aspects:

- Planning: This section provides guidance on the planning of site investigations, including the purpose of the investigation, the scope of work, and the selection of appropriate investigation techniques.
- Desk Study: This section provides guidance on the collection and review of existing information, such as geological maps, site records, and historical data, that can aid in the planning and execution of site investigations.
- Site reconnaissance: This section provides guidance on the preliminary site visit to collect data on site characteristics and conditions.
- Investigation methods: This section provides guidance on the selection of appropriate investigation methods, such as drilling, sampling, and testing techniques, based on the site characteristics and the purpose of the investigation.
- Field testing: This section provides guidance on the execution of field testing, such as in-situ testing, geophysical surveys, and environmental testing.
- Laboratory testing: This section provides guidance on the selection and execution of laboratory testing, such as soil and rock testing, and the interpretation of laboratory results.
- Reporting: This section provides guidance on the reporting of site investigations, including the presentation of data, the interpretation of results, and the conclusions and recommendations.

Scoping site investigations and sampling regime in terms of sampling locations and frequency is an important and dynamic process. While BS 5930 details sampling frequency in terms of soil and rock geotechnical and environmental testing, standard provides guidance on the spacing and frequency of sampling points, which may vary depending on the site conditions, the purpose of the investigation, and the type of sampling method being used. It is important to scope and align appropriate methodologies and sampling regime with specific objectives and within specific environments, including Peat & Slope Stability Risk Assessments in peatland areas.

2.2.1.2 Scottish Government (2017) Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Developments

The Scottish Government's Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Developments is a document that provides guidance on the assessment of landslide hazard and risk in peatland areas, particularly in relation to proposed electricity generation developments. The document is published and written in context of Scottish peatlands, however in the absence of relevant guidance, it is widely accepted as relevant guidance in Ireland.

The guide emphasizes the need for a comprehensive assessment of landslide hazard and risk in peatland areas, which is particularly important due to the unique characteristics of these environments. Peatlands are often found in areas of high rainfall, and the accumulation of peat can result in unstable ground conditions, which can increase the risk of landslides.

The guide provides a step-by-step approach to landslide hazard and risk assessment, including the identification of potential landslide triggers, the characterization of the peatland environment, the assessment of landslide susceptibility, and the estimation of landslide hazard and risk. The guide also provides guidance on the selection of appropriate methods for landslide hazard and risk assessment, such as field mapping, remote sensing, and numerical modelling. The guide emphasizes the importance of stakeholder engagement and communication in the landslide hazard and risk assessment process, particularly in relation to proposed electricity generation developments, which can potentially have significant impacts on the surrounding environmental receptors and communities. The guide covers the following aspects which should be included in the site risk assessment;

- Sampling Regime: The guide recommends a sampling regime that includes both surface and subsurface surveys, using techniques such as; depth probing, gouge coring, trialpitting, drilling, and geophysical surveys. The aim is to obtain a comprehensive understanding of the geology and hydrogeology of the site, as well as the depth and condition of the peat layer.
- Assessment of Desk Top Data: The guide recommends an assessment of desktop data to identify potential sources of instability, such as steep slopes, drainage features, and areas of peat degradation. This assessment should be based on available data sources such as geological maps, aerial photographs, and LiDAR data.
- Degree of Geomorphological Assessment: The guide recommends a high degree of geomorphological assessment, using methods such as aerial photography interpretation and field mapping to identify potential instability features such as landslides and erosion channels. Many sources of data can input to the interpretation of stability risk at any particular location, and field reconnasance is also a valuable tool in this repsect.
- Interpretation of Data: The guide recommends a detailed interpretation of all data collected, including the results of field surveys and laboratory testing. This should involve the identification of key parameters such as peat depth, soil properties, and groundwater levels or saturation, as well as the integration of all available data to develop a comprehensive understanding of the potential for instability. This can result in screening out peat stability risk, for example; in areas of extensive shallow bedrock or bedrock outcrops, or areas with very minor inclines. Conversly, high risk areas can potentially be identified by desk top assessment alone, for example; steep slopes in excess 15 degrees, or areas with historical stability issues or historic landslides.
- The development of numerical models for peat stability risk assessments has been driven by advances in computer technology (e.g. QGIS) and modeling techniques, as well as an increased awareness of the risks associated with peat instability. The use of numerical modeling in peat stability risk assessments typically involves the following steps:
    - Development of a conceptual model: This involves the development of a conceptual model of the site based on the results of field investigations and laboratory testing. The conceptual model should include information on the geometry and properties of the peat layer, as well hydrogeological characteristics such as pore water pressure or bul unit weight (saturation).
    - Selection of appropriate modeling techniques: There are a variety of modeling techniques that can be used to simulate peat stability, including finite element and finite difference methods. The selection of an appropriate modeling technique will depend on the specific characteristics of the site and the goals of the assessment.
    - Calibration and validation of the model: The model is calibrated and validated using data collected during field investigations and laboratory testing. This involves adjusting model parameters to improve the match between simulated and observed data.

Overall, the guide emphasizes the importance of a comprehensive and integrated approach to peat landslide hazard and risk assessments, which includes a thorough sampling regime, an assessment of desktop data, a high degree of geomorphological assessment, and a detailed interpretation of all data collected. By following these guidelines potential hazards and risks associated with peat instability can be identified and managed effectively.

2.2.2 Desktop baseline characterisation & approach

The site and proposed development are assessed using QGIS mapping software with relevant environmental data layers published by relevant bodies including; EPA, and GSI.

Open source Global Digital Elevation Model (DGEM) data is used to determine the general nature of the topography at the site, including interrogating elevation data to determine slope inclines across the site.

Areas of the site undergo preliminary risk assessment and development constraints are identified and mapped. This will include slope inclines >8 degrees, 50m and 150m surface water or other environmental receptor buffers, etc. This data is used to inform the initial design phase of a project and to scope the site survey and sampling regime.

On completion of the initial phases of site surveys, georeferenced data is compiled and mapped in QGIS along with the initial desktop data. The site undergoes further preliminary risk assessment, preliminary modelling and constraints are updated and the process repeats i.e. phase 2.

Other environmental data, including peatland ecological data is incorporated where relevant.

2.2.3 Peat depth probing & topography assessments

Peat depth probing was undertaken at the site including at each proposed potential turbine location, at proposed locations for other infrastructure, and elsewhere on site where desktop assessment could not screen out stability risk.

Depth probing was conducted using a fibreglass depth probe and at each survey point the depth of peat, local incline (incline within a c. 5-10 m radius of the survey point) and grid reference (Irish Grid) were recorded. Notes on observations were also recorded including time of taking photographs, presence of drains etc.

A number of inferred peat depth probe points with a value of 0.5m, distributed in 2 no. transects at proposed turbine location T2. The inferred transects are intended to assess variability of peat stability corresponding with variability of incline, and to risk assess stability in close proximity to sensitive receptors.

2.2.4 Peat gouge coring & qualitative assessments

Gouge coring of peat was carried out to a limited extent (peat depth generally shallow). Peat quality assessment were made at existing cuttings and during trial pitting.

2.2.5 Piezometer installation & groundwater assessments

Not applicable. Peat depth at the site observed to be shallow generally at the site.

2.2.6 Topography & substrate topology

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

2.2.7 Peat stability numerical assessment

This stability assessment has been undertaken using a relatively simple infinite slope stability approach (Boylan, N, and Long, M, 2012) (derived from Bromhead's formula (Scottish Gov., 2017)), as follows;

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

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

Qualifying peat stability at all peat survey points and trial pit locations was done using the following parameters;

Table 1: Formula Parameters & Symbols

Symbol	Description	Unit
FoS	Factor of Safety	FoS
c_u	Effective cohesion or Undrained Shear Strength	kPa
y	Bulk Unit Weight of Peat	kN/m3
z	Depth to failure plain	m
α	Slope Angle	Degrees

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

Table 2: Factor of Safety (FoS) Classifications (Scottish Gov., 2017)

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

As per the guidance listed in Section 2 of this report, FoS values of 1.0 or greater are considered acceptable in terms of peat stability (Scottish Gov., 2017).

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

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

Undrained shear strength (effective cohesion) (c_u) has been derived by means of assessing moisture content results, which is; there is a correlation between peat moisture content and shear strength (effective cohesion). Shear vane testing has been carried out on the site however, shear vane test, or in situ barrel shear tests are not considered representative of shear strength characteristics of the peat being assessed in terms of stability assessment given numerous flaws with the test itself, namely; the shear vane test evaluates the shear strength where by the force is exerted in a vertical and cylindrical plane, which is not indicative of forces at play with respect slope stability or mass movement; and fibres and roots within the peat will effect the test itself, potentially exaggerating, or giving misleading data. The following graph presents conceptual shear strength values for peat (Boylan N, Jennings P & Long M., 2008).

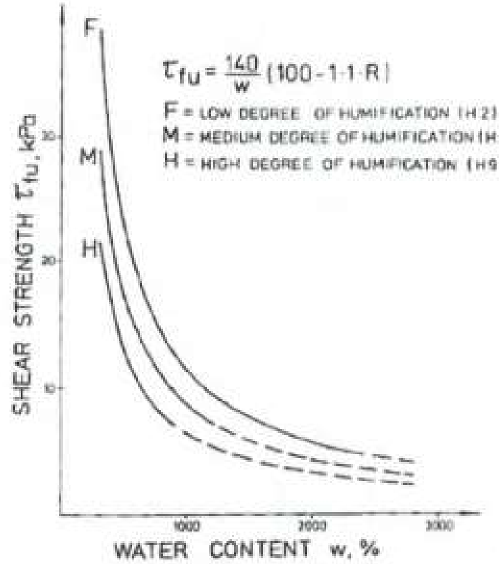


Figure 1: Correlation Between Moisture Content and Shear Strength of Peat (N. Boylan, P. Jennings & M. Long, 2008)

The following table presents the typical minimum, average and maximum moisture content which been used to determine indicative shear strength values for the Site.

Table 3: Peat Moisture Content Range & Indicative Shear Strength

Category	Moisture Content (%)	Indicative Shear Strength (kPa)
Minimum	200	>20
Average	750	10-20
Maximum	1500	<10

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

In situ bulk density (kg/m³), or bulk unit weight (kN/m³) of peat (y) is typically within the range of 900-1100 kg/m³ (Munro R, 2004), or 8.8-10.8kN/m³. For the purpose of assessing peat stability for the Site a conservative bulk unit weight value will be used in numerical assessments i.e., 11kN/m³.

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

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

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

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

Table 4: Formula Parameters, Symbols & Inferred Conservative Values

Symbol	Description	Value	Unit
c_u	Effective cohesion	3.5	kPa
y	Bulk Unit Weight of Peat	11	kN/m3
z	Depth to failure plain	Depth of Peat	m
α	Slope Angle	Surface Topography	Degrees

2.2.8 Risk Matrices & Ranking

In assessing the risk in relation to peat stability on site it is important to rate the risk in terms of the hazard, the likelihood and the consequences if any such issue should arise. Therefore, the slope stability risk assessment considers the following parameters, which are assessed by means of a series of risk matrices (Scottish Gov., 2017).

Table 5: Parameters Included in Risk Matrices and Assessed

Category	Description
Landslide History	Considers the likelihood of landslide events occurring based on the history of the site, including the current site use.
Factor of Safety	As described above, includes the following; • Peat depth • Peat quality / condition • Moisture content • Incline (surface topography) • Shear strength • Bulk unit weight of peat
Substrate Topology	Identifying and qualifying variance in substrate topology and qualifying variance from theory underlining the stability formula used i.e., Infinite Slope (Parallel and no foot and head forces)
Significance of Receptor	Qualifying potential receptors in terms of significance.
Distance to Receptor	Qualifying localised proposed development areas in terms of distance to nearest receptor.

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

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

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

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

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

Risk Matrices are presented in **Appendix I**.

2.2.9 Interpretation of Results.

Results of the numerical stability risk assessment are modelled / mapped and interrogated in the context of site topography, site conditions, the Project and receptor sensitivity and susceptibility. Interpretation of results in the context of the development, activity and any potential consequences is an important step of the slope stability risk assessment. It is important to consider groups of data sets and site-specific dynamics at a particular location (for example, at a proposed turbine location) and to qualitatively risk assess stability in the context of all observed site characteristics, including topography, substrate topology, geology, hydrogeology, and hydrology, etc. For example; data might indicate a single point of unacceptable FoS / stability, however this needs to be considered in context of neighbouring data and actual site conditions, such as the presence of deep peat within a localised basin confined by shallow bedrock at the surface at neighbouring points, that is; deep, "unstable" peat (by numerical model) observed to be confined by shallow bedrock does not equate to an elevated risk of a catastrophic landslide event occurring, but does equate to potential localised stability issues arising if excavating at that particular location with deep peat.

In turn, any potential stability hazard must be considered in risk assessments in terms of potential consequences to receptors, and not simply likelihood of a stability issues arising. For example, in an area with low risk in terms of stability or Factor of Safety (FoS), but immediately and directly upgradient of a sensitive receptor such as a surface water body, in the unlikely event (low risk = acceptable FoS) that a significant stability issue should arise, due to the proximity to the receiving receptor the consequences of such an event have the potential to be significant.

The following table presents the interpretation of stability risk assessment data in the context of stability, or factor of safety (FoS) (Adjusted, Scenario B) at each significant development infrastructure unit.

2.3 Subsoil & Slope Stability Risk Assessment Methodology

2.3.1 Subsoil stability numerical assessment

This stability assessment has been undertaken in a similar manner to the peat stability assessment. However, due to the limited data available (compared to number of peat depth probing locations) qualifying stability in subsoils at the Site will infer data obtained at nearest neighbour trial pit locations.

Subsoils observed on site generally are classified as follows;

- Clayey, silty, sandy, GRAVEL (or TILL) with coobles and boulders.

The undrained shear strength observed in till subsoils at the Site ranged from 15 to 180kPa (**Appendix B**). This data is not considered highly reliable due to numerous site-specific factors including particle size distribution of subsoils, particularly with high gravel / cobble content in this instance.

The undrained shear strength for inorganic silty sandy soils is typically in the range of 50 to 75kPa but is highly variable depending on the particular particle sizes and their character comprising the soil. It should be noted saturation / pore water pressure can also dramatically impact and reduce shear strength, or cohesion values in soils.

For the purpose of assessing subsoil stability for the Site a conservative undrained shear strength (effective cohesion) value will be used in numerical assessments, i.e., 40 kPa.

In situ bulk density (kg/m^3), or bulk unit weight (kN/m^3) of soils/subsoils (y), namely silty sandy subsoils, is typically within the range of 2500 to 2700 kg/m^3, or 24.5 to 26.5 kN/m^3. For the purpose of assessing subsoil stability for the Site a conservative bulk unit weight value will be used in numerical assessments i.e., 27 .0 kN/m^3.

The depth to failure plane (z) is presumed to be thickness or depth of subsoils at any given sampling point being assessed. However, subsoil depths will be inferred in areas of the site with limited data. It should be noted that the failure plane can potentially be within subsoils (subsoil on subsoil movement), or the substrate i.e., weathered bedrock. In relation to the Site specifically, it is important to note the presence of iron pan. Iron pan is a layer of oxidised iron within the subsoil. The iron pan layer is relatively impermeable which can impede or significantly alter groundwater movement in the subsoils. Under the right circumstances the iron pan layer can therefore become a slip or failure plane. In such instances the failure plane has the potential to parallel to the overlying topography.

Slope angle (α) is presumed to be topographical incline measured on site / evaluated using high resolution elevation data at any given sampling point being assessed, however it should be noted that the slope angle (α) relates to the failure plane angle, which is presumed to be the peat and substrate interface, and which is presumed to be parallel to the surface when using FoS Formula (Infinite Slope Formula). In reality the underlying substrate (bedrock) is unlikely to be parallel to the surface topology. However, considering the presence of iron pan in subsoils at the site it is important to consider the potential for parallel failure planes when assessing stability at the site.

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

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

Table 6: Formula Parameters, Symbols & Inferred Conservative Values

Symbol	Description	Value	Unit
c_u	Effective cohesion	40	kPa
y	Bulk Unit Weight of Peat	27.0	kN/m3
z	Depth to failure plain	Depth of subsoil to bedrock	m
α	Slope Angle	Surface Topography	Degrees

2.3.2 Risk Matrices & Ranking

In assessing the risk in relation to subsoil stability on site it is important to rate the risk in terms of the hazard, the likelihood and the consequences if any such issue should arise. Therefore, the slope stability risk assessment considers the following parameters, which are assessed by means of a series of risk matrices (Scottish Gov., 2017)

Table 7: Parameters Included in Risk Matrices and Assessed

Category	Description
Landslide History	Considers the likelihood of landslide events occurring based on the history of the site, including the current site use.
Factor of Safety	As described above, includes the following; • Subsoil depth (to failure plain)

Category	Description
	• Subsoil composition (PSD) • Moisture content • Incline (surface topography) • Shear strength • Bulk unit weight of subsoil
Substrate Topology	Identifying and qualifying variance in substrate topology and qualifying variance from theory underlining the stability formula used i.e., Infinite Slope (Parallel and no foot and head forces) **For the purposes of considering worst case conditions (the potential for iron pan and parallel failure plains), substrate topology is considered parallel.**
Significance of Receptor	Qualifying potential receptors in terms of significance.
Distance to Receptor	Qualifying localised proposed development areas in terms of distance to nearest receptor.

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

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

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

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

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

Risk Matrices are presented in **Appendix I**.

3. Baseline Conditions

3.1 Site Description & History

There no recorded landslide events in close proximity to the Site (GSI, Accessed 2021).

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

The Site is mapped as having areas ranging from Low Risk to High Risk in terms of Landslide Stability, that is; full spectrum of slope stability risk categories (GSI, ND). Larger areas of High-Risk landslide susceptibility are associated with relatively expansive steep slopes.

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

3.2 Site Geology

Consultation with Geological Survey Ireland Spatial Resources (GSI) indicates that the bedrock at 1:1,000,000 scale the Site is underlain by;

- Gun Point Formation (GP) – Green-grey to purple medium to fine-grained sandstones, interbedded with green and red to purple siltstones to fine sandstones.

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

Rocky outcrops are common within the Site Boundary.

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

3.3 Site Soils & Subsoils

Consultation with available maps (GSI) indicate that the soil type across the entire area of the Site, and the general area in the region is mostly Blanket Peat and Till derived from Devonian sandstones with several significant areas mapped as being Bedrock at Surface.

Peat depths observed on the Site are generally 'Rock' to 'shallow' with isolated pockets of moderately deep peat, however depths at most sampling points are within the range of 0.0-0.5 m and areas with deeper, particularly extremely deep peat have been avoided in terms of the Project footprint. Peat depths are mapped and presented in **Appendix A**.

Peat quality assessment (by gouge coring / trial pitting / observations at cut locations) indicate relatively moderate to high Von Post values (generally H5 to H8) across the Site.

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

3.4 Topography & Substrate Topology

The topography at and in the immediate area surrounding the Site is highly variable with multiple peaks, ridges with variable elevations and inclines. At lower elevations the topography is relatively flat or comprising of low magnitude inclines, however at mid and high elevation relative to the Site, steep high magnitude inclines are commonplace.

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

3.5 Hydrology & Climate

Three (3no.) mapped rivers run through and directly adjacent to the Site. Several extensive constructed drainage channels associated with forestry, agriculture and peat cutting activities exist at the site.

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

3.6 Receptors

Receptors associated with the Project footprint are generally limited to non-critical infrastructure and water bodies.

Receptors associated with the Project, which is; streams, rivers, lakes and groundwater, are considered highly sensitive receptors considering;

- 'Good' WFD River status and objective to protect same.
- 'Moderate' WFD Lake (Carrigdrohid) status and objective to restore same to at least good status by 2027.
- The numerous downgradient designations (sensitive protected areas) associated with each of the two associated catchments and the sensitive habitats and species associated with same.
- Designation of some downgradient surface water bodies and all groundwater bodies as sources of drinking water (Sullane_050).

Ultimately, all surface water and groundwater associated with the Site is considered sensitive and must be protected.

Risk to receptors must consider both the hazard, and likelihood of adversely impacting on any given sensitive receptor, and therefore parameters such as; distance from potential source of hazard to receptor, pathway directness and/or connectivity, and assimilative capacity of the receiving water body should also be considered.

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

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

4. Site Investigation Data & Results

4.1 Peat Depth Data

Approximately 150 no. peat depth probe locations were assessed at the Site. Georeferenced and categorized peat depth locations are presented in **Appendix A**. Peat depth data is presented in **Appendix B**. Number of probe locations by Depth Category are presented in **Table 8**.

Table 8: Peat Depth Probe Points per Depth Category

Peat Depth Category	No.
A – Rock (0.00-0.01 m)	16
B – Very Shallow (0.01-0.5 m)	92
C – Shallow (0.5-2.0 m)	66
D – Moderately Deep (2.0-3.5m)	12
E – Deep (3.5-5.0 m)	1
F – Very Deep (>5.0 m)	0
TOTAL	187 (21 Inferred)

4.2 Trial Pit Data

A total of 16 no. Trial Pits were completed, logged and sampled at the Site. Trial Pit and Borehole locations are presented in **Appendix C**. Trial Pit Logs are presented in **Appendix D**. Trial Pit and Site Investigation Photos are presented in **Appendix E**. A total of 3 no. subsoil samples were obtained from the Site and tested for particle size distribution (PSD). Subsoil laboratory certificates are presented in **Appendix G**.

Particle Size Distribution (PSD) Soil Description results for subsoils (BS 1377: Part 2: 1990: Clause 9) at the site are presented in **Table 9**. Note: cobble size particles observed on trial pit log sheets and have likely been screened out to a degree at the time of sampling.

Table 9: Reported Subsoil Description (PSD)

Sample ID	Cobbles (%)	Gravel (%)	Sand (%)	Silt & Clay (%)	Description
TP03-A2 (SS1)	0.0	43.0	32.0	25.0	Very clayey very sandy GRAVEL
TP08-A2 (SS1)	0.0	50.0	19.0	31.0	Slightly sandy gravelly CLAY
TP11-A2 (SS1)	0.0	51.0	26.0	22.0	Very clayey very sandy GRAVEL

Cobbles were observed on site and were likely screened out at the time of sampling. Further details are presented in **Appendix D.** Iron pan was observed in several trial pits as listed in **Appendix H**, and presented in **Appendix C, Appendix D** and **Appendix E**.

4.3 Borehole Data

A total of 1 no. rotary core borehole was completed, logged, and sampled at the Site. Borehole logs are presented in **Appendix F**. Drill logs indicate that;

- Bedrock underlying the site is described as SILTSTONE (BH01I)
- Bedrock shows minor signs of weathering.
- Driller notes water strike at BH01I at ~2.50m bGL likley perched groundwater on top of unweathered bedrock. .

Siltstone is mainly comprised of silt-sized particles. Silt-sized particles range between 0.002 and 0.063 millimeters in diameter (BS 5930). They are intermediate in size between coarse clay on the small side and fine sand on the large side.

Bedrock cores obtained were tested for Unconfined Compressive Strength (UCS) and Point Load Strength (PL). Rock core testing laboratory certificates are presented in **Appendix F**. Unconfined Compressive Strength (UCS) results presented in **Table 10** indicate bedrock underlying the site is considered weak.

Table 10: Bedrock Core Laboratory Strength Testing Results

Parameter	(Unit)	BH01I
UCS Results	*Kn*	23.3
UCS Results	*MPa*	5.17
Rock Strength (UCS MPa)	*BS 5930* *BS EN ISO 14689*	Weak

4.4 Peat Stability Risk Assessment Results

Review of peat stability assessment result data and maps as presented in **Appendix I** indicate that the factor of safety is generally acceptable and very low to low stability risk across the site with the exception of minor isolated areas or pockets of deeper peat.

Summary of risk at the site under varying conditions and scenarios is presented in in the following tables.

Table 11: Factor of Safety (Adjusted) at Peat Probe Locations

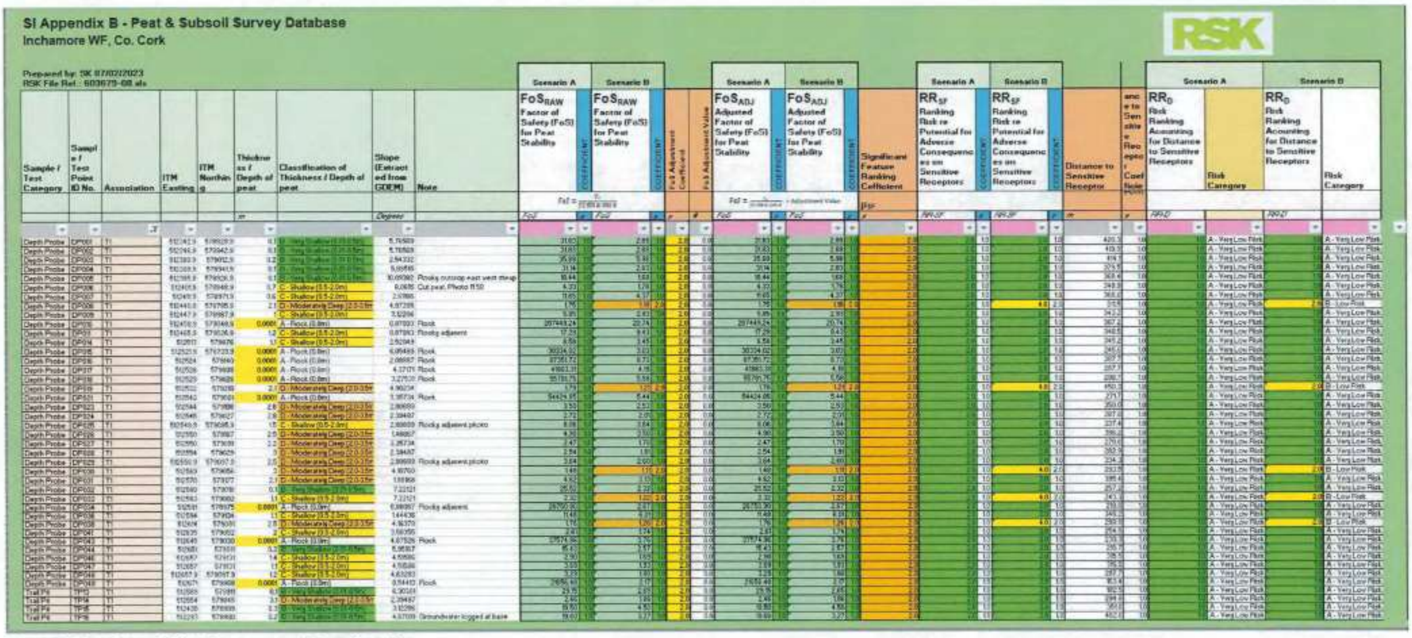
	Acceptable	Marginally Stable	Unstable
FoS (Adj.) Scenario A	149	1	0
FoS (Adj.) Scenario B	118	24	8

Table 12: Risk Ranking (Distance) at Peat Probe Locations

	Very Low	Low	Moderate	High
RR (Dist.) Scenario A	104	11	34	1
RR (Dist.) Scenario B	81	27	37	5

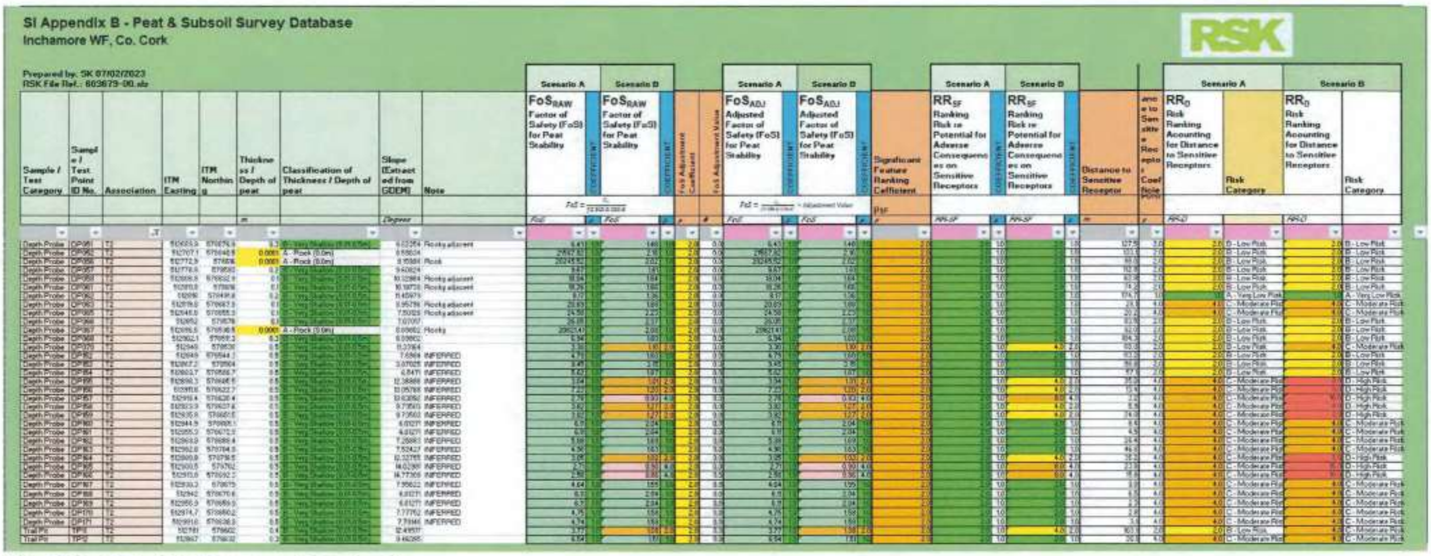
Areas of elevated stability risk, even at a localised scale, are considered geo-hazards requiring mitigation. Geo-hazards are presented in **Appendix H**.

The following plates present the available peat data per proposed turbine locations, including the results of numerical model stability risk assessment.



SI Appendix B - Peat & Subsoil Survey Database
Inchamore WF, Co. Cork

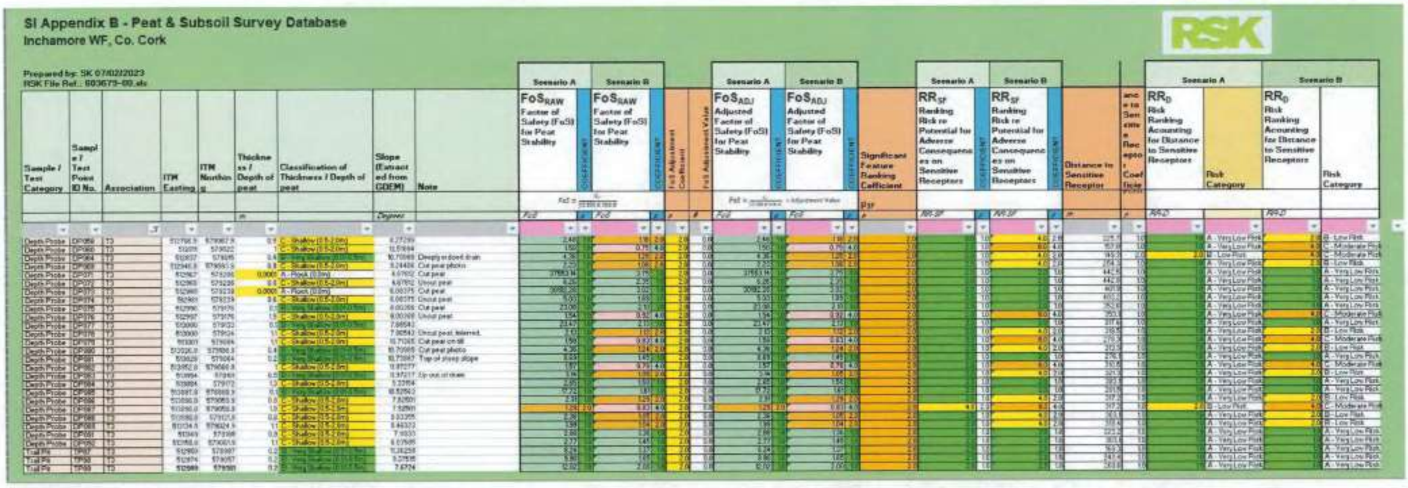
Plate 1: Peat Data & Risk Assessment Results – T1



SI Appendix B - Peat & Subsoil Survey Database
Inchamore WF, Co. Cork

Prepared by: SK 07/02/2023
RSK File Ref.: 603679-00.xlsx

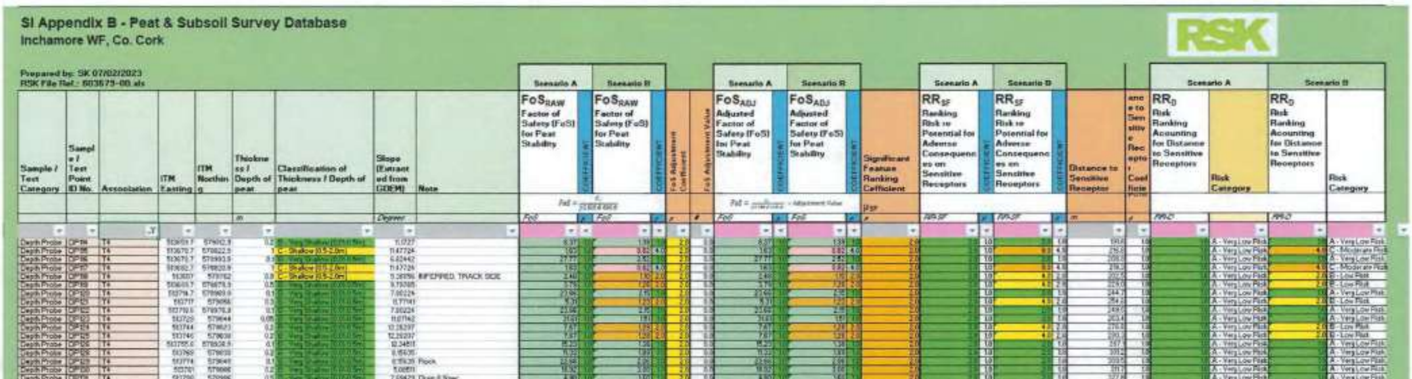
Plate 2: Peat Data & Risk Assessment Results – T2



SI Appendix B - Peat & Subsoil Survey Database
Inchamore WF, Co. Cork

Prepared by: SK 07/02/2023
RSK File Ref.: 603679-00.xls

Plate 3: Peat Data & Risk Assessment Results – T3



SI Appendix B - Peat & Subsoil Survey Database
Inchamore WF, Co. Cork

Prepared by: SK 07/02/2023
RSK File Ref.: 603679-00.xls

Plate 4: Peat Data & Risk Assessment Results – T4

SI Appendix B - Peat & Subsoil Survey Database
Inchamore WF, Co. Cork

Prepared by: SK 07/02/2023

Sample / Test Category | Sample / Test Point ID No. | Association | ITM Easting | ITM Northing | Thickness / Depth of peat | Classification of Thickness / Depth of peat | Slope (Extracted from GDEM) | Note

Scenario A: FoS

Scenario A | Scenario B: FoS RAW Factor of Safety (FoS) for Peat Stability

FoS Adjustment Coefficient | FoS Adjustment Value

Scenario A | Scenario B: FoS ADJ Adjusted Factor of Safety (FoS) for Peat Stability

Significant Feature Ranking Coefficient

Scenario A | Scenario B: RR SF Ranking Risk re Potential for Adverse Consequences on Sensitive Receptors

Distance to Sensitive Receptor

Scenario A | Scenario B: RR D Risk Ranking Accounting for Distance to Sensitive Receptors | Risk Category

Plate 5: Peat Data & Risk Assessment Results – T5

Plate 6: Peat Data - FoS (ADJ) (B) with Slope (GDEM) presents peat stability risk assessment Factor of Safety (FoS (ADJ) (Scenario B)) results, receptors and associated 50m buffer zones, and slope (GDEM).

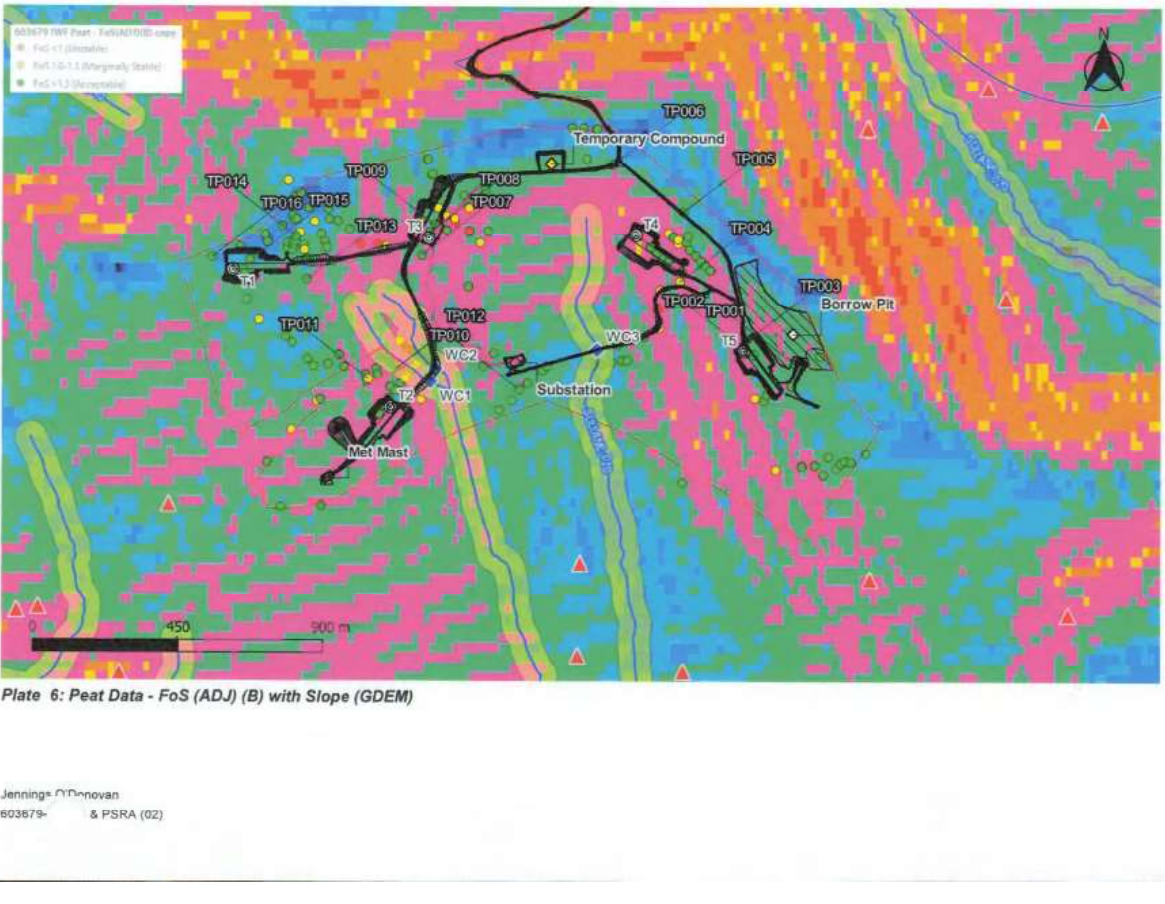


Plate 6: Peat Data - FoS (ADJ) (B) with Slope (GDEM)

4.5 Peat Stability Risk Assessment Interpretation

Table 13: Peat Stability Risk Assessment – Factor of Safety (Adjusted) (Scenario B) at Main Infrastructure Units presents the interpretation of stability risk assessment data in the context of stability, or factor of safety (FoS) (Adjusted, Scenario B) at each significant development infrastructure unit.

Table 13: Peat Stability Risk Assessment – Factor of Safety (Adjusted) (Scenario B) at Main Infrastructure Units

Turbine No. / Unit	FoS_{ADJ} (Factor of Safety adjusted according considering site specific conditions)	Geo-Hazard / Comment (Important to consider when carrying out detailed design and preconstruction planning)
T1	Generally acceptable. Data indicates peat stability is primarily acceptable, with the exception of * pockets of moderately deeper peat (marginally acceptable / unstable at localised scale north of proposed turbine locality).	Localised steep inclines and potential for pockets of deep peat. Residual risk = localised stability issues. Relatively extensive area of deep peat to north / northwest of development footprint at T1. Development footprint avoids this area however vehicular movements must be managed, and this area avoided completely.
T2	Generally acceptable with localised areas of marginally stable FoS, localised areas of unstable peat. Data indicates that peat depth in the area is generally shallow with relatively extensive rock outcrops. Steep inclines in the area are a key driver of unfavourable results.	Localised steep inclines and potential for pockets of deep peat. Residual risk = localised stability issues. Proximity to receptor (river).
T3	Data indicates peat stability is primarily acceptable, marginally acceptable. Some locations on approach (access tracks) possess locally unstable data due to relatively higher localized slope angles, and/or deeper peat however peat depths are shallow.	Localised steep inclines and potential for pockets of deep peat. Residual risk = localised stability issues.
T4	Generally acceptable. Data indicates peat stability is primarily acceptable, with isolated pockets Marginally acceptable.	Localised steep inclines and potential for pockets of deep peat. Residual risk = localised stability issues.
T5	Generally acceptable. Data indicates peat stability is primarily acceptable, with isolated pockets Marginally acceptable.	Localised steep inclines and potential for pockets of deep peat. Residual risk = localised stability issues.

Turbine No. / Unit	**FoS_{ADJ}** **(Factor of Safety adjusted according considering site specific conditions)**	**Geo-Hazard / Comment** **(Important to consider when carrying out detailed design and preconstruction planning)**
Met Mast	Generally acceptable. Data indicates peat stability is primarily acceptable, with isolated pockets Marginally acceptable.	Localised steep inclines and potential for pockets of deep peat. Residual risk = localised stability issues.
Borrow Pit	Generally acceptable. Data indicates peat stability is primarily acceptable, with isolated pockets Marginally acceptable.	Localised steep inclines and potential for pockets of deep peat. Residual risk = localised stability issues.
Substation	Data indicates peat stability is acceptable. Very Low Risk in terms of Receptors	Potential for localised stability issues.

The following table presents the interpretation of stability risk assessment data in the context of stability, or factor of safety (FoS) in context of receptor type (RR (SF)) and distance to receptor (RR(D)) at each significant development infrastructure unit.

Table 14: Peat Stability Risk Assessment – Factor of Safety (Adjusted) (Scenario B) at Main Infrastructure Units

Turbine No. / Unit	**RR(D)** **(Ranked Risk considering Distance to Sensitive Receptors)**	**Geo-Hazard / Comment** **(Important to consider when carrying out detailed design and preconstruction planning)**
T1	Very Low to Low Risk	Localised stability and drainage network.
T2	Low to High Risk	Localised stability and proximity to sensitive receptor (river). Minor, localised stability issues have the potential to have significant adverse impacts on receptors.
T3	Very Low to Moderate Risk	Localised stability and drainage network.
T4	Very Low to Moderate Risk	Localised stability and drainage network. Limited data between downstream receptors. Potential for deep pockets of peat but peat depth generally shallow. Max (GDEM) incline = approx. 8 degrees, moderate incline.
T5	Very Low to Low Risk	Localised stability and drainage network.
Met Mast	Very Low to Moderate Risk	Localised stability and drainage network.