CHAPTER 11: GEOLOGY AND CARBON BALANCE

Figures (Volume 3)

Technical Appendices (Volume 4)

11. Geology and Carbon Balance

11.1 Executive Summary

11.1.1 The potential impacts of construction and operation of the Proposed Development on geology and carbon balance have been identified and assessed.

11.1.2 Peat deposits are present across the majority of the site. Bedrock across the site comprises the Crom Granodiorite Formation, the Allt Crom Complex, the Garva Bridge Psammite Formation and Loch Laggan Psammite Formation.

11.1.3 Potential effects in relation to geology and carbon balance are most likely during construction and may relate to effects on peat stability and excavation. The results of a peat slide risk assessment have informed the layout design.

11.1.4 Baseline conditions were identified through desk-based assessment, consultation and field survey, including peat depth surveys. The assessment undertaken has identified the presence of sensitive receptors within the Site, namely areas of nationally important carbon rich soils with priority peatland habitat (Class 1 or 2).

11.1.5 As part of the conceptual design, the disruption of peat has been minimised by avoiding areas of thick peat deposits as far as practicable, and the re-use of excavated peat would be maximised in accordance with best practice management.

11.1.6 The potential construction effects identified have been assessed and would not be significant in term of the EIA Regulations.

11.2 Introduction

11.2.1 This Chapter considers the potential effects of Cloiche Wind Farm (hereafter referred to as 'the Proposed Development') on geology and soils. It details the baseline conditions at the Site, followed by the identification and assessment of effects on each receptor, and where relevant, the identification of measures proposed to mitigate potentially significant effects. A carbon balance calculation has also been carried out.

11.2.2 Surveys and assessment methodologies are described and mitigation measures outlined to prevent or reduce identified potential effects.

11.2.3 Planning policies of relevance to this assessment are provided in Chapter 6: Planning Policy of this EIA Report.

11.2.4 The geology (including peat) and carbon balance assessment was undertaken by Mott MacDonald Ltd. The assessors hold professional memberships to the Geological Society of London, with the reviewers both being Chartered Geologists with over ten years' experience.

11.2.5 This Chapter is supported by the following figures:

- Figure 11.1: Solid Geology;
- Figure 11.2 (a)-(m): Peat Depth; and
- Figure 11.3: Carbon and Peatland Classification.

11.2.6 This Chapter is supported by the following appendices:

- Technical Appendix 11.1: Borrow Pit Assessment Report;
- Technical Appendix 11.2: Peat Slide Risk Assessment (PSRA);
- Technical Appendix 11.3: Draft Peat Management Plan (PMP); and
- Technical Appendix 11.4: Carbon Calculation.

11.2.7 Throughout this Chapter, the 'Site' and 'study area' are defined by the area within the site boundary where construction is proposed, i.e. areas of existing infrastructure within the site boundary, including access roads, have not been assessed.

11.3 Scope of Assessment

Effects Assessed in Full

11.3.1 The following effects have been assessed in full in relation to the geological baseline of the Site. The following key issues were identified at the Scoping stage for consideration in the assessment of the baseline condition:

- Direct and indirect potential effects during construction:
  - Excavation, removal and storage of soils and peat; and
  - Impacts on ground conditions.
- Direct and indirect potential effects during operation:
  - Impacts on ground conditions.

Effects Scoped Out

11.3.2 At this stage operational effects, including cumulative operational effects, have been scoped out on the basis that regulatory and good practice measures are implemented

during construction will continue throughout the Proposed Development's operational phase.

11.3.3 The operational effects scoped out include:

- Effects from chemical or hydrocarbon pollution on superficial geology, (excluding peat), peat and soils;
- Effects from erosion and sedimentation on superficial deposits (excluding peat), peat and soils;
- Effects from the loss and compaction of soils on peat and soils; and
- Effects on peat stability.

11.3.4 The potential effects of decommissioning have been scoped out on the basis that the effects would be similar in nature to the construction stage but with a lesser impact, and that the same principals and good practice would be employed.

Study Area

11.3.5 The Proposed Development is located approximately 11km south-east of Fort Augustus on the Glendoe and Garrogie Estates. The study area for this assessment is defined in section 11.2.

Consultation Reponses

11.3.6 In undertaking the assessment, consideration has been given to the Scoping responses and other consultation undertaken as detailed in Table 11.1.

Table 11.1: Consultation Responses

Consultee	Issue Raised	Response / Action Taken
Scottish Government	An assessment of peat landslide risks and details of mitigation measures should be included in the EIA Report including the risk for pollution on watercourses and risk to population, human health and public safety where paths, roadways or properties could be impacted by landslides. Reference 'The Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Developments (Second Edition) http://www.gov.scot/Publications/2017/04/8868	A PSRA has been undertaken (Technical Appendix 11.2) and best practice and mitigation measures are discussed in this Chapter.
Scottish Environmental Protection Agency (SEPA)	The following information should be addressed in the EIA in support of the Proposed Development: a) Map and assessment of all engineering activities in or impacting on the water environment including propose buffers, details of any flood risk assessment and details of any related Controlled Activity Regulations (CAR) applications; b) Map and assessment of impacts upon Groundwater Dependent Terrestrial Ecosystems (GWDTEs) and buffers; c) Map and assessment of impacts upon groundwater abstractions and buffers;	a) Provided in Chapter 10: Hydrology and Hydrogeology b) Provided in Chapter 8: Ecology c) Provided in Chapter 10: Hydrology and Hydrogeology d) Peat depths are indicated on Figure 11.2 and a draft PMP is included in Technical Appendix 11.3.

	d) Peat depth survey and table detailing re-use proposals; e) Map and site layout of borrow pits; and f) Schedule of mitigation including pollution prevention measures.	e) A Borrow Pit Report is included in Technical Appendix 11.1. f) A Schedule of Mitigation is included in Chapter 18: Schedule of Mitigation and includes pollution prevention measures.
	It is important that the initial application is supported by enough peat probing information to inform the layout and should be clearly demonstrated to avoid the areas of deepest peat. The EIA Report must: a) Demonstrate how the layout has been designed to minimise disturbance of peat and consequential release of CO_2; and b) Outline the preventative / mitigation measures to avoid significant drying or oxidation of peat through, for example, the construction of access tracks, drainage channels, cable trenches, or the storage and re-use of excavated peat.	a) Chapter 2: Site Selection and Design Evolution details how the Proposed Development has been designed to minimise disturbance of peat. This has also been addressed within the Design Considerations section of this Chapter. b) Construction methodologies and mitigation measures are described in the PSRA in Technical Appendix 11.2 and Draft Peat Management Plan in Technical Appendix 11.3.
	The submission must include: a) A detailed map of peat depths to full depth and in accordance with 'Guidance on Developments on Peatland - Peatland Survey' (Scottish Government, 2017) with all the built elements (including peat storage areas) overlain to demonstrate how the development avoids areas of deep peat and other sensitive receptors such as GWDTE. 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.	Peat depths are indicated on Figure 11.2 and a draft PMP is included in Technical Appendix 11.3. Impacts on GWDTEs are assessed in Chapter 8: Ecology and Chapter 10: Hydrology and Hydrogeology.
	The information must be in accordance with SEPA's 'Guidance on the Assessment of Peat Volumes, Reuse of Excavated Peat and Minimisation of Waste' and 'Developments on Peat and Off-Site uses of Waste Peat'.	The information presented in this Chapter and its associated appendices is in accordance with the noted guidance.
	Dependent upon the volumes of peat likely to be encountered and the scale of the Proposed Development it must be considered whether a full Peat Management Plan (as detailed in the above guidance) is required or whether the above	A Draft PMP is included in Technical Appendix 11.3.

	information would be best submitted as part of the schedule of mitigation.	
	If new borrow pits are proposed then ground investigation needs to be carried out prior to the application being submitted to ensure that the areas proposed are likely to yield the material required. Specific areas should be identified rather than large areas of search.	Specific areas have been targeted based on site observations, previous use, previous ground investigation data from Stronelairg Wind Farm and topography. A ground investigation will be undertaken at detailed design stage.
	A Site Management Plan should be submitted in support of the application containing the following information 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. It must be demonstrated that a site-specific proportionate buffer can be achieved. On this map, a site-specific buffer must be drawn around each loch or watercourse proportionate to the depth of excavations and at least 10m from access tracks. If this minimum buffer cannot be achieved each breach must be numbered on a plan with an associated photograph of the location, dimensions of the loch or watercourse, drawings of what is proposed in terms of engineering works; c) A justification for the proposed location of borrow pits and evidence of the suitability of the material to be excavated for the proposed use, including any risk of pollution caused by degradation of the rock; d) A ground investigation report giving existing seasonally highest water table including sections showing the maximum area, depth and profile of working in relation to the water table; e) A site map showing cut-off drains, silt management devices and settlement lagoons to manage surface water and dewatering discharge. Cut-off drains must be installed to maximise diversion of water from entering quarry works; f) A site map showing proposed water abstractions with details of the volumes and timings of abstractions; g) A site map showing the location of pollution prevention measures such as spill kits, oil interceptors, drainage associated with welfare facilities, recycling and bin storage and vehicle	a) Maps are included as part of the Borrow Pit Assessment Report in Technical Appendix 11.1. b) Please refer to draft CEMP in Technical Appendix 3.1. c) The suitability of borrow pits is discussed in Technical Appendix 11.1. d) A ground investigation will be undertaken post consent to inform borrow pit design. e) Please refer to draft CEMP in Technical Appendix 3.1. f) Please refer to draft CEMP in Technical Appendix 3.1. g) Please refer to draft CEMP in Technical Appendix 3.1. h) Proposed peat storage areas and dimensions are presented in the PMP in Technical Appendix 11.3. Peat depths are indicated on Figure 11.2. i and j) Indicative borrow pit restoration profiles are provided in the PMP in Technical Appendix 11.3. Further details of phasing and rock processing, etc.,

	washing areas. The drawing notes should include a commitment to check these daily; h) A site map showing where soils and overburden will be stored including details of the heights and dimensions of each store, how long the material will be stored for and how soils will be kept fit for restoration purposes. Where the development will result in the disturbance of peat or other carbon rich soils then the submission must also include a detailed map of peat depths (this must be to full depth and follow the survey requirement of the 'Developments on Peatland - Peatland Survey (Scottish Government, 2017)) with all the built elements and excavation areas overlain so it can clearly be seen how the development minimises disturbance of peat and the consequential release of CO_2; i) Sections and plans detailing how restoration will be progressed including the phasing, profiles, depths and types of material to be used; and j) Details of how the rock will be processed in order to produce a grade of rock that will not cause siltation problems during its end use on tracks, trenches and other hardstanding.	will be provided post-consent.
Scottish Natural Heritage (SNH)	The latest guidance from SNH for wind farm developments should be followed. Of relevance to geology and soils, this includes guidance in relation to developments on peatlands and carbon rich soils.	The most recent guidance has informed this assessment and the undertaking of site surveys.
	The Applicant needs to demonstrate through the EIA Report and draft Construction Method Statement that a wind farm can be built on this site without significant loss and damage to carbon rich soils, deep peat and priority peatland habitat. Refer to: - Scottish Planning Policy – especially Table 1 and Paragraph 205; - Scottish Government's Climate Change Plan; - Scottish Government's Draft Peatland and Energy Policy Statement; - Scotland's National Peatland Plan; and - Carbon and Peatland 2016 Map.	The presence of peat and carbon rich soils has been considered in the development of the layout design. The noted guidance documents have been referred to in the preparation of this Chapter.
Royal Society for the Protection of Birds (RSPB)	The carbon calculator should be used as early as possible in the planning process, to inform siting and micrositing of both turbines and tracks and other infrastructure, and not simply undertaken after the site layout has been determined. This must be clearly addressed in the EIA Report which should also include all the information input into the model. RSPB Scotland considers that the maximum payback period should be six months as a maximum and should ideally be as close to zero as possible.	The carbon balance calculation has been undertaken as reported in (Technical Appendix 11.4).

	The Proposed Development should achieve 'no net loss' of peatland, firstly through avoiding deep peat disturbance and secondly through commitments to restoration. A suitable area of modified blanket bog should be identified and restored as compensation for the loss of any functioning blanket bog. There are large areas within the proposed wind farm site where the peat is currently dissected by deep gullies that the applicant could consider restoring to blanket bog.	Please refer to Technical Appendix 8.6: Outline Habitat Management Plan.

11.4 Legislation, Policy and Guidance

11.4.1 The following legislation, policy and guidance documents have been taken into account in the preparation of this Chapter:

- Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017;
- Scottish Planning Policy (Scottish Government, 2014); and
- All other publications as listed in section 11.4.2.

11.4.2 This assessment is carried out in accordance with the principles contained within the following documents:

- Scottish Renewables (2019) Good Practice During Windfarm Construction 4th Edition (co-authored by Scottish Natural Heritage, Scottish Environment Protection Agency, Forestry Commission Scotland, and Historic Environment Scotland);
- Scottish Government (2018) Carbon Calculator for Wind Farms on Scottish Peatlands;
- Scottish Government (2017) Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Developments;
- Scottish Government (2017) Guidance on Development on Peatlands: Peatland Survey; and
- SEPA (2012) Guidance on the Assessment of Peat Volumes, Reuse of Excavated Peat and Minimisation of Waste.

11.5 Methodology

Desk Based Research and Data Sources

11.5.1 The following data sources have informed the baseline of the geological assessment:

- British Geological Survey (BGS) mapping;
- British Geological Survey Onshore GeoIndex;
- The Coal Authority Interactive Map;
- SEPA / SNH Scotland's Soils Scotland Environment Map;
- Ordnance Survey mapping; and
- National Library of Scotland Map Images.

11.5.2 Additional data sources are included in individual technical appendices.

Field Survey

11.5.3 Site reconnaissance, including inspection of potential borrow pit locations and two phases of peat depth surveys were completed between March and November 2019.

11.5.4 The surveys focused on undertaking initial and detailed peat probing to feed into the layout constraints for both peat depth and stability and identifying appropriate locations for borrow pits.

Assessing Significance

11.5.5 The predicted significance of the effect was determined through a standard method of assessment based on professional judgement, guidance documents and best practice documents, taking account of three key factors:

- Sensitivity of the receiving environment;
- Potential magnitude of the effect; and
- Probability of the effect occurring.

Sensitivity

11.5.6 The receptor sensitivity represents its ability to absorb the anticipated impact without perceptible change resulting. Three levels of sensitivity have been used as shown in Table 11.2. Evaluation of sensitivity of geology and soils requires a considerable degree of judgement, based on defined characteristics and values and calling on professional experience, which is accordingly applied during evaluation.

Table 11.2: Geology Receptor Sensitivity

Receptor Sensitivity	Criteria
High	Receptor is a designated site protected under national or international legislation, such as Sites of Special Scientific Interest (SSSI), Special Areas of Conservation (SAC), and Special Protection Areas (SPA), for the disciplines assessed in this Chapter; Receptor contains Geological Conservation Review (GCR) sites designated as SSSIs or Candidate SSSIs; Receptor contains geological or geomorphological features considered to be of national importance, i.e. SSSI; and / or Receptor contains areas of nationally important carbon rich soils with priority peatland habitat, i.e. Class 1 or 2.
Medium	Receptor has areas containing geological features of Regionally Important Geological and Geomorphological Sites (RIGS) considered worthy of protection for their research, educational, historic importance; and / or Receptor has areas of soils with peatland vegetation, i.e. Class 3 and 4.
Low	Receptor contains geological features not currently protected and not considered worthy of specific protection; Receptor contains areas of soils that do not support peatland vegetation or mineral soils, i.e. Class 5 and 0; and / or Receptor has areas of already altered geology / soils i.e. within quarries and areas of no soil.

Magnitude

11.5.7 The magnitude of change has been assessed by the criteria presented in Table 11.3. The magnitude of the impact takes into account the timing, scale, size and duration of the potential effect.

Table 11.3: Magnitude of Change

Magnitude	Criteria
High	Long-term (≥12 months) or permanent loss of resource; and / or Partial loss of, or damage to, key characteristics, features or elements.
Medium	Mid-term (≥6 months) measurable change in attributes, quality or vulnerability; Minor loss of, or alteration to, one or more key characteristics, features, elements or temporary loss of resource and / or quality; and / or Partial loss of, or damage to, key characteristics, features or elements.
Low	Short-term (≥1 month) minor loss or detrimental alteration to one or more characteristics, features or elements or temporary measurable change in attributes, quality or vulnerability; and / or Minor loss of, or alteration to, one or more key characteristics, features or elements.
Negligible	Temporary very minor loss, or no loss, or detrimental alteration to one or more characteristics, features or elements.

Significance

11.5.8 The predicted significance of the effect was determined through a standard method of assessment based on professional judgement, considering both sensitivity and magnitude of change as detailed in Table 11.4 below. Major and Moderate effects are considered significant in the context of the EIA Regulations.

11.5.9 The probability of occurrence of an effect has been evaluated as being high (≥50%), medium (<50% and ≥20%) or low (<20%) during the phase of work being assessed.

11.5.10 The application of good practice and mitigation measures greatly reduce the probability of an effect occurring.

Table 11.4: Significance Criteria

Sensitivity	Magnitude	Probability	Significance of Effect
High	**Major**	High	Major
		Medium	Major
		Low	Moderate
	Moderate	High	Moderate
		Medium	Moderate
		Low	Minor
	Minor	High	Minor
		Medium	Minor
		Low	Minor
	Negligible	High	Minor

Sensitivity	Magnitude	Probability	Significance of Effect
		Medium	Negligible
		Low	Negligible
Medium	**Major**	High	Major
		Medium	Moderate
		Low	Minor
	Moderate	High	Moderate
		Medium	Minor
		Low	Minor
	Minor	High	Minor
		Medium	Minor
		Low	Negligible
	Negligible	High	Negligible
		Medium	Negligible
		Low	Negligible
Low	**Major**	High	Moderate
		Medium	Minor
		Low	Negligible
	Moderate	High	Minor
		Medium	Minor
		Low	Minor
	Minor	High	Minor
		Medium	Negligible
		Low	Negligible
	Negligible	High	Negligible
		Medium	Negligible
		Low	Negligible

Assessment Limitations

11.5.11 Peat probing works were undertaken using hand-held Global Positioning System (GPS) units which were noted to be accurate to <3m.

11.5.12 Peat probing represents a record of peat depth at a discrete location. A depth auger was used to characterise the nature of the peat (i.e. moisture, fibrous content) as well as depth.

11.6 Baseline

11.6.1 This section describes the current baseline environmental conditions of the Site in relation to geology.

Site History and Land Use

11.6.2 A review of historical maps indicates the study area has remained largely undeveloped, comprising open grazing moorland. Stronelairg Wind Farm is situated between the eastern and western clusters of the Proposed Development, and Glendoe Hydroelectric Scheme is located to the west.

Geology

Solid Geology

11.6.3 The BGS GeoIndex viewer 1:50,000 solid geological mapping indicates that solid geology is varied throughout the Site; predominantly comprising Neoproterozoic metamorphosed rock sequences, as shown on Figure 11.1.

11.6.4 The eastern cluster is underlain by the Allt Crom Granodiorite Formation; granodiorite with abundant rafts of psammite, appinitic diorite and semi-pelite. Granodiorite is an intrusive igneous rock which has penetrated the host sedimentary rocks (psammite – sandstone (and semi-pelite – mudstone)) which have in turn undergone periods of metamorphism and deformation. Similarly, the south-east section of the western cluster is underlain by Granodiorite of the Allt Crom Complex.

11.6.5 The western cluster is generally underlain by metamorphic sequences of the Garva Bridge Psammite Formation and Loch Laggan Psammite Formation. The predominant rock type in these formations is pebbly and micaceous psammite (metamorphosed sandstone) occasionally interbedded with semi-pelite (finer grained metamorphosed sediments).

11.6.6 During the site reconnaissance, psammite outcrops were observed in the south-west area of the Site around turbines C15 and C16.

11.6.7 A Borrow Pit Assessment Report (Technical Appendix 11.1) completed for the Proposed Development was informed by assessment of nine potential borrow pit areas identified at the Site, including three borrow pits utilised at the Stronelairg Wind Farm site. This concludes that potential rock resources that can be won from the search areas are granodiorite, psammite and semi-pelite.

Superficial Geology

11.6.8 The 1:50,000 BGS Superficial Geology Map from the BGS Onshore GeoIndex Viewer (Reference 2) indicates variable superficial geology across the Site, with some areas underlain by Glacial Till (Diamicton) and localised alluvial deposits comprising clay, silt, sand and gravel indicated within the vicinity of watercourses. Peat is shown predominantly in the north of the western cluster; however, it is understood that detailed superficial mapping has not been undertaken in the area and more widespread peat is known to occur. Superficial cover is indicated to be absent in some areas, suggesting that bedrock is at or close to the surface in these localities, notable in the south-west of the western cluster.

Peat

11.6.9 Peat depth probing surveys were completed at the Site between April and November 2019 to inform the iterative design of the Proposed Development and the results are summarised in the PSRA Report (Technical Appendix 11.2) and PMP (Technical Appendix 11.3). A significant volume of peat probing data was also available from nearby developments and this was considered in the assessment.

11.6.10 Peat depths were found to vary across the Site, but the majority of peat was found to be less than 1.0m depth (66%). 273 peat depth probes encountered peat of greater than 2.0m depth out of a total of 3,188 probes undertaken (less than 9%). Peat Depths are shown on Figure 11.2 (a)-(m).

11.6.11 A Qualitative Risk Assessment (QRA) was undertaken to determine the baseline peat stability conditions within the development area of the Proposed Development. The QRA approach is based on a system where factors and influences are multiplied together to generate Risk Rating Scores and corresponding qualitative relative risks. The QRA methodology is described in more detail in the PSRA (Technical Appendix 11.2).

11.6.12 The baseline assessment found that the risk of peat slide events occurring would be Very Low to Low, with localised areas of the Site indicated to have Medium risk. The rating of Medium was based on the following factors: peat depths were found to be relatively thick (typically between 1 to 2m, locally greater than 2m), on moderately sloping ground (6 – 10°) that was found to be saturated / boggy ground within an area where both convex and concave changes in slope are present (i.e. topographic saddle). Evidence of instability was also noted in the form of peat hags.

11.6.13 As part of the PSRA, changes to the baseline peat stability conditions from the construction of floating tracks was assessed using Quantitative Slope Stability Analysis (based on the infinite slope model). Details of the methodology and assumptions made for the parameters used in the infinite slope stability analysis are provided in the PSRA. Using both engineering judgement and the findings of the slope stability analysis, risks from peat instability during the construction of the Proposed Development are considered to remain Low to Very Low, provided recommendations and constraints described in the PSRA are followed.

11.6.14 The Scotland's Soils Scotland Environment Map, Carbon and Peatland data set has been developed, presenting soil classes of importance of environmental interest. The classes have been derived using a matrix of soil carbon categories (derived from Soil Survey of Scotland maps) and peatland habitat types (derived from Land Cover of Scotland 1988 map). Class 1 and 2 soils are considered priority peatland. On the basis of this mapping, as shown in Figure 11.3:

- The north-west area of the Site is predominantly Class 1 soils;
- The south-west area of the Site comprises Class 1 soils adjacent to the existing Stronelairg Wind Farm and to the south, with Class 0 soils in between. Areas of Class 5 and -2 soils are present in the far south; and
- The east of the Site is comprised predominantly Class 1 soils, with areas of Class 2, 3 and 5 soils to the south, Class 5 soils around turbine C34 and Class 3 and 5 soils to the north.

11.6.15 The presence of priority Class 1 and Class 2 peatland habitat soils places the Site within Group 2 of the Scottish Government planning policy category, where wind farms may be appropriate in some circumstances.

Mining and Quarrying

11.6.16 The Site is not located within a Coal Authority reporting area.

11.6.17 Existing and restored borrow pits used as part of Stronelairg Wind Farm are located within the Site boundary and are proposed to be reused as part of the Proposed Development.

11.6.18 No known quarries are located within the Site.

Designated Sites

11.6.19 No RIGS, SSSI or other sites of geological importance are present within the Site or within or in the vicinity (within 5km).

Carbon Balance

11.6.20 An assessment of the carbon impact of the Proposed Development has been carried out using the SEPA Carbon Calculator Tool v1.6.0[1]. The summarised results are as follows:

11.6.21 The net emissions of carbon dioxide from the project are expected to be 402,550 tonnes of CO_2e. Because the project is expected to generate over 21 million MWh of electricity over its 50-year lifetime, this represents a savings of carbon dioxide for each unit of electricity generated by the project which otherwise would have been generated by other sources. Once the wind farm is operational, it is expected to result in an annual savings of 107,478 tonnes of CO_2e versus grid-mix electricity generation. As such, the project has a payback time of 3.7 years compared to grid-mix electricity generation. These savings are even greater (and payback time faster) when compared to fossil fuel-mix electricity and coal-fired electricity. The project is expected to provide electricity at a ratio of 19.00 gCO_2e/kWh. All values described here are for the expected scenario. Full details on the results for all three scenarios (expected, minimum, and maximum) are available in Technical Appendix 11.4.

11.7 Design Considerations

11.7.1 The following constraints were considered in the design of the Proposed Development:

- Identification of areas of deep peat to protect from physical damage, minimise excavation and transportation of peat (including use of floating roads), reduce potential for peat instability and minimise potential soil carbon loss; and
- Identification of areas with slope angles greater than 8˚, to minimise soil loss and potential instability.

Micrositing

11.7.2 A micrositing allowance of 50m for infrastructure will allow potential effects on geology, including peat, to be considered during detailed design.

11.8 Potential Effects

11.8.1 The assessment of effects is based on the Proposed Development description as outlined in Chapter 3: Description of Development. Unless otherwise stated, potential effects identified are considered to be adverse. Assessments are based on the criteria for sensitivity, magnitude, probability and significance provided in Section 11.4 of this Chapter.

11.8.2 The assessment assumes the integral good practice measures in relation to design and construction methodologies are employed. Such measures are discussed further in the

[1] Scottish Government. Carbon Calculator Tool v1.6.0. Available online at https://informatics.sepa.org.uk/CarbonCalculator/

technical appendices and highlighted in Table 11.6 and will be incorporated in the Draft Construction Environment Management Plan (CEMP) (see Technical Appendix 3.1).

11.8.3 Mitigation is considered as additional measures beyond the design principles and good practice; the application of such measures are separately noted and residual effects evaluated.

Sensitivity Assessment

11.8.4 Table 11.5 summarises the geology related existing conditions of the Site and assesses the sensitivity based on the requirements in Table 11.2.

Table 11.5: Sensitivity Assessment

Receptor	Description	Sensitivity
Solid Geology	No designated sites relating to solid geology.	Low
Superficial Geology (excluding Peat)	No designated sites relating to mineral soils.	Low
Peat	Site predominantly Class 1 and 2 peatland habitat soils.	High

Construction Effects

11.8.5 Potential construction effects are outlined in Table 11.6.

Table 11.6: Predicted Construction Effects in Relation to Geology

Potential Construction Effects	Sensitivity of Receptor	Relevant Best / Good Practice	Probability of Change	Magnitude of Change	Significance of Effect
Construction in peat areas may cause overloading and compaction of peat deposits, increasing the risk of peat slides or collapse of the internal peat structure with potential effects on the hydrological regime of relatively large areas. The risk of peat slide has been assessed as Very Low to Low.	High	PSRA (Technical Appendix 11.2) CEMP (Technical Appendix 3.1) Regular inspections of peat stability by an engineering geologist throughout construction Minimisation of additional loading on peat	Low	Moderate	Minor
Active or passive dewatering of peat deposits during construction may degenerate the structure of the peat by decreasing its water content, making it more susceptible to erosion.	High	CEMP (Technical Appendix 3.1) SEPA Guidance on the Assessment of Peat Volumes, reuse of Excavated Peat and the Minimisation of Waste	Medium	Minor	Minor
Excavation or disturbance of peat may also lead to disposal and have implications in terms of carbon balance.	High	Carbon Balance Calculation (Technical Appendix 11.4) PMP (Technical Appendix 11.3) SEPA Guidance on the Assessment of Peat Volumes, reuse of Excavated Peat and the Minimisation of Waste Minimisation of peat excavation through investigation / design / micrositing	Medium	Minor	Minor
Erosion can be caused by stripping of vegetation, excavations, ground disturbance, installation of drainage ditches and construction of access tracks. Mineral soils are expected to be thin, therefore the potential risk of erosion / instability is low.	Low	CEMP (Technical Appendix 3.1) Drainage design to minimise impact	Medium	Moderate	Minor
Activities interacting with bedrock such as blasting have the potential to increase fracturing.	Low	Planning Advice Note (PAN) 50 Annex D 'The Control of Blasting at Surface Mineral Workings (Scottish Executive, 2000) BS5607 'Code of practice for the safe use of explosives in the construction industry Trial Blasts	Medium	Minor	Negligible

11.9 Mitigation

11.9.1 Specific mitigation measures would not be required as the significance of effect for all potential effects would be Minor or Negligible, and thus **not significant**.

11.10 Residual Effects

11.10.1 As no specific mitigation measures are required, no residual effects on geology or soils would be associated with the Proposed Development.

11.11 Cumulative Effects

Construction

11.11.1 It is considered that the cumulative effect of the neighbouring Dell Wind Farm (consented) and Glenshero Wind Farm (proposed) on geology will remain Minor assuming similar best / good practice measures are employed in the construction of the Proposed Development.

11.12 Conclusion

Further Survey Requirements and Monitoring

11.12.1 Intrusive ground investigation is required to be completed within critical areas at the Site, i.e. turbine foundations, crane hardstandings, laydown and borrow pit areas to inform civil design, quantify borrow pit resource and finalise the Peat Management Plan.

Summary of Significant Effects

11.12.2 The potential construction effects identified are considered to be Minor and are therefore not considered significant in the context of the EIA Regulations.

11.13 References

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