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Chapter 10: Geology and Soils

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INDEX

10 GEOLOGY AND SOILS

10.1 Introduction

10.1.1.1 This Chapter of the Environmental Impact Assessment (EIA) Report (EIAR) presents an assessment of the potential significant impacts to the geology and soils environment associated with the construction, operation and decommissioning of the Proposed Development, as described in **Volume 1 Chapter 3: Development Description.**

10.1.1.2 Where likely significant effects are predicted, appropriate mitigations measures are proposed and the significance of predicted residual effects are assessed.

10.1.1.3 This Chapter includes the following elements:

- Scope of Assessment and Methodology;
- Baseline Conditions;
- Assessment of Likely Significant Effects;
- Cumulative Effects;
- Mitigation;
- Residual Effects; and
- Summary and Conclusions.

10.1.1.4 This Chapter is supported by the following figures, found within **Volume 2a**:

- Figure 10.1: Site Plan;
- Figure 10.2: Superficial Geology;
- Figure 10.3: Bedrock Geology;
- Figure 10.4: National Soils Map of Scotland; and
- Figure 10.5: Carbon and Peatland Map.

10.1.1.5 This assessment uses information and findings presented in **Chapter 8: Ecology and Nature Conservation.**

10.1.1.6 In addition, this Chapter refers to **Technical Appendix 3.1: outline Construction Environmental Management (oCEMP)**, which details good construction practice measures and works that are established and effective measures to which the Applicant will be committed through the planning consent.

10.2 Scope of Assessment and Methodology

10.2.1.1 The potential effects of the Proposed Development on the geology and soils environment have been assessed through completion of a desk study and an impact assessment across the Proposed Development.

10.2.1.2 The following terms are used within this Chapter to describe the Proposed Development:

- Proposed Development – the physical process involved in the development, construction and operation of the Solar Farm and associated Battery Energy Storage System;
- The Site - all land within the proposed red line boundary, as shown in **Figure 10.1**; and
- Study Area - a defined area for the consideration of environmental effects (including direct, indirect and cumulative) on each relevant factor listed under Regulation 4(3) of the EIA Regulations.

10.2.1.3 **Figure 10.1** details the Proposed Development location and boundary.

10.2.1.4 The Proposed Development site will extend to a total area of 184 hectares. The solar will have a generating capacity of up to approximately 165MW (AC). The Battery Energy Storage System (BESS) will be comprised of up to 40 BESS units with a capacity of up to 80MW.

10.2.2 Legislation, Policy and Guidance

10.2.2.1 Relevant policy and guidance documents have been reviewed and considered as part of this assessment.

Planning Policy

10.2.2.2 The National Planning Framework 4 (NPF4)[1], adopted by the Scottish Government on 13 February 2023, provides planning guidance and policies regarding sustainable development. The NPF4 outlines how nationally important land use planning matters should be addressed.

10.2.2.3 Policy 5 within the NPF4 details the approach to soils:

10.2.2.4 "Development proposals will only be supported if they are designed and constructed:

- *In accordance with the mitigation hierarchy by first avoiding and then minimising the amount of disturbance to soils on undeveloped land; and*
- *In a manner that protects soil from damage including from compaction and erosion, and that minimises soil sealing.*

1 The Scottish Government (2024) National Planning Framework 4 [Online] Available at: National Planning Framework 4 (www.gov.scot) [Accessed March 2025]

10.2.2.5 Development proposals on prime agricultural land, or land of lesser quality that is culturally or locally important for primary use, as identified by the LDP, will only be supported where it is for:

- *Essential infrastructure and there is a specific locational need and no other suitable site;*
- *Small-scale development directly linked to a rural business, farm or croft or for essential workers for the rural business to be able to live onsite;*
- *The development of production and processing facilities associated with the land produce where no other local site is suitable;*
- *The generation of energy from renewable sources or the extraction of minerals and there is secure provision for restoration; and*
- *In all of the above exceptions, the layout and design of the proposal minimises the amount of protected land that is required."*

10.2.2.6 In addition, Policy 9 within the NPF4 details the approach to potential brownfield sites and contaminated land:

"Where land is known or suspected to be unstable or contaminated, development proposals will demonstrate that the land is, or can be made, safe and suitable for the proposed new use."

Guidance, Standards and Legislation

10.2.2.7 The following guidance and legislation is relevant to this Chapter:

- NatureScot (2022) General Pre-Application Guidance for Solar Farms[2];
- The Scottish Government (2009) The Scottish Soil Framework[3];
- The Scottish Office (1996) Planning Advice Note (PAN) 50 – Controlling the Environmental Effects of Surface Mineral Working[4];
- Construction Industry Research and Information Association (CIRIA) (2023) C741 Environmental Good Practice on Site[5];
- The Waste Management Licensing (Scotland) Regulations 2011[6];

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2 NatureScot (2022) – General pre-application and scoping advice for solar farms [Online]. Available at: General pre-application and scoping advice for solar farms | NatureScot [Accessed March 2025]
3 The Scottish Government (2009) The Scottish Soil Framework [Online]. Available at: http://www.gov.scot/Publications/2009/05/20145602/0 [Accessed March 2025].
4 The Scottish Office (1996) Planning Advice Note (PAN) 50 – Controlling the Environmental Effects of Surface Mineral Working. [Accessed March 2025].
5 CIRIA (2023) Environmental Good Practice on Site Guide (Fifth Edition) [online]. Available at: https://www.ciria.org/ItemDetail?iProductCode=C811D&Category=DOWNLOAD&WebsiteKey=3f18c87a-d62b-4eca-8ef4-9b09309c1c91 [Accessed March 2025]
6 Scottish Government 2011, The Waste Management Licensing (Scotland) Regulations 2011. https://www.legislation.gov.uk/sdsi/2011/9780111012147/contents. [Accessed March 2025]

- BS 10175:2011+A2:2017 (2017) "Investigation of potentially contaminated sites. Code of practice"[7]; and
- CIRIA:C552 (2001) – Contaminated Land Risk Assessment – a guide to good practice[8].

10.2.3 Scoping and Consultation

10.2.3.1 To inform the scope of the assessment for the Proposed Development, consultation was undertaken with statutory and non-statutory bodies through early consultation and a formal EIA scoping process

10.2.3.2 Full details of the consultation process and responses are included in **Chapter 4: EIA Methodology.**

10.2.3.3 Specific scoping responses, relevant to the geology and soils environment, are provided in **Table 10.1**.

[7] BS 10175:2011+A2:2017 (2017) "Investigation of potentially contaminated sites. Code of practice". British Standards Institution. [Accessed March 2025].
[8] CIRIA (2001) – CIRIA:C552 Contaminated Land Risk Assessment – a guide to good practice. [Accessed March 2025].

TABLE 10.1 SCOPING CONSULTATION RESPONSES

CONSULTEE	TYPE AND DATE	SUMMARY OF CONSULTATION RESPONSE	EIA/DESIGN RESPONSE TO CONSULTEE
East Lothian Council	Scoping Response 7th January 2025	The Council has data from a Phase 1 habitat survey carried out in the late 1990s which shows some areas of wet woodland habitat within the Proposed Development, that can sometimes be peat forming.	A UK Habitat Classification Survey has since been undertaken by the ERM Ecology team. Results from these surveys found no habitats associated with National Vegetation Classification (NVC) communities that are indicative of potential peatland and that the Site was predominantly modified grasslands, arable fields and grazing pastures with some small areas of broadleaved woodland. These site surveys confirmed the absence of peatland across the Site, therefore, peat assessments were scoped out of this EIA. Full Habitat Survey results are included in **Chapter 8, Technical Appendix 8.1: Habitat Survey Report**.
		The Council is not aware of any specific contaminated land issues. We note that a Contaminated Land Desktop Study is to be included in the EIAR and this will inform any requirement for an intrusive site investigation and subsequent geo-environmental assessment.	Contaminated Land Assessment included in **Section 10.3** of this Chapter.
		The EIAR should consider the effect on use of soil for agricultural purposes. This should take into account potential effects of unavoidable climate change, which may have the effect of improving the range of crops that can be grown on some land.	It is anticipated that the Proposed Development, through implementation of good practice measures and the detailed mitigation outlined within Technical **Appendix 3.1: oCEMP**, will not significantly impact the surrounding soils used for agricultural purposes. The effect on agricultural land has been considered in **Chapter 13: Socioeconomics**.
		Site designated for geology are not mentioned in the Scoping Report. It is unlikely any of these sites would	Geological designated sites have been considered within **Section 10.3** of this Chapter, and none have been identified across the Site.

CONSULTEE	TYPE AND DATE	SUMMARY OF CONSULTATION RESPONSE	EIA/DESIGN RESPONSE TO CONSULTEE
		be affected by the proposal but a brief note that they have been considered should be included.	
Energy Consents Unit (ECU)	Scoping Opinion 29th January 2025	Scottish Ministers consider that there is a requirement for peat landslide hazard and risk assessment (PLHRA). Where a PLHRA is not required clear justification for not carrying out such a risk assessment is required.	Assessment of desk-based sources and the UK Habitat Classification Survey results indicate that there is no evidence of peat across the Site. Therefore, the assessment of peat (and the associated PLHRA and PMP) has been excluded from this Chapter.
Scottish Environment Protection Agency (SEPA)	Scoping Response 10th December 2024	To avoid delay and potential objection the EIA submission must contain a series of scale drawings of sensitivities, including peat depth survey maps with probe locations and peat depth interpolation. The detailed series of layout drawings above should demonstrate that development proposals avoid any near natural peatland and all excavation is on peat less than 1m deep.	Assessment of desk-based sources and the UK Habitat Classification Survey results indicate that there is no evidence of peat across the Site. Therefore, the assessment of peat (and the associated PLHRA and PMP) has been excluded from this Chapter.
		SEPA note that impacts on peat are scoped out of further assessment and that the justification for this relies on the Carbon and Peatland Map (2016) showing no Class 1 or Class 2 peatland within 500m of the site. We are of the view that currently, insufficient information has been provided to support this topic being scoped out of EIAR. High resolution (phase 1) peat probing must be carried out in order to determine whether peat or other carbon-rich soils (as defined in NPF4) are present on site.	A UK Habitat Classification Survey has since been undertaken by the ERM Ecology team. Results from these surveys found no habitats associated with National Vegetation Classification (NVC) communities that are indicative of potential peatland and that the Site was predominantly modified grasslands, arable fields and grazing pastures with some small areas of broadleaved woodland. These site surveys confirmed the absence of peatland across the Site. Therefore, using the survey results in addition to the evidence from desk-based resources, peat probing is not deemed necessary and peat assessments will not be undertaken as part of this Chapter.
		The Outline Peat Management Plan (PMP) must include volumes of acrotelmic, catotelmic and	Assessment of desk-based sources and UK Habitat Classification Survey results indicate that there is no

CONSULTEE	TYPE AND DATE	SUMMARY OF CONSULTATION RESPONSE	EIA/DESIGN RESPONSE TO CONSULTEE
		amorphous peat to be excavated, details of temporary storage and handling of peat.	evidence of peat across the Proposed Development. Therefore, the assessment of peat (and the associated PLHRA and PMP) has been excluded from this Chapter.
	Response to Further Consultation 16th May 2025	Habitat maps provided by ERM do not show any habitats associated with peat formation, and therefore SEPA accept the scoping out of peat from the assessment. The site is predominantly grassland which is considered to be a carbon store however on the basis that values from Scotland's Soil indicate topsoil organic carbon concentration to be less than 7% on the site we are also content for Carbon Rich Soils to be scoped out.	Response Noted. No further action required.

* Further consultation was undertaken with SEPA on the 4th March 2025 regarding the exclusion of peat assessments and peat probing surveys, seeking confirmation that the proposed justification is appropriate. The consultation included the UK Habitat Classification Survey Results collected. These results, in addition to the desk-based resources, all confirmed that peat is absent across the Site and that further assessment is not considered to be required. As detailed in Table 10.1, SEPA responded on 16th May 2025 with acceptance of this approach and acknowledged that peat and carbon-rich soils are scoped out of this assessment.

10.2.4 Potential Impacts Assessed in Full

10.2.4.1 The following effects on geology and soils related to the Proposed Development are considered within this Chapter due to the potential for significant effects as agreed during the consultation and scoping process:

- Potential effects relating to loss and compaction of soils;
- Potential effects relating to soil as waste material;
- Potential effects relating to the potential contaminated land associated with former land uses and coal mining; and
- Potential effects relating to bedrock geology.

10.2.4.2 The effects of the Proposed Development on agricultural land have been considered in **Chapter 13: Socioeconomics**.

10.2.5 Issues Scoped Out of Assessment

10.2.5.1 The following effects have been scoped out of the assessment:

- Potential effects relating to the disturbance of peat and the subsequent effects from excavated peat and management of peat and peaty soils;
- Potential effects relating to the peat instability and peat slide risk;
- Potential effects relating to geological statutory designations;
- Potential transboundary effects; and
- Potential effects relating to the cumulative impact during construction and operation.

10.2.5.2 As detailed previously in **Table 10.1**, UK Habitat Classification surveys have been undertaken (see **Chapter 8, Technical Appendix 8.1: Habitat Survey Report**). The results of these surveys found no habitats that are associated with NVC communities that are indicative of potential peat-forming habitats. The habitats identified across the Site were predominantly modified grasslands, arable fields and grazing pastures with some small areas of broadleaved woodland. These site surveys did not identify any areas of peatland or peat-forming habitats/vegetation. In addition, further review of desk-based resources across the Site (2016 Carbon and Peatland Map[9], Scottish Soils Mapping[10] and British

[9] Scottish Natural Heritage, Carbon Peatland Map 2016, available at https://soils.environment.gov.scot/maps/thematic-maps/carbon-and-peatland-2016-map/ [Accessed March 2025]
[10] James Hutton Institute, National soil map of Scotland, available at: https://soils.environment.gov.scot/maps/ [Accessed March 2025]

Geological Society[11]) indicate that the Site is underlain by mineral soils and/or brown earths and that no peat is anticipated to be present across the Site.

10.2.5.3 Therefore, using the information and resources detailed above, the assessment of peat is excluded from this Chapter and no peat focused assessments will be undertaken across the Site (i.e. Peat Landslide Hazard and Risk Assessment and an outline Peat Management Plan).

10.2.5.4 In addition, cumulative impacts relating to adjacent developments have been scoped out of this assessment. Geology and soils are considered to be site-specific, localised receptors which are not influenced by external factors in the surrounding area. Therefore, cumulative developments will not affect the geology and soils across the Site.

10.2.6 Desk Study

10.2.6.1 A review of baseline data has been undertaken using publicly available information and open-source data from a range of sources to evaluate potential short- and long-term impacts that the Proposed Development may have on the geological environment.

10.2.6.2 The data review included:

- Ordnance Survey (OS) 1:50,000 and 1:25,000 scale mapping;
- NatureScot (formerly Scottish National Heritage (SNH)) SiteLink[12];
- British Geological Survey (BGS) Onshore GeoIndex[11];
- Scotland's Environment web-based maps[13];
- NatureScot (formerly Scottish National Heritage (SNH)) Carbon and Peatland 2016 Map[9;]
- James Hutton Institute, The National Soils Map of Scotland (1:250,000)[10];
- The Coal Authority Interactive Map[14];
- Zetica Unexploded Ordnance (UXO) Desk Study & Constraints Assessment[15];

[11] British Geological Survey GeoIndex (onshore), available at https://www.bgs.ac.uk/map-viewers/geoindex-onshore/ [Accessed March 2025]
[12] Nature Scot SiteLink, available at https://sitelink.nature.scot/home [Accessed March 2025]
[13] Scotland's Environment (various) Scotland's Environment Web Map, available at: https://www.environment.gov.scot/ [Accessed March 2025]
[14] Coal Authority Interactive Map (2024), available at: https://datamine-cauk.hub.arcgis.com/ [Accessed March 2025]
[15] Zetica UXO (2024), available at: https://zeticauxo.com/guidance/risk-maps/ [Accessed March 2025]

- National Library of Scotland Historical Maps[16];
- Argyll Environmental Site Solutions Report[17]; and
- Landmark Envirocheck Report[18].

10.2.7 Methodology for the Assessment of Effects

10.2.7.1 The assessment of effects is based on the Proposed Development design detailed in **Chapter 3: Development Description**. The assessment considers the sensitivity of the receptor and the potential magnitude of impact to conclude whether the effect is significant.

Sensitivity of Receptors

10.2.7.2 The sensitivity of the baseline conditions, including the importance of environmental features on or near to the Proposed Development of the sensitivity of potentially affected receptors, was assessed in line with best practice guidance, legislation, statutory designations and professional judgement.

10.2.7.3 **Table 10.2** details the framework for determining the sensitivity of receptors.

TABLE 10.2 FRAMEWORK FOR DETERMINING THE SENSITIVITY OF RECEPTORS

SENSITIVITY OF RECEPTOR	DEFINITION
Very High	The receptor has little or no ability to absorb change without fundamentally altering its present character, is of very high environmental value, or of international importance.
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 cover >20% of the development area; Areas containing geological or geomorphological features considered to be of national importance (e.g., geological SSSIs); and Receptor contains areas of regionally important economic mineral deposits.
Medium	Soil type and associated land use are moderately sensitive (e.g., commercial forestry);

[16] National Library of Scotland (2025) Historic Maps Side by Side Viewer. Available at: https://maps.nls.uk/geo/explore/side-by-side/#zoom=5.0&lat=56.00000&lon=-4.00000&layers=1&right=ESRIWorld [Accessed March 2025].
[17] Landmark Information Group (2023) Argyll Environmental Site Solutions Report. Report Reference: 312723645. [Accessed March 2025].
[18] Landmark Information Group (2025) "Envirocheck Report for site at Springfield, UK. Order Number: 371214905". [Accessed March 2025].

SENSITIVITY OF RECEPTOR	DEFINITION
	Class 1 or 2 priority peatland, carbon-rich and peaty soils cover <20% of the Development Area; Class 3 and 5 peatland areas, carbon rich and peaty soils; Receptor contains areas of locally important economic mineral deposits; and Areas containing geological features of designated regional importance including Regionally Important Geological / geomorphological Sites (RIGS), considered worthy of protection for their historic or aesthetic importance.
Low	Geological features or geology not protected and not considered worthy of specific protection; Soil type and associated land use not sensitive to change in hydrological regime (e.g., intensive grazing); and Receptor contains Class -2, -1, 0, and 4 non-peatland areas, with no carbon-rich and/or peaty soils.
Negligible	The receptor is resistant to change and is of little environmental value.

Magnitude of Impact

10.2.7.4 The potential magnitude of impact would depend upon whether the potential impact would cause a fundamental, material or detectable change. In addition, the timing, scale, size and duration of the potential impact resulting from the Proposed Development are also determining factors.

10.2.7.5 The magnitude of impact was identified through consideration of the Proposed Development, the degree of change to baseline conditions predicted as a result of the Proposed Development, the duration and reversibility of an effect and professional judgement, best practice guidance and legislation.

10.2.7.6 The criteria for assessing the magnitude of impact are presented in **Table 10.3**.

TABLE 10.3 FRAMEWORK FOR DETERMINING THE MAGNITUDE OF IMPACT

IMPACT MAGNITUDE	DEFINITION
High	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 human or environmental health; Catastrophic failure of site infrastructure due to ground instability; Long term/permanent change to baseline resource; and

IMPACT MAGNITUDE	DEFINITION
	Major or total loss of a geological site or mineral deposit, where the value of the Proposed Development would be severely affected.
Medium	Loss of, or alteration to the baseline resource such that post development characteristics or quality will be partially changed; Mid-term/permanent change to human or environmental health; Ground failure that requires remediation but does not cause catastrophic failure of site infrastructure; Mid-term/permanent change to baseline resource; and Partial loss of a geological site or mineral deposit, with major effects to the settings, or where the value of the Proposed Development would be affected.
Low	Small loss of soils or peatland, or where soils will be disturbed but the value not impacted; Short-term change to human or environmental health; Ground settlement/subsidence that does not adversely affect site infrastructure or require remedial action; Short-term change to baseline resource; and Small effect on a geological site or mineral deposit, such that the value of the Proposed Development would not be affected.
Negligible	Minimal or no change to soils or peatland deposits; Minimal or no change to human or environmental health; Minimal or no change to ground stability; A very slight change from the baseline conditions. The change is barely distinguishable, and approximates to the 'no-change' situation; and Minimal or no change to a geological site or mineral deposit.

Significance of Effect

10.2.7.7 The significance of the effects of the Proposed Development have been assessed by considering the sensitivity of the receiving environment and the potential magnitude of impact, should that effect occur.

10.2.7.8 This approach allows for identification of the areas where mitigation measures are required and for the identification of mitigation measures appropriate to the significance of likely effects presented by the Proposed Development.

10.2.7.9 The sensitivity of the receptors and the predicted magnitude of impact was used as a guide, in addition to professional judgement, to predict the significance of the likely effects. **Table 10.4** summarises guideline criteria for assessing the Significance of Effects.

TABLE 10.4 FRAMEWORK FOR ASSESSMENT OF THE SIGNIFICANCE OF EFFECTS

MAGNITUDE OF IMPACT	SENSITIVITY OF RESOURCE OR RECEPTOR				
	VERY HIGH	HIGH	MEDIUM	LOW	NEGLIGIBLE
High	Major	Major	Moderate	Moderate	Minor
Medium	Major	Moderate	Moderate	Minor	Negligible
Low	Moderate	Moderate	Minor	Negligible	Negligible
Negligible	Minor	Minor	Negligible	Negligible	Negligible

10.2.7.10 Effects predicted to be of major or moderate significance are considered to be 'significant' in the context of the EIA Regulations.

Limitations of the Assessment

10.2.7.11 A variety of sources and information have been consulted to provide an understanding of the Study Area, including publicly available data sources, commercial data supply companies and additional information supplied from stakeholders during the scoping and consultation stages.

10.2.7.12 One limitation is that the desk-based assessments uses large scale mapping which does not necessarily include the localised environment and minor variations in ground conditions. In addition, as mentioned previously, no peat or soil data was collected across the Proposed Development due to the extensive presence of farmland and mineral soils and the absence of peatland vegetation.

10.2.7.13 Notwithstanding the above, it is considered that the data and information used to complete this assessment is robust and that there are no significant data gaps or limitations.

10.3 Baseline Conditions

10.3.1.1 This section of the Chapter outlines the present conditions which form the existing baseline environment for geology and soils within the Study Area. For the full description of the Proposed Development, refer to **Chapter 3: Development Description**.

10.3.2 Statutory Designations

10.3.2.1 Review of the NatureScot SiteLink[12] indicates that there are no statutory designations across the Site relating to geology and soils.

10.3.3 Land Use, Topography and Slope

10.3.3.1 The predominant land uses across the Site are agricultural land, including arable fields and pasture fields. In addition, there are localised areas of woodland across the Site.

10.3.3.2 Surface water drainage flow across the Site is predominantly from the southwest to the northeast. The Site is drained by a series of burns and field drains which make up the headwaters of the Bilsdean Burn. The Bilsdean Burn exits the Site in the northeast and is ultimately discharged into the Firth of Forth approximately 2km downstream from the Site boundary.

10.3.3.3 OS mapping indicates that the highest elevation across the Site is approximately 190m above ordinance datum (AOD) in the southwestern extents at Cockithat Hat Strip and the lowest elevation across the Site is approximately 85m AOD in the northeastern extents to the south of Birnieknowes.

10.3.3.4 In general, the Proposed Development is situated across gentle to moderate slopes which are down-gradient towards the north / northeast. Steeper slopes are generally present in the north, northeast and south of the Site. The centre, west and localised areas in the north of the Site are situated across gentle slopes and flatter expanses.

10.3.4 Soils

10.3.4.1 The 1:250,000 National Soil Map of Scotland[10] indicates that the main soil type mapped across the Site is brown earths. In addition, there is a localised area of non-calcareous gleys situated in the northeastern extents of the Site.

10.3.4.2 Soil Mapping across the Site is detailed in full in **Figure 10.4**.

10.3.5 Carbon-rich Soils, Deep Peat and Priority Peatland Habitats

10.3.5.1 Review of the Carbon and Peatland 2016 Mapping[9] indicates that the Site is mapped entirely as mineral soils (Class 0) where peatland habitats are not typically found. There are no areas of Class 1 and 2 priority peatland habitats or deep peat mapped across the Site.

10.3.5.2 Carbon and Peatland Mapping across the Site is detailed in full in **Figure 10.5**.

10.3.6 Superficial Geology

10.3.6.1 The BGS GeoIndex[11] Superficial Geology Mapping indicates that glaciofluvial deposits (gravel, sand and silt) are mapped across the north, northeast and south of the Site. In addition, Devensian glacial till (Diamicton) is mapped across areas in the centre, east and west of the Site. These deposits are comprised of a heterogeneous mixture of clay, sand, gravel and potential boulders.

10.3.6.2 Alluvial deposits are present across the Site, predominantly concentrated at or adjacent to watercourses and streams.

10.3.6.3 Superficial Geology across the Site is detailed in full in **Figure 10.2**.

10.3.7 Bedrock Geology

10.3.7.1 The BGS GeoIndex[11] Bedrock Geology Mapping indicates that the majority of the Site is underlain by the Ballagan Formation. This formation is comprised of sedimentary rocks, including sandstone, siltstone, mudstone and dolomitic limestone.

10.3.7.2 The south and southwestern extents of the Site are underlain by the Stratheden Group and Inverclyde Group. This formation is comprised of sedimentary rocks including sandstone and argillaceous rocks.

10.3.7.3 Bedrock Geology across the Site is detailed in full in **Figure 10.3**.

10.3.8 Linear Features

10.3.8.1 BGS GeoIndex[11] indicates that there is one major fault situated across the central area of the Site, trending in an east–west direction. The fault is inferred and the displacement direction is unknown.

10.3.9 Hydrogeological Conditions

10.3.9.1 From review of BGS GeoIndex Hydrogeology Maps[11]and Scotland's Environment Web map[13], there are two major aquifers underlying the Site.

10.3.9.2 The north, central and eastern areas of the Site are underlain by the Inverclyde Group (Class 2B). This bedrock aquifer is classed as a moderately productive, multi-layered aquifer with fracture flow yielding up to 10 L/s.

10.3.9.3 The south and southwestern areas of the Site are underlain by the Stratheden Group (Class 1B). This bedrock aquifer is classed as a moderately productive aquifer comprised of sandstone, partly pebbly with subordinate siltstone and mudstone holding moderate amounts of groundwater.

10.3.10 Mines and Quarries

10.3.10.1 According to BGS GeoIndex[11], there are no mines and quarries mapped across the Site.

10.3.10.2 However, the Coal Authority Interactive Map Viewer[14] indicates that the northern area of the Site is situated within a Coal Mining Reporting Area. However, the web viewer indicates that there are no coal deposits or seams across the Site and no historic surface mining, past or probable coal mining working occurred. In addition, the Site is not situated within a Development High Risk Area. This is addressed further in **Section 10.3.12** of this Chapter.

10.3.11 Unexploded Ordnance (UXO)

10.3.11.1 A Preliminary Desk Study Assessment for the Site was completed by Zetica[15] to assess the UXO Risk on the Proposed Development. This assessment found the following that could pose a risk of UXO:

- Two WWII strategic targets located in the vicinity of the Site;

- Barbed wire obstacles were set up on the southern portion of the Site as part of the Dunglass Stop Line in WWII; and
- 1 Allied aircraft crashed in the vicinity of the Site.

10.3.11.2 However, according to the UXO Bomb Risk Maps, the Site is situated in an area of low risk with an estimate of 15 bombs or less per 1000acre area. Precautions will be taken across the Proposed Development prior to breaking ground, and the appropriate subsurface clearance and UXO scanning should take place to ensure the ground conditions are safe to excavate.

10.3.12 Phase 1 Contaminated Land Assessment

10.3.12.1 During the scoping stages, a full review of the Site was undertaken and key resources were consulted, such as historic maps[16] and the Coal Authority website[14], to identify any potential contaminative sources. From the historical review, it was concluded that there is no evidence of landfills, mining or water/waste treatment facilities across the Site. However, as detailed in **Section 10.3.10**, the northern area of the Site is situated within a Coal Mining Reporting area. In addition, although there is no record of coal mining within the Proposed Development boundary, there is an area of shallow mine working recorded approximately 250 – 500m to the north of the Site which may have resulted in potential contamination within the northern extents of the Site.

10.3.12.2 Therefore, a targeted Phase 1 Contaminated Land Assessment has been undertaken across the northern area of the Site and to encompass the coal mining area recorded to the north outwith the Site. It is considered that the remainder of the Site, outwith this northern area, is not at risk of significant contamination from historic activities.

10.3.12.3 Information from a 2025 Envirocheck Report[18] was used, which targeted the northern area of the Site located within the Coal Mining Reporting Area and the potential area of coal mining situated outwith the northern boundary of the Site. In addition, information from an Argyll Environmental Site Solutions Report[17] (2023) was reviewed which assesses the entirety of the Site.

10.3.12.4 For avoidance of doubt, the targeted area in the northern section of the Site that has been used for the Envirocheck Report has been referred to as the 'assessment area' throughout this Phase 1 Contaminated Land assessment. This area is shown in Appendix A.

The Site

10.3.12.5 The targeted assessment area situated across the north of the Site and outwith the northern extents of the Site comprises approximately 35.13 Ha of land located to the west of Dunglass. The predominant land uses across the entirety of the Site are agricultural land, including arable fields and pasture fields. In addition, there are localised areas of woodland across the Site.

Historical Land Uses

10.3.12.6 Historical Ordnance Survey (OS) Maps and aerial imagery was used from Envirocheck, covering a time period between 1854 and 2024, which are included within Appendix A. **Table**

10.5 below summarises the historical review of historical map extracts across the assessment area of the Site and surrounding area within a 500 m buffer.

TABLE 10.5 HISTORICAL REVIEW OF THE SITE AND SURROUNDING AREA

YEAR	ASSESSMENT AREA OF THE SITE	SURROUNDING AREA
1854	• The assessment area is recorded as unoccupied fields conjectured to be for agricultural use. There are also some roads in between the fields. • Lawfield Cottage is recorded along the northern boundary of the assessment area.	• Palmerton was recorded approximately 200 m to the east of the assessment area. • Birnieknowes was recorded approximately 200 m to the east of the assessment area. • Gallows Law Plantation was recorded to the immediate southeast of the assessment area. • Braidlaw was recorded to the immediate south of the assessment area. • Threeplandhill was recorded approximately 300 m to the west of the assessment area. • Billsdean Burn was recorded approximately 300 m to the south of the assessment area. • Harp Law was recorded approximately 300 m to the north of the assessment area. • North British Railway was recorded approximately 500 to the east of the assessment area, aligned in a northwest to southeast direction.
1894 – 1895	The assessment area remains unchanged.	The surrounding area remains unchanged.
1899 – 1900	The assessment area remains unchanged.	Fairies Oven Rock was recorded approximately 400 m to the southeast of the assessment area.
1907 – 1909	A 'cistern' is recorded in the southeast area of the assessment area.	Threepland hill was replaced by Branxton on the map.
1957	The assessment area remains unchanged.	The surrounding area remains unchanged.
1969 – 1971	The assessment area remains unchanged.	The surrounding area remains unchanged.
1977	The assessment area remains unchanged.	The surrounding area remains unchanged.
1983 – 1987	The assessment area remains unchanged.	The surrounding area remains unchanged.

YEAR	ASSESSMENT AREA OF THE SITE	SURROUNDING AREA
1991 – 1999	The assessment area remains unchanged.	• A track was recorded along Harp Law approximately 300 m to the north of the assessment area • The sheepwash at Birnieknowes was no longer recorded. • Birnieknows Farm Cottages were recorded approximately 200 m to the east of the assessment area
2006 – 2009	The assessment area remains unchanged.	The surrounding area remains unchanged.
2024 / Present Day	The assessment area is recorded to still be in use for agricultural purposes with roads and areas of localised woodland.	The surrounding area remains largely unchanged from the earliest available historical map with very minimal development in the area.

10.3.12.7 The desk study has indicated that the assessment area and surrounding area have remained largely unchanged since the earliest available historical maps with minimal development within the area. As such, the assessment area and the remainder of the Site has been classed as 'greenfield' in nature with the potential for minimal localised made ground to exist from agricultural activities.

10.3.12.8 It should be noted that Torness Power Station is located to the north of the assessment area, however, this is more than 500 m outwith the assessment area.

Mining and Quarrying

10.3.12.9 According to BGS GeoIndex[11], there are no mines and quarries mapped across the Site.

10.3.12.10 However, the Coal Authority Interactive Map Viewer[14] indicates that the northern area of the Site is situated within a coal mining reporting area and that there is a historic shallow coal mining area situated approximately 250 m to 500 m north of the Site.

10.3.12.11 Within the Site itself, there are no mapped coal deposits or seams and no historic surface mining, past or probable coal mining working occurred. In addition, the Site is not situated within a Development High Risk Area.

10.3.12.12 In addition, historical maps do not show any evidence or mapped locations of any mining within the Site and the immediate surrounding area.

10.3.12.13 Therefore, the Site is not considered to be at risk from historical shallow mining.

Environmental Considerations and Sensitive/Contaminative Land Uses

10.3.12.14 Information regarding the environmental and engineering considerations for the assessment area of the Site was obtained from the Envirocheck Report[18] (included in Appendix B). The report includes information covering potentially sensitive land

uses/receptors and potential historic industrial land uses, geology, hydrology, hydrogeology, discharge consents, pollution incidents and radon risk.

Sensitive Land Uses

10.3.12.15 The Envirocheck Report indicates that the following sensitive land uses are located within the assessment area of the Site:

- Ancient woodland (long established plantation origin); and
- Nitrate vulnerable zones (polluted water).

Industrial Land Uses (Trade Directory Entries)

10.3.12.16 The Envirocheck Report indicates there no trade directory entries within the assessment area or within 500 m of the assessment area boundary. However, 2 manufacturing and production points of interest were recorded between 148 m and 437 m from the assessment area boundary and were noted as a tank and sheep wash respectively.

Discharge Consents

10.3.12.17 There are no registered discharge consents within the assessment area. However, 2 discharge consents were recorded within 500 m of the assessment area.

10.3.12.18 One discharge consent is situated 26 m to the east at Birnieknowes Farm Cottages, recorded as a septic tank with an unknown status. The other discharge consent is situated 283 m to the east of the assessment area, recorded as a septic tank, the status of which is also unknown.

Water Abstraction

10.3.12.19 The Envirocheck Report indicates that there are no licensed water abstractions across the assessment area or within 500 m of the assessment area.

Pollution Incidents

10.3.12.20 The Envirocheck Report recorded no pollution incidents to controlled waters or substantiated pollution incidents within 500 m of the assessment area.

Registered Landfills and Waste Management

10.3.12.21 The Envirocheck Report recorded no Registered Landfill Sites or Waste Management within 1 km of the assessment area.

10.3.12.22 However, there is Local Authority Landfill Coverage by East Lothian Council, recorded in the Envirocheck Report that is situated in the centre of the assessment area. There is no recorded landfill data associated with this coverage.

10.3.12.23 There is also no potentially infilled land within the assessment area or within 500 m of the assessment area.

Explosive sites

10.3.12.24 The Envirocheck Report recorded no explosive sites within 500 m of the assessment area.

Radon Gas

10.3.12.25 According to the UK Radon Map[19] and the Envirocheck report, the majority of the Site is situated in an area with higher radon probability, where 10-30% of buildings are estimated to be at or above the action level. Where this gas occurs under buildings, the external walls may contain it and radon gas may accumulate over time within buildings which can ultimately pose a risk to human health. The amount of radon that collects in a building depends on its location, structure and how it is used[20].

10.3.12.26 With reference to the Scottish Government Building Standards[21], every building must be designed and constructed in such a way that there will not be a threat to the health of people in or around the building due to the emission and containment of radon gas. Since buildings are proposed in the north of the Site that will be occupied by site users, radon protection measures will be required within any proposed building structures on the Site. These may include ventilation systems or the installation of a membrane to prevent the ingress of radon gas into the buildings.

Geotechnical Considerations

10.3.12.27 The Envirocheck Report indicates that there are several ground stability hazards noted across the assessment area, these are classified as either 'No Hazard' 'Very Low', 'Low' or 'Moderate' hazard potential:

- Potential for Collapsible Ground Stability Hazards - 'No Hazard', 'Very Low' or 'Highly Unlikely' Hazard Potential;
- Potential for Compressible Ground Stability Hazards – 'No Hazard' or 'Moderate' Hazard Potential;
- Potential for Ground Dissolution Stability Hazards – 'No Hazard;
- Potential for Landslide Ground Stability Hazards - 'Very Low', Low' and 'Moderate' Hazard Potential;
- Potential for Running Sand Ground Stability Hazards – 'Low' Hazard Potential; and
- Potential for Shrinking or Swelling Clay Ground Stability Hazards – 'No Hazard' or 'Very Low' Hazard Potential.

10.3.12.28 From review of this information, ground stability hazards may pose a moderate risk to the assessment area.

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[19] UK Health Security Agency (2024) UK Radon Map, available at: https://www.ukradon.org/information/ukmaps [Accessed March 2025]
[20] Health and Safety Executive (2025), Radon in the workplace. Available at: https://www.hse.gov.uk/radiation/ionising/radon.htm [Accessed May 2025].
[21] Scottish Government (2025), Building Standards Technical Handbook 2025: Non-Domestic. Available at: https://www.gov.scot/publications/building-standards-technical-handbook-january-2025-non-domestic/ [Accessed May 2025].

Potential Contaminative Land Uses

10.3.12.29 Based on information collated from the historical review and from review of aerial imagery, it is concluded that the assessment area and surrounding area have not significantly changed and the primary land use over time has been agricultural. Very minimal localised made ground may exist below the Site associated with agricultural activities, however, there is no record of this within the sources reviewed as part of this assessment.

10.3.12.30 Two manufacturing and production points of interest were recorded approximately 148 m east and 437 m west of the assessment area and were noted as a tank and sheep wash respectively.

10.3.12.31 There are no Control of Major Accident Hazard Sites (COMAH) or Notification of Installations Handling Hazardous Substances (NIHHS) recorded within 500m of the Site.

10.3.12.32 There are no Planning Hazardous Substance Consents recorded within 500 m of the Site.

Conceptual Site model

Introduction

10.3.12.33 This assessment has been undertaken in accordance with BS 10175 'Investigation of Potentially Contaminated Sites'[7] and the desk-based research has supported the development of a preliminary Conceptual Site Model (CSM). A CSM represents the potential contaminative 'Source-Pathway-Receptor' linkages which could be a hazard or risk to sensitive receptors at the assessment area or in the surrounding area.

10.3.12.34 The desk study assessment established previous uses, ground conditions, previous ground investigations, and hydrological and hydrogeological environments, taking account of the Site end-use.

10.3.12.35 In the context of land contamination, there are three essential elements to any risk:

- Source contaminant – a substance that is in, on or under the land and has the potential to cause harm or to cause pollution of a receptor;
- Pathway – a route or means by which a receptor can be exposed to, or affected by, a contaminant; and
- Receptor – in general terms, something that could be adversely affected by a contaminant, such as people, an ecological system, property, or a water body.

10.3.12.36 While each of these elements can exist independently, risk exists only in the scenario where there is a pollutant linkage.

Potential Contamination Source

10.3.12.37 The historical map review provides an understanding of the historical uses both across the assessment area and in the surrounding area. This allows an assessment of possible contamination sources to be identified.

10.3.12.38 The historical review indicates that the targeted northern assessment area of the Site and surrounding area have remained largely unchanged and are agricultural in nature. Therefore,

the assessment area has been classed as 'greenfield'. However, unmapped localised made ground associated with agricultural activities may be present. In addition, the soils across the Site may also have been sprayed with herbicides and pesticides during agricultural activities, and if any Phase 2 intrusive ground investigations are to occur, these should be tested for.

10.3.12.39 Vigilance should be maintained for potential unrecorded contamination sources during any future assessments and intrusive site works across the Site.

10.3.12.40 The north of the Site (the assessment area) is situated within a 'Coal Mining Reporting Area' and, although mining is not considered a risk, contamination from the surrounding area may be present across the Site.

10.3.12.41 **Table 10.6** provides a summary of the potential contamination sources that could be present across the Site associated with current and historical uses.

TABLE 10.6 POTENTIAL CONTAMINATION RISKS AT THE SITE AND THE SURROUNDING AREA

SOURCE	POTENTIAL RISK	POTENTIAL CONTAMINANTS AND / OR CONSIDERATIONS
Contaminated soils associated with minimal localised made ground agricultural activities such as herbicide/pesticide spraying at the Site and surrounding areas.	Potential for risk to site personnel, construction materials and groundwater systems from contaminated soil beneath the Site.	Hydrocarbons, herbicides, pesticides and ground gases.
Contaminated groundwater associated with agricultural activities at the Site and surrounding areas.	Potential for risk to site personnel, construction materials and groundwater systems from contaminated soil beneath the Site.	Hydrocarbons, herbicides and pesticides.
Potentially harmful ground gases from soils and rock. Potential for mine gas in the northern site area from surrounding areas.	Potential for risk to site personnel, construction materials and structures within the Site.	Potentially hazardous ground gases including Methane, Carbon Dioxide, Radon and Carbon Monoxide.

Potential Pathways

10.3.12.42 Based on the Site, the following potential pathways outlined in **Table 10.7** are considered for the newly constructed area.

TABLE 10.7 POTENTIAL CONTAMINATION PATHWAYS

POTENTIAL PATHWAYS	DESCRIPTION OF PATHWAY	POTENTIAL RECEPTORS
Dermal Contact	Skin contact with soils, dust or water	Site personnel
Ingestion	Potential for risk to site personnel, construction materials and groundwater systems from contaminated soil beneath the Site.	Site personnel
Inhalation	Potential for risk to site personnel, construction materials and structures within the Site.	Site personnel, Site end-users and adjacent land users
Mobilisation and Leaching of Contaminants	Mobilisation of contamination through leaching of contaminants from soil to surrounding groundwater	Water Environment
Degradation of Materials through Direct Contact	Corrosion and breakdown of any potential buried structures and services	Construction materials and buried structures / services
Potentially Hazardous Ground Gas	Generation and migration of ground gases from soils or rock, potentially leading to asphyxiation, explosion and/or fires	Site personnel and Site end-users

Potential Receptors

10.3.12.43 Potential receptors associated with the Proposed Development include:

- Site personnel during construction phase;
- End-users including site personnel and visitors and infrastructure occupants;
- Adjacent land users;
- Water environment – groundwater aquifer and surface watercourses; and
- Construction materials – potential buried structures and services, future concrete foundations and water supply pipes.

10.3.12.44 The Envirocheck Report indicates that there are several recorded ground stability hazards across the assessment area, however, all of these are classed as either 'No Hazard' or 'Very Low' Hazard risk.

Risk Assessment

10.3.12.45 This desk study includes a preliminary qualitative contamination risk assessment carried out for the Site using the findings of the desk study.

10.3.12.46 The Proposed Development will comprise a Solar PV Array, an electrical substation, Battery Energy Storage System, access roads and other associated infrastructure.

10.3.12.47 The risk assessment has been carried out in line with current UK guidance, CIRIA Report C552 'Contaminated Land Risk Assessment – a guide to good practice'[8], adopting the Source-Pathway-Receptor assessment principle based on a Conceptual Site Model developed for the Site.

10.3.12.48 The Conceptual Site Model is presented further below. This details the potential connectivity between potential sources, pathways and receptors. A pathway must be present for the source to provide any risk to any given receptor. The magnitude of any such risk is assessed by considering the vulnerability of the receptor and the possible impact of the source.

Identification of Hazards

10.3.12.49 Shallow subsurface excavations are proposed to take place across areas where new access roads are proposed and for infrastructure foundations such as the solar panel mounts, substation and BESS.

10.3.12.50 On this basis, risk from contamination for construction personnel, construction materials and end-users must be considered.

10.3.12.51 It is important to consider the implications of any contamination and potential pathways to the surrounding area, therefore, risks associated with adjacent land users and ecological receptors must be considered.

Identification of Pollutant Linkage

10.3.12.52 The potential receptors and exposure pathways considered are summarised below:

- Site users/construction personnel – dermal contact with contaminated soil and inhalation of dust, vapours or ground gas;
- Site end-users – inhalation of vapours or ground gas, accumulation and explosion of any ground generating gas within confined spaces;
- Ecological Receptors – planting, flora and fauna;
- Adjacent land-users – inhalation of dust or vapours during construction works;
- Water environment – leaching of contaminants from soil to underlying groundwater via lateral or vertical migration through drift deposits;
- Construction materials – degradation of construction materials due to aggressive contaminants within soil or groundwater; and
- Buried utilities and water supply pipes – corrosion of utilities and potential permeation into water supply.

Risk Assessment

10.3.12.53 The risks identified as having potential to affect receptors have been assessed through a preliminary qualitative risk assessment based on the CIRIA C552 guidance[8], as shown in **Table 10.8** and **Table 10.9** below.

TABLE 10.8 RISK CLASSIFICATION MATRIX

		Consequence			
		Severe	Medium	Mild	Minor
Likelihood	High Likelihood	Very High	High	Moderate	Moderate / Low
	Likely	High	Moderate	Moderate / Low	Low
	Low Likelihood	Moderate	Moderate / Low	Low	Very Low
	Unlikely	Moderate / Low	Low	Very Low	Very Low

TABLE 10.9 RISK CLASSIFICATION DEFINITION

RISK CLASSIFICATION	DEFINITION
Very High	Avoid project development at these locations.
High	Harm is likely to arise to a designated receptor from an identified hazard. Realisation of the risk is likely to present a substantial liability. Urgent investigation (if not undertaken already) is required and remedial works may be necessary in the short term and are likely over the longer term.
Moderate	It is possible that harm could arise to a designated receptor from an identified hazard. However, it is either relatively unlikely that such harm would be severe, or if any harm were to occur it is more likely that the harm would be relatively mild. Investigation (if not already undertaken) is normally required to clarify the risk and to determine the potential liability. Some remedial works may be required in the longer term.
Low	It is possible that harm could arise to a designated receptor from an identified hazard, but it is likely that this harm, if realised, would at worst normally be mild.
Very Low	There is a low possibility that harm could arise to a receptor. In the event of such harm being realised it is not likely to be severe.

10.3.12.54 **Table 10.10** summarises the possible source-pathway-receptor relationships and estimates the consequence and probability of the risks posed. Effects predicted to be of major or moderate significance are considered to be 'significant' in the context of the EIA Regulations.

10.3.12.55 Risk to site end-users being exposed to soil contamination is classified as Low. The Site has been identified as a greenfield site with limited potential for contaminated soils. Once the Proposed Development has been constructed, there will be limited activity on the Site that requires excavation and areas of infrastructure that require resurfacing of the ground will create a barrier against any potential underlying contamination. There is not an anticipated

risk for site end-users across areas of the Site without hardstanding due to the greenfield nature of the Site with no significant contaminative sources identified. Activities on the Site should be restricted to equipment and infrastructure maintenance and monitoring the continued operation of the Site. In addition, during the decommissioning phase, it is not anticipated that there will be any additional risks to site end-users as the same ground will be disturbed as the construction phase.

10.3.12.56 Given the greenfield nature of the Site, it is not considered likely that contaminants should leach into the groundwater, however, given the possible presence of herbicides and pesticides, the risk is not negligible. The bedrock aquifer underlying the Site is classed as a minor or moderately permeable, where fractures or potentially fractured rocks do not have high permeability, which lowers the risk of potential contaminants migrating and leaching within the groundwater across the bedrock strata. Cohesive soils with generally low permeability act as a barrier to any potential contaminants at the Site. Therefore, a Low risk has been applied. If any future ground investigations are proposed, it is advised that leachate or groundwater testing is undertaken to determine the presence of any unacceptable risk at the Site.

10.3.12.57 It is not likely that the construction materials proposed for use in the Proposed Development could come into contact with aggressive ground conditions, such as elevated pH or sulphates, or contamination from historical development due to the predominantly greenfield nature of the Site. Ground contamination can be detrimental to water supply pipes by corroding joints which can lead to contaminants entering the water supply systems ultimately affecting Site end-users. Given the greenfield nature of the Site, albeit with the potential for contamination associated with agricultural activities and herbicides and pesticides, it is considered that the risk posed to building materials across the assessment area can be classified as Low.

TABLE 10.10 PRELIMINARY CONCEPTUAL SITE MODEL

POTENTIAL RECEPTOR	POTENTIAL SOURCE	POTENTIAL PATHWAY	CONSEQUENCE OF RISK	LIKELIHOOD OF RISK	LEVEL OF RISK (WITHOUT MITIGATION)	MITIGATION AND BEST PRACTICE GUIDANCE	RESIDUAL RISK (POST-MITIGATION)
Site Personnel	Potential localised made ground/potential contamination from agricultural activities / herbicides and pesticides.	Direct dermal contact, ingestion, inhalation of soil / water / dust / vapours.	Medium	Low	Moderate / Low	There are no Control of Major Accident Hazard Sites (COMAH) or Notification of Installations Handling Hazardous Substances (NIHHS) recorded within 500m of the Site. In addition, there are no pollution incidents recorded within 1km of the Site. Vigilance should be maintained for potential unrecorded contamination sources during any future assessments and intrusive site works. In the event that potentially contaminated materials are encountered, samples should be taken and a subsequent risk assessment and remediation strategy may be required.	Low
	Ground gases associated with localised made ground, potential mine gas and recorded radon gas.	Inhalation of ground generating gases such as radon, carbon dioxide, hydrogen sulphide, methane or depleted oxygen.	Medium	Low Likelihood	Moderate / Low	The Radon UK map has indicated the Site is situated in an area above the radon action level. During the construction phase, there will not be any deep or enclosed excavations where radon gas may accumulate and pose a risk to human health. Radon gas is only considered a risk in areas of infrastructure which may allow for the accumulation of the gas from the subsurface (i.e. buildings). Since buildings are proposed in the north of the Site that will be occupied by site users, radon protection measures will be required within building structures on the Site. These may include ventilation systems or the installation of a membrane to prevent the ingress of radon gas into the buildings.	Low
Site end-users	Localised made ground / herbicides and pesticides.	Direct dermal contact, ingestion, inhalation of soil / dust / water/ vapours.	Medium	Unlikely	Low	The Site has been identified as a greenfield site with limited potential for contaminated soils. The risks of soil and groundwater contamination to site end-users being exposed is classified as Low given that, once constructed, there will be limited activity at the Site that requires excavation and areas of infrastructure that require resurfacing of the ground will create a barrier against any potential underlying contamination. Across these areas of the Site, it is considered that the pathway will be inactive in terms of end user risk, as any contamination will be contained below the infrastructure foundations and hardstandings. There is not an anticipated risk for site end-users across areas of the Site without hardstanding due to the greenfield nature of the Site with no significant contaminative sources identified. Activities across the Site should be restricted to equipment and infrastructure maintenance and monitoring the continued operation of the Site. It is understood that when end-users enter the Site intermittently, appropriate PPE should be worn and good site hygiene should be observed at all times, this may include the use of hand protection. In addition, no work within confined spaces is anticipated.	Very Low
	Ground gases associated with localised made ground, potential mine gas and recorded radon gas.	Inhalation of ground generating gases such as radon, carbon dioxide, hydrogen sulphide, methane or depleted oxygen.	Medium	Unlikely	Low	As indicated previously, the Radon UK map has indicated the Site is situated in an area above the radon action level. Following construction of the Site and implementation of radon protective measures within occupied buildings, it is not anticipated that there will be any risk relating to radon gas across the Proposed Development. In open areas of infrastructure, such as the solar panels, radon gas is not considered to pose a risk to site end-users as these are exposed in open air and do not allow for the accumulation of the gas. Throughout the operational life of the Proposed Development, if significant changes are made to a building or to the work processes carried out within it, then a radon risk assessment should be undertaken and the need to remeasure the radon levels should be considered.	Very Low

POTENTIAL RECEPTOR	POTENTIAL SOURCE	POTENTIAL PATHWAY	CONSEQUENCE OF RISK	LIKELIHOOD OF RISK	LEVEL OF RISK (WITHOUT MITIGATION)	MITIGATION AND BEST PRACTICE GUIDANCE	RESIDUAL RISK (POST-MITIGATION)
Adjacent Land Users	Soil dust from made ground or contaminated soils.	Inhalation of soil particles during construction.	Mild	Unlikely	Very Low	Made ground is not anticipated across the majority of the Site. In addition, extensive excavations are not anticipated at the Site that would result in significant contaminated soil dust being airborne. Therefore, it is considered unlikely that contaminated soil dust would impact the adjacent land users given the greenfield nature of the Site. However, as a precautionary measure, mitigation will be implemented to suppress any soil dust particles (e.g. dampening down of soils to minimise airborne particles) as required and discussed in the oCEMP.	Very Low
Water Environment	Contamination in groundwater due to contaminated soil (herbicides and pesticides)	Vertical or lateral migration of contaminants to groundwater within made ground and / or underlying natural soils.	Medium	Low	Moderate / Low	Herbicides and Pesticides could potentially have leached into the groundwater or surface waters across the Site. However, as the Site has been identified as a greenfield site, there is not significant contamination anticipated within the soils that could potentially leach into the water environment.	Low
Construction Materials	Exposure to altered pH and/or sulphates or other corrosive contaminants through soil infiltration to buried concrete.	Degradation of materials	Mild	Unlikely	Very Low	Due to the greenfield nature of the Site, it is not anticipated that there would be any potentially corrosive contaminants within the soils across the Site. Therefore, the level of risk is considered Very Low.	Very Low

Risk Classification, Mitigation and Conclusion

10.3.12.58 From the findings of this desk study and in the absence of mitigation measures, it is considered that the maximum risk to the identified receptors is Moderate/Low associated with potentially contaminated soils, potential harmful ground gases and the potential for contaminants to leach into the water environment.

10.3.12.59 Through implementation of the mitigation measures detailed below and within **Table 10.11,** it is considered that the Proposed Development has the potential to pose a Low risk in relation to contaminated land.

Mitigation and Residual Risk

10.3.12.60 Recommended good practice mitigation to be implemented included:

- Potential wider ground investigations to identify any contaminants or potential ground gas sources at the Site with subsequent updates to the CSM;
- A site-specific contamination risk assessment should be carried out to allow the design of any appropriate remedial measures. Implementation of suitable remedial measures will mitigate any contamination risks identified;
- Vigilance should be maintained during any construction for unrecorded contamination as it cannot be discounted that contamination may be present associated with potential historic industrial activities in close proximity to the Site;
- During construction, the safe storage of chemicals, fuels and other construction equipment should be practiced in order to reduce pollution and accidental spillage; and
- During the construction and operational phase of the Proposed Development, appropriate PPE should be worn at all times.

10.4 Assessment of Likely Significant Effects

10.4.1.1 An assessment of the effects of the Site on the geology and soils environment has been undertaken, identifying significant effects during the construction, operational and decommissioning phases.

10.4.2 Construction Phase

Loss and Compaction of Soils

10.4.2.1 During the construction phase, there is the potential that the Proposed Development infrastructure may result in degradation, removal or loss of soils. In particular, plant and vehicle movements, soil stripping and stockpiling may affect the nature of the soils across the Site. Plant and vehicle movements may compact areas of unstripped soils. All activities requiring removal, transport and stockpiling of soils may cause erosion of soils and loss of structure, resulting in overall soil degradation.

10.4.2.2 The key infrastructure which may cause potential loss and compaction of soils are new access tracks, steel pile supports for solar panels, inverter transformer, BESS compound,

substation and temporary compound facilities. Each solar panel will be mounted on aluminium frames, with steel supports pile driven into the ground at a depth of approximately 1.5 – 2.5 m. In some cases, the solar panels may sit on concrete footings, with no subsurface elements. In addition, the BESS compound is anticipated to sit on 6 concrete pillars with an anticipated height above ground level of 0.2 m.

10.4.2.3 All traffic routes will be clearly demarcated across the Proposed Development and vehicles would not be permitted outwith these areas. In addition, only tracked or low ground pressure vehicles would be permitted to access any unstripped ground.

10.4.2.4 As there is no peat-forming vegetation across the Site and no anticipated peatland deposits (>0.5m thick), soils across the Site are anticipated to be less than 0.5m thick and are generally classed as mineral soils that are not considered nationally or environmentally significant. These soils would be reinstated in the vicinity of their origin where possible.

10.4.2.5 In regard to compaction of soils, the construction of access tracks and movement of construction traffic, in the absence of good construction practice, could potentially lead to the compaction of the thin soils underlying the Proposed Development. Compaction reduces soil permeability, resulting in increased run-off and erosion of the soils. Permeability of the superficial soils underlying the Proposed Development may vary, therefore, any potential compaction of soils could result in a significant increase in run-off, altering the existing ground conditions.

10.4.2.6 Considering all relevant factors and in accordance with the criteria outlined in **Table 10.2,** soil is classed as a Low sensitivity receptor, in relation to compaction and loss. The soil type and associated land use across the Site is not carbon-rich and is not sensitive to change in the hydrological regime, therefore, soil across the Site has been assigned a Low sensitivity. The overall magnitude of impact is Low; therefore, the significance of effect associated with the loss of soils is considered to be Negligible and **Not Significant** in accordance with the EIA regulations.

Soil as a Waste Material

10.4.2.7 As discussed in the section above, excavation of thin soils across the Proposed Development for installation of proposed infrastructure and tracks could result in the loss of soils. Soils will be reinstated, where possible, at the original excavation location. However, there may be a surplus of excavated soils.

10.4.2.8 It is anticipated, however, that the soils across the Site are shallow, mineral soils and that it is unlikely that a surplus will be generated that would result in off-site transportation or disposal of soils. At the time of construction, if this is required, the soils should be transported and dealt with accordingly following best practice guidance and the relevant legislation (e.g. The 2011 Waste Management Licensing (Scotland) Regulations[6]).

10.4.2.9 Considering all relevant factors, soil is classed as a Low sensitivity receptor, in relation to waste material. The overall magnitude of impact is Low; therefore, the significance of effect associated with the soil as a waste material is considered to be Negligible and **Not Significant** in accordance with the EIA regulations.

Impacts on Geology

10.4.2.10 As detailed in **Section 10.3**, there are no geological designated sites associated with the geology and soils environment across the Site. Therefore, the bedrock geology formations underlying the Proposed Development are not considered to be of national importance or high conservation value and the sedimentary geological strata are widespread throughout Scotland.

10.4.2.11 The Site should not require bedrock excavations as part of the design. Excavations across the Site should only affect shallow soils and the underlying superficial deposits (glaciofluvial deposits, glacial till and alluvium). The greatest subsurface impact will be pile-driven steel supports at depths of approximately 1.5 – 2.5 m below ground level (BGL) for the solar panel frames, however, it is anticipated that these excavations would be situated within the superficial geology layers. In some cases, the solar panels may sit on concrete footings and will not require subsurface excavations.

10.4.2.12 On this basis, while the receptor sensitivity is assessed as Low where "geological features or geology [are] not protected and [are] not considered worthy of specific protection", the magnitude of impact would be Negligible due to minimal or no change to bedrock geology across the Proposed Development. Therefore, the significance of effect is classed as **Not Significant** accordance with the EIA regulations and guidance.

Contaminated Land

10.4.2.13 The Contaminated Land Assessment undertaken in **Section 10.3.12** identified potential sources of contamination within the Site and the immediate surrounding area. Following a review of the relevant desktop resources and the Envirocheck and Landmark reports, the main potential sources of contamination identified across the Site were the potential for herbicides and pesticides associated with agricultural activities, the potential presence of coal mining to the north of the Site and the potential for radon gas. However, during a site walkover and visual inspection of the ground conditions across the targeted northern area of the Site, no evidence of contaminated land was identified. In addition, the contaminated land assessment concluded that there was no identified risk to the Proposed Development in relation to coal mining activities.

10.4.2.14 If any evidence of potential contamination is encountered during the construction phase of the Proposed Development, appropriate action would be taken in accordance with the outline CEMP (**Technical Appendix 3.1: outline Construction Environmental Management (oCEMP)**) and relevant conditions on the Section 36 consent. The oCEMP will outline construction management best practice for the Proposed Development and will also be consulted on should any potential contamination be encountered during construction.

10.4.2.15 With the implementation of mitigation measures proposed during the Contaminated Land Assessment, the residual risk of contaminated land across the Site was classed as Low. On this basis, contaminated land across the Site can be regarded as a Low sensitivity receptor with a Low magnitude of impact. Therefore, the significance of effect is classed as Negligible and **Not Significant** in accordance with the EIA regulations and guidance.

10.4.3 Operational Phase

10.4.3.1 During the operational phase and maintenance activities, it is anticipated that there would be no further disturbance towards the soils and geology environment across the Site.

10.4.3.2 It is assumed that the access across the Site will be via the permanent proposed track infrastructure, suitably constructed to account for the low volume of maintenance traffic. Minimal traffic is anticipated during the operational phase of the Proposed Development, and it is assumed that all vehicles will only drive on the permanent access tracks. It is not anticipated that vehicles will require off-road access which could potentially impact soils. Any significant maintenance operations requiring off-road access will require further detailed environmental assessment.

10.4.3.3 In relation to contaminated land, it is not anticipated that there would be any activities across the Proposed Development that would require disturbance of the ground and that any site access would be for non-intrusive routine maintenance of Proposed Development infrastructure. In addition, it is not anticipated that the Proposed Development will result in contamination associated with operational infrastructure. Adherence to the relevant UK guidance and good construction practices, as detailed in **Technical Appendix 3.1: oCEMP**, will mitigate the risk of any potential spills or contamination of soils across the Proposed Development. This is discussed in detail in Section 10.6: Mitigation.

10.4.3.4 Therefore, there would be no anticipated impacts upon soils and geology during the operational phase of the Proposed Development and the effects on geology and soils will be **Not Significant** in accordance with EIA regulations.

10.4.4 Decommissioning Phase

10.4.4.1 Once the Proposed Development has reached its operational lifetime, the decommissioning phase will commence, and the Proposed Development will be restored in accordance with the decommissioning and restoration plan. All solar infrastructure will be removed from the Proposed Development, including modules, mounting structures and cabling. These would be removed from the Proposed Development and recycled or disposed of in accordance with good practice guidance and market conditions at that time. Access tracks will likely remain across the Proposed Development for use by the landowner.

10.4.4.2 It is anticipated that the effects of the decommissioning phase will be of lesser magnitude than the construction phase of the Proposed Development. Ground disturbance in relation to decommissioning activities will only occur at the infrastructure locations, therefore, it is anticipated that there will be little or no requirement for further disturbance of the soils and geology across the Proposed Development and that the effects of the decommissioning phase are anticipated to be **Not Significant.**

10.5 Cumulative Effects

10.5.1.1 Geology and soils are considered localised receptors specific to the defined Proposed Development area, therefore, cumulative developments in the wider vicinity of the Proposed Development have not been considered to have a cumulative effect on the geology and soils environment.

10.5.1.2 Although the cumulative effects are considered Not Significant in relation to the soils and geology environment; **Chapter 16: In-combination Effects** details a full summary of findings for all EIA chapters.

10.6 Mitigation

10.6.1.1 Mitigation has been developed as the Proposed Development design has progressed through the scoping and EIA stages. Standard mitigation measures relating to the soils and geology environment, during construction and operational phases, are embedded through the design and adoption of best practice measures during construction to ensure that disturbance of geology and soils is avoided or minimised.

10.6.1.2 **Chapter 3: Development Description** provides further details of the mitigation embedded into the design of the Proposed Development, avoiding key environmental constraints and limiting the impacts on the geological environment, as well as taking cognisance of hydrological and ecological features and associated buffers.

Outline Construction Environmental Management Plan (oCEMP)

10.6.1.3 Detailed embedded mitigation measures, relevant to the geology and soils environment and other environmental factors, are set out within the oCEMP (**Technical Appendix 3.1: oCEMP**) comprising good practice methods and guidelines, including UK and Scottish guidance on good practice for construction of infrastructure projects. These are established and effective measures to which the applicant will be committed to throughout the planning consent and duration of the Proposed Development.

10.6.1.4 A final CEMP will be developed for the Proposed Development and used during the construction phase. The principal objective of this document will be to provide information on the proposed infrastructure and to aid in avoiding, minimising and controlling adverse environmental impacts associated with construction of the Proposed Development. Furthermore, the CEMP will aim to define good construction practice as well as specific actions required to implement mitigation identified in the EIAR, the planning process and / or other licencing or consenting processes. The CEMP would be updated during the pre-construction phase and would form part of the contractor documents between the Applicant and the appointed construction contractor.

10.6.1.5 The CEMP will also outline measures to ensure that the works minimise the risk to soils and the geological environment. It is expected that the measures outlined within the oCEMP will be included in the final CEMP and would ensure the works are undertaken in accordance with good practice guidance.

10.7 Residual Effects

10.7.1.1 Following the inclusion of and adherence to the embedded mitigation measures detailed in the oCEMP (**Technical Appendix 3.1: oCEMP**), no potential residual effects have been identified that will impact the soils and geology across the Proposed Development in relation to loss and compaction of soils, soils as a waste material, impact on geology and contaminated land. Therefore, all factors addressed are considered **Negligible and Not** Significant in accordance with the EIA regulations**.** No additional mitigation is required for loss and compaction of soils, soils as a waste material and the impact on geology. In regard

to contaminated land, additional mitigation should be implemented regarding radon protection measures in the northern areas of the Site where buildings are proposed that will be occupied by site end-users.

10.7.1.2 **Table 10.11** provides a summary of the effects and mitigation detailed within this Chapter.

TABLE 10.11 CONSTRUCTION PHASE - SUMMARY OF EFFECTS

RECEPTOR	POTENTIAL EFFECT	EMBEDDED MITIGATION	SIGNIFICANCE OF EFFECT	ADDITIONAL MITIGATION	RESIDUAL EFFECT
Soils	Loss and Compaction of Soils	Mitigation has been embedded into the design of the Proposed Development through the implementation of good practice measures and through following key legislation and guidance documents. Further information on embedded mitigation measures is detailed in **Section 10.6** and the oCEMP (**Technical Appendix 3.1**).	Negligible	No additional mitigation required.	Negligible
Soils	Soil as a Waste Material		Negligible	No additional mitigation required.	Negligible
Geology	Impact on Bedrock Geology		Negligible	No additional mitigation required.	Negligible
Contaminated Land	Impact of Contaminated Land		Negligible	Radon protection measures should be implemented for proposed buildings across the Site to protect end-users.	Negligible

10.8 Summary and Conclusions

10.8.1.1 This Chapter has assessed the likely significance of effects on the geology and soils environment during the construction, operational and decommissioning phase of the Proposed Development.

10.8.1.2 Following the implementation of embedded mitigation measures outlined in **Technical Appendix 3.1: oCEMP**, the residual effects on the geology and soils environment are considered to be of negligible significance. Therefore, given that only effects of moderate significance or greater are considered in terms of the EIA regulations, the potential effects on geology and soils are **Not Significant.**