Orsted Onshore Ireland Midco Limited

6: MEMORANDUM RESPONSE TO SUBMISSIONS RECEIVED

Land, Soils and Geology

Proposed Oatfield Wind Farm Project, Co. Clare: ABP Case No. ABP-318782-24

June 2024

CONTENTS

TABLES

FIGURES

1 LAND, SOILS AND GEOLOGY

1.1 Introduction

The following memorandum has been prepared to address submissions received during the observations and submissions period associated with the Oatfield Wind Farm Planning Application. The planning application for the aforementioned Proposed Development was submitted to An Bord Pleanála on 22nd December 2023 (ABP Case Number: ABP-318782-24). The period for submissions and observations was 22nd December 2023 to 19th February 2024.

This is memorandum number 6 in the Oatfield Wind Farm submission response documentation, which addresses common themes identified within the discipline of Land, Soils and Geology (corresponding to **Chapter 10 of the EIAR**, submitted as part of the planning application made to An Bord Pleanála).

Reference is made to submission response on Hydrology and Hydrogeology (memorandum no. 5 of the submission response documentation, hereafter referred to as **memorandum no. 5**).

Responses to submissions received from regulatory & prescribed bodies are presented in Section 2 and responses to common themes in submissions received from the general public are presented in Section 3.

1.2 Statement of authority

RSK (Ireland) Ltd. (RSK), part of RSK Group, is a consultancy providing environmental services in the hydrological, hydrogeological, geological 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;

- Project Manager & Lead Author: Sven Klinkenbergh – B.Sc. (Environmental Science), P.G.Dip. (Environmental Protection). Current Role: Principal Environmental Consultant. Experience c. 10 years
- Project Scientist: Deirdre Walsh – B.Sc. (Geology), M.Sc. (Geoscience), PhD (Geomodelling). Current Role: Environmental Consultant

2 REGULATORY & PRESCRIBED BODIES

2.1 Clare County Council

The following response is based on the below extract from the Clare County Council Submission. It should be noted that the Council's response in this section also relates to the Hydrology and Hydrogeology discipline. Refer to **memorandum no. 5** for further information.

> *''The site is located in an upland setting consisting predominately of coniferous plantation forestry, with blanket bog, wet heath, rough/wet grassland and agricultural land being the remainder of the habitat types. Peat depths range generally from 0.5 to 1.5m and down to 4m at Turbine no. 11. Peat has a very low compressive strength and low density. Generally it has a higher water content and once disturbed a very low shear strength which can enable long run-out landslides to form. In particular, special care is necessary to prevent instability in areas of blanket peat coverage/cut over bog and pockets of deep poorly drained mineral soil.*
>
> *It is also noted (as outlined in Section 9.4.3.2 of the EIAR) that the likely tree felled area will be approximately 67ha. This is represents 32% of the application area (outlined in blue) and is considered significant in the context of the nature of the landscape and implications for soil/peat slippage. Furthermore there is also an extensive drainage network on the subject site, with 39 crossings required on the site itself, and 11 crossings/HOD drillings required for the grid connections and cable routes.*
>
> *The Planning Authority has serious concerns in respect of the impact of this development on surface waters and the potential contamination of water bodies both within and downstream of the site by reason of the following:*

- *The upland nature of the site and the soil type which includes peat;*
- *The high density of drainage channels throughout the site and the upgrade works required for same which will require careful oversight and detailed mitigation measures;*
- *The extensive area of trees to the felled (67ha) along with other site clearance works;*
- *The timing of construction works outside of the breeding season for birds coinciding with wetter periods (8.5.3 of EIAR);*
- *The volumes of spoil material requiring excavation, handling, storage and management on the site;*
- *The nature and extent of the construction works, hardstanding areas, cable connection works, road upgrades and potential alterations to the hydrological regime of the site;*
- *The hydrological connectivity of the watercourses to the Lower River Shannon SAC.*

Overall, having reviewed the EIAR as submitted, it is considered that the proposed development would present a significant risk of adverse environmental impact on the sensitive natural habitats of the site and of the wider area, constituting an unacceptable risk of pollution of watercourses in the area and seriously injuring the amenities of the area''.

In summary, this response document addresses the following concerns raised by Clare County Council regarding soils and geology:

- *''The upland nature of the site and the soil type which includes peat''.*
- *''The volumes of spoil material requiring excavation, handling, storage and management on the site''.*
- *''The nature and extent of the construction works, hardstanding areas, cable connection works, road upgrades and potential alterations to the hydrological regime of the site''.*

The remaining concerns are addressed in **memorandum no. 5**. The residual risks for both disciplines do not exceed moderate. The residual risks associated with each of the concerns raised are summarised below.

2.1.1 The upland nature of the site and peat

The area of the Proposed Development is characterised by relatively complex (hilly) topography with associated elevations ranging between c. 130 to 270 mAOD. The slope is variable for construction areas but ranges from approximately 0.5-14 degrees.

There are no recorded or observed landslides in the area. The Proposed Development is considered to be of 'Low Risk' to 'Moderate Risk' in terms of landslide susceptibility (Section 10.3.6 of **EIAR Chapter 10 Land Soils and Geology**, hereafter referred to as **EIAR Chapter 10**). T6 and T10 are in areas which have been identified as 'moderately high' risk of landslide susceptibility.

Peat depth across the site is generally very shallow to shallow with the exception of isolated pockets of deeper peat in the Western PDA (**EIAR Chapter 10**, Section 10.3.7 and **EIAR Volume III, Appendix 10.1**). There was no very deep peat observed at the site. The management of saturated peat will be required at relatively few locations.

Factor of safety is generally acceptable and very low to low stability risk across the site with the exception of some minor isolated areas where there are areas of steeper slopes or pockets of deeper peat. The full risk assessment is provided in **EIAR Volume III Appendix 10.1.**

The risk of a stability issue or landslide at the Proposed Development is low.

2.1.1.1 Mitigation measures related to peat and stability

As outlined in **EIAR Chapter 10** and **EIAR Volume III Appendix 10.1** Peat Stability Risk assessment (PSRA) the risk of a landslide is low on site. There are no recorded or observed landslides in the area.

List of mitigation measures to prevent stability issues (from **EIAR Chapter 10**, Section 10.5.2.8). Also, additional mitigation measures related to the excavation of peat and the storage of peat are in **EIAR Chapter 10**, Section 10.5.2.5 and 10.5.2.6 respectively:

Peat and slope stability investigations at the Proposed Development indicate that the area has a generally low risk probability with respect to peat slippage and slope failure under the footprint of the Proposed Development. A number of mitigation measures will also be applied as recommended in the PSRA (included as **EIAR Volume III, Appendix 10.1**).

2.1.2 Excavation, handling, storage and management on site

As outlined in **EIAR Chapter 10**, Section 10.4.3.5, it is expected that the total volume of spoil for the Proposed Development is approximately 190,843 m^3.

Material to be temporarily stored for a relatively long period during the construction phase will be stored in a designated area Storage Area A (close to T5) and Storage Area B (on the access track to T8) in both the western and eastern development areas (WDA and EDA respectively 6,000 m^2) and will be limited to 2m height. Short term temporary stockpiles elsewhere on the site will be limited to 1m and will be confined to the footprint of the Proposed Development (**EIAR Chapter 10**, Section 10.4.3.6).

The mitigation measures for excavation activities are included in (**EIAR Chapter 10**, Section 10.5.2.5).

The management, movement, and temporary stockpiling of material, including a materials balance assessment and plan is detailed in the CEMP, this will include identification of suitable temporary set down areas which will be located within the Development footprint and will consider and avoid geo-constraints identified in this report (**EIAR Volume III, Appendix 10.1**). Temporary set down / stockpile areas will be considered similarly to active excavation areas in terms of applying precautionary measures and good practices, and mitigation measures, including those relating to control of runoff and entrapment of suspended solids.

The mitigation measures for the storage of material on site are outlined in **EIAR Chapter 10,** Section 10.5.2.6.

Management of excavations arising will be carried out in a phased approach (**EIAR Volume III, Appendix 9.5 Tile 30 – Tile 34**);

1. Excavate to competent ground in areas to facilitate access to temporary storage locations. Excavation arisings will be managed within the infrastructure layout and temporary storage locations.
2. Construct initial sections of access track including deposit of engineering fill / crushed rock arising at turbine locations.
3. Excavate and prepare first turbine hardstand area to competent ground. Material arising will be managed within the infrastructure outline, reused directly where possible, and thereafter within temporary storage areas as necessary.
4. Excavate and prepare next turbine hardstand area to competent ground. Material arising will be managed within the infrastructure outline, reused directly where possible including previously excavated hardstand areas, and thereafter within temporary storage areas as necessary.
5. Complete hardstand areas, backfill / landscaping etc using materials in temporary storage.

Temporary stockpile locations are identified and will be used to avoid the temporary placement of any excavation arisings outside of the footprint of the Proposed Development which are appropriate for short term storage and to facilitate the orderly segregation of material types. Stockpiles will be isolated from the receiving surface water network (**EIAR Chapter 9 Hydrology and Hydrogeology,** hereafter referred to as **EIAR Chapter 9**) by the use of silt screens etc., are limited in height, and are covered in plastic sheeting during extended temporary periods and ahead of storm alerts.

Two storage areas one in each of the DAs (Storage Area A and B) will be managed in a similar manner to that described above and will be allowed stabilise for a period during the construction phase, following which the material will be vegetated and managed in line with other improvement works on site. Promoting the vegetating of the material will aid in binding the material and minimising erosion.

Whenever possible, soil will be re-used on the Wind Farm immediately, thereby reducing the need for double handling, reducing the requirements of stockpiles. Topsoil and peat will be transported to the designated spoil storage areas. Peat will only be stockpiled temporarily in areas of thin or absent peat and only in areas which have been assessed for stability by a suitably experienced geotechnical engineer. Peat should be stockpiled no higher than 2m and follow the recommendations set out in the (NRA, 2014[1]).

Mitigation measures for stockpiles related to the Grid Connection Route, IPP connection route and Turbine delivery route include restricting stockpiles to less than 1.5m in height and will be subject to approval by the Site Manager and Project Ecological Clerk of Works (ECoW). Additionally, any excavated material will be later used to backfill the trench where appropriate, any surplus material will be transported to a licensed facility.

2.1.3 Nature and extent of the construction works

The land take associated with the Proposed Development (both temporary and permanent) is 16.74 ha (**EIAR Chapter 10**, Table 10.13). Through design phase of the Proposed Development, mitigation by design / avoidance reduced the land take in as far as practical, without compromising or reducing the development itself.

Land take will be required during the construction and operation of the wind farm. This will be required for construction of site access tracks, turbine generators with hardstands and blade lay down areas, substation, meteorological mast, temporary spoil repository areas, a temporary contractors lay down area and for temporary land take to facilitate the laying of grid connection cable ducting both on and off the site.

Also, land take is required for the Turbine Delivery Route (TDR), although the majority of the route will traverse already existing roadways (i.e., existing access tracks, public and local road networks) Therefore the land take along the turbine delivery route will be minimal.

One land take requirement along this route has been identified at the turn from R463 to the R471. This will involve the temporary loss of agricultural lands and some hedgerow.

Minimal land take is required for the Grid Connection route considering the cable ducting will be buried in existing public roadways and verges and will be reinstated following

[1] National Roads Authority (NRA) (2014) Guidelines for the Management of Waste from National Road Construction Projects

laying of ducts. Temporary land take will be required to facilitate the HDD at the two locations along the GCR (Table 5.8 of **EIAR Chapter 5 Project Description**, hereafter referred to as **EIAR Chapter 5**) one of which will result in excavation in adjacent farmland and temporary loss of hedgerow which will be reinstated post construction.

The IPP cable route connecting the EDA to the WDA is 10.5km. Minimal land take is required for the IPP 33kV cable interconnector considering the line will principally be buried in or directly adjacent to existing roadways.

3 GENERAL PUBLIC

3.1 Theme 1: Stability, landslide, mudslide

There were a number of submissions which raised concerns for landslide risk, These responses included concerns relating to:

- *General landslide / mudslide risk*
- *Peat slippage*
- *Similar consequences to those seen at Derrybrien and Meenbog.*

3.1.1 Baseline, stability

Summary of baseline slope, landslide risk, peat depth and peat factor of safety results as outlined in **EIAR Chapter 10** and **EIAR Volume III Appendix 10.1** Peat Stability Risk assessment.

The risk of significant peat landslide events occurring at the Site is low given the nature, namely the relatively thin peat (very shallow to shallow <2m) and where there are areas of thicker peat (<3.8m) coincides with relatively flat topography at the Site.

A number of mitigation measures which will be implemented are outlined below.

Additional figures (Figures 3.1 – 3.8) have been included as part of this response to more clearly show the baseline stability described below.

3.1.1.1 Topography (EIAR Chapter 10, Section 10.3.2)

The area of the Proposed Development is characterised by relatively complex (hilly) topography with associated elevations ranging between c. 130 to 270 metres Above Ordnance Datum (mAOD). The slope is variable for construction areas but ranges from approximately 0.5-14 degrees. The topography for the wind farm is shown below in Figure 3.1.

3.1.1.2 Landslide susceptibility (EIAR Chapter 10, Section 10.3.6)

There are no recorded or observed landslides in the area. The Proposed Development is considered to be of 'Low Risk' to 'Moderate Risk' in terms of landslide susceptibility as mapped by GSI (Figure 3.2). T6 and T10 are in areas which have been identified as 'moderately high' risk of landslide susceptibility. The closest mapped Landslide Event (GSI, Landslide Events) recorded is c. 12km to the northeast which was described as a peat flow.

3.1.1.3 Peat depth (Appendix 10.1, Section 4.1)

Peat depth across the site is generally very shallow to shallow (<2m) with the exception of isolated pockets of deeper peat (up to 3.8m) in the Western Development Area (DA) (Figure 3.3 and Figure 3.4). There was no very deep peat (>5m) observed at the site.

3.1.1.4 Peat stability results (Appendix 10.1, Section 4.2)

Factor of safety (FoS) is generally acceptable (Figure 3.5 and Figure 3.6) and indicates a very low to low (Figure 3.7 and Figure 3.8) stability risk across the site, with the exception of some minor isolated areas where there are areas of steeper slopes or pockets of deeper peat.

The two unstable points along the track to T10 and north of T11 are isolated with surrounding 'Acceptable' locations.

The factor of safety for all infrastructure (turbines, substation, access tracks) was found to be acceptable (**EIAR Volume III**, **Appendix 10.1**). Table 10.11 of **EIAR Chapter 10** summarises the peat depth, slope and factor of safety for the main infrastructure units.

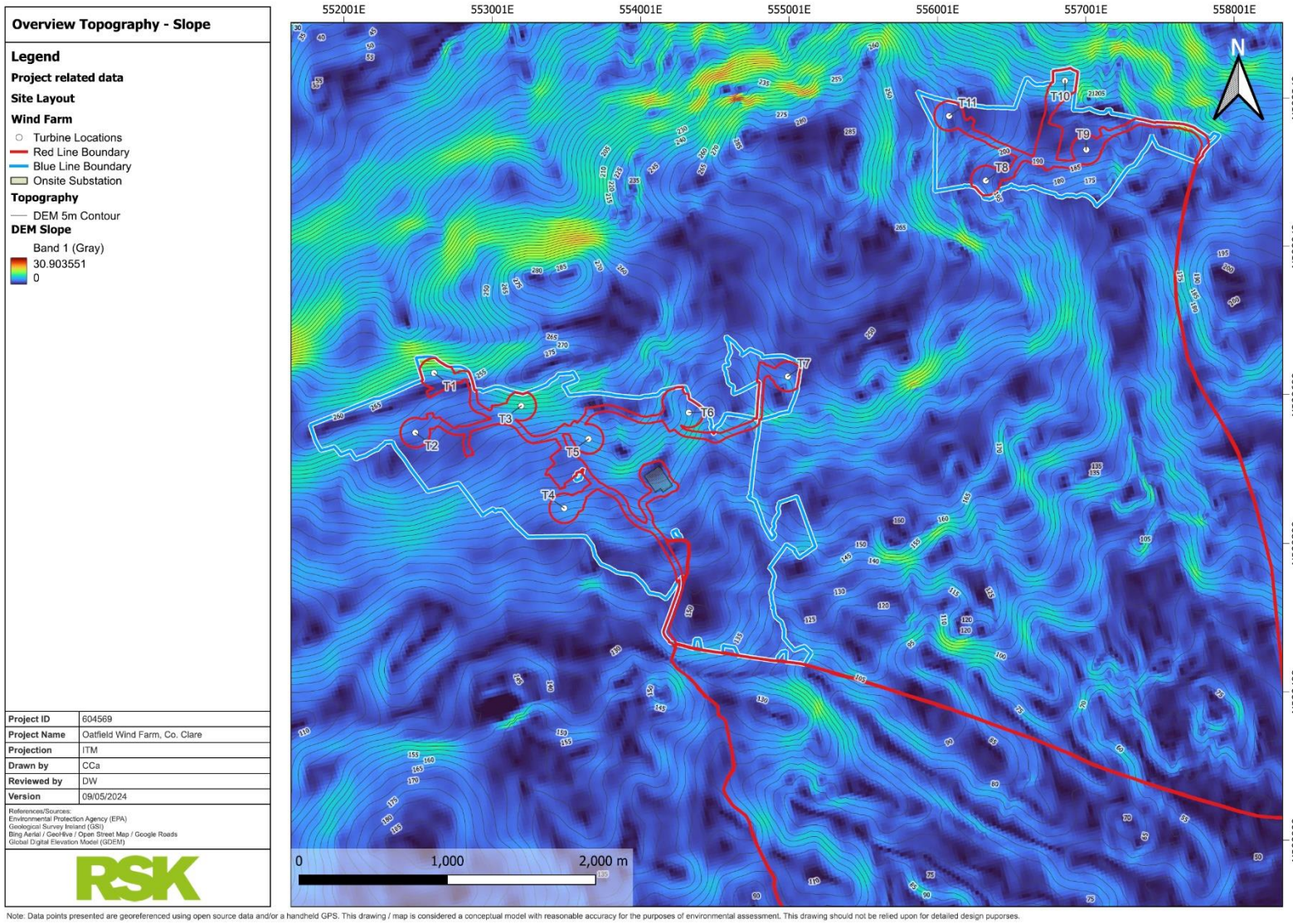

Figure 3.1: Site topography and slope map

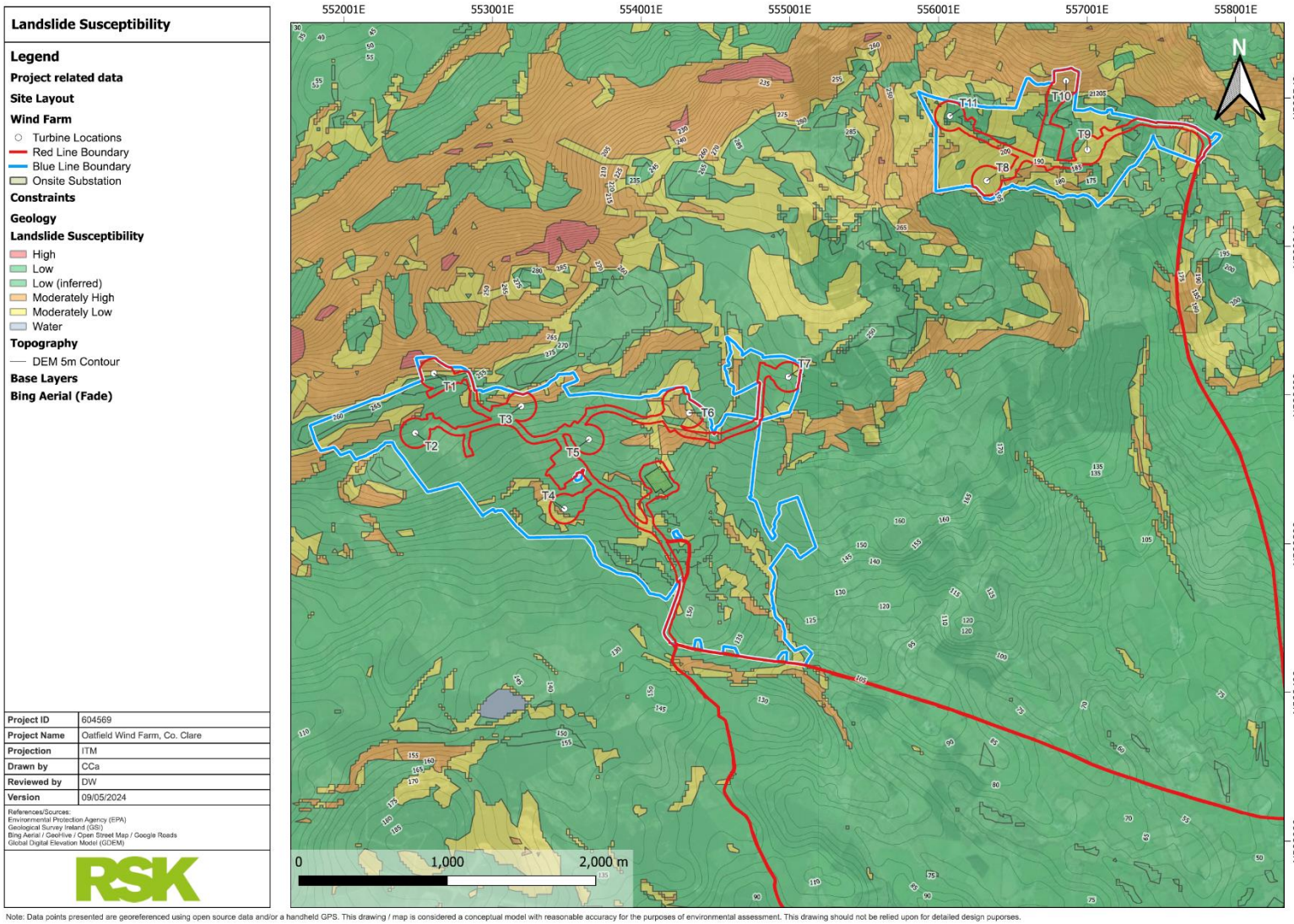

Figure 3.2: Landslide susceptibility map

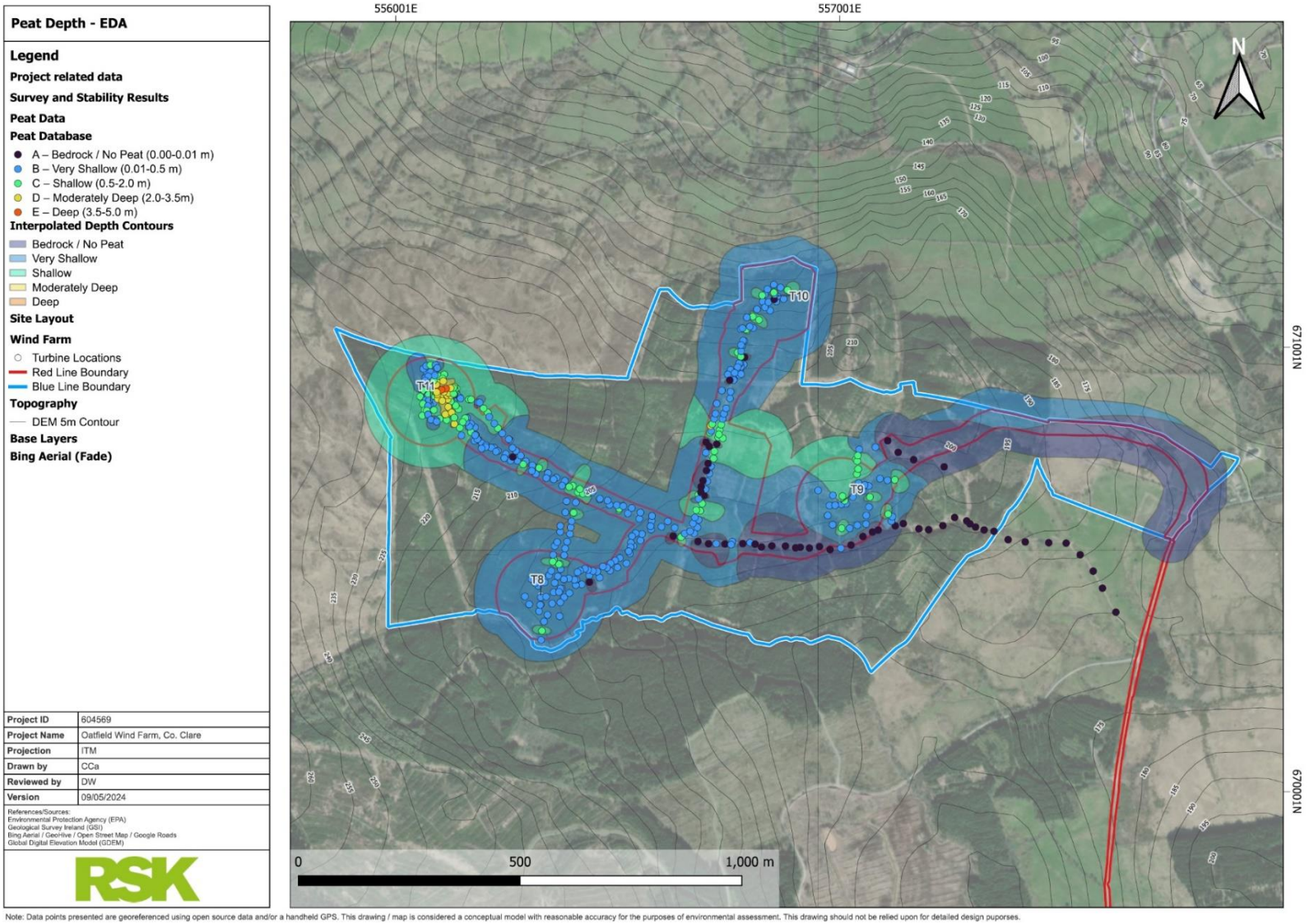

Figure 3.3: Peat depth map of EDA

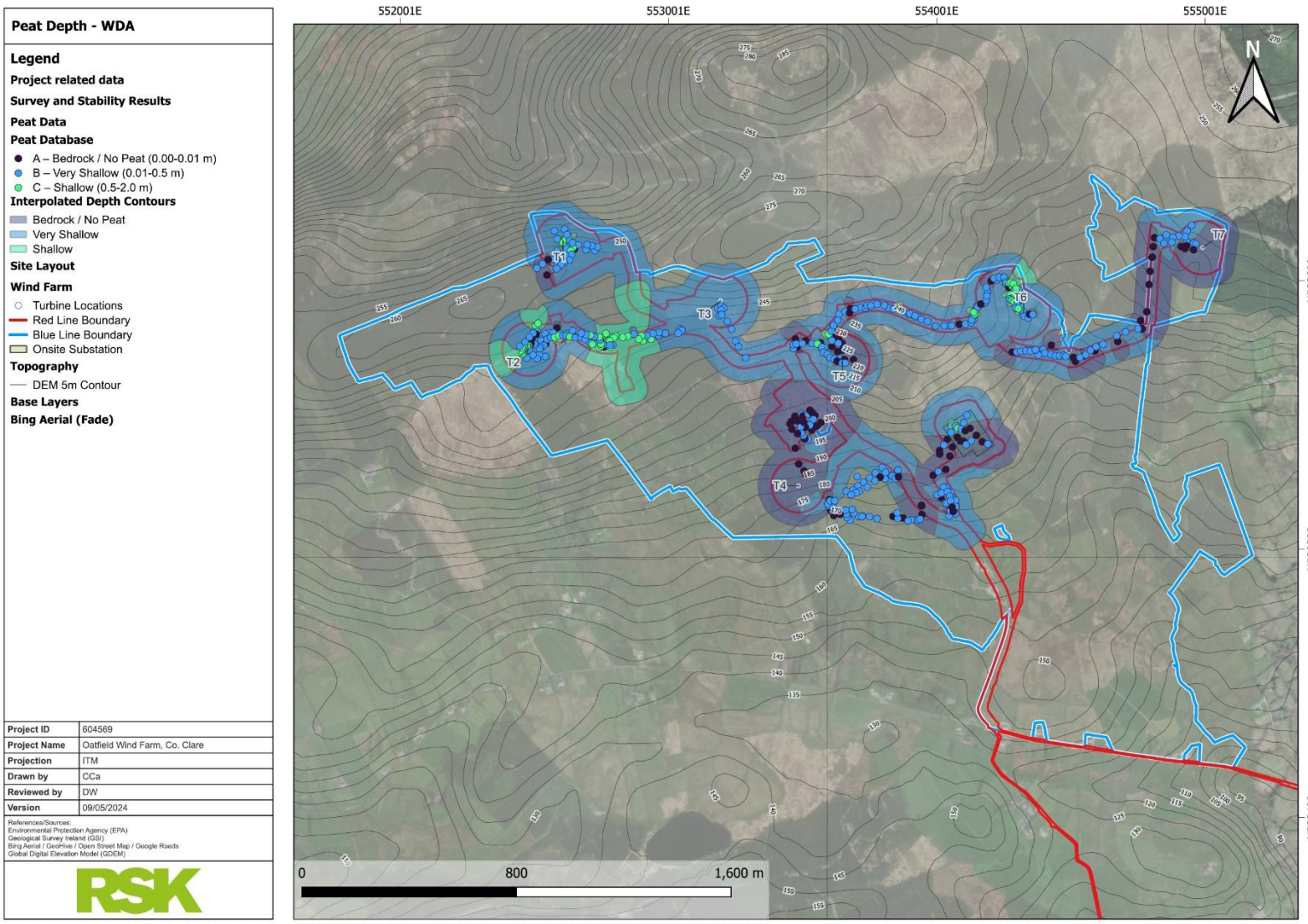

Figure 3.4: Peat depth map of WDA

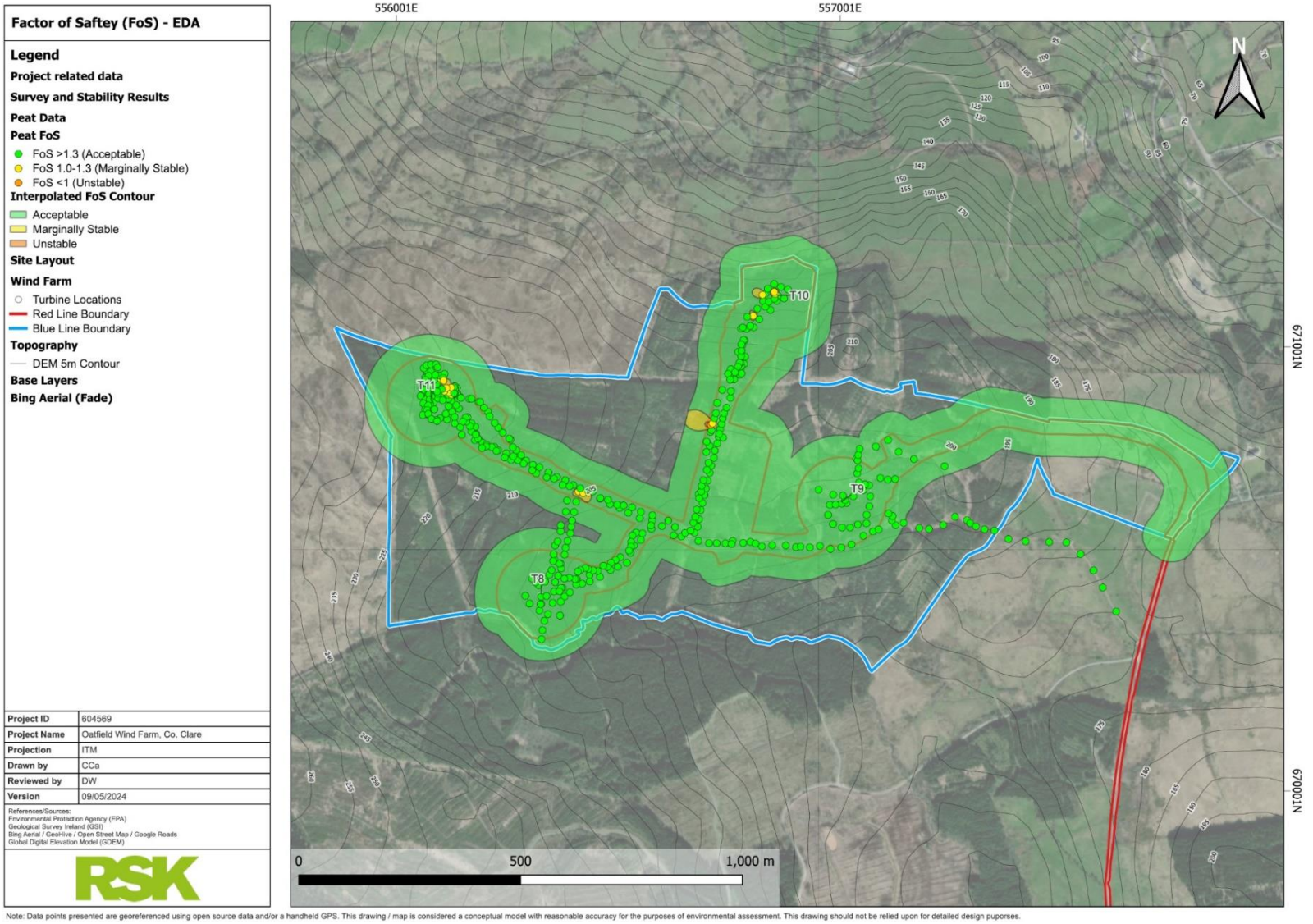

Figure 3.5: Factor of Safety (FoS) map of EDA

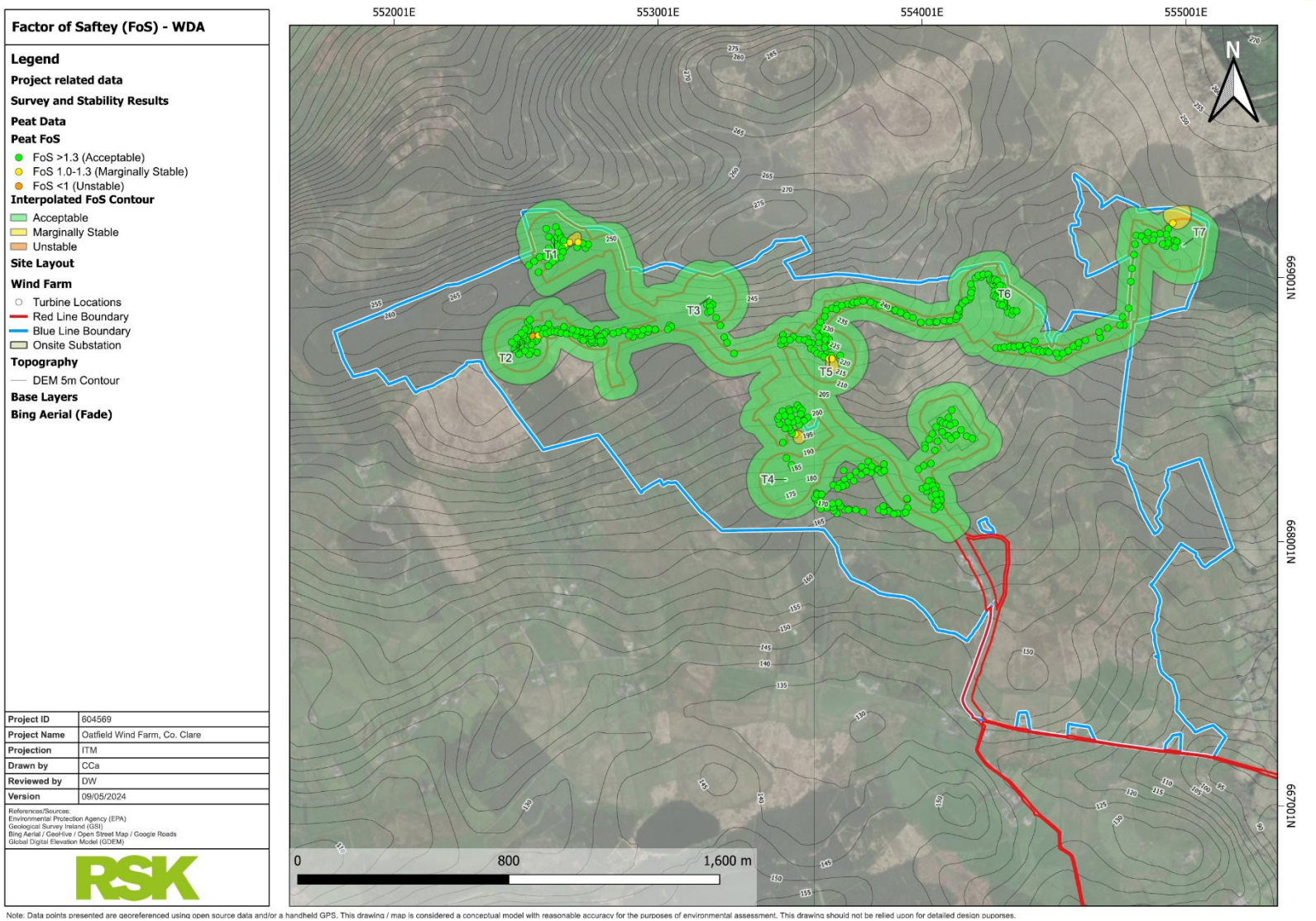

Figure 3.6: Factor of Safety (FoS) map of WDA

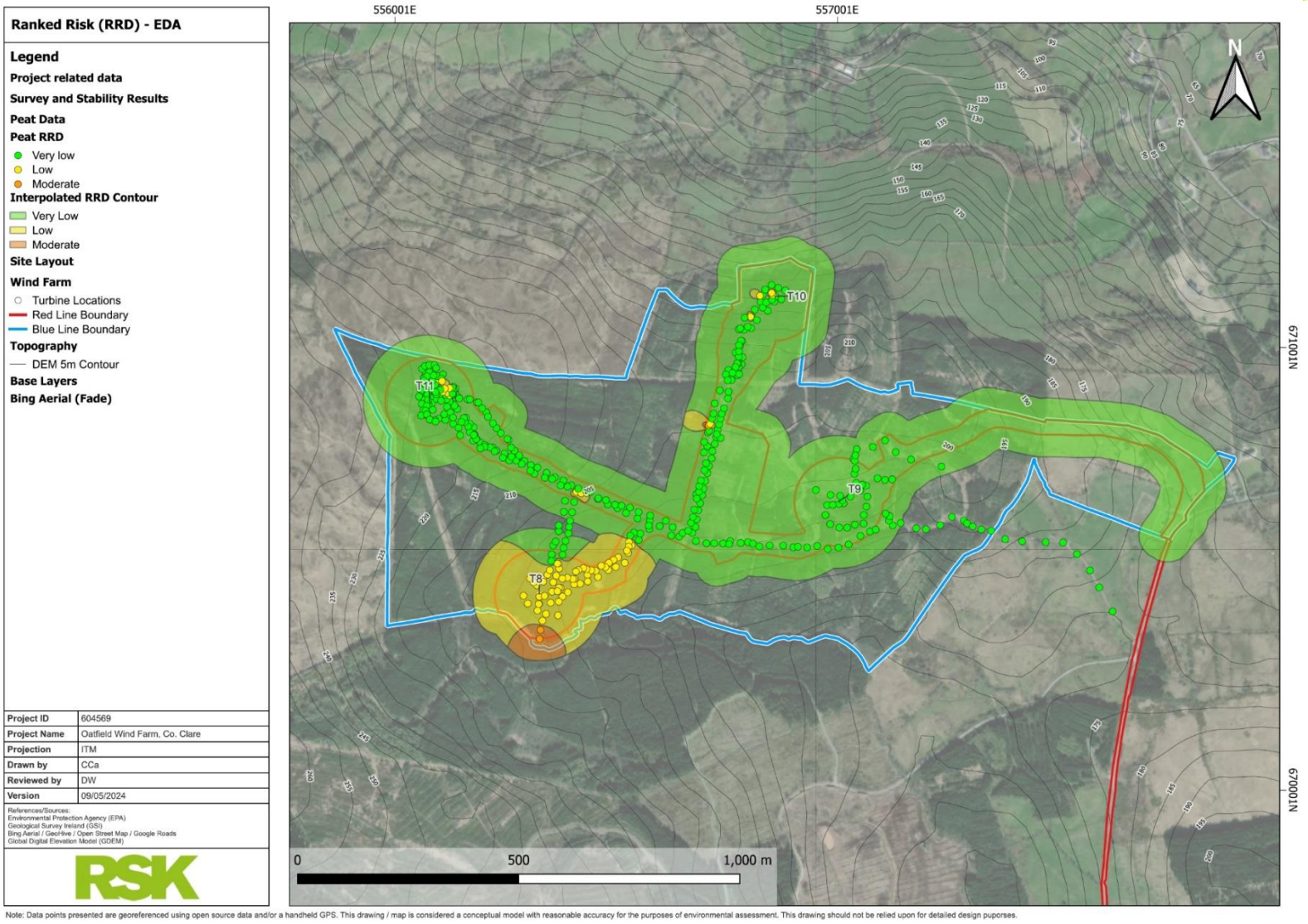

Figure 3.7: Ranked Risk map considering distance to receptors (RRD) map of EDA

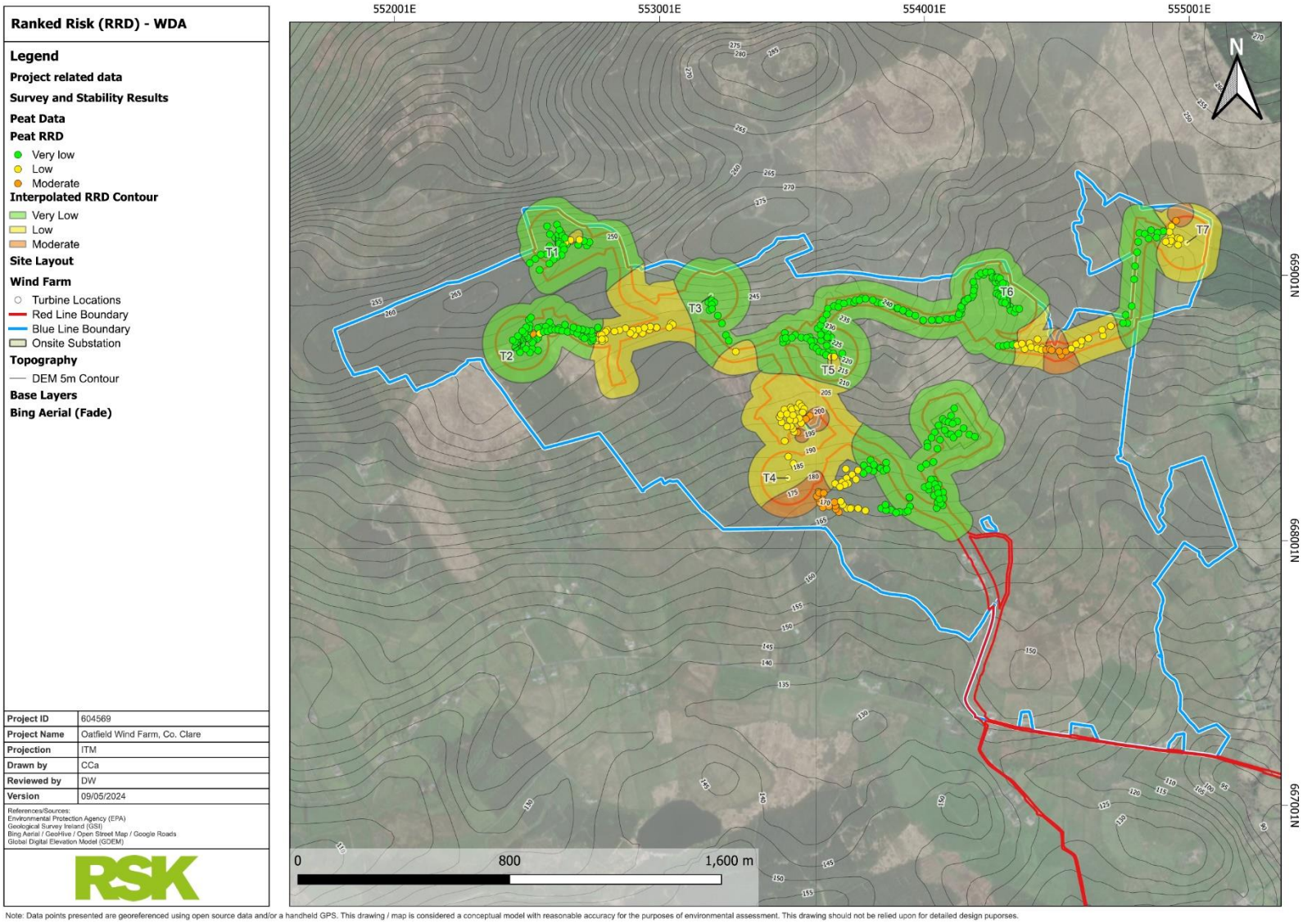

Figure 3.8: Ranked Risk map considering distance to receptors (RRD) map of WDA

3.1.2 Peat stability issues during construction of other wind farms in Ireland

Peat stability issues have occurred during the construction of other wind farms in Ireland most notably Derrybrien and more recently Meenbog. These peat slides have resulted in pollution events which have had an adverse effect on the receiving environment.

In order to reduce the risk of a potential stability issue there are a number of mitigation measures to be implemented these include management of stockpiled material or arisings, monitoring by a geotechnical engineer/engineering geologist, establishment of drainage prior to excavation, dewatering of construction areas and monitoring of weather.

Peat depth at the Site is generally very shallow to shallow (<2m), and management of saturated peat will be required at relatively few locations.

3.1.2.1 Meenbog, Co Donegal, 2020

Meenbog Windfarm bogflow (November, 2020) failure was likely related to construction of a new access road[2]. Peat in this area was recorded at depth between 2.5 and 3.5m.

3.1.2.2 Derrybrien Peat Slide (2003)

This peat slide occurred on the 16th of October, immediately downslope from the Excavation works at T68 (Figure 3.9). Placing of excavation arisings onto the intact peat slope is believed to be likely mechanism for this failure. Placing of excavated arisings caused additional loading which caused localised shear failure of intact peat below the placing of excavation arisings. This reduction in shear resistance caused lateral load transfer to downslope peat and progressive failure.

[2] Dykes, A. P. (2022) Landslide investigations during pandemic restrictions: initial assessment of recent peat landslides in Ireland. Landslides 19:515-525.

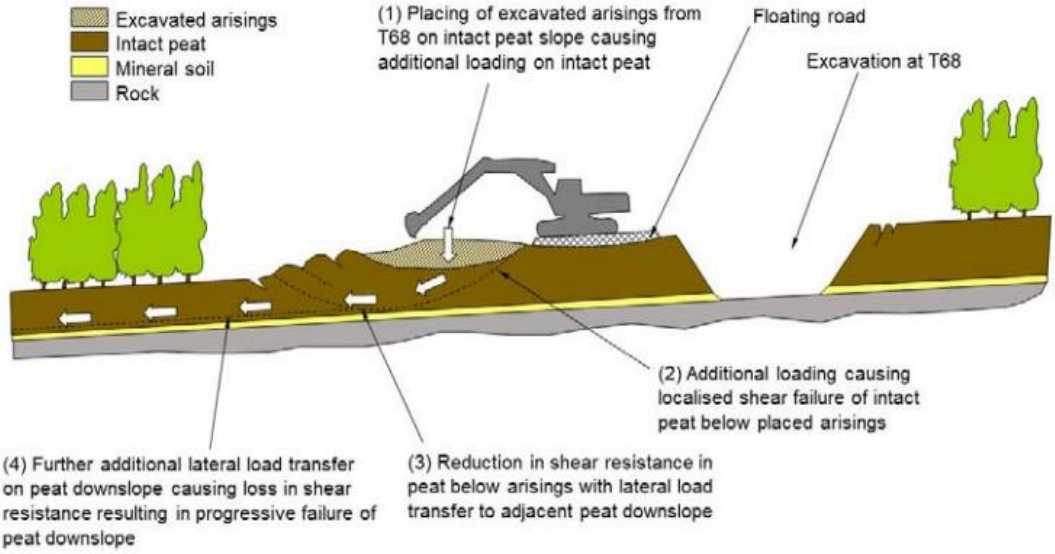

Figure 3.9: Schematic of likely failure mechanism of 16th October peat slide (Figure 4.7[3])

There are a number of mitigation measures which have been outlined in **EIAR Chapter 10** to prevent a peat slide from occurring, similar to what occurred at Derrybrien. The average peat thickness at Derrybrien is 2.5m (0.4-5.5m)[4]. The average peat depth in the Eastern DA where there is mapped blanket peat is 0.56m (range = 0.1-3.8m). The majority of the peat surveyed at this site was very shallow to shallow (<2m). There was no peat deep (>5m) surveyed.

Peat and slope stability investigations at the Proposed Development indicate that the area has a generally low risk probability with respect to peat slippage and slope failure under the footprint of the Proposed Development. The stability risk at the Proposed Development is low and not comparable to Derrybrien.

3.1.3 Mitigation measures to reduce to the risk of stability issues

There are a number of mitigation measures which have been outlined in **EIAR Chapter 10,** Section 10.5, which will be put into place to prevent stability issues as a result of the Proposed Development.

The list of mitigation measures to prevent stability issues (from **EIAR Chapter 10**, Section 10.5.2.8) and additional mitigation measures related to the excavation of peat and the storage of peat are in **EIAR Chapter 10**, Section 10.5.2.5 and 10.5.2.6 respectively:

[3] ESB (2020) Remedial Environmental Impact Assessment Report: Non-Technical Summary. Available at https://www.pleanala.ie/publicaccess/EIAR-NIS/308019/Vol%202%20Section%208%20rEIAR%20Non%20Technical%20Summary/Vol%202%20Section%208%20rEAIR%20Non%20Technical%20Summary.pdf?r=837209. [Accessed May 2024]

[4] Lindsay, R. and Bragg, L. (2005) Wind farms and blanket peat a report on the Derrybrien bog slide. Available at: https://irishriverproject.com/wp-content/uploads/2023/06/Wind_Farms_and_Blanket_Peat_-_a_report_on_the_Derr.pdf

Peat and slope stability investigations at the Proposed Development indicate that the area has a generally low risk probability with respect to peat slippage and slope failure under the footprint of the Proposed Development. Additional mitigation measures will also be applied as recommended in the PSRA (included as **EIAR Volume III Appendix 10.1**).

The mitigation measures outlined in **EIAR Chapter 10**, Section 10.5.2.2 are related to forestry and minimising erosion of soils.

Mitigation by design has ensured that the amount of earth materials excavated is kept to a minimum in order to limit the effect on the geotechnical and hydrological balance of the Site. The mitigation measures outlined in **EIAR Chapter 10**, Section 10.5.2.5 relate to excavation and reducing the risk of stability issues.

3.1.4 Residual effects

The residual effects following mitigation measures for stability issues are considered to be negligible/neutral.

3.2 Theme 2: Designated areas

A number of submissions raised concerns over the nearby Gortacullin Bog and if the turbines were located within the NHA.

The Gortacullin Bog is an NHA [002401] comprised of blanket bog which is to the north and west of T11 in the EDA. It is outside of the proposed red line boundary with no infrastructure located in it. T11 is approximately 100m from the edge of the NHA (Figure 3.10). The drainage away from T11 is to the east and south away from the NHA. Therefore, the NHA is largely upgradient from T11.

The Proposed Development is not expected to have any effects relating to the land, soils and geology of any designated areas. The hydrologically connectivity of designated areas is considered in **EIAR Chapter 9**, Section 9.4.3.10.

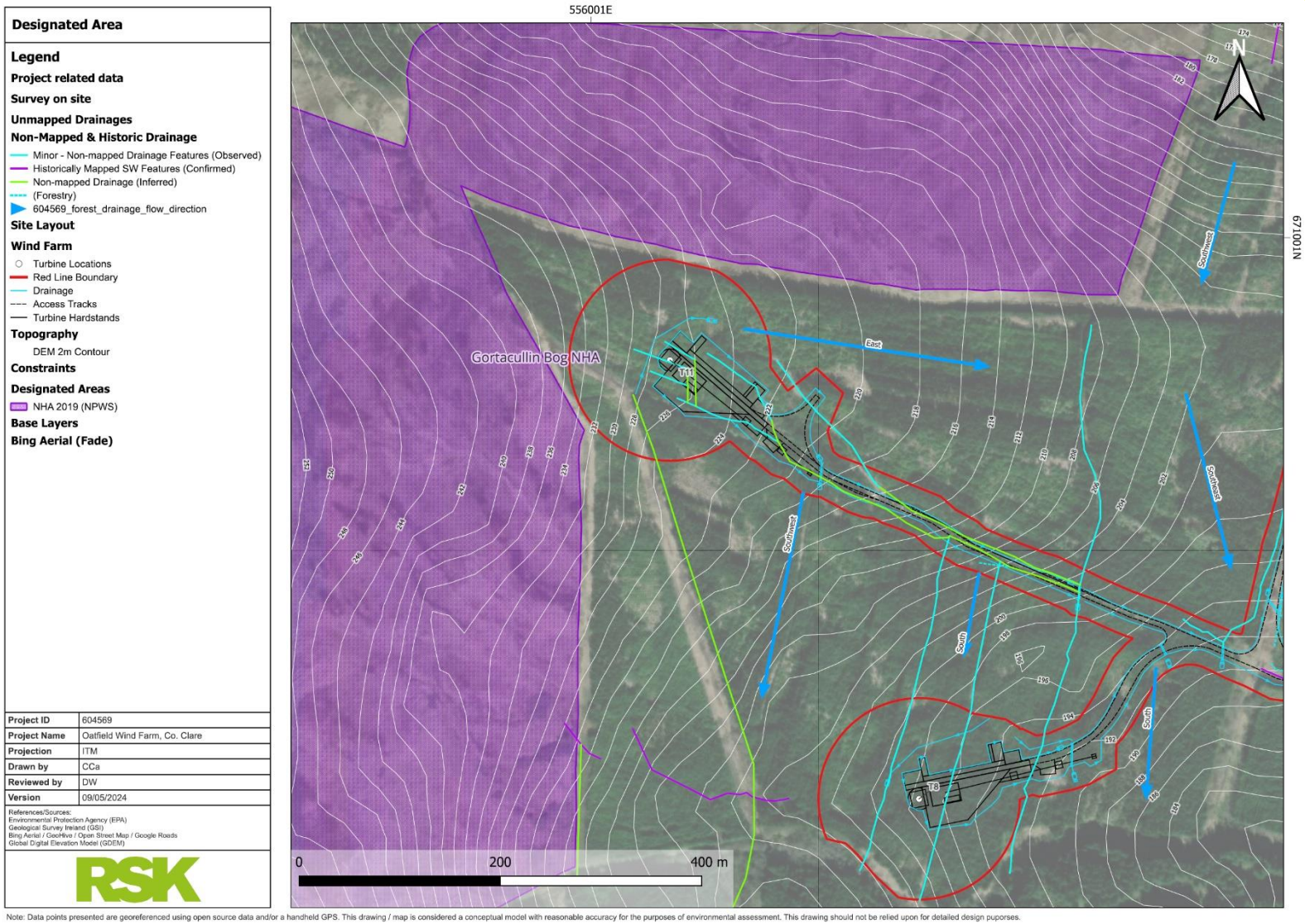

Figure 3.10: Designated area located outside of the red line boundary.

3.3 Theme 3: Excavation, removal of peat and soils

A number of submissions raised concerns over the quantities of material excavated and removal of peat and soil.

Excavation is limited to the footprint of the Proposed Development. Excavations greater than >1m are limited to trenches and foundations of the proposed infrastructure. Mitigation by design has minimised the quantities to be excavated. The Spoil Management Plan is part of the CEMP (**EIAR Volume III Appendix 5.1**). This outlines the sustainable management of spoil and its reuse on site.

Whenever possible, soil will be re-used on the Wind Farm immediately, thereby reducing the need for double handling, reducing the requirements of stockpiles. No permanent stockpiles will be left on site following the construction phase of the Proposed Development.

3.3.1 Excavation quantities

According to **EIAR Chapter 10**, Section 10.4.3.5, the expected total volume of excavated material amounts to c.188,875m³ or 190,843 m³ for both Option A (North Overhead Line (OHL)) and B (South OHL) for the Grid Connection (Table 10.14 of **EIAR Chapter 10**).

Excavations will be required for most aspects of the Proposed Development including for load bearing portions of turbine hardstands including turbine foundations, site access tracks, met mast and substation foundations, and works associated with the improvement or construction of watercourse crossings and culverts, temporary construction compounds, cable trenches and grid connection route.

Excavation depth varies depending on infrastructure summarised below in Table 3.1. This table is a summary of the excavation depth detail included in **EIAR Chapter 10**, Section 10.4.3.5 by wind farm component land take (Table 10.13 of **EIAR Chapter 10**).

Table 3.1: Summary of land take and approximate excavation depths (see EIAR Chapter 10, Table 10.13 and Section 10.4.3.5)

Wind Farm Component	Land Take (ha)	Excavation depth (mbGL, Approx)
Roads	6.25	0.3
Compound	0.165	0.3
Drainage	3.1	0.6
Hardstands	5.54	0.3
Turbine Foundations	0.49	3
Substation	2.73	1
OHL Mast	0.002	3
Meteorological mast	0.005	1.5
Internal grid	0.44	1
IPP	0.636	1.2
GCR Option A	0.23	1.2
GCR Option B	0.25	1.2

Volumes of peat and soils/subsoils to be excavated on the wind farm site are relatively low relative to the development footprint (Table 3.2). Increased excavation and peat / soil / subsoil / bedrock removal activity will be concentrated to particular locations of the Proposed Development, including turbine foundations and OHL Mast.

Land take for both temporary and permanent infrastructure (for the construction phase) is a moderate adverse effect at approximately 23% (red line boundary = 84.73ha and land take = 19.6ha). Following the construction phase temporary land take will be reinstated (compounds, storage areas, internal grid, IPP, GCR).

Table 3.2: Excavation depth by area, and assessment of magnitude of potential effects

Land Take (ha)	Excavation depth range	Proportion of construction phase land take (19.6ha)	Proportion of red line boundary (84.73 ha)	Magnitude of effect (Table 10.5, Chapter 10.5)
15.06	<1 mbGL	76.8%	18%	Moderate adverse
4.06	1-2 mbGL	20.7%	5%	Small Adverse
0.5	>2 mbGL	2.5%	1%	Small Adverse

The mitigated residual effects associated with peat, subsoil and bedrock removal are considered to be not significant.

3.3.2 Storage of peat and soils

As described in **EIAR Chapter 10**, Section 10.5.2.6, best practice will be applied during construction which will minimise the amount of soil and rock excavation and therefore also reduce storage and stockpile requirements. All works will be managed and carried out in accordance with the CEMP (refer to **EIAR Volume III, Appendix 5.1**), which will be updated by the civil engineering contractor and agreed prior to any Site works commencing.

During excavation works, arisings will be segregated and stored locally before being transported directly to a backfill / deposit area or to a dedicated temporary stockpile area as necessary. Material stored in temporary storage areas will be reused elsewhere on site as backfill, berms, landscaping and reinstatement of construction areas. No permanent stockpiles will remain on site.

Temporary stockpile locations are identified and will be used to avoid the temporary placement of any excavation arisings outside of the footprint of the development. All temporary stockpiles will be positioned on established and existing hardstand areas or in designated areas which are appropriate for short term storage.

Whenever possible, soil will be re-used on the Wind Farm immediately, thereby reducing the need for double handling, reducing the requirements of stockpiles.

The residual risk to the land, soils and geology associated with the storage of stockpiles is slight to negligible. The risk of a stability issue associated with storage of stockpiles is slight to negligible. The residual risk of the release of suspended solids to the surface water network is neutral or slight.

3.3.3 Compaction, erosion and degradation of soils

Soil compaction will be limited to the footprint of the development and is therefore considered to have a small adverse effect on the soils.

Erosion and degradation of soils is a likely potential effect of the Proposed Development. Forest felling, soil striping, vehicular movement, excavation works and temporary storage

of material during the construction phase have the potential to lead to erosion and degradation of soils by water / wind. A number of mitigation measures have been outlined in **EIAR Chapter 10** to reduce the risk and magnitude of the potential soil loss and degradation through erosion of exposed soils. These mitigation measures are included in **EIAR Chapter 10**, Section 10.5.2.3 Compaction, erosion and degradation, Section 10.5.2.5 Subsoil and bedrock removal and Section 10.5.2.7, Vehicular movement.

With implementation of the mitigation measures, the residual effects associated with erosion and degradation of soils is not significant.

3.3.4 Contamination of soil

The risk of hydrocarbon contamination to the underlying soils is considered to be a localised effect. The scale of any potential contamination impact will likely be minor in scale, for example, plant machinery leak (on exposed ground), as opposed to a fuel tank rupture (in bunded structure).

Protecting soils from such will in turn mitigate against the potential for contaminates reaching the hydrological network and other downstream receptors associated with the Site.

The mitigation measures to reduce the risk of soil contamination is outlined in **EIAR Chapter 10**, Section 10.5.2.9.

The residual effects associated with soil contamination are slight to negligible. The object of the mitigation measures is to protect the soils and not adversely affect other sensitive receptors including water quality.

3.4 Theme 4: Concrete foundations

A number of submissions raised concerns about concrete foundations.

The impartation of approximately 8,650m^3 will be required for the construction of the wind farm foundations, substation buildings and meteorological mast foundations. The use of concrete is limited to only minor areas and therefore only has a small adverse impact on the land soils and geology of the Proposed Development.

3.4.1 Replacement of soil and rock with concrete

8,650m^3 of concrete is required for the construction of the Proposed Development (**EIAR Chapter 5**).

The turbine foundation radius is 12m of concrete foundation, a 45-degree excavation angle and 1m around for workspace, down to a level where the underlying soil or rock can bear the weight of a structure without shifting or compressing. It is estimated that each foundation will have a maximum depth of approximately 3m.

The excavations for foundations are outlined in Table 10.15 of **EIAR Chapter 10**. Soil, subsoil and rock will be excavated at each turbine foundation location to a depth where the underlying soil or rock can bear the weight of the structure. The exact depth of excavation will be confirmed at detailed design stage dependant of the ground conditions at each turbine foundation location.

3.4.2 Potential effects of concrete

Depending on the chemistry of the material in question, the introduction of such materials can lead to a local change in hydrochemistry and impact on sensitive attributes e.g., ecology. For example, the introduction of cementitious material (concrete / cement / lean mix etc.) can lead to changes in soil and water pH, and increased concentrations of sulphates and other constituents of concrete can further impact water quality.

The use of concrete is a relatively impermeable material however the land take associated with the turbine foundations, substation and met mast foundation is equal to 3.2 ha (<4% of the red line boundary) and therefore the use of concrete on groundwater recharge and the potential for flooding is a negligible to small adverse effect.

The potential for contamination from concrete is localised to areas where wet concrete is used. Once concrete is set it is effectively inert, therefore any potential effects on water quality are small adverse, localised and temporary.

3.4.3 Mitigation measures

Mitigation measures for concrete management (as per **EIAR Chapter 5** and **EIAR Chapter 9**):

- Using weather forecasting to assist in planning large concrete pours, and avoiding large pours where prolonged periods of heavy rain is forecast;
- Ensuring that excavations are sufficiently dewatered before concreting begins and that dewatering continues while concrete sets;
- Ensuring covers are available so that areas can be covered if heavy rain arrives during the curing process to prevent runoff of concrete; and
- The small volume of water that will be generated from washing of the concrete lorry's chute will be directed into a temporary lined impermeable containment area, or a Siltbuster-type concrete wash unit or equivalent.

3.4.4 Decommissioning and concrete

As per **EIAR Chapter 5** in the decommission phase the concrete plinth above ground will be removed, and the remainder of the foundations will be covered by soils typical of the surrounding environment and then reseeded or left to re-vegetate. Leaving the turbine foundations in situ is considered a more environmentally sensible option as to remove the reinforced concrete associated with each turbine would result in adverse environmental effects such as noise and vibration and dust.

3.4.5 Residual effects

With appropriate environmental engineering controls and measures, the potential risks associated with concrete will be significantly reduced and are considered likely to be insignificant.

3.5 Theme 5: Clear felling of forestry

3.5.1 Clear felling of forestry

The construction phase of the Proposed Development will require the clear-felling of commercial conifer plantation and replanting in accordance with the licensing requirements of the Forest Service of the Department of Agriculture, Food and the Marine. Afforestation of alternative lands equivalent in area to those of permanent felling will take place (see **Chapter 5**).

Felling of commercial forestry is in line with baseline conditions and is likely to happened with or without the Proposed Development.

The runoff from these areas will be controlled and monitored (**EIAR Chapter 9**, Section 9.5.2.3).

The residual effects on the soils and geology associated with felling are slight to beneficial.