Peat and overburden management plan for Curraglass Renewable Energy Development

GAVIN AND DOHERTY GEOSOLUTIONS LTD
UNIT 2A NUTGROVE OFFICE PARK,
RATHFARNHAM, DUBLIN 14, D14 X627 IRELAND
Tel: +353 1 207 1000 | www.gdgeo.com

Project Title:	Curraglass Renewable Energy Development
Report Title:	Peat and overburden management Plan
Document reference:	19162-002-03

Client:	MKO Planning & Environmental Consultants
Ultimate Client:	
Essential Requirements:	This report is best viewed in colour

Document Control

Revision	**Date**	**Authored:**	**Checked:**	**Approved:**
00	21/02/2020	CB		
	Issued as work in progress			
Revision	**Date**	**Authored:**	**Checked:**	**Approved:**
01	22/04/2020	LB	PQ	PQ
Revision	**Date**	**Authored:**	**Checked:**	**Approved:**
02	07/05/2020	LB	PQ	PQ
Revision	**Date**	**Authored:**	**Checked:**	**Approved:**
03	02/06/2020	LB	PQ	PQ

Guidelines of use of report:

This report (hereafter the "Services") was prepared by Gavin & Doherty Geosolutions Ltd. (GDG) for MKO Planning & Environmental Consultants (hereafter the "Client") in accordance with the terms of a contract between MKO Planning & Environmental Consultants and GDG. GDG performed the services with the skill and care ordinarily exercised by a reasonable geotechnical civil engineering specialist at the time the services were performed. The Services were performed by GDG taking into account the limits of the scope of works required by the Client, the time scale involved and the resources agreed between MKO Planning & Environmental Consultants and GDG. Third parties using any information contained within this report do so at their own risk. The design decisions in this report and related comments expressed herein are based on the information received, the conditions recorded during site investigation works, and on the results of tests made in the field and laboratory. However, there may be conditions existing at the site which have not been disclosed by the investigation available and which have not been taken into account in the report.

GDG provide no other representation or warranty whether express or implied, in relation to the Services expressly contained in the paragraph above. This report should not be used for any other purposes apart from those expressly stated in this document.

Table of Contents

List of Tables

Table of Figures

1 Introduction

Gavin and Doherty Geosolutions (GDG) was requested by MKO Planning & Environmental Consultants (MKO) to prepare a Peat and overburden Management Plan (PMP) on behalf of Wingleaf Ltd., as part of an application for planning permission to Cork County Council to construct a renewable energy development on the site of the original wind farm located in the townlands of Cappaboy Beg, Derreendonee and Curraglass, Co. Cork. The proposed wind farm layout and peat depth plan is presented in Appendix A.

GDG has been involved in many wind farm developments in both Ireland and the UK at various stages of development i.e. preliminary feasibility, planning, peat stability assessment, design and construction. The GDG team, made up of engineering geologists, geomorphologists, geotechnical engineers and environmental scientists, have developed expertise in the design and construction of developments in areas of peat.

This PMP has been prepared with consideration of industry best practice relating to wind farm construction and peatlands. This best practice includes:

- *Draft Revised Wind Energy Development Guidelines*. Department of Housing, Planning and Local Government (2019);
- *Good practice during wind farm construction. A joint publication by Scottish Renewables, Scottish Natural Heritage, Scottish Environment Protection Agency, Forestry Commission Scotland* (2015);
- *Scottish Government, Guidance on Developments on Peatland* – Site Surveys (2014);
- *Guidance on the Assessment of Peat Volumes, Reuse of Excavated Peat and the Minimisation of Waste,* Scottish Renewables and SEPA (2012); and
- *Floating Roads on Peat*, Scottish Natural Heritage (2011).

Many of the publications listed above have been developed by the Scottish Government which are considered to be best practice in Ireland and are therefore appropriate for refer to within this PMP

This PMP and compliance with it shall not relieve the developer of any obligations to undertake detailed ground investigations or geotechnical design prior to construction or any obligations relating to other aspects of the environment.

1.1 Proposed development

The Curraglass Renewable Energy Development site is located in Co. Cork. The site is located approximately 5.6km northeast of Kealkill and 5.5km southwest of the village of Ballingeary.

The previous wind turbines at the site were granted planning permission in 2002 and the site was constructed and became operational in 2006. The turbines were removed in June 2018 as they had reached the end of their productive lifespan. The previous development consisted of 10 turbines, with a hub height of 50m and a total tip height of 75m.

Wingleaf Ltd. is now seeking to optimise the site with a renewable energy development comprising 7 turbines with a tip height of up to 178.5 metres.

The full description of the proposed development, as per the public planning notices, is as follows:

1. Up to 7 no. wind turbines with an overall blade tip height of up to 178.5 metres and all associated foundations and hard-standing areas;
2. 2 No. borrow pits;
3. 1 No. permanent meteorological mast with a maximum height of up to 112 metres;
4. Upgrade of existing and provision of new site access roads;
5. Upgrade to existing access junction;
6. A 38kV electricity substation, including 4 no. battery storage containers, 1 no. control building with welfare facilities, associated electrical plant and equipment, security fencing, wastewater holding tank,
7. Forestry Felling;
8. A temporary construction compound;
9. Site Drainage;
10. All associated internal underground cabling, including underground grid connection cabling to the existing overhead line; and
11. All associated site development and ancillary works.

1.2 Scope of report

This report contains the following:

- A summary of construction activities on-site;
- A review of peat conditions on-site;
- Preliminary road construction types;
    - Methodologies for the construction of each type of access road and typical road construction details;
- Summary of borrow pits on-site and typical detail drawings; and
- Guidelines for handling and storing of excavated peat;
- Preliminary earthworks volumes;
- General recommendations for good construction practice.

1.3 Summary of construction activities

For the construction phase, the activities that are considered likely to generate peat and spoil are as follows:

1. The upgrade and widening of existing founded access roads.
2. The construction of new excavated roads. We note that floating road construction does not require peat excavation.

3. Excavations for turbine bases, hardstandings, met mast, substation, construction compounds and borrow pits.

2 Peat conditions and stability

GDG visited the site on 21st January 2020 and 6th February 2020 to carrying a site walkover and peat probing.

The depth of peat varies across the site. Readings typically ranged from 0.0m to 2.0m.

There is a discrete area of deep buoyant peat (soft, waterlogged and unstable underfoot) observed adjacent to, but offset from, an existing access roadway (see Figure 2-2). The maximum peat depth measured locally in this area was 5.5m but the proposed site infrastructure avoids this area other than the upgrade of an existing road.

Across the site, there is evidence that peat has been side-cast during previous construction works. In these areas, the probe was unable to penetrate to full depth due to either peat compaction or due to the abundance of float (loose rock) within the side-cast peat itself.

The peat was generally observed in existing road cuttings as fibrous and compact, however, the peat is waterlogged in some limited locations, as can be expected.

A detailed breakdown of the site observation at each turbine can be found in the Peat Stability Risk Assessment produced for the development by GDG (2020). Key observations are presented in Figure 2-1 and Figure 2-2.

Figure 2-1 Left: Excavation exposing a thin layer of peat over till at proposed T4. Right: Waterlogged peat in the vicinity of the proposed temporary compound.

Figure 2-2 Area of buoyant peat (soft, waterlogged and unstable under foot) 250m west of T2

The location of the buoyant peat is indicated in Appendix A as a safety buffer area and has been avoided in the project design.

2.1 Peat stability risk assessment

Particular restricted areas have been identified as part of the Peat Stability Risk Assessment (GDG, 2020) for this development (Ref: 19162-002) and are shown presented in Appendix A.

These consist of:

- Safety buffer areas 01 and 02 – areas which shall be restricted for construction and should not be used for storage or side casting of peat or any overburden materials.
- Peat stockpile restriction 01, 02 and 03 – areas that are not restricted for construction but shall not be used for stockpiling of peat or any overburden materials.

3 Road construction types

Existing roads will need to be upgraded and new access roads will need to be constructed at the Curraglass Renewable Energy Development. The following factors are considered in the preliminary proposals for road construction types:

- Constructability;
- Serviceability requirements for construction and wind turbine delivery and maintenance vehicles;
- Peat depth;
- Horizontal longitudinal and cross fall gradient of the roads;
- Minimisation of excavation arisings; and
- The requirement to minimise disruption to peat hydrology.

Whilst the above key factors are used to determine the road design the actual construction technique employed for a particular length of road will be determined on the prevailing ground conditions encountered during the detailed site investigation and road design stages.

Floating roads minimise the impact on the peat, particularly peat hydrology. As there is no excavation required no peat arisings are generated. However, where the underlying peat has insufficient bearing capacity or due to topographic restrictions, a founded type access road may be more suitable.

The preliminary road construction details proposed for the development are summarised below in Table 3-1. Typical details of the road construction types are included in Appendix B.

Table 3-1 Road construction types

Construction method	Detail reference	Construction type
Construction of new roads	A	Founded
Upgrade of existing access roads	B	Founded
	C	Floating

It is anticipated that the majority of the roads will be a founded construction (Detail A and B), although a methodology and a detail (Detail C) is provided for upgrading of floating access roads, to account for the unlikely case that is found to be necessary during detailed design or construction. As per the figure in Appendix A.1, all existing road infrastructure will typically be that of an upgraded founded construction method (B), whereas all new roads will typically be that of a new founded construction method (A). The final road construction and extents of each construction type used will be determined at detailed design stage.

General construction methodologies are presented in the following sections. This methodology aims to minimise impacts on the stability of the peat and may be amended following detailed design prior to construction. The methodology is not intended to cover all aspects of construction such as drainage

and environmental considerations. Inspection and monitoring plans should be implemented during construction for each methodology to monitor peat stability.

3.1 Construction methodology for new roads

The general methodology to construct new founded roads (i.e. See Detail A of the typical road construction detail drawings presented in Appendix B) is presented below.

1. Excavation of the new access road to competent strata (see Section 5 for guidance on the correct handling and storage the different peat layers).
    a. For excavations in overburden and peat, side slopes shall not generally be greater than 1(V): 2 or 3(H), respectively. Slacker slopes may be required if localised areas of weaker peat are encountered.
    b. Drainage shall be installed to divert surface and groundwater from the construction areas.
2. Placement of granular fill in layers following the designer's specification (typically 200mm, but which will be subject to detailed design).
3. Access roads to be finished with a layer of capping across the full width of the road.
    a. A layer of geogrid/geotextile may be required at the surface of the existing access road following the designer's specification.

The presence of excavations can destabilise the road. Temporary excavations, where required, should be excavated in short lengths and backfilled as soon as practicable.

Spoil materials can be side-cast on the upslope side of roads only, where slope and ground conditions allow. Side cast materials should be placed to heights of typically 1m and widths of 2 to 3m unless specific site-specific designs allow larger volumes of to be placed. Large stockpiles of materials shall not be placed on or adjacent to floated access roads. This is to avoid bearing failure of the underlying peat.

Particular buffer areas have been highlighted in the peat stability risk assessment report prepared by GDG (2020) for this development (Ref: 19162-002) and are shown presented in Appendix A.

These consist of:

- Safety buffer 01 and 02 – areas which will be construction buffer zones
- Peat stockpile restriction 01, 02 and 03 – areas that shall not be used for stockpiling of peat or any overburden materials.

3.2 Construction methodology to upgrade existing roads

The general methodology to upgrade existing founded roads (i.e. See Detail B of the typical road construction detail drawings presented in Appendix B) is presented below.

1. Excavation on one or both sides of the existing access road to competent strata.

   a. For excavations in peat and overburden, side slopes shall not generally be greater than 1(V): 2 or 3(H), respectively. Slacker slopes will be required where areas of weaker peat are encountered.
2. Benching of existing road and placement of granular fill in layers, following the designer's specification.
3. Overlay of the existing access road with selected granular fill following the designer's specification.
   a. Where coarse granular fill has been used in the existing floated access road make-up, a layer of geogrid should be placed on top of the existing floated access road.
4. Access roads to be finished with a layer of capping across the full width of the road.
   a. A layer of geogrid/geotextile may be required at the surface of the existing access road following the designer's specification.

The general methodology to upgrade existing floating roads (i.e. See Detail C of the typical road construction detail drawings presented in Appendix B) is presented below. As noted, it is not anticipated that this will be necessary on site, but is included to account for the unlikely case that this construction is found to be necessary during detailed design or construction.

1. Placement of tree brash and/or a geotextile onto on one or both sides of the existing access road directly onto the peat surface, following the designer's specification.
2. Benching of existing road and placement of granular fill and reinforcing geogrids in layers following the designer's specification, with due regard to any settlement of peat anticipated for the widened area.
   a. It may be necessary to stage the widening to maintain peat stability – i.e. to reduce rate of placement of fill to allow the peat layers to consolidate and increase in strength.
   b. It may be necessary to anchor the geogrids into the existing roads which would require significant benching of existing roads.
3. Overlay of the existing access road with selected granular fill following the designer's specification.
   a. Where coarse granular fill has been used in the existing floated access road make-up, a layer of geogrid should be placed on top of the existing floated access road.
   b. The surface of the existing access road should be graded/levelled before the placement of any geogrid/geotextile, where necessary (to prevent damaging the geogrid/geotextile).
4. Access roads to be finished with a layer of capping across the full width of the road.
   a. A layer of geogrid/geotextile may be required at the surface of the existing access road following the designer's specification.

Where there are cross slopes, any road widening works required should be carried out on the upslope side of the existing access road, where possible. Particular design details will be required at detailed design at the transitions between floating and founded roads to smooth out differentials settlements between the two construction types.

4 Borrow Pits

Two borrow areas are proposed for the development, namely Borrow Pit 1 and Borrow Pit 2 as shown in Appendix A and C. The peat depths within the development footprints of the borrow pits are generally less than 1m.

The rock within each proposed borrow pit footprint will be removed by either breaking or blasting depending on its excavatability, which will be determined from a ground investigation carried out at each of the proposed borrow pits. The excavated rock from the borrow pits will be used in the construction of the infrastructure elements (turbine bases, roads, etc.) at the wind farm. A typical excavation profile for each borrow pit is shown in Appendix C. Where necessary, the project design engineer will determine the appropriate depth of excavation.

Slopes within the excavated rock formed around the perimeter of the borrow pits should be formed at stable inclinations to suit local in-situ rock conditions. An interceptor drain should also be installed upslope of the borrow pit, where necessary. This drain will divert any surface water away from the borrow pit and hence, prevent water from ponding and lodging on the re-instated borrow pit area.

Upon removal of the rock from the borrow pit, it is proposed to reinstate the borrow pit using surplus excavated peat and spoil. The contractor excavating the rock will be required to develop the borrow pits in a way which will allow the excavated peat and spoil to be placed safely. It is proposed to place peat to approximately 2m deep across the base of the borrow pit.

It may be necessary to construct cells/rock buttresses or leave upstands of intact bedrock within the borrow pits to help contain the reinstated peat and overburden. This will allow for the safe placement and grading of the materials using dumper trucks and excavators.

The typical layouts of both borrow pits are presented in Appendix C.

5 Handling and storing excavated peat

- Care shall be taken during peat excavation to ensure it is segregated from other soil types, therefore, particular care should be taken to review recorded peat depths.
- Peat shall be separated and stored by type, namely the acrotelmic and catotelmic layers.
    - Acrotelm (top about 0.3 to 0.4m of peat) is generally required for landscaping and shall be stripped and temporarily stockpiled for re-use as required. Acrotelm stripping shall be undertaken before the main excavations.
    - Where possible, the acrotelm shall be placed with the vegetation part of the sod facing the right way up to encourage the growth of plants and vegetation.
    - All catotelm peat (peat below about 0.3 to 0.4m depth) shall be moved immediately on excavation to the designated areas.
- Construction sequence planning shall minimise the time that peat is stockpiled before reuse.
- Peat stockpiles shall not be allowed to substantially erode or become dry.
- Material stockpiles shall be located at least 50m away from watercourses, including site ditches, to reduce the potential for sediment to be transferred into the wider hydrological system.
- Peat stockpile locations should be selected to limit re-handling as far as reasonably possible.
- Excavated peat shall be stored and reused within that immediate area to ensure peat is used to restore peatland habitat.
- The Contractor shall consult the Ecological Clerk of Works (ECoW) to agree on locations for material stockpiles and consider minimising impacting sensitive ecological receptors.
- The Contractor shall consult the site Geotechnical Engineer and review and take into account the Peat Stability Risk Assessment 19162-001 by GDG (2020), to avoid the risk of peat instability in peat excavations, peat stockpiling and all material stockpiling in areas underlain by peat.
- Run-off from stockpiles shall be directed through the site drainage system that shall include silt fences, settlement ponds and other drainage measures as described in Section 4.6 of the EIAR. This is detailed in the Contractor's Construction and Environmental Management Plan.

The following particular recommendations/best practice guidelines for the placement of peat & spoil alongside the founded roads should be considered and taken into account during construction.

- Peat and spoil shall be side-cast along founded roads only where it can be placed in a stable formation i.e. where the topography and ground conditions allow.
- Peat and spoil shall only be cast to safe heights and slope angles, considering the topography and the ground conditions. This height shall generally be up to 1m, and the slopes shall be not greater than 1 (v): 2 or 3 (h) unless a site-specific assessment during detailed design indicates a greater height and angle is safe.

The following particular recommendations/best practice guidelines for the placement of peat & in borrow pits should be considered and taken into account during construction.

- Where possible, the surface of the placed peat & spoil should be shaped to allow efficient run-off of surface water from borrow pit areas.
- Silting ponds may be required at the lower side/outfall location of the borrow pits.
- A layer of geogrid to strengthen the surface of the placed peat & spoil within the borrow pits may be required.
- Infilling of the peat &spoil should commence at the back edge of the borrow pit and progress towards the borrow pit entrance/rock buttress. The contractor excavating the rock will be required to develop the borrow pits in a way which will allow the excavated peat & spoil to be placed safely.
- The height of the rock buttresses constructed should be greater than the height of the placed peat & spoil to prevent any surface peat & spoil run-off. Buttresses up to 5m in height are likely to be required.

6 Preliminary earthwork volumes

It is expected that peat excavation will be required for the following elements of the proposed development:

1. Founded access roads;
2. Turbine foundations and crane hardstandings;
3. Substation compound;
4. Construction compound;
5. Meteorological mast foundation; and
6. Borrow pits.

A preliminary estimate of the approximate volumes of excavation and fill needed to construct the development was carried out. This was produced using typical limits to road and hardstand gradients and using road and hardstanding thickness typical to the windfarm ground conditions. Peat probe depths were reviewed to assess the depth of peat across the site. The average peat depth of 0.4m across the site was incorporated into the model along with the site layout and preliminary alignment to estimate the volume of peat expected to be excavated.

A breakdown of the estimated volumes are summarised in Table 6-1 to **Error! Reference source not found.**.

Table 6-1: Summary of preliminary excavation volumes

Infrastructure Item	Excavated volume (m^3)		
	Peat *	Non-peat *	
		Overburden **	Rock **
Access Roads (including cable trench)	13000	8500	33800

Infrastructure Item	Excavated volume (m^3)		
	Peat *	Non-peat *	
		Overburden **	Rock **
Turbine foundations and crane hardstandings	8000	5400	21300
Compound hardstanding	100	100	0
Substation hardstanding	800	0	0
Met mast hardstanding	200	50	150
Borrow Pit 1	2200	0	62000
Borrow Pit 2	1200	0	7600
Total	**25,500**	**14,050**	**124,850**

* The volume of peat versus non-peat material excavated has been estimated using the average peat depth calculated across the site to define the basal surface of the peat.

** The breakdown of the constituents of the non-peat materials excavated (i.e. the ratio of overburden to rock) is based on observations of rock and overburden exposures made during the site reconnaissance and desk study.

Peat generated during construction can be reused or reinstated across the development. Peat may be reused for landscaping on edges of constructed infrastructure (including road verges, turbine foundations) and shall be placed as soon as reasonably practical after construction. This shall act as part of the landscaping restoration and tie-in with surrounding topography, reducing visual impacts and restore the existing habitat. 4m of excavated peat and overburden is proposed to be placed in borrow pit 1 as part of reinstatement. Borrow pit 2 may be backfilled with peat or overburden up to 2m deep, or deeper where site-specific detailed designs are produced. Potential peat reuse/reinstatement volumes have been estimated and are also presented in **Error! Reference source not found.**.

Table 6-2: Summary of preliminary reinstatement volumes

Infrastructure Item	Reinstatement volume (m^3)		Comments
	Peat	Overburden	
Access Roads	11200		Placement of arisings (3m wide and 1m depth) alongside existing and new founded roads, where topography allows
Turbine foundations and crane hardstandings	900		This is a conservative estimate of the volume of peat and overburden that will be required for landscaping purposes at each of the turbine locations.
Compound hardstanding	0		Volumes for landscaping at these infrastructures have been conservatively omitted from preliminary calculations
Substation hardstanding	0		
Met mast hardstanding	0		
Borrow Pit 1	12300	12300	Assumes 2m of overburden and 2m of peat reinstated along the base of borrow pit
Borrow Pit 2	4000	2000	Assumes 2m of peat (or overburden, as required) reinstated along the base of borrow pit
Total	**28,400**	**14,300**	

Table 6-3: Summary of preliminary fill volumes

Infrastructure Item	Total fill required (m^3)	Capping material required (m^3)	General fill required (m^3)
Access Roads	91,200	11,200	80,000
Turbine foundations and crane hardstandings	7800	6200	1600
Compound hardstanding	1000	1000	0
Substation hardstanding	5900	1100	4800
Met mast hardstanding	400	200	200
Total	**106,300**	**19,700**	**86,600**

The summary of preliminary earthwork volumes indicates that the peat storage capacity of the development, namely that provided once Borrow Pit 1 and 2 are reinstated, is greater than the volume of peat excavated for the various infrastructures. Temporary storage of peat will likely be required during construction. It is recommended that suitably level areas, which do not have peat at surface, can be used for the temporary storage of peat.

7 General recommendations for good construction practice

To minimise the risk of construction activity causing potential peat instability, it is recommended that the construction method statements for the project should also take into account, but not be limited, to the guidance listed in Section 1, the general recommendations below together with the specific recommendations above. Some of these general recommendations are already included in more detail within the specific recommendations but are reiterated again.

- Avoidance of uncontrolled concentrated water discharge onto peat slopes identified as being unsuitable for such discharge.
- All excavation shall be suitably supported to prevent collapse and development of tension cracks.
- Installation and regular monitoring of geotechnical instrumentation, as appropriate, during construction in areas of possible poor ground, such as deeper peat deposits
- Site reporting procedures to ensure that working practices are suitable for the encountered ground conditions.
- Regular briefing of all site staff (e.g. toolbox talks) to provide feedback on construction and ground performance and to promote reporting of any observed change in ground conditions.
- Routine inspection of wind farm site by the contractor to include an assessment of ground stability conditions (e.g. cracking, excessive floating road settlement, disrupted surface, closed-up drains) and drainage conditions (e.g. blocked drains, absence of water in previously flowing drains, springs, etc.).

Appendix A – Site maps

A.1 – Site layout and peat depth plan

A.2 – Factor of safety maps (from the peat stability risk assessment (GDG, 2020)) and derived peat stockpile restriction areas

A.3 – Safety buffer map

9°20'W
9°19'W
9°18'W
51°49'N
51°48'N
564,000
563,000
562,000
508,000
509,000
510,000
T1
T3
T4
T5
T7
Buoyant and deep peat with overgrown drainage
CURRAGLASS
Owvane [Coar]
CULLENAGH 2
N
W
E
S
0
0.25
0.5
1
1.5
km

200 km
Dublin
53°N
7°W
Curraglass WF

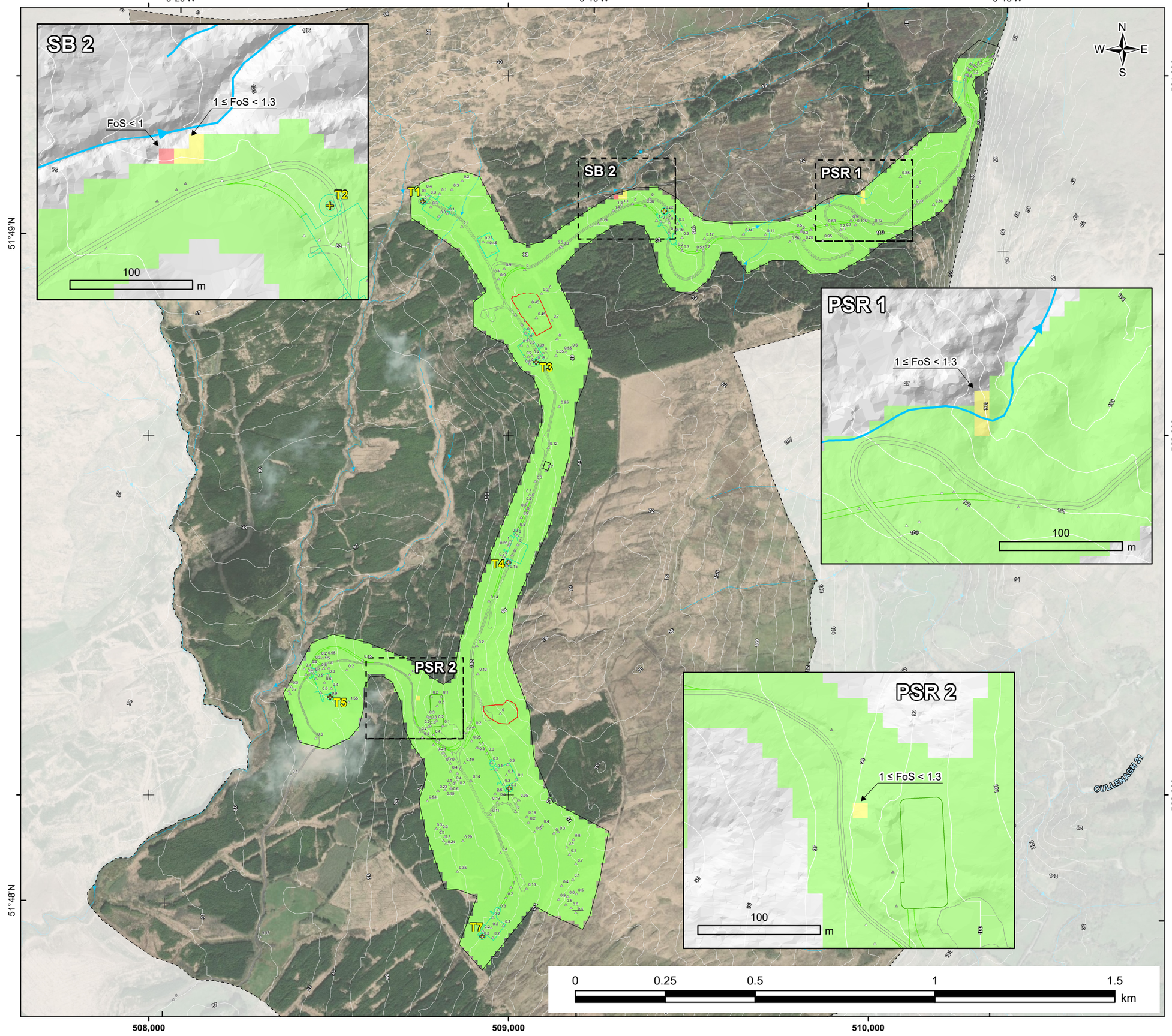
Legend

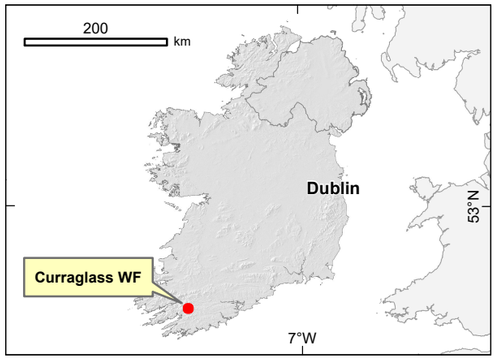
- Executed peat probes (239)
- Proposed turbine locations
- Proposed substation
- Proposed hardstandings
- Proposed new roads
- Proposed temporary compound
- Proposed borrow pits
- Proposed met mast location
- Overhead line (OHL)
- Current substation
- Minor roads
- Secondary roads
- Rivers
- Water bodies

Peat depth (m)

- 0 - 0.5
- 0.6 - 1
- 1.1 - 2
- 2.1 - 3.5
- 3.6 - 5.5

Client: MKO	GDG GAVIN & DOHERTY GEOSOLUTIONS	
Project: Curraglass Renewable Energy Development		
Map title: GI Exe 0 Client & Exe 1 GDG & Exe 2 GDG & Exe 3 Client & Interpolation		
File: 19162 CWF - GI Exe0Client & Exe1GDG & Exe2GDG & Exe3Client & PPInterpolation.pdf		
Sheet size: A3	CRS: 2157	Authored: EA
Date: 2020/06/01	Source: GDG Client	Checked: LB





Legend

- Executed peat probes (239)
- Curraglass WF limit
- Proposed turbine locations
- Proposed substation
- Proposed hardstandings
- Proposed new roads
- Proposed temporary compound
- Proposed borrow pits
- Proposed met mast location
- Minor roads
- Rivers
- Water bodies
- FoS < 1
- 1 ≤ FoS <1.3
- FoS ≥1.3

$$F = \frac{c' + (\gamma z - \gamma_w h_w)\cos^2\alpha \tan\phi'}{\gamma z \sin\alpha \cos\alpha}$$ Bromhead (1986)

F = Factor of Safety
c' = Effective cohesion (4 kPa)
Y = Bulk unit weight of peat (10 kN/m^3)
z = Depth to potential failure surface (peat depth: Map 29 + 1 m surcharge)
Y_w = Unit weight of water (9.8 kN/m^3)
h_w = Height of water table above failure surface (= z)
α = Slope angle (Map no. 11b)
φ' = Effective friction angle (25º)

Client: MKO / GDG Gavin & Doherty Geosolutions		
Project: Curraglass Renewable Energy Development		
Map title: Peat FoS (Drained 4 kPa, 10 kN/m^3, 25º, Surcharge)		
File: 19162 CWF - Peat FoS Drained 4 kPa 10 kNm3 25º Surcharge.pdf		
Sheet size: A3	CRS: 2157	Authored: EA
Date: 2020/04/20	Source: Bromhead (1986) GDG	Checked: LB

Ground-based photos
Safety buffers
Contours 1 m
Executed peat probes (239)

Peat depth (m)
0 - 0.5
0.6 - 1
1.1 - 2
2.1 - 3.5
3.6 - 5.5

IMG_0589.JPG
IMG_0586.JPG
IMG_0587.JPG
IMG_0582.JPG
IMG_0584.JPG
IMG_0583.JPG
IMG_0585.JPG
IMG_0566.JPG
IMG_0567.JPG
5.5
3.8
0

Safety Buffer 1

Buoyant and deep peat with overgrown drainage

IMG_0583.JPG

0 10 20 40 60 m

509,050 509,100 509,150 509,200 509,250
563,550
563,500

200 km
Dublin
Curraglass WF
53°N
7°W

Safety buffers
T1 T2 T3 T4 T5 T6 T7
0.5 km

Ground-based photos
Safety buffers
Fluvial escarp
Executed peat probes (239)
Proposed turbine locations
Rivers
Contours 1 m
FoS (Drained 4 kPa 10 kN/m³ 25°)
1.01 - 1.29
1.3 - 1,801.66

Safety Buffer 2

IMG_0591.JPG
1.9
1.3
1.1
0
0.38

0 5 10 20 30 m

509,250 509,300 509,350
563,650

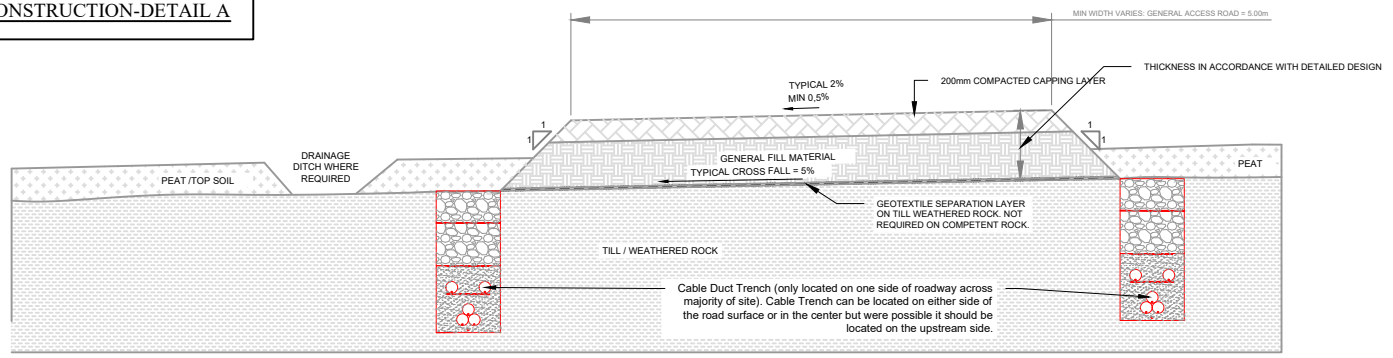
General legend
Safety buffers
Proposed turbine locations
Proposed substation
Proposed new roads
Proposed borrow pits
Minor roads

Client: MKO / GDG Gavin & Doherty Geosolutions		
Project: Curraglass Renewable Energy Development		
Map title: Safety buffers no. 01 & 02		
File: 19162 CWF - Safety buffers 01 & 02.tif		
Sheet size: A3	CRS: 2157	Authored: EA
Date: 2020/04/20	Source: GDG	Checked: LB

Appendix B – Typical road construction details

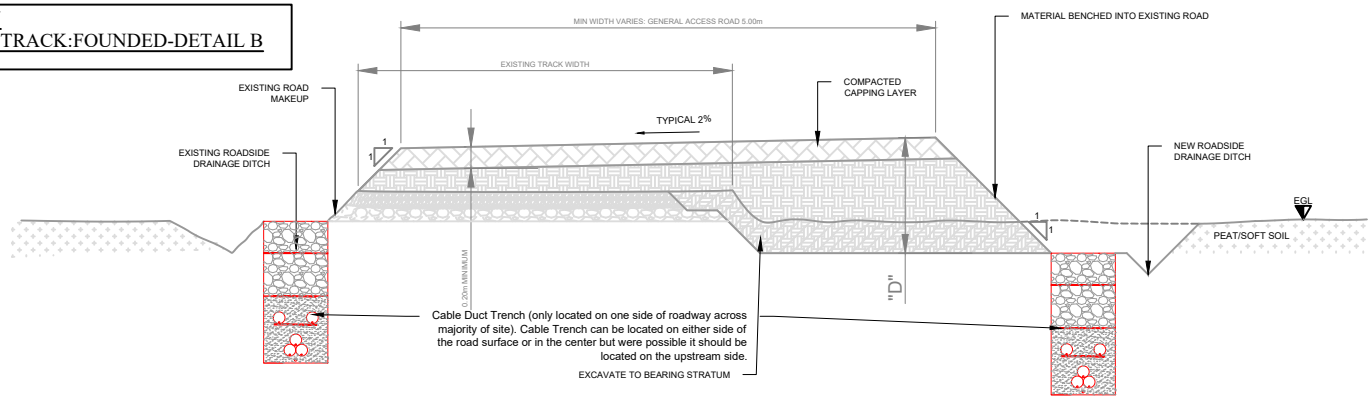
TYPICAL SECTON THROUGH ACCESS ROADS NEW CONSTRUCTION-DETAIL A

SCALE 1:50



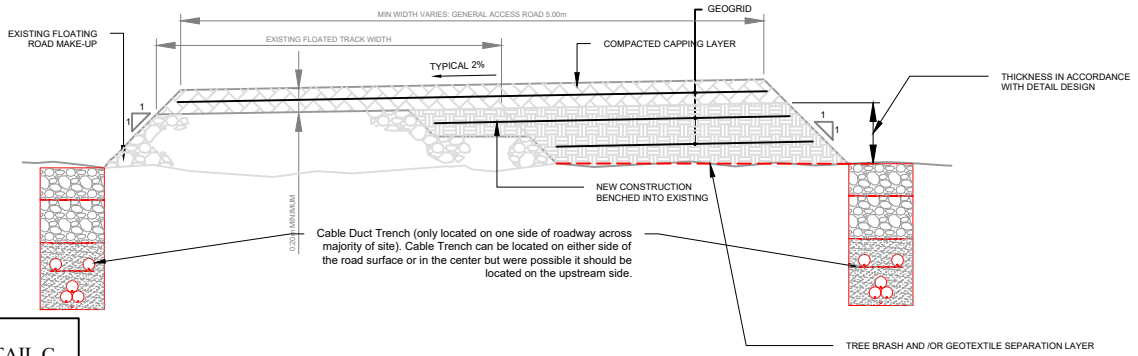
TYPICAL CROSS SECTON WIDENING OF EXISTING TRACK:FOUNDED-DETAIL B

SCALE 1:50



TYPICAL CROSS SECTON WIDENING OF EXISTING TRACK:FLOATED-DETAIL C

SCALE 1:50



NOTES:

1. ALL DIMENSIONS ARE IN METRES UNLESS OTHERWISE STATED
2. USE DIMENSIONS ON DRAWINGS (DO NOT SCALE FROM DRAWINGS).
3. THE STRENGTH OF THE SUBFORMATION SOILS MUST BE ASSESSED BY A SUITABLY QUALIFIED GEOTECHNICAL ENGINEER PRIOR TO PLACEMENT OF FILL.
4. DRAINAGE TO BE PROVIDED TO PREVENT WATER DEGRADATION OF THE SUBFORMATION SOILS.

HEALTH & SAFETY:

1. NO OPERATIVES TO ACCESS ANY UNSUPPORTED TRENCHES. TRENCHES TO BE ADEQUATELY BATTERED BACK OR SUPPORTED WHERE NECESSARY. SAFE TEMPORARY BATTER ANGLES TO BE ASSESSED IN ACCORDANCE WITH CIRIA REPORT 97 "TRENCHING PRACTICE".

REV:	FI -01	DATE: 29/05/20	DRAWN BY: CJM	CHECKED BY: LB
DESCRIPTION:	ISSUED FOR INFORMATION			
REV:	FI -00	DATE: 15.04.20	DRAWN BY: CJM	CHECKED BY: LB
DESCRIPTION:	ISSUED FOR INFORMATION			

GDG
GAVIN & DOHERTY GEOSOLUTIONS

Unit A2,
Nutgrove Office Park,
Rathfarnham,
Dublin 14, D14 X627
Ireland.
T +353 (0)1-2071000
E info@gdgeo.com
www.gdgeo.com

ISSUED AS: FOR INFORMATION

CLIENT:

PROJECT TITLE: CURRAGLASS RENEWABLE ENERGY DEVELOPMENT

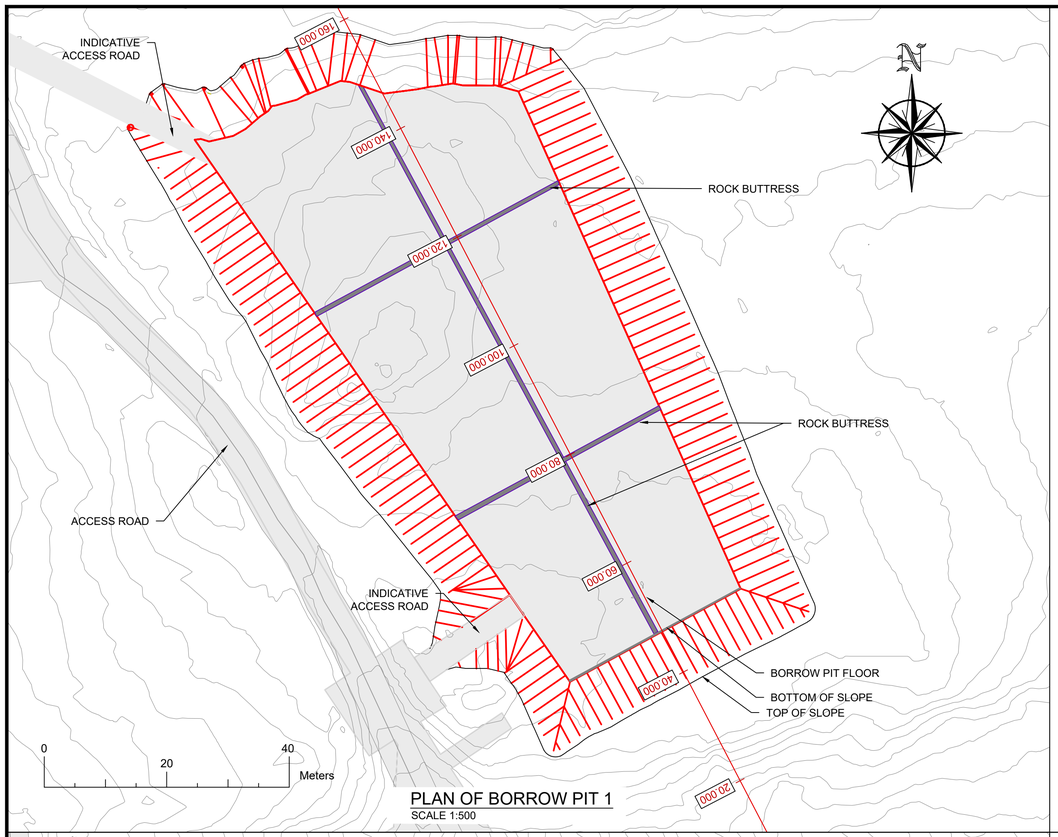
DRAWING No: 19162-GDG-XX-XX-DR-G-0002

DWG No.190301 - 21 Revision: -FI -01

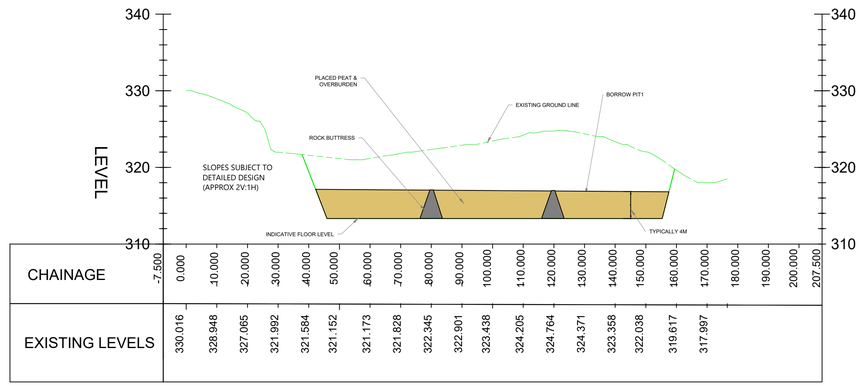
DRAWING TITLE: TYPICAL SECTION THROUGH GENERAL ACCESS TRACK DETAILS

SCALE:	SHOWN	SHEET SIZE:	A3	DATE:	24/06/2020
DRAWN BY:	CJM	CHECKED BY:	L.B	APPROVED BY:	P.Q.

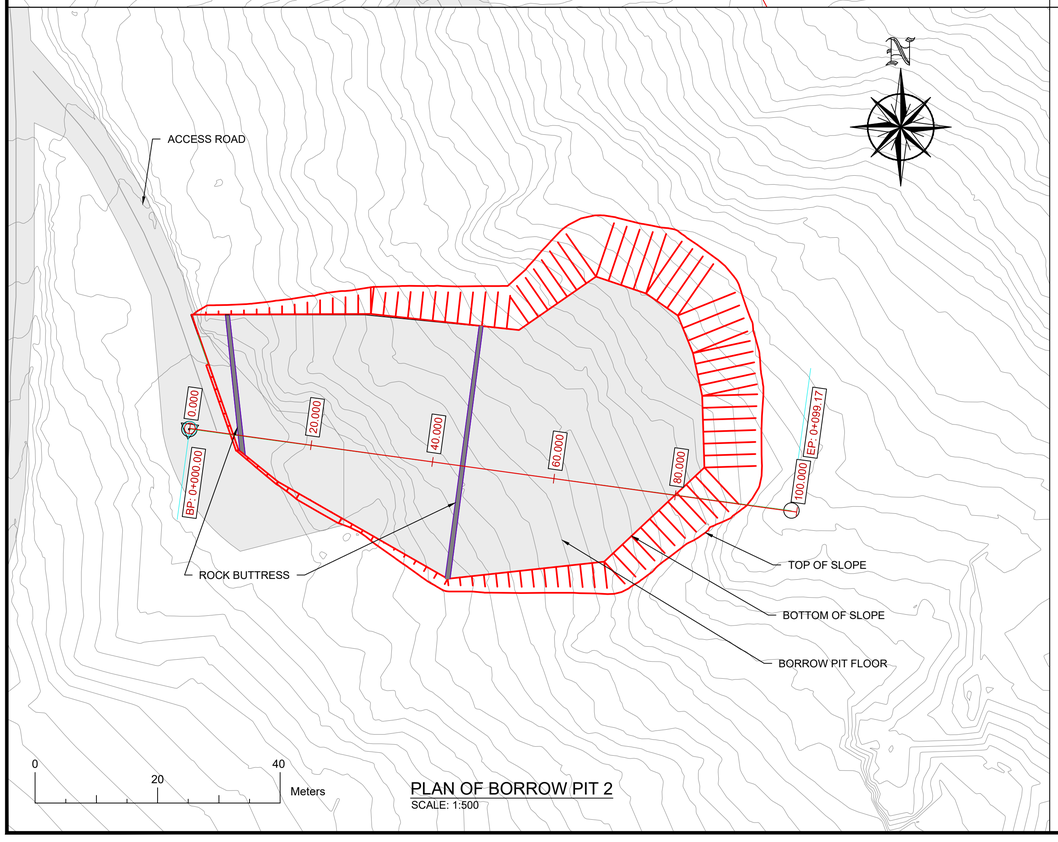
Appendix C – Typical borrow pit details



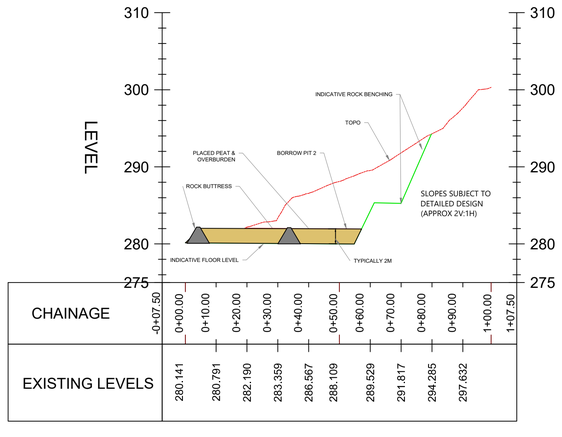
PLAN OF BORROW PIT 1
SCALE 1:500



INDICATIVE LONG SECTION OF BORROW PIT 1
SCALE Horizontal: 1:250, Vertical: 1:50



PLAN OF BORROW PIT 2
SCALE: 1:500



INDICATIVE LONG SECTION OF BORROW PIT 2
SCALE Horizontal: 1:250, Vertical: 1:50

NOTES:

1. THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT ENGINEER'S DRAWINGS AND SPECIFICATIONS.
2. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
3. THE OUTLINE AND CROSS SECTIONS ARE INDICATIVE AND ARE SUBJECT TO DETAILED DESIGN AND SLOPE STABILITY ASSESSMENT.
4. EXPOSED ROCK SLOPES SHALL BE FORMED AT SHALLOWER INCLINATIONS (TYPICALLY 60°) WITH FACE LEFT IRREGULAR WITH DECLIVITIES TO PROMOTE RE-VEGETATION AND PROVIDE A NATURALISTIC APPEARANCE (SLOPE FACE EXAGGERATED IN SECTION).
5. ENGINEERED ROCK BUTTRESS MAY BE LEFT IN-SITU TO RESTRAIN CELLS OF PLACED PEAT OVERBURDEN.
6. EXCAVATION SHOULD BE OPTIMISED TO AVOID AREAS OF DEEPER PEAT.
7. IN-SITU ROCK SLOPE SHALL BE FORMED AT STABLE INCLINATIONS TO SUIT LOCAL ROCK CONDITIONS AND SUBJECT TO DETAILED DESIGN.
8. GEOGRID TO BE PLACED TO STRENGTHEN SURFACE OF PLACED PEAT & SPOIL, AS REQUIRED.
9. THE LOCATION OF THE ROCK BUTTRESSES SHOWN FOR THE BORROW AREAS ARE INDICATIVE ONLY AND MAY CHANGE SUBJECT TO LOCAL CONDITIONS ENCOUNTERED ON SITE DURING CONSTRUCTION.
10. THE EXCAVATABILITY OF THE ROCK AND DEPTH TO TOP OF ROCK WITHIN EACH OF THE BORROW AREAS WILL NEED TO BE DETERMINED FROM A GROUND INVESTIGATION.

LEGEND:

REV:	FI -01	DATE:	29/05/20	DRAWN BY:	CJM	CHECKED BY:	LB
DESCRIPTION:	ISSUED FOR INFORMATION						
REV:	FI -00	DATE:	22.04.20	DRAWN BY:	CJM	CHECKED BY:	LB
DESCRIPTION:	ISSUED FOR INFORMATION						

GDG
GAVIN & DOHERTY GEOSOLUTIONS
Unit A2,
Nutgrove Office Park,
Rathfarnham,
Dublin 14, D14 X627
Ireland.
T +353 (0)1-2071000
E info@gdgeo.com
www.gdgeo.com

ISSUED AS: FOR INFORMATION

CLIENT: MKO

PROJECT TITLE: CURRAGLASS RENEWABLE ENERGY DEVELOPMENT

DRAWING No: 19162-GDG-XX-XX-DR-C-0001

Revision: -FI -01

DRAWING TITLE: BORROW PITS PLAN AND CROSS SECTION

SCALE:	1:250	SHEET SIZE:	A1	DATE:	22/04/2021
DRAWN BY:	CJM	CHECKED BY:	L.B	APPROVED BY:	L.B.

Offices

Dublin (Head Office)
Gavin & Doherty Geosolutions
Unit A2, Nutgrove Office Park
Rathfarnham
Dublin 14, D14 X627
Phone: +353 1 207 1000

London
Geosolutions Engineering UK Ltd
35 Great St. Helens
London
England, EC3A 6AP
Phone: +44 203 287 9815

Edinburgh
Geosolutions Engineering UK Ltd
21 Young Street
Edinburgh
Scotland, EH2 4HU
Phone: +44 1 313 444 605

Belfast
Geosolutions Engineering UK Ltd
Scottish Provident Building
7 Donegall Square West
Belfast, BT1 6JH
Phone: +44 (0) 289 091 8845

Website: www.gdgeo.com
Email: info@gdgeo.com