Chapter 10

Geology, Ground Conditions and Hydrogeology

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10. Geology, Ground Conditions and Hydrogeology

10.1 Introduction

10.1.1 This chapter presents the geology and ground conditions impact assessment undertaken for this PEIR, and provides a description of the geology, ground conditions and hydrogeology within, and also in the immediate vicinity of, the Project Site.

10.1.2 This chapter also provides details of the geological conditions and the presence of potentially contaminated land and hazardous materials. The effects of the Project on the ground conditions and of constraints posed by the existing ground conditions on the Project are considered for the construction, operational and decommissioning phases of the Project. Where appropriate, mitigation measures are presented to minimise the effects of actual or predicted adverse effects.

10.1.3 Data used within this chapter includes that presented within the Preliminary Geo-environmental Risk Assessment (Appendix. 10.1).

10.1.4 This chapter has been updated in response to the change in Project design and the potential effects on existing ground conditions.

a) Objectives of the assessment

10.1.5 The objectives of the assessment were to describe:

- The legislation, policy and guidance which have been taken into account in the assessment;
- The assessment methodology, including the consultation outcomes which have informed the assessment;
- Baseline conditions currently existing at the Project Site and in the surrounding study area;
- The likely significant effects of the Project (including the embedded mitigation and avoidance measures) during the construction, operation and decommissioning phases;
- The additional mitigation required to prevent, reduce or offset any significant adverse effects; and,
- The likely residual effects and cumulative effects after these measures have been employed.
- This PEIR assesses the development for which development consent is proposed to be sought, the Power Generation Plant, the Electrical Connection, the Gas Connection and the Project.

10.2 Changes since the 2014 PEIR

10.2.1 There have been changes to the design as a result of design evolution and consultation as detailed in **Chapter 3: Project and Site Description**. To aid the reader, Table 10-1 outlines the changes to this assessment compared with the 2014 PIER.

Table 10-1: A Summary of Changes since the 2014 PEIR to the Geology, Ground Conditions and Hydrogeology Assessment

Section	Changes since the 2014 PEIR	Section Reference
Methodology	Greater detail regarding the sensitivity and magnitude has been incorporated into the text	Section 10.4
Baseline	An updated Envirocheck Report has been used to allow that the most up to date information to be used in the assessment	Section 10.5
Assessment of Effects	More extensive embedded mitigation measures have been incorporated into the design have reduced the presence of significant effects.	Section 10.7

10.3 Legislation, policy and guidance

10.3.1 Legislation and policy has been considered on an international, national, regional and local level. The following is considered to be relevant to the geology, ground conditions and hydrogeology effects assessment as it has influenced the sensitivity of receptors and requirements for mitigation or the scope and/or methodology of the EIA.

a) International and EU

- Directive 2010/75/EU on 24th November 2010 on industrial emissions (integrated pollution prevention and control), the Industrial Emissions Directive (IED) (Ref. 10.2). The IED is implemented in Wales by the Environmental Permitting (England and Wales) Regulations 2016;
- Water Framework Directive (WFD) 2000/60/EC aims to ensure that all surface water and groundwater reaches 'good' status (in terms of ecological and chemical quality and water quantity as appropriate), promotes sustainable water use, reduce pollution and contribute to the mitigation of flood and droughts (Ref. 10.3). The WFD is implemented in Wales by the Water Environment (Water Framework Directive) (England and Wales) Regulations 2017;
- Groundwater Directive 2006/118/EC aims to set groundwater quality standards and introduce measures to prevent or limit pollutants entering groundwater, including those listed within the 'List of Priority substances' (Ref. 10.4); and
- Seventh Environmental Action Programme came into force on 17th January 2014 to ensure land is managed more sustainably in the European Union (EU), that soil is adequately protected and that the remediation of contaminated sites is well underway (Ref. 10.5). It also commits the EU and its Member States to increasing efforts to reduce soil erosion, increase soil organic matter and to remediate contaminated sites.

b) National Legislation

i. Environmental Protection Act

10.3.2 The contaminated land regime in Part 2A of the Environment Protection Act (EPA) 1990 (Ref. 10.9) was introduced to specifically address the historical legacy of land contamination. Part 2A of the Environmental Protection Act 1990 has introduced the following statutory definition for "contaminated land":

> *"any land which appears to the local authority in whose area it is situated to be in such a condition by reason of substances in, on, or under the land, that:*
>
> *Significant harm is being caused or there is significant possibility of such harm being caused; or*
>
> *Significant pollution of controlled waters is being caused, or there is a significant possibility of such pollution being caused."*

10.3.3 Part 2A provides a means of dealing with unacceptable risks posed by land contamination to human health and the environment. Enforcing authorities are required to identify and deal with such land but Part 2A is only to be used by the Enforcing Authority where no appropriate alternative solution exists.

10.3.4 The term 'contaminant linkage' indicates that all three elements (i.e. contaminant / pathway / receptor) have been identified. The land can only be determined as Contaminated Land if there is a contaminant linkage and the contamination meets the criteria, outlined above.

c) National Policy

ii. Overarching National Policy Statement for Energy (NPS EN-1)

10.3.5 The relevant assessment principles in terms of generic impacts ('Biodiversity and Geological Conservation' and 'Land Use including Open Space, Green Infrastructure and Green Belt' and 'Waste Management') from Part 5 of NPS EN-1 (Generic Impacts) are set out below (Ref. 10.6).

10.3.6 Paragraphs 5.10.8 to 5.10.9 of NPS EN1 state "*Applicants should seek to minimise impacts on the best and most versatile agricultural land (defined as Grades 1, 2 and 3a of the Agricultural Land Classification) and preferably use land in areas of poorer quality (Grades 3b, 4 and 5) except where this would be inconsistent with other sustainability considerations. Applicants should also identify any effects and seek to minimise impacts on soil quality taking into account any mitigation measures proposed. For developments on previously developed land, applicants should ensure that they have considered the risk posed by land contamination.*

10.3.7 Applicants should safeguard any mineral resources on the proposed site as far as possible, taking into account the long-term potential of the land use after any future decommissioning has taken place".

iii. National Policy Statement for Gas Supply Infrastructure and Gas and Oil Pipelines (NPS EN-4)

10.3.8 Sections 2.20 - 2.23 of NPS EN-4 (Ref. 10.7) set out additional policy for assessing the potential impacts of gas and oil pipelines, relating to: noise and vibration; biodiversity, landscape and visual; water quality and resources; and soil and geology.

10.3.9 Paragraph 2.23.1 of EN-4 states that, 'it will be important for applicants to understand the soil types and the nature of the underlying strata.' Accordingly, applicants should consult with the relevant statutory consultees at an early stage regarding the potential impact of gas pipelines on soil and geology (paragraph 2.23.4). Paragraph 2.23.2 states that applicants should assess the stability of the ground conditions associated with the pipeline route, including considering the options for installing the pipeline.

iv. National Policy Statement for Electricity Networks Infrastructure (NPS EN-5)

10.3.10 NPS EN-5 (Ref. 10.8) includes limited information regarding impacts on geology, although Paragraph 2.8.9 recognises that an underground line is likely to have more potential impacts on geology and soils than an overhead line.

v. Environment Agency Guidance

10.3.11 In April 2013, National Resources Wales (NRW) was formed from a merger of Environment Agency Wales, the Countryside Council for Wales and the Forestry Commission Wales and undertakes the environmental regulatory duties in Wales. However Environmental Agency guidance documents continue to be used as representing "best practice" in the field of land contamination.

10.3.12 The Environment Agency's Model Procedures for the Management of Land Contamination (also known as Contaminated Land Report 11 (CLR11)) (Ref. 10.10), form the core reference guidance across the range of land contamination-related regulatory regimes in the UK and are integral to most projects dealing with land contamination. The report provides a road map/ flowcharts for structured decision making required for the management of land affected by contamination. CLR11 consolidates the general approach for the assessment of land contamination that was introduced with the CLR in 2000. CLR11 is based on a phased, risk-based approach using the 'source/ contaminant – pathway – receptor' concept as the key part of a Conceptual Site Model (CSM). A contaminant linkage is said to exist when all three components of the model can be identified on a site. A contaminant is a substance which is in, on or under the land and which has the potential to cause harm or to cause pollution of the water environment. A receptor is either a living organism, a group of living organisms, an ecological system or a piece of property which is being, or could be, harmed, by a contaminant; or a water environment which is being, or could be, polluted by a contaminant. A pathway is one or more routes or means by, or through, which a receptor is being exposed to, or affected by, a contaminant, or could be so exposed or affected. CLR11 uses tiered risk assessment, from qualitative risk screening through to detailed

quantitative risk assessment, followed by remedial options appraisal and implementation of the agreed remediation strategy.

10.3.13 The Environment Agency's Guiding Principles for Land Contamination (GPLC) (Ref. 10.11), provide a simplified overview of the approach laid out in CLR11 for site/ problem holders and their professional advisors/ consultants. The aim of the GPLC is to clarify roles and responsibilities, encourage good practice and comply with or avoid the need for regulation and to provide a link to relevant advice in other guidance documents.

10.3.14 NRW have adopted the Environment Agency's approach to protecting groundwater. The Environment Agency's approach to groundwater protection document (Ref 10.12) details position statements that describe the Environment Agency's approach to managing and protecting groundwater. The position statements set a framework which assist the Environment Agency is making decisions on groundwater management, including a position statement on mining induced pollution

10.3.15 The following CIRIA Guidance documents are relevant:

- Control of water pollution from construction sites (C532) (Ref. 10.13);
- The SuDS (Sustainable Urban Drainage Systems) manual 2015 (C753) (Ref. 10.14), and the SuDS manual 2007 (C697) (Ref. 10.15);
- Environmental good practice on site guide (C741) (Ref. 10.16);
- Assessing risks posed by hazardous ground gases to buildings (C665) (Ref. 10.17); and
- Contaminated land risk assessment - a guide to good practice (C552) (Ref. 10.18).

vi. Planning Policy Wales

10.3.16 Section 4.10 of PPW (Ref. 10.19) discusses the requirement for conserving the best, most versatile agricultural land, as a finite resource for the future. "*Land of grades 1, 2, and 3a should only be developed if there is an overriding need for the development, and either previously developed land or land in lower agricultural grades is unavailable, or available lower grade land has an environmental value recognised by a landscape, wildlife, historic or archaeological designation which outweighs the agricultural considerations*."

10.3.17 Section 13.5, discusses dealing with unstable and contaminated land, and how "*the planning system should guide development to lessen the risk from natural or human made hazards, including risk from land instability and land contamination*."

10.3.18 Section 13.7 discusses development management and contaminated land, outlining what planning decisions need to take into account, "*evidence of a detailed investigation and risk assessment prior to the determination of the application to enable beneficial use of the land*."

10.3.19 Section 13.9 outlines development management policies for unstable land. "*Planning decisions need to take into account the potential hazard that instability*

could create, and the results of a specialist investigation and assessment to determine the stability of the ground."

vii. Technical Advice Note (TAN) 5: Nature Conservation and Planning

10.3.20 TAN 5 (Ref. 10.20) provides "*advice about how the land use planning system should contribute to protecting and enhancing biodiversity and geological conservation*".

d) Local

10.3.21 The Project Site is located on land identified as 'Coal' resource, as illustrated on the City and County of Swansea (CCS) Unitary Development Plan (UDP) Proposals Map, where UDP Policy R2 applies (Ref. 10.21). Policy R2 states that development proposals that would affect the working of known potential resources will have to be accompanied by a full assessment of the potential resource and the impact of the proposal in terms of sterilising the resource.

10.3.22 An area of the Gas Connection within the Project Site is located on land identified as 'Sand and Aggregates' resource, as illustrated on the UDP Proposals Map, where UDP Policy R4 applies. Policy R4 states that development proposals that would affect the working of known potential mineral resources will have to be accompanied by a full assessment of the potential mineral resource and the impact of the proposal in terms of sterilising the resource. These areas are shown on Figure 10-1.

10.3.23 Policy 1 of the UDP states that the County's environment will be protected from materially harmful development and where possible enhanced. Development that would result in adverse environmental effects will not be permitted, particularly in respect of:

- Air, noise or light pollution;
- Flood risk;
- The quality and quantity of water resources;
- Land contamination; and
- Land instability or subsidence.

10.4 Methodology

a) Scope of the assessment

10.4.1 The scope of this assessment has been determined through a formal EIA scoping process undertaken with the Secretary of State (SoS). Comments raised on the Scoping Report (Appendix 4.1) have been taken into account in the development of the assessment methodology and these are detailed where relevant in this chapter.

b) Consultation

10.4.2 The scope of the assessment has also been informed by ongoing consultation with statutory consultees throughout the design and assessment process, including the SoS, CCS, NRW, Public Health England, Coal Authority and local residents.

10.4.3 A summary of the comments raised and responses are detailed in Table 10-2.

Table 10-2: Summary of Consultation Responses

Consultee	Date	Comment	Response
Secretary of State (SoS) (Scoping Opinion, para.3.60 Ref. 10.22)	-	The SoS welcomes that the foundations of the development will be designed so as not to present a preferential pathway for contaminant migration if present at the project site. The SoS notes that this consideration should be extended to other works forming part of the development, including underground gas and electricity connections.	Noted.
SoS (Scoping Opinion, para.3.61)	-	The SoS draws the attention of the applicant to the comments of the Coal Authority indicating that the site is in a Development High Risk Area, as the site has been subject to past coal mining activity and is located within an area of surface coal resource.	A Coal Authority Report (see Appendix 10.4) has been obtained along with mine abandonment plans (see Figure 10.3).
SoS (Scoping Opinion, para.3.62)	-	The SoS recommends that the applicant takes into consideration the location and stability of abandoned mine entries, the extent and stability of shallow mine workings, outcropping coal seams, unrecorded mine workings, hydrogeology, mine water and mine gas.	A Coal Authority Report has been obtained along with mine abandonment plans which indicate the whole of the Project Site is overlying mine workings. Findings summarised in this chapter. However the depth to which the workings extend is unknown. This will be investigated as part of the future ground investigation works and reported in a mining risk assessment report, in which remedial recommendations for stabilising the mine workings will be identified as required. The assessment assumes as a worst case that piling will be required for stabilisation.
SoS (Scoping Opinion, para.3.63)	-	The SoS recommends that the applicant considers, if surface coal resources are present, whether prior extraction of the mineral resource is practical and viable. The applicant should also consider whether Coal Authority permission is required to intersect, enter, or disturb any coal or coal workings during site investigation or development work.	A Coal Authority Report has been obtained. Findings summarised in Chapter 10 of this PEIR (paras 10.4.16 to 10.4.20). There are no surface coal resources present. Coal Authority Permit is required.
NRW	22nd	Site survey work undertaken should take into	Completion of all necessary ground investigation and

Consultee	Date	Comment	Response
	July 2014	account current environmental permitting and likely future requirements under the Industrial Emissions Directive (IED) to undertake intrusive works to gather baseline contamination data as part of the environmental permitting process.	risk assessments is identified in Chapter 3: Project as Site Description of this PEIR as embedded mitigation and will be required as part of a DCO Requirement.
NRW	-	Requires information for the landfill, abstraction wells, discharge consents, and pollution controls or incidents. Ground instability should be assessed and the applicant should be satisfied that piling operations and any vibration associated with the construction process will not disturb the Water Mains that traverses the Project Site, historic mine workings, adits, or groundwater. Both landfills within the Project Site now fall outside NRW's regulation. A contaminated land risk assessment should be undertaken.	A Preliminary Geo-Environmental Risk Assessment (PRA) Report has been completed (Appendix 10.1) which presents the documentation and drawings provided by NRW relating to the landfill and landfill extension within the vicinity of the Project Site. This information will be used to design the ground investigation.
Public Health England (PHE)	23rd July 2014	PHE would expect the promoter to provide details of any hazardous contamination present on site (including ground gas) as part of the site condition report.	Ground investigation works will be undertaken and to intersect mine workings/coal seams to provide ground gas monitoring and assessment. Ground gas and detail of hazardous contamination will be included in a Site Condition Report A Coal Authority permit will be required.
City and County of Swansea Council (CCS)	-	The PEIR referred to a historic land use as an inert landfill and the results of the 'comprehensive ground investigation work' should be supplied to the LA. Take into consideration / protection of groundwater as there are private water abstractions in the area.	A ground investigation will be required prior to development and the report will be submitted to and approved by CCS prior to commencement of development works. It is expected that this will be required to discharge the relevant DCO Requirement. Details of private abstractions have been requested from CCS (para 10.5.30). Clean drilling techniques will be used during the ground investigation to protect private groundwater abstractions.
Coal	-	CA requested Coal Authority report and mine entry	The Coal Authority provided all information requested.

Consultee	Date	Comment	Response
Authority (CA)		information. Followed up by requesting mine abandonment plans.	A permit / licence will be required for any ground investigation activities that penetrate the coal measures strata. If coal seams / workings are not encountered during the ground investigation, the Coal Authority may not require a permit to be issued for the construction works if they are not going to be penetrated.
NRW	14th Nov 2014	We note that there have previously been two landfills within the planning development boundary and that both sites now fall outside our regulation. A contaminated land risk assessment should be undertaken as part of the ES. You are advised to contact the local authority to agree the scope of the assessment as they are the lead authority for land quality.	A preliminary contaminated land risk assessment has been completed (Appendix 10.1). This report recommended that a ground investigation is undertaken to input into the design of the Project. The site investigation will form part of the embedded mitigation measures (See Section 10.6)
NRW	18th March 2015	The landfills listed in close proximity to the application site boundary have ceased to have a permit with NRW or Environment Agency Wales. We believe that they are likely to have been surrendered. We advise that you contact the City and County of Swansea as the lead regulator for land quality under the Contaminated Land Regulations as they may hold further information on this matter.	None. Data regarding the landfills is provided in the Envirocheck Report (Appendix 10.2)

c) Study area

10.4.4 An approximate 1 km search buffer has been used from the Project Site for purposes of relevant environmental data searches and a historical mapping review. This study area has been chosen for the assessment based on professional judgement as it is considered to incorporate all potential receptors that could be impacted by geology, ground conditions and hydrogeology relating to the Project (i.e. sensitive environments, surface water and groundwater resources, etc.) and activities that may impact on the Project (i.e. historical development in the surrounding area, potentially contaminative permitted activities, waste operations, etc.).

d) Sensitivity

10.4.5 The criteria used to assess the sensitivity of contaminated land receptors are presented in Table 10-43. This table is specifically for assessing the sensitivity of geology, ground conditions and hydrogeology receptors and complements the generic tables presented in **Chapter 4: Approach to Environmental Impact Assessment**.

Table 10-3: Sensitivity of Geology, Ground Conditions and Hydrogeology Receptors

Sensitivity of Receptors	Example Receptor Definition
High	Feature of international importance, for example a Special Area of Conservation (SAC). Critical social or economic uses such as for water supply, navigation or mineral extraction. Groundwater is a valuable resource because of its high quality and yield; is designated as a Principal Aquifer and/ or is known to be extensively exploited for water supply. Potable water supply source in close proximity. Site within a SPZ. Alternatively, groundwater is critical to designated sites of nature conservation.
Medium	Feature of national importance, for example a Special Area of Conservation (SSSI). High classification for water quality (i.e. A1 Excellent or A2 Good) or sensitive habitats of national importance. Groundwater is a locally valuable resource because of its moderate quality and/or yield is designated as a Secondary Aquifer and/or is known to be locally exploited for non-potable water supply.
Low	Feature of regional or local importance. Moderate water quality (i.e. B Moderate). Sensitive habitats of regional importance. Limited social or economic uses. Groundwater of limited value because its quality does not allow potable or other quality sensitive uses. Exploitation of local groundwater is not extensive and/or local areas of nature conservation known to be sensitive to groundwater impacts.
Negligible	Heavily modified with poor water quality (i.e. C Poor and D seriously

Sensitivity of Receptors	Example Receptor Definition
	Polluted). Minimal economic or social uses. Poor groundwater quality and/or very low permeabilities make exploitation unfeasible. Changes to groundwater flow or quality not expected to impact on local ecology. Associated habitats less than local importance.

e) Magnitude

10.4.6 The criteria used to assess the magnitude of effects are presented in Table 10-44. This table is specifically for assessing the magnitude of potential effects on geology, ground conditions and hydrogeology and complement the generic tables presented in **Chapter 4: Approach to Environmental Impact Assessment**.

Table 10-4: Geology, Ground Conditions and Hydrogeology Magnitude Assessment Criteria

Magnitude	Description
High	Short term acute effect on human health affecting both Site users and users of sites in the vicinity, arising from contamination on the Application Site, or Chronic damage to human health affecting users of both the site and other sites in the vicinity arising from contamination on the Application Site. Persistent or extensive effects on water quality, closure of an abstraction, major damage to agriculture. Persistent or extensive effects to ecosystems. Catastrophic damage to buildings or property on or in the vicinity of the Application Site arising from contamination on the Application Site.
Moderate	Chronic damage to human health of users of the Application Site. Significant effect on water quality e.g. notification required to abstractors, significant damage to agriculture, reduction in amenity value. 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.
Low	Non-permanent effects to human health e.g. short term intermittent nuisance such as odours not hazardous to human health. Minor or short-lived damage to water quality or ecosystems, which is unlikely to result in a substantial adverse change in its functioning or harm to a species of special interest. Minor damage to crops, buildings or property.
Negligible	No observed effect on human health. Poor vegetation growth, choice of landscaping species restricted. Repairable effects of damage to buildings, structure and services e.g. staining or discoloration of building materials. No observed effects on water quality or ecosystems.

f) Effect definitions

10.4.7 Table 10-5 details the matrix used for the classification of effects whilst Table 10-6 sets out the generic significance criteria definitions.

Table 10-5: Classification of Effects

Magnitude	Value and sensitivity of receptor			
	High	**Medium**	**Low**	**Negligible**
High	Major	Major	Moderate	Moderate
Medium	Major	Moderate	Moderate	Minor
Low	Moderate	Moderate	Minor	Negligible
Negligible	Minor	Minor	Negligible	Negligible

10.4.8 Following the classification of an effect as detailed in Table 10.6, a clear statement is made as to whether the effect is 'significant' or 'not significant'. As a general rule, major and moderate effects are considered to be significant and minor and negligible effects are considered to be not significant. However, professional judgement is also applied where appropriate.

Table 10-6: Significance Criteria Definitions

Significance of Effect	Description
Major	Effects, both adverse and beneficial, which are likely to be important considerations at a national to regional level because they contribute to achieving national/regional objectives, or, which are likely to result in exceedance of statutory objectives and/or breaches of legislation.
Moderate	Effects that are likely to be important considerations at a regional and local level.
Minor	Effects that could be important considerations at a local level.
Negligible	An effect that is likely to have a negligible or neutral influence, irrespective of other effects.

10.5 Baseline Environment

10.5.1 This section describes the baseline environmental characteristics for the Project Site and surrounding areas with specific reference to geology, ground conditions and hydrogeology.

10.5.2 This assessment has been undertaken using desk based information currently available including the Landmark Envirocheck Report (dated October 2017 and presented in Appendix 10.2) and the Preliminary Geo-Environmental Risk Assessment for Abergelli Power Project (Appendix 10.1), and a site walkover undertaken in July 2014.

10.5.3 The ground conditions have not been assessed via an intrusive ground investigation. It is expected that investigation works will be required as per a DCO Requirement.

a) Current and Surrounding Land-use

10.5.4 The land-use is predominantly agricultural, used for sheep and horse grazing bounded by drainage ditches, fencing and hedgerows. There are no residential buildings within the Project Site.

10.5.5 A detailed description is presented in **Chapter 3: Project and Site Description**, Section 3.3.

b) Geological information

10.5.6 The baseline geology, ground conditions and hydrogeology data of the Project Site has been gathered from the following sources:

- Landmark Information Group Envirocheck Report. Presented in Appendix 10.2;
- British Geological Survey (BGS) Borehole Log SN65200160 Aber-gelli-fach Farm - Dated 7 October 1991. Presented in Appendix 10.3;
- Preliminary Geo-Environmental Risk Assessment from Abergelli Power Project (Ref. 10.1); and
- BGS. Digital Geological map of Great Britain at 1:50,000 scale (Ref. 10.23).

i. Made Ground

10.5.7 There is no Made Ground indicated within the Project Site, based on published BGS records. Made Ground is only considered to be likely to be present an areas associated with previous development such as the landfill and colliery. It may also be present if the landowner undertook land levelling. If any Made Ground is present within the Project Site, its composition and provenance would be unknown.

ii. Superficial Geology

10.5.8 There are four types of superficial deposits identified across the Project Site comprising: glacial diamicton till, glaciofluvial deposits of sand and gravel, alluvium deposits of clay, silt, sand and gravel and quaternary peat.

10.5.9 The glaciofluvial deposits are located along the Access Road, and areas to the north of the Laydown Area, while till is present on the Access Road, across the Laydown Site, in the western portion of the Generating Equipment Site and the mid-section of the Gas Connection. Alluvium deposits are located across the Ecological Mitigation Site and along the eastern boundary of the Generating Equipment Site while peat is present in the north east of the Generating Equipment Site and to the north west of Abergelli Farm.

10.5.10 The BGS indicates that there are three boreholes located in the Project Site, however only one is available to view online and presented in Appendix 10.3. The borehole log is located east of Abergelli Farm in an area mapped as being underlain by Devensian glaciofluvial deposits of sand and gravel.

10.5.11 The borehole log indicates superficial deposits comprising yellow brown sandy gravelly clay down to 6.4 metres below ground level (mbgl), overlying grey brown clayey gravelly sand, clayey sand and sandy clay down to 15.8 mbgl considered to be representative of glaciofluvial deposits. These are underlain by firm yellow clay becoming stiff grey gravelly clay described in the log as possible boulder clay which is likely to be glacial till; proven to a maximum depth of 16.8 mbgl. Traces of coal were identified at 10.7 mbgl within the clayey sand.

iii. Bedrock Geology

10.5.12 The bedrock geology underlying the Project Site consists of the Grovesend Formation of the South Wales Upper Coal Measures Formation, comprising argillaceous mudstones and siltstones, with well-developed coals, and minor lithic sandstones. The BGS (Ref. 10.24) indicates that the Grovesend Formation is the youngest unit found in the South Wales coalfield.

10.5.13 The north eastern corner of the 1 km search buffer surrounding the Project Site is underlain by the Swansea Member, comprising green-grey Pennant Sandstone, with thin mudstone/siltstone and seatearth interbeds and (mainly thin) coals. This geological formation is overlain conformably by the Grovesend Formation.

10.5.14 The geological map (Appendix 10.2) indicates the presence of one fault crossing the Project Site running north west to south east through the Access Road. There are numerous other faults identified within the 1 m search buffer around the Project Site predominantly running from north-west to south east.

10.5.15 The Preliminary Geo-Environmental Risk Assessment (Ref.10.1) indicates that there was a 'Slant' (inclined shaft or level) identified at Abergelli Colliery, which provided access to both the Graigola and Swansea Four Feet coal seams.

c) Soils and Agriculture

10.5.16 The soil and agriculture land classifications are discussed in the Preliminary Geo-Environmental Risk Assessment (Ref. 10.1) and indicate the following:

- There are two different soil classification areas across the Project Site. The predominant soil classification is described as "slowly permeable, wet, very acidic upland soils with a peaty surface". The soils are described as "low fertility" and land cover is described as "moorland rough grazing and forestry". The precipitation "drains to the stream network". Overgrazing of this soil could lead to accelerated run-off and soil erosion.
- Through the centre and north eastern section of the Project Site, the soils are described as "freely draining, slightly acid loamy soils". The soils are of "low fertility", with "arable and grassland" land cover and precipitation "drains to local groundwater and rivers". There is potential for groundwater contamination with these soils, comprising nitrate, siltation and nutrient enrichment of streams from soil erosion.
- The agricultural land classification for the land within and surrounding the Project Site is Grade 4 ("poor quality agricultural land") "with severe limitations

which significantly restricts the range of crops and/or level of yields, mainly suited to grass with occasional arable crops".

- The Project Site is known to be utilised as improved grazing for sheep and horses, with small areas of marshy grassland and woodland copses interspersing the improved grassland to the north and east.

d) Ground Workings and Mineral Resources

10.5.17 The Envirocheck (Appendix 10.2) does not indicate the presence of any historical ground workings on the Project Site, however within the 1 km search buffer there are ten records of historical ground working features. These have all ceased production and are listed in Table 10-7. These comprise nine opencast mines producing sandstones and sands and gravel and one underground mine producing coal.

Table 10-7: Recorded Opencast and Underground Mines

Site Name	Distance and direction	Type of site	Status	Geology and Commodity
Aber-Gelli-Fach Gravel Pit	161 m NE	Opencast	Ceased	Glaciofluvial Deposits - sand and gravel
Bryn-Whilach Plantation Gravel Pit	456 m SE	Opencast	Ceased	Till - sand and gravel
Waen Ffyrdd Plantation Sand Pit	474 m W	Opencast	Ceased	Glaciofluvial Deposits - sand
Gelli-Gron	621 m NE	Opencast	Ceased	Swansea Member - sandstone
Llidiard -Y-Cleders	648 m NW	Opencast	Ceased	Grovesend Formation - sandstone
Bryn-Whilach	676 m SE	Underground	Ceased	Grovesend Formation - deep coal
Nant-Y-Ganol Wood Sand Pit	800 m S	Opencast	Ceased	Till - sand
Waterworks Cottage	893 m N	Opencast	Ceased	Swansea Member - sandstone
Gelli-Feddan	956 m N	Opencast	Ceased	Grovesend Formation - sandstone
Pen-Y-Fedw-Isaf	976 m W	Opencast	Ceased	Swansea Member - sandstone

10.5.18 The Coal Authority Mining Report (Appendix 10.4) identified Abergelli Colliery located adjacent to the Project Site approximately 500 m north of Abergelli Farm. A coal pit, shaft, colliery, and mine spoil heap have all been identified on historical mapping at locations extending to between 480 m and 1 km from the Project Site boundary (i.e. outside the boundaries of the Project Site).

10.5.19 The Coal Authority Mining Report (dated 30 July 2014) indicated that the Project Site is in the "likely zone of influence from workings in three seams of coal, at shallow to a depth of 380 m". Figure 10.2 presents the mine workings from the mine abandonment plan across the Project Site. This plan shows that the entire Project Site is influenced by mine workings.

10.5.20 There are two mine entries adjacent to the Project Site, one of which is located in the vicinity of Abergelli Colliery (north of Abergelli Farm). The other is located south of the Substation at (NGR 264970, 200800). There is no record of any treatment to the mine entries. These mine entries are shown on Figure 10.3.

10.5.21 The Coal Authority indicates that reserves of coal exist and could be worked in the future. However, the Project Site is currently not in an area for which the Coal Authority is determining to grant a licence to remove coal using underground methods, where a licence has been granted or in an area that is likely to be affected at the surface from any planned future underground workings.

10.5.22 The Coal Authority report states that the Project Site is not within the boundary of an opencast site from which coal has been removed by opencast methods, and does not lie within 200 m of a boundary of an opencast site. It also states that the Project Site is not within 800 m of the boundary of an opencast site for which the Coal Authority are determining whether to grant a licence to remove coal by opencast methods, or for which a licence to remove coal has been granted.

e) Ground Stability/Subsidence

10.5.23 The Coal Authority Mining Report indicates that no notice of the risk of the land being affected by subsidence has been given under Section 46 of the Coal Mining Subsidence Act 1991.

10.5.24 Abergelli Farm has been subject to remedial works, by or on behalf of the Coal Authority under its emergency surface hazard call out procedures. No further information was provided, however two damage notices or claims for alleged subsidence damage were made in June 1995 and November 1996 both of which were rejected.

10.5.25 Geological hazards across the Project Site have been identified in the Landmark Envirocheck Report; these are detailed in Table 10-8.

Table 10-8: Geological Hazards

Geological Hazard		Hazard Potential:
Stability Hazards	Collapsible Ground	No hazard to very low
	Compressible Ground	No hazard to high
	Ground Dissolution	No hazard
	Landslide Ground	Very low to low
	Running Sand Ground	No hazard to low
	Shrinking or Swelling Clay Ground	No hazard to very low

Radon Affected Areas	Lower probability radon area (less than 1% of homes are estimated to be at or above the Action Level).
Radon Protection Measures	No radon protective measures are necessary in the construction of new dwellings or extensions

10.5.26 The high compressible ground hazard is assumed to be associated with the peat located in the north east of the Generating Equipment Site and to the north west of Abergelli Farm. The presence of peat and nature of its compressibility will be determined during the ground investigation.

10.5.27 Consideration of this hazard will be made in the design of any ground works (including ground investigation, earthworks, de-watering) and foundation design. There is an impact associated with any measure selected to mitigate the risk of settlement of compressible peat deposits (if present). The final design will incorporate suitable mitigation on the basis of the ground investigation findings to minimise the interaction of the Project with the peat / disturbance of the peat as a result of the Project. In the event that there will be some disturbance of peat, part of the embedded mitigation is to produce a Peat Management Plan, which will ensure that this is handled properly and on-site reuse of any excavated peat is maximised. The Peat Management Plan will be prepared and included in the final ES at DCO submission.

f) Hydrogeology

10.5.28 The superficial glaciofluvial deposits and the bedrock geology are both classified as Secondary A Aquifers. Secondary A Aquifers are defined as '*permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers*.'

10.5.29 The superficial glacial till deposits are classed as Unproductive Strata, defined as '*rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow'*.

10.5.30 The Landmark Envirocheck report has identified no groundwater abstraction licences associated with the Project Site. There is only one licence located within 100 m of the Project Site, recorded 56 m to the north-east for a well at Abergelli Farm, licence number 22/59/4/0027 dated February 1993, for general farming and domestic use. There are a further seven licensed groundwater abstractions within 1 km of the site all for general farming and domestic use and a further 21 within 2 km of the Project Site. Swansea Council has also identified a number of private water supplies located in close proximity to the Project Site. Further detail relating to water abstractions including the potential presence of unlicensed private water supplies is included in **Chapter 9: Water Quality and Resources**.

10.5.31 The Project Site does not lie within a groundwater Source Protection Zone (SPZ).

10.5.32 The Landmark Envirocheck identifies the groundwater vulnerability classification of the soils beneath the Project Site and surrounding area. These vary between Low (L) to High (H) Leaching Potentials (classifications of L, H1, H3, I1 and U). These classifications are described as follows:

- L: Soils in which pollutants are unlikely to penetrate the soil layer because water movement is largely horizontal or they have large ability to attenuate diffuse pollutants. Lateral flow from these soils contributes to groundwater recharge elsewhere in the catchment.
- H1: Soils which readily transmit liquid discharges because they are either shallow or susceptible to rapid by-pass flow directly to rock, gravel or groundwater.
- H3: Coarse textured or moderately shallow soils which readily transmit non-absorbed pollutants and liquid discharges but which have some ability to attenuate absorbed pollutants because of their large clay or organic matter contents.
- I1: Soils which can possibly transmit a wide range of pollutants.
- U: Soil information for restored mineral workings and urban areas is based on fewer observations than elsewhere. A worst case vulnerability classification (H) assumed, until proved otherwise.

10.5.33 The Envirocheck Report identifies areas prone to flooding associated by the Afon Llan in the south of the Project Site in the Ecological Mitigation Area. NRW website (Ref. 10.25) indicates a medium chance of flooding from rivers or the sea with a chance of flooding of between 1 in 100 (1%) and 1 in 30 (3.3%).

10.5.34 The Envirocheck Report indicates the presence of two discharge consents to groundwater on the Project Site, however these have both been surrendered. Both were held by the Felindre Gas Compressor Station, one for discharging sewage to an unnamed land drain, effective between 2007 and 2010; and one for trade discharges (site drainage) to the Afon Llan, effective from 2006 until it was surrendered in 2011. There are a further three discharge consents within 250 m of the Project Site, all of which have expired.

10.5.35 There have been no Pollution Incidents to Controlled Waters recorded on the Project Site by the Envirocheck Report. There have been three between 250 m and 500 m of the Project Site, which were classed as Category 3 minor incidents and a further eight incidents between 500 km and 1 km of the Project Site. These were classed between Category 1 major incident and Category 3 minor incidents.

g) Soil Chemistry

10.5.36 The Envirocheck Report has identified the estimated background soil chemistry (for selected key elements) across the Project Site. They are summarised as:

- Arsenic: 25 – 35 mg/kg,
- Cadmium: <1.8 – 3.0 mg/kg,
- Chromium: 60 – 90 mg/kg
- Nickel: 15 – 45 mg/kg; and
- Lead: <100 mg/kg.

h) Groundwater Quality

10.5.37 Groundwater quality in the study area has been assessed against the objectives of the Water Framework Directive (WFD). Details are presented in **Chapter 9: Water Quality and Resources**.

i) Landfill

10.5.38 The Envirocheck Report indicates that there are no landfill sites located within the Project Site boundary.

10.5.39 The closest landfill sites to the Project Site is one registered landfill and an adjacent historic "Landfill Extension" located at Abergelli Fach Farm located between 92 m and 121 m north east of the Project Site. The current status of the registered landfill is 'closed' and it was only able to accept non-biodegradable wastes. The total void space was calculated at 75,000 m^3 with a total tonnage of 142,500 t.

10.5.40 The Landfill Extension is reported to have accepted inert waste. The planning application for this extension was granted in 1997. NRW provided the Working Plan and associated drawings for the landfill which were dated March 1994. The total void space was calculated at 99,898 m^3, with a total tonnage of 179,816 t. The Working Plan described the land as low lying, and poorly drained. Approximately three quarters of the landfill area was covered by a mine soil dump from Abergelli Colliery. This mine waste was removed leaving a layer of well compacted mine waste over the majority of the landfill area. The area of ground that was covered by the mine spoil was used for drying out of water treatment sludge (aluminium sulphate) though ceased when the landfill became operational. No further information on this operation is known.

10.5.41 Swansea City Waste Disposal Company Ltd gained planning permission for 'excavation and removal of inert material from landfill site and restoration' at Abergelli Farm in February 2003 (CCS Ref: 2002/0312). This consent was subsequently amended, extending the permission to allow the excavation and removal of inert material until 31st December 2010 (2007/0907). The site has now been fully restored.

10.5.42 There are also an additional three historical landfills within 400 m of the Project Site, all located between 294 m and 402 m south-east of the Project Site. The first is located 294 m east of the Project Site at Gorswen Farm and accepted unspecified waste between 1971 and 1972. The second landfill was licenced to British Steel and located 309 m south-east. It was active between 1980 and 1994 and received deposited waste included industrial and household waste. The third landfill is located 402 m south-east and was active been 1955 and 1970 receiving deposited waste included inert, industrial and special waste.

j) Recorded Animal Burial Grounds

10.5.43 Information obtained from CCS indicates there was no local cull of animals in Swansea, Neath Port Talbot or Carmarthenshire during the Foot and Mouth outbreak in 2001. No mass burial of animals have been recorded at the Project Site.

k) Historical Land Use

10.5.44 Historical maps have been provided in the Landmark Envirocheck Report, presented in Appendix 10.2. The historical development of the Project Site is summarised in Table 10-9.

Table 10-9: Historical Development

Dates / Sources	On Project Site	Off Project Site
1877 1:2,500 1884 1:10,560	The Project Site is predominantly agricultural fields and tracks, with areas of woodland and marshland.	The land is predominantly agricultural. A lime kiln is identified approx. 325 m south east of the Project Site; west of the Maes-eglwys development. There are a number of buildings associated with Abergelli Fach to the east of the Project Site, Abergelli Fawr to the west of the Site and Bryn Mawr along the north western corner of the Project Site. Bryn-whilach Pit is identified approx. 775 m south of the Site.
1890 1:10,560 1898 – 1899 1:2,500	The woodland in the south west of the Project Site has now been identified as Abergelli Fach Plantation and Lletty Morfil Plantation.	A gravel pit is identified to the west of Abergelli Fach approx. 250 m west of the Site. An old gravel pit is identified approx. 425 m to the south of the Project Site that was not previously identified in Bryn-whilach Plantation.
1921 1:10,560 1917-1918 1:2,500	Rises and streams are now indicated on the map.	Two old quarries have been identified. One approximately 1 km west and one approximately 650 m north west of the Project Site. A tank is identified next to a spring 250 m west of the Project Site, north of Abergelli Fach Plantation. The gravel pit located to the west of the Site is now identified as 'old'. The limekiln previously identified west of Maes-eglwys is now labelled as 'Old Limekiln'. Bryn-whilach Pit is identified approx. 775 m south of the Site is now labelled as 'Old Coal Pit'.
1935-1936 1:10,560 1935 1:2,500	No significant changes.	Abergelli Colliery, associated buildings, engine houses, railway sidings, slant (loading bay) and tank are identified on the map, north of Abergelli Fach and adjacent to the Site boundary. The gravel pit to the west of Abergelli Fach is no longer labelled. The gravel pit located to the south of the Site is no longer shown. The two old quarries to the northwest and west of the Site are no longer shown.

Dates / Sources	On Project Site	Off Project Site
1951 1:10,560	No significant changes.	The buildings associated with Abergelli Colliery have changed slightly but still appear to be operational
1964 1:10,560 1961 1:2,500	No significant changes.	The colliery is now identified as disused. A spoil heap/tip adjacent to the colliery is identified to the north west of the mine with a routeway into the centre of the tip. Railway sidings tracks run through the colliery and ends at the edge of the spoil heap/tip. The tank next to Abergelli Plantation is no longer identified. A large Works building is located 650 m south of an access road.
1976 1:10,000 1973-1975 1:2,500	Electricity pylons are identified across the Project Site, towards the central section of the Project Site, running in a north-east to south-west direction.	The majority of the buildings associated with Abergelli Colliery no longer remain. The tip to the south of the Project Site has extended to the north east and is now labelled 'tip'. The Substation is presented adjacent to the south of access road. Associated pylons run south towards the tip and also north and east.
1986 1:2,500	No significant changes.	A gas valve compound is shown adjacent to the north western Project Site boundary. Beyond the gas valve compound are covered reservoirs and associated water treatment works.
1990 1:2,00	No significant changes.	The spoil heap/tip/landfill adjacent to the former Abergelli colliery is no longer present on the map.
1991 1:10,000 1992 1:2,500 1999 Google Earth Pro imagery	Two ponds are labelled in the proposed area of the Generating Power Plant. [HOLD3] The Substation is present in the south western corner of the Project Site, adjacent to Lletty-morfil Plantation.	A large warehouse building is now present in the area adjacent to the former Abergelli Colliery (which is no longer labelled). From the earliest imagery available on Google Earth Pro the landfill adjacent the former Abergelli colliery appears to be backfilled and the slope graded. The majority of the landfill extension to the south of the Project Site is vegetated. Abergelli Fach is now labelled as Abergelli Farm and looks to have been redeveloped. Abergelli Fawr to the east of the Project Site is now labelled as ruins. The Works building to the south of the Project Site is now labelled as Velindre Works. A tip is located approximately 300 m to the south of the Project Site

Dates / Sources	On Project Site	Off Project Site
1999 1:10,000	No significant changes.	Velindre Works to the south of the Project Site is no longer present.
2000 Aerial photography	No significant changes.	The tip located to the south of the Project Site appears to be vegetated.
2002 1:10,000 2002 Google Earth Pro imagery	No significant changes.	Two buildings associated with the former colliery remain along with a large warehouse. The tip to the south of the Project Site is becoming vegetated. The northern part of the landfill extension looks to be currently worked.
2006 1:10,000	No significant changes.	An area to the west of Abergelli Farm is cleared of vegetation. Part of the former tip to the north of the former Abergelli Colliery has been redeveloped into an area of hardstanding. The tip located approximately 300 m to the south of the Project Site is no longer present.
2008 Google Earth Pro imagery	No significant changes.	The gas compression station located immediately adjacent to the north of the access road is being developed. A large tract of land leading north from the station is cleared of vegetation to allow for the pipelines to be buried. The area of ground west of Abergelli Farm which was cleared in 2006 now has a number of small buildings present.
2010 Google Earth Pro imagery	No significant changes.	There is a new access road serving the gas compression station development running along the northern boundary of the tip to the south of the Site. Two new residential dwellings have been built on the open ground to the west of Abergelli Farm.
2013 Google Earth Pro imagery	No significant changes.	The access road serving the Felindre Gas Compressor Station development is no longer present.
2015 Google Earth Pro imagery	No significant changes.	A new area of hardstanding has been developed on the landfill site adjacent to the former Abergelli Colliery. Two solar parks have been developed; Rhyd-y-pandy solar park to the east of the Project Site and Abergelli Farm to the west of the Site.

l) Sensitive Land Uses

10.5.45 There are four areas of ancient woodland on the Project Site. One area of ancient woodland is located close to the Generating Equipment Site and other three surround the Substation and Felindre Gas Compressor Station. More information on the ancient woodland is provided in **Chapter 8: Ecology**.

m) Potentially Contaminative Land Uses

10.5.46 Table 10-10 lists land uses identified which have the potential to cause contamination on the Project Site and within 250 m of the Project Site boundary. Land uses further than 250 m from the Project Site boundary are not considered as they are unlikely to affect the Project Site. The table also details contaminant groups potentially present as a result of these land uses.

Table 10-10: Land Uses and Potentially Present Contaminant Groups

Process / Land use	Location	Contaminant Groups Potentially Present
Abergelli Colliery with associated engine houses, tanks, conveyor belt and spoil heap	Off-Site: North of Abergelli Fach (Farm) immediately west of the Project Site.	Metals and metalloids, phenols, sulphates, asbestos, total petroleum hydrocarbons (TPH) and polycyclic aromatic hydrocarbons (PAHs). Ground gas including coal bed methane.
Railway sidings associated with Abergelli Colliery	Off-Site: North of Abergelli Fach (Farm) immediately west of the Project Site.	Hydrocarbons including lubricating oils/fuel, PCBs, PAHs, ethylene glycol, heavy metals, asbestos, combustion ash, herbicides, creosote, sulphate.
Drying out of water treatment sludges	Off-Site: Abergelli Colliery and location of landfill extension (~120 m west of Project Site).	Aluminium sulphate and heavy metals
Historic Landfill and Landfill Extension	Off-Site: North west and west of Abergelli Colliery (north of Abergelli Fach) ~100 m west of the Project Site at its closest point.	Heavy metals, hydrocarbons, asbestos and other unknown contaminants associated with the waste (reported to be non-biodegradable wastes). Mining wastes including mine tailings/spoil potentially containing high concentrations of arsenic, copper and other metals, phenols, sulphates, asbestos, TPH and PAHs. Gases such as carbon dioxide, methane and hydrogen sulphide generated from fill materials of unknown constituents.

Process / Land use	Location	Contaminant Groups Potentially Present
Felindre Gas Compressor Station, the Substation and electricity pylons	Off-Site: West of the Project Site, located north and south of the Access Road. Sites operated by National Grid Gas Plc. Electricity pylons located across the Project Site	Polychlorinated biphenyls (PCB's), other transformer oils and solvents
Agricultural land	On-Site: Across the majority of the Project Site including plantations to the south of the Project Site.	Fertilisers, pesticides, herbicides, fuel and oil hydrocarbons associated with machinery, organic and biological contaminants.

n) Sources of Contamination

10.5.47 It is considered that the most likely sources of contamination for the Project Site are:

- Contamination associated with the off-site historic landfill and landfill extension including aluminium sulphate sludge; and
- Contamination from agricultural land use.

o) Preliminary Conceptual Site Model (CMS)

10.5.48 On the basis of the information summarised above, a preliminary CSM has been developed for the Project Site. The CSM identifies potential contaminants, receptors (both on and off-site) and exposure pathways that may be present. The identification of such potential "pollutant linkages" is a key aspect of the evaluation of potentially contaminated land. Potential "pollutant linkages" associated with the Project Site are detailed within Table 10-11.

10.5.49 It should be noted that the identification of potential "pollutant linkages" does not indicate that they are significant in any way or that the Project Site is unsuitable for its current/proposed use. It does, however, act as a way of focusing future data collection at the Project Site and identifying any key potential risks associated with the Project Site.

10.5.50 The model is based on a desk study and a walkover undertaken in 2014 and will be confirmed through intrusive investigation prior to detailed design and as per a DCO Requirement.

Table 10-11: Preliminary Conceptual Site Model

Source	Pathway	Receptor	Risk	Risk Description
Off-Site: Waste within the historic landfill and landfill extension (including the process of drying out water treatment sludge)	Direct contact with shallow groundwater impacted with landfill leachates.	Construction Workers	Low	The majority of the development area will comprise hardstanding; therefore the risk of exposure is negligible. Regular contact with this potential contaminative source is unlikely. The presence of vegetation across the majority of the Project Site limits exposure via the direct contact pathway.
Landfill gas generation	Inhalation of soil vapours outdoors	Construction Workers	Low	There is potential for landfill gases to be present within the landfill and landfill extension. The gas generation is anticipated to be low as the landfill was licenced to only receive inert and non biodegradable waste. This needs to be considered as buried structures will be constructed to the east of the landfills. The exposure durations are limited and the receptor class is less sensitive; the Generating Equipment Site is relatively distant from the landfill hence the "Low" classification.
	Migration of ground gases / vapours into buildings including accumulation in confined spaces	Human Health: Future workers on the Generating Equipment	Low	
		Built environment / structures / services		
Mine gas generation	Inhalation of soil vapours outdoors	Construction workers	Moderate / Low	During the construction works there is a possibility that ground gas from coal bed methane or mine workings may be disturbed. The Coal Authority report indicates that there are shallow workings present in 3 seams of coal to depths of 380 m. Ground investigation is required to assess the likelihood and level of risk. With current land use the risk is considered to be moderate to low as there has been minimal ground disturbance.
	Migration of ground gases / vapours into buildings including accumulation in confined spaces	Human Health: Future workers on the Generating Equipment		
		Built environment / structures / services		

Source	Pathway	Receptor	Risk	Risk Description
Natural gas from potential peat stratum	Inhalation of soil vapours outdoors	Human Health: Future workers on the Generating Equipment	Moderate / Low	There is potential for natural ground gases to be present within the peat stratum mapped in localised areas within the Project Site. The gas generation is anticipated to be moderate to low in these areas and this currently vents naturally.
	Migration of ground gases / vapours into buildings including accumulation in confined spaces	Construction workers	Moderate / Low	Construction workers may potentially disturb the peat habitat during the construction works; this is particularly relevant with sub-surface construction activities where ground gas may accumulate.
		Built environment / structures / services		
Agricultural land (potential sheep dips, use of fertilisers)	Surface run-off	Controlled waters (groundwater in Secondary A superficial and bedrock aquifers and drainage ditches within the Project Site boundary)	Low	Fertilisers could be washed into receiving surface waters. Drainage ditches run across the Project Site and may transport contaminants. The farming practices and potential use of chemicals is unknown but as the land is predominantly used for grazing the risk is considered low.
	Dermal contact and ingestion of soils and dust Inhalation of dust	Human Health: Future workers on the Generating Equipment	Low	The majority of the development area will comprise hardstanding; therefore the risk of exposure is negligible. Regular contact with this potential contaminative source is unlikely. The presence of vegetation across the majority of the Project Site limits exposure via the direct contact pathway.
		Construction workers	Low	As above. In addition, the exposure durations are limited and the receptor class is less sensitive. Regular contact with site soils is unlikely.

Source	Pathway	Receptor	Risk	Risk Description
Natural radon gas	Inhalation of soil vapours outdoors	Human Health: Future workers on the Generating Equipment	Low	The Envirocheck report indicates that the radon potential is low in this area.
	Inhalation of soil vapours indoors	Construction workers		
Aggressive soil conditions	Direct contact with shallow groundwater and soil	Buried concrete structures of the Project	Low	Whilst aggressive soil conditions (sulphate / pH) may be present, the area which will require buried structures is on greenfield land and therefore the probability of the risk occurring is unlikely; therefore the risk is considered low.
Chemicals used during construction works including oils/fuels, liquid concrete and other materials	Accidental releases to ground including spillage/ leakage from containers and engines, followed by vertical/lateral migration	Controlled Waters: Secondary A superficial and bedrock aquifers	Low	If spillage of chemicals occurred during construction operations it is likely that this would be quickly recognised and contained, due to operational requirements. Construction industry pollution prevention guidelines will be followed, as detailed in the CEMP, such as use of bunded storage of any chemicals or fuel kept on site, the introduction of petrol interceptors to filter run off from areas of hardstanding created for construction plant.

10.6 Embedded Mitigation

10.6.1 As detailed in **Chapter 3: The Project and Site Description**, a number of embedded mitigation measures have been identified through the iterative EIA process and have been incorporated into the design and construction planning of the Project.

10.6.2 As these mitigation measures have been embedded into the design, are legal requirements or are standard practices that will be implemented, the assessment of likely significant effects assumes that they are in place.

10.7 Assessment of Effects

10.7.1 This section presents the findings of the geology, ground conditions and hydrogeology assessment for the construction phase, the operational phase and decommissioning of the Project.

10.7.2 This section identifies any likely significant effects that are predicted to occur following embedded mitigation measures and Section 10.8 highlights the additional mitigation and monitoring measures that are proposed to reduce or eliminate the identified significant effects.

a) Construction

i. Power Generation Plant

Geology and Soils: Sand and Gravel Reserves

10.7.3 The UDP Proposals Map indicates that sand and gravel reserves are present underlying the Project Site. These areas are presented in Figure 10.1. The sand and gravel reserves have historically been worked adjacent to the Project Site; the location of the disused gravel pit is shown in Figure 10.3.

10.7.4 Should the ground investigation provide evidence that sand and gravel reserves are available directly under the Power Generation Plant footprint, there will be a permanent sterilisation of those potentially available reserves. The sand and gravels reserves are considered to be of low sensitivity due to minimal economic use. The magnitude of the impact is assessed as low, as while there will be permanent (for the duration of the Project) sterilisation of the reserves, a relatively small area of the reserves will be affected compared to the full extent. The significance of the effects is therefore considered to be **Minor** adverse which is not significant.

Geology and Soils: Coal Reserves

10.7.5 The UDP Proposals Map indicates that coal reserves are present underlying the Project Site. These areas are presented in Figure 10.1. The coal reserves have historically been worked underlying the Project Site; the location of the workings is shown in Figure 10.2. Should the ground investigation provide evidence of further commercially viable coal reserves under the footprint of the Power Generation Site, there could be a permanent sterilisation of potentially available reserves.

10.7.6 The coal reserves are considered to be of low sensitivity due to minimal economic use. The magnitude of the impact is assessed as low, as while there will be permanent constraint on future extraction, a relatively small area of the coal reserves will be affected compared to the full extent. The significance of the effects is therefore considered to be **Minor** adverse which is not significant in EIA terms.

Geology and Soils: Peat Deposits

10.7.7 There are areas of peat identified across the region with one deposit shown to be located within or close to the Power Generation Plant. The peat deposits are characterised as being of Low sensitivity due to their limited spatial extent (pockets located north east of the Generating Equipment Site and to the north west of Abergelli Farm).

10.7.8 The interaction of the Project with the peat is likely to be minimal. The volume of peat affected will be determined through the completion of the ground investigation and therefore cannot be currently assessed as the thickness of the unit is unknown but likely to variable. The area of mapped peat within the Project Site is ~2.3 ha compared to the total area of the mapped deposit of ~7.4 ha that extends beyond the Project Site's boundary. The magnitude of the impact is therefore considered to be low and the significance of the effects is therefore **Minor** which is not significant.

Agricultural Land

10.7.9 There will be a direct, permanent (for the duration of the Project) local loss of approximately 3 ha of Grade 4 agricultural land in the area of the Generating Equipment Site. Grade 4 land is defined as land with severe limitations which significantly restrict the range of crops and / or level of yield and therefore the sensitivity of this receptor is considered to be negligible. While there will be sterilisation of the receptor under the Project structures, this is over a relatively small area of the Project Site. Therefore the magnitude is assessed as negligible and the significance of the effects also considered to be **Negligible** which is not significant.

Structures

10.7.10 There is high potential for the ground beneath the structures to become unstable from previous mining activities, ground workings, and compressible ground (in particular the peat deposits where directly impacted). The sensitivity of the receptor is considered to be high as these effects can lead to loss or damage to plant and structures. A comprehensive ground investigation will be undertaken prior to construction (as per a DCO Requirement) which will inform the foundation design and any remediation required to be undertaken as standard and as required as part of the embedded mitigation for the Project. Once the embedded mitigation has been taken into account, the magnitude of effect is considered to be negligible. The significance of the effects has therefore been assessed as **Minor** adverse which is not significant.

Controlled Waters

10.7.11 Piling is anticipated to be the realistic worst case scenario required as part of the construction works. There is potential for the quality of the groundwater present in the Secondary A superficial and bedrock aquifers to be impacted by the piling process producing additional pollutant migration pathways for contaminated shallow groundwater or surface waters to impact deeper aquifer groundwater. The sensitivity of the groundwater is assessed as high due to the Secondary Aquifer designation and the presence of water abstractions and private water supplies. Once the embedded mitigation such as pollution control measures have been taken into account, the magnitude of effect is considered to be negligible. The significance of the effects has therefore been assessed as **Minor** adverse which is not significant.

10.7.12 The depth to and extent of coal workings is currently unconfirmed and therefore it is currently not assessed as to whether the proposed piles will intercept worked or unworked coal measures or will be founded in strata not affected by the zone of influence of mine workings. If grouting is required as part of remediation/stabilisation of mine workings this could also have an impact upon groundwater quality. However potential effects would be mitigated by the CEMP and are likely to be short term in duration once the grout has set and no bleed water is present to leach into the surrounding strata.

10.7.13 There is potential for the introduction of contaminated material to enter the ground or controlled waters during the construction phase of the Power Generation Plant. This may occur due to incorrect storage/transport/use of materials such as fuels, oils and chemicals. The pollutants from the spill/leak could infiltrate into the ground, contaminating soils and / or groundwater, or run off directly into surface water bodies. The sensitivity of the groundwater is assessed as high due to the Secondary Aquifer designation and the presence of water abstractions and private water supplies. The magnitude of this effect is however assessed as negligible once embedded mitigation measures have been taken into account such as pollution control measures. The significance of the effects considered to be **Minor** adverse which is not significant.

Human Health: Construction Workers

10.7.14 The construction workers are considered to have high sensitivity as construction groundworks will be required and as such the workforce may be in direct contact with soil and groundwater. Contamination within soils (the presence of which is to be confirmed during the ground investigation) has the potential to affect the health of construction workers adversely. Any ground disturbance has the potential to cause temporary, moderate adverse effect to health arising from oral, inhalation or dermal contact with potential contaminants including potential sheep dips, use of fertilisers, ground gas/landfill gas/mine gas or mine water. However once embedded mitigation measures detailed in the CEMP are taken into account, it is considered to have a **Minor** adverse effect which is considered to be not significant.

ii. Gas Connection

10.7.15 The Gas Connection will be in the form of a new above ground installation (AGI) and underground gas pipeline connection (the Gas Pipeline), which will be approximately 1.4 km in length.

Geology and Soils: Sand and Gravel Reserves

10.7.16 Should ground investigation works demonstrate that there is sand and gravel reserves at the depth of the Gas Connection works, there will be a permanent sterilisation of potential sand and gravel reserves along the Gas Connection corridor where the pipe laying activities are expected to occur. The sand and gravels reserves are considered to be of low sensitivity due to minimal economic use. The magnitude of the impact is assessed as low, as while there will be permanent (for the duration of the Project) sterilisation of the reserves, a relatively small area of the reserves will be affected compared to the full extent. The significance of the effects is therefore considered to be **Minor** adverse which is not significant.

10.7.17 Sand and gravel reserves were not identified within the AGI area on the UDP Proposals Map (shown in Figure 10.1).

Geology and Soils: Coal Reserves

10.7.18 The UDP Proposals Map indicates that coal reserves are present underlying the Gas Connection (including AGI), shown in Figure 10.1. Should the ground investigation works demonstrate that coal reserves will be directly affected by the depth of the Gas Connection; there will be permanent sterilisation on future coal extraction along the Gas Pipeline route. The coal reserves are considered to be of low sensitivity due to minimal economic use. The magnitude of the impact is assessed as low, as while there will be permanent constraint on future extraction, a relatively small area of the coal reserves will be affected compared to the full extent. The significance of the effects is therefore considered to be **Minor** adverse which is not significant.

10.7.19 Coal reserves were not identified within the AGI area on the UDP Proposals Map (shown in Figure 10.1).

Agricultural Land

10.7.20 The construction phase associated with the Gas Connection will be a corridor with a working width of 50 m to 200 m wide and result in a temporary sterilisation of Grade 4 agricultural land during the construction period. Grade 4 land is defined as land with severe limitations which significantly restrict the range of crops and / or level of yield and therefore the sensitivity of this receptor is considered to be negligible. While there will be sterilisation of the receptor over a relatively small area of the Project Site and therefore the magnitude is assessed as **Negligible** and the significance of the effects also considered to be negligible which is not significant.

10.7.21 The Above Ground Installation (AGI) will be approximately 2,975 m^2, and result in the localised, permanent sterilisation of poor quality agricultural land. Grade 4 land is defined as land with severe limitations which significantly restrict the range of crops and / or level of yield and therefore the sensitivity of this receptor is considered to be negligible. While there will be sterilisation of the receptor, it will only be over a relatively small area of the Project Site and therefore the magnitude is assessed as negligible and the significance of the effects also considered to be **Negligible** which is not significant.

iii. Electrical Connection

10.7.22 The Electrical Connection will involve short sections of open cut trench at either end of the access road and the installation of cable ducts. The baseline conditions and receptors are the same to that of the Power Generation Plant and Gas Connection (described above). The Electrical Connection also coincides with the Access Road for approximately 500 m which extends to the Substation.

Geology and Soils: Sand and Gravel Reserves

10.7.23 The Electrical Connection will be routed adjacent to the Felindre Gas Compressor Station and the Substation and along the Access Road. Therefore the land is already sterilised in this area. The sand and gravels reserves are considered to be of low sensitivity due to minimal economic use. The magnitude of the impact is assessed as low, as while there will be permanent sterilisation of the reserves, a relatively small area of the reserves will be affected compared to the full extent. The significance of the effects is therefore considered to be **Minor** adverse which is not significant.

Geology and Soils: Coal Reserves

10.7.24 The Electrical Connection will be routed adjacent to Felindre Gas Compressor Station and the Substation, where the land is already sterilised in this area. The coal reserves are considered to be of low sensitivity due to minimal economic use. The magnitude of the impact is assessed as low, as while there will be permanent constraint on future extraction, a relatively small area of the coal reserves will be affected compared to the full extent. The significance of the effects is therefore considered to be **Minor** adverse which is not significant.

Agricultural Land

10.7.25 The construction works associated with the Electrical Connection will result in the direct, local and permanent sterilisation of agricultural land. However, the route will be result in the permanent loss of approximately 0.33 ha of agricultural land. As above, the sensitivity of the agricultural land is considered to be negligible and the magnitude also negligible due to the limited extent of the impact. The significance of effect is therefore considered to be **Negligible** which is not significant.

iv. Project

10.7.26 Overall, it is considered that the construction phase of the Project will have a localised, minor adverse significance of effect on mineral resources (sand and

gravel reserves) but a negligible effect on peat deposits and agricultural land. Effects on controlled waters, structures and human health have been assessed that **Minor** adverse significance. The significance of effect is not considered to be significant.

Table 10-12: Summary of Potential Impacts during the Construction Phase

Receptor	Receptor Sensitivity	Type of Effect	Magnitude	Assessment of significance (pre- mitigation)
Power Generation Plant				
Mineral resources – sand and gravel reserves	Low	Sterilisation of available mineral deposits for extraction.	Low	Minor Adverse Local spatial extent Direct. Permanent
Mineral resources – coal reserves	Low	Permanent constraint on future extraction.	Low	Minor Adverse Local spatial extent Direct. Permanent
Peat deposits	Low	Loss of peat habitat.	Negligible	Negligible
Agricultural land	Negligible	Sterilisation of Grade 4 agricultural land	Negligible	Negligible
Structures (Potential injuries / fatalities, loss or damage to Plant and Structures)	High	Unstable ground from previous mining activities/ workings/ compressible ground	Negligible	Minor Adverse Local spatial extent Direct. Permanent
Controlled Waters	High	Impact to groundwater quality, from creating migration pathways for potentially contaminated soils and groundwater through the piling process	Negligible	Minor Adverse Local spatial extent Direct. Permanent
Quality of land and / or Controlled waters	High	Incorrect storage / transport / use of materials leading to spills/leaks contaminating soils, groundwater or surface waters	Negligible	Minor Adverse Local spatial extent Direct. Permanent
Human health: Construction Workers	High	Disturbance and mobilisation of potentially contaminated soils, groundwater, ground gas impacting on human health, ground instability	Negligible	Minor Adverse Local extent Direct. Temporary

Receptor	Receptor Sensitivity	Type of Effect	Magnitude	Assessment of significance (pre- mitigation)
Gas Connection				
Mineral resources – sand and gravel reserves	Low	Sterilisation of available mineral deposits for extraction.	Low	Minor Adverse Local spatial extent Direct. Permanent No mapped reserves - AGI
Mineral resources – coal reserves	Low	Sterilisation of available mineral deposits for extraction.	Low	Minor Adverse Local spatial extent Direct. Permanent No mapped reserves - AGI
Agricultural land	Negligible	Sterilisation of Grade 4 agricultural land	Negligible	Negligible
Electrical Connection				
Mineral resources – sand and gravel reserves	Low	Sterilisation of available mineral deposits for extraction.	Low	Minor Adverse Local spatial extent Direct. Permanent No mapped reserves - AGI
Mineral resources – coal reserves	Low	Sterilisation of available mineral deposits for extraction.	Low	Minor Adverse Local spatial extent Direct. Permanent No mapped reserves - AGI
Agricultural land	Negligible	Sterilisation of Grade 4 agricultural land	Negligible	Negligible
Project				
Ground conditions (mineral resources)	Low	Sterilisation of future mineral resources and permanent constraint on future extraction	Low	Minor Adverse Local spatial extent

Receptor	Receptor Sensitivity	Type of Effect	Magnitude	Assessment of significance (pre- mitigation)
				Direct. Permanent
Ground conditions (peat and agricultural land)	Negligible	Sterilisation of agricultural land and loss of peat habitat	Negligible	Negligible
Controlled waters, structures and human health	High	Unstable ground, impacts to human health and controlled waters	Negligible	Minor Adverse Local extent Direct. Temporary to permanent

b) Operation and Maintenance

10.7.27 Potential impacts during the operational phase of the Project (including expected maintenance activities) are detailed below.

i. Power Generation Plant

Geology and Soil - Sand and Gravel, Coal and Peat Reserves and Agricultural Land

10.7.28 Operation and maintenance is anticipated to have a Minor adverse effect on the geology and soils present on the Power Generation Plant as the potential impact would have occurred during the construction phase which is not significant.

Structures

10.7.29 Previously unstable land will be directly stabilised during the construction works. The sensitivity of the structures is assessed high as the effect of unstable land can lead to loss or damage to operational plant and structures. Once embedded mitigation measures have been taken into account the magnitude of effect is considered to be negligible. The significance of the effects has therefore been assessed as **Minor** beneficial which is not significant.

10.7.30 There is potential for long term chemical attack on the foundations of the structures. Chemical compounds such as sulphate and pH levels in natural ground or polluted ground can cause damage to foundations and other sub surface structures. The sensitivity of the structures is assessed as high as the receptor has low ability to absorb change without fundamentally altering its character. Once embedded mitigation measures are taken into account the magnitude of the effect is assessed as negligible. The significance of the effect has been assessed as **Minor** adverse which is not significant.

Land and/or Controlled Waters

10.7.31 There is potential for the accidental release of stored fuels and chemicals directly affecting localised areas of the land or groundwater quality, during the operation and maintenance phase of the Project. These pollution incidents may occur due to incorrect storage / transport / use of materials such as fuels, oils and chemicals. With containment in place, any accidents may result in the containment system being affected and a greater risk of measures being defeated. The sensitivity of the groundwater is assessed as high due to the Secondary Aquifer designation and the presence of water abstractions and private water supplies. Once the embedded mitigation such as pollution control measures has been taken into account, the magnitude of effect is considered to be negligible. The significance of the effects has therefore been assessed as **Minor** adverse which is not significant.

Human Health: Site Workers

10.7.32 There are no potential human health pollutant linkages anticipated to remain during the operational phase or during maintenance as it is assumed that the design of the Project will embed suitable mitigation for the protection of human health. The sensitivity of the site workers is assessed as high. However once embedded

mitigation measures detailed in the CEMP are taken into account it is considered to have a negligible magnitude. The resulting **Minor** effect is considered to be not significant in EIA terms.

ii. Gas Connection

Geology and Soil - Sand and Gravel, Coal and Peat Reserves and Agricultural Land

10.7.33 Operation and maintenance is anticipated to have a **Minor** adverse effect on the geology and soils present at the Gas Connection as the potential impact would have occurred during the construction phase which is not significant.

10.7.34 Structures

10.7.35 There is potential for long term chemical attack on the Gas Pipeline during the operational phase of the Project. Chemical compounds such as sulphate and pH levels in natural ground or polluted ground can cause damage to sub surface structures. The sensitivity of the structures is assessed as high as the receptor has low ability to absorb change without fundamentally altering its character. Once the embedded mitigation has been taken into account, the magnitude of effect is considered to be negligible. The significance of the effects has therefore been assessed as **Minor** adverse which is not significant.

Controlled Waters

10.7.36 Operation and maintenance of the Project is anticipated to have a **Minor** adverse effect on the controlled waters as while the potential impact would have occurred during the construction phase, the sensitivity of the receptor remains high although the magnitude is considered to be negligible. This is not significant.

Human Health: Site Workers

10.7.37 Operation and maintenance of the Project is anticipated to have a **Minor** adverse effect on the human health as, while the potential impact would have occurred during the construction phase, the sensitivity of the receptor remains high although the magnitude is considered to be negligible. This is not significant.

iii. Electrical Connection

Geology and Soil - Sand and Gravel, Coal and Peat Reserves and Agricultural Land

10.7.38 Operation and maintenance is anticipated to have a **Negligible** effect on the geology and soils present at the Electrical Connection as the potential impact would have occurred during the construction phase which is not significant.

Structures

10.7.39 There is potential for long term chemical attack on the underground cable ducts during the operational phase of the Project. Chemical compounds such as sulphate and pH levels in natural ground or polluted ground can cause damage to sub surface structures. The sensitivity of the structures is assessed as high as the

receptor has low ability to absorb change without fundamentally altering its character. Once the embedded mitigation has been taken into account, the magnitude of effect is considered to be negligible. The significance of the effects has therefore been assessed as **Minor** adverse which is not significant.

Controlled Waters

10.7.40 Operation and maintenance of the Project is anticipated to have a **Minor** adverse effect on the controlled waters as while the potential impact would have occurred during the construction phase, the sensitivity of the receptor remains high although the magnitude is considered to be negligible. This is not significant.

Human Health: Site Workers

10.7.41 Operation and maintenance of the Project is anticipated to have a **Minor** adverse effect on the human health as while the potential impact would have occurred during the construction phase, the sensitivity of the receptor remains high although the magnitude is considered to be negligible. This is not significant.

iv. Project

10.7.42 Overall, it is considered that the operational phase and maintenance of the Project will have a localised, **Minor** adverse significance of effect on mineral resources (sand, gravel and reserves), peat deposits and agricultural land. Stability effects on structures have been assessed as **Minor** beneficial and effects on controlled waters, structures and human health have been assessed as **Minor** adverse significance.

Table 10-13: Summary of Potential Impacts during the Operation Phases of the Project

Receptor	Receptor Sensitivity	Type of Effect	Magnitude	Classification of effect (pre-mitigation)
Power Generation Plant				
Geology and Soil - sand and gravel, coal and peat reserves and agricultural land	Medium	Sterilisation of available mineral deposits for extraction and agricultural land.	Negligible	Minor Adverse Local spatial extent Direct. Permanent
Structures (Potential injuries / fatalities, loss or damage to Plant and Structures)	High	Stabilisation of previously unstable ground from previous mining activities /workings / compressible ground conditions	Negligible	Minor Beneficial Local Extent Direct. Permanent
End structure	High	Chemical attack on foundations and other subsurface structures	Negligible	Minor Adverse Local Extent Direct. Temporary
Quality of land and or Controlled waters	High	Incorrect storage / transport / use of materials leading to spills / leaks contaminating soils, groundwater or surface waters	Negligible	Minor Adverse Local Extent Direct. Temporary
Human health: Site workers	High	N/A	Negligible	Minor Adverse Local extent Direct. Temporary
Gas Connection				
Geology and Soil - sand and gravel, coal and peat reserves and agricultural land	Medium	Sterilisation of available mineral deposits for extraction and agricultural land.	Negligible	Minor Adverse Local spatial extent Direct. Permanent
End structure	High	Chemical attack on Gas Pipeline.	Negligible	Minor Adverse

Receptor	Receptor Sensitivity	Type of Effect	Magnitude	Classification of effect (pre-mitigation)
				Local Extent Direct. Temporary
Controlled waters	High	Incorrect storage / transport / use of materials leading to spills / leaks contaminating soils, groundwater or surface waters	Negligible	Minor Adverse Local Extent Direct. Temporary
Human health: Site workers	High	N/A	Negligible	Minor Adverse Local extent Direct. Temporary
Electrical Connection				
Geology and Soil - sand and gravel, coal and peat reserves and agricultural land	Medium	Sterilisation of available mineral deposits for extraction and agricultural land.	Negligible	Minor Adverse Local spatial extent Direct. Permanent
End structure	High	Chemical attack on underground Gas Pipeline	Negligible	Minor Adverse Local Extent Direct. Temporary
Controlled waters	High	Incorrect storage / transport / use of materials leading to spills / leaks contaminating soils, groundwater or surface waters	Negligible	Minor Adverse Local Extent Direct. Temporary
Human health: Site workers	High	N/A	Negligible	Minor Adverse Local extent Direct. Temporary
Project				
Geology and Soil -	Medium	Sterilisation of available mineral	Negligible	Minor Adverse

Receptor	Receptor Sensitivity	Type of Effect	Magnitude	Classification of effect (pre-mitigation)
sand and gravel, coal and peat reserves and agricultural land		deposits for extraction and agricultural land.		Local spatial extent Direct. Permanent
Structures (Potential injuries / fatalities, loss or damage to Plant and Structures)	High	Stabilisation of previously unstable ground from previous mining activities /workings / compressible ground conditions	Negligible	Minor Beneficial Local Extent Direct. Permanent
Controlled waters, structures and human health	High	Chemical attack, impacts to human health and controlled waters	Negligible	Minor Adverse Local Extent Direct. Temporary

c) Decommissioning

i. Power Generation Plant

Geology and Soil

10.7.43 The Power Generation Plant will be returned to a pre-construction condition. The potential mineral reserves underlying the Power Generation Plant that may have been sterilised during the construction and operation phases of the Project may become available again. The significance of the effect is therefore considered to be **Minor** adverse which is not significant.

10.7.44 If mine workings are stabilised as part of the pre-construction works, the land will be returned to a better than baseline condition which will enable future development. The coal reserves are considered to be of low sensitivity due to minimal economic use however the magnitude of the impact is assessed as high, as the baseline has fundamentally been changed. The significance of the effect is therefore considered to be **Moderate** beneficial which is significant.

10.7.45 Agricultural Land

10.7.46 The Power Generation Plant will be returned to a pre-construction condition. Therefore the land will become available for agricultural use once again. The sensitivity of the agricultural land is considered negligible due to the low quality nature of the land and the magnitude considered to be low due to the permanent loss of surface soils. This is anticipated to result in a **Negligible** effect which is not significant.

Controlled Waters

10.7.47 If piled foundations are used, these will likely be retained in the ground following decommissioning of the Power Generation Plant as this would create less direct disturbance to the groundwater regime and ground conditions. The sensitivity of the groundwater is assessed as high due to the Secondary Aquifer designation and the presence of water abstractions and private water supplies. The magnitude of this effect is however assessed as negligible as there will only be a minor shift from baseline conditions. The significance of the effects considered to be **Minor** adverse which is not significant.

10.7.48 There is potential for the accidental release of stored fuels and chemicals directly affecting localised areas of the land or groundwater quality, during the decommissioning of the Project. These pollution incidents may occur due to incorrect storage / transport / use of materials such as fuels, oils and chemicals. With containment in place, any accidents may result in the containment system being affected and a greater risk of measures being defeated. The sensitivity of the groundwater is assessed as high due to the Secondary Aquifer designation and the presence of water abstractions and private water supplies. Once the embedded mitigation such as pollution control measures has been taken into account, the magnitude of effect is considered to be negligible. The significance of the effects has therefore been assessed as **Minor** adverse which is not significant.

Human Health: Demolition Workers

10.7.49 The demolition workers are considered to have high sensitivity as groundworks will be required during demolition and as such the workforce may be in direct contact with soil and groundwater. The construction phase of the project is likely to have addressed any contamination issues within soils which would have the potential to affect the health of demolition workers adversely and once embedded mitigation measures detailed in the CEMP are taken into account it is considered to have a **Negligible** effect which is considered to be not significant.

ii. Gas Connection

10.7.50 The decommissioning works associated with the Gas Connection will include the Gas Pipeline being capped and left in situ. The AGI will be removed and land will be returned to a pre-construction condition.

Geology and Soil - Sand and Gravel, Coal and Peat Reserves

10.7.51 The Gas Pipeline is to be left in situ and a narrow strip of land and potentially any easement permanently sterilised until it is removed for any future development. The sand, gravel and coal reserves are considered to be of low sensitivity due to minimal economic use. The magnitude of the impact is assessed as low, as while there will be permanent constraint on future extraction, a relatively small area of the mineral reserves will be affected compared to the full extent. The significance of the effects is therefore considered to be **Minor** adverse which is not significant.

10.7.52 The decommissioning of the AGI is anticipated to make potential mineral reserves that may have been sterilised during the construction and operation phases of the Project become available again. The sand, gravel and coal reserves are considered to be of low sensitivity due to minimal economic use. The magnitude of the impact is assessed as low, as the underlying composition of the mineral reserves will be similar to the pre-development situation. The significance of the effect is therefore considered to be **Minor** adverse which is not significant.

Agricultural Land

10.7.53 The Gas Connection will be left in situ and the narrow strip of land therefore permanently sterilised until it is removed for any future development. The AGI land area will be returned to a pre-construction condition. Therefore the land will become available for agricultural use once again. The sensitivity of the agricultural land is considered low, as while there will be permanent constraint on future agricultural only a relatively small area will be affected and the land is considered to be low quality in nature. The magnitude considered low due to the permanent loss of low quality surface soils. This is anticipated to result in a **Minor** adverse effect which is not significant.

Controlled Waters

10.7.54 There is potential for the accidental release of stored fuels and chemicals directly affecting localised areas of the land or groundwater quality, during the decommissioning of the Project. These pollution incidents may occur due to

incorrect storage / transport / use of materials such as fuels, oils and chemicals. With containment in place, any accidents may result in the containment system being affected and a greater risk of measures being defeated. The sensitivity of the groundwater is assessed as high due to the Secondary Aquifer designation and the presence of water abstractions and private water supplies. Once the embedded mitigation such as pollution control measures has been taken into account, the magnitude of effect is considered to be negligible. The significance of the effects has therefore been assessed as **Minor** adverse which is not significant.

Human Health: Demolition Workers

10.7.55 The demolition workers are considered to have high sensitivity as groundworks will be required during demolition and as such the workforce may be in direct contact with soil and groundwater. The construction phase of the project is likely to have addressed any contamination issues within soils which would have the potential to affect the health of demolition workers adversely and once embedded mitigation measures detailed in the CEMP are taken into account it is considered to have a negligible magnitude of effect. The significance of the effects has therefore been assessed as **Minor** adverse which is not significant.

iii. Electrical Connection

Geology and Soil - Sand and Gravel, Coal and Peat Reserves

10.7.56 The decommissioning works will include the Electrical Connection being capped and left in situ and the narrow strip of land and potentially an easement therefore permanently sterilised until it is removed for any future development. The sand, gravel and coal reserves are considered to be of low sensitivity due to minimal economic use. The magnitude of the impact is assessed as low, as while there will be permanent constraint on future extraction, a relatively small area of the mineral reserves will be affected compared to the full extent. The significance of the effects is therefore considered to be Minor adverse which is not significant.

Agricultural Land

10.7.57 The Electrical Connection will be left in situ therefore the land will become available for agricultural use once again. There is anticipated to be permanent sterilisation of narrow strip of land directly over the cable and any potential easement. The sensitivity of the agricultural land is considered negligible due to the low quality nature of the land and the magnitude considered to be low due to the permanent loss of low quality surface soils. This is anticipated to result in a **Negligible** effect which is not significant.

Controlled Waters

10.7.58 There is potential for the accidental release of stored fuels and chemicals directly affecting localised areas of the land or groundwater quality, during the decommissioning of the Project. These pollution incidents may occur due to incorrect storage / transport / use of materials such as fuels, oils and chemicals. With containment in place, any accidents may result in the containment system being affected and a greater risk of measures being defeated. The sensitivity of the

groundwater is assessed as high due to the Secondary Aquifer designation and the presence of water abstractions and private water supplies. Once the embedded mitigation such as pollution control measures has been taken into account, the magnitude of effect is considered to be negligible. The significance of the effects has therefore been assessed as **Minor** adverse which is not significant.

Human Health: Demolition Workers

10.7.59 The demolition workers are considered to have high sensitivity as groundworks will be required during demolition and as such the workforce may be in direct contact with soil and groundwater. The construction phase of the project is likely to have addressed any contamination issues within soils which would have the potential to affect the health of demolition workers adversely and once embedded mitigation measures detailed in the CEMP are taken into account it is considered to have a negligible magnitude of effect. The significance of the effects has therefore been assessed as **Minor** adverse which is not significant.

iv. Project

10.7.60 Overall, it is considered that the decommissioning phase of the Project will have a localised, Minor adverse significance of effect on mineral resources (sand, gravel and reserves), peat deposits and agricultural land. Stability effects on structures have been assessed as moderate beneficial and effects on controlled waters and human health from contamination have been assessed as **Minor** adverse significance.

Table 10-14: Summary of Potential Impacts Following Decommissioning

Receptor	Receptor Sensitivity	Type of Effect	Magnitude	Classification of effect (pre- mitigation)
Power Generation Plant				
Mineral resources – sand, gravel and coal reserves	Low	Previously sterilised mineral reserves will become available again for extraction if all development is decommissioned to preconstruction condition.	Low	Minor Adverse Local spatial extent Direct. Permanent
	Low	If mine workings are stabilised as part of pre-construction works land will be returned to better than baseline condition.	High	Moderate beneficial Local extent Direct. Permanent
Agricultural land	Low	Previously sterilised Grade 4 agricultural land will become available again for use	Low	Minor Adverse Local extent Direct. Permanent
Controlled waters	High	If piles are used, they will likely be retained to create less direct disturbance	Negligible	Minor adverse Local extent Direct. Permanent
	High	Incorrect storage / transport / use of materials leading to spills / leaks contaminating soils, groundwater or surface waters	Negligible	Minor Adverse Local extent Direct. Temporary
Human Health: Demolition Workers	High	Disturbance and mobilisation of potentially contaminated soils, groundwater, ground gas impacting on human health, ground instability	Negligible	Minor Adverse Local extent Direct. Temporary
Gas Connection				
Mineral resources – sand, gravel and coal reserves	Low	The Gas Pipeline to be capped and left in-situ. Permanent sterilisation of narrow strip of land and potential easement.	Low	Minor Adverse Local extent Direct. Permanent

Receptor	Receptor Sensitivity	Type of Effect	Magnitude	Classification of effect (pre- mitigation)
Agricultural Land	Low	Previously sterilised Grade 4 agricultural land available for use however permanent loss of surface soils.	Low	Minor Adverse Local extent Direct. Permanent
Controlled Waters	High	Incorrect storage / transport / use of materials leading to spills / leaks contaminating soils, groundwater or surface waters	Negligible	Minor Adverse Local extent Direct. Temporary
Human Health: Demolition Workers	High	Disturbance and mobilisation of potentially contaminated soils, groundwater, ground gas impacting on human health, ground instability	Negligible	Minor Adverse Local extent Direct. Temporary
Electrical Connection				
Mineral resources – sand, gravel and coal reserves	Low	Electrical Connection to be capped and left in-situ. Permanent sterilisation of narrow strip of land and potential easement.	Low	Minor Adverse Local extent Direct. Permanent
Agricultural Land	Low	Previously sterilised Grade 4 agricultural land available for use however permanent loss of surface soils.	Low	Minor Adverse Local extent Direct. Permanent
Controlled Waters	High	Incorrect storage / transport / use of materials leading to spills / leaks contaminating soils, groundwater or surface waters	Negligible	Minor Adverse Local extent Direct. Temporary
Human Health: Demolition Workers	High	Disturbance and mobilisation of potentially contaminated soils, groundwater, ground gas impacting on human health, ground instability	Negligible	Minor Adverse Local extent Direct. Temporary

Receptor	Receptor Sensitivity	Type of Effect	Magnitude	Classification of effect (pre- mitigation)
Project				
Geology and soils - sand, gravel and coal reserves and agricultural land	Low	Previously sterilised agricultural land and future mineral resources becoming available again	Low	Minor Adverse Local spatial extent Direct. Permanent
Mineral resources – coal reserves	Low	Land is stabilised as part of pre-construction works	High	Moderate beneficial Local extent Direct. Permanent
Controlled waters and human health	High	Impacts to human health and controlled waters from contamination	Negligible	Minor Adverse Local extent Direct. Permanent to Temporary

10.8 Additional Mitigation Measures

10.8.1 As a general rule, additional mitigation measures are proposed where a significant effect is predicted to occur. Embedded mitigation measures, which have been incorporated within the design of the Project or are standard practice measures that have been committed to are summarised in Chapter 3: Project and Site Description and have been taken account of in the assessment described above. These include the ground investigation which is expected to be undertaken post-consent and as required by a DCO Requirement.

10.8.2 The impact assessment detailed in Section 10.7 has not indicated the presence of any significant effects that would require additional mitigation measures. It is not anticipated that any requirement for monitoring.

10.9 Residual Effects

10.9.1 There were no significant effects identified during the life cycle of the Power Generation Plant, Gas Connection, Electrical Connection, or the Project. Therefore, there are no residual effects identified and therefore no additional mitigation measures were deemed necessary.

10.10 Cumulative Effects

10.10.1 It is considered that there is no potential for cumulative impacts on geology, ground conditions and hydrogeology receptors as a result of construction, operation and maintenance or decommissioning of the Project in combination with other schemes for the following reasons:

- Solar park developments such as Abergelli Solar Farm and Brynwhilach Solar Park would not impact significantly on the geology and hydrogeology of the Project Site as it is understood there would be limited excavation works for the construction of those projects. The identified potential impacts on the geology and hydrogeology of the Project would comprise accidental pollution incidents during the construction phase. This would not have a cumulative effect with the other projects.
- Based on information available at this time, it is anticipated that the planning applications for the sustainable urban village at Felindre, and Felindre Business Park will not have an impact on geology and hydrogeology such that a cumulative impact would occur alongside the Project's impacts; and
- The development of the Project or other planned developments within the area are not anticipated to have any cumulative effects as they will not likely create a larger contamination or ground instability impact than the individual projects taken in isolation. In addition, none of the planned developments will remove large amounts of good quality agricultural land or sites of important geology.

10.11 References

Ref. 10.1 Parson Brinckerhoff. Preliminary Geo-Environmental Risk Assessment. March 2014

Ref. 10.2 Directive 2010/75/EU on industrial emissions (integrated pollution prevention and control)

Ref. 10.3 Directive 2000/60/EC Water Framework Directive

Ref. 10.4 Directive 2006/118/EC Groundwater Framework Directive.

Ref. 10.5 Decision No. 1386/2013/EU. General Union Environment Action Programme to 2020 'Living well, within the limits of our planet'. November 2013

Ref. 10.6 Department of Energy and Climate Change. Overarching National Policy Statement for Energy (EN1). July 2011.

Ref. 10.7 Department of Energy and Climate Change. National Policy Statement for Gas Supply Infrastructure and Gas and Oil Pipelines (EN-4). July 2011.

Ref. 10.8 Department of Energy and Climate Change. National Policy Statement for Electricity Networks Infrastructure (EN-5). July 2011

Ref. 10.9 Environmental Protection Act 1990, Part 2A (Contaminated Land).

Ref. 10.10 Environment Agency. Model Procedures for the Management of Land Contamination (Contaminated Land Report 11 (CLR11)). 2004

Ref. 10.11 Environment Agency. Guiding Principles for Land Contamination. August 2016.

Ref. 10.12 Environment Agency. The Environment Agency's approach to groundwater protection. March 2017.

Ref. 10.13 CIRIA. Control of water pollution from construction sites (C532). 2001

Ref. 10.14 CIRIA. The SuDS (Sustainable Urban Drainage Systems) manual (C753). 2015.

Ref. 10.15 CIRIA. The SuDS manual (C697). 2007

Ref. 10.16 CIRIA. Environmental good practice on site guide (C741). 2015

Ref. 10.17 CIRIA. Assessing risks posed by hazardous ground gases to buildings (C665). 2007

Ref. 10.18 CIRIA. Contaminated land risk assessment - a guide to good practice (C552). 2001.

Ref. 10.19 Welsh Government. Planning Policy Wales. Edition 9, November 2016.

Ref. 10.20 Welsh Assembly Government. Planning Policy Wales Technical Advice Note 5. Nature Conservation and Planning. September 2009.

Ref. 10.21 City and County of Swansea. Unitary Development Plan (UDP) Proposals Map. November 2008. (Online) Available from URL address: http://swansea.devplan.org.uk/map.aspx?map=41&layers=all (accessed October 2017)

Ref. 10.22 The Planning Inspectorate. Scoping Opinion Proposed Abergelli Power Project. August 2014

Ref. 10.23 British Geological Survey. Digital Geological map of Great Britain at 1:50,000 scale. (Online) Available from URL address: www.bgs.ac.uk/geoindex (accessed October 2017)

Ref. 10.24 Natural Environment Research Council. The BGS Lexicon of Named Rock Units - Grovesend Formation. 2017 (Online) Available from URL address: http://www.bgs.ac.uk/lexicon/lexicon.cfm?pub=GDB (accessed October 2017)

Ref. 10.25 National Resources Wales. Long term Flood Risk. 2017. (Online) Available from URL address: https://www.naturalresourceswales.gov.uk/evidence-and-data/maps/long-term-flood-risk/?lang=en (accessed October 2017)