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11. Ground Conditions

11.1 Introduction

- 11.1.1 This chapter presents the assessment of the likely significant effects of the Proposed Development with respect to Ground Conditions, including consideration of land contamination and soil receptors. It should be read in conjunction with the Project description provided in **Chapter 4: Description of the Proposed Development** and with respect to relevant parts of the following chapters:
- **Chapter 2: Approach to Environmental Impact Assessment, Appendix 2A Carbon Balance** - Section 5 of **Appendix 2A** outlines quantifiable values for the carbon losses and carbon gains associated with the Proposed Development including consideration of peatland.
 - **Chapter 8: Biodiversity** - a large proportion of the biodiversity in terrestrial ecosystems is present in soil, and pollutants associated with land contamination have the potential to impact on biodiversity, this chapter should therefore be read in conjunction with **Chapter 8** which considers the potential for significant effects on biodiversity.
 - **Chapter 10: Water Environment** - the water environment chapter considers the likely significant effects of the Proposed Development on water resources, there are common receptors between water environment and land contamination receptors, and there is interaction between the water environment and soil resources e.g., in relation to land drainage, soil compaction, and erosion/runoff.
- 11.1.2 This chapter describes:
- the legislation, policy and technical guidance that has informed the assessment (**Section 11.2**);
 - consultation and engagement that has been undertaken and how comments from consultees relating to Ground Conditions have been addressed (**Section 11.3**);
 - the methods used for baseline data gathering (**Section 11.4**);
 - overall baseline (**Section 11.5**);
 - embedded measures relevant to Ground Conditions (**Section 11.6**);
 - the scope of the assessment for Ground Conditions (**Section 11.7**);
 - the methods used for the assessment (**Section 11.8**);
 - the assessment of Ground Conditions effects for soils (**Section 11.9**);
 - the assessment of Ground Conditions effects for land contamination (**Section 11.10**);
 - assessment of cumulative (inter-project) effects (**Section 11.11**); and
 - a summary of the significance conclusions (**Section 11.12**).

Limitations and assumptions

11.1.3 The Draft ES has been produced to fulfil the Applicant’s consultation duties and enable consultees to develop an informed view of the likely significant effects of the Proposed Development.

11.2 Relevant legislation, planning policy and technical guidance

11.2.1 This section identifies the legislation, planning policy and technical guidance that has informed the assessment of effects with respect to Ground Conditions. Further information on policies relevant to the Proposed Development is provided in **Chapter 5: Legislation and policy overview**.

Legislation

11.2.2 A summary of the relevant legislation for Ground Conditions is given in **Table 11.1**.

Table 11.1 Legislation relevant to the Ground Conditions assessment

Legislation	Legislative context
Environment (Wales) Act 2016¹	The Act makes provisions within Wales for the planning and managing of natural resources at national and local level.
Well-being of Future Generations (Wales) Act (2015)²	The Act does not refer explicitly to soils or land contamination; however, it requires public bodies in Wales to think about the long-term impact of their decisions. It requires them to act in accordance with sustainable development principles, with the aim of achieving well-being goals, including maintaining and enhancing a biodiverse natural environment with healthy functioning ecosystems that support social, economic, and ecological resilience and the capacity to adapt to change (for example climate change).
Environmental Protection Act (1990)³	<p>Part 2 of the Act makes provision for the improved control of pollution arising from certain industrial and other processes. Part 2A of the Act provides the regulatory basis for the identification, designation, and remediation of contaminated land.</p> <p>The potential for the Proposed Development to be built on land potentially affected by historical contamination requires assessment to ensure it is suitable for the proposed land-use and that, where necessary, remediation is carried out to ensure the land cannot be determined as Contaminated Land under the Act.</p> <p>Appropriate embedded environmental measures have been put in place as detailed in Section 11.6 of this chapter to address risks associated with potential land contamination.</p>

¹ UK Government (2016). Environment (Wales) Act 2016. (Online). Available at: <https://www.legislation.gov.uk/anaw/2016/3/contents/enacted>. (Accessed 01 December 2021).

² UK Government (2015). Well-being of Future Generations (Wales) Act 2015. (Online). Available at: <https://www.futuregenerations.wales/wp-content/uploads/2017/01/WFGAct-English.pdf>. (Accessed 01 December 2021).

³ UK Government (1990). Environmental Protection Act 1990. (Online). Available at: <https://www.legislation.gov.uk/ukpga/1990/43/contents>. (Accessed 01 December 2021).



Legislation**Legislative context****Water Resources Act 1991⁴ as amended by the Water Act 2003⁵**

The Water Resources Act 1991 states that it is an offence to cause or knowingly permit polluting, noxious, poisonous or any solid waste matter to enter controlled waters.

The Act was revised by the Water Act 2003, which provides the definition of and regulatory controls for the protection of water resources, including the quality standards expected for controlled waters.

The 2003 Act sets out the definition of controlled waters which has been used to define the scope of receptors for the assessment in **Section 11.7**.

Appropriate embedded environmental measures have been put in place as detailed in **Section 11.6** of this chapter to help ensure the protection of controlled waters.

The Environmental Damage (Prevention and Remediation) (Amendment) (Wales) Regulations 2015

Regulations implementing the European Union (EU) Directive on environmental liability setting out the principles for prevention and remedy of environmental damage.

Construction and operational activities for the Proposed Development have the potential to cause pollution and the regulations place emphasis on businesses to proactively implement pollution prevention measures so that damage to the environment does not arise.

Appropriate embedded environmental measures have been put in place as detailed in **Section 11.6** of this chapter to help ensure the prevention of pollution.

Health and Safety at Work etc. Act 1974

The Health and Safety at Work etc. Act and regulations made under the Act place responsibilities upon employers to carry out a risk assessment for every work activity and to document it. Besides carrying out a risk assessment, employers also need to: make arrangements for implementing the health and safety measures identified as necessary by the risk assessment; appoint competent people to help them implement the arrangements; set up emergency procedures; provide clear information and training to employees; and work together with other employers sharing the same workplace.

Land contamination poses a hazard to groundworkers and potentially others in proximity to the construction work. Appropriate risk assessments must be carried out and arrangements made to protect the health and safety of workers directly involved in groundworks for the Proposed Development and other human receptors who could be affected.

Compliance with the Act during construction and operation is an embedded measure considered in the assessment and detailed in **Section 11.6**.

The Construction (Design and Management) Regulations 2015

The Construction (Design and Management) Regulations (CDM) place specific duties on clients, designers, and contractors, so that health and safety is considered throughout the life of a construction project from its inception to its subsequent final demolition and removal.

⁴ UK Government (1991). Water Resources Act 1991. (Online). Available at: <https://www.legislation.gov.uk/ukpga/1991/57/contents>. (Accessed 01 December 2021).

⁵ UK Government (2003). Water Act 2003. (Online). Available at: <https://www.legislation.gov.uk/ukpga/2003/37/contents>. (Accessed 01 December 2021).

Legislation	Legislative context
Control of Asbestos Regulations 2012	<p>They include the requirement to appoint a Principal Designer and Principal Contractor to co-ordinate health and safety aspects during construction.</p> <p>Under the CDM regulations, designers must avoid foreseeable risks so far as reasonably practicable by: eliminating hazards from the construction, cleaning, maintenance, and proposed use and demolition of a structure; reducing risks from any remaining hazard; and giving collective safety measures priority over individual measures.</p> <p>Construction of the Proposed Development will fall under the requirements of the Regulations requiring consideration of health and safety to be incorporated into the design of the Proposed Development components and at construction stage.</p> <p>Compliance with CDM during construction is an embedded measure considered in the assessment and detailed in Section 11.6.</p> <p>The Control of Asbestos Regulations 2012 (CAR 2012) apply to employers who carry out work which disturbs, or is likely to disturb, asbestos. This includes groundworks where there is asbestos present or suspected to be present in the ground as loose fibres or as asbestos containing materials (ACMs).</p> <p>To comply with CAR 2012, in respect of asbestos-contaminated soil and construction and demolition materials, employers must consider people other than their own employees in the risk assessment required by Regulation 6, and in the action taken to prevent or control exposure required by Regulation 11. The other key regulation relevant to the Proposed Development is the requirement under Regulation 16 to prevent or reduce the spread of asbestos. Every employer must prevent or, where this is not reasonably practicable, reduce to the lowest level reasonably practicable, the spread of asbestos from any place where work under the employer's control is carried out.</p> <p>During construction works for the Proposed Development there is the potential for localised asbestos containing materials or soils to be encountered in the ground. Asbestos can be found on agricultural land or in any made ground e.g., due to historical ad hoc waste disposal to land, incorporation of demolition material into made ground or releases of fibres from Asbestos Containing Materials ('ACM') structures in poor condition, and subsequent spread by vehicle movements.</p> <p>Compliance with CAR 2012 during construction is an embedded measure considered in the assessment and detailed in Section 11.6.</p>

Planning policy

11.2.3 A summary of the relevant national and local planning policy for Ground Conditions is given in **Table 11.2**.



Table 11.2 Planning policy relevant to the Ground Conditions assessment

Policy	Policy context
National planning policy	
Planning Policy Wales, Edition 11, 2021⁶	<p>The 2021 Planning Policy Wales document, Distinctive and Natural Linkages chapter, page 124, states that decisions on planning applications must consider the policy topics of the Distinctive and Natural Places theme, including “opportunities in all areas to improve the resilience of ecosystems by addressing building on floodplains, diffuse pollution, soil compaction and sealing, ensuring the protection of peat resources” and “opportunities to improve health and well-being are taken, in particular, to... ensure water sensitive design, address soil carbon management... so as to improve capacity for adaptability to the challenges of climate change such as flood risk and increased temperatures”.</p> <p>Chapter 6, Section 6.4 Biodiversity and Ecological Networks states that development proposals must consider the need to: “safeguard protected and priority species and existing biodiversity assets from impacts which directly affect their nature conservation interests and compromise the resilience of ecological networks and the components which underpin them, such as water and soil, including peat”.</p> <p>Chapter 6, Section 6.9.16 Land Contamination states that <i>“Whenever development or re-development potential exists the planning system will be the preferred means of addressing potential land contamination.”</i> 6.9.17 states that where land potentially meets the definition of contaminated land under Part 2A, the onus will remain with the developer to ensure that the land is suitable for its proposed use and would not meet the legal definition of contaminated land under Part 2A. Section 6.9.19 states that “Where land contamination issues arise, the planning authority will require evidence of detailed investigation and risk assessment prior to the determination of the application” as well as <i>“If contamination cannot be overcome satisfactorily, the authority may refuse planning permission.”</i></p>
Local planning policy	
Blaenau Gwent Local Development Plan (LDP) up to 2021⁷	<p>The LDP identifies where allocations for new developments such as housing, employment, community facilities, and roads have been made. It provides a framework for local decision making and brings together both development and conservation interests to ensure that any changes in the use of land are coherent and provide maximum benefits to the community.</p> <p>Policy DM1 requires new development to demonstrate sustainable design, including minimising construction waste and pollution and no adverse impact upon the water environment or an unacceptable risk to the quality of controlled waters, and that the land is made stable and capable of supporting the development without risk of damage to buildings on the site or adjoining land, and that practicable and effective measures are taken to treat, contain or control any contamination.</p> <p>Section 7.14 notes that much of the Blaenau Gwent area was subject to past underground mining activities and is therefore within a Coal Mining Referral Area. Responsibility for determining the extent and effects of these constraints rests with the developer. Where development is proposed in these areas, the developer should consult with the Coal Authority. The Local Planning Authority will be guided by advice from the Coal Authority and the</p>

⁶ Welsh Government (2021) Planning Policy Wales, Edition 11, February 2021. (Online). Available at: https://gov.wales/sites/default/files/publications/2021-02/planning-policy-wales-edition-11_0.pdf. (Accessed 01 December 2021).

⁷ Blaenau Gwent County Borough Council (2012) Local Development Plan up to 2021. (Online). Available at: <https://www.blaenau-gwent.gov.uk/en/resident/planning/local-development-plan/adopted-ldp-allocations/adopted-local-development-plan-2006-2021/>. (Accessed 01 December 2021).



Policy	Policy context
<p>Blaenau Gwent Local Agenda 21 Strategy 2001</p>	<p>Council’s own technical staff whether development is acceptable and whether conditions requiring ground stability precautions should be attached to permissions. In other instances, development may affect landslip areas. In such instances, applications will need to be supported by a geotechnical investigation and stability report to identify any remedial measures to deal with any instability.</p> <p>Section 7.15 notes that the disturbance of contaminated land can have risks to public health and the environment. Where development is proposed on sites known, or suspected to be contaminated, or where the site is in the vicinity of a former landfill site, the developer will be required to carry out a risk assessment at the planning application stage. This must establish any possible pollutant pathways and identify all necessary mitigation measures, if any, to reduce the risks and allow development to proceed.</p> <p>This document describes the council’s commitment to the sustainable care of natural and physical resources in accordance with the Agenda 21 process. The key components of the document address the current sustainability challenges and issues, the council’s responsibilities, targets and current situation, action plans and implementation mechanisms.</p>

Technical guidance

11.2.4 A summary of the technical guidance for Ground Conditions is given in **Table 11.3**.

Table 11.3 Technical guidance relevant to the Ground Conditions assessment

Technical guidance document	Context
<p>The Development of Land Affected by Contamination: A Guide for Developers, version 3⁸</p>	<p>The guidance outlines the information planning authorities require on the land contamination status of proposed development sites and how associated planning conditions will be discharged. The document sets out best practice for land contamination management procedures, these follow a phased approach, and require the development and refinement of a conceptual model. The process starts at initial desk based assessment, then may progress to site investigation, to remediation options appraisal, development of a remediation strategy and implementation and verification of remediation, as set out in the Model Procedures for the Management of Land Contamination CLR 11 (Defra & Environment Agency 2004), Guidance for the Safe Development of Housing on Land Affected by Contamination R&D 66 (NHBC and Environment Agency 2010)*. For sites where preliminary risk assessment identifies potentially unacceptable risks, or requiring site investigation.</p> <p>*The CLR 11 guidance has been withdrawn and replaced by the Environment Agency Land Contamination Risk Management Guidance (see below), which outlines a similar approach to land contamination assessment as in CLR 11.</p>

⁸ Welsh Local Government, Natural Resources Wales & Welsh Government (2017) The Development of Land Affected by Contamination: A Guide for Developers, version 3 May 2017. (Online). <https://www.claire.co.uk/home/news/893-new-guidance-added-to-wall>. (Accessed 01 December 2021).



Technical guidance document	Context
Welsh Government, Contaminated Land Statutory Guidance – 2012⁹	This guidance outlines the legal framework for dealing with contaminated land in Wales under Part 2A of the Environmental Protection Act 1990. It elaborates on the remediation provisions of Part 2A, such as the goals of remediation, and how enforcing authorities should ensure that remediation requirements are reasonable.
Environment Agency, Land Contamination Risk Management (LCRM)	In addition to the above guidance, Natural Resources Wales refers developers or those seeking to voluntarily remediate a site to the Environment Agency LCRM guidance ¹⁰ , which provides the technical framework for applying a risk management process when dealing with land affected by contamination.
CAR-SOIL: Control of Asbestos Regulations 2012, Interpretation for Managing and Working with Asbestos in Soil and Construction and Demolition Materials (2016)¹¹	Provides interpretation and guidance to all involved in the management of asbestos in both soils and construction and demolition arisings in accordance with the Control of Asbestos Regulations 2012 (CAR 2012) ¹² . Requirements include the use of measures to prevent the spread of asbestos during construction work. As made ground and demolished buildings are present within the Proposed Development application boundary, there is potential for asbestos to be encountered during groundworks and suitable management measures are, therefore, needed. These are included in the embedded environmental measures in Section 11.6 .
Welsh Assembly Government, Environment Department, Environment Agency Land Quality Department., Appraisal of state, pressures and controls on the sustainable use of soils: executive summary 2002¹³	This document notes that the treatment of stripped soil materials is covered in guidance to the mineral extraction industry, but no such guidance is given to the building and construction industry. To date no guidance specifically for the management of soils during construction has been published for Wales.
CL:AIRE, Definition of Waste: Development Industry Code of Practice (DoWCoP), Version 2, 2011	The Definition of Waste: Development Industry Code of Practice (DoWCoP) is a voluntary Code launched in September 2008 (applicable to England and Wales) and updated in 2011 to provide a clear, concise, and auditable process to enable the sustainable remediation and development of land and suitable reuse of recovered materials/resources, including topsoil, subsoil, and potentially contaminated soil, that may initially be classified as

⁹ Welsh Government (2012), Welsh Government Guidance Document, Contaminated Land Statutory Guidance – 2012, Number: WG19243. (Online). Available at: <https://gov.wales/sites/default/files/publications/2019-08/contaminated-land-statutory-guidance-2012.pdf>. (Accessed 01 December 2021).

¹⁰ Natural Resources Wales (2021). Land Contamination. (Online) Available at: <https://naturalresources.wales/guidance-and-advice/business-sectors/planning-and-development/advice-for-developers/land-contamination/?lang=en&mssckid=f31e500cc14d11ec96571fe68fd7786f>. (Accessed 20 April 2022).

¹¹ CL:AIRE (2016). CAR-SOIL: Control of Asbestos Regulations 2012, Interpretation for Managing and Working with Asbestos in Soil and Construction and Demolition Materials (Online). Available at: <https://www.clair.co.uk/projects-and-initiatives/asbestos-in-soil>. (Accessed 01 December 2021).

¹² UK Government (2012). The Control of Asbestos Regulations 2012. (Online). Available at: <https://www.legislation.gov.uk/uksi/2012/632/contents/made>. (Accessed 01 December 2021).

¹³ Welsh Assembly Government, Environment Department, Environment Agency Land Quality Department., Appraisal of state, pressures and controls on the sustainable use of soils: executive summary 2002. (Online). Available at: <https://gov.wales/appraisal-state-pressures-and-controls-sustainable-use-soils-executive-summary-html>. (Accessed 01 December 2012).



Technical guidance document	Context
Defra Construction Code of Practice for the Sustainable Use of Soils on Construction Sites¹⁴	<p>waste/contaminated, by the use of a Materials Management Plan (MMP).</p> <p>The development and use of an MMP is an embedded measure, as detailed in Section 11.6.</p> <p>Outlines current guidance and legislation concerning the use of soil in construction projects, before offering stage by stage guidance on the use, management, and movement of soil on site, and the completion of appropriate soil resource surveys to inform the site working strategy (e.g., Site Waste Management Plan or Material Management Plan) and for the construction phase preparation of a Soil Resource Plan.</p> <p>Measures to avoid damage to soil health/soil structure are an embedded measure in the Construction Environmental Management Plan (CEMP), as detailed in Section 11.6.</p>
CIRIA C665 Assessing risks posed by hazardous ground gases to buildings	<p>Provides guidance on ground gas monitoring and assessing the level of risk posed by ground gas, including mine gas, to developments.</p> <p>Consideration of the risks to the built environment from ground gas (in particular, enclosed spaces where ground gas can accumulate) is an embedded measure through compliance with LCRM, as detailed in Section 11.6.</p>
Welsh Government, Predictive Agricultural Land Classification Map (Wales) The Hollington Map, Guidance Note Version 2.1 - May 2021¹⁵	<p>Provides guidance on how to use the Predictive ALC Map. The Predictive Agricultural Land Classification Map replaces the Welsh 'Provisional' 1:250,000 Series of maps produced between 1967 and 1974. States that where the Predictive ALC Map identifies grades 1, 2 or 3a, a survey will be required to determine the grades present and in what proportion. For grades 3b, 4 or 5, a survey is not required.</p> <p>The baseline status of the Proposed Development site in relation to ALC grade is detailed in Section 11.5.</p>
Highways England, Design Manual for Roads and Bridges LA 109 - Geology and Soils¹⁶	<p>Sets out the approach to assessing and reporting the effects of highway projects on geology and soils used on Highways England projects. As a published approach to assessing the effects of developments on soil in EIA, this can be adapted for use on other projects. The guidance stops short of providing a methodology to assess the effects of a project on agricultural land and soil functions. This guidance informs the assessment methodology for soils as set out in Section 11.8.</p>

¹⁴ Defra (2009) Construction Code of Practice for the Sustainable Use of Soils on Construction Sites. (Online). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/716510/pb13298-code-of-practice-090910.pdf (Accessed: February 2022).

¹⁵ Welsh Government (2021). Predictive Agricultural Land Map (Wales), The Hollington Map, Guidance Note, Version 2.1 – May 2021. (Online). Available at: <https://gov.wales/sites/default/files/publications/2021-05/agricultural-land-classification-predictive-map-guidance.pdf> (Accessed February 2022).

¹⁶ Highways England (2019). Design Manual for Roads and Bridges LA109 Sustainability & Environment Appraisal LA 109 Geology and soils (Online). Available at: <https://www.standardsforhighways.co.uk/dmr/search/adca4c7d-4037-4907-b633-76eaed30b9c0> (Accessed 6 December 2021).

Technical guidance document	Context
Institute of Environmental Management & Assessment (IEMA) (2022) IEMA Guide: A New Perspective on Land and Soil in Environmental Impact Assessment ¹⁷	Provides information and guidance on how the practical implications of soil functions, soil biodiversity, soil health, ecosystem services and natural capital should be applied within the overarching framework of climate change, to incorporate them effectively into the EIA process. This guidance informs the assessment methodology for soils as set out in Section 11.8 .
Institute of Civil Engineers (ICE), The Environmental Impact Assessment Handbook - A Practical Guide for Planners, Developers and Communities (3rd Edition) ¹⁸	Provides an approach to assessing the potentially significant effects of development projects on soil and defines the sensitivity of different soil types to handling during construction projects. The guide notes that soil is a non-renewable resource, and that disturbance should be limited as far as possible, that soil is particularly prone to structural degradation if it is handled when too wet, and that adverse effects can be mitigated by following best practice guidance, such as the Defra 2009 Code of Practice for the Sustainable Use of Soils on Construction Sites.

11.3 Consultation and engagement

Scoping Direction

- 11.3.1 A Scoping Direction was issued by Planning and Environmental Decisions Wales (PEDW, formerly Planning Inspectorate Wales), on behalf of the Welsh Ministers, on 15 June 2021. A summary of the relevant responses received in the Scoping Direction in relation to Ground Conditions and confirmation of how these have been addressed within the assessment to date is presented in **Table 11.4**.

Table 11.4 Summary of EIA Scoping Direction responses for Ground Conditions

Consultee	Consideration	How addressed in this Draft ES
PEDW	Peat PEDW draws attention to NRW's comments in relation to peat and the requirement to seek an agreed approach from the local authority and NRW in relation to this aspect of the environment.	A Phase 1 peat survey has been completed and has confirmed there are no deep peat deposits ¹⁹ within the Proposed Development application boundary for the Wind Farm development. The baseline data for the Grid Connection, as recorded in Section 11.5 below, indicates that peat is unlikely to be present on the Grid Connection and no peat survey is, therefore, proposed of this area.

¹⁷ Institute of Environmental Management & Assessment (IEMA) (2022) IEMA Guide: A New Perspective on Land and Soil in Environmental Impact Assessment. IEMA; March, UK

¹⁸ Institute of Civil Engineers (ICE) (2019). The Environmental Impact Assessment Handbook - A Practical Guide for Planners, Developers and Communities (3rd Edition). ICE Publishing; London, UK.

¹⁹ Defined as >0.5m thickness of surface peat in accordance with the Unified peat map for Wales. Evans, CD et al (2020). United Peat Map for Wales (Online). Available at: <https://catalogue.ceh.ac.uk/documents/58139ce6-63f9-4444-9f77-fc7b5dcc00d8>. (Accessed January 2022).



Consultee	Consideration	How addressed in this Draft ES
	<p>Coal Mining The Inspectorate welcomes the stated approach to provision of a Coal Mining Risk Assessment. The Coal Authority provides comments that may be of assistance to the applicant.</p>	<p>Agreement acknowledged that a Coal Mining Risk Assessment is needed. This has been completed for the Wind Farm development site, with reference to the Grid Connection site, and is included as an appendix to the Phase 1 Geo-environmental desk study in Appendix 11A.</p>
<p>Natural Resources Wales (NRW)</p>	<p>Ground Conditions NRW note the potential for historical coal mining and associated management (including waste) and other potentially contaminating land uses on and in proximity to the development boundary.</p> <p>Peat NRW noted the intention to complete a Phase 1 peat depth survey and advised that peat depth should be mapped across the site and a detailed assessment be made of the impact of the whole scheme (including all infrastructure and ancillary development) on peat, to enable the effects of the Proposed Development in relation to habitat loss and CO2 release from the modification and drainage of the habitat to be assessed.</p> <p>Potential for contamination of land or water to arise because of construction work NRW provides additional advice as follows that is not considered necessary to include in the ES but is to be considered when preparing the application: <i>It would be useful for a provisional wind farm infrastructure plan to be drafted that shows the likely wind turbine locations, foundation design, haul road and cable run locations and any other infrastructure required for the windfarm. A provisional construction plan should also be drafted that highlights how particular aspects of the wind farm will be constructed, how chemicals that will be required during the construction phase will be managed and stored, where particular heavy plant may be required and whether or not dewatering may be required e.g., for foundation construction including the nature and location of the dewatering.</i></p>	<p>Agreement acknowledged that a Phase 1 Geo-environmental desk study is needed. This is included in Appendix 11A of this Draft ES. A Phase 1 peat survey and a Coal Mining Risk Assessment have been completed and are included as appendices to the Phase 1 Geo-environmental desk study. This information has been used to inform the baseline description in Section 11.5 and the assessments in Section 11.9 and 11.10.</p> <p>Agreement acknowledged that a Phase 1 peat depth survey is needed. A peat survey has been completed and this has confirmed there are no deep peat deposits within the Proposed Development application boundary for the Wind Farm Development. The Phase 1 peat survey is included as an appendix to the Phase 1 Geo-environmental desk study in Appendix 11A of this Draft ES. The baseline data for the Grid connection, as recorded in Section 11.5 below, indicates that peat is unlikely to be present on the Grid connection and no peat survey is, therefore, proposed of this area or has been completed.</p> <p>The Applicant is committed to the development and implementation of a CEMP which will address the management of construction work to avoid potential effects on land or water quality through leakages and spillages of oils and chemicals, silty or otherwise contaminated water derived from excavation dewatering and to avoid effects on soils such as compaction and cross contamination through materials management planning and the use of suitable construction plant and equipment. These measures are described in Section 11.6.</p>
<p>The Coal Authority</p>	<p>The Coal Authority notes that the Scoping Report confirms that a geo-environmental desk study</p>	<p>Agreement acknowledged that a Coal Mining Risk Assessment is needed. This has been completed</p>



Consultee	Consideration	How addressed in this Draft ES
	and a mining risk assessment will be produced to support the development proposal. It is advised that the Coal Mining Risk Assessment should utilise up-to-date coal mining and geological information to assess the extent to which past mining activity poses any risk to the development proposal and, where necessary, propose mitigation measures to address any issues of land instability. This could include further intrusive investigations on site to establish the exact situation regarding coal mining legacy affecting the site.	for the Wind Farm development site, with reference to the Grid Connection site, and is included as an appendix to the Phase 1 Geo-environmental desk study in Appendix 11A . This has been used to inform the baseline description in Section 11.5 and the assessment in Sections 11.9 and 11.10 . Embedded measures to address potential land instability are included in Table 11.6 .

Technical engagement

- 11.3.2 No technical engagement is currently ongoing with consultees in relation to Ground Conditions.

11.4 Data gathering methodology

Study area

Wind Farm development and Grid Connection

- 11.4.1 The study area for Ground Conditions for contaminated land receptors includes the Proposed Development application boundary (Site) and a 250m buffer area beyond the boundary. This is considered appropriate based upon professional experience in land contamination assessment and consideration of the site conceptual model in relation to the potential for contaminants to migrate from the site to offsite receptors through the soil or in groundwater, or to migrate onto the site through soil or in groundwater from offsite sources. The conceptual model considers the environmental setting (including geology, hydrogeology and hydrology) and the nature and extent of the identified potential contamination sources, potential receptors and available pathways for receptors to be exposed to contaminants.
- 11.4.2 The likely significant effects of the Proposed Development on soil receptors include temporary effects during construction activity, such as vehicle/plant movements, soil handling, storage, and reinstatement, and permanent effects (e.g., permanent removal of soil for construction of buildings), that will occur within the Proposed Development Site. No external zone of influence for soil has been identified beyond the Proposed Development application boundary. The rationale for the study area is that the soils are geographically discrete and will not be substantially influenced by changes to their surroundings or vice versa. In relation to excavations, the hydrogeological effects of dewatering could potentially extend beyond the Proposed Development Site. Assessment of hydrogeological effects is included in **Chapter 10: Water Environment**.

Desk study

11.4.3 A summary of the organisations that have supplied data, together with the nature of that data is outlined in **Table 11.5**.

Table 11.5 Data sources used to inform the Ground Conditions assessment

Organisation	Data source	Data provided
Department for Environment, Food & Rural Affairs (Defra)	Multi-Agency Geographic Information for the Countryside (MAGIC) interactive map. Available online at: https://magic.defra.gov.uk/MagicMap.aspx .	Topographical mapping
Natural Soil Resources Institute, Cranfield University.	LandIS Soilscales Map. Available online at: http://www.landis.org.uk/soilscales/# .	Regional soil mapping and information on soil types
British Geological Survey (BGS)	GeoIndex Onshore. Available online at: https://mapapps2.bgs.ac.uk/geoindex/home.htm	Geological information, including exploratory hole records.
British Geological Survey (BGS)	BGS sheet 1:50 000 Abergavenny Sheet 232 Solid and Drift 1990	Geological map for the study area and surrounding area
Welsh Government and Natural Resources Wales	Lle Geo-Portal, Unified Peat Map of Wales. ²⁰	Broad mapping of peat conditions across Wales including lowland and upland peat.
Natural Resources Wales	Welsh Peatlands Data Portal. ²¹	Updates information in the Unified Peat Map of Wales up to 2022 based on current evidence sources including detailed soil survey records and point survey observations of peat presence. The data layers were created on a 50m grid whereby the presence and thickness of peat are estimated from a range of sources for each 50m grid cell across Wales ²² . A peatland evidence score defines the level of confidence in the presence of peat in any given grid cell, with those cells scoring more than 2 on this scale of 1-10, captured in the 'Peatlands of Wales' peat distribution map. For the purpose of this database and in accordance with the Welsh Government approach ²² , peat is defined as

²⁰ Geography & Technology, Welsh Government (2022). Unified Peat Map of Wales. (Online) Available at: <http://lle.gov.wales/catalogue/item/UnifiedPeat?lang=en> .(Accessed April 2022).

²¹ Natural Resources Wales (2022). Welsh Peatlands Data Portal (Online). Available at: <https://smnr-nrw.hub.arcgis.com/apps/d18ef8c74ecc4dc4a0cbf71ab6935ba0/explore>. (Accessed April 2022).

²² Natural Resources Wales (2022). Peatland Data Portal Map Layers (Online) Available at: <https://naturalresources.wales/evidence-and-data/maps/peatland-data-portal-map-layers/?lang=en>. (Accessed April 2022).

Organisation	Data source	Data provided
		having a thickness of more than 40cm of organic material within the upper 80cm of a soil profile.
Welsh Government and Natural Resources Wales	Lle Geo-Portal, Predictive Agricultural Land Classification Map, Version 2. ²³	<p>Predictive Agricultural Land Classification (ALC) map for Wales, based on the principles of the Agricultural Land Classification System of England & Wales, the Revised Guidelines & Criteria for Grading the Quality of Agricultural Land (Ministry of Agriculture, Forestry and Fisheries (MAFF) 1988)²⁴. Land is categorised into one of the following grades:</p> <ul style="list-style-type: none"> ● Grade 1: excellent quality agricultural land ● Grade 2: good quality agricultural land ● Grade 3a: good to moderate quality agricultural land ● Grade 3b: moderate quality agricultural land ● Grade 4: poor quality agricultural land ● Grade 5: very poor quality agricultural land. <p>Grades 1 to 3a are defined in Welsh planning policy as Best and Most Versatile (BMV) land.</p>
Coal Authority	Coal Authority Interactive Map. Available online at: https://mapapps2.bgs.ac.uk/coalauthority/home.html .	Coal mining information including recorded mine entries, shallow coal mining workings, coal outcrops, fissures and breaklines, and Development High Risk Areas.
Coal Authority	Consultants Coal Mining Report, Mynydd Carn Y Cefn, Blaenau Gwent, The Coal Authority, Reference 51002643910001, 24 August 2021.	<p>Site specific coal mining information identifying potential mining related risks.</p> <p>This report is included as an appendix to the Phase 1 Geo-environmental desk study, included in Appendix 11A.</p>
Wood (2022)	Coal Mining Risk Assessment	<p>Mining risk assessment to assist in defining the level of risk associated with historical mining activities within the Proposed Development application boundary and to determine if further assessment is needed to quantify the risk and define mitigation measures.</p> <p>This report is included as an appendix to the Phase 1 Geo-environmental desk study, included in Appendix 11A.</p>
Wood (2021)	Technical Note: Mynydd Carn y Cefn Wind Farm – Peat Depth Survey	Peat depth survey results for land within the Proposed Development application boundary. The survey used

²³ Geography & Technology, Welsh Government (2019). Predictive Agricultural Land Classification (ALC) Map 2 (Online). Available at: <http://lle.gov.wales/catalogue/item/PredictiveAgriculturalLandClassificationALCMap2/?lang=en> .(Accessed April 2022).

²⁴ Ministry of Agriculture, Fisheries and Food (1988) Revised Guidelines & Criteria for Grading the Quality of Agricultural Land. (Online) Available at: <http://publications.naturalengland.org.uk/publication/6257050620264448> (Accessed April 2022).



Organisation	Data source	Data provided
	Report (Ref. 42863-WOOD-XX-XX-RP-OG-0001+S2_P01.1, November 2021).	<p>the Scoping application boundary and, therefore, covers a larger area than the Proposed Development application boundary.</p> <p>This report is included as an appendix to the Phase 1 Geo-environmental desk study, included in Appendix 11A.</p>
Wood (2022)	Mynydd Carn y Cefn Wind Farm, Phase 1 Geo-environmental Desk Study (Ref. 42863-WOOD-XX-XX-RP-OC-0001_S0_P01, January 2022).	<p>Desk study to assist in determining whether the site is suitable for its proposed use, included in Appendix 11A. The report includes a review of selected contemporary information including geological, environmental, hydrological and hydrogeological data, review of historical mapping for the site and its surroundings, and a walkover of the key elements of the site (conducted in 2021) to identify potential evidence of contamination and verify desk study information as necessary. It includes the development of a Conceptual Model (CM) and a Tier 1: Preliminary Risk Assessment, to assess the status of potential contamination and identify potentially significant contaminant linkages that require further consideration in line with current guidance including Land Contamination Risk Management (LCRM) guidance published by the Environment Agency. It also identifies information gaps, geo-environmental development constraints, and requirements for further assessment.</p>

11.5 Overall baseline

Survey work

Wind Farm development

- 11.5.1 A Phase 1 peat depth survey was conducted by Wood during September 2021 within the Proposed Development Site to determine whether deep peat (defined by the Welsh Government as >0.4m of organic material within the upper 0.8m of a soil profile – see **Table 11.5**) is present on the Wind Farm development site. The findings are reported in the Peat Depth Survey Report (Wood, 2021).
- 11.5.2 During December 2021, a site walkover was carried out by Wood of the Proposed Development Site, to inform the Phase 1 Geo-environmental desk study and Coal Mining Risk Assessment (CMRA). The walkover was completed by an experienced contaminated land consultant, photographs were obtained of key features identified through desk-based review or observed during the walkover, and observations from the site walkover are recorded in the Phase 1 Geo-environmental desk study (Wood, 2022). An additional walkover within the Proposed Development Site was completed in March 2022 to support the Coal Mining Risk Assessment and was also used to supplement the previous walkover for the Phase 1 Geo-environmental desk study.



Grid Connection

- 11.5.3 During December 2021, a site walkover was carried out by Wood of the Grid Connection corridor to inform the Phase 1 Geo-environmental desk study and Mining Risk Assessment. The walkover was completed by an experienced contaminated land consultant, photographs were obtained of key features identified through desk-based review or observed during the walkover, and observations from the site walkover are recorded in the Phase 1 Geo-environmental desk study (Wood, 2022).
- 11.5.4 No peat survey was carried out on the Grid Connection corridor or is proposed, as the desk-based information does not identify the potential for peat deposits to be present within this area.

Current baseline

Wind Farm development

Topography

- 11.5.5 A detailed description of topography is presented in **Chapter 10: Water Environment**. In summary, the Proposed Development Site is located on the Mynydd Carn-y-Cefn ridge which slopes to the south falling from 440m AOD in the north to 260m AOD in the southeast close to Aberbeeg. The Proposed Development Site is an inverted V-shape with the Cwm Big valley in the centre dividing the ridge in western and eastern sections.

Soils (including agricultural land)

- 11.5.6 Information reviewed on the LandIS Soilscales map²⁵ indicates the likely soil types within the Proposed Development Site to comprise very acid loamy upland soils with a wet peaty surface, a peaty texture and high carbon content (type 16), and, freely draining acid loamy soils over rock, with a loamy texture and medium carbon content (type 13).
- 11.5.7 The Welsh Peatlands Data Portal shows no deep peat on the proposed development site and the absence of deep peat was confirmed by a peat survey completed in 2021 (Wood, 2021). The peat survey comprised a Phase 1 peat depth survey undertaken on a 100m by 100m grid of points, with peat depth measurement taken at each point, and it covered the entire Proposed Development Site and some adjoining land (of the 286 survey points 211 are located within the Wind Farm development site). The recorded peat thickness was >0.1m in 5% of the locations, >0.2m in 1% of locations and a single location in the northeast of the Proposed Development Site recorded a thickness of 0.3m. The average thickness was 0.03m. The total area of the site where shallow peat is present is likely to be less than 6%. The survey report concluded that the Site is not underlain by deep peat. Considering the thin peat layers encountered and the absence of deep peat on the Proposed Development Site, no further surveys or slope stability (peat slide) assessment is needed.

²⁵ Cranfield University (2022). Soilscales (Online) Available at: <http://www.landis.org.uk/soilscales/#>, (Accessed March 2021).

- 11.5.8 Bedrock is shallow across the site, with a thin soil layer present, however, based on the Phase 1 Geo-environmental desk study (Wood, 2022) some of this is likely to be placed (and potentially imported) soil or restored soil on top of former landfill or mine workings. Based on information in the Phase 1 Geo-environmental desk study, made ground is present on approximately 20% of the Proposed Development Site (comprising restored mineworkings, landfill, other made ground areas and land where farm buildings/outbuildings are present). In addition, approximately 4% of the total Proposed Development Site is developed as an operational solar farm.
- 11.5.9 The Predictive Agricultural Land Classification (ALC) Map 2²³ indicates that the agricultural land classification within the Proposed Development Site, which is also the study area applied for soils and agricultural land, is Grade 4 and 5 and, therefore, is not likely to include any 'Best and Most Versatile' (BMV) land (categories 1, 2 or 3a). The Welsh Government only requires an agricultural land classification survey where the Predictive ALC Map identifies Grades 1, 2 or 3a, and to provide a conservative assessment the land is, therefore, assumed to be Grade 4.

Geology

- 11.5.10 The British Geological Survey (BGS) 1:50,000 scale geology mapping²⁶ shows superficial deposits as thin or absent within the Proposed Development Site. The mapping generally indicates that bedrock is close to surface (<10m below ground level) or at surface. In the wider study area, alluvial deposits (clay, silt, sand, and gravel) are present along the base of the river valleys of the Afon Ebwy and Afon Ebwy Fach and between the south-eastern and south-western extents of the Wind Farm development site along the valley of Cwm Big, through which the watercourse, known as the Nant Big flows. Head deposits (clay, silt, sand, and gravel) and till (diamicton) are also shown to the east, southeast and west by the Afon Ebwy Fach and Afon Ebwy. Details of watercourses close to the Proposed Development Site are provided in **Chapter 10: Water Environment**.
- 11.5.11 The British Geological Survey (BGS) GeoIndex Onshore map²⁶ indicates that bedrock geology on the Proposed Development Site comprises the Hughes Member of the Pennant Sandstone Formation, which is described as "*green-grey, lithic arenites ..., with thin mudstone/siltstone and seatearth interbeds, and mainly thin coals.*"²⁷
- 11.5.12 BGS sheet 1:50 000 Abergavenny Sheet 232 Solid and Drift 1990 shows a landslip and area of foundered strata (collapsed rock) in Cwm Big just beyond the southern boundary of the Proposed Development Site. Notes on the BGS sheet indicate that these occur where thick Pennant Sandstone overlies impervious weak Coal Measures mudstones on the steep valley sides resulting in mass movement. It is apparent that the foundered strata are associated with a coal seam outcrop and so may be mining related. The seam is not identified on the map but from its elevation is likely to be the Cefn Glas seam. The BGS GeoIndex shows several areas of landslide deposits on the lower reaches of the valley sides to the east and west.

²⁶ British Geological Survey (2022). GeoindeX Onshore (Online) Available at: <http://mapapps2.bgs.ac.uk/geoindex/home.html>, Accessed March 2021

²⁷ British Geological Survey (2022). The BGS Lexicon of Named Rock Units – Result Details (Online). Available at: <https://webapps.bgs.ac.uk/lexicon/lexicon.cfm?pub=H>, (Accessed March 2021)

- 11.5.13 Coal seam outcrops are shown around the margin of the topographic high which forms the Proposed Development Site, with the Cefn Glas and Brithdir seams the shallowest named seams in this area. These seams are inferred to underlie the Site. Several mine entries are shown at the base of valley sides.
- 11.5.14 Within the Proposed Development Site, the Mynyddislwyn seam outcrops as a small circular feature in the southeast. Three adit entrances are shown on the BGS sheet around this circular outcrop, and it is assumed to have been mined at shallow depth in this location.
- 11.5.15 A large area in the southeast of the Site is shown as an opencast coal prospecting site (Site number 070883).
- 11.5.16 Several faults are shown crossing the Site – there appear to be two sets, one running broadly north to south and the other running northwest to southeast, which is consistent with the regional pattern.
- 11.5.17 There are limited BGS borehole records available for the Proposed Development Site. Borehole ref. SO20SW16²⁸ is a below ground borehole associated with Six Bells Colliery to locate the Garw coal seam. The borehole commenced at 193m BOD (below Ordnance Datum), with the seam identified at 215.4m BOD. Borehole record SO20SW15²⁹ is located outside the Proposed Development Site within Cwm Big. This is also a below ground borehole associated with Six Bells Colliery to locate the Garw coal seam. The borehole commenced at 185.87m BOD with the seam encountered at 205.53m BOD. These two boreholes encountered siltstone, sandstone, and mudstone.
- 11.5.18 **Figure 11.1** shows the identified potential mining and geological hazards.

Geodiversity

- 11.5.19 The MAGIC interactive database³⁰ indicates that there are no geological Sites of Special Scientific Interest (SSSIs) located within the Proposed Development Site or in the wider study area.
- 11.5.20 The Natural Resources Wales dataset for Regionally Important Geodiversity Sites (RIGS)³¹ was consulted and indicates there are no RIGS within the Proposed Development Site or in the wider study area.
- 11.5.21 Given the absence of non-statutory and statutory geological designations within the Proposed Development Site or in the study area, these receptors have been scoped out of the EIA.

²⁸ British Geological Survey (undated). BGS ID: 264161 : BGS Reference: SO20SW16. British National Grid (27700) : 320380,203040 (Online) Available at: http://scans.bgs.ac.uk/sobi_scans/boreholes/264161/images/10528009.html. (Accessed April 2022).

²⁹ British Geological Survey (undated). BGS ID: 264160 : BGS Reference: SO20SW15. British National Grid (27700) : 320550,203060 (Online) Available at: http://scans.bgs.ac.uk/sobi_scans/boreholes/264160/images/10528009.html. (Accessed April 2022).

³⁰ Defra (2022). Magic Maps. (Online) Available at: <https://magic.defra.gov.uk/MagicMap.aspx>, (Accessed March 2021).

³¹ Natural Resources Wales (2022). Regionally Important Geological and Geomorphological Sites (RIGS) (Online). Available at: <https://data.gov.uk/dataset/8aafe661-c368-4135-9be1-0423b6366bab/regionally-important-geological-and-geomorphological-sites-rigs>, (Accessed February 2022).

Minerals

- 11.5.22 The Wind Farm development site is within an Aggregates Safeguarding Area, Mineral Buffer Zone and Preferred Area defined in the Blaenau Gwent Local Development Plan 2012. In relation to coal resources, Welsh Government planning policy is to move away from extraction of energy minerals.
- 11.5.23 Given that there are no known proposals for mineral extraction at the Proposed Development Site and that the wind farm development footprint would only occupy a small proportion of the Proposed Development Site effects on minerals have been scoped out of the EIA.

Land contamination

- 11.5.24 The Phase 1 Geo-environmental desk study (Wood, 2022) has identified potential sources of land contamination on the Proposed Development Site to include a former licensed landfill and other potential landfill areas, residual mine waste from onsite surface workings, made ground (disturbed ground evident on aerial photography or historical maps), historical farm operations including use of fuels/oils, agricultural chemicals such as pesticides, dilapidated farm buildings with possible asbestos content which may be released as asbestos fibres to ground, mine gas from former deep workings on the site and ad hoc use of the northern area of the site for motorbike scrambling. These are shown on **Figure 11.2**.
- 11.5.25 A licensed landfill was in the southwest of the Site. The licence status in the Envirocheck is listed as 'operational as far as is known', although the licence is noted to expire in 2003, and there is anecdotal evidence from the current landowner that the landfill is clay lined and capped. The site category was a 'Landfill Taking Other Wastes' ('Construction, Demolition, Dredgings') and authorised waste was inert soil, subsoils and excavation wastes. The maximum input rate is noted to be large (75,000 to 250,000 tonnes per year). The licence location shown in the Envirocheck is not consistent with the location of possible tipping/material placement identified from aerial photographs, OS maps and by site walkover to inform the Phase 1 Geo-environmental desk study (Wood, 2022). The landfill was indicated to be approximately 3m thick during the site walkover. The licensed area as shown on the Envirocheck, and the suspected landfill area based on the desk study are shown on **Figure 11.2**.
- 11.5.26 The Phase 1 Geo-environmental desk study (Wood, 2022) identified several areas of historical coal mining and mine waste disposal on the Proposed Development Site. Five mine entries are shown on the Coal Authority Interactive Map in the southeast of the Proposed Development Site associated with the outcrop of the Mynyddislwyn coal seam. The outcrop of the Mynyddislwyn seam defines an area of identified surface mining (past and current) shown on the Coal Authority Interactive Map. A small linear area of past shallow coal mining is also identified in the southern part of the outcrop.
- 11.5.27 Two large Development High Risk Areas are shown within the site boundary on the Coal Authority Interactive Map. One in the southeast associated with the shafts and seam outcrop, as noted above, corresponds to an area identified by the Coal Authority as the Six Bells and Vivian Tip, the other is in the northwest. Two shafts in the southeast are identified on the Envirocheck Report as potentially infilled land. Several additional clusters

of small Development High Risk Areas are shown in the northeast and southwest and are noted on the Coal Authority Interactive Map to be associated with fissures and breaklines. A large area of probable shallow mine workings shown in the northwest of the Proposed Development Site is coincident with the large Development High Risk Area in this area.

- 11.5.28 Much of the south-eastern limb of the Proposed Development Site has previously been occupied by colliery spoil tips. Aerial imagery from 2010 shows ongoing tip reclamation works in the southeast of the Proposed Development Site on land immediately northwest of the Six Bells and Vivian Tip at the south-eastern extent of the site. Reclamation of the Six Bells and Vivian Tip is reported anecdotally by the current landowner to have been completed by around 2006. In relation to the tipped material immediately northwest of this, it is unclear if all the tip material was removed, or simply regraded to create a new landform. During the walkover survey of the site in 2021, the location of this tip was noted as a prominent feature on the high point of the hill, but no spoil materials were apparent.
- 11.5.29 Other areas of the Proposed Development Site were identified in the Phase 1 Geo-environmental desk study (**Appendix 11A**, Wood, 2022) as having evidence of ground disturbance/ground reworking, this could indicate the presence of made ground which is a potential source of contaminants including asbestos, metals, and hydrocarbons.
- 11.5.30 Regarding contamination from agricultural activities, any contamination present, such as that arising from fuel/oil/chemical usage or leaks/spills, or ad hoc waste disposal is likely to be localised and of limited extent. Historical agricultural buildings may include asbestos containing materials, for instance included within roofing and/or cladding materials. When in a dilapidated state there is the potential for these to release asbestos fibres to ground. The main source areas are likely to be associated with the current and former farm buildings, where the main storage areas and operations were likely to have taken place.
- 11.5.31 Former mine workings are a potential source of toxic and explosive gases and the Phase 1 Geo-environmental desk study (Wood, 2022) identifies a potential risk of ground gas being present. Whilst the turbines are not associated with significant enclosed spaces, the risk relates to the proposed built environment, particularly the substation building. No historical mine gas issues have been identified at the site based on desk study evidence.
- 11.5.32 The area in the north of the site is used as a mountain biking track and for ad hoc use for motorbike scrambling, giving rise to possible fuel leaks or spills. However, this is a potential dispersed and small-scale localised source of contamination that is unlikely to give to significant risks to site users or the environment.
- 11.5.33 Potential sources of contamination are present in the surrounding area including former quarries, former mining activities and associated waste disposal activities. However, no current or historical activities with the potential to impact on land quality on the Proposed Development Site were identified in the Phase 1 Geo-environmental desk study (Wood, 2022).

Environmental setting: hydrogeology, hydrology, and sensitive land uses

- 11.5.34 A detailed description of hydrogeology is presented in **Chapter 10: Water Environment**. In summary, the South Wales Upper Coal Measures underlying the Proposed Development Site and the alluvium deposits present within the study area are classified by

NRW as Secondary A Aquifers. The till and head deposits within the study area are classified as Secondary Undifferentiated aquifers. The South Wales Upper Coal Measures is a designated WFD groundwater body and achieved 'Good' quantitative status and 'Poor' chemical status in the 2016 WFD classification (Cycle 2). The Proposed Development Site and the wider study area are not within a Source Protection Zone (SPZ).

- 11.5.35 A detailed description of hydrology is presented in **Chapter 10: Water Environment**. In summary, the nearest watercourses are the:
- Nant Big, which issues within the Proposed Development Site and flows to the south.
 - Afon Ebwy, which flows south to the west and then south of the Proposed Development Site.
 - Afon Ebwy Fach, which flows south to the east of the Proposed Development Site and joins Afon Ebwy.
- 11.5.36 There are also ponds/lakes within the Proposed Development Site and the wider study area, and springs within the study area.
- 11.5.37 There are no statutory designated ecological sites on the Proposed Development Site or within the study area. The assessment of the likely significant effects of the Proposed Development on biodiversity is presented in **Chapter 8: Biodiversity**.

Grid Connection

Topography

- 11.5.38 The Grid Connection corridor covers a small segment of the western face of the Mynydd Carn-y-Cefn ridge, traversing the slope between the top of the ridge and the road (A4046) which runs parallel with the ridge. The highest elevation is approximately 410m AOD, whilst the lowest elevation is 230m AOD at the road level.

Soils (including agricultural land)

- 11.5.39 Information provided by the LandIS Soils map²⁵ indicates the likely soil types within the Grid Connection corridor to comprise freely draining acid loamy soils over rock, with a loamy texture and medium carbon content (Type 13).
- 11.5.40 The Unified Peat Map of Wales shows no peat deposits on the Grid Connection corridor. The absence of deep peat on the adjacent Proposed Development Site was confirmed by a peat survey completed in 2021. Although the Grid Connection corridor was not included in this survey the available desk study information described above does not indicate the potential presence of peat and no further survey is proposed.
- 11.5.41 Most of the corridor is considered to be directly underlain by bedrock. A thin soil layer is likely to be present across the site and, based on the Phase 1 Geo-environmental desk study (Wood, 2022), some of this is likely to be placed (and potentially imported) soil or restored soil on top of former surface workings.

- 11.5.42 The Predictive Agricultural Land Classification (ALC) Map 2²³ indicates that the agricultural land classification within the Grid Connection corridor is predominantly non-agricultural, with a small area of possible Grade 4 land in the north. It does not include any Best and Most Versatile' (BMV) land (Grades 1, 2 or 3a).

Geology

- 11.5.43 The British Geological Survey (BGS) 1:50,000 scale geology mapping²⁶ shows superficial deposits are thin or absent within the Grid Connection corridor except for its northwest corner where Head deposits (clay, silt, sand, and gravel) are shown. Immediately southwest of the Grid Connection corridor a linear section of glaciofluvial sand and gravel is shown to run along the valley side. The mapping generally indicates that bedrock is close to surface (<10m below ground level) or at surface.
- 11.5.44 Immediately west of the Grid Connection corridor, the BGS GeoIndex 1:50,000 scale mapping shows a large area of artificial ground. This is coincident with the former Marine Colliery which was present between 1901 and 1999 and included several railway sidings.
- 11.5.45 The BGS GeoIndex²⁶ indicates that bedrock geology in the east of the Grid Connection corridor comprises the Hughes Member of the Pennant Sandstone Formation. In the west of the Grid Connection site where the ground level drops at the valley side the bedrock geology changes to the Brithdir Member – mudstone, siltstone and sandstone (Green-grey, lithic arenites ("Pennant sandstones") with conglomerate lenses at bases of units; thin mudstone/siltstone and seatearth interbeds and mainly thin coals)³² and the Rhondda Member – sandstone (green-grey, lithic arenites ("Pennant sandstones") with thin mudstone/siltstone and seatearth interbeds and mainly thin coals.)³³. The BGS mapping shows an inferred outcropping coal seam. In the northwest of the Grid Connection corridor the BGS GeoIndex shows an inferred coal seam on the valley side, and the Coal Authority Interactive Map shows a coal outcrop associated with the Brithdir Member where it underlies the Grid Connection corridor.
- 11.5.46 There are no BGS borehole record available within the Grid Connection corridor, and those available in the surrounding area are unlikely to be representative of its ground conditions.
- 11.5.47 With respect to former coal mining on the Grid Connection corridor, the seam layout for the Brithdir seam is consistent with the published geological map and it is inferred to underlie the entire Grid Connection corridor at shallow depth. The Coal Authority Interactive Map shows the Cefn Glas seam to outcrop beneath the centre of the Grid Connection corridor, running approximately north to south, with a dislocation of the seam noted close to its northern boundary.
- 11.5.48 The Coal Authority Interactive Map shows several shafts within or on the western edge of the Grid Connection corridor. Two shafts and an adit are shown within the Grid Connection corridor, identified as follows: 319204-015, shaft; 319204-006 shaft; and, 318204-005 adit, bearing 80°. All these mine entries have a treatment indicator of 'False'. Additional shafts and an adit are shown adjacent to the western boundary on and to the

³² British Geological Survey (2022). The BGS Lexicon of Named Rock Units – Result Details (Online). Available at: <https://webapps.bgs.ac.uk/lexicon/lexicon.cfm?pub=BD>, (Accessed January 2022).

³³ British Geological Survey (2022). The BGS Lexicon of Named Rock Units – Result Details (Online). Available at: <https://webapps.bgs.ac.uk/lexicon/lexicon.cfm?pub=RA>, (Accessed January 2022).

west of to the A4046. The north-eastern and northern areas of the Grid Connection corridor are within an area of probable shallow coal mine workings, which is defined as a Development High Risk Area. Additional Development High Risk Areas extend beneath the central and western areas of the Grid Connection corridor associated with the seam outcrops noted above.

- 11.5.49 An area of past shallow coal mine workings encroaches slightly into the north-western area of the Grid Connection corridor.
- 11.5.50 A large number of mine entries are shown around the margin of the site associated with seam outcrops at the base of the topographical high, and also within Cwm Big, the valley to the south of the corridor. Two adit entrances are shown in Cwm Big, in the area of foundered strata.
- 11.5.51 **Figure 11.1** shows the identified potential mining and geological geohazards.

Geodiversity

- 11.5.52 The MAGIC interactive database³⁰ indicates that there are no geological SSSIs located within the Grid Connection corridor or in the wider study area.
- 11.5.53 The Natural Resources Wales dataset for Regionally Important Geodiversity Sites (RIGS)³¹ was consulted and indicates there are no RIGS within the Grid Connection corridor or in the wider study area.
- 11.5.54 Given the absence of non-statutory and statutory geological designations within the Proposed Development site or in the study area, these receptors have been scoped out of the EIA.

Minerals

- 11.5.55 The Grid Connection corridor is within an Aggregates Safeguarding Area, and partially within a Mineral Buffer Zone defined in the Blaenau Gwent Local Development Plan 2012.
- 11.5.56 Given that there are no known proposals for mineral extraction at the Grid Connection corridor effects on minerals have been scoped out of the EIA.

Land contamination

- 11.5.57 The Phase 1 Geo-environmental desk study (Wood, 2022) identifies historical coal mining on and in proximity to the Grid Connection corridor. Shafts were present on or at the western edge of the Grid Connection corridor. The north-eastern and northern areas of the Grid Connection corridor are within an area of probable shallow coal mine workings identified by the Coal Authority, and an area of known past shallow coal mine workings encroaches slightly into the north-western area of the Grid Connection corridor. The small area (approximately 0.4ha) of known workings is in the part of the site where residential properties are present. No indication of colliery or other waste tipping has been identified within the Grid Connection corridor.

- 11.5.58 Llandafal Tip, a historical landfill, is located 100m west of the Grid Connection corridor. This feature is unlikely to impact on land quality at the Grid Connection corridor due its location downgradient of the Grid Connection corridor.
- 11.5.59 No other sources of potential contamination have been identified within the Grid Connection corridor and no sources have been identified within the study area that could potentially impact on the Grid Connection corridor due to onsite migration of contaminants.

Environmental setting: hydrogeology, hydrology and sensitive land uses

- 11.5.60 A detailed description of hydrogeology is presented in **Chapter 10: Water Environment**. In summary, the South Wales Upper Coal Measures are classified by NRW as Secondary A Aquifers. The head deposits are classified as Secondary Undifferentiated aquifers. The South Wales Upper Coal Measures underlying the study area is a designated WFD groundwater body and achieved 'Good' quantitative status and 'Poor' chemical status in the 2016 WFD classification (Cycle 2). The Grid Connection corridor and the wider study area are not within a SPZ.
- 11.5.61 A detailed description of hydrology is presented in **Chapter 10: Water Environment**. In summary, the nearest watercourse is the Afon Ebwy, which flows south 140m west of the Grid Connection corridor.
- 11.5.62 There are no statutory designated ecological sites on the Grid Connection corridor or within the study area. The assessment of the likely significant effects of the Proposed Development on biodiversity is presented in **Chapter 8: Biodiversity**.

Future baseline

- 11.5.63 In the absence of the Proposed Development, the current land uses (agriculture, forestry, public open space) within the Proposed Development Site and Grid Connection corridor are likely to continue. There is some evidence of diversification of the farming activities on the site, which now include a regular festival, however, this does not currently require any hard development (such as buildings or hardstanding) that would result in soil sealing (covering the ground with an impermeable material or structure).
- 11.5.64 With respect to land contamination, this is managed in Wales by Part 2A of the Environmental Protection Act 1990. Part 2A requires county councils to identify potentially contamination land in their area and ensure potential risks from historical contamination are assessed and mitigated accordingly. For future developments, The Town and Country Planning Act 1990 requires the consideration of the potential for contamination to be present and ensure a site is suitable for the proposed end use. Therefore, it is reasonable to conclude that in the absence of the Proposed Development there would not be a change in ground conditions over time within the study area.

11.6 Embedded measures

11.6.1 A range of environmental measures have been embedded into the Proposed Development as outlined in **Chapter 4, Section 4.9. Table 11.6** outlines how these embedded measures will influence the ground conditions assessment.

Table 11.6 Summary of the embedded environmental measures related to Ground conditions

Receptor	Potential changes and effects	Embedded measures	Compliance mechanism
Construction			
Soil	Compaction of soil by vehicles or during stockpiling during construction leading to damage to soil structure resulting in damage to/loss of soil functions	<p>Storage and handling of soil will be informed by the Defra (2009) Construction Code of Practice for the Sustainable Use of Soils on Construction Sites to avoid damage to soil structure and help to minimise soil compaction. This measure is integrated into the Draft CEMP submitted alongside this Draft ES.</p> <p>If ground conditions require it, a temporary trackway of either metal, wood, or plastic, would be used for vehicles to access the working areas. This would be removed once construction is complete.</p> <p>During topsoil stripping, machinery with low ground pressure will be used to minimise soil compaction, including during construction of the access tracks, the tracks will then be available for heavier vehicles to use to avoid impacts on other areas.</p> <p>Temporary storage of soils will be carried out in accordance with the MMP. This document will outline where excavated non-waste materials will be reused in line with the CL:AIRE Definition of Waste Code of Practice (DoWCoP). The MMP will include a declaration by a Qualified Person that the MMP has been completed in accordance with the DoWCoP and that best practice is being followed. The Draft CEMP refers to the MMP.</p>	CEMP and Materials Management Plan (MMP)
Soil	Erosion of soil during construction, leading to loss of organic matter in runoff	<p>Storage and handling of soil will be informed by the Defra (2009) Construction Code of Practice for the Sustainable Use of Soils on Construction Sites to avoid damage to soil structure and help to minimise soil erosion from surface water runoff. This measure is integrated into the Draft CEMP.</p> <p>Measures to avoid soil compaction (which can result in soil erosion by increasing surface run-off) are integrated into the Draft CEMP to avoid damage to soil.</p>	CEMP and MMP



Receptor	Potential changes and effects	Embedded measures	Compliance mechanism
		<p>The Draft CEMP refers to the MMP which will detail how temporary storage of soils is to be managed.</p> <p>Soil stockpiles will be stored for the shortest amount of time possible.</p>	
Soil	<p>Permanent loss of soil and associated soil functions due to construction of the wind farm</p>	<p>Elements of the Proposed Development which require removal of topsoil during construction and where topsoil cannot be reinstated will be kept to the minimum footprint required for the Proposed Development.</p> <p>Storage and handling of soil will be informed by the Defra (2009) Construction Code of Practice for the Sustainable Use of Soils on Construction Sites to avoid damage to soil structure. This measure is integrated into the Draft CEMP.</p> <p>Permanently displaced soil will be reused within the Proposed Development Site where practicable in accordance with the MMP, as referenced in the Draft CEMP.</p>	<p>CEMP and MMP</p>
Soil resources temporarily or permanently displaced, or to be translocated within the Proposed Development application boundary	<p>Degradation of soil functions and agricultural land quality due to cross-contamination of topsoil with contaminated soil/material excavated/disturbed during construction work</p>	<p>A Phase 1 geo-environmental desk study has been completed for all elements of the Proposed Development (Appendix 11A). This has identified potential contamination sources within agricultural areas.</p> <p>A Phase 2 geo-environmental ground investigation will be completed at the pre-construction stage to characterise soil chemistry at target areas. This will include environmental testing of shallow soil (top 0.3m) for potential contaminants, including asbestos, metals and hydrocarbons as identified in the Phase 1 Geo-environmental desk study, in addition to geotechnical testing to inform the design and material selection. Deeper soil testing will be carried out as needed to inform the detailed (post consent) design of the Proposed Development in relation to infrastructure within former landfill, former colliery tip areas or other areas of suspected made ground. The results of the soil testing will be used to carry out a contaminated land risk assessment to confirm that the soils are suitable for use in the Proposed Development. The contaminated land risk assessment will be completed in accordance with the Environment Agency LCRM guidance. Prior to construction, an MMP will be prepared outlining where excavated non-waste materials will be reused in line with the CL:AIRE Definition of Waste Code of Practice (DoWCoP).</p>	<p>CEMP, MMP and DNS condition</p>



Receptor	Potential changes and effects	Embedded measures	Compliance mechanism
		<p>The Draft CEMP includes a procedure for encountering unexpected contamination or suspected contamination, which will require additional testing and risk assessment to determine appropriate measures. Materials will be segregated where possible to prevent cross-contamination occurring and will only be reused if confirmed to be suitable for use and in accordance with other requirements of the MMP.</p> <p>Any temporary onsite storage of excavated materials suspected or confirmed to be contaminated will be placed on impermeable sheeting, covered over and with adequate leachate/ runoff drainage to prevent migration of contaminants from the stockpile.</p>	
<p>Contaminated land receptors: Site workers/site users including construction workers</p>	<p>Impacts on human health due to land contamination</p>	<p>A Phase 1 geo-environmental desk study has been completed for all elements of the Proposed Development (Appendix 11A).</p> <p>Phase 2 intrusive geoenvironmental ground investigation will be completed during the pre-construction phase, including soil sampling and chemical testing, to confirm the ground conditions.</p> <p>Potential risks to human health from any known, suspected or unexpected ground contamination will be avoided by adopting appropriate working methods and all aspects of construction will be completed in compliance with the Construction (Design and Management) Regulations 2015, CAR 2012 and the Health and Safety at Work Act (1974) and regulations made under the Act. These legal obligations include the requirement for risk assessments and method statements for all construction related activities and the use of appropriate working methods, training and Personal Protective Equipment (PPE).</p> <p>Temporary storage of excavated materials will be in accordance with the MMP.</p> <p>Contamination if found will be subject to appropriate risk assessment and if necessary, either removed, treated and/or mitigated as part of the Proposed Development. The Draft CEMP includes an unexpected contamination protocol.</p> <p>Best practice air quality management measures will be applied as described in Institute of Air Quality Management (IAQM) (2014) guidance on the Assessment of Dust from Demolition and Construction 2014, version 1.1.</p>	<p>CEMP, MMP and DNS condition</p>



Receptor	Potential changes and effects	Embedded measures	Compliance mechanism
<p>Contaminated land receptors: soil, groundwater, surface water, humans (site users)</p>	<p>Groundwater may be encountered during construction and may require pumping from excavations. Due to the site’s historical uses, there is potential for localised contamination to be present. Uncontrolled releases of contaminated groundwater could impact on soil, groundwater or surface water quality.</p>	<p>A Phase 1 geo-environmental desk study has been completed for all elements of the Proposed Development and the report is appended (Appendix 11A).</p> <p>Generally, the Phase 1 Geo-environmental desk study indicates that the Proposed Development Site is well drained and shallow groundwater is unlikely to be encountered. However, if water is present and requires to be pumped from excavations and is suspected to be contaminated, appropriate measures will be taken in accordance with NRW guidance and the Environmental Permitting Regulations to prevent uncontrolled or unauthorised releases of this water to ground or to the water environment.</p> <p>Phase 2 intrusive geoenvironmental ground investigation will be completed during the pre-construction phase, including soil sampling and chemical testing, to confirm the ground conditions.</p>	<p>CEMP and DNS condition</p>
<p>Contaminated land receptors: soil and groundwater, humans (site users)</p>	<p>Leaks or spills of fuels or oils from construction vehicles or plant</p>	<p>During construction, vehicle maintenance and refuelling of machinery will be undertaken within designated areas where spillages can be easily contained, and machinery will be routinely checked to ensure it is in good working condition. These areas at risk of spillage or containing hazardous materials, such as vehicle maintenance areas and hazardous substance stores (including fuel, oils and chemicals) will comply with industry good practice, be bunded, have appropriate containment and segregation. Additionally, the bunded areas will have impermeable bases to limit the potential for migration of contaminants into groundwater following any leakage/spillage.</p>	<p>CEMP</p>
<p>Built environment (buildings, structures, services)</p>	<p>Unstable ground conditions with potential to cause damage to buildings/structures due to ground movement.</p> <p>Potential ground gas associated with former mine workings.</p>	<p>A Phase 1 geo-environmental desk study has been completed for all elements of the Proposed Development and the report is appended to the Draft ES (Appendix 11A).</p> <p>The Phase 1 Geoenvironmental Desk Study and the Coal Mining Risk Assessment have identified shallow mining related risk in the north of the Wind Farm site, and a more widespread risk of displacement has been identified based on the occurrence of subsidence and fissuring/fault reactivation across the site. Although there is no record of any recent subsidence, either anecdotal or from the Coal Authority. This requires further assessment including clarification with the Coal Authority regarding the definition of shallow mining risk areas and to obtain a better</p>	<p>DNS condition</p>



Receptor	Potential changes and effects	Embedded measures	Compliance mechanism
		<p>understanding of the subsidence claims and a consideration of fault reactivation/fissuring. This additional assessment forms an embedded measure to be completed preconstruction and pre – ground investigation. The Phase 1 Geoenvironmental Desk Study, and the follow-on desk-based assessment described above, will inform a programme of Phase 2 intrusive investigation and testing to allow better quantification of the identified constraints in the proposed wind farm infrastructure locations, in particular those arising from filled/disturbed ground and historic mineworkings.</p> <p>Consideration of the risks from ground gas will be given in the design of the preconstruction Phase 2 ground investigation, in areas of the Proposed Development where there could be potential for ground gas accumulation to take place in enclosed spaces (this depends on the detailed design of these buildings/structures in addition to the presence of ground gas).</p> <p>All aspects of the Proposed Development from construction to operation will comply with the Health and Safety at Work etc. Act and regulations made under the Act.</p> <p>The design for the Proposed Development will comply with good practice in structural design including compliance with the Eurocodes and relevant British Standards. The design will account for the expected ground conditions and design loads, accounting for the effects of climate change. The design of the Proposed Development will be completed in accordance with CDM 2015.</p>	
<p>Built environment (buildings, structures, services)</p>	<p>Aggressive ground conditions with potential to cause damage to buildings/structures due to chemical attack.</p>	<p>A Phase 1 geo-environmental desk study has been completed for all elements of the Proposed Development and the report is appended to the Draft ES (Appendix 11A).</p> <p>Phase 2 intrusive geoenvironmental ground investigation will be completed during the pre-construction phase, including soil sampling and chemical testing, to confirm the ground conditions. The design for the Proposed Development will be based on the data obtained from the investigation and will comply with good practice in structural design to mitigate risks from aggressive ground conditions.</p>	<p>DNS condition</p>
<p>Operation</p>			



Receptor	Potential changes and effects	Embedded measures	Compliance mechanism
Soils/agricultural land	Damage to soil during maintenance activities requiring excavation	Maintenance activities requiring ground disturbance will be infrequent and limited in extent and are therefore likely to require minimal disturbance to soil.	Standard operating procedures (SOPs)
Contaminated land receptors: soil and groundwater, humans (site users)	Leaks or spills of fuels or oils from vehicles or plant during wind farm or grid connection maintenance	During operation, vehicle maintenance and refuelling of machinery will be undertaken within defined areas where spillages can be easily contained, and machinery will be routinely checked to ensure it is in good working condition. These areas at risk of spillage or containing hazardous materials, such as vehicle maintenance areas and hazardous substance stores (including fuel, oils, and chemicals) will comply with industry good practice, be bunded, have appropriate containment and segregation. Additionally, the bunded areas will have impermeable bases to limit the potential for migration of contaminants into groundwater following any leakage/spillage.	Standard operating procedures (SOPs)
Contaminated land receptors: humans (site users)	Impacts on site users' health due to encountering contaminants in soil	<p>A Phase 1 geo-environmental desk study has been completed for all elements of the Proposed Development and the report is appended to the Draft ES (Appendix 11A).</p> <p>A Phase 2 geo-environmental ground investigation will be completed at the pre-construction stage to assess the presence of contaminants in the shallow soil that could subsequently be mobilised e.g., as dust or loose fibres that can be inhaled, or tracked back into vehicles/enclosed spaces. this will include a human health risk assessment to confirm whether additional measures are needed. The contaminated land risk assessment will be completed in accordance with the Environment Agency LCRM guidance. The assessment will determine whether the soil is suitable for use and this information will inform the MMP. If material is not suitable for use, then it will be disposed of offsite in accordance with the Waste Management Regulations.</p> <p>All aspects of construction will be completed in compliance with the Construction (Design and Management) Regulations 2015, CAR 2012 and the Health and Safety at Work Act (1974) and regulations made under the Act.</p> <p>The Draft CEMP includes an unexpected contamination protocol.</p>	DNS planning condition
Contaminated land receptors: humans (site users), buildings	Accumulation of mine gas within enclosed spaces leading to potentially toxic and/or	A Phase 1 geo-environmental desk study has been completed for all elements of the Proposed Development and the report is appended to the Draft ES (Appendix 11A).	DNS planning condition



Receptor	Potential changes and effects	Embedded measures	Compliance mechanism
	explosive atmospheres in enclosed spaces.	A Phase 2 geo-environmental ground investigation will be completed at the pre-construction stage where the potential for gas accumulation in enclosed spaces is identified (e.g., substation buildings). This will include adequate gas monitoring so that a ground gas risk assessment can be completed in accordance with CIRIA C665 ³⁴ , which is likely to entail a minimum of six monitoring rounds over a minimum period of three months.	
Built environment (buildings, structures, services)	Aggressive or unstable ground conditions with potential to cause damage to buildings/structures due to ground movement or chemical attack.	<p>The Phase 1 Geoenvironmental Desk Study and the Coal Mining Risk Assessment have identified that there is documented, and visual evidence of subsidence associated with mining across the Wind Farm development site in the form of resolved mining subsidence claims and fractures/fissures identified by the current site occupier anecdotally. To allow the potential subsidence risk to be better understood, further desk-based investigation is recommended in the Coal Mining Risk Assessment, which will then require intrusive investigation during the pre-construction phase e.g., boreholes. Remediation may subsequently be needed. The design of the intrusive investigation will be based upon the findings of the further desk study work.</p> <p>The basis of the structural design for the Proposed Development will be completed in general accordance with design standards to minimise the risk of future structural or geotechnical instability.</p>	DNS planning condition
Decommissioning			
The embedded mitigation measures for the decommissioning phase are anticipated to be similar to those for the construction phase.			

11.7 Scope of the assessment

The Proposed Development

- 11.7.1 This section sets out the scope of the assessment for Ground Conditions, specifically in relation to soils and contaminated land. This scope has been developed as the design of the Proposed Development has evolved, and in response to the feedback to date as set out in **Section 11.3**.

³⁴ CIRIA (2007) Assessing risks posed by hazardous ground gases to buildings (C665). CIRIA; UK



Spatial scope

- 11.7.2 The spatial scope of the assessment of Ground Conditions covers the area of the Proposed Development contained within the red line boundary ('the Proposed Development Site'), together with the Zones of Influence (Zols) that have formed the basis of the study area described in **Section 11.4**.
- 11.7.3 For contaminated land receptors the Zol has been defined as an area extending 250m from the boundary of the Proposed Development Site. Due to the location of the Proposed Development Site on top of the ridge, and the Grid Connection corridor on the slope at the west side of the ridge, there is limited potential for onsite migration of contamination and the nature of the surrounding land use means there are limited potential sources.

Temporal scope

- 11.7.4 The temporal scope of the assessment of Ground Conditions in relation to land contamination is consistent with the period over which the Proposed Development would be carried out and, therefore, covers the construction (approximately 22 months), operational (30 years) and decommissioning (approximately 6 months) periods.
- 11.7.5 In relation to effects on soils and agricultural land, the highest potential for significant effects applies to the construction of the Proposed Development (period of approximately 22 months). Consideration is also given in the assessment to potential effects on soils during the operation and maintenance (30 years), and decommissioning phases (approximately 6 months).

Potential receptors

- 11.7.6 The principal Ground Condition receptors that have been identified as being potentially subject to effects are summarised in **Table 11.7**.

Table 11.7 Ground condition receptors subject to potential effects

Receptor	Reason for consideration
Soils	
Soil resources	<p>Land within the Proposed Development Site is predominantly in agricultural use. There is no BMV agricultural land within the study area, however, grazing of sheep and cattle and over-winter fodder (turnips) growing takes place.</p> <p>Peaty soils are present within the Proposed Development Site and some thin layers of peat/localised peat up to 0.3m in thickness are present. Key soil functions on the land include supporting crop growth, storage of organic carbon, providing habitat and supporting biodiversity and a role in the hydrological cycle.</p>
Land Contamination	



Receptor	Reason for consideration
<p>Humans – site users (agricultural workers, maintenance workers/ operatives (e.g., solar farm workers), public open space users)</p> <p>Humans – construction workers</p> <p>Humans - future site users (agricultural workers, maintenance workers/ operatives (e.g., solar farm workers/wind farm workers), public open space users)</p>	<p>Potential for human health impacts to these receptors has been identified in the Phase 1 geo-environmental desk study due to land contamination. Effects could occur either during construction or operation.</p>
<p>Controlled water - Groundwater – Secondary A aquifer (Coal Measures), Secondary (undifferentiated) aquifer (head deposits), Secondary A aquifer (fluvioglacial sand and gravel)</p>	<p>Groundwater has been identified as a potential receptor in the Phase 1 geo-environmental desk study. Effects on the water environment due to land contamination could occur either during construction or operation.</p>
<p>Controlled water; Surface water – Nant Big, Afon Ebwy river and Afon Ebwy Fach river</p>	<p>Surface water has been identified as a potential receptor in the Phase 1 geo-environmental desk study. Effects on the water environment due to land contamination could occur either during construction or operation.</p>
<p>Buildings and services</p>	<p>Potential for impacts on the built environment (future wind farm development) due to land contamination have been identified in the Phase 1 geo-environmental desk study.</p> <p>Potential for impacts on the built environment (future wind farm development) due to land instability have been identified in the Phase 1 geo-environmental desk study and Coal Mining Risk Assessment.</p>

Likely significant effects

11.7.7 The effects on ground condition receptors which have the potential to be significant and have been taken forward for detailed assessment are summarised in **Table 11.8**.

Table 11.8 Ground condition receptors scoped in for further assessment

Receptor	Likely significant effects
Construction	
Soil resources/agricultural land	<p>Compaction of soil by construction vehicles or during stockpiling leading to damage to soil structure, damage to/loss of soil functions and degradation of agricultural land.</p> <p>Erosion of soil during construction, leading to loss of organic matter in runoff, causing degradation of soil function and agricultural land quality.</p> <p>Permanent loss of agricultural land, soil, and associated soil functions when soil is removed from the Proposed Development Site for construction of the permanent</p>



Receptor	Likely significant effects
	features of the proposed development: turbine foundations, crane pads, access tracks, kiosks and substation.
	Impacts on soil quality/agricultural land quality due to cross-contamination with contaminated soil/material excavated/disturbed during soil handling for construction of the Proposed Development.
Operation	
Contaminated land receptors: site users (agricultural workers, maintenance workers/ operatives (e.g., solar farm/wind farm workers), public open space users)	Exposure to land contamination via numerous pathways (e.g., inhalation, direct contact, ingestion) resulting in health effects to site users.
Contaminated land receptors: site users (agricultural workers, maintenance workers/ operatives (e.g., solar farm/wind farm workers), public open space users), built environment (buildings, structures, services)	Accumulation of mine gas within enclosed spaces leading to potentially toxic and/or explosive atmospheres in enclosed spaces.
Decommissioning	
The potential effects during decommissioning are similar to those during construction.	

11.7.8 The receptors/effects detailed in **Table 11.9** have been scoped out from being subject to further assessment because the potential effects are not considered likely to be significant.

Table 11.9 Summary of effects scoped out of the ground conditions assessment

Receptors/potential effects	Justification
Construction	
Geology (geodiversity)	There are no geological features with statutory or non-statutory designations for conservation of geodiversity within the study area.
Minerals	Although the Wind Farm development site and the Grid Connection site are within an Aggregates Safeguarding Area, and partially within a Mineral Buffer Zone defined in the Blaenau Gwent Local Development Plan 2012, there are no known proposals for mineral extraction within the study area. Additionally, in relation to coal resources, Welsh Government planning policy is to move away from the extraction of energy minerals.
Peat - degradation or loss of peatland	There is limited thin/shallow peat on the site, and no deep peat*. Effects on peatland are, therefore, scoped out. Effects on thin peat/peaty soils (anticipated across less than 6% of the total area of Proposed Development Site) are incorporated into the assessment of effects on soil resources.

Receptors/potential effects	Justification
<p>Contaminated land receptors: Site users (agricultural workers, maintenance workers, operatives (e.g., solar farm workers), public open space users) – impacts on human health due to encountering land contamination</p>	<p>*The Welsh Government defines deep peat as having a thickness of >0.4m organic material in the upper 0.8m of a soil profile³⁵.</p> <p>The embedded measures include a commitment that potential risks to human health from any known, suspected, or unexpected ground contamination will be avoided by adopting appropriate working methods and all aspects of construction will be completed in compliance with the Construction (Design and Management) Regulations 2015, CAR 2012 and the Health and Safety at Work Act (1974) and regulations made under the Act. These legal obligations include the requirement for risk assessments and method statements for all construction related activities and the use of appropriate working methods, training, and Personal Protective Equipment (PPE), and protection of the general public e.g., through site security measures to prevent access to construction areas and control of dusts. Contamination if found will be subject to appropriate risk assessment and if necessary, either removed, treated and/or mitigated as part of the Proposed Development.</p>
<p>Contaminated land receptors: Construction workers – impacts on human health from known, suspected or unexpected land contamination</p>	<p>Risks to construction workers will be dealt with under the Health and Safety at Work Act (1974) and regulations made under the act. Site-specific contamination data obtained from all site investigations will be included in the pre-construction information (requirement of Construction Design and Management Regulations, 2015) for the proposed works, to enable appointed contractors to address and manage potential risk from contamination as necessary in their risk assessments and method statements.</p>
<p>Contaminated land receptors: soil and groundwater, humans (site users - agricultural workers, maintenance workers, operatives (e.g., solar farm workers), public open space users) – impacts on human health or the water environment due to leaks or spills or fuels or oils from construction vehicles or plant</p>	<p>The embedded measures include limitations on where and how refuelling/maintenance of plant and vehicles can take place. During construction, vehicle maintenance and refuelling of machinery will be undertaken within designated areas where spillages can be easily contained, and machinery will be routinely checked to ensure it is in good working condition. These areas at risk of spillage or containing hazardous materials, such as vehicle maintenance areas and hazardous substance stores (including fuel, oils, and chemicals) will comply with industry good practice, be bunded, have appropriate containment and segregation. Additionally, the bunded areas will have impermeable bases to limit the potential for migration of contaminants into groundwater following any leakage/spillage.</p>
<p>Built environment (buildings, structures, services) - Aggressive ground conditions with potential to cause damage to buildings/structures due to chemical attack.</p>	<p>The embedded measures include a commitment to the basis of the structural design for the Proposed Development being completed in general accordance with design standards. Any peat is likely to be acidic and sulphate minerals may be present within the Coal Measures strata. This will be assessed through ground investigation completed during the pre-construction to determine the requirements for in ground concrete structures. Therefore, no significant effects are likely relating to chemical attack on structures.</p>
<p>Operation</p>	
<p>Soils/agricultural land</p>	<p>Maintenance activities requiring ground disturbance will be infrequent and limited in extent and are therefore likely to require minimal disturbance to soil.</p>

³⁵ Natural Resources Wales (2022), Peatland Data Portal Map Layers (Online), Available at: <https://naturalresourceswales.gov.uk/evidence-and-data/maps/peatland-data-portal-map-layers/?lang=en>. (Accessed April 2022).



Receptors/potential effects	Justification
Contaminated land receptors: soil and groundwater, humans (site users) - Leaks or spills of fuels or oils from vehicles or plant during wind farm or grid connection maintenance	The embedded measures include limitations on where and how refuelling/maintenance of plant and vehicles can take place during operation. Vehicle maintenance and refuelling of machinery will only be permitted within designated areas where spillages can be easily contained, and machinery will be routinely checked to ensure it is in good working condition. These areas at risk of spillage or containing hazardous materials, such as vehicle maintenance areas and hazardous substance stores (including fuel, oils, and chemicals) will comply with industry good practice, be bunded, have appropriate containment and segregation. Additionally, the bunded areas will have impermeable bases to limit the potential for migration of contaminants into groundwater following any leakage/spillage.
Built environment (buildings, structures, services) - Aggressive ground conditions with potential to cause damage to buildings/structures due to chemical attack.	The embedded measures include a commitment to the basis of the structural design for the Proposed Development being completed in general accordance with design standards. Any peat is likely to be acidic and sulphate minerals may be present within the Coal Measures strata. This will be assessed through ground investigation completed during the pre-construction to determine the requirements for in ground concrete structures. No significant effects are, therefore, likely relating to chemical attack on structures.
Built environment (buildings, structures, services) – Land instability with potential to result in subsidence	Potential for unstable ground conditions arising from former coal mining activity will be dealt with through the embedded measures. These include the geohazard and mining hazard assessments completed to date (Phase 1 Geoenvironmental Desk Study and Coal Mining Risk Assessment in Appendix 11A), further desk-based mining assessment, then intrusive ground investigation, to be completed during the pre-construction phase. These investigations will inform the development of a remediation strategy if one is needed. Remediation verification will be undertaken if remediation is subsequently undertaken. With these embedded measures, the basis of the structural design for the Proposed Development will be completed in general accordance with design standards and land instability is not considered further in the assessment.

11.8 Assessment methodology

- 11.8.1 The generic project-wide approach to the assessment methodology is set out in **Chapter 2: Approach to the Environmental Impact Assessment**. However, whilst this has informed the approach that has been used in this ground conditions assessment, it is necessary to set out how this methodology has been applied, and adapted as appropriate, to address the specific needs of this assessment for soil and land contamination receptors.
- 11.8.2 The approach to assessment is set out in **Section 11.9** for agricultural land and soils, and land contamination. The methodology for land contamination considers the change in risk level to various land contamination receptors because of the Proposed Development, whereas the approach to agricultural land and soil assessment considers the magnitude/consequence of potential effects on soils caused by the Proposed Development.



11.9 Assessment of ground condition effects

Assessment methodology: Soils

- 11.9.1 The magnitude/consequence of the loss or damage to soil resources is based upon the:
- Likely nature and scale of soils effects (positive, neutral, or negative) during the construction and operational phases of the project, and during decommissioning (which is anticipated to have the potential for similar effects as the construction phase but smaller in scale).
 - Likelihood of the Proposed Development to result in significant effects.
 - Issues requiring further assessment and the methods to be applied.
- 11.9.2 The sensitivity of the soil on the Proposed Development Site has been assigned based on the findings of the Phase 1 peat survey and the desk-based information detailed in **Table 11.5**. The classifications in **Table 11.10** are intended to reflect the importance of soils in relation to their soil organic matter content and climate change resilience and mitigation, biodiversity, and flood management functions, as well as the Welsh Government’s Peatland Policy³⁶.

Table 11.10 Sensitivity classifications for soils (including agricultural land)

Value / Sensitivity	Description Example
Very high	Soils: soils (<i>other than peat</i>) directly supporting an EU designated site (e.g., SAC, SPA, Ramsar) <i>designated peatlands (any statutory designation including SSSI)</i>
	Agricultural land: Grade 1 and 2 agricultural land ³⁷ according to the Agricultural Land Classification (ALC) system ³⁸
High	Soils: soils (<i>other than peat</i>) directly supporting a UK designated site (e.g., SSSI) <i>peat: deep peat with no designation</i>
	Agricultural land: Grade 3a agricultural land ³⁹ according to the ALC system
Medium	Soils:

³⁶ Welsh Government (2020). Welsh Government launches National Peatlands Action Programme to help lock in carbon and reinvigorate vital habitats. (Online) Available at: <https://gov.wales/welsh-government-launches-national-peatlands-action-programme-help-lock-carbon-and-reinvigorate> (Accessed April 2022).

³⁷ Grade 1: Excellent quality agricultural land with no or very minor limitations to agricultural use. Grade 2: Very good quality agricultural land with minor limitations which affect crop yield, cultivation or harvesting.

³⁸ Welsh Government (2021) Agricultural land classification, frequently asked questions, May 2021. (Online). Available at: <https://gov.wales/sites/default/files/publications/2021-05/agricultural-land-classification-frequently-asked-questions.pdf>. (Accessed February 2022).

³⁹ Subgrade 3a: Good quality agricultural land capable of producing moderate to high yields of a narrow range of arable crops or moderate yields of a wider range of crops.



Value / Sensitivity	Description Example
	Soils (<i>other than peat</i>) supporting non-statutory designated sites (e.g., Local Nature Reserves (LNR), LGSs, Sites of Nature Conservation Importance (SNCIs)) <i>peat: peaty soils</i>
	Agricultural land: Grade 3b agricultural land according to the ALC system
Low	Soils: soils (<i>other than peat</i>) supporting non-designated notable or priority habitats
	Agricultural land: Grade 4 ⁴⁰ and 5 agricultural land according to the ALC system
Very Low	Soils: soils (<i>other than peat</i>) on previously developed land formerly in 'hard uses' with little potential to return to agriculture

11.9.3 The approach to assigning the consequence of any damage or loss will be based on the DMRB LA 109 guidance and IEMA guidance summarised in **Table 11.11**.

Table 11.11 Magnitude classifications soils (including agricultural land)

Magnitude	Description Example
Major	Soils and agricultural land: physical removal or permanent sealing of >20 ha soil resource or agricultural land.
Moderate	Soils: permanent loss / reduction of one or more soil function(s) and restriction to current or approved future use of 1ha to 20ha (e.g., through degradation, compaction, erosion of soil resource.)
Minor	Soils: temporary loss / reduction of one or more soil function(s) and restriction to current or approved future use (e.g., through degradation, compaction, erosion of soil resource.)
Negligible	Soils: no discernible loss / reduction of soil function(s) that restrict current or approved future use.
No change	Soils: no loss / reduction of soil function(s) that restrict current or approved future use.

11.9.4 The determination of significance combines the sensitivity and magnitude using the matrix presented in **Table 11.12**.

⁴⁰ Grade 4: Land with severe limitations which significantly restrict the range of crops and/or the level of yields. It is mainly suited to grass with occasional arable crops (e.g., cereals and forage crops) the yields of which are variable. In moist climates, yields of grass may be moderate to high but there may be difficulties in utilisation. The grade also includes very droughty arable land.



Table 11.12 Soil effects significance evaluation matrix

		Magnitude of change				
		No change	Negligible	Minor	Moderate	Major
Sensitivity/importance/value	Very high	Neutral	Slight	Moderate or large	Large or very large	Very large
	High	Neutral	Slight	Slight or moderate	Moderate or large	Large or very large
	Medium	Neutral	Neutral or slight	Slight	Moderate	Moderate or large
	Low	Neutral	Neutral or slight	Neutral or slight	Slight	Slight or moderate
	Negligible	Neutral	Neutral	Neutral or slight	Neutral or slight	Slight

Note: Significant effects are those identified as 'Very large' or 'large'. 'Moderate' effects have the potential to be significant, and they would normally be deemed to be significant, however in some instances these are deemed to be acceptable based on professional judgment.

Assessment of Soils Effects (including agricultural land): Construction phase

- 11.9.5 The assessment in this chapter is based on the maximum design scenario to establish the potential maximum (worst-case) adverse effect on ground condition receptors. During construction of the Proposed Development some soil would be removed and not reinstated. These areas are summarised below and detailed in **Chapter 4: Description of the Proposed Development**.
- 11.9.6 The maximum extent of the substation is 0.13 hectares (37.5m x 35m). This will be a compound and topsoil from the compound will be removed and not reinstated within the compound. Crane pads at each turbine will be covered by hardstanding and are typically sized at 0.25 hectares, with eight turbines there will therefore be a total area of 2 hectares where soil is removed and/or sealed. Wind turbine foundations will typically be 20m in diameter, based on eight turbines the total area occupied by turbine foundations will, therefore, be approximately 0.25 hectares. There will also be a small kiosk adjacent to each turbine, in total the eight kiosks will cover around 0.01 hectares.
- 11.9.7 Access tracks constructed for the Proposed Development would run for approximately 6.3km and will be 5m wide, these will occupy around 3.15 hectares. This is a worst-case scenario since existing tracks (approximately 2.9km) will be used wherever possible to minimise environmental impact. The site access track would typically have a 2m verge on either side, equating to a maximum verge area of 2.52 hectares where soil would be disturbed/ removed, though some of this soil would be reused within the verge. The maximum area of soil lost because of the Proposed Development would, therefore, be approximately 8.06 hectares.
- 11.1.1 In addition to long term/permanent loss of soil due to the Proposed Development, some elements of the Proposed Development require the temporary removal of soil that can be



stockpiled and reinstated on completion of construction. These elements of the Proposed Development are summarised below and detailed in **Chapter 4: Description of the Proposed Development**.

- 11.9.8 The main construction compound would be a maximum of 0.25 hectares (50m x 50m). Once the erection and commissioning of the wind turbines is complete, this compound would be removed and the soil reinstated. Soil removed from this area would, therefore, be stockpiled within the Proposed Development Site and reused. Electrical connections between the turbines and the substation would be by underground cables, installation of the cables would require excavation of a trench 0.45m in width. The length of cable is not known, therefore a length similar to the access track has been used, giving a total cable trench area of 0.28 hectares. Other small temporary features would be required including a temporary site office, car parking space and layby at the entrance to the construction site. In total these will occupy around 65m². The maximum area of soil to be disturbed and/or temporarily displaced because of the Proposed Development Site would therefore be approximately 0.54 hectares.
- 11.9.9 As detailed in **Section 11.5**, available information on the soil on the Proposed Development Site indicates the absence of deep peat, the limited presence of thin peat (average 0.03m thickness, likely to be present across less than 6% of the Proposed Development Site), with the likelihood that approximately 20% of the Proposed Development Site is underlain by made ground, in some areas (e.g. historical landfill and restored mine workings) with topsoil at surface which may be either be site derived topsoil (excavated, stored and later reinstated) or imported topsoil. Additionally, approximately 3% of the total Wind Farm development site is covered by an operational solar farm. The remaining area (approximately 71% of the Proposed Development Site, equating to around 215 hectares) may have the original soils still in situ and these may be relatively undisturbed. Based on desk study information these are likely to comprise a combination of very acid loamy upland soils with a wet peaty surface, a peaty texture and high carbon content, and freely draining acid loamy soils over rock, with a loamy texture and medium carbon content. These are soils which are likely to have medium to high sensitivity to handling.
- 11.9.10 Based on the presence of localised thin peat/peaty soils on the Proposed Development Site, the soil sensitivity is assessed based on the criteria in **Table 11.10** to be Low to Medium.
- 11.9.11 The Grid Connection would require only small-scale excavation of soil for installation of the wooden poles, this soil will be stored on a short-term basis and then reinstated when the pole is installed. The assessment of effects on soils includes soil within the Grid Connection corridor. The maximum area of soil to be excavated for the Grid Connection has not been quantified. However, it will be sufficiently small that the assessment is still conservative for the assessment of effects on soils due to the Proposed Development.
- 11.9.12 As described in **Section 11.5**, the agricultural classification for the Proposed Development Site is assumed, for the purposes of the assessment, to be Grade 4, and based on the criteria in **Table 11.10** the agricultural land sensitivity is Low. Most of the Proposed Development Site is provisionally classed as non-agricultural with a small area of possible Grade 4 in the north, the classification of the agricultural sensitivity receptor as Low is, therefore, also applicable to the Grid Connection corridor.

- 11.9.13 On this basis that the soil and agricultural land conditions are similar on the Proposed Development Site and the Grid Connection corridor the relevant effects have been assessed collectively for soils and agricultural land for the entire development boundary.

Compaction of soil by vehicles or during stockpiling during construction leading to damage to soil structure resulting in damage to/loss of soil functions

- 11.9.14 The maximum area of soil to be disturbed and/or temporarily displaced because of the proposed wind farm and grid connection would be approximately 0.54 hectares. Embedded environmental measures include the use of machinery with low ground pressure during topsoil stripping to minimise soil compaction, including during construction of the access tracks, the tracks will then be available for heavier vehicles to use to avoid impacts on other areas.
- 11.9.15 The Draft CEMP includes measures for the storage and handling of soil based on the Defra (2009) Construction Code of Practice for the Sustainable Use of Soils on Construction Sites to avoid damage to soil structure and help to minimise soil compaction.
- 11.9.16 Based on the Low sensitivity of the agricultural land receptor and potential for a Minor magnitude of change, this results in a **Neutral or Slight negative** effect which is not significant.
- 11.9.17 For soils, based on Low to Medium sensitivity of the soil and a Minor magnitude of change, the effect is **Neutral or Slight negative** or **Slight negative**. For the temporarily displaced soil the embedded mitigation measures will limit the potential for soil to be damaged during handling, storage, and reinstatement. No significant effects are therefore anticipated.

Erosion of soil during construction, leading to loss of organic matter in runoff

- 11.9.18 The maximum area of soil to be disturbed and/or temporarily displaced because of the proposed wind farm and grid connection would be approximately 0.54 hectares and soil stripping and stockpiling will be needed for the permanent development elements which cover an area of approximately 8.06 hectares, giving a total area of 8.6 hectares. Embedded environmental measures include measures defined in the Draft CEMP to avoid soil compaction in the areas of the Proposed Development where temporary disturbance to soils will occur, as soil compaction can cause/exacerbate soil erosion. Embedded measures also include measures to minimise surface runoff from stockpiles.
- 11.9.19 Based on the Low sensitivity of the agricultural land receptor and potential for a Minor magnitude of change, this results in a magnitude of change of **Neutral or Slight negative**, which is not significant in EIA terms.
- 11.9.20 For soils, based on Low to Medium sensitivity of the soil and a Minor magnitude of change, the effect is **Neutral or Slight negative** or **Slight negative**. For the temporarily displaced soil, the embedded mitigation measures will limit the potential for soil erosion to occur during handling and storage, or because of soil compaction. No significant effects are therefore anticipated.

Permanent loss of agricultural land, soil, and associated soil functions when soil is removed from the Wind Farm development site for construction of the permanent features of the proposed development: turbine foundations, crane pads, access tracks, kiosks and substation

- 11.9.21 The maximum area of potential permanent/long-term loss of soil/agricultural land due to the proposed wind farm and grid connection is 8.06 hectares, and approximately 0.54 hectares of soil would potentially be disturbed by disturbed and/or temporarily displaced because of the Proposed Development. As some permanent loss of soil is envisaged, but on an area <20 hectares, the magnitude of impact is assessed to be Moderate. Embedded environmental measures include the requirement to keep the permanent removal of topsoil to the minimum footprint required for the Proposed Development.
- 11.9.22 Based on the Low sensitivity of the agricultural land receptor this results in a magnitude of change of **Slight negative**, which is not significant in EIA terms.
- 11.9.23 For soils, based on the Low to Medium sensitivity of the soil and a Moderate magnitude of change, the effect is **Slight negative**, which is not significant in EIA terms, or **Moderate negative**, which is potentially significant in EIA terms. Measures in the detailed design, based on information from the peat survey (appended within **Appendix 11A**), supplemented by the pre-construction ground investigation, such as reuse of existing tracks, can potentially be employed to bring the overall effect down to **Slight negative**.

Degradation of soil functions and agricultural land quality due to cross-contamination of topsoil with contaminated soil/material excavated/disturbed during construction work

- 11.9.24 The maximum area of soil to be temporarily displaced because of the wind farm and grid connection would be approximately 0.54 hectares, and the maximum area of permanent/long-term loss of soil/agricultural land is 8.06 hectares, giving a total of 8.6 hectares of soil potentially subject to excavation, handling and storage for reinstatement/reuse or offsite disposal. The embedded environmental measures to avoid cross-contamination of soils include completion of a pre-construction targeted Phase 2 geo-environmental ground investigation to investigate and characterise potentially contaminated areas and identify any further measures needed to ensure the suitability of the soils for use in the Proposed Development. The working methods will include compliance with an MMP. Materials will be segregated where possible to prevent cross-contamination of soils occurring. Such materials will only be reused if they are confirmed as suitable for use in line with the requirements of the MMP. The Draft CEMP includes a procedure for encountering unexpected/suspected contamination, and any temporary onsite storage of excavated materials suspected/confirmed to be contaminated will be on impermeable sheeting, covered over and with adequate leachate/runoff drainage to prevent migration of contaminants from the stockpile.
- 11.9.25 Based on the Low sensitivity of the agricultural land receptor and potential for a Minor magnitude of change, this results in a magnitude of change of **Neutral or Slight negative**, which is not significant in EIA terms.
- 11.9.26 For soils, based on Low to Medium sensitivity of the soil and a Minor magnitude of change, the effect is **Neutral or Slight negative** or **Slight negative**, which is not significant in EIA terms.

11.10 Assessment of land contamination effects

Assessment methodology: Land Contamination

11.10.1 For land contamination receptors, the effect of the Proposed Development has been assessed through desk-based studies to understand the baseline condition land contamination status within the Proposed Development Site and the Zol. This information is then used to inform the assessment of the likely land contamination status resulting from the Proposed Development.

Risk assessment

11.10.2 The process of managing land contamination, as set out in the Environment Agency guidance *Land Contamination: Risk management* (LCRM), is based on risk assessment. The assessment of risks from contaminated land is based upon the identification and subsequent assessment of a contaminant linkage. A contaminant linkage requires the presence of a:

- source of contamination;
- receptor that can be adversely affected by the contamination; and
- pathway capable of exposing a receptor to the contaminant.

11.10.3 The risk assessment aims to assess the significance of each potential contaminant linkage. The key to the classification is that the designation of risk is based upon the consideration of both of the following.

- The magnitude of the potential consequence (for instance, severity). It considers both the potential severity of the hazard and the sensitivity of the receptor.
- The magnitude of probability (for instance, likelihood). It considers both the presence of the hazard and receptor and the integrity of the pathway.

11.10.4 The definitions for the qualitative risk assessment have been taken from "*Guidance for the Safe Development of Housing on Land Affected by Contamination*" Annex 4 R&D Publication 66: 2008 Volume 2.

11.10.5 The likelihood classifications for the contaminant linkages being realised is presented in **Table 11.13**.

Table 11.13 Likelihood classifications for contaminant linkages

Classification	Definition	Examples
High Likelihood	There is contaminant linkage, and an event would appear very likely in the short-term and almost inevitable over the long-term, or there is evidence at the receptor of harm or pollution	a) Elevated concentrations of toxic contaminants are present in soils in the top 0.5m in a residential garden. b) Ground/groundwater contamination could be present from chemical works, containing several USTs, having been in operation on the same site for over 50 years.

Classification	Definition	Examples
Likely	There is contaminant linkage, and all the elements are present and in the right place, which means that it is probable that an event will occur. Circumstances are such that an event is not inevitable, but possible in the short-term and likely over the long-term.	<p>a) Elevated concentrations of toxic contaminants are present in soils at depths of 0.5-1.0m in a residential garden, or the top 0.5m in public open space.</p> <p>b) Ground/ groundwater contamination could be present from an industrial site containing a UST present between 1970 and 1990. The tank is known to be single skin. There is no evidence of leakage although there are no records of integrity tests.</p>
Low Likelihood	There is contaminant linkage and circumstances are possible under which an event could occur. However, it is by no means certain that even over a long period such an event would take place and is less likely in the shorter term.	<p>a) Elevated concentrations of toxic contaminants are present in soils at depths > 1m in a residential garden, or 0.5-1.0m in public open space.</p> <p>b) Ground/groundwater contamination could be present on a light industrial unit constructed in the 1990s containing a UST in operation over the last 10 years – the tank is double skinned but there is no integrity testing or evidence of leakage.</p>
Unlikely	There is contaminant linkage, but circumstances are such that it is improbable that an event would occur even in the very long-term.	<p>a) Elevated concentrations of toxic contaminants are present below hardstanding.</p> <p>b) Light industrial unit < 10 years old containing a double skinned UST with annual integrity testing results available.</p>

11.10.6 The magnitude of the potential consequence of a contaminant linkage gives an indication of the sensitivity of a given receptor to a particular source or contaminant of concern under consideration. It is based on full exposure *via* the linkage being examined. The classification of consequence is presented in **Table 11.14**.



Table 11.14 Classification of consequence

Classification	Human Health	Controlled Water	Ecology	Property / Structures/ Crops and animals	Examples
Severe	Highly elevated concentrations likely to result in "significant harm" to human health as defined by the EPA 1990, Part 2A, if exposure occurs.	Equivalent to Environment Agency (EA) Category 1 pollution incident including persistent and/or extensive effects on water quality; leading to closure of a potable abstraction point; major impact on amenity value or major damage to agriculture or commerce.	Major damage to aquatic or other ecosystems, which is likely to result in a substantial adverse change in its functioning or harm to a species of special interest that endangers the long-term maintenance of the population.	Catastrophic damage to crops, buildings or property.	Significant harm to humans is defined in the Contaminated Land Statutory Guidance as death, life threatening diseases (e.g. cancers), other diseases likely to have serious impacts on health, serious injury, birth defects, and impairment of reproductive functions. Major fish kill in surface water from large spillage of contaminants from site. Highly elevated concentrations of Hazardous or priority substances present in groundwater close to small potable abstraction (high sensitivity). Explosion, causing building collapse (can also equate to immediate human health risk if buildings are occupied).
Medium	Elevated concentrations which could result in "significant harm" to human health as defined by the EPA 1990, Part 2A if exposure occurs.	Equivalent to EA Category 2 pollution incident including significant effect on water quality; notification required to abstractors; reduction in amenity value or significant damage to agriculture or commerce.	Significant damage to aquatic or other ecosystems, which may result in a substantial adverse change in its functioning or harm to a species of special interest that may endanger the long-term maintenance of the population.	Significant damage to crops, buildings or property.	Significant harm to humans is defined in the Contaminated Land Statutory Guidance as death, life threatening diseases (e.g., cancers), other diseases likely to have serious impacts on health, serious injury, birth defects, and impairment of reproductive functions. Damage to building rendering it unsafe to occupy e.g. foundation damage resulting in instability. Ingress of contaminants through plastic potable water pipes.



Classification	Human Health	Controlled Water	Ecology	Property / Structures/ Crops and animals	Examples
Mild	Exposure to human health unlikely to lead to "significant harm".	Equivalent to EA Category 3 pollution incident including minimal or short-lived effect on water quality; marginal effect on amenity value, agriculture, or commerce.	Minor or short-lived damage to aquatic or other ecosystems, which is unlikely to result in a substantial adverse change in its functioning or harm to a species of special interest that would endanger the long-term maintenance of the population.	Minor damage to crops, buildings or property.	Exposure could lead to slight short-term effects (e.g., mild skin rash). Surface spalling of concrete.
Minor	No measurable effects on humans.	Equivalent to insubstantial pollution incident with no observed effect on water quality or ecosystems.	Equivalent to insubstantial pollution incident with no observed effect on water quality or ecosystems.	Repairable effects of damage to buildings, structures and services.	The loss of plants in a landscaping scheme. Discoloration of concrete.



11.10.7 The risk matrix to link the likelihood and consequence is shown in **Table 11.15**.

Table 11.15 Risk Matrix

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

11.10.8 The overall risk definitions are summarised in **Table 11.16**.

Table 11.16 Risk Definitions

Risk	Definition
Very High	There is a high probability that severe harm could arise to a designated receptor from an identified hazard at the site without remediation action OR there is evidence that severe harm to a designated receptor is already occurring. Realisation of that risk is likely to present a substantial liability to be site owner/or occupier. Investigation is required as a matter of urgency and remediation works likely to follow in the short-term.
High	Harm is likely to arise to a designated receptor from an identified hazard at the site without remediation action. Realisation of the risk is likely to present a substantial liability to the site owner/or occupier. Investigation is required as a matter of urgency to clarify the risk. Remediation 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 any such harm would be severe, and if any harm were to occur it is more likely, that the harm would be relatively mild. Further investigative work is normally required to clarify the risk and to determine the potential liability to site owner/occupier. Some remediation works may be required in the longer term.
Low	It is possible that harm could arise to a designated receptor from identified hazard, but it is likely at worst, that this harm if realised would normally be mild. It is unlikely that the site owner/or occupier would face substantial liabilities from such a risk. Further investigative work (which is likely to be limited) to clarify the risk may be required. Any subsequent remediation works are likely to be relatively limited.
Very Low	It is a low possibility that harm could arise to a designated receptor, but it is likely at worst, that this harm if realised would normally be mild or minor.



Significance evaluation methodology

- 11.10.9 To use risk assessment as the basis for the evaluation of the significance of effects in relation to land contamination, it is necessary to evaluate the change in risk from baseline conditions to those during the construction, operation and decommissioning of the Proposed Development. To define the baseline risk, the initial assessment and classification of risk is carried out for the study area in its pre-development state. A separate assessment of risk will then be conducted based on the Proposed Development taking place (including environmental measures inherently embedded in the development) to enable an evaluation of the change in risk due to the Proposed Development.
- 11.10.10 **Table 11.17** uses the risk classification pre- and post-development as the basis for a significance evaluation matrix for the purposes of EIA.

Table 11.17 Land contamination effects significance evaluation matrix

			Risk Post-development (including embedded environmental measures)					
			Very Low	Low	Moderate / Low	Moderate	High	Very High
Risk Pre-development	Existing Receptors	Very High	Major Positive (Significant)	Major Positive (Significant)	Moderate Positive (Potentially Significant)	Moderate Positive (Potentially Significant)	Minor Positive (Not Significant)	Negligible (Not Significant)
		High	Major Positive (Significant)	Moderate Positive (Potentially Significant)	Moderate Positive (Potentially Significant)	Minor Positive (Not Significant)	Negligible (Not Significant)	Minor Negative (Not Significant)
		Moderate	Moderate Positive (Potentially Significant)	Moderate Positive (Potentially Significant)	Minor Positive (Not Significant)	Negligible (Not Significant)	Minor Negative (Not Significant)	Moderate Negative (Potentially Significant)
		Moderate / Low	Moderate Positive (Potentially Significant)	Minor Positive (Not Significant)	Negligible (Not Significant)	Minor Negative (Not Significant)	Moderate Negative (Potentially Significant)	Moderate Negative (Potentially Significant)
		Low	Minor Positive (Not Significant)	Negligible (Not Significant)	Minor Negative (Not Significant)	Moderate Negative (Potentially Significant)	Moderate Negative (Potentially Significant)	Major Negative (Significant)
		Very Low	Negligible (Not Significant)	Minor Negative (Not Significant)	Moderate Negative (Potentially Significant)	Moderate Negative (Potentially Significant)	Major Negative (Significant)	Major Negative (Significant)
	No Receptor Present Pre-development	N/A	Minor Negative (Not Significant)	Moderate Negative (Potentially Significant)	Moderate Negative (Potentially Significant)	Major Negative (Significant)	Major Negative (Significant)	Major Negative (Significant)
Risks that remain at moderate, high, or very high post-development are unlikely to be considered acceptable and further environmental measures will be required to enable the development to proceed.								



- 11.10.11 If the embedded measures are effective the risks post-development should be less than moderate; or the risks from the project are likely to be considered unacceptable.

Assessment of Land Contamination Effects

Operation phase: Exposure to land contamination via numerous pathways (e.g., inhalation, direct contact, ingestion) resulting in health effects for site users

- 11.10.12 The embedded measures (**Table 11.6**) during the construction phase include development and implementation of an MMP for the reuse of soils within the Proposed Development Site and a protocol in the CEMP for dealing with potentially contaminated soils requiring disposal as opposed to reuse.
- 11.10.13 In addition, there is a commitment to ensure that the land subject to construction will be suitable for the proposed future use in line with LCRM guidance (Environment Agency, 2020). This will demonstrate the land is suitable for the future use and there are no significant risks to human health.
- 11.10.14 The current risk level to site users from the identified potential sources of contamination ranges from low risk (based on a medium consequence, for contaminants such as metals and hydrocarbons, and a likelihood of a contaminant linkage being realised of 'unlikely') to moderate/low risk (based on a severe consequence, for contaminants such as asbestos and ground gas, and a likelihood of unlikely). The assessment uses the highest level of risk identified to site users based upon current knowledge of the baseline conditions and compares this to the highest risk level resulting from the Proposed Development. With the embedded measures, the potential for the land contamination risk to increase during operation due to inappropriate reuse/placement of materials is not likely. On this basis, the maximum risk level to site users remains moderate/low based on a severe consequence and a likelihood of unlikely, and the effects of the Project on human health receptors during the operation phase are considered to be **negligible**, which is **Not Significant** in EIA terms.

11.11 Assessment of cumulative (inter-project) effects

- 11.11.1 A cumulative effects assessment (CEA) has been undertaken for the Proposed Development which considers the combined impacts with other developments on the same single receptor or resource (inter-project effects). The detailed method followed in identifying and assessing potential cumulative effects is set out in **Section 2.8** of **Chapter 2**.
- 11.11.2 Effects on soil and agricultural land are limited in extent within the Proposed Development Site, and no high sensitivity soil or agricultural land receptors are present. With the embedded environmental measures, there will be limited permanent effects on soil and agricultural land from the development. It is, therefore, unlikely that there will be any effects which could act cumulatively with effects from other developments to produce significant cumulative effects on soil or agricultural land receptors at a local or national level.

- 11.11.3 Ground conditions effects on the built environment relating to unstable ground conditions arising from former coal mining activity are likely to be limited to the extent of the Proposed Development, and, with the embedded environmental measures, there will be a very low likelihood that effects will occur. It is, therefore, unlikely that there will be effects which act cumulatively with effects from other developments to produce cumulative effects.
- 11.11.4 For land contamination receptors, a Zol of 250m from the edge of the Proposed Development Site has been applied for the CEA to assess the potential for direct and indirect cumulative effects. This study area accounts for shared receptors that could experience an effect due to the Proposed Development and other developments. No other developments have been identified within the study area and there are, therefore, no identified cumulative ground conditions effects relating to land contamination.

11.12 Significance conclusions

- 11.12.1 A summary of the results of the ground conditions assessment for soils is provided in **Table 11.18**, and a summary of the assessment for land contamination is provided in **Table 11.19**.

Table 11.18 Summary of significance of effects: soils

Receptor and summary of predicted effects	Sensitivity/ importance/ value of receptor ¹	Magnitude of change ²	Significance ³	Summary rationale
Construction phase:				
<u>Agricultural land</u> Compaction of soil by vehicles or during stockpiling during construction leading to damage to soil structure resulting in damage to/loss of soil functions	Low	Minor	Neutral or Slight negative effect (Not significant)	The assessment is based upon the area of soil to be disturbed and/or temporarily displaced, and the embedded environmental measures to limit and avoid soil compaction.
<u>Soil</u> Compaction of soil by vehicles or during stockpiling during construction leading to damage to soil structure resulting in damage to/loss of soil functions	Low to Medium	Minor	Neutral or Slight negative or Slight negative (Not significant)	The assessment is based upon the area of soil to be disturbed and/or temporarily displaced, and the embedded environmental measures to limit and avoid soil compaction.
<u>Agricultural land</u> Erosion of soil during construction, leading to loss of organic matter in runoff	Low	Minor	Neutral or Slight negative effect (Not significant)	For the temporarily displaced soil, the embedded mitigation measures will limit the potential for soil erosion to occur during handling and storage, or because of soil compaction.



Receptor and summary of predicted effects	Sensitivity/ importance/ value of receptor ¹	Magnitude of change ²	Significance ³	Summary rationale
Soil Erosion of soil during construction, leading to loss of organic matter in runoff	Low to Medium	Minor	Neutral or Slight negative or Slight negative (Not significant)	For the temporarily displaced soil, the embedded mitigation measures will limit the potential for soil erosion to occur during handling and storage, or because of soil compaction.
Agricultural land Permanent loss of agricultural land, soil, and associated soil functions when soil is removed from the Wind Farm development site for construction of the permanent features of the proposed development: turbine foundations, crane pads, access tracks, kiosks and substation.	Low	Moderate	Slight negative effect (Not significant)	The assessment is based upon the area of soil to be permanently lost and the embedded measures which include minimising the footprint required for the Proposed Development, it assumes that the soil will be removed from the site as waste and not reused within the Proposed Development.
Soil Permanent loss of agricultural land, soil, and associated soil functions when soil is removed from the Wind Farm development site for construction of the permanent features of the proposed development: turbine foundations, crane pads, access tracks, kiosks and substation.	Low to Medium	Moderate	Slight negative (Not significant) or Moderate negative	The assessment is based upon the area of soil to be permanently lost and the embedded measures which include minimising the footprint required for the Proposed Development, it assumes that the soil will be removed from the site as waste and not reused within the Proposed Development. Measures in the detailed design, based on information from the peat survey (appended within Appendix 11A), supplemented by the pre-construction ground investigation, such as avoidance of areas with known peat or peaty soils, and reuse of existing tracks, can potentially be employed to bring the overall effect down to Slight negative.



Receptor and summary of predicted effects	Sensitivity/ importance/ value of receptor ¹	Magnitude of change ²	Significance ³	Summary rationale
Agricultural land Degradation of agricultural land quality due to cross-contamination of topsoil with contaminated soil/material excavated/disturbed during construction work	Low	Minor	(Potentially significant) Neutral or Slight negative effect (Not significant)	The assessment is based upon the area of soil to be temporarily or permanently displaced, and the embedded environmental measures including completion of a pre-construction targeted Phase 2 geo-environmental ground investigation to investigate and characterise potentially contaminated areas and identify any further measures needed to ensure the suitability of the soils for use in the Proposed Development. The embedded environmental measures include the use of a MMP to ensure materials will only be reused if they are confirmed as suitable for use in line with the requirements of the MMP, and the CEMP including a procedure for encountering unexpected/suspected contamination, and any temporary onsite storage of excavated materials suspected/confirmed to be contaminated will be on impermeable sheeting, covered over and with adequate leachate/runoff drainage to prevent migration of contaminants from the stockpile.
Soil Degradation of soil functions due to cross-contamination of topsoil with contaminated soil/material excavated/disturbed during construction work	Low to Medium	Minor	Neutral or Slight negative or Slight negative (Not significant)	The assessment is based upon the area of soil to be temporarily or permanently displaced, and the embedded environmental measures including completion of a pre-construction targeted Phase 2 geo-environmental ground investigation to investigate and characterise potentially contaminated areas and identify any further measures needed to ensure the suitability of the soils for use in the Proposed Development. The embedded environmental measures include the use of a MMP to ensure materials will only be reused if they are confirmed as suitable for use in line with the requirements of the MMP, and the CEMP including a procedure for encountering unexpected/suspected contamination, and any temporary onsite storage of excavated materials suspected/confirmed to be contaminated will be on impermeable sheeting, covered over and with adequate leachate/runoff drainage to prevent migration of contaminants from the stockpile.



Receptor and summary of predicted effects	Sensitivity/ importance/ value of receptor ¹	Magnitude of change ²	Significance ³	Summary rationale
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No operational phase effects on soils/agricultural land have been identified. Effects during decommissioning are likely to be similar to construction but smaller in scale.

1. The sensitivity/importance/value of a receptor is defined using the criteria set out in **Section 11.8** and is defined as (very low, low, medium, high, and very high).
2. The magnitude of change on a receptor resulting from activities relating to the development is defined using the criteria set out in **Section 11.8** and is defined as (very low, low, medium, high, and very high).
3. The significance of the environmental effects is based on the combination of the sensitivity/importance/value of a receptor and the magnitude of change and is expressed as major (significant), moderate (potentially significant) or minor/negligible (not significant), subject to the evaluation methodology outlined in **Section 11.8**.



Table 11.19 Summary of significance of land contamination effects

Potential effect	Baseline Assessment			Assessment with Proposed Development			Change in Risk (Significance)
	Likelihood	Consequence	Risk	Likelihood	Consequence	Risk	
Operational phase: Human health Exposure to land contamination via numerous pathways (e.g., inhalation, direct contact, ingestion) resulting in health effects to site users	Severe	Unlikely	Moderate/low	Severe	Unlikely	Moderate/low	Negligible (Not significant) Embedded measures (Table 11.6) include ground investigation pre-construction, and during construction, measures include development of an MMP for the reuse of soils within the Proposed Development and a protocol in the CEMP for dealing with potentially contaminated soils requiring disposal as opposed to reuse. There is a commitment to ensure that the land subject to construction will be suitable for the proposed future use in line with LCRM guidance (Environment Agency, 2020). This will demonstrate the land is suitable for the future use and there are no significant risks to human health.

The approach to assessment of the significance is based on the change in the level of risk from the baseline condition, as a result of the Proposed Development, subject to the evaluation methodology outlined in **Section 11.8**.

