12. Geology and Peat

12.1. Introduction

12.1.1. This chapter provides an appraisal of the impact of the Proposed Development on Geology and Peat and provides a preliminary geological assessment of the existing ground conditions while considering peat stability. A peat landslide hazard and risk assessment has been undertaken to:

- Identify areas susceptible to peat slide risk which could be affected by the construction of the wind farm,
- Assign hazard and likelihood of occurrence, and
- Detail mitigation measures to reduce any identified risks.

12.1.2. This geological assessment identifies areas of geological interest and features of note. The information and data collated from the peat and geological assessments have informed the site layout to minimise the potential impacts on peat and geology as a result of the Proposed Development.

12.1.3. This Chapter is supported by the following Technical Appendices provided in Volume 4 of this EIA Report:

- **Appendix 12.1:** Peat Slide Risk Assessment (PSRA);
- **Appendix 12.2:** Outline Peat Management Plan; and
- **Appendix 12.3:** Borrow Pit Assessment (BPA);

12.1.4. This Chapter is also supported by the following figures:

- **Figure 12.1:** Superficial soils
- **Figure 12.2:** Bedrock Geology;
- **Figure 12.3:** National Soils of Scotland;
- **Figure 12.4:** Extract from Carbon and Peatland 2016; and
- **Figure 12.5:** Recorded Peat Depths.

12.1.5. This chapter is structured as follows:

- Legislation, policy and guidance;
- Assessment methodology and significance criteria;
- Scoping responses and consultation;
- Baseline conditions;
- Assessment of potential effects;
- Mitigation measures;
- Residual Effects; and
- Summary.

12.2. Legislation, Policy and Guidance

12.1.6. The Scottish Planning Policy (SPP)[1] was published in 2014 and is a non-statutory document which sets out the Scottish Government's policy on how nationally important land use planning matters should be addressed.

[1] The Scottish Government (2014) Scottish Planning Policy [Online] Available at: http://www.gov.scot/Publications/2014/06/5823 (Accessed 08/01/2018)

12.1.7. In relation to peat and organic soils, paragraph 205 from SPP states that where peat and other carbon rich soils are present, applicants should assess the likely effects of development on carbon dioxide (CO2) emissions. Where peatland is drained or otherwise disturbed, there is liable to be a release of CO2 to the atmosphere. Developments should aim to minimise this release.

12.1.8. In addition to the SPP, guidance includes:

- Scottish Natural Heritage (SNH) (2015), Good Practice During Wind Farm Construction[2];
- The Scottish Government (2017), Peat Landslide Hazard and Risk Assessments - Best Practice Guide for Proposed Electricity Generation Developments[3];
- Scottish Government, Scottish Natural Heritage, SEPA (2017) Peatland. Guidance on Development on Peatland, on-line-version-only[4]
- The Scottish Government (2009), The Scottish Soil Framework[5];
- The Construction Industry Research and Information Association (CIRIA) (2015), Environmental Good Practice on Site (C741)[6]; and
- Planning Advice Note PAN 50 Controlling the Environmental Effects of Surface Mineral Workings[7].

12.3. Assessment Methodology and Significance Criteria

12.1.9. The methodology employed for the Peat Slide Hazard and Risk Assessment (PSHRA) is in accordance with Energy Consents Unit (ECU) Scottish Government guidance Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Developments (Second Edition)[8]. Using experience from other windfarm projects, the assessment endeavours to assess the effects on geology and soils either affected directly or indirectly by construction or operation of the Development.

12.1.10. Desk studies have not identified any areas of contaminated land within the Core Study Area. Should potentially contaminated land be encountered during excavations, appropriate action would be taken in accordance with The Environmental Protection Act 1990. As a result, potential effects arising from contaminated land have been scoped out of this assessment.

[2] SNH (2015b) Good practice during windfarm construction, 3rd Edition [Online] Available at: http://www.snh.gov.uk/docs/A1168678.pdf (Accessed 08/01/2018)

[3] The Scottish Government (2017) Peat Landslide Hazard and Risk Assessments - Best Practice Guide for Proposed Electricity Generation Developments Guidance [Online] Available at: http://www.gov.scot/Resource/0051/00517176.pdf (Accessed 08/01/2018)

[4] Scottish Government, Scottish Natural Heritage, SEPA (2017) Peatland Survey. Guidance on Developments on Peatland, on-line version only Available at: https://www.gov.scot/Resource/0051/00517174.pdf (Accessed 08/01/2018)

[5] The Scottish Government (2009) The Scottish Soil Framework [Online] Available at: http://www.gov.scot/Publications/2009/05/20145602/0 (Accessed 08/01/2018)

[6] The Construction Industry Research and Information Association (CIRIA) (2015) Environmental Good Practice on Site Guide (C741), CIRIA: London.

[7] Scottish Government, Planning Advice Note PAN 50 Controlling the Environmental Effects of Surface Mineral Workings http://www.gov.scot/Publications/1996/10/17729/23423

[8] Scottish Government (2017) Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Developments. Available at: http://www.gov.scot/Publications/2017/04/8868/0 [Accessed 08/02/2018]

Assessment Methodology

12.1.11. The assessment of peat and geology has included the review of publicly available information in relation to the current condition of the soils at the Proposed Development. The information is detailed in the baseline description. The information has been reviewed in the context of the Proposed Development to evaluate the short and long term impacts.

12.1.12. The assessment has involved a review of the following data sources detailed below:

- National Soil Map of Scotland;
- Carbon and Peatland 2016 Map;
- British Geological Survey Geoindex – Superficial Soils; and
- British Geological Survey Geoindex – Solid Geology.

12.1.13. Soil types are considered to be of high sensitivity where they are categorised as peat soils and soil of high moisture content, such as those found in blanket bog.

Stage 1 Peat Probing

12.1.14. Initial phase 1 peat probing from 2013 was supplemented by additional Phase 1 level probing in April 2018. This was carried out in accordance with Scottish Government Guidance. The supplementary probing focussed on areas where it had previously not been possible to collect peat data, however, some localised areas of the site remained inaccessible due to the presence of dense young forestry plantation. The information gathered informed the outline civil design and supported the Peat Landslide Hazard and Risk Assessment.

Stage 2 Peat Probing

12.1.15. Following design freeze, Stage 2 peat probing was undertaken comprising 50 m centres along proposed track alignments and where possible 10 m centres across turbine locations.

12.1.16. It should be noted that a Peat Slide Risk Assessment (PSRA) was undertaken on the findings of all phases of probing with focus upon the Phase 2 peat probe data, as this was within the proposed infrastructure envelope. Details of the assessment are included **Appendix 12.1**

Significance Criteria

Sensitivity

12.1.17. Table 12.1 provides an overview of the different categories of sensitivity that are used within this chapter to inform the assessment of effects on existing geology and peat and identify whether the effects would be significant under the EIA Regulations.

Table 12.1: Receptor Sensitivity Criteria

Receptor Sensitivity	Sensitivity Description
High	• Soil type and associated land use are highly sensitive (e.g. peat/blanket bog) • Class 1 or 2 priority peatland, carbon-rich and peaty soils) and covers >20% of the Development Area • Receptor contains areas of regionally important economic mineral deposits
Medium	• Soil type and associated land use are moderately sensitive (e.g. commercial forestry) • Class 1 or 2 priority peatland, carbon-rich and peaty soils cover <20% of the Development Area, or Class 3 and 5 peatland areas, carbon rich and peaty soils • Receptor contains areas of locally important economic mineral deposits
Low	• Soil type and associated land use not sensitive to change in hydrological regime (e.g. intensive grazing) • Receptor contains Class -2, -1, 0, and 4 non-peatland areas, with no carbon-rich and/or peaty soils

Magnitude

12.1.18. The magnitude is determined by the timing, scale, size and duration of the potential effect resulting from the Proposed Development. The magnitude of potential effects can be classified as major, moderate, minor or negligible, as outlined in Table 12.2.

Table 12.2: Impact Magnitude Criteria

Impact Magnitude	Description
Major	• Major or total loss of or alteration to peatland resource such that post development characteristics or quality will be fundamentally or irreversibly changed • Long term /permanent change to baseline resource • Major or total loss of a geological site or mineral deposit, where the value of the site would be severely affected
Moderate	• Loss of, or alteration to the baseline resource such that post development characteristics or quality will be partially changed • Mid-term /permanent change to baseline resource • Partial loss of a geological site or mineral deposit, with major effects to the settings, or where the value of the site would be affected
Minor	• Small loss of soils or peatland, or where soils will be disturbed but the value not impacted • Short-term change to baseline resource • Small effect on a geological site or mineral deposit, such that the value of the site would not be affected
Negligible	• Minimal or no change to soils or peatland deposits

	• A very slight change from the baseline conditions. The change is barely distinguishable, and approximates to the 'no-change' situation • Minimal or no change to a geological site or mineral deposit

12.1.19. The sensitivity of the receiving environment is defined as its ability to absorb an effect without perceptible change and can be classified as high, medium or low. These classifications are dependent on factors such as the nature and extent of peat, associated habitats, and soil characteristics as well as the site geology and their purpose and existing influences, such as land-use.

12.1.20. The categorisation of significance criteria being major, moderate, minor or negligible as detailed in Table 12.3 relies also on professional judgment to ensure that the effects are appropriately assessed.

Table 12.3: Matrix for Defining Significant Effects

Sensitivity / Magnitude	Low	Medium	High
Negligible	Negligible	Negligible	Negligible
Minor	Negligible	Minor	Moderate*
Moderate	Minor	Moderate*	Major*
Major	Minor*	Major*	Major*

*denotes "significant" effects as per the EIA Regulations

Assessment Limitations

12.1.21. Following the outline civil design freeze, the second phase of probing targeted the proposed infrastructure to assist with the stability assessment and ascertain additional peat depths. Some areas of young forestry were densely planted and difficult to access. Within mature forestry, wind-blown tree damage limited access. Additionally, in dense mature tree cover, it was difficult to obtain an accurate peat probe location.

12.4. Scoping Responses and Consultation

12.1.22. Throughout the scoping exercises, and subsequently during the ongoing EIA process, relevant organisations were contacted with regards to the Development. Table 12.4 outlines the consultation responses received in relation to Peat and Geology.

Table 12.4: Consultation

Consultee	Details	Where Addressed in EIA Report
Scottish Environment Protection Agency (SEPA) scoping response of 10th April 2018 made the following	3.3 The submission must include: a) A detailed map of peat depths (this must be to full depth and follow the survey requirement of the Scottish Government's Guidance on Developments on Peatland - Peatland Survey (2017)) with all the built elements	Figure 12.5 Interpolated Peat Depths Further information is available in Appendix 12.1 Peat Slide Risk Assessment and 12.2

Consultee	Details	Where Addressed in EIA Report
comments in relation to Peat and Geology relating to the submission of information for the application	(including peat storage areas) overlain to demonstrate how the development avoids areas of deep peat and other sensitive receptors such as Groundwater Dependent Terrestrial Ecosystems. b) A table which details the quantities of acrotelmic, catotelmic and amorphous peat which will be excavated for each element and where it will be re-used during reinstatement. Details of the proposed widths and depths of peat to be re-used and how it will be kept wet permanently must be included. 3.5 Dependent upon the volumes of peat likely to be encountered and the scale of the development, applicants must consider whether a full Peat Management Plan (as detailed in the above guidance) is required or whether the above information would be best submitted as part of the schedule of mitigation. 7.2 The following information should also be submitted for each borrow pit: a) A map showing the location, size, depths and dimensions. b) A map showing any stocks of rock, overburden, soils and temporary and permanent infrastructure including tracks, buildings, oil storage, pipes and drainage, overlain with all lochs and watercourses to a distance of 250 metres.	Outline Peat Management Plan Appendix 12.2 Outline Peat Management Plan Appendix 12.2 Outline Peat Management Plan Appendix 12.3 Borrow Pit Assessment Details on stocks of rock, oil storage and permanent infrastructure will be confirmed by way of planning condition.

12.5. Baseline Conditions

Study Area

12.1.23. The Proposed Development site occupies a rural setting to the east of Carsphairn in Dumfries and Galloway and consists of extensive commercial forestry to the north-east of Galloway Forest Park, Dumfries and Galloway. With the exception of locally steep areas in the vicinity of Marscalloch (circa 381 mAOD) and Cragengillan (circa 401 mAOD), the majority of the site comprises smooth rolling topography. The site is covered by a combination of mature forestry, newly planted dense conifer plantation or areas subject to felling operations. The area subject to felling operations has a brashy ground surface covered with timber and tree trunk waste.

Superficial Soils

12.1.24. Published geological mapping of superficial soils indicates the majority of the site to be vacant of superficial soil cover, primarily within the regions of Craigengillan Hill and Marscalloch Hill. Till deposits typically comprising clay, sand and gravel are shown across the eastern and southern site areas Peat deposits are shown within the north-western part of the site area. Figure 12.1 illustrates the published superficial soils.

Bedrock Geology

12.1.25. Published bedrock geology mapping indicates the site to be underlain by Caradoc aged rocks comprising Portpatrick Formation Wacke. A geological fault is recorded within the southern site area orientated south-west to north-east through Muirdochwood. No other faults are noted. Within the northern site area, dykes intrude, noted as North Britain Siluro-Devonian aged Calc-Alkaline Dyke Suite comprising Microdiorite and Porphyritic rocks. One of the major dykes is orientated south-west/north-east across the western face of Craigengillan Hill. Figure 12.2 illustrates the published Bedrock Geology.

National Soils of Scotland

12.1.26. The following information is a summary of the information on soil units within Scotland's Soils, Scotland's Environment website[9].

12.1.27. National Soils Map of Scotland mapping indicates the northernmost part of the site to primarily be within an area of peaty gleys, with peaty podzols present in the upper regions of Craigengillan Hill. Consistent with the BGS information, blanket peat was present in the north-west site area. Within the southernmost part of the site, the majority of the soils were recorded as peaty gleys with peaty podzols present in the upper regions of Marscalloch Hill. Brown soil is also shown within the most southern regions, towards Knowehead. Figure 12.3 illustrates the published National Soils of Scotland extract.

12.1.28. A brief description of the characteristics and formation of component soil groupings is detailed below, as described by Scotland's Soils Map, although these do not include information on depths or engineering properties:

- Blanket Peat: Poorly drained upland soil with an organic surface layer generally greater than 50 cm thick, unconfined and 'blankets' the landscape;
- Podzols: Podzols are acid soils with a grey leached layer just below the surface and bright orangey-brown coloured subsoils and/or dark brown to black, organic rich subsoils;
- Gleys: Gleys are soils that are periodically or permanently waterlogged; and
- Brown soils: Brown soils are moderately acid soils with brown mineral topsoils and brown or yellowish subsoils.

Carbon-rich Soils, Deep Peat and Priority Peatland Habitats

12.1.29. The Carbon and Peatland Map (SNH, 2016) indicates the Carbon-rich soils and peatland importance to be categories 4 and 5 across the majority of the site.

[9] http://soils.environment.gov.scot/

These categories are indicative of areas of vegetation not associated with priority peatland, but have acidic type soils and areas unlikely to include carbon rich soils respectively. Within the southern-most area, a small area of mineral soil was recorded.

12.1.30. A summary of the peat survey is summarised below and the details are included in **Appendix 12.1**. The appendix provides site-specific peat depth information which informed the design of the layout of the Proposed Development and the subsequent assessment of effects. Figure 12.4 provides the Carbon and Peatland 2016 Map extract.

Peat

12.1.31. Peat is a sedimentary material, which is dark brown or black in colour and comprises partially decomposed remains of plants and organic materials preserved in anaerobic conditions, essentially within a waterlogged environment. There are two principal types of peat:

- Acrotelm is the upper layer, quite fibrous and contains plant roots. Acrotelmic peat is relatively dry, generally lying above the groundwater table and has some tensile strength; and
- Catotelm is the lower layer of peat, highly amorphous and has a very high water content, generally lying below the ground water table and has a very low tensile strength.

Field Surveys

12.1.32. The desk-based assessment recorded the potential presence of peat and peaty soils in line with the SNH data described above. Initial phase peat probing across a 100 m x 100 m grid was supplemented by further infrastructure-specific probing undertaken to inform the layout design and to support the PSRA and PMP.

12.1.33. The results of the peat probing indicated that peat was generally thin across the Site, varying only with depth according to local topographic conditions, with pockets of deep peat situated in topographically flat areas.

12.1.34. Following the design freeze, targeted peat probing was carried out across proposed infrastructure. This probing was generally at 50 m intervals along the centre line of the tracks with probes at 25 m on either side of the tracks to provide a corridor for micro-siting. In addition, probing at turbine locations was at 10 m intervals where possible, particularly in areas previously recoding peat.

12.1.35. During the course of the works, a total of 1,293 probes were undertaken within the study area. The peat probe locations and peat depth interpolation are shown in **Figure 12.5** with further details on the peat probing included in **Appendix 12.1**.

12.1.36. Table 12.5 summarises the peat depth findings.

Table 12.5: Peat Depth Summary

Peat Depth Range (m)	Number of peat probes	Percentage of Total (%)
<0.50m	934	72.2
0.51m - 1.00m	142	11
1.01m - 1.50m	75	5.8
1.51m - 2.00m	51	4
2.01m - 2.50m	48	3.7
2.51m - 3.00m	28	2.2
>3.00m	15	1.1

12.1.37. Recorded peat depths averaged 0.54 m, with 72.2% less than 0.5 m and 83.2% less than 1.0 m. Peat greater than 1.0 m was localised, generally found in topographically low lying, flat areas.

12.1.38. With exception of small zones of peat greater than 0.5 m in the central site area, peat greater than 0.5 m depth existed mainly across the western site area, close to the boundary. This was consistent with the desk based studies and Scottish Soils mapping. Within the western site areas, peat was recorded locally to a maximum depth of 4.5m. Naturally, thicker peat deposits would be anticipated in low lying/shallow topographic areas, and further detailed assessment is undertaken in the PSRA (**Appendix 12.1**) to confirm the relationship between the peat thicknesses, slope gradient and other influencing factors.

Borrow Pits

12.1.39. Potential borrow pit locations were identified within the Development site boundary which could provide aggregate for construction of site access tracks, crane hardstanding areas, upgrades of existing forestry tracks. The potential borrow areas have been selected based on their:

- Topography;
- Previous uses;
- Accessibility from existing or propose access tracks;
- Orientation with respect to visibility; and
- Potential aggregate volume;
- Proximity of rock to the surface.

12.1.40. The areas subject to assessment have been selected as they can be accessed directly from either existing tracks or proposed new tracks while consideration of topography, considering steeper topography is preferable for quarrying, and where soils coverage will be limited. Landscape and visualisation impacts were also considered south face of Marscalloch Hill.

12.1.41. The borrow pit locations are in areas where the peat cover is thin or vacant and where bedrock outcrops and aggregate reserves are expected to occur near the surface. Further details on Borrow Pits is included in Appendix 12.3 Borrow Pit Assessment. The assessment sections below discuss the significance of effects of the Proposed Development on peat including the proposed mitigation measures to decrease the significance of effects.

Peat Stability and Peat Management

12.1.42. Due to the presence of peat within the Site, a Peat Slide Risk Assessment and Outline Peat Management Plan are included as Technical **Appendices 12.1 and 12.2** respectively.

12.1.43. The peat slide risk assessment utilises the peat depths and existing slope information to identify potential hazard areas in relation to peat slide risk. Details on peat slide risk assessment methodology and data interpretation and results are provided in **Appendix 12.2**.

12.1.44. The outline peat management plan utilises peat depth data to calculate estimated excavation volumes based on the proposed civil design infrastructure, identifies rational options for reuse of excavated material and provides guidance on good practice storage and management of excavated material, including peat. Further details are provided in **Appendix 12.2**.

12.6. Assessment of Potential Effects

12.1.45. The effect of the Proposed Development on soils and geological receptors has been considered for the construction and operation phases. Effects occurring during construction are considered to be short term effects, with those occurring as a result of the operational development being considered as long term effects.

Potential Construction Effects

12.1.46. The nature and magnitude of effects that could result from construction activities, as described in Chapter 4: Description of the Proposed Development are assessed in the following paragraphs.

Peat Disturbance

12.1.47. The turbines and associated infrastructure affected by the deep peat are T4, T6, T8, T9, and T13 where peat was recorded up to 3.0 m depth and at T16 where peat was recorded to 4.5m. Generally, these areas were within either extensive commercial forestry or had undergone deforestation. However, the areas of peat recorded were consistent with the National Soils of Scotland Mapping, which classified the low-lying western site area to be blanket peat.

12.1.48. While the National Soils of Scotland mapping indicates peat, Carbon and Peatland 2016 mapping indicates Class 4 or 5 soils across the majority of site, including the western site area. This is due to there being almost no peatland vegetation, due to forestry, and areas of modified bog within the dense

commercial forestry, although soils are carbon rich and representative of deep peat.

12.1.49. The assessment of peat disturbance has highlighted localised areas of peat at risk from the Proposed Development, in particular the western part of the site. This indicates a Medium risk in accordance with carbon-rich and peaty soils cover, disturbance to an area <20% of the Development Area, the presence of class 5 peatland areas (carbon rich and peaty soils), and commercial forestry. The magnitude of effect is considered to be Moderate due to loss of, or alteration to the baseline resource such that post development characteristics or quality will be partially changed and a mid-term /permanent change to the baseline resource.

12.1.50. On this basis, in the absence of mitigation, the Proposed Development is considered to result in a potential effect of moderate and would therefore have a significant effect, in accordance with the EIA Regulations.

Peat Stability

12.1.51. Peat instability is generally the result of a combination of causative factors. Several construction activities have the potential to increase the likelihood of peat slides in areas where peat is present at a sufficient depth and where gradients are sufficiently steep to result in a peat slide event.

12.1.52. Construction activities that have the potential to increase the likelihood of peat slides include locating proposed infrastructure including track networks on sloping ground which often involves removal of surface vegetation and excavation of peat and other soils.

12.1.53. Due to the presence of peat, a Peat Slide Risk Assessment was undertaken and is included in **Appendix 12.1**. This PSRA was carried out in accordance with the Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Developments, 2017, which is a requirement for projects with a generating capacity of 50MW or above, falling under Section 36 of the Electricity Act 1989.

12.1.54. Peat slides can affect soils and local sensitive habitats and have the potential to affect surface water systems from soil inundation, leading to sedimentation. This can have an effect by reducing water quality and/or modify drainage patterns. Receptors identified across the Proposed Development area are:

- Existing forestry tracks and paths
- Existing minor watercourses
- Proposed Wind Farm Infrastructure

12.1.55. Peat depths are typically shallow, generally less than 1.0 m across the wider site area, and localised potential peat stability issues are generally on slopes with shallow peat or non-peat soils. However, within the Proposed Development footprint, with the exception of very localised pockets in some track areas, two key areas were highlighted as having a low hazard rank in terms of slide risk. These were located at proposed turbine no. T13 and T16, a result of deep peat located within areas of non-flat areas, just greater than 2 degrees.

12.1.56. On this basis, in the absence of mitigation, the Proposed Development is considered to result in a potential effect of minor and would therefore not be significant, in accordance with the EIA Regulations.

12.1.57. Good practice measures are embedded in the design principles and adoption of further best practices, as detailed in **Appendix 4.1** Outline Construction Environmental Management Plan (CEMP). These will reduce the effect of peat instability. Steep slopes and deep peat have generally been avoided and there would be further avoidance of the of loading materials on or at top of slopes and the removal of slope support during construction.

Loss and Compaction of Peat and Soils

12.1.58. In its regulatory position statement, SEPA states that "developments on peat should seek to minimise peat excavation and disturbance to prevent the unnecessary production of waste soils and peat". The key items of infrastructure which influence this effect are the dimensions, location and type of new access tracks, turbine base foundations and crane hardstandings. Other features which should also be considered for excavation requirements include borrow pits, substation and temporary construction compound facilities.

12.1.59. While the layout design process has sought to avoid most areas where deep peat is recorded, five turbine and associated crane hardstands are affected by deep peat, following the design exercise. **Appendix 12.2** Outline Peat Management Plan details the volumes estimated for excavated materials and re-use possibilities.

12.1.60. Given the majority of soils being affected by the site are thin deposits, generally classified as either peaty or mineral soils, and, soils would be reinstated fully within the areas of origination, the significance of effects associated with the loss of soils is considered to be minor and not significant, in accordance with the EIA Regulations.

12.1.61. In relation to compaction of soils, investigations at the site have recorded generally thin soil cover, and construction of access tracks and movement of construction traffic, in the absence of construction good practice, could lead to compaction of the soil. This can reduce soil permeability, potentially leading to increased run-off and increased erosion. The superficial soils underlying the Proposed Development is of varying permeability, so the effects of compaction could result in a significant increase in runoff from existing conditions. The total surface area affected by the footprint of the proposed layout equates to approximately 240,000 m^2, just over 3% of the total site area.

12.1.62. Therefore, in the absence of mitigation, the significance of effects associated with the compaction of soils is considered to be minor and not significant, in accordance with the EIA Regulations.

Operational phase

12.1.63. There would be minimal or no impacts upon peat and soils during the operational phase, and significant effects are not anticipated.

Decommissioning Phase

12.1.64. During decommissioning, the bases would be broken out to below ground level. All cables would be cut off below ground level, de-energised, and left in the ground. Access tracks would be left for use by the landowner. No stone would be removed from the Site. The decommissioning works are estimated to take six months. This approach is considered to be less environmentally damaging than seeking to remove foundations, cables and roads entirely.

12.1.65. Therefore, it is considered that decommissioning, activities would be less intrusive and would not disturb peat, therefore no significant effects are anticipated.

Assessment of Cumulative Effects

12.1.66. Geology and peat are considered as a site-specific consideration and it is not considered that there will be cumulative effects.

12.7. Mitigation Measures

12.1.67. The peat disturbance mitigation measures are location-specific and relate to turbine locations and associated infrastructure being within areas of moderate risk. Probing data available indicates that turbines located in areas with peat depths greater than 1 m (i.e. T4, T6, T8, T9, T10, T13 and T16) could be micro-sited within 75 m of the original location, reducing significantly the impact on deep peat and peaty soils.

12.1.68. In relation to peat stability risks, T13 and T16 are indicated as being within the general areas of peat stability risk. Micro-siting of T13 and T16 in line with the approach detailed in section 12.1.68 to minimise disturbance, will mitigate peat stability risk in parallel.

12.1.69. Mitigation proposed at paragraph 12.1.67 states that turbines will be micro-sited outwith the deep peat areas in order to reduce the overall impact on peat and loss of soils. Maintenance of existing drainage is critical to avoid compaction of soils; therefore, all existing drainage network channels would be maintained and, where necessary, channelled below the access track construction drainage ditches on the upslope of the track.

12.1.70. Additional site investigation will be undertaken following forest clearance at turbine locations located within areas of peat.

12.1.71. Slope stability monitoring will occur during pre-construction and construction phases of work, including for both peat stability and non-peat related stability. These would focus on locations highlighted as being of risk as highlighted on the Hazard Risk Zonation Plan, Further peat probing and stability assessments shall be undertaken post-forestry clearance such as at T13 and T16.

12.1.72. Best practice measures for managing excavated peat and peaty soils are detailed in the Outline Peat Management Plan, **Appendix 12.2**.

12.8. Residual Effects

12.1.73. Following incorporation of mitigation measures as detailed on Table 12.6, there will only be one minor residual effect associated with peat disturbance while soil compaction, soil losses and operational and de-commissioning phases will all be negligible.

12.1.74. With the mitigation proposed, the magnitude of effects on peat disturbance can be reduced from moderate to minor, and are therefore not significant in accordance with the EIA Regulations.

12.9. Summary of Effects

12.1.75. This Chapter identified no likely residual significant effects, through inclusion of the measures as outlined in Table 12.6.

Table 12.6: Summary of Effects

Receptor	Potential Effect	Significance of Effect	Mitigation Proposed	Residual Significance
Construction				
Peat and Peaty Soils	Disturbance of peat and peaty soils – Affect carbon-rich and peaty soils; Disturbance to an area <20% of the Development Area, the presence of class 5 peatland areas (carbon rich and peaty soils) Affecting commercial forestry;	Moderate	Micro-siting of turbine locations (T4, T6, T8, T9, T10, T13 and T16) within areas of deep peat up to a maximum distance of 75m. Adoption of best practice measures for dealing with peat excavations, storage and subsequent backfilling.	Minor
Peat and Peaty Soils	Peat Stability - Small loss of soils or peatland, or where soils will be disturbed but the value not impacted	Minor	Micro-siting of turbine locations (T13 and T16) in line with the approach to minimise disturbance will reduce peat stability risks in parallel. Adoption of best practice measures for dealing with peat excavations, storage and	Negligible

Receptor	Potential Effect	Significance of Effect	Mitigation Proposed	Residual Significance
			subsequent backfilling. Additional ground investigations following forestry felling. Slope stability monitoring will occur during pre-construction and construction phases of work.	
Peat and Peaty Soils	Soil Compaction - Impediments to Flow	Minor	Adoption of best practice measures for dealing with peat excavations, storage and subsequent backfilling.	Negligible
Peat and Peaty Soils	Loss of Soils - Acidification as a result of felling	Minor	Adoption of best practice measures for dealing with peat excavations, storage and subsequent backfilling.	Negligible
Operation				
Peat and Peaty Soils	Minimal impact anticipated	Negligible	None	Negligible
Decommissioning				
Peat and Peaty Soils	Works would be less intrusive and not considered to have a significant impact.	Negligible	None	Negligible

Statement of Significance

12.1.76. This Chapter has assessed the likely significance of effects of the Proposed Development on Geology and Peat. Given that only effects of moderate significance or greater are considered significant in terms of the EIA Regulations, the potential effects on Geology and Peat are considered to be not significant.