

Contents

11.	Ground Conditions	3
11.1	Introduction	3
	Limitations and assumptions	3
11.2	Relevant legislation, planning policy and technical guidance	4
	Legislation	4
	Planning policy	7
	Technical guidance	9
11.3	Consultation and engagement	12
	Overview	12
	Scoping Opinion	12
	Technical engagement	15
11.4	Data gathering methodology	15
	Study area	15
	Desk study	15
	Survey work	19
11.5	Overall baseline	19
	Current baseline	19
	Future baseline	27
11.6	Embedded measures	28
11.7	Scope of the assessment	39
	The Proposed Development	39
	Spatial scope	39
	Temporal scope	39
	Potential receptors	39
	Likely significant effects	40
11.8	Assessment methodology	43
11.9	Preliminary assessment of Ground Conditions effects	43
	Overview	43
	Assessment methodology: Soils	46
	Preliminary assessment of Soils Effects (including agricultural land): Construction phase	48
11.10	Preliminary assessment of land contamination effects	51
	Assessment methodology: Land Contamination	51
	Preliminary assessment of Land Contamination Effects	59
11.11	Preliminary assessment of cumulative (inter-project) effects	59
11.12	Preliminary significance conclusions	60
11.13	Further work to be undertaken	66
	Baseline	66
	Assessment	66
	Environmental measures	66

Table 11.1	Legislation relevant to the Ground Conditions assessment	4
Table 11.2	Planning policy relevant to the Ground Conditions assessment	7
Table 11.3	Technical guidance relevant to the Ground Conditions assessment	9
Table 11.4	Summary of EIA Scoping Direction responses for Ground Conditions	12
Table 11.5	Data sources used to inform the Ground Conditions assessment	15
Table 11.6	Summary of the embedded environmental measures	28
Table 11.7	Ground Conditions receptors subject to potential effects	39
Table 11.8	Ground Conditions receptors scoped in for further assessment	40
Table 11.9	Summary of effects scoped out of the Ground Conditions assessment	41
Table 11.10	Sensitivity classifications for soils (including agricultural land)	46
Table 11.11	Magnitude classifications soils (including agricultural land)	47
Table 11.12	Soil effects significance evaluation matrix	48
Table 11.13	Likelihood classifications for contaminant linkages	52
Table 11.14	Classification of consequence	53
Table 11.15	Risk Matrix	55
Table 11.16	Risk Definitions	55

11. Ground Conditions

11.1 Introduction

11.1.1 This chapter presents the preliminary assessment of the likely significant effects of the Proposed Development with respect to Ground Conditions. It includes consideration of geology, land contamination, mineral resources and soil receptors. The preliminary assessment is based on information obtained to date. 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 8: Biodiversity**, healthy soil is in itself biodiverse, and soil health is integral to supporting terrestrial ecology, sensitive ecological sites can also be potential land contamination receptors and relevant sites are discussed in this chapter; and
- **Chapter 10: Water Environment**, soil carries out important hydrological cycle functions such as filtering run-off and floodwater attenuation, and groundwater and surface water are potential land contamination receptors, where relevant (e.g., where they are in proximity to a land contamination source), receptors identified in the Water Environment assessment are considered in the assessment in this chapter.

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**);
- the 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 preliminary assessment of Ground Conditions effects for soils (**Section 11.9**);
- the preliminary assessment of Ground Conditions effects for land contamination (**Section 11.10**);
- preliminary assessment of cumulative (inter-project) effects (**Section 11.12**);
- a summary of the preliminary significance conclusions (**Section 11.12.2**);
- additional measures proposed (**Section 11.12**);
- an outline of further work to be undertaken for the Environmental Statement (ES) (**Section 11.14**).

Limitations and assumptions

11.1.3 The information provided in this Draft ES is preliminary, the final assessment of likely significant effects will be reported in the ES. The Draft ES has been produced to fulfil

Pennant Walters' consultation duties and enable consultees to develop an informed view of the likely significant effects of the Proposed Development.

- 11.1.4 The following surveys are required to be undertaken to support the assessment work that has already been undertaken:
- **Additional Peat Survey:** this is scheduled for late October 2022 and will include Phase 1 Peat Survey (based on 100 x 100m grid spacing) for areas in the west and southeast of the Wind Farm development site that were not previously surveyed – the proposed access route from the A233 and the grid connection corridor within the Site - due to not being included in the Scoping Boundary, and delineation survey (at 10m x 10m grid spacing) to delineate the peat bog features identified within the Wind Farm development area of the Site during the previous Phase 1 Peat Survey.
- 11.1.5 A Phase 1 Peat Survey was completed in 2021, and based on this information, the Wind Farm development has been designed to avoid areas of peat, which is an embedded measure in **Table 11.6**.

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 is given in **Table 11.1**.

Table 11.1 Legislation relevant to the Ground Conditions assessment

Legislation	Legislative context
<i>The Environment (Wales) Act 2016</i> ¹	The Act makes provisions within Wales for the planning and managing of natural resources at national and local level. Natural resources are defined in Part 1, 2, as including several resources of relevance to the Ground Conditions assessment: <i>“(a) animals, plants and other organisms; (b) air, water and soil; (c) minerals; (d) geological features and processes.”</i>
<i>Well-being of Future Generations (Wales) Act (2015)</i> 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).

¹ UK Government (2016). Environment (Wales) Act 2016. (Online). Available at: <https://www.legislation.gov.uk/anaw/2016/3/contents/enacted>. (Accessed October 2022).

² National Assembly for Wales (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 October 2022).

Legislation	Legislative context
<i>Environmental Protection Act (1990)</i> 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>
<i>Water Resources Act 1991⁴ as amended by The Water Act 2003⁵</i>	<p>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.</p> <p>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.</p> <p>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.</p> <p>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.</p>
<i>The Environmental Damage (Prevention and Remediation) (Amendment) (Wales) Regulations 2015⁶</i>	<p>Regulations implementing the European Union (EU) Directive on environmental liability setting out the principles for prevention and remedy of environmental damage.</p> <p>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.</p> <p>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.</p>
<i>Health and Safety at Work etc. Act 1974⁷</i>	<p>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</p>

³ UK Government (1990). Environmental Protection Act 1990. (Online). Available at: <https://www.legislation.gov.uk/ukpga/1990/43/contents>. (Accessed October 2022).

⁴ UK Government (1991). Water Resources Act 1991. (Online). Available at: <https://www.legislation.gov.uk/ukpga/1991/57/contents>. (Accessed October 2022).

⁵ UK Government (2003). Water Act 2003. (Online). Available at: <https://www.legislation.gov.uk/ukpga/2003/37/contents>. (Accessed 01 October 2022).

⁶ National Assembly for Wales (2015) The Environmental Damage (Prevention and Remediation) (Amendment) (Wales) Regulations 2015. (Online). Available at: <https://www.legislation.gov.uk/wsi/2015/1394/made>. (Accessed October 2022).

⁷ <https://www.legislation.gov.uk/ukpga/1974/37/contents>. (Accessed October 2022).

Legislation	Legislative context
	<p>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.</p> <p>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.</p> <p>Compliance with the Act during construction and operation is an embedded measure considered in the assessment and detailed in Section 11.6.</p>
<p><i>The Construction (Design and Management) Regulations 2015⁸</i></p>	<p>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.</p> <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><i>The Control of Asbestos Regulations 2012⁹</i></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>

⁸ UK Government (1974) The Construction (Design and Management) Regulations 2015. (Online). Available at: <https://www.legislation.gov.uk/ukxi/2015/51/contents/made>. (Accessed October 2022).

⁹ UK Government (2012). The Control of Asbestos Regulations 2012. (Online). Available at: <https://www.legislation.gov.uk/ukxi/2012/632/contents/made>. (Accessed October 2022).

Legislation	Legislative context
	<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	
<p><i>Planning Policy Wales, Edition 11, 2021</i>¹⁰</p>	<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 “Whenever development or re-development potential exists the planning system will be the preferred means of addressing potential land contamination.”</p> <p>6.9.17 states that where land potentially meets the definition of contaminated land under Part 2A of the Environmental Protection Act 1990, 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</p>

¹⁰ 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. (Online). (Accessed October 2022).

Policy	Policy context
	<p><i>application” as well as “If contamination cannot be overcome satisfactorily, the authority may refuse planning permission.”</i></p>
<p>Local planning policy</p>	
<p><i>Rhondda Cynon Taf Local Development Plan (LDP) up to 2021, Adopted March 2011¹¹</i></p>	<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 provides maximum benefits to the community.</p> <p>Soils Policy AW 8 – Protection and Enhancement of the Natural Environment, states that: <i>“Rhondda Cynon Taf’s distinctive natural heritage will be preserved and enhanced by protecting it from inappropriate development and development proposals will only be permitted where:-</i></p> <ol style="list-style-type: none"> 1. <i>They would not cause harm to the features of a Site of Importance for Nature Conservation (SINC) or Regionally Important Geological Site (RIGS) or other locally designated sites, unless it can be demonstrated that:-</i> <ol style="list-style-type: none"> a) <i>The proposal is directly necessary for the positive management of the site; or</i> b) <i>The proposal would not unacceptably impact on the features of the site for which it has been designated; or</i> c) <i>The development could not reasonably be located elsewhere and the benefits of the proposed development clearly outweigh the nature conservation value of the site.</i> 2. <i>There would be no unacceptable impact upon features of importance to landscape or nature conservation, including ecological networks, the quality of natural resources such as air, water and soil, and the natural drainage of surface water.”</i> <p>Ground conditions including land contamination Policy AW 10 - Environmental Protection and Public Health states that <i>“development proposals will not be permitted where they would cause or result in a risk of unacceptable harm to health and / or local amenity because of:- ... 4. Contamination; 5. Landfill gas; 6. Land instability; 7. Water pollution; ... 9. Or any other identified risk to the environment, local amenity and public health or safety unless it can be demonstrated that measures can be taken to overcome any significant adverse risk to public health, the environment and / or impact upon local amenity.”</i></p> <p>Minerals Policy AW 14 – Safeguarding of Minerals defines mineral resources that shall be safeguarded from any development which would unnecessarily sterilise them or hinder their extraction.</p> <p>These include resources of sandstone underlying the Proposed Development site and surrounding area, as shown on the proposals</p>

¹¹ Rhondda Cynon Taf County Borough Council (2011) Rhondda Cynon Taf Local Development Plan up to 2021, Adopted March 2011. (Online). Available at: <https://www.rctcbc.gov.uk/EN/Resident/PlanningandBuildingControl/LocalDevelopmentPlans/LocalDevelopmentPlan20062021.aspx>. (Accessed October 2022).

Policy	Policy context
	map ¹² . Chapter 5 of the LDP, paragraph 5.92 states that “ <i>the Pennant sandstone covers approximately 70% of the surface area of Rhondda Cynon Taf. The deposits are generally centrally located running north to south. Previous studies to establish the quality of the deposits and refine the potential safeguarding areas to the most important deposits, have determined that their quality was in the main remarkably uniform.</i> ”

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
<i>The Development of Land Affected by Contamination: A Guide for Developers, version 3</i> ¹³	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 Land Contamination Risk Management (LCRM) (Environment Agency 2020), Development on Land Affected by Contamination: A Guide for Developers (Welsh Local Government Associations, Natural Resources Wales and the Welsh Government 2017)
<i>Contaminated Land Statutory Guidance</i> ¹⁴	This 2012 guidance from the Welsh Government 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.
<i>Environment Agency, Land Contamination Risk Management (LCRM)</i> ¹⁵	Natural Resources Wales ¹⁶ refers developers or those seeking to voluntarily remediate a site to the Environment Agency LCRM guidance, which provides the technical framework for applying a risk management process when dealing with land affected by contamination.

¹² <http://www.cartogold.co.uk/rhondda/Rhondda.htm>

¹³ 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 October 2022).

¹⁴ Welsh Government (2012), Welsh Government Guidance Document, Contaminated Land Statutory Guidance – 2012, Number: WG19243. (Online). Available at: <https://gov.wales/contaminated-land-guidance-local-authorities>. (Accessed October 2022).

¹⁵ Environment Agency (2021). Guidance: Land contamination risk management (LCRM). (Online). Available at: <https://www.gov.uk/government/publications/land-contamination-risk-management-lcrm>. (Accessed October 2022).

¹⁶ 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&msclkid=f31e500cc14d11ec96571fe68fd7786f>. (Accessed October 2022).

Technical guidance document	Context
<p><i>CAR-SOIL: Control of Asbestos Regulations 2012, Interpretation for Managing and Working with Asbestos in Soil and Construction and Demolition Materials</i>¹⁷</p>	<p>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)¹⁸. 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.</p> <p>These are included in the embedded environmental measures in Section 11.6.</p>
<p>Welsh Assembly Government, Environment Department, Environment Agency Land Quality Department, <i>Appraisal of state, pressures and controls on the sustainable use of soils: executive summary 2002</i>¹⁹</p>	<p>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.</p>
<p><i>CL:AIRE, Definition of Waste: Development Industry Code of Practice (DoWCoP), Version 2, 2011</i>²⁰</p>	<p>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 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><i>Defra, Construction Code of Practice for the Sustainable Use of Soils on Construction Sites</i>²¹</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>

¹⁷ Joint Industry Working Group (JIWG) (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.clare.co.uk/projects-and-initiatives/asbestos-in-soil>. (Accessed October 2022).

¹⁸ UK Government (2012). The Control of Asbestos Regulations 2012. (Online). Available at: <https://www.legislation.gov.uk/uksi/2012/632/contents/made>. (Accessed September 2022).

¹⁹ 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 October 2022).

²⁰ CL:AIRE (2011). Definition of Waste: Development Industry Code of Practice (DoWCoP), Version 2. (Online). Available at: https://www.clare.co.uk/projects-and-initiatives/38-costar/index.php?option=com_content&view=category&layout=blog&id=27&Itemid=183. (Accessed October 2022).

²¹ 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: October 2022).

Technical guidance document	Context
CIRIA, <i>Assessing risks posed by hazardous ground gases to buildings (C665)</i> ²²	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 .
Welsh Government, <i>Predictive Agricultural Land Classification Map (Wales) The Hollington Map, Guidance Note Version 2.1 - May 2021</i> ²³	<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> <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, <i>Design Manual for Roads and Bridges, LA 109 - Geology and Soils</i> ²⁴	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 .
Institute of Environmental Management & Assessment (IEMA) (2022) <i>IEMA Guide: A New Perspective on Land and Soil in Environmental Impact Assessment</i> ²⁵	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), <i>The Environmental Impact Assessment Handbook - A Practical Guide for Planners, Developers and Communities (3rd Edition)</i> ²⁶	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.

²² CIRIA (2007) *Assessing risks posed by hazardous ground gases to buildings (C665)*.

²³ Welsh Government (2021). *Predictive Agricultural 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 October 2022).

²⁴ 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/dmrb/search/adca4c7d-4037-4907-b633-76eaed30b9c0> (Accessed October 2022).

²⁵ Institute of Environmental Management & Assessment (IEMA) (2022) *IEMA Guide: A New Perspective on Land and Soil in Environmental Impact Assessment*. IEMA; March, UK

²⁶ 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.

Technical guidance document	Context
Scottish Government, Scottish Natural Heritage (SNH), Scottish Environment Protection Agency (SEPA) (2017) Peatland Survey. Guidance on Developments on Peatland²⁷	<p>The Scottish Government, SNH (now NatureScot) and SEPA guidance for peatland survey sets out a phased approach to quantifying and qualifying peat material on site and provides advice on how to publish peat surveys as part of wider site investigations for development management applications, with a particular focus on win farm developments.</p> <p>This defines peat as: <i>“the partially decomposed remains of plants and soil organisms which have accumulated at the surface of the soil profile. Peat accumulates where the rate of input of organic material from the surface exceeds the rate of decomposition and ‘turn-over’ of this new material. A peat layer does not include a mineral fraction (hence being differentiated from topsoil)”</i> and, states that: <i>“Peat soil is an organic soil which contains more than 60 per cent of organic matter and exceeds 50 centimetres in thickness”</i>.</p>

11.3 Consultation and engagement

Overview

- 11.3.1 The assessment has been informed by consultation responses and ongoing stakeholder engagement. An overview of the approach to consultation is provided in **Section 2.4 of Chapter 2: Approach to Environmental Impact Assessment**.

Scoping Opinion

- 11.3.2 A Scoping Direction was issued by PEDW (formerly the Planning Inspectorate), on behalf of the Welsh Ministers, on 01 December 2021. A summary of the relevant responses received in the Scoping Opinion in relation to Ground Conditions, and confirmation of how these have been addressed within the assessment to date is presented in **Table 11.4**.
- 11.3.3 The information provided in the Draft ES is preliminary and not all of the Scoping Direction comments have been addressed at this stage, due to the requirement for additional peat survey, however all comments will be addressed within the ES.

Table 11.4 Summary of EIA Scoping Direction responses for Ground Conditions

Consultee	Consideration	How scoping response has been addressed in this Draft ES
Planning and Environment Decisions (PEDW)	<p>Coal Mining: the intention stated in the Scoping Report to produce a Coal Mining Risk Assessment (CMRA) is welcomed. Geology: It is agreed that effects on solid geology can be scoped out.</p> <p>Agricultural land: it is agreed that effects on best and most versatile (BMV) agricultural land can be scoped out.</p>	<p>A CMRA has been produced for the Proposed Development, a draft of which is provided in Appendix 11A, Annex B. Available information on the baseline coal mining status of land within the Site is included in Section 11.5.</p> <p>Available desk based information on coal mining is reported in the baseline in Section 11.5.</p>

²⁷ Scottish Government, Scottish Natural Heritage, SEPA (2017) Peatland Survey. Guidance on Developments on Peatland. (Online). Available at: <https://www.gov.scot/publications/peatland-survey-guidance/>. (Accessed October 2022).

Consultee	Consideration	How scoping response has been addressed in this Draft ES
	<p>Operational effects on land and soils: it is agreed that operational phase effects on land and soils can be scoped out.</p> <p>It is agreed that decommissioning stage effects of the Project can be assumed to be no greater than construction effects and can be scoped out.</p>	<p>As agreed with PEDW, effects on BMV agricultural land, operational effects on land and soils, and decommissioning stage effects are scoped out in this Draft ES.</p>
<p>Rhondda Cynon Taf County Borough Council</p>	<p>Coal mining: Rhondda Cynon Taf County Borough Council state that: <i>“The Coal Authority advise that areas of the site are located within the defined Development High Risk Area and therefore the site has been subject to past coal mining activity. Consequently, any ES should properly address the risks posed and access routes should be informed by the findings of appropriate site investigations, especially in relation to any on site mine entries and their associated zones of influence.”</i></p>	<p>A CMRA has been produced for the Proposed Development, a draft of which is provided in Appendix 11A, Annex B. Available information on the baseline coal mining status of land within the Site is included in Section 11.5. The findings will be used to inform any intrusive investigations needed to further assess the coal mining risk, and to inform the final design of the Project.</p> <p>A Phase 1 Geoenvironmental Desk Study has been produced for the Proposed Development, a draft of which is provided in Appendix 11A. This provides further information on the baseline status of the land in relation to land contamination and will include recommendations for any further investigation needed such as intrusive ground investigation.</p> <p>Available desk based information on coal mining is reported in the baseline in Section 11.5.</p>
<p>Natural Resources Wales (NRW)</p>	<p>NRW notes that: <i>“Potential damage to peatland habitats and carbon stores is a potential likely significant effect. Development on peat has the potential to damage peat through direct disturbance or indirectly through the effects of changes to site hydrology leading to drainage, drying out and subsequent oxidation of peat. The ES should therefore consider the extent to which the proposed development may impact upon peat soils and peatland habitats.”</i></p> <p>The ES and scheme design is to be based upon comprehensive survey information concerning the extent, depth and condition of peat across the site, and NRW welcomes the commitment to use a phased approach to peat depth mapping across the site, and confirms that the approach set out in the Scottish</p>	<p>Appendix 11A includes a report detailing the findings of a Phase 1 Peat Survey (based on 100 x 100m grid spacing) for the Scoping Boundary. Further Phase 1 Peat Survey is programmed for October 2022 for the additional land now included in the Proposed Development (access and grid connection) and at the same time delineation of the peat bog features identified during the previous Phase 1 Peat Survey will be completed. The aim of the delineation work is to better define the extents of the features to inform the layout of the Project and to avoid peat wherever possible. The additional Phase 1 Peat Survey and the Peat Delineation Survey report will be appended to the Final ES.</p> <p>Consideration of the effects of dewatering on peat is in Chapter 10: Water Environment and the assessment of the effects of dewatering on peat will be</p>

Consultee	Consideration	How scoping response has been addressed in this Draft ES
	<p>Government and NatureScot Peatland Survey, Guidance on Developments on Peatland is appropriate.</p> <p>NRW also advises that Phase 1 Habitat types should be used to supplement the identification of areas of deep peat during the assessment of the windfarm layout, including for the access route, and that peat depth maps showing the extent and depth of peat deposits need to be produced so that they can be overlaid with other plans such as habitat survey maps.</p> <p>NRW expects that disturbance and/or destruction of peat would be avoided as far as possible, and where it was not possible, such impacts would be minimised. They also recommend that opportunities to halt the deterioration of existing degraded peat and/or to restore active peat forming vegetation are exploited as part of a strategic environmental management plan for the site.</p>	<p>updated in the Final ES once the additional peat survey information is available.</p> <p>Currently available information on peat is presented in the baseline in Section 11.5. The findings have been used to inform the design evolution to date in order to avoid identified deep peat.</p>
<p>The Coal Authority</p>	<p>The Coal Authority notes that the Project is located within a Development High Risk Area in relation to coal mining, and that the Project information provided to date includes a commitment that: <i>“the ES will address coal mining legacy, which will be considered in a geo-environmental study. This is considered to be the equivalent of a Coal Mining Risk Assessment to meet National policy requirements, which we assume will be used to inform the relevant chapter of the ES.”</i></p>	<p>A CMRA has been produced for the Proposed Development, a draft of which is provided in Appendix 11A, Annex B. Available information on the baseline coal mining status of land within the Site is included in Section 11.5. The findings will be used to inform any intrusive investigations needed to further assess the coal mining risk, and to inform the final design of the Project.</p> <p>A Phase 1 Geoenvironmental Desk Study has been produced for the Proposed Development, a draft of which is provided in Appendix 11A. This will provide further information on the baseline status of the land in relation to land contamination and will include recommendations for any further investigation needed such as intrusive ground investigation.</p> <p>Available desk based information on coal mining is reported in the baseline in Section 11.5.</p>

Technical engagement

- 11.3.4 The Phase 1 geo-environmental desk study recommends that liaison with the Coal Authority is undertaken in relation to obtaining clarification on mining hazards present at the Wind Farm development site, in addition to obtaining mine abandonment plans. This will be undertaken prior to Final ES submission.

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 Site. No external zone of influence for soil has been identified beyond the Site. 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	LandIS Soilscales Map. Available online at: http://www.landis.org.uk/soilscales/# .	Regional soil mapping and information on soil types

Organisation	Data source	Data provided
Institute, Cranfield University.		
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
Natural Resources Wales	Welsh Peatlands Data Portal. ²⁸	<p>The Peatlands of Wales map series provides an updated distribution of Welsh Peatlands based on current evidence sources up to 2022. 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.</p> <p>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 a scale of 1-10, captured in the 'Peatlands of Wales' peat distribution map.</p> <p>For the purpose of this database and in accordance with the Welsh Government approach^{Error! Bookmark not defined.}, peat is defined as having a thickness of more than 40cm of organic material within the upper 80cm of a soil profile.</p>
Welsh Government and Natural Resources Wales	Lle Geo-Portal, Predictive Agricultural Land Classification Map, Version 2. ²⁹	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) ³⁰ . Land is

²⁸ Natural Resources Wales (2022). Welsh Peatlands Data Portal (Online). Available at: <https://datamap.gov.wales/maps/peatlands-of-wales-maps/>. (Accessed October 2022).

²⁹ Welsh Government (2022). Predictive Agricultural Land Classification (ALC) Map 2 (Online). Available at: https://datamap.gov.wales/maps/new?layer=inspire-wg:wg_predictive_alc2#/. (Accessed October 2022).

³⁰ 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
		<p>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 Y Glyn, Rhondda Cynon Taf, The Coal Authority, Reference 51002644897001, 31 August 2021.	<p>Site specific coal mining information identifying potential mining related risks.</p> <p>This report was based on the Scoping Boundary and therefore provides coverage of most of the Site. Additional Coal Authority information was obtained, as below, to provide full coverage of the Site.</p>
Coal Authority	Consultants Coal Mining Report, Mynydd Y Glyn, Rhondda Cynon Taf, The Coal Authority, Reference 51003317529001, 11 October 2022.	<p>Site specific coal mining information identifying potential mining related risks.</p> <p>This report covers the additional land to the west and southeast of the Scoping Boundary in order to provide full coverage of the Site.</p>
Wood (2022)	Coal Mining Risk Assessment (Ref. Doc Ref. 42864-WOOD-XX-XX-RP-OG-0002_S0_P01, October 2022)	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

Organisation	Data source	Data provided
Wood (2021)	Technical Note: Mynydd y Glyn Phase 1 Peat Survey Factual Report (Ref. 42864-WOOD-XX-XX-RP-OG-0001_S2_P01.1, November 2021).	<p>quantify the risk and define mitigation measures.</p> <p>This report is included as an annex to the Phase 1 Geo-environmental desk study, included in Appendix 11A.</p>
Wood (2022)	Mynydd Carn y Cefn Wind Farm, Phase 1 Geoenvironmental Desk Study (Ref. 42864-WOOD-XX-XX-RP-OG-0003_S0_P01, October 2022).	<p>Peat depth survey results for land within the Scoping Boundary. The Site now covers additional land that was not previously surveyed and this is being addressed through further Phase 1 Peat Survey.</p> <p>This report is included as an appendix to the Phase 1 Geo-environmental desk study, included in Appendix 11A.</p> <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 October 2022) 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>

Survey work

Wind Farm development and Grid Connection

- 11.4.4 A Phase 1 peat depth survey was conducted by Wood during September 2021 within the Wind Farm development area of the Site where it is coincident with the Scoping Boundary 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 11.6**) is present on the Site. The findings are reported in the Peat Depth Survey Report (Wood, 2021).
- 11.4.5 A site walkover was completed on 11 October 2022 to inform the Phase 1 Geo-environmental desk study. The walkover was completed by an experienced contaminated land consultant and was used to obtain photographs of key features of the Site, which were identified through desk based review of information on the Site's environmental setting and historical development. Observations from the site walkover are recorded in **Section 11.5** and will be recorded in the Phase 1 Geo-environmental desk study being produced to inform, and which will be appended to the Final ES.

11.5 Overall baseline

Current baseline

Wind Farm development

Topography

- 11.5.1 The Proposed Development is located on Mynydd y Glyn which peaks at 377 mAOD near the northern edge of the Proposed Development site. The highest elevations are located on the northern half and towards the centre of the Proposed Development site with ground levels falling in all directions but more steeply on the western edge. The Proposed Development site boundary roughly flanks the 300 m AOD elevation contour. The Afon Rhondda Fawr valley is to the north, Nant Muchudd valley is to the southwest, and Nant Gelliwion valley is to the southeast of the Proposed Development site.

Soils (including agricultural land)

- 11.5.2 Information reviewed on the LandIS Soilsmap³¹ indicates a range of soil types within the Wind Farm development. The access route from the west is shown with mainly freely draining acid loamy soils over rock, with a loamy texture and medium carbon content (type 13), there are also three areas shown with slowly permeable wet very acid upland soils with a peaty surface, a peaty or humose loamy texture, and high carbon content (type 19). These soils continue along the western and southwestern edge of the Wind Farm development. On the top of Mynydd y Glyn, the Soilsmap shows very acid loamy upland soils with a wet peaty surface, a peaty texture and high carbon content (type 16).
- 11.5.3 The Peatland of Wales dataset shows the distribution of peat across Wales, with peat defined as having a thickness of more than 40cm of organic material within the upper 80cm of a soil profile. Within the Wind Farm development area of the Site there are three

³¹ Cranfield University (2022). Soilsmap (Online) Available at: <http://www.landis.org.uk/soilsmap/#>, (Accessed March 2021).

areas of peat shown on the Peatlands map. No peat is shown along the access road in the west of the Wind Farm development.

- 11.5.4 The three areas shown on the Peatlands Map correspond approximately to the largest feature on the interpolated peat depth figure from the 2021 peat survey, see paragraph below.
- 11.5.5 The 2021 Phase 1 Peat Survey of the Scoping Boundary found that peat was only present in localised areas within this area, predominantly on relatively flat ground to the west of the summit of Mynydd y Glyn. 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 Scoping Boundary. The survey indicated that the site is generally not underlain by peat. However, a localised peat bog is present to the west of the summit of Mynydd y Glyn with peat depths ranging from 2.4m below ground level (bgl) to a maximum surveyed depth of at least 4.10m bgl. The 2021 Peat Survey report, including a plan showing the interpolated peat depth across the Scoping Boundary, is included as an Annex to Phase 1 Geoenvironmental Desk Study in Appendix 11A. The majority of the Scoping Boundary was considered to have bedrock at or close to surface, with little or no cover by superficial deposits. Due to localised peat bogs being identified a higher density survey was recommended to delineate these features.
- 11.5.6 As described in the paragraph above, bedrock is shallow across the site, typically with a thin soil layer present. As reported in the Phase 1 Geo-environmental desk study (Wood, 2022) in **Appendix 11A** there is potential for placed (and potentially imported) material (made ground) including spoil from historical mining activities, however these areas are expected to be infrequent across the Wind Farm development site and small in extent.
- 11.5.7 The Predictive Agricultural Land Classification (ALC) Map 29 indicates that the agricultural land classification within the Wind Farm development, which is also the relevant 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

- 11.5.8 The British Geological Survey (BGS) 1:50,000 scale geology mapping³² shows superficial deposits as thin or absent across most of the Wind Farm development site. Four areas of peat are shown around the plateau crest, and Glacial Till (diamicton) is present on the valley sides around the flanks of the plateau, extending into the south-eastern corner of the Wind Farm development site.
- 11.5.9 The British Geological Survey (BGS) GeoIndex Onshore map³² indicates that bedrock geology on the Proposed Development Site comprises the Upper Coal Measures (Carboniferous Age) Brithdir Member of the Pennant Sandstone Formation, which overlies the Rhondda Member. Both are described as "*Green-grey, lithic arenites ("Pennant sandstones") with conglomerate lenses at bases of units; thin mudstone/siltstone and seatearth interbeds and mainly thin coals.*"³³ The Rhondda member extends from the base of the No 2 Rhondda coal to the base of the Brithdir coal seam. It is noted to be up to 320 m thick.

³² British Geological Survey (2022). Geoindex Onshore (Online) Available at: <http://mapapps2.bgs.ac.uk/geoindex/home.html>, Accessed March 2021

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=BD>, and, <https://webapps.bgs.ac.uk/lexicon/lexicon.cfm?pub=RA> (Accessed October 2022).

- 11.5.10 Several coal seam outcrops are shown beneath the Wind Farm development site, with the outcrop pattern defined by the topography, amended by faulting.
- 11.5.11 The Brithdir Rider seam is the shallowest named seam, outcropping beneath the southern area of the Wind Farm development site. The underlying Brithdir seam is shown to outcrop in the southern area and also in the northern and central areas around the summits of Mynydd y Glyn. The No 1 Rhondda Rider and No 1 Rhondda seams outcrop beneath the western area and around the valley sides. The No 2 Rhondda seam outcrops outside the Site boundary.
- 11.5.12 The stratigraphic sequence on BGS Sheet 248 Pontypridd³⁴ indicates an intermittent thin coal between the No 1 Rhondda Rider and the Brithdir seam. The BGS Memoir for Sheet 248 indicates that the No 1 Rhondda is closely overlain by a thin coal on the valley slopes to the west of the Site.
- 11.5.13 The Sheet Memoir also notes that the No 1 Rhondda Rider has extensive outcrops around the flanks of Mynydd y Glyn and is overlain by one of the principal sandstones of the Pennant, which is approximately 60 m to 75 m thick. The Memoir indicates that the No 2 Rhondda is the most important coal of the group and was worked extensively in the Southern Rhondda area. The Brithdir seam is noted to be degraded in this area and only locally worked. The Brithdir Rider is also thin and has only been worked sporadically and never on a commercial scale; it is approximately 45 m to 60 m above the Brithdir, with predominantly sandstone between. The Memoir indicates that it underlies the highest point of Mynydd Glyn, but this is not shown on the published mapping.
- 11.5.14 The Phase 1 Geo-environmental desk study (Wood, 2022) identifies one historical mine entry to be present in the southeast area of the Wind Farm development site. The associated seam is also considered to underlie the southern area, which is crossed by the Grid Connection Corridor. A large number of mine entries are noted on the lower valley slopes around the Wind Farm development site. Suspected mine entries have been identified in the north-western area of the Wind Farm development site based on aerial imagery.
- 11.5.15 Recorded shallow mining is only locally noted beneath a very small area of the western area of the Wind Farm development site, beneath the proposed access road, likely associated with the No 1 Rhondda seam based on the BGS seam outcrop (Coal Authority records these workings in No 2 Rhondda Rider seam). The Brithdir seam underlies the northeast of the Wind Farm development site and whilst not documented, there is some evidence of localised mining/trials in this seam. Suspected mine entries or areas of shallow trials have been identified on Google Earth on the northern and north-western valley slopes, and the seam extends beneath Turbine T2. It is considered unlikely that the surface workings are associated with extensive below ground workings, based on examination during the site visit completed for the Phase 1 Geo-environmental desk study.
- 11.5.16 Several faults are shown crossing the Wind Farm development site or in the vicinity. The predominant orientation is northwest to southeast.
- 11.5.17 Limited existing borehole data has been identified on the BGS website for the Wind Farm development site and immediate surrounding area. The following existing records been identified and viewed, all of the locations but one are clustered in the central area of the Wind Farm development site, but these are of limited relevance:
- ST08NW14: Cymmer Colliery No 16 BH – underground borehole from the Lower Five Feet to prove Upper Five Feet coal seam. Borehole commenced at 229 m bgl;

³⁴ British Geological Survey (BGS) 1:50 000 Geological Sheet 248, Pontypridd, Solid, 1963 and Drift, 1975.

- ST08NW15: Cymmer Colliery No 17 BH - underground borehole from the Lower Five Feet to prove Upper Five Feet coal seam. Borehole commenced at 212 m bgl;
- ST08NW16: Cymmer Colliery No 18 BH - underground borehole from the Lower Five Feet to prove Upper Five Feet coal seam. Borehole commenced at 213 m bgl.
- ST08NW/87 and 88 – shallow boreholes (BH56 and BH56A) from 1980. Encountered firm to stiff CLAY (Glacial Till) to a depth of 0.2 m to 0.4 m bgl overlying bedrock which comprised very strong SANDSTONE.

Geodiversity

- 11.5.18 The MAGIC interactive database³⁵ indicates that there are no geological Sites of Special Scientific Interest (SSSIs) located within the Wind Farm development site. The Rhos Tonyrefail SSSI is located within the study area, immediately south of the western area of the Wind Farm Development Site which includes the access road. This is a large lowland site of special interest for its marshy grassland, acid flush, species rich neutral grassland, wet heath and blanket mire.
- 11.5.19 The Welsh Government datasets for Geological Conservation Review (GCR) Sites³⁶ and Regionally Important Geological and Geomorphological Sites (RIGS) was consulted and indicates there are no GCR or RIGS sites within the Wind Farm development site or in the wider study area.
- 11.5.20 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

- 11.5.21 The Coal Authority Interactive Map shows that the Wind Farm development site is affected by historical coal mining, including the presence of coal outcrops and development high risk areas. In relation to coal resources, Welsh Government planning policy is to move away from extraction of energy minerals.
- 11.5.22 In relation to the risk posed to development by sites with a legacy of coal mining, a Coal Mining Risk Assessment has been produced for the Proposed Development and this is included as **Annex B** to the Phase 1 Geo-environmental desk study, included in **Appendix 11A**.
- 11.5.23 In relation to sandstone resources beneath the Wind Farm development site (as described in **Table 11.2**), 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 review of historical mapping in the Phase 1 Geo-environmental desk study (Wood 2022) did not identify potentially significant sources of contamination. Despite the area's history of mining, no spoils heaps were identified on historical mapping and no evidence of spoil was observed during the site reconnaissance. Nevertheless, it is possible that

³⁵ Defra (2022). Magic Maps. (Online) Available at: <https://magic.defra.gov.uk/MagicMap.aspx>, (Accessed October 2022).

³⁶ Welsh Government (2022). DataMap Wales, Regionally Important Geological and Geomorphological Sites (RIGS) (Online). Available at: [https://datamap.gov.wales/maps/new?layer=inspire-nrw:NRW_GCR_SITES#/,](https://datamap.gov.wales/maps/new?layer=inspire-nrw:NRW_GCR_SITES#/) (Accessed October 2022).

localised small areas of spoil, potentially associated with trial excavations, are present. Current and historical farm operations have the potential to be a source of contamination however no specific areas of potential contamination were identified. The mining history of the Wind Farm development site results in potential for mine gas to be present.

- 11.5.25 Regarding contamination from agricultural activities, any contamination, if 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.
- 11.5.26 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.
- 11.5.27 No offsite sources of potential contamination with potential to significantly affect the land quality on the Wind Farm development site have been identified in the Phase 1 Geo-environmental desk study (Wood, 2022). This is based on the Wind Farm development site being at a higher elevation than the identified sources (including offsite farm buildings and mining spoil) which reduces the likelihood of onsite migration. Offsite sources were therefore not considered further in the risk assessment.

Environmental setting: hydrogeology, hydrology, and sensitive land uses

- 11.5.28 A detailed description of hydrogeology is presented in **Chapter 10: Water Environment**. In summary, the South Wales Upper Coal Measures is classified by NRW as a Secondary A Aquifer. The till is classified as a Secondary Undifferentiated aquifer. The groundwater vulnerability of the bedrock and superficial deposits is categorised as High Vulnerability in the north and south and Medium Vulnerability in the centre, southeast and southwest of the study area. 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 Proposed Development area and the wider study area are not within a source protection zone (SPZ).
- 11.5.29 A detailed description of hydrology is presented in **Chapter 10: Water Environment**. In summary, the Proposed Development site extends over three hydrological catchments, the northern part draining to the Afon Rhondda Fawr, the southern part draining to the Nant Muchudd and a small section of the access road in the west draining to Afon Elai. The Afon Rhondda Fawr joins the Afon Taf 1.3 km east of the study area whilst Nant Muchudd joins Afon Elai 3.7 km south of the study area. A number of tributaries of the Afon Rhondda Fawr and Nant Muchudd issue within the study area. The Afon Rhondda Fawr, Afon Taf and Afon Elai are classified by NRW as Main Rivers whilst their tributaries are ordinary watercourses.
- 11.5.30 Details of the watercourses within the Wind Farm Development site are provided in **Chapter 10: Water Environment**. Features within the site include the Afon Rhondda Fawr, which flows southeast within the northern edge of the study area. Six tributaries of the Afon Rhondda Fawr issue within the northern and western edges of the Wind Farm development site with additional tributaries issuing in the wider study area. Two tributaries of Nant Muchudd issue within the southern edge of the Proposed Development site with several additional tributaries issuing in the wider study area. The OS map shows five springs issuing within the southern and eastern parts of the Wind Farm development area. The southern springs drain south to the Nant Muchudd, whilst the eastern springs drain east to the Nant Gelliwion. There are two ponds within the Wind Farm development site.
- 11.5.31 There are no statutory designated ecological sites on the Wind Farm development site, the only designated site within the study area is the Rhos Tonyrefail SSSI, as described in

paragraph **11.1.47**. The assessment of the likely significant effects of the Proposed Development on biodiversity is presented in **Chapter 8: Biodiversity**.

Grid Connection

Topography

11.5.32 The Grid Connection corridor is located on the south-eastern face of the Mynydd y Glyn slope, with the overhead section extending to the Proposed Development boundary at approximately NGR ST 04359 88432. The highest elevation within this overhead section is approximately 350mAOD, whilst the lowest elevation is 210 mAOD at the road level. Along the underground connection route towards the grid connection point, the elevation declines to approximately 50mAOD at Upper Boat. The Grid Connection Corridor is mainly covered by pasture and arable fields, with access via some informal tracks and footpaths, however the proposed Grid Connection route runs along roads which pass through the villages of Pen-y-coedcae and Church Village.

Soils (including agricultural land)

- 11.5.33 From the Grid Connection's northern point to its south-eastern point within the Site (the overhead line), the LandIS Soils map³⁷ shows the following soil types: very acid loamy upland soils with a wet peaty surface, a peaty texture and high carbon content (type 16), then freely draining acid loamy soils over rock, with a loamy texture and medium carbon content (type 13), then slowly permeable wet very acid upland soils with a peaty surface, a peaty or humose loamy texture, and high carbon content (type 19).
- 11.5.34 The Grid Connection then continues as an underground line generally southeast to Black Road, running through slowly permeable wet very acid upland soils with a peaty surface, a peaty or humose loamy texture, and high carbon content (type 19), it then runs through freely draining acid loamy soils over rock, with a loamy texture and medium carbon content (type 13) until it reaches Upper Church Village, where the soil type changes to slowly permeable seasonally wet acid loamy and clayey soils, with a loamy and clayey texture and medium carbon content (type 17). Where the underground line runs along the highway the natural soils are likely to have been removed during construction of the road.
- 11.5.35 The Peatland of Wales dataset shows no peat deposits on the Grid Connection corridor within the overhead line on the Site or along the underground line route. Only the northern extent of the Grid Connection corridor has been subject to Phase 1 Peat Survey to date (where it coincides with the Scoping Boundary). The additional land in the southeast of the Wind Farm Development site which includes the overhead line Grid Connection will be subject to Phase 1 Peat Survey in October 2022.
- 11.5.36 The Predictive Agricultural Land Classification (ALC) Map 2²⁹ indicates that the agricultural land classification within the Grid Connection corridor (overhead line and underground line) is predominantly Grades 4 and 5, with a small area of possible Grade 3b land in the southeast of the underground line only to the north of Church Village, the village itself is shown as urban. The Grid Connection therefore does not include any Best and Most Versatile' (BMV) land (Grades 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, based on the ALC map data, the Grid Connection land is assumed to be (on average) Grade 4 to provide a conservative assessment.

³⁷ Cranfield University (2022). Soils (Online) Available at: <http://www.landis.org.uk/soils/#/>, (Accessed March 2021).

Geology

- 11.5.37 The British Geological Survey (BGS) 1:50,000 scale geology mapping³⁸ shows superficial deposits as thin or absent across most of the Grid Connection. Glacial Till (diamicton) is present in the south-eastern corner of the overhead line (OHL) section of the Grid Connection, in the southeast of the Proposed Development Site, as described in **4.2.13 in Chapter 4: Project Description**.
- 11.5.38 The underground section of the Grid Connection corridor is shown on the BGS GeoIndex 1:50,000 scale mapping as being underlain, from northwest to southeast by Glacial Till to Bron y Carn Barn, then superficial deposits are absent until Llantrisant Road where a localised area of peat is shown where the route leaves the road east of Llantrisant Road, there is then a localised area of Glacial Till centrally between Llantrisant Road and Black Road, then localised peat between Black Road and Maindy Road, superficial deposits are then absent until Maendy where the route encounters a localised area of peat (although this may have been removed during construction of Maindy Road). For the remainder of the route superficial deposits are largely absent until Main Road and Tonteg Road where some Glacial Till is present before the route encounters a small area of glaciofluvial deposits (sand and gravel) and beyond this at its south-eastern extent alluvium (clay, silt, sand and gravel).
- 11.5.39 The British Geological Survey (BGS) GeoIndex Onshore map³² indicates that bedrock geology on the Grid Connection OHL section comprises the Upper Coal Measures (Carboniferous Age) Brithdir Member of the Pennant Sandstone Formation, this overlies the Rhondda Member. Both are described as “*Green-grey, lithic arenites ("Pennant sandstones") with conglomerate lenses at bases of units; thin mudstone/siltstone and seatearth interbeds and mainly thin coals.*”³⁹ The Rhondda member extends from the base of the No 2 Rhondda coal to the base of the Brithdir coal seam. It is noted to be up to 320 m thick.
- 11.5.40 The BGS GeoIndex³² indicates that for the underground section of the Grid Connection, the bedrock geology also mainly comprises the Brithdir Member – Sandstone, of the Pennant Sandstone Formation. In two locations roughly centrally along its length, the route encounters the Hughes Member, also of the Pennant Sandstone Formation, comprising of green-grey, lithic arenites (“Pennant sandstones”), with thin mudstone/siltstone and seatearth interbeds, and mainly thin coals⁴⁰.
- 11.5.41 Two coal seam outcrops are shown beneath the OHL section of the Wind Farm development site, and several are shown beneath the underground section of the Grid Connection, the outcrop pattern is defined by the topography, amended by faulting.
- 11.5.42 There are some BGS borehole record available on or close to the Grid Connection underground section, however most of these relate to colliery activity and are of limited relevance due to commencing underground. At its eastern end there are several borehole records available recording the near surface ground conditions. One of these boreholes⁴¹ records topsoil to 0.45m bgl, overlying very silty, very gravelly sand to 1.8m bgl, then gravel of sandstone and silty sand to 2.0m bgl, then from 2.0 to 8.0m bgl bluish grey, medium grained slightly weathered sandstone.

³⁸ British Geological Survey (2022). Geoindex Onshore (Online) Available at: <http://mapapps2.bgs.ac.uk/geoindex/home.html>, Accessed March 2021

³⁹ 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>, and, <https://webapps.bgs.ac.uk/lexicon/lexicon.cfm?pub=RA> (Accessed October 2022).

⁴⁰ BGS (2022) The BGS Lexicon of Named Rock Units – Result Details (Online). Available at: <https://webapps.bgs.ac.uk/lexicon/lexicon.cfm?pub=H>. (Access October 2022).

⁴¹ BGS ID: 375611 : BGS Reference: ST08NE202, British National Grid (27700) : 309740,186960. Available at: http://scans.bgs.ac.uk/sobi_scans/boreholes/375611/images/10687968.html.

Geodiversity

- 11.5.43 The MAGIC interactive database⁴² indicates that there are no geological Sites of Special Scientific Interest (SSSIs) located within the Grid Connection.
- 11.5.44 The Welsh Government datasets for Geological Conservation Review (GCR) Sites⁴³ and Regionally Important Geological and Geomorphological Sites (RIGS) was consulted and indicates there are no GCR or RIGS sites within the Grid Connection or in the wider study area.
- 11.5.45 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

- 11.5.46 The Coal Authority Interactive Map shows that the Grid Connection corridor is affected by historical coal mining, including the presence of coal outcrops and development high risk areas. In relation to coal resources, Welsh Government planning policy is to move away from extraction of energy minerals.
- 11.5.47 In relation to the risk posed to development by sites with a legacy of coal mining, a Coal Mining Risk Assessment has been produced for the Proposed Development and this is included as **Annex B** to the Phase 1 Geo-environmental desk study, included in **Appendix 11A**. The CMRA is only applicable to the OHL section of the Grid Connection.
- 11.5.48 In relation to sandstone resources beneath the Wind Farm development site (as described in **Table 11.2**), given that there are no known proposals for mineral extraction at the Proposed Development Site and that the Grid Connection footprint would only occupy a small proportion of the Proposed Development Site, effects on minerals have been scoped out of the EIA.

Land contamination

- 11.5.49 The review of historical mapping in the Phase 1 Geo-environmental desk study (Wood 2022) did not identify potentially significant sources of contamination. Despite the area's history of mining, no spoils heaps were identified on historical mapping and no evidence of spoil was observed during the site reconnaissance. Nevertheless, it is possible that localised small areas of spoil, potentially associated with trial excavations, are present. Current and historical farm operations have the potential to be a source of contamination however no specific areas of potential contamination were identified. The mining history of the Grid Connection site results in potential for mine gas to be present.
- 11.5.50 The Phase 1 Geo-environmental desk study provided in **Appendix 11A** (Wood, 2022) identifies one historical mine entry to be present in the southeast area of the Wind Farm development site. The associated seam is also considered to underlie the southern area, which is crossed by the Grid Connection Corridor. A large number of mine entries are noted on the lower valley slopes around the Wind Farm development site. Suspected mine entries have been identified in the north-western area of the Wind Farm development site based on aerial imagery.

⁴² Defra (2022). Magic Maps. (Online) Available at: <https://magic.defra.gov.uk/MagicMap.aspx>, (Accessed October 2022).

⁴³ Welsh Government (2022). DataMap Wales, Regionally Important Geological and Geomorphological Sites (RIGS) (Online). Available at: [https://datamap.gov.wales/maps/new?layer=inspire-nrw:NRW_GCR_SITES#/,](https://datamap.gov.wales/maps/new?layer=inspire-nrw:NRW_GCR_SITES#/) (Accessed October 2022).

- 11.5.51 Recorded shallow mining is only locally noted beneath a very small area of the western area of the Wind Farm development site, beneath the proposed access road, likely associated with the No 1 Rhondda seam based on the BGS seam outcrop (Coal Authority records these workings in No 2 Rhondda Rider seam). The Brithdir seam underlies the northeast of the Wind Farm development site and whilst not documented, there is some evidence of localised mining/trials in this seam. Suspected mine entries or areas of shallow trials have been identified on Google Earth on the northern and north-western valley slopes, and the seam extends beneath Turbine T2. It is considered unlikely that the surface workings are associated with extensive below ground workings, based on examination during the site visit completed for the Phase 1 Geo-environmental desk study.
- 11.5.52 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.
- 11.5.53 Former mine workings are a potential source of toxic and explosive gases and the Phase 1 Geo-environmental desk study (**Appendix 11A**) identifies a potential risk of ground gas being present, the risk is only potentially significant where enclosed spaces are present where gas may accumulate (e.g. substation building on the Wind Farm development site).. No historical mine gas issues have been identified at the Site based on desk study evidence.
- 11.5.54 There are two historical landfills shown on or adjacent to the underground section of the Grid Connection, these comprise Maendy Quarry, approximately centred at grid reference 307294, 187763 which was licensed to Industrial Waste Disposal South Wales Limited and accepted industrial and commercial waste between 1966 and 1970, and Power Station Hill Landfill / Tip, approximately centred at 309685, 186732, which dates from 1970, no details of the waste types deposited there have been provided.

Environmental setting: hydrogeology, hydrology and sensitive land uses

- 11.5.55 A detailed description of hydrogeology is presented in **Chapter 10: Water Environment**. In summary, the South Wales Upper Coal Measures underlying the overhead Grid Connection site are classified by NRW as Secondary A Aquifers.
- 11.5.56 A detailed description of hydrology is presented in **Chapter 10: Water Environment**. In summary, the Grid Connection Corridor extends over four hydrological catchments, the OHL section draining to the Nant Muchudd and the underground cable section draining (from west to east) to Afon Rhondda Fawr, Nant Clun and Afon Taf. The Afon Rhondda Fawr, Afon Taf and Nant Clun are classified by NRW as Main Rivers whilst their tributaries are ordinary watercourses. The OS mapping shows that tributaries of Nant Gelliwion, Nant Muchudd and Nant Ty'rarlwydd (Ordinary Watercourses) cross the proposed underground cable route.
- 11.5.57 There are no mapped ponds or springs within the Grid Connection Corridor.
- 11.5.58 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

- 11.5.59 In the absence of the Proposed Development, the current agricultural land use (mainly sheep grazing on the Wind Farm development site, and more diverse farming on the lower lying land of the Grid Connection) within the Proposed Development Site and Grid Connection corridor are likely to continue. Developments on farmland local to the Grid

Connection include solar farms, and this sort of development is likely to increase in future, particularly since the agricultural land grades within the Wind Farm development site and the Grid Connection are below the best and most versatile categories where solar array developments are not encouraged through the planning system⁴⁴.

- 11.5.60 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. Table 11.6** outlines how these embedded measures will influence the Ground Conditions assessment.

Table 11.6 Summary of the embedded environmental measures

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	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 Construction Environmental Management Plan (CEMP) submitted alongside this Draft ES. 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. During topsoil stripping, machinery with low ground pressure will be used to minimise soil compaction, including during construction of	CEMP and MMP secured via DNS condition

⁴⁴ Welsh Government (2022). Guidance: Best and most versatile agricultural land and solar PV arrays. <https://gov.wales/best-and-most-versatile-agricultural-land-and-solar-pv-arrays>.

Receptor	Potential changes and effects	Embedded measures	Compliance mechanism
		<p>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 Materials Management Plan (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 CEMP refers to the MMP.</p>	
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 CEMP.</p> <p>Measures to avoid soil compaction (which can result in soil erosion by increasing surface run-off) are integrated into the CEMP to avoid damage to soil.</p> <p>The 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>	CEMP and MMP secured via DNS condition
Soil	Permanent loss of soil and associated soil functions due to construction of the wind farm	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	CEMP and MMP secured via DNS condition

Receptor	Potential changes and effects	Embedded measures	Compliance mechanism
		<p>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 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 CEMP.</p>	
<p>Soil resources temporarily or permanently displaced, or to be translocated within the Proposed Development application boundary</p>	<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 soil for potential contaminants, including 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</p>	<p>CEMP, MMP secured via DNS condition</p>

Receptor	Potential changes and effects	Embedded measures	Compliance mechanism
		<p>contaminated land risk assessment will be completed in accordance with the Environment Agency LCRM guidance.</p> <p>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>The 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>	
Peat	<p>Degradation / loss of peat functions due to handling during construction works or permanent displacement of peat due to construction (with loss of peat functions including carbon storage and peatland habitat biodiversity functions)</p>	<p>The Proposed Development will avoid significant impacts on peat through design, based upon peat survey to date and additional peat survey to be completed in October 2022. There is currently no NRW or Welsh Government guidance for developments on peat, therefore the SEPA guidance 'Developments on Peat and Off-site Uses of Waste Peat'⁴⁵ will be applied. This includes use of</p>	<p>CEMP secured via DNS condition</p>

⁴⁵ SEPA (2017) SEPA Guidance – WST-G-52: Developments on Peat and Off-Site Uses of Waste Peat. [online]. Available at: <https://www.sepa.org.uk/media/287064/wst-g-052-developments-on-peat-and-off-site-uses-of-waste-peat.pdf>. Checked October 2022.

Receptor	Potential changes and effects	Embedded measures	Compliance mechanism
<p>Contaminated land receptors: Site workers/site users including construction workers</p>	<p>Impacts on human health due to land contamination</p>	<p>the peat management hierarchy, where peat should be avoided through design, and if this is not possible, further measures are needed. The guidance applies only in Scotland, however it is designed for wind farm developments and can be applied to all types of development on peat.</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 geo-environmental 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</p>	<p>CEMP, MMP and DNS condition</p>

Receptor	Potential changes and effects	Embedded measures	Compliance mechanism
		Proposed Development. The CEMP includes an unexpected contamination protocol.	
		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.	
Contaminated land receptors: soil, groundwater, surface water, humans (site users)	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.	A Phase 1 geo-environmental desk study has been completed for all elements of the Proposed Development and the report is appended (Appendix 11A).	CEMP and DNS condition
		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.	
		Phase 2 intrusive geo-environmental ground investigation will be completed during the pre-construction phase, including soil sampling and chemical testing, to confirm the ground conditions.	
Contaminated land receptors: soil and groundwater, humans (site users)	Leaks or spills of fuels or oils from construction vehicles or plant	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	CEMP

Receptor	Potential changes and effects	Embedded measures	Compliance mechanism
		<p>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)</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 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</p>	<p>DNS condition</p>

Receptor	Potential changes and effects	Embedded measures	Compliance mechanism
Built environment (buildings, structures, services)	Aggressive ground conditions with potential to cause damage to buildings/structures due to chemical attack.	<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 ES (Appendix 11A).</p> <p>Phase 2 intrusive geo-environmental ground investigation will be completed during the pre-construction phase, including soil sampling and chemical testing, to confirm the ground conditions. The</p>	DNS condition

Receptor	Potential changes and effects	Embedded measures	Compliance mechanism
<p>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>Operation</p>			
<p>Soils/agricultural land</p>	<p>Damage to soil during maintenance activities requiring excavation</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>	<p>Standard operating procedures (SOPs)</p>
<p>Contaminated land receptors: soil and groundwater, humans (site users)</p>	<p>Leaks or spills of fuels or oils from vehicles or plant during wind farm or grid connection maintenance</p>	<p>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.</p>	<p>Standard operating procedures (SOPs)</p>
<p>Contaminated land receptors: humans (site users)</p>	<p>Impacts on site users' health due to encountering contaminants in soil</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>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.,</p>	<p>DNS planning condition</p>

Receptor	Potential changes and effects	Embedded measures	Compliance mechanism
		<p>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>	
<p>Contaminated land receptors: humans (site users), buildings</p>	<p>Accumulation of mine gas within enclosed spaces leading to potentially toxic and/or explosive atmospheres in enclosed spaces.</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>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 C665⁴⁶, which is likely to entail a minimum of six monitoring rounds over a</p>	<p>DNS planning condition</p>

⁴⁶ CIRIA (2007) Assessing risks posed by hazardous ground gases to buildings (C665). CIRIA; UK

Receptor	Potential changes and effects	Embedded measures	Compliance mechanism
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>minimum period of three months.</p> <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 specialist desk based mining risk assessment, as recommended in the Coal Mining Risk Assessment, is being undertaken, which will then inform 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. The planned intrusive investigations and any remediation work required based on the findings of these investigations will be communicated to the Coal Authority in advance of undertaking the works.</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 environmental 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**.

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 Ground Conditions assessment 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 24 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 24 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 Conditions receptors that have been identified as being potentially subject to effects are summarised in **Table 11.7**.

Table 11.7 Ground Conditions receptors subject to potential effects

Receptor	Reason for consideration
Soils	
Soil resources	<p>Land within the Proposed Development Site is in agricultural use. There is no BMV agricultural land within the study area, however, grazing of sheep takes place.</p> <p>Peaty soils are present within the Proposed Development Site. Key soil functions on the land include supporting grassland / forage plant growth, storage of organic carbon, providing habitat and supporting biodiversity and a role in the hydrological cycle.</p>

Receptor	Reason for consideration
Soil resources: peat (having a thickness of more than 40cm of organic material within the upper 80cm of a soil profile)	Peat is present locally within the Proposed Development boundary. Peat has distinctive characteristics including high sensitivity to handling and its high organic content, healthy peatlands carry out an important carbon cycling / storage function. Peatlands areas protected through the planning system by the Welsh Government.
Land Contamination	
Humans – current and future site users (agricultural workers, maintenance workers/ operatives, public open space users)	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.
Humans – construction workers	
Controlled water: Groundwater – Secondary A aquifer (Coal Measures), Secondary (undifferentiated) aquifer (Glacial Till)	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.
Controlled water; Surface water – Nant Muchudd, Afon Rhondda Fawr	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.
Current and future buildings and services	<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 Conditions 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 Conditions 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>

Receptor	Likely significant effects
	Permanent loss of agricultural land, soil, and associated soil functions when soil is removed from the Proposed Development Site for construction of the permanent 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.
Soil Resources: Peat	Degradation / loss of peat functions due to damage caused by handling and storage during construction works (with loss of peat functions including carbon storage and peatland habitat biodiversity functions)
	Permanent displacement / loss of peat due to construction of permanent development (e.g. wind turbines, access tracks, substation)
Operation	
Contaminated land receptors: future site users (agricultural workers, maintenance workers/ operatives, 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: future site users (agricultural workers, maintenance workers/ operatives, public open space users), future buildings and 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 a Safeguarding Area for sandstone, there are no known proposals for mineral extraction within the study area. The Wind Farm

Receptors/potential effects	Justification
Contaminated land receptors: current site users (agricultural workers, maintenance workers/ operatives, public open space users) – impacts on human health due to encountering land contamination	<p>development footprint would only occupy a small proportion of the Proposed Development Site. Additionally, in relation to coal resources, Welsh Government planning policy is to move away from the extraction of energy minerals.</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>
Contaminated land receptors: construction workers – impacts on human health from known, suspected or unexpected land contamination	<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>
Contaminated land receptors: current site users (agricultural workers, maintenance workers/ operatives, public open space users) – impacts on human health due to encountering land contamination – impacts on human health or the water environment due to leaks or spills or fuels or oils from construction vehicles or plant	<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>
Built environment (buildings, structures, services) - Aggressive ground conditions with potential to cause damage to buildings/structures due to chemical attack.	<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>
Built environment (buildings, structures, services) – Land instability with potential to result in subsidence	<p>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 review</p>

Receptors/potential effects	Justification
	<p>as recommended in the CMRA, 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.</p>

11.8 Assessment methodology

- 11.8.1 The generic project-wide approach to the assessment methodology is set out in **Chapter 2: Approach to 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 Ground Conditions assessment.
- 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 Preliminary assessment of Ground Conditions effects

Overview

- 11.9.1 The assessments in this chapter for Ground Conditions receptors, including soils and land contamination receptors, 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**.

Wind Farm development site

- 11.9.2 The permanent development features within the Wind Farm development comprise the following:
- the seven wind turbines will each require foundations, likely to be formed by a reinforced concrete slab base approximately 20m in diameter, the total area required for all seven turbine foundations will therefore be 0.22ha. Each turbine will also require a transformer, in some instances this can be incorporated into the base of the tower itself, however for a worst case assessment it is assumed that an external kiosk is needed to house the transformer and that this would have a maximum area of 5.0m x 2.5m (12.5m²). The seven kiosks will therefore require a total area of 87.5m² (0.009ha);
 - each wind turbine requires an adjacent area of hardstanding for use as a crane pad, and these will be left in place during the operational phase for use during maintenance

/ replacement of parts and could also be used during decommissioning. Each crane pad will require approximately 2,500m² in area, the maximum total area of the seven crane pads will therefore be 1.75ha;

- the wind farm will require internal access tracks, of approximately 5.4km in length. The tracks will be approximately 5m wide and will have a 2m wide grassed verge on either side. The total track area will therefore be approximately 2.70ha and the verges will occupy an area of 2.16ha. Soil will be disturbed / removed to construct the verges however it is likely that some will be reused within the verge. The assessment assumes a worst case figure of 2.16ha as the maximum area of soil loss for the access tracks;
- the Wind Farm development requires an internal substation to connect the wind farm into the national distribution system. This may require a transformer within the substation compound within a stoned area of approximately 37.5m x 35m. The substation building will be a single storey building, approximately 14m x 10m, housing metering, protection and control equipment, storage and welfare facilities. To provide a worst case assessment it is therefore assumed that the substation building and transformer compound will require a total area of 0.15ha; and
- the substation welfare facilities will include a water supply system which is likely to be rainwater fed.

11.9.3 Based on the above details, the total area of permanent development where soil is likely to be permanently removed or sealed will be 6.99ha (this includes the verges in order to provide a worst case assessment).

11.9.4 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 features are summarised below:

- temporary use of land will be required for construction compounds, there will be two compounds, each requiring an area of around 0.25ha, making a total of 0.5ha. Once the erection and commissioning of the wind turbines is complete, these compounds would be removed and the soil reinstated during the construction phase; and
- temporary ground disturbance will be required to install the underground cables running between the turbines and the substation, these will be placed in cable trenches approximately 0.45m wide and 0.75m deep. The length of cable is not known, therefore the length of the access track has been used as an equivalent value, giving a total cable trench area of 0.24 hectares.

11.9.5 The maximum area of soil to be disturbed and/or temporarily displaced because of the Proposed Development Site would therefore be approximately 0.75 hectares.

11.9.6 The total area of land that will undergo temporary and / or permanent disturbance is therefore estimated at 7.74ha.

11.9.7 As detailed in **Section 11.5**, available information on the soil on the Proposed Development Site indicates the absence of deep peat across most of the Wind Farm development site, however there are localised areas of peat >0.4m (>40cm) in thickness that were confirmed during the Phase 1 Peat Survey (Wood, 2021) and there is potential for peat in areas not surveyed to date. The design of the Wind Farm has been adapted to avoid the known areas of peat. Further delineation of the identified peat is being undertaken as further work for the ES (see **Section 11.14**) with the intention of further avoidance as needed e.g., through micrositing. There is some potential for made ground within the Wind Farm development site, where the original soils will have been removed / replaced following historical mining activity, however these areas are expected to be

infrequent across the Wind Farm development site and small in extent. Most of the Wind Farm development site is likely to 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.

- 11.9.8 Based on the presence of peaty soils on the Wind Farm development site, the soil sensitivity is assessed based on the criteria in **Table 11.11** to be Low to Medium.

Grid Connection

- 11.9.9 The applicant has received an offer of a grid connection from Western Power Distribution (WPD) as the Distribution Network Operator (DNO). The connection is planned between the on-site substation and the electricity grid at Upper Boat. This connection will be comprised of two components, the first of which is an overhead line to the south eastern boundary of the Site towards Upper Boat, subsequently the line will be undergrounded to the connection point. The underground cable will be delivered by WPD, whilst the overhead Line will be consented as part of this DNS process. As requested by PEDW in the Scoping Direction, and described in **Chapter 1**, paragraph 1.1.4, potential effects from the grid connection have been considered in this Draft ES.
- 11.9.10 **Figure 4.3** illustrates the corridor within which the proposed connection would be routed, between the on-site substation and the electricity grid at Upper Boat. The desk-based assessment of potential effects from the grid connection presented in this Draft ES is based on the connection being likely to be approximately 8.5km in length, with 33kV overhead line on wooden poles for 1.4km and undergrounded 33kV cable following the highway up to the connection point for 7.1km.
- 11.9.11 The OHL section of 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 each pole is installed. This soil excavation has not been quantified given its limited extent, and use of the maximum area of temporary soil disturbance for the Wind Farm development site in the assessment is therefore considered to be sufficient to provide a conservative assessment of the effects of the Grid Connection OHL section.
- 11.9.12 Design information is not yet available for the undergrounded section of the Grid Connection, this will require sufficient working width for the trenches. The underground section of the Grid Connection will require temporary ground disturbance to install the underground cables running between the turbines and the substation, these will be placed in cable trenches and then the trench backfilled.
- 11.9.13 As detailed in **Section 11.5**, available information on the soil on the Proposed Development Site indicates the absence of deep peat on the OHL section of the Grid Connection site, however there are localised areas of peat >0.4m (>40cm) in thickness that were confirmed during the Phase 1 Peat Survey (Wood, 2021) and there is potential for peat in areas not surveyed to date. The design of the Grid Connection has been adapted to avoid known areas of peat. Further delineation of the identified peat is being undertaken as further work for the ES (see **Section 11.14**) with the intention of further avoidance as needed e.g., through micrositing. There is some potential for made ground within the Grid Connection OHL section, where the original soils will have been removed / replaced following historical mining activity, and there is potential for made ground within the underground section as a result of historical landfilling, and also road construction. Most of the Grid Connection OHL section is likely to 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.

- 11.9.14 Based on the presence of peaty soils on the Grid Connection site (OHL route), the soil sensitivity is assessed based on the criteria in **Table 11.10** to be Low to Medium. It is assumed that if deep peat is present on the underground route that this will also be avoided, in accordance with the embedded measures in **Table 11.6**, however as some peaty soils are present, a conservative classification of medium sensitivity has also been applied to soils in the underground section of the Grid Connection.

Assessment methodology: Soils

- 11.9.15 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; and
 - issues requiring further assessment and the methods to be applied.
- 11.9.16 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 **Section 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 Policy⁴⁷.

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 ⁴⁸ according to the Agricultural Land Classification (ALC) system ⁴⁹
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:

⁴⁷ 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).

⁴⁸ 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.

⁴⁹ 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).

Value / Sensitivity	Description Example
	Grade 3a agricultural land ⁵⁰ according to the ALC system
Medium	Soils: 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 ⁵¹ 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

11.9.17 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.

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

⁵⁰ 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.

⁵¹ 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.

**Preliminary assessment of Soils Effects (including agricultural land):
Construction phase**

- 11.9.19 As described in **Section 11.5**, the agricultural classification for the Proposed Development site, including the Wind Farm development site and the Grid Connection 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.
- 11.9.20 On the 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

- 11.9.21 The maximum area of soil to be disturbed and/or temporarily displaced because of the proposed Wind Farm and Grid Connection OHL section would be approximately 0.75 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.
- 11.9.22 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.
- 11.9.23 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.

- 11.9.24 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.
- 11.9.25 The underground Grid Connection section has similar soil conditions and is assessed as having an overall ALC classification of Grade 4; based on standard best practice measures being adopted for the underground Grid Connection construction work, no significant effects are anticipated.

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

- 11.9.26 The maximum area of soil to be disturbed and/or temporarily displaced because of the proposed Wind Farm and Grid Connection OHL section would be approximately 0.75 hectares. Soil stripping and stockpiling will be needed for the permanent development elements which cover an area of approximately 6.99 hectares, giving a total area of 7.74 hectares where soil would be temporarily or permanently removed. 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.
- 11.9.27 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.
- 11.9.28 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.
- 11.9.29 The underground Grid Connection section has similar soil conditions and is assessed as having an overall ALC classification of Grade 4. Based on standard best practice measures being adopted for the underground Grid Connection construction work, no significant effects are 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

- 11.9.30 The maximum area of potential permanent/long-term loss of soil/agricultural land due to the proposed Wind Farm and Grid Connection OHL section is 6.99 hectares. The area of permanent loss of soil is less than 20 hectares and 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.
- 11.9.31 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.
- 11.9.32 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 additional peat survey (October 2022) and pre-construction ground investigation, can be employed once additional information on ground conditions is available to bring the overall effect down to **Slight negative** e.g. through micro-siting to minimise development on peaty soils.

- 11.9.33 The underground Grid Connection section is likely to result in only minimal permanent loss of soil (e.g., if joint boxes were required), therefore no significant effects are anticipated for this section of the Grid Connection in regard to permanent soil loss.

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

- 11.9.34 The maximum area of soil to be temporarily displaced because of the Wind Farm and Grid Connection would be approximately 0.75 hectares, and the maximum area of permanent/long-term loss of soil/agricultural land is 6.99 hectares, giving a total of 7.74 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.
- 11.9.35 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.
- 11.9.36 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.
- 11.9.37 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.
- 11.9.38 Based on standard best practice measures being adopted for the underground Grid Connection construction work, no significant effects are anticipated.

Degradation of peat, due to damage caused by handling and storage during construction works (with loss of peat functions including carbon storage and peatland habitat biodiversity functions)

- 11.9.39 Peat within the Wind Farm development site includes peat mapped on the NRW Peatlands of Wales map. This is therefore considered to be a very high sensitivity receptor. Based on the available peat survey information (see 2021 Peat Survey report included as an Annex to Phase 1 Geoenvironmental Desk Study in **Appendix 11A**) it is anticipated that the Proposed Development can avoid peat, as defined in **Table 11.5** through design e.g. through micrositing. Avoidance of peat is an embedded measure in **Table 11.6** in accordance with the peat hierarchy. The Proposed Development will therefore not result in significant effects on peat. Handling of peaty soils during construction will be in accordance with the embedded measures in **Table 11.6**, which

include that the 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.

- 11.9.40 This assessment will be updated in the Final ES based upon the additional peat survey information.

Permanent displacement peat, due to due to construction of permanent development (e.g. wind turbines, access tracks, substation)

- 11.9.41 Based on the available peat survey information (see 2021 Peat Survey report included as an annex to Phase 1 Geoenvironmental Desk Study in **Appendix 11A**) it is anticipated that the Proposed Development can avoid peat, as defined in **Table 11.5** through design e.g. through micro-siting. Avoidance of peat is an embedded measures in **Table 11.6**. Excavation and permanent loss of peat will therefore be avoided by the Proposed Development, and significant effects on peat due to the loss of peat as waste, will be avoided.
- 11.9.42 This assessment will be updated in the Final ES based upon the additional peat survey information.

11.10 Preliminary 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; and
 - 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	<p>a) Elevated concentrations of toxic contaminants are present in soils in the top 0.5m in a residential garden.</p> <p>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.</p>
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)

		Risk Post-development (including embedded environmental measures)					
		Very Low	Low	Moderate / Low	Moderate	High	Very High
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.

Preliminary 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 Draft 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 on the Wind Farm development site, and the OHL section of the Grid Connection, ranges from very low (based on a mild consequence, the limited potential sources present, and a likelihood of a contaminant linkage being realised of 'unlikely') to low risk (based on a severe consequence, for ground gas, and a likelihood of unlikely). With regard to contaminants present in soils there is no change in the risk level for the future site users. With regard to ground gas, there will be enclosed spaces present in the Proposed Development and this increases the risk to site users from gas accumulation in enclosed spaces. Without the embedded measures, the risk level increases to moderate (based on a severe consequence and, based on the low usage of the future enclosed spaces, a low likelihood). However, with the embedded measures, the risk level can be reduced to moderate/low, as the likelihood of a contaminant linkage is reduced to unlikely. On this basis, the maximum risk level to site users is moderate/low, which is an increase from low (with no enclosed spaces present currently, the consequence is medium, and likelihood unlikely, giving a low risk), and the effects of the Project on human health receptors during the operation phase are considered to be **minor negative**, which is **Not Significant** in EIA terms.
- 11.10.15 There has been no contaminated land assessment of the underground Grid Connection site to date, however based on the embedded measures in **Table 11.6** for the Wind Farm development site being applied to this area, and the additional surveys completed as outlined in paragraph **11.13.3** no significant effects are anticipated in relation to land contamination receptors.

11.11 Preliminary 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. Peat is a high sensitivity receptor, however the embedded measures in **Table 11.6** include avoidance of peat. There are no other high sensitivity soil or agricultural land

receptors present. With the embedded environmental measures, there will be limited permanent effects on soil and agricultural land from the Proposed 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 ZoI 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 Preliminary significance conclusions

- 11.12.1 A summary of the results of the preliminary Ground Conditions assessment is provided in **Table 11.18** for soils and agricultural land, and in **Table 11.19** for land contamination receptors.

Table 11.18 Preliminary 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
<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,

Receptor and summary of predicted effects	Sensitivity/ importance/ value of receptor ¹	Magnitude of change ²	Significance ³	Summary rationale
<p><u>Agricultural land</u> Degradation of agricultural land quality due to cross-contamination of topsoil with contaminated soil/material excavated/disturbed during construction work</p>	Low	Minor	<p>(Potentially significant)</p> <p>Neutral or Slight negative effect</p> <p>(Not significant)</p>	<p>can be employed once additional information on ground conditions is available, to bring the overall effect down to Slight negative.</p> <p>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 Draft 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.</p>
<p><u>Soil</u> Degradation of soil functions due to cross-contamination of topsoil with contaminated soil/material excavated/disturbed during construction work</p>	Low to Medium	Minor	<p>Neutral or Slight negative</p> <p>or</p> <p>Slight negative</p> <p>(Not significant)</p>	<p>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 Draft 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</p>

Receptor and summary of predicted effects	Sensitivity/ importance/ value of receptor ¹	Magnitude of change ²	Significance ³	Summary rationale
				sheeting, covered over and with adequate leachate/runoff drainage to prevent migration of contaminants from the stockpile.
Soil: Peat Degradation of peat, due to damage caused by handling and storage during construction works (with loss of peat functions including carbon storage and peatland habitat biodiversity functions)	Very high	None	No effect	As peat is localised within the Proposed Development Site, the embedded measures include the avoidance of peat in accordance with the peat hierarchy. This will be achieved through design informed by further peat survey.
Soil: Peat Permanent displacement peat, due to due to construction of permanent development (e.g. wind turbines, access tracks, substation)	Very high	None	No effect	As peat is localised within the Proposed Development Site, the embedded measures include the avoidance of peat in accordance with the peat hierarchy. This will be achieved through design informed by further peat survey.

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 Preliminary summary of significance of effects: land contamination

Potential effect	Baseline Assessment			Assessment with Proposed Development			
	Likelihood	Consequence	Risk	Likelihood	Consequence	Risk	Change in Risk (Significance)
Operational phase:							

Potential effect	Baseline Assessment			Assessment with Proposed Development			
	Likelihood	Consequence	Risk	Likelihood	Consequence	Risk	Change in Risk (Significance)
<p>Human health Exposure to land contamination via numerous pathways (e.g., inhalation, direct contact, ingestion) resulting in health effects to site users</p>	Medium	Unlikely	Low	Severe	Unlikely	Moderate/low	<p>Negligible (Not significant)</p> <p>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 Draft 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. 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.</p>

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**.

11.13 Further work to be undertaken

- 11.13.1 The information provided in this Draft ES is preliminary, the final assessment of likely significant effects will be reported in the Final ES. This section describes the further work to be undertaken to support the Ground Conditions assessment presented in the Final ES.
- 11.13.2 The Final ES will be informed by additional peat survey to include Phase 1 Peat Survey (based on 100 x 100m grid spacing) for areas within the Wind Farm development site that were not previously surveyed (proposed access route and grid connection corridor within the Site), and delineation survey (at 10m x 10m grid spacing) to delineate the peat bog features identified within the Wind Farm development site during the previous Phase 1 Peat Survey. The design of the Proposed Development will then be amended as necessary to comply with the embedded measures in **Table 11.6**, and it is anticipated that the Ground Conditions assessment conclusions will remain unchanged.
- 11.13.3 In relation to the underground section of the Grid Connection, WPD will be undertaking further feasibility assessment of the route. Desk based assessments will be undertaken as required and these are likely to include a Phase 1 geo-environmental desk study, and desk based review of soil and agricultural land quality, to inform surveys (such as ground investigation) to be undertaken pre construction. Appropriate mitigation will be developed by WPD for any identified potentially significant effects on Ground Conditions receptors. As a minimum, the embedded measures in **Table 11.6** including application of the peat hierarchy and avoidance of peat, will be applied.

Baseline

- 11.13.4 As detailed in paragraph **11.13.2** the baseline information on peat presence and extent on the Wind Farm development site will be updated in the Final ES based on additional peat survey to be completed in October 2022.

Assessment

- 11.13.5 The assessment of the effects on peat will be updated in the Final ES on completion of the additional peat survey to be completed in October 2022, and with regard to the latest design information.

Environmental measures

- 11.13.6 No additional environmental measures beyond those outlined in **Table 11.6** are currently anticipated to be required.