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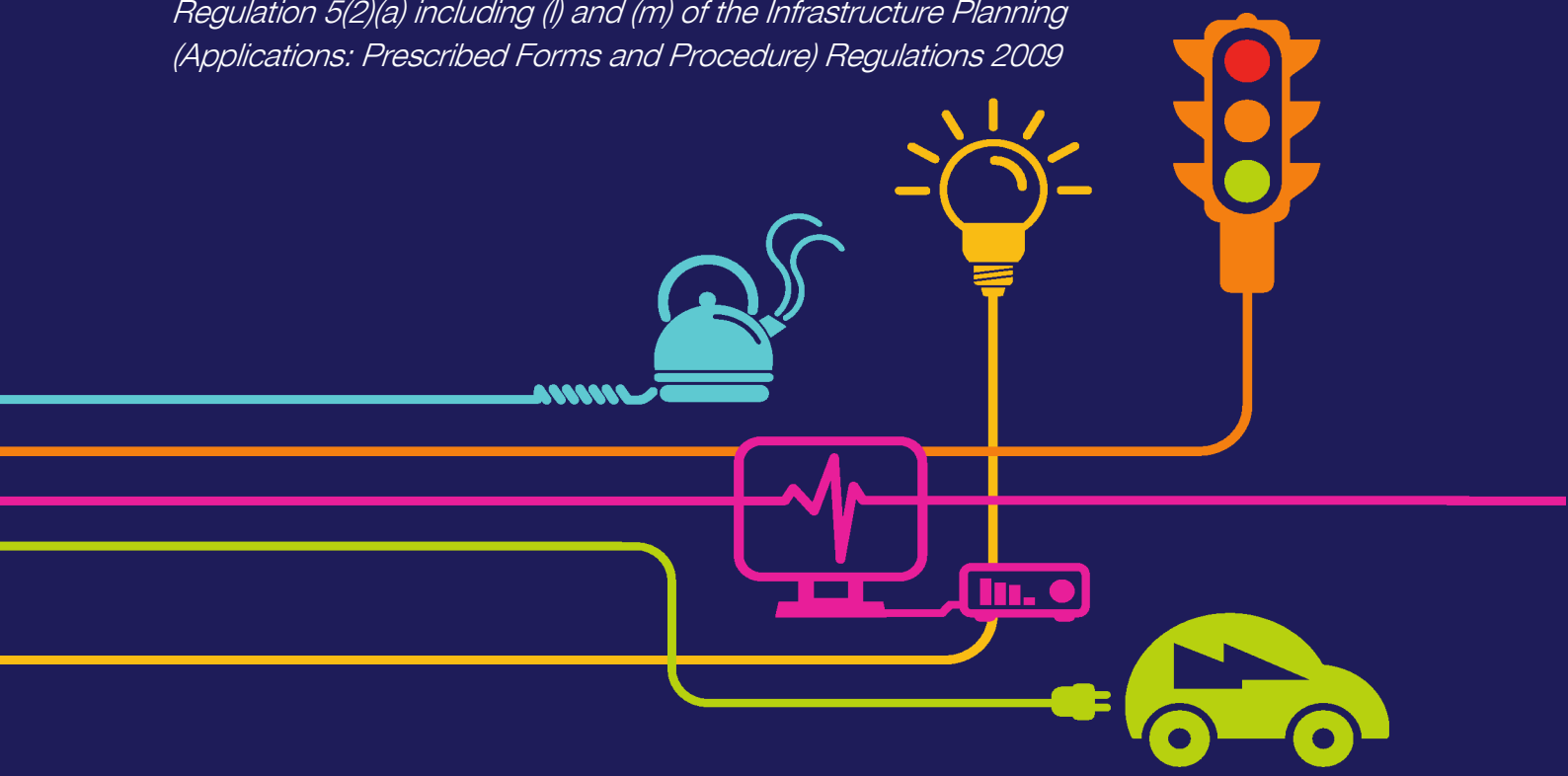
Environmental Statement Chapter 11

Geology, Hydrogeology and Ground Conditions

National Grid (North Wales Connection Project)

Regulation 5(2)(a) including (l) and (m) of the Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009



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1 Introduction

1.1 INTRODUCTION

1.1.1 This chapter presents information about the effects related to geology, hydrogeology and ground conditions that could result from the Proposed Development (as described in Chapter 3, Description of Proposed Development (**Document 5.3**)). The chapter considers both the potential effects of the Proposed Development on the geological and hydrogeological characteristics within the Study Area (as defined in section 6 Study Area) and the potential effects of the existing ground conditions on the Proposed Development. It also identifies mitigation measures that would be necessary to prevent, reduce or offset likely significant adverse effects of the Proposed Development, as well as measures to enhance beneficial effects, where possible.

1.1.2 The effects of the Proposed Development on the agricultural quality of soils are considered in Chapter 18, Agriculture (**Document 5.18**).

1.1.3 This chapter is supported by the Appendices listed below:

- Appendix 11.1 Local Planning Policy (**Document 5.11.2.1**);
- Appendix 11.2 Tables for Figures 11.5 - 11.9 (**Document 5.11.2.2**);
- Appendix 11.3 Regulator Correspondence (**Document 5.11.2.3**);
- Appendix 11.4 Coal Authority Report (**Document 5.11.2.4**);
- Appendix 11.5 Walkover Survey (**Document 5.11.2.5**);
- Appendix 11.6 Private Water Supply Assessment (**Document 5.11.2.6**);
- Appendix 11.7 Ground Investigation Information (**Document 5.11.2.7**); and
- Appendix 11.8 Shaft and Tunnel Groundwater Inflow Assessment (**Document 5.11.2.8**).

1.1.4 Other chapters that are useful to consider in association with this chapter are: Chapter 12, Water Quality Resources and Flood Risk (**Document 5.12**) which covers surface water and hydrology and is therefore useful to consider together with the assessment of hydrogeology presented in this chapter; Chapter 18, Agriculture (**Document 5.18**) which covers agricultural soils; Chapter 19, Intra-Project Cumulative Effects (**Document 5.19**); and Chapter 20, Inter-Project Cumulative Effects **(Document 5.20)** which reports any cumulative effects on geological and hydrogeological receptors;. Other documents that are useful to consider are the Construction Environmental Management Plan (CEMP) (**Document 7.4**), Outline Materials Management Plan (OMMP) (**Document 7.12**)**;** and Outline Waste Management Plan (OWMP) (**Document 7.11**).

1.1.5 All technical terms and abbreviations used within this chapter are defined in the Glossary **(Document 1.4)**.

2 Legislation and Planning Policy

2.1 INTRODUCTION

2.1.1 This section sets out the legislation and planning policy framework that is relevant to the geology, hydrogeology and ground conditions assessment. A full review of compliance with national and local planning policy is provided in the Planning Statement (**Document 7.14**) and a full review of relevant legislation is set out in the Legislation Compliance Audit (**Document 5.28.2.1**).

2.2 LEGISLATION

2.2.1 The following European and national environmental legislation and guidance documents are relevant:

European

2.2.2 The Environmental Quality Standards Directive (2008/105/EC) (Ref 11.1) lays down environmental quality standards (EQS) for priority substances and certain other pollutants as provided for in Article 16 of the Water Framework Directive 2000/60/EC (WFD) (Ref 11.4), with the aim of achieving good surface water chemical status and in accordance with the provisions and objectives of Article 4 of that Directive;

2.2.3 The Groundwater Directive (2006/118/EC) (replacing 1980/68/EC) (Ref 11.2) is a directive on the protection of groundwater against pollution by certain dangerous substances;

2.2.4 The Dangerous Substances Directive (2006/11/EC) (Ref 11.3) provides guidance on pollution caused by certain dangerous substances discharged into the aquatic environment; and

2.2.5 The Water Framework Directive (2000/60/EC) (Ref 11.4) provides a system to protect all water bodies including surface water and groundwater. The primary objectives for groundwater are to meet Good Chemical and Quantitative Status and to not cause deterioration. Specifically with regards to groundwater, the WFD states that measures should be implemented to 'prevent or limit inputs of pollutants into groundwater' and 'to reverse any significant and sustained upward trends.'

National

2.2.6 The Water Environment (Water Framework Directive) Regulations 2017 (Ref 11.5) provide guidance for establishing a framework for community action in the field of water policy. These Regulations revoke and replace the 2003 regulations;

2.2.7 The Private Water Supplies (Wales) Regulations 2017 (Ref 11.6) apply to private water supplies intended for human consumption. The Regulations set out the requirements and imposes a duty on each local authority to carry out a risk assessment of every private water supply in its area. The Regulations place a duty on local authorities to monitor private water supplies and to ensure that each sample taken is analysed. It also requires the local authority to make and keep records for every private water supply in its area. The Regulations also require supplies to be sampled before being brought back into use if decommissioned or if supplies are new;

2.2.8 The Environmental Permitting (England and Wales) Regulations 2016 (Ref 11.7) provide guidance for those carrying out activities that may cause imminent threats of, or actual 'environmental damage', which require a permit, and also outline the authorities responsible for enforcing the Regulations;

2.2.9 The Environmental Damage (Prevention and Remediation) (Wales) Regulations 2015 (Ref 11.8),describes the main parts of the regulations, when they apply and what is required when they do. It sets out the Welsh Government views on how they should be applied and how particular terms should be interpreted;

2.2.10 Contaminated Land (Wales) Regulations, 2006 (Ref 11.9) provides guidance on the processes of risk assessment and identification/ evaluation of remediation options. Additional guidance is also provided in the Contaminated Land Statutory Guidance for Wales (WAG 2012);

2.2.11 The Water Act 2003 (Ref 11.10) relates to matters within the responsibilities of holding and issuing licences for water abstractions. The four broad aims

of the Act are to ensure sustainable use of water resources, to strengthen the voice of consumers, to increase competition and to promote water conservation;

2.2.12 The Environment Act, 1995 (Ref 11.11) makes provision with respect to contaminated land and abandoned mines;

2.2.13 The Water Resources Act 1991 (as amended) (Ref 11.12) gives Natural Resources Wales powers and duties to prevent or remedy the pollution of controlled waters. Previously under the Act and now under the Environmental Permitting (England and Wales) Regulations 2010 (as amended 2012) it is a criminal offence for a person to cause or knowingly permit pollution of controlled water;

2.2.14 The Land Drainage Act 1991 (as amended) (Ref 11.13), requires that a watercourse be maintained by its owner in such a condition that the free flow of water is not impeded. The owner must accept the natural flow from upstream but need not carry out work to cater for increased flows resulting from some types of works carried out upstream, for example a new housing development; and

2.2.15 The Environmental Protection Act Part IIA, 1990 (Ref 11.14) 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.

2.3 NATIONAL POLICY

National Policy Statements

2.3.1 National Policy Statements set out the primary policy test against which the application for a Development Consent Order (DCO) for the Proposed Development would be considered.

2.3.2 The Overarching National Policy Statement for Energy (EN-1) (Ref 11.15) and National Policy Statement for Electricity Networks Infrastructure (EN-5) (Ref 11.16) were adopted by Parliament in July 2011. The documents provide the main policy tests in relation to the Proposed Development. Table 11.1 provides details of the elements of NPS EN-1 and NPS EN-5 that are relevant to this chapter, and how and where they have been addressed in the ES.

Table 11.1 Compliance with NPS (EN-1) and NPS (EN-5) Requirements	
NPS EN-1 Section	Where this has been covered in the ES
5.3.3 Where the development is subject to EIA the applicant should ensure that the ES clearly sets out any effects on internationally, nationally and locally designated sites of … geological conservation importance.	A search for areas of geological conservation importance has been undertaken, and the results provided in section 7 baseline conditions. No effects on designated sites of geological conservation importance have been identified.
5.3.4 The applicant should show how the project has taken advantage of opportunities to conserve and enhance … geological conservation interests.	Opportunities for enhancement of geological conservation interests are limited. However borehole logs and, if requested, drilling cores from ground investigation works would be provided to the British Geological Survey (BGS). In particular this will provide greater information about the geology of the Menai Strait. This is set out in the Enhancement Strategy (**Document 7.13**). The University of Bangor has been provided with access to view the onshore ground investigation site works that have already been undertaken.
5.3.7 As a general principle, and subject to the specific policies below, development should aim to avoid significant harm to … geological conservation interests, including through mitigation and consideration of reasonable alternatives …; where significant harm cannot be avoided, then appropriate compensation measures should be sought.	A search for areas of geological interest has been undertaken as described in section 7 baseline conditions. No effects on designated sites of geological conservation importance have been identified.

Table 11.1 Compliance with NPS (EN-1) and NPS (EN-5) Requirements	
NPS EN-1 Section	Where this has been covered in the ES
5.10.8 - Applicants should … identify any effects and seek to minimize 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.	The soil types and the risk posed by land contamination within the Study Area have been identified in section 7 baseline conditions and are assessed in section 8 potential effects and section 9 mitigation and residual effects.
NPS EN-5 Section	Covered in ES Section
2.2.6 ...developers will be influenced by Schedule 9 to the Electricity Act 1989, which places a duty on all transmission and distribution licence holders, in formulating proposals for new electricity networks infrastructure, to 'have regard to the desirability of preserving natural beauty, of conserving flora, fauna and geological or physiographical features of special interest.	A search for areas of geological interest has been undertaken as described in section 7 baseline conditions. No effects on designated sites of geological conservation importance have been identified. The soil types and the risk posed by land contamination within the Study Area have been identified in section 7 baseline conditions and assessed in section 8 potential effects and section 9 mitigation and residual effects.

Planning Policy Wales (Edition 9)

2.3.3 National Planning Policy in Wales is set out in The Welsh Government (2016) Planning Policy Wales Edition 9 (PPW) (Ref 11.17). Policy in relation to the development of contaminated and unstable land is detailed in Chapter 13 Minimising and Managing Environmental Risks and Pollution, and development in relation to minerals is detailed in Chapter 14 Minerals of PPW.

2.3.4 PPW is supported by a number of Technical Advice Notes (TANs) however none of these are considered to be directly relevant to this chapter.

Draft Planning Policy Wales (Edition 10)

2.3.5 At the time of writing, Planning Policy Wales is undergoing consultation and is currently available as the document Draft Planning Policy Wales (Edition 10) (Ref 11.18). This document sets out policy relevant to this chapter with regards to materials balance, recycled materials (including aggregates), minerals, safeguarding of mineral sources and adaptable design choices to prevent Waste framed in the context of a Circular Economy and Sustainable Development.

2.4 LOCAL PLANNING POLICY

2.4.1 There are a number of local planning policies set out in the Joint Local Development Plan 2018 (Ref 11.19) that relate to Geology, Hydrogeology and Ground Conditions. These are set out in Appendix 11.1 (**Document 5.11.2.1**).

3 Scope of Assessment

3.1 INTRODUCTION

3.1.1 This section describes the scope of the assessment, with reference to the Scoping Opinion received from the Secretary of State (SoS) and consultation with stakeholders.

Welsh Language

3.1.2 Consideration has been given to the potential for this topic to impact on the Welsh language in any way, drawing upon the findings of the Welsh Language Impact Assessment (**Document 5.26**). It has been concluded that there is no potential for the sources of effects or affected receptors dealt with in this chapter to have any effects upon the Welsh language.

3.2 UPDATES SINCE SCOPING

3.2.1 There have been no changes proposed to the scope of assessment as presented in the Scoping Report and as requested by the SoS in the Scoping Opinion.

3.3 SECRETARY OF STATE'S SCOPING OPINION

3.3.1 Table 11.2 below identifies the issues raised in the SoS Scoping Opinion and responses to them. The issues and responses are also included as Appendix 5.1, Schedule of Response to the Scoping Opinion (**Document 5.5.2.1**).

Table 11.2: Issues Raised and Responses to the SoS Scoping Opinion

Paragraph	Issue Raised by SoS	Response
3.94	The baseline for the ES should explain and justify the extent of the study area. This will be important to ensure that the impacts are considered over a sufficiently wide	Section 6 study area explains the extent of the study area for this topic.

Table 11.2: Issues Raised and Responses to the SoS Scoping Opinion		
Paragraph	Issue Raised by SoS	Response
	area.	
3.95	The Applicant's attention is drawn to the comments of the Councils (see Appendix 3 of this Opinion) regarding information sources to inform the baseline environment.	These information sources have been consulted to inform the baseline presented in section 7 baseline conditions.
3.96	Table 8.10 of the Scoping Report has identified Source Protection Zones (SPZs) as an example receptor, however the Scoping Report has not identified whether or not SPZs are present within the Scoping Study Area. The ES should identify any SPZs around potable groundwater abstractions.	In the absence of SPZ boundaries in Wales, SPZs have been identified as 50 m around potable groundwater abstractions, in line with guidance provided by Natural Resources Wales. This is further explained in section 7 baseline conditions.
3.97	Limited information has been provided in the Scoping Report regarding the baseline conditions under the Menai Strait. The Secretary of State would expect the ES to include a detailed baseline description and a robust assessment of the potential impacts of crossing the Strait.	The geology underlying the Menai Strait is described in section 7 baseline conditions. Potential impacts are identified for the tunnel crossing of the Menai Strait, as described in section 8 potential effects and section 9 mitigation and residual effects. Further information is provided in Chapter 9, Ecology and Nature Conservation (**Document 5.9**) which also considers impacts on the marine environment.
3.98	Table 8.10 of the Scoping Report identifies four levels of sensitivity of receptors; however Table 8.12 identifies only three levels of 'value'	There are 4 levels of value in the matrix, however, this table was split over two pages in the

Table 11.2: Issues Raised and Responses to the SoS Scoping Opinion		
Paragraph	Issue Raised by SoS	Response
	in the matrix used to define significance. The Applicant should ensure that this discrepancy is resolved within the ES.	Scoping Report. The significance matrix is included as Table 11.5 of this chapter.
3.99	The Secretary of State notes the potential for using piling to construct the pylon foundations. The ES should detail the depth of the piled foundations and the construction methodology to be utilised for these activities as these could have implications for ground conditions and groundwater. If piling would take place around areas of contaminated land, the ES should assess the likely effects and if necessary provide mitigation measures that would be required to protect sensitive receptors e.g. groundwater. Where piling works are proposed close to existing structures (e.g. buildings or bridges) the ES should also assess whether these might be affected by changes in the stability of the land.	Plans DE/PS/08 Sheet 3 of 4 (**Document 4.13**) submitted with the application illustrate the foundation type for a typical lattice pylon. Details of the proposed foundation types for the pylons and gantries are included in Chapter 3, Description of Proposed Development (**Document 5.3**). The potential effects of piling are considered within section 8 potential effects and section 9 mitigation and residual effects.
3.100	The Scoping Report identifies the potential for shallow mining areas to be present within the Scoping Study Area; the potential effects on such areas have not been considered in section 8.7 but should be assessed in the ES and any necessary mitigation measures identified.	An assessment of coal mining areas is included in section 7 baseline conditions. Potential effects are considered within section 8 potential effects and section 9 mitigation and residual effects.

Table 11.2: Issues Raised and Responses to the SoS Scoping Opinion		
Paragraph	Issue Raised by SoS	Response
3.101	The ES should give due consideration to the potential impacts of undergrounding the cables on geology, hydrogeology and ground conditions. The ES should detail how any excavated soil would be stored on site during the cable laying process and any necessary mitigation measures. Appropriate cross reference should be made to the Agriculture topic chapter of the ES.	As stated in Chapter 4, Construction, Operation, Maintenance and Decommissioning (**Document 5.4**) the proposed connection would cross the Menai Strait by means of a tunnel. There would be short sections of underground cable within concrete trenches between the Cable Sealing End Compounds (CSECs) and the Tunnel Head Houses (THH). In addition relocated third party power cables could be laid underground and these works are considered within section 8 potential effects and section 9 mitigation and residual effects.
3.102	If tunnelling is the chosen option for crossing the Menai Strait, information should be provided on the storage and disposal of spoil from these works. The Secretary of State advises that a Material Management Plan may be an appropriate method to control significant effects. The Applicant should ensure that the plan includes sufficient detail to demonstrate efficacy and it will need to be adequately secured.	As stated in Chapter 4, Construction, Operation, Maintenance and Decommissioning (**Document 5.4**) of the ES the Menai Strait would be crossed by means of a tunnel. Tunnel arisings would be stored on-site before being removed to an appropriate location in line with the Outline Waste Management Plan (OWMP) (**Document 7.11**) and Outline Materials Management Plan (OMMP) (**Document 7.12**).
3.104	The relationship with other topic areas such as, for instance, water	The relationship with other topic areas has been considered and

Table 11.2: Issues Raised and Responses to the SoS Scoping Opinion		
Paragraph	Issue Raised by SoS	Response
	quality, water resources and ecology should be considered and appropriate cross-reference made within the ES.	cross references included within this chapter where appropriate.

3.4 CONSULTATION

3.4.1 Meetings have been held with Isle of Anglesey County Council (IACC) and Gwynedd Council to discuss the scope, methodology and assessment results of the geology, hydrogeology and ground conditions assessment as described within this chapter. Chapter 5 EIA Consultation (**Document 5.5**) lists all the meetings which have taken place and the topics discussed.

3.4.2 Responses to comments from Stage 3 Consultation can be found in Chapter 5 Appendix 5.2, Schedule of Responses to the Preliminary Environmental Information Report (**Document 5.5.2.2**) and the Consultation Report (**Document 6.1**). Responses to comments provided during the technical stakeholder review of the draft ES are provided in Chapter 5, Appendix 5.3 Schedule of Responses to the technical stakeholder review of the draft Environmental Statement (**Document 5.5.2.3**).

4 Methodology

4.1 INTRODUCTION

4.1.1 This section outlines the technical methods used to determine the baseline ground and groundwater conditions; how they could be affected by the Proposed Development (i.e. the impacts); and how significant the effects of these impacts are likely to be.

4.2 GUIDANCE SPECIFIC TO GEOLOGY, HYDROGEOLOGY AND GROUND CONDITIONS

4.2.1 The assessment method has followed guidance in the Design Manual for Roads and Bridges (DMRB) Vol 11, Section 3, Part 11, Geology and Soils (Ref 11.20) and DMRB HD45/09, Part 10, Road Drainage and the Water Environment (Ref 11.21). As there is no specific guidance in relation to transmission infrastructure for assessing soils, geology and hydrogeology, impacts, DMRB has been used as it is considered to be the most appropriate methodology for the Proposed Development because it is designed for assessing effects of linear schemes, albeit road schemes. It is also a well-established and tested methodology, familiar to the statutory consultees.

4.2.2 In relation to ground contamination the Environment Agency's 'Guiding Principles for Land Contamination' (GPLC1 (Ref 11.22), GPLC2 (Ref 11.23) and GPLC3 (Ref 11.24)) have been followed.

4.2.3 A preliminary qualitative risk assessment has been undertaken based on the source-pathway-receptor methodology promoted by Defra and NRW in the report 'Model Procedures for the Management of Land Contamination (CLR 11) (Ref 11.25).

4.3 BASELINE DATA GATHERING AND FORECASTING METHODS

4.3.1 The identification of baseline conditions has drawn on the information sources listed below:

- British Geological Survey (BGS) 1:50,000 mapping;
- BGS Geoindex Online Mapping Service available at http://mapapps2.bgs.ac.uk/geoindex/home.html;

- UKRadon Online Interactive Mapping Service for Radon in England and Wales availiable at http://www.ukradon.org/information/ukmaps
- Coal Authority Interactive Map Viewer available at http://mapapps2.bgs.ac.uk/coalauthority/home.html;
- Welsh Government 'Lle' Geo-Portal for Wales available at http://lle.gov.wales/home;
- Gwynedd and Anglesey Joint Local Development Plan Consultation Portal Online Mapping and Online Constraints Mapping available at http://gwynedd.opus3.co.uk/ldf/maps;
- Groundsure Report , report reference GS-321688, May 2016;
- Groundsure Report, report reference GS-359309, January 2016;
- Natural Resource Wales (NRW), LANDMAP;
- The Coal Authority CON29M Non-Residential Mining Report, report reference 51001161664001, May 2016;
- Records and geo-environmental data held by Isle of Anglesey County Council (IACC), Gwynedd Council and NRW relating to current and historical contaminative land uses;
- Records and geo-environmental data held by IACC, Gwynedd Council and NRW relating to waste management sites, and quarrying/ mining sites;
- Records held by IACC and Gwynedd Council of water abstractions and Private Drinking Water supplies;
- Records held by NRW regarding details of surface water abstractions (NRW holds no information regarding groundwater abstractions or private drinking water supplies); and
- A site survey undertaken at various locations within the Order Limits for the Proposed Development following identification of potential sources and receptors through analysis of the above sources of information.

4.4 TECHNICAL ANALYSIS

4.4.1 Using the baseline information, and considering the details of the Proposed Development (as detailed in Chapter 3, Description of the Proposed

Development (**Document 5.3**) and Chapter 4, Construction, Operation, Maintenance and Decommissioning (**Document 5.4**)) a qualitative and where relevant a quantitative assessment has been undertaken to identify potential effects of the Proposed Development on geological and hydrogeological receptors and also potential effects of the existing ground and groundwater conditions on the Proposed Development.

Ground Contamination

4.4.2 In relation to ground contamination a preliminary qualitative risk assessment has been undertaken based on the source-pathway-receptor methodology For there to be an identifiable risk, not only must there be contaminants present on the site (i.e. a source) there must also be a receptor and a pathway which allows the source to impact upon the receptor. All three elements must be present before a contaminant linkage can be identified. This qualitative risk assessment has not required any modelling work.

4.4.3 In addition this assessment has been taken further into a generic quantitative risk assessment (GQRA) (CLR11 Stage 2) for the tunnel shaft locations, as intrusive ground investigation works have been undertaken in these locations. The methodology for the GQRA is presented in Appendix 11.7 Ground Investigation Information (**Document 5.11.2.7**).

Private Water Supplies

4.4.4 A Private Water Supply Risk Assessment has been undertaken and is presented as Appendix 11.6 (**Document 5.11.2.6**).

4.5 ASSESSMENT CRITERIA

4.5.1 The assessment of the significance of the effects related to geology and soils follows guidance in the DMRB Vol 11, Section 3, Part 11, Geology and Soils (Ref 11.20).

4.5.2 The assessment of the significance of effects on groundwater follows DMRB HD45/09, Part 10, Road Drainage and the Water Environment (Ref 11.21).

4.5.3 Slightly different approaches have been taken depending upon whether the assessment is of the Proposed Development affecting the baseline environment or aspects of the baseline environment, specifically contamination, affecting the Proposed Development structurally, or impacting upon construction workers.

Effects of the Proposed Development on the Baseline Environment

Sensitivity

4.5.4 The sensitivity or importance of the receptor reflects both the quality of the receptor and its ability to absorb an effect without perceptible change. The various levels of sensitivity used in this assessment, and examples, are described in Table 11.3.

Table 11.3 Criteria to determine the sensitivity of receptors

Sensitivity/ Importance	Criteria	Typical examples
Very High	Attribute has a high quality and rarity on regional or national scale, or is particularly sensitive to the type of development proposed.	Aquifer providing a regionally important water resource or supporting site protected under European and UK habitat legislation, such as a RAMSAR Site or a Site of Special Scientific Interest (SSSI); SPZ1; Critical social or economic uses (water supply, navigation or mineral extraction); and Nationally important geological/geomorphological features.
High	Attribute has a high quality and rarity on local scale or is highly sensitive to the type of development proposed.	Aquifer providing locally important water resource or supporting river ecosystem; Principal Aquifer; Important social and/or economic uses such as water supply, navigation or mineral extraction; and Regionally important geological/geomorphological features.
Medium	Attribute has a medium quality and rarity on local scale or a moderate sensitivity to the type of	Aquifer providing water for agricultural or industrial use with limited connection to surface water;

Table 11.3 Criteria to determine the sensitivity of receptors		
Sensitivity/ Importance	Criteria	Typical examples
	development proposed.	Secondary A and B Aquifers; Limited social or economic uses; and Locally important geological/geomorphological features.
Low	Attribute has a low quality or rarity on a local scale or has a low or negligible sensitivity to the type of development proposed.	Unproductive groundwater strata; Minimal or no economic or social uses; and Geology or geomorphology of less than local importance.

Magnitude

4.5.5 The magnitude of a potential effect considers the scale of the predicted change to the baseline condition, taking into account its spatial scale, but also its duration and reversibility (i.e. the magnitude may be moderated by the effects being temporary rather than permanent, short-term rather than long-term or reversible rather than irreversible). Definitions of the magnitude of effects are described in Table 11.4. It is unlikely that any effects on geology and soils would be beneficial, so the examples of magnitude all relate to adverse effects.

Table 11.4: Criteria to determine the magnitude of effect		
Magnitude	Criteria	Typical examples
Very High	Total loss or major alteration to key features of the baseline conditions such that post development character/composition of baseline condition will be fundamentally changed.	Pollution of potable sources of water abstraction or Principal Aquifer; Loss of, or extensive change, to an aquifer or groundwater supported designated wetlands; and Loss of, or extensive change, to nationally important geological/geomorphological features.

Table 11.4: Criteria to determine the magnitude of effect		
Magnitude	Criteria	Typical examples
High	Loss or alteration to one or more key features of the baseline conditions such that post development character/composition of baseline condition will be materially changed.	Partial loss or change to an aquifer – level or quality; Partial loss of the integrity of groundwater supported designated wetlands; and Permanent loss of regionally important geological/geomorphological features, or substantial changes to nationally important geological/geomorphological features.
Medium	Results in some measurable change in attributes quality or vulnerability compared to baseline conditions. Changes arising from the alteration will be detectable but not material; the underlying character/ composition of baseline condition will be similar to the post-development situation.	Measurable effect on aquifer (level or quality) but of limited size or proportion, which does not lead to a reduction in the aquifer status; Minor effects on groundwater supported wetlands; and, Minor changes to regionally important geological/geomorphological features or small changes to nationally important geological/geomorphological features without affecting status.
Low	Very little change from baseline conditions. Change is barely distinguishable, approximating to a 'no change' situation.	No measurable effect on groundwater, or geology/geomorphology.

Significance

4.5.6 The significance of a specific potential effect is derived from a combination of the sensitivity/importance of the feature and the magnitude of the effect. An indication as to the potential significance of effects can be then determined using the matrix presented in Table 11.5. Where there is a split,

reasoned judgement this has been undertaken and is detailed in section 9 mitigation and residual effects for each relevant effect. Effects can be beneficial or adverse and their significance Major, Moderate, Minor or Negligible (equivalent to a neutral effect in DMRB).

Table 11.5: Table of Significance Categories

Sensitivity of Resource	Magnitude of Effect			
	Very High	High	Medium	Low
Very High	Major	Major/ Moderate	Moderate/ Minor	Negligible
High	Major/ Moderate	Moderate/ Minor	Minor/ Negligible	Negligible
Medium	Moderate	Minor	Minor/ Negligible	Negligible
Low	Minor	Minor/ Negligible	Negligible	Negligible

Note – Shaded effects are considered to be Significant. The terminology is different from DMRB but approach and outcome are the same.

4.5.7 Any effect predicted to be **Minor** or **Negligible** is considered to be 'Not Significant'. Effects assessed as **Moderate** or **Major** are considered to be 'Significant'.

Effects of the Baseline Environment on the Proposed Development

4.5.8 The potential effects from contaminated soils, groundwater and ground gas on the Proposed Development have also been identified. These effects have been identified through a qualitative assessment using the same 'source-pathway-receptor' approach to determine the potential risks posed to construction workers, buildings/infrastructure, operation/maintenance workers, and during decommissioning of the Proposed Development.

4.5.9 The potential significance of these effects is reported in line with Table 11.6, which is broadly based on guidelines given in R&D Publication 66 (NHBC and Environment Agency, 2008) (Ref 11.26). The rationale for the assessment of significance is based on the risk assessment process and

therefore takes account of the different sensitivities (importance) of the potential receptors.

Table 11.6 Ground contamination assessment significance criteria	
Significance	Rationale for assessment of significance
Major Adverse	Highly elevated concentrations of contaminants likely to result in 'significant harm' to human health as defined by the EPA 1990, Part 2A, if exposure occurs. Major damage to controlled waters or other ecosystems, including soils and geology, which is likely to result in a substantial adverse change in its functioning. Catastrophic damage to crops, buildings or property.
Moderate Adverse	Elevated concentrations which could result in 'significant harm' to human health as defined by the EPA 1990, Part 2A if exposure occurs. Significant damage to controlled waters or other ecosystems, including soils and geology, which may result in a substantial adverse change in its functioning. Significant damage to crops, buildings or property.
Minor Adverse	Exposure to human health unlikely to lead to 'significant harm'. Minor or short lived damage to controlled waters or other ecosystems, including soils and geology which is unlikely to result in a substantial adverse change in its functioning. Minor damage to crops, buildings or property.
Negligible	No measurable effect on humans. No or minimal effect on controlled waters. No or minimal effects to soils, geology, buildings, structure and services.

4.5.10 The magnitude of effects for soils, geology, groundwater and ground contamination have been assessed taking control and management measures (CMM) into account. The assessment has considered the need for less standard or more invasive approaches to mitigation. Effects that remain once all mitigation measures have been taken into consideration are residual effects (see section 9 mitigation and residual effects). Temporary effects are considered in the construction, maintenance and decommissioning periods. Operational effects are considered to be permanent.

4.6 ASSUMPTIONS AND LIMITATIONS

4.6.1 The duration of dewatering for the placement of shallow foundations for pylons has been assumed to be three to six days per foundation.

5 Basis of Assessment

5.1 INTRODUCTION

5.1.1 The basis of assessment section sets out the assumptions that have been made in respect of the design flexibility maintained within the draft DCO. The assessment has also considered alternative scenarios and the sensitivity of the assessment to changes in the construction commencement year.

5.1.2 Details of the available flexibility are included in Chapter 3, Description of Proposed Development, (**Document 5.3**), Chapter 4, Construction, Operation, Maintenance and Decommissioning (**Document 5.4**) and are also considered in Chapter 6, EIA Methodology (**Document 5.6**).

5.2 FLEXABILITY ASSUMPTIONS

5.2.1 The main assessment has been undertaken based upon the design shown on the Works Plans (**Document 4.4**), the Construction Plans (**Documents 5.4.1.1 and 5.4.1.2**) and the Design Plans (**Document 4.13**). To take account of the flexibility allowed for in the DCO, the assessment has also considered the potential for effects to be of greater significance should any of the permanent or temporary infrastructure elements be moved within the LOD or Order Limits.

5.2.2 Where relocating temporary or permanent infrastructure within the LOD may have changed the significance of an effect, an environmental commitment has been made to restrict works in these areas. The Schedule of Environmental Commitments is provided in Volume 7 (**Document 7.4.2.1**) for more information.

5.2.3 Wherever there could be the potential for more significant effects as a result of re-locating a pylon and the new location could not be avoided, a commitment has been made in the CEMP (**Document 7.4**) to a staged approach of risk assessment and remediation. No areas have had to be excluded, as all areas of contamination are considered to be manageable in terms of remediation. Therefore, irrespective of where a pylon would be located it can be confirmed that although effects may be slightly increased

or decreased, there is no realistic potential for them to be of greater overall significance.

5.2.4 The assumptions made regarding the use of flexibility for the main assessment, and any alternative assessment, are set out in Table 11.7 below.

Table 11.7 Flexibility assumptions

Element of flexibility	Proposed Development assumption for initial assessment	Flexibility assumptions considered
Horizontal Limits of Deviation for pylons and conductors	The pylons are assessed in their current horizontal location as shown on the Works Plans (**Document 4.4**). The conductors have been assessed based on the location of the pylons and centreline shown on the Works Plans (**Document 4.4**).	Where use of the horizontal LOD could lead to different effects, these differences are identified in section 9.
Vertical Limits of Deviation for pylons and conductors.	Assessed at the heights shown on the Indicative Pylon Schedule (**Document 5.3.2.1**).	If extensions were required deeper foundations may be required. Wherever there could be the potential for more significant effects as a result of different foundation options, a commitment has been made in the CEMP (**Document 7.4**) to a staged approach of risk assessment and remediation. As a result it can be confirmed that although effects may be slightly increased or decreased, there is no realistic potential for them to be of greater overall significance.
Pylon footprint	The potential difference in footprint size is not substantial	N/A

Table 11.7 Flexibility assumptions		
Element of flexibility	Proposed Development assumption for initial assessment	Flexibility assumptions considered
	enough to lead to effects of different magnitudes. The assessment is therefore equally applicable to any potential footprint.	
Pylon foundation type	The foundations have all been assumed to be standard column and pad foundations, which are considered to be the worst case for geology and hydrogeology receptors.	N/A
Tunnel alignment within LOD	The only effects relate to the volume of arisings and these are calculated from a worst case (longest) alignment.	N/A
Tunnel depth	The assessment is based upon the indicative alignment, and the likely quantity of groundwater abstracted and rock excavated for this alignment.	No additional assumptions have needed to be assessed as it is considered highly unlikely that shafts or tunnel gradients leading to a substantially greater depth would be used, as deeper shafts/tunnel than necessary would add engineering operational complexity and cost.
Tunnel construction compounds	Construction work could take place anywhere within the compounds area identified on the Works Plans (**Document 4.4**).	N/A
Braint and Tŷ Fodol THH/CSEC/ and Pentir Substation	The assessment has been undertaken based on the maximum parameters shown on Design Plans (**Document**	N/A

Table 11.7 Flexibility assumptions		
Element of flexibility	Proposed Development assumption for initial assessment	Flexibility assumptions considered
	4.13).	
Access Tracks and Working Areas	Access tracks and working areas would be located where they are currently shown on the Construction Plans (**Document 5.4.1.1**). The assessment has considered the possible effects of locating access tracks and working areas anywhere else within the Order Limits.	Wherever there could be the potential for more significant effects as a result of different access track locations, and there is considered to be an increased risk of encountering contaminated or unstable ground, a commitment has been made in measure CL21 and CL22 of the CEMP (Document 7.4) to a staged approach of risk assessment and remediation. As a result it can be confirmed that although effects may be slightly increased or decreased, there is no realistic potential for them to be of greater overall significance.
Penmyndd Road Compound	Construction work could take place anywhere within the compounds area identified on the Works Plans (**Document 4.4**).	N/A
Pentir Construction Compound	Construction work could take place anywhere within the compounds area identified on the Works Plans (**Document 4.4**).	N/A
Third Party Services	It has been assumed that all third party services would be undergrounded within the LOD shown on the Third Party Services Construction Plans	Wherever there could be the potential for more significant effects as a result of different access track locations, and there is considered to be an

Table 11.7 Flexibility assumptions		
Element of flexibility	Proposed Development assumption for initial assessment	Flexibility assumptions considered
	(**Document 5.4.1.2**). Access tracks and working areas would be located where they are currently shown on the Third Party Services Construction Plans (**Document 5.4.1.2**).	increased risk of encountering contaminated or unstable ground, a commitment has been made in measure CL21 and 22 of the CEMP (**Document 7.4**) to a staged approach of risk assessment and remediation. As a result it can be confirmed that although effects may be slightly increased or decreased, there is no potential for them to be of greater overall significance.

5.3 CONSIDERATION OF SCENARIOS

5.3.1 There are three sets of options which have been considered by the assessment. These are:

- Option A and B as explained in Chapter 3, Description of Proposed Development (**Document 5.3**);
- Direction of and methodology for Tunnelling (Scenarios 1, 2 and 3) as explained in Chapter 4, Construction, Operation, Maintenance and Decommissioning (**Document 5.4**); and
- Construction traffic using the existing A5025 alignment or using the new alignment as proposed by Horizon Nuclear Power as explained in Chapter 4, Construction, Operation, Maintenance and Decommissioning (**Document 5.4**).

5.3.2 Table 11.8 details where these options are relevant to the geology, soils and groundwater assessment and how they have been assessed in section 9 mitigation and residual effects.

Table 11.8 Consideration of Scenarios	
Scenario	How it has been considered within the assessment
Option A and B as explained in Chapter 3, Description of Proposed Development (**Document 5.3**)	There is no difference between the options in terms of the potential for residual effects identified in this chapter. As such both Option A and Option B Order Limits have been assessed.
Direction and method of Tunnelling (Scenarios 1 and 2 and 3) as explained in Chapter 4, Construction, Operation, Maintenance and Decommissioning (**Document 5.4**)	Scenario 1 (Braint – Tŷ Fodol using a TBM), Scenario 2 (Tŷ Fodol to Braint using a TBM) and Scenario 3 (Drill and Blast Tunnel) may produce different amounts of material arising, as detailed in **Document 5.4**. However….. In addition there would be different rates of dewatering associated with different methods of tunnel construction and these differences are therefore considered in this chapter.
Construction traffic using the existing A5025 alignment or using the new alignment as proposed by Horizon Nuclear Power as explained in Chapter 4, Construction, Operation, Maintenance and Decommissioning (**Document 5.4**)	The options proposed relate only to the routeing of traffic which does not affect this assessment.

5.4 SENSITIVITY TEST

5.4.1 Under the terms of the draft DCO, construction could commence in any year up to five years following the grant of DCO. Consideration has been given for this in this chapter; it has therefore not been necessary to undertake a more detailed assessment for an alternative programme to that set out in Chapter 4, Construction, Operation, Maintenance and Decommissioning (**Document 5.4**).

5.4.2 It is possible that some construction activities may take a longer or shorter length of time to complete than currently predicted in the construction

programme used for the purposes of assessment. Certain assessment methodologies use defined durations when considering effects within the assessment, for example in relation to peak periods of construction, such as that considered for construction traffic effects (consideration is given to the peak week of traffic and the average weekly traffic over the peak year). To ensure a robust assessment, additional consideration has been given to any difference in the effects as assessed should there be any increase or decreases in the duration of individual construction activities, or indeed the construction programme as a whole.

5.4.3 For geology, hydrogeology and ground conditions it is considered that there is no potential for any changes to the duration of construction activities, or the programme as a whole, to alter the assessment findings as reported in section 9 mitigation and residual effects.

6 Study Area

6.1 STUDY AREA DESCRIPTION

6.1.1 In general the receptors and sources of contamination, have been identified within the Order Limits or within approximately 1 km of the Order Limits, as interaction between the Proposed Development and receptors, or sources, of contamination beyond 1 km would generally not occur as a result of the ground conditions present in and around the Proposed Development. Table 11.9 shows the study area for each source or receptor outlined in section 7 baseline conditions.

Table 11.9 Study Area For Each Source or Receptor

Source or Receptor	Approximate Search Area	Approximate Study Area
Soils	Order Limits	Order Limits
Geology	Order Limits	Order Limits
Geological Landscape Classification	Order Limits	Order Limits
Historical Boreholes	Within 250 m of the Order Limits	Order Limits + 50 m
Sites Designated for Geodiversity Interest	Within 1 km of the Order Limits	Order Limits
Hydrology	Within 2 km of the Order Limits	Order Limits + 2 km
Hydrogeology	Within 1 km of the Order Limits	Order Limits + 1 km
Groundwater Abstractions	Within 5 km of the Order	Order Limits + 1 km

Table 11.9 Study Area For Each Source or Receptor

Source or Receptor	Approximate Search Area	Approximate Study Area
	Limits	
Private Water Supplies	Within 2 km of the Order Limits	Order Limits + 200 m (1km for the tunnel shafts)
Potential Areas of Contaminated Land	Within 1 km of the Order Limits	Order Limits + 1 km
Discharge Consents	Within 1 km of the Order Limits	Order Limits + 100 m
Integrated Pollution and Prevention Controls	Within 1 km of the Order Limits	Order Limits + 1 km
National Incidents and Records of Pollution	Within 1 km of the Order Limits	Order Limits + 100 m
Registered Radioactive Substances	Within 1 km of the Order Limits	Order Limits + 1 km
Historical and Current Mineral Surface Ground Workings, Quarrying and Mining	Within 1 km of the Order Limits	Order Limits
Coal Mining	Within 1 km of the Order Limits	Order Limits + 500 m
Mineral Protection Area	Order Limits	Order Limits
Landfilling	Within 1 km of the Order Limits	Order Limits + 1 km
Waste Sites	Within 1 km of the Order Limits	Order Limits + 1 km

7 Baseline Conditions

7.1 INTRODUCTION

7.1.1 The following section provides a summary of the existing ground conditions within the respective subtopic study area for the Proposed Development. The information is presented based on the division of significant sources and receptors. Generally the baseline conditions presented refer to sources and receptors within the Order Limits; however, relevant significant sources and receptors identified that are located outside of the Order Limits that may affect or be affected by the Proposed Development, are also identified in the baseline.

7.1.2 Where descriptions are by sections A to F, these are set out in Chapter 3, Description of Proposed Development (**Document 5.3**).

7.2 SOILS

7.2.1 The Study Area for 'Soils' is limited to the area within the Order Limits.

7.2.2 Soil Survey of England and Wales (1984), Soils and their Use in Wales (Ref 11.27) identifies ten soil associations within the Order Limits. A summary of published soil association data is provided in Table 11.10 below, together with a calculation of the area each association occupies within the Order Limits. The distribution of these ten soil associations within the Order Limits is shown on Figure 18.5 (**Document 5.18.1.5**).

Table 11.10: Soil Associations within the Order Limits

Soil Association	Soil Series	Soil Type	Soil Characteristics	Area (ha). (% of total land within the Order Limits)
Eardiston 1 (541c)	Eardiston, Bromyard, Bromsgrove	Typical brown earths	Well drained reddish coarse loamy soils over sandstone, shallow in places especially on brows. Some reddish	12.7 (1.8 %)

Table 11.10: Soil Associations within the Order Limits

Soil Association	Soil Series	Soil Type	Soil Characteristics	Area (ha). (% of total land within the Order Limits)
			fine silty soils over shale and siltstone.	
Denbigh 1 (541j)	Denbigh, Powys, Sannan, Barton, Manod	Typical brown earths	Well drained fine loamy and fine silty soils over rock. Some similar soils with slowly permeable subsoils and slight seasonal waterlogging.	13.6 (1.9 %)
Wick 1 (541r)	Wick, Arrow, Newport	Brown Earths	Deep, well drained coarse sandy loam soils over glaciofluvial drift	53.3 (7.4 %)
East Keswick 1 (541x)	East Keswick, Nercwys, Arrow	Typical brown earths	Deep well drained fine loamy soils and similar soils with slowly permeable subsoils and slight seasonal waterlogging.	103.9 (14.5 %)
East Keswick 3 (541z)	East Keswick, Wilderhope, Crwbin	Typical brown earths	Well drained fine loamy soils often deep but sometimes over limestone. Very shallow soils in places.	91.2 (12.7 %)
Fforest (713c)	Fforest, Wenallt, Llangendeirne	Cambic stagnogley soils	Slowly permeable seasonally waterlogged reddish fine silty and fine loamy soils, some with a peaty surface horizon.	41.9 (5.8 %)
Cegin (713d)	Cegin, Greyland, Brickfield, Sannan, Denbigh	Cambic stagnogley soils, typical stagnogley soils, Pelo-	Slowly permeable seasonally waterlogged fine silty and clayey soils.	117.7 (16.4 %)

Table 11.10: Soil Associations within the Order Limits				
Soil Association	Soil Series	Soil Type	Soil Characteristics	Area (ha). (% of total land within the Order Limits)
		stagnogley soils		
Brickfield 2 (713f)	Brickfield, Nercwys, East Keswick	Cambic stagnogley soils, with Stagnogleyic and typical brown earths	Loamy and clayey soils with Impeded drainage.	248.7 (34.6 %)
Wilcocks 1 (721c)	Wilcocks, Kielder, Fordham	Cambic stagno-humic gley soils	Slowly permeable seasonally waterlogged fine loamy and fine loamy over clayey upland soils with a peaty surface horizon.	32.4 (4.5 %)
Conway (811b)	Conway, Clwyd, Fladbury	Typical alluvium gley soils	Deep stoneless fine silty and clayey soils variably affected by groundwater.	0.1 (<0.01 %)
Adventurers (1024a)	Adventurers Altcar	Amorphous and semi-fibrous peat	Deep peat soils.	3.4 (0.5 %)

7.2.3 The majority of the soils are classified as Brickfield 2, Cegin, and East Keswick 1&3, these make up approximately 80% of the soil types across the Proposed Development.

7.2.4 The sensitivity of the soils present within the study area is considered to be **Low.**

7.2.5 Details of the agricultural value of soils are provided in Chapter 18, Agriculture (**Document 5.18**).

7.3 GEOLOGY

7.3.1 The Study Area for 'Geology' is limited to the area within the Order Limits.

7.3.2 Published BGS geological maps (1:50,000 Map Sheets 92 & 96, parts of 94, 105 & 106) and GIS data sourced from the BGS indicate the Order Limits are underlain by the geological succession as summarised in Table 11.11 and shown in Figures 11.1 (**Document 5.11.1.1**) and 11.2 (**Document 5.11.1.2**). Descriptions of the geological units underlying the Order Limits are summarised below in Table 11.12. The majority of descriptions and definitions of the units are from the online BGS Lexicon of Named Rock Units.

Table 11.11: Summary of Geology within the Order Limits	
Summary of Geology for Section A	
Stratum Type	Description
Superficial	The majority of this section is indicated to be underlain by Glacial Till which comprises predominantly clays but also consists of silts, sands, gravels and boulders. Localised areas of Alluvium comprising clays, silts, sands and gravel are also present. Coastal Zone Deposits are present at the littoral zone of Wylfa Head which comprise of sands, silts and clay.
Bedrock	For the majority of this section the solid geology is generally indicated to be Mica Schist and Psammite of the New Harbour Group. Major exceptions to this are the schist and igneous rock of the Gwna Group at Wylfa and psammite and pelite of the South Stack Formation between Tyddyn Cywarch and Rosgoch.
Summary of Geology for Section B	
Stratum Type	Description
Superficial	The majority of this section is indicated to be underlain by Glacial Till which comprises predominantly clays but also consists of silts, sands, gravels and boulders. Occasionally Alluvium, consisting of clays, silts, sands and gravel may be

Table 11.11: Summary of Geology within the Order Limits	
	present, particularly west of Gaer Farm.
Bedrock	The majority of this section is underlain by Ordovician Rocks of interbedded mudstone and sandstone. Igneous intrusions are indicated to be present in the vicinity of Bodneithior.
Summary of Geology for Section C	
Stratum Type	Description
Superficial	The majority of this section is indicated to be underlain by Glacial Till which comprises predominantly clays but also consists of silts, sands, gravels and boulders. Localised areas of Glaciofluvial Deposits, consisting of sand and gravel are also present. Two large bands of Alluvium are shown in the vicinity of Cefn-Du Mawr.
Bedrock	This section is predominantly underlain by hornfels, schists and micas from various geological groups with the predominant group being the Central Anglesey Shear Zone. Sedimentary bedrock includes the Red Sandstone of the Old Red Sandstone Group and interbedded sandstones and mudstones in the vicinity of Capel Coch. East of Capel Coch is the Lligwy Sandstone Formation which is formed of interbedded sandstone and conglomerate. The entire length of the section is crossed with occasional bands of igneous and metamorphic rock types such as hornblende.
Summary of Geology for Section D	
Stratum Type	Description
Superficial	The majority of this section is indicated to be underlain by Glacial Till which comprises predominantly clays but also consists of silts, sands, gravels and boulders. Localised areas of Glaciofluvial Deposits, consisting of sand and gravel are also present. A band of Tidal Flat Deposits crosses the corridor in

Table 11.11: Summary of Geology within the Order Limits	
	association with the Afon Ceint.
Bedrock	This section is underlain by sandstone in the vicinity of the B5110 and limestone from Talwrn to the B5420. In the area of Plas Pynmyndd Farm there is an intrusion of igneous rocks from the east of the corridor. South of this area the mapping indicates a band of mudstone and sandstone with a band of schist.
Summary of Geology for Section E	
Stratum Type	Description
Superficial	The land immediately adjacent to the Afon Ceint is underlain Tidal Flat Deposits of organic sands, gravels, silts and clays. The rest of the section is predominantly underlain by Glacial Till which comprises predominantly clays but also consists of silts, sands, gravels and boulders. Occasionally, there are pockets of Alluvium in the southern portion of this section.
Bedrock	The bedrock in this section is comprised of limestone of the Clwyd Limestone Group in the vicinity of the Afon Ceint. This gives way to interbedded mudstones and sandstones of Ordovician Rocks around Cefn Poeth. South of Cefn Poeth the bedrock is dominated by the Central Anglesey Shear Zone and the Berw Shear Zone which comprise schist and mica. Occasionally, pockets of gneiss and hornblende are to be found in this section.
Summary of Geology for Section F	

Table 11.11: Summary of Geology within the Order Limits	
Stratum Type	Description
Superficial	The overhead line (OHL) is underlain by Alluvium at the position of dividing line between sections E and F. As the OHL joins the Braint Tunnel Head House / Cable Sealing End Compound it is underlain by Glacial Till. An area of Alluvium is indicated by geological mapping to be south-east of the Braint within the LOD. An area of Head deposits is present approximately 150 m north-west of the Tŷ Fodol Construction Compound which again gives way to Glacial Till as the tunnel alignment reaches the Tŷ Fodol Construction Compound. The Tŷ Fodol Construction Compound is predominantly underlain by Glacial Till with the OHL to the Pentir Substation crossing a band of Alluvium and Peat.
Bedrock	The area near Afon Braint is dominated by the Central Anglesey Shear Zone and Berw Shear Zone, which are comprised of schist and mica. The northern bank of the Menai Strait is underlain by limestone of the Clwyd Limestone Group. From the southern bank of the Menai Strait, the LOD of the tunnel is entirely underlain by limestone of the Loggerheads Limestone Formation crossing two bands of sandstone of the same geological group in the vicinity of Vaynol Park. South-east of Vaynol Park sedimentary rocks dominate with the alignment passing through sandstone of the Allt Lwyd Formation in addition to a short section of conglomerate, mudstone and sandstone belonging to the Minffordd Formation. The Tŷ Fodol Construction Compound is underlain by felsic tuff of the Padarn Tuff Formation. The OHL to the Pentir Substation is underlain by the Minifordd Formation which in this area also consists of interbedded conglomerate and sandstone.

Table 11.12: Detailed Description of Encountered Geological Units

Table 11.12: Detailed Description of Encountered Geological Units	
Geological Unit	Description
Peat	Two main lithologies: 'brushwood' (freshwater) peat and 'phragmites' (brackish water) peat; may be an organic-rich clay; humic deposits accumulation of wet, dark brown, partially decomposed vegetation.
Alluvium	Normally soft to firm consolidated, compressible silty clay, but can contain layers of silt, sand, peat and basal gravel. A stronger, desiccated surface zone may be present.
Coastal Zone Deposits	Shingle, gravel, sand, silt and clay, locally with peat layers; may be bedded or chaotic; from the coastal zone.
Marine Beach Deposits	Shingle, sand, silt and clay; may be bedded or chaotic; beach deposits may be in the form of dunes, sheets or banks; in association with the marine environment.
Tidal Flat Deposits	Normally consolidated soft silty clay, with layers of sand, gravel and peat. Characteristically low relief; from the tidal zone.
Glacial Till	No Description within BGS Lexicon of Named Rock Units. Glacial Till is derived from the abrasive action of glaciers. The deposited material is often heterogeneous in nature and can consist of soft to stiff clays, fine to medium sands and gravels as well as cobbles and boulders of various lithologies.
Glaciofluvial Deposits	Sand and gravel, locally with lenses of silt, clay or organic material; of glaciofluvial origin.
Central Anglesey Shear Zone	No Description within BGS Lexicon of Named Rock Units. 1:50,000 scale geological mapping indicates that schists and mica are the main rock types in the part of the unit underlying the Proposed Development.

Table 11.12: Detailed Description of Encountered Geological Units	
Clwyd Limestone Group	Diverse range of limestone facies with subordinate sandstone and mudstone units, exhibiting local dolomitisation. Records the initiation and growth of a carbonate platform along the northern flank of the Wales-Brabant Massif.
Gwna Group	Grit, phyllite, quartzite, limestone, jasper, graphitic phyllite, spilitic pillow lavas and tuffs.
Lligwy Sandstone Formation	Cross-bedded sandstones, pebbly sandstones and conglomerates with subordinate siltstone and mudstone beds. Records fluvial deposition along the margin of the North Wales Dinantian platform throughout the late Asbian.
Loggerheads Limestone Formation	Thickly bedded, massive, pale grey shelly limestones (packstones and grainstones), locally mottled and pseudo-brecciated, arranged in shoaling upwards cycles capped by calcretes, hummocky palaeokarstic surfaces and associated thin bentonitic clay seams (palaeosols) and rare coals. Locally dolomitised and with scattered chert nodules. The Loggerheads Limestone Formation records late Asbian platform carbonate deposition on the North Wales Dinantian shelf. Each cyclic sequence records a shoaling upwards unit developed in response to transgressive and regressive movements in sea level. Many regressions culminated in emergence of the platform surface and the formation of calcrete and karstic dissolution features. During these periods of emergence, wind blown volcanic ash accumulated on the platform surface to form thin bentonitic soils.
Minifordd Formation	No Description within BGS Lexicon of Named Rock Units. 1:50,000 scale geological mapping indicates that conglomerates, mudstones and sandstones are the main rock types in the part of the unit underlying the Proposed Development.
New Harbour Group	Fissile green mica schist, gritty green mica schist, with bedded jasper, jaspery phyllite and pelitic lava.

Table 11.12: Detailed Description of Encountered Geological Units	
Old Red Sandstone Group	No Description within BGS Lexicon of Named Rock Units. 1:50,000 scale geological mapping indicates that sandstone is the main rock type in the part of the unit underlying the Proposed Development.
Ordovician Rocks	No Description within BGS Lexicon of Named Rock Units. 1:50,000 scale geological mapping indicates that interbedded mudstones and sandstones are the main rock types in the part of the unit underlying the Proposed Development.
Padarn Tuff Formation	Strongly welded rhyolitic ash-flow tuffs with abundant phenocrysts of quartz and sodic plagioclase, subordinate air-fall tuffs and rhyolite lavas.
South Stack Formation	Schistose greywackes with partings of mica-schist, or interbedded metasandstones, pelites and subordinate quartzites.

Historical BGS Borehole Logs

7.3.3 The BGS holds the records of 45 historical boreholes within the Order Limits, and an additional 15 within close proximity to the existing 400 kV line. Most of the records are related to the ground investigation for the existing pylons. The records received have limited geological descriptions, and a summary is in Table 11.13. Locations of historical boreholes are shown on Figure 11.2 (**Document 5.11.1.2**). It should be noted that on the log that each strata is recorded to the bottom of that strata. It has therefore been assumed that the depth to the bottom of the strata, for the strata described as rock, is the base of the borehole and therefore the depth of the bedrock is unproven.

Table 11.13 Historic BGS Boreholes

BGS Borehole number	Current Pylon	Nearest Proposed Pylon	Geological Strata	Depth to bottom of strata (mbgl) (as described on log)
SH39SE1	4AP003	4ZA006	Superficial	2.53
			Rock	3.14
SH39SE2	4AP004	4ZA007	Superficial	2.43
			Rock	4.45
SH39SE3	4AP006	4ZA009	Superficial	0.60
			Rock	3.22
SH39SE4	4AP007	4ZA010	Superficial	2.53
			Rock	3.14
SH39SE5	4AP008	4ZA012	Superficial	3.45
SH39SE6	4AP009	4ZA013	Superficial	2.23
			Rock	3.14
SH39SE7	4AP011	4ZA015	Superficial	1.62
			Rock	3.14
SH39SE8	4AP012	4ZA016	Superficial	4.09
SH39SE9	4AP013	4ZA017	Superficial	3.45

Table 11.13 Historic BGS Boreholes

BGS Borehole number	Current Pylon	Nearest Proposed Pylon	Geological Strata	Depth to bottom of strata (mbgl) (as described on log)
SH39SE10	4AP014	4ZA018	Superficial	1.52
			Rock	5.53
SH39SE11	4AP015	4ZA019	Superficial	2.99
			Rock	4.21
SH39SE12	4AP016	4ZA020	Superficial	0.06
			Rock	3.81
SH39SE13	4AP017	4ZA021	Superficial	1.52
			Rock	3.14
SH39SE14	4AP018	4ZA022	Superficial	1.82
			Rock	3.73
SH38NE1	4AP019	4ZA023	Superficial	0.30
			Rock	3.45
SH48NW1	4AP020	4ZA024	Superficial	0.60
			Rock	3.73
SH48NW2	4AP021	4ZA025	Superficial	0.30
			Rock	5.23

Table 11.13 Historic BGS Boreholes

BGS Borehole number	Current Pylon	Nearest Proposed Pylon	Geological Strata	Depth to bottom of strata (mbgl) (as described on log)
SH48NW3	4AP022	4ZA026	Superficial	0.22
			Rock	3.14
SH48NW4	N/A	4AP024 and 4ZA028	Superficial	0.10
			Rock	3.70
SH48NW5	N/A	4AP025 and 4ZA029	Superficial	0.15
			Rock	3.20
SH48NW6	N/A	4AP027 and 4ZA031	Superficial	2.13
			Rock	3.16
SH48NW7	N/A	4AP028 and 4ZA032	Superficial	3.04
			Rock	3.30
SH48NW8	N/A	4AP029 and 4ZA033	Superficial	2.74
			Rock	3.16
SH48NW9	N/A	4AP030 and 4ZA034	Superficial	0.91
			Rock	3.27
SH48NW10	4ZA035	4AP031	Superficial	2.84
SH48NW11	4ZA036	4AP032	Superficial	4.01

Table 11.13 Historic BGS Boreholes

BGS Borehole number	Current Pylon	Nearest Proposed Pylon	Geological Strata	Depth to bottom of strata (mbgl) (as described on log)
			Rock	4.62
SH48NW12	4ZA037	4AP033	Superficial	3.25
SH48NW13	4ZA038	4AP034	Superficial	2.53
			Rock	4.19
SH48NW14	4ZA039	4AP035	Superficial	4.31
			Rock	4.92
SH48NW15	4ZA040	4AP036	Superficial	3.04
			Rock	4.09
SH48NW16	N/A	4AP037 and 4ZA041	Superficial	3.42
SH48NW17	4AP038	4ZA042	Superficial	3.65
SH48NW18	4AP039	4ZA043	Superficial	1.21
			Rock	3.96
SH48SE2	4AP040	4ZA044	Superficial	0.30
			Rock	3.50
SH48SE3	N/A	4AP041	Superficial	1.82

Table 11.13 Historic BGS Boreholes

BGS Borehole number	Current Pylon	Nearest Proposed Pylon	Geological Strata	Depth to bottom of strata (mbgl) (as described on log)
		and 4ZA045	Rock	3.25
SH48SE4	N/A	4AP042 and 4ZA046	Superficial	1.52
			Rock	3.25
SH48SE5	4ZA047	4AP043	Superficial	3.50
			Rock	4.41
SH48SE6	4ZA048	4AP044	Superficial	1.82
			Rock	3.17
SH48SE7	4ZA049	4AP045	Superficial	1.52
			Rock	3.52
SH48SE8	4ZA050	4AP046	Superficial	3.04
			Rock	5.66
SH48SE9	4ZA051	4AP047	Superficial	4.11
SH48SE10	4ZA053	4AP049	Superficial	2.53
			Rock	3.40
SH48SE11	4ZA055	4AP052	Superficial	1.44
			Rock	3.25

Table 11.13 Historic BGS Boreholes

BGS Borehole number	Current Pylon	Nearest Proposed Pylon	Geological Strata	Depth to bottom of strata (mbgl) (as described on log)
SH48SE12	4ZA056	4AP054	Superficial	2.13
			Rock	5.33
SH48SE13	4ZA057	4AP055	Superficial	2.23
			Rock	3.45
SH57SW5	AZA082	N/A	Superficial	3.35
SH57SW6	AZA083	N/A	Superficial	3.35
SH57SW7	AZA084	N/A	Superficial	3.01
			Rock	3.35
SH57SW8	AZA085	N/A	Superficial	3.35
SH57SW9	AZA086	N/A	Superficial	3.35
SH57SW10	AZA087	N/A	Superficial	3.01
SH57SW11	AZA088	N/A	Superficial	3.35
SH57SW12	AZA089	N/A	Superficial	5.17

Table 11.13 Historic BGS Boreholes

BGS Borehole number	Current Pylon	Nearest Proposed Pylon	Geological Strata	Depth to bottom of strata (mbgl) (as described on log)
SH57SW13	AZA090	N/A	Superficial	4.57
SH57SW14	AZA091	N/A	Superficial	4.87
SH57SW15	AZA092	N/A	Superficial	4.57
SH57SW16	AZA093	N/A	Superficial	0.60
			Rock	4.57
SH57SW17	AZA094	N/A	Rock	4.57
SH57SW18	AZA095	N/A	Superficial	0.45
			Rock	4.57
SH57SW19	AZA096	N/A	Superficial	0.45
			Rock	4.57

Sites Designated for Geodiversity Interest

7.3.4 Three Regionally Important Geodiversity Sites (RIGS) have been identified within 1km of the Order Limits, in the vicinity of Wylfa Nuclear Power Station. These are Porth Wnal Dolerite, Porth Wnal Granite and Cemaes Bay. These features are not within the OHL LOD and as such are not considered further. Additionally, the whole of Anglesey is designated as a Geopark (GeoMôn). A Geopark is a UNESCO-designated area containing one or more sites of particular geological importance, intended to conserve

the geological heritage and promote public awareness of it. The majority of the sites are located along the coastal area of Anglesey. None of the sites of geological importance are within the Order Limits and none are considered to be within areas that may be affected by the Proposed Development.

7.4 HYDROLOGY

7.4.1 The Study Area for 'Hydrology' is within the 2 km of the Order Limits.

7.4.2 The study area contains a number of surface water features which are discussed in Chapter 12, Water Quality, Resources and Flood Risk (**Document 5.12**). Table 11.14 provides a list of the fresh water dependent designated sites which lie within the Local and Wider Hydrological Study Areas and where a flow pathway exists from the Proposed Development to the designated site. These are also included in this assessment, because of the potential for mobilised contaminants from existing contaminated ground to reach these designated sites and a potential for groundwater continuity.

Table 11.14: Fresh Water Dependent Designated Sites

Designated Site	Relevant Aquatic Designated Feature	Hydrological/ Hydrogeological Connectivity To The Proposed Development
Local Hydrological Study Areas		
Tre'r Gof SSSI	Mineral rich wetland	Located approximately 45 m downslope of the Section A Order Limits. There are no watercourses which connect the Proposed Development to the SSSI.
Llyn Alaw SSSI and Drinking Water Protected Area (DWPA)	Lake	Located over 400 m downslope from the Section B Order Limits. Also downstream of watercourses crossing the Order Limits. Potential

Table 11.14: Fresh Water Dependent Designated Sites		
Designated Site	Relevant Aquatic Designated Feature	Hydrological/ Hydrogeological Connectivity To The Proposed Development
		direct pathway from within the Order Limits.
Cors Erddreiniog (part of the Anglesey Fens SAC/SSSI/Ramsar/NNR)	Wetland habitat – calcareous/alkaline fens and meadows on clay-silt soils.	Located adjacent to and within the Section C Order Limits. Also downstream of watercourses within the Order Limits. Potential direct pathways from within the Order Limits.
Caeau Talwrn (SSSI)	Mixture of dry grassland and wetland habitat – blunt flowered rush	Located within the Section D Order Limits, potential direct runoff from within the Order Limits.
Cors Tregarnedd Mawr Wildlife Site	Wetland habitat connected to the Malltraeth Marshes.	
Y Fenai a Bae Conwy/ Menai Strait and Conwy Bay SAC	Wetland habitat. Meadows and ditches. Potentially vulnerable to turbid or contaminated surface water flow.	Located more than 2 km downstream of the Section F Order Limits. Potential pathway from within the Order Limits.
Wider Hydrological Study Areas		
Malltraeth Marshes (SSSI)	Wetland habitat. Meadows and ditches.	Located more than 2 km downstream of the Order Limits. Potential pathway from within the Order Limits.

7.5 HYDROGEOLOGY

7.5.1 The Study Area for 'Hydrogeology' is within 1 km, of the Order Limits.

7.5.2 Hydrogeology within the Order Limits and within 1 km of, the boundary of the Order Limits are shown on Figure 11.3 (**Document 5.11.1.3**) and Figure 11.4 (**Documents 5.11.1.4**). The hydrogeology within the Study Area is summarised in Table 11.15.

Table 11.15: Summary of Hydrogeology within the Study Area			
Summary of Hydrogeology for Section A			
Stratum	Description	Aquifer Designation	Sensitivity
Superficial Deposits	Alluvium	Secondary A Aquifer	Medium
	Coastal Zone Deposits	Secondary B Aquifer	Medium
	Glacial Till	Secondary (Undifferentiated)	Medium
Bedrock	All Units	Secondary B Aquifer	Medium
Summary of Hydrogeology for Section B			
Stratum	Description	Aquifer Designation	Sensitivity
Superficial Deposits	Alluvium	Secondary A Aquifer	Medium
	Glacial Till	Secondary (Undifferentiated)	Medium
Bedrock	All Units	Secondary B Aquifer	Medium
Summary of Hydrogeology for Section C			
Stratum	Description	Aquifer Designation	Sensitivity

Table 11.15: Summary of Hydrogeology within the Study Area			
Superficial Deposits	Glaciofluvial Deposits	Secondary A Aquifer	Medium
	Alluvium	Secondary A Aquifer	Medium
	Glacial Till	Secondary (Undifferentiated)	Medium
Bedrock	Lligwy Sandstone Formation	Principal Aquifer	High
	Clwyd Limestone Group	Principal Aquifer	High
	Old Red Sandstone Supergroup	Secondary A Aquifer	Medium
	Coedana Complex	Secondary B Aquifer	Medium
	Central Anglesey Shear Zone and Berw Shear Zone	Secondary B Aquifer	Medium
	Gwna Group	Secondary B Aquifer	Medium
	Ordovician Rocks	Secondary B Aquifer	Medium
Summary of Hydrogeology for Section D			
Stratum	Description	Aquifer Designation	Sensitivity

Table 11.15: Summary of Hydrogeology within the Study Area			
Superficial Deposits	Glaciofluvial Deposits	Secondary A Aquifer	Medium
	Alluvium	Secondary A Aquifer	Medium
	Glacial Till	Secondary (Undifferentiated)	Medium
	Tidal Flat Deposits	Unproductive Superficial Aquifer	Low
Bedrock	Lligwy Sandstone Formation	Principal Aquifer	High
	Clwyd Limestone Group	Principal Aquifer	High
	Gwna Group	Secondary B Aquifer	Medium
Summary of Hydrogeology for Section E			
Stratum	Description	Aquifer Designation	Sensitivity
Superficial Deposits	Glaciofluvial Deposits	Secondary A Aquifer	Medium
	Alluvium	Secondary A Aquifer	Medium
	Glacial Till	Secondary (Undifferentiated)	Medium
	Tidal Flat Deposits	Unproductive Superficial Aquifer	Low

Table 11.15: Summary of Hydrogeology within the Study Area			
Bedrock	Clwyd Limestone Group	Principal Aquifer / Secondary A Aquifer	High
	Lligwy Sandstone Formation	Principal Aquifer	High
	Gwna Group - Schist	Secondary B Aquifer	Medium
	Ordovician Rocks	Secondary B Aquifer	Medium
	Coedana Complex	Secondary B Aquifer	Medium
	Central Anglesey Shear Zone and Brew Shear Zone	Secondary B Aquifer	Medium
Summary of Hydrogeology for Section F			
Stratum	Description	Aquifer Designation	Sensitivity
Superficial Deposits	Marine Beach Deposits	Secondary A Aquifer	Medium
	Alluvium	Secondary A Aquifer	Medium
	Glacial Till	Secondary (Undifferentiated)	Medium
	Coastal Zone Deposits	Secondary (Undifferentiated)	Medium

Table 11.15: Summary of Hydrogeology within the Study Area			
	Clay, Silt, Sand and Gravel (Unlitihified Deposits)	Secondary (Undifferentiated)	Medium
	Peat	Unproductive Strata	Low
Bedrock	Clwyd Limestone Group	Principal Aquifer	High
	Loggerheads Limestone Group	Principal Aquifer	High
	Padarn Tuff Formation	Secondary A Aquifer	Medium
	Alt Lywd Formation	Secondary A Aquifer	Medium
	Minffordd Formation	Secondary A Aquifer	Medium
	Central Anglesey Shear Zone	Secondary B Aquifer	Medium
Summary of Hydrogeology for Braint THH and CSEC			
Stratum	Description	Aquifer Designation	Sensitivity
Superficial Deposits	Glacial Till	Secondary (Undifferentiated)	Medium

Table 11.15: Summary of Hydrogeology within the Study Area			
Bedrock	Central Anglesey Shear Zone	Secondary B Aquifer	Medium
Summary of Hydrogeology for Tŷ Fodol THH and CSEC			
Stratum	Description	Aquifer Designation	Sensitivity
Superficial Deposits	Glacial Till	Secondary (Undifferentiated)	Medium
Bedrock	Padarn Tuff Formation	Secondary A Aquifer	Medium

Groundwater Abstractions

7.5.3 The Study Area for 'Groundwater Abstractions' is within 1 km of the Order Limits.

7.5.4 Information was provided by NRW regarding groundwater abstractions within 5 km of the Order Limits. On analysis of the data it was found that none of the abstractions are within 1 km of the Order Limits and all therefore were outside of the Study Area.

Private Water Supplies

7.5.5 Information regarding private water supplies and groundwater has been obtained from IACC and Gwynedd Council within 2 km of the Order Limits. In addition some private water supplies have been identified during site reconnaissance visits and through interaction of the North Wales Connection project team with landowners. The Study Area for private water supplies and groundwater abstractions is within 200 m of the Order Limits as well as those within 1 km of the THH. The locations of identified private water supplies are shown in Figure 11.6 (**Document 5.11.1.6**) and are identified in Table 11.16. The Private Water Supply Risk Assessment and methodology is presented as Appendix 11.6 (**Document 5.11.2.6**).

Table 11.16: Private Water Supplies			
Number/Name on Figure	Eastings	Northings	Section
Isle of Anglesey County Council Public Wells			
IPW001	235930	392620	A
IPW002	236250	392620	A
IPW003	236250	392200	A
IPW004	238800	389890	A
IPW005	239300	389910	A
IPW006	239300	389910	A
IPW007	242250	388030	B
IPW008	242040	387810	B
IPW009	243370	386300	B
IPW010	245030	384650	C
IPW011	246350	382460	C
IPW012	245580	381290	C
IPW013	245920	380300	C
IPW014	248440	377350	D
IPW015	251100	372210	E
IPW016	250850	372100	E

Table 11.16: Private Water Supplies			
Number/Name on Figure	Eastings	Northings	Section
Isle of Anglesey County Council Private Water Supplies			
Number/Name on Figure	Eastings	Northings	Section
IPSW001	240346	389234	B
IPSW002	244605	385329	B
IPSW003	249166	372796	E
IPSW004	252157	371754	F
IPSW005	251329	370696	F
Private Water Supplies Identified During Site Surveys and Interaction with Landowners			
APWS001	246985	380198	C
DPWS001	237437	391101	A
DPWS004	239309	389904	A
DPW006	242561	386881	B
DPW008	243970	385846	B
DPW009	244050	386168	B
DPW010	244119	386255	B
DPW011	244926	384281	C

Table 11.16: Private Water Supplies			
Number/Name on Figure	Eastings	Northings	Section
DPW019	247174	380175	C
DPW020	247370	378559	C
DPW021	247371	378694	C
DPW022	248576	375168	D
DPW027	249539	372972	E
DPW030	250630	370985	E
DPW036	254134	367829	F
DPW037	254339	368391	F
DPW038	255307	367712	F

7.6 GROUND INVESTIGATION INFORMATION

7.6.1 Intrusive ground investigations were undertaken to obtain preliminary geotechnical and geo-environmental information for the onshore areas between the proposed Braint and Tŷ Fodol THH/CSECs and several overhead line pylon locations. These investigations were limited to terrestrial areas and provided more detailed information of the geology and groundwater conditions at the locations where the tunnel shafts and several pylons would be located.

7.6.2 To date the investigations have consisted of the following:

- 31 No. Boreholes progressed to depths between 4.20 mbgl (metres below ground level) and 122.40 m bgl using cable percussive and rotary coring techniques;

- 15 No. machine dug Trial Pits progressed to depths between 1.20 mbgl and 4.50 mbgl; and

- Contamination testing on 23 No. soil samples from 13 No. exploratory holes; 14 No. leachate samples from 12 No. exploratory holes; and 18 No. groundwater samples from 18 No. groundwater monitoring wells. Three rounds of ground gas monitoring have been undertaken from a gas monitoring well installed in a borehole (BH210A) designed to investigate the ground gas regime in the vicinity of the Tŷ Fodol THH/CSEC deemed to potentially be at risk from ground gas ingress from the Nant y Garth Landfill. All monitoring wells were installed within natural strata.

7.6.3 Details regarding the locations of exploratory holes, engineer's logs of exploratory holes and results of contamination testing are included as Appendix 11.7 Ground Investigation Information (**Document 5.11.2.7**).

7.6.4 A contamination screening assessment is included in Appendix 11.7 (**Document 5.11.2.7**). The findings of the contamination assessments carried out on soil, leachate and groundwater samples taken from the exploratory holes is summarised as follows:

- One soil sample (taken from borehole BH06 at 0.30 m bgl) contained slightly elevated Semi volatile Organic Compounds (SVOCs) above the limit of detection used as a conservative assessment criterion where no calculated guideline is available. The remainder of the soils did not exceed the human health screening criteria for a commercial end use for any of the chemicals tested;

- The majority of the leachate samples marginally exceeded the screening criteria for a selection of metals in controlled waters; three samples also marginally exceeded the criteria for Polycyclic Aromatic Hydrocarbons (PAHs). However, the exceedances were marginal and are likely to be representative of a worst case leaching from samples;

- The majority of the groundwater samples exceeded the chosen screening criteria for a number of metals. One sample (taken from borehole BH102) also contained low levels of the SVOCs n-Dibuytlpthalate, Phenol and Napthalene, the Volatile Organic Compound (VOC) Bezene and Total Petroleum Hydrocarbons (TPH); and

- Three rounds of ground gas monitoring undertaken on BH210A (targeting the Braint THH/CSEC) did not record levels of methane,

hydrogen sulphide or carbon monoxide at levels above the limit of detection and therefore not at levels harmful to human health as defined by the Health and Safety Executive Work Place Exposure Limits (EH40/2005). Carbon dioxide was present at concentrations of up to 1.4% by volume which is above the long-term exposure limits of 0.5% but below the short-term exposure of 1.5% as defined by the Health and Safety Executive Work Place Exposure Limits (EH40/2005).

7.6.5 Table 11.17 below presents a summary of the ground conditions encountered across the 46 exploratory holes. The spatial variation of geological units encountered generally reflects what is indicated by the BGS mapping, which is also summarised in Table 11.12 above. Groundwater strikes/seepages are summarised in Table 11.18. The groundwater monitoring results are summarised in Table 11.19. A geological longitudinal section based on the intrusive ground investigations is shown in Figure 11.11 (**Document 5.11.1.11**).

Table 11.17: Summary of Stratigraphy

Geological Unit	Typical Description	Range of depths to top of stratum (mbgl)	Range of thickness (m)
Braint THH/CSEC			
Topsoil	Brown slightly gravelly sandy CLAY / Brown slightly gravelly, clayey SAND	0.00	0.10 – 0.45
Glacial Till	Soft to stiff brown sandy gravelly CLAY	0.10 – 4.00	0.15 – 1.60
Glaciofluvial Deposits	Medium dense slightly clayey gravelly SAND or medium dense very sandy GRAVEL	0.60 – 8.70	0.70 – 2.00
Central Anglesey Shear Zone	Strong very narrowly to narrowly banded dark purple and bluish green fine grained fresh MICA	2.15 – 62.42	0.05 – >24.62

Table 11.17: Summary of Stratigraphy			
Geological Unit	Typical Description	Range of depths to top of stratum (mbgl)	Range of thickness (m)
and Berw Shear Zone	SCHIST.		
Microgabbro – Igneous Intrusion	Very strong massive black to greenish grey fine grained fresh MICROGABBRO	58.23 – 59.00	0.42 – 3.42
Braint THH/CSEC to the northern bank of the Menai Strait			
Topsoil	Brown slightly gravelly sandy CLAY / Brown slightly gravelly, clayey SAND	0.00	0.20 – 0.45
Alluvium (only encountered in BH104)	Soft brown slightly gravelly sand CLAY/ loose grey GRAVEL	0.25 – 2.00	0.55 – 1.20
Glacial Till	Soft to stiff brown sandy gravelly CLAY	0.20 – 5.35	0.20 – 1.95
Glaciofluvial Deposits (only encountered in BH106)	Loose to medium dense brown slightly clayey sandy GRAVEL	3.40 – 4.50	0.10- 1.10
Central Anglesey Shear Zone and Berw Shear Zone	Highly weathered to strong very narrowly to narrowly banded dark purple and bluish green fine grained fresh MICA SCHIST and HORNBLENDE.	2.80 – 6.10	0.25 – >70.55

Table 11.17: Summary of Stratigraphy			
Geological Unit	Typical Description	Range of depths to top of stratum (mbgl)	Range of thickness (m)
Clwyd Limestone Group (only encountered in BH106)	Alternates between subordinate layers of weak to strong thinly to thickly laminated brownish grey fine grained fresh SANDSTONE, medium strong lenticular dark brown MUDSTONE, weak thinly laminated dark grey fresh SILTSTONE and strong massive grey and brownish grey fine grained fresh argillaceous LIMESTONE.	4.80	>64.50
Southern bank of the Menai Strait to Tŷ Fodol THH/CSEC			
Topsoil	Brown slightly gravelly sandy CLAY / Brown slightly gravelly, clayey SAND	0.00	0.10 – 0.50
Alluvium	Soft brown slightly gravelly sandy CLAY/ Loose brown slightly clayey gravelly SAND	0.10 – 0.40	0.15 – 1.00
Glacial Till	Soft to stiff brown sandy gravelly CLAY	0.10 – 1.60	0.20 – 1.80
Glaciofluvial Deposits	Medium dense slightly clayey gravelly SAND or medium dense very sandy GRAVEL	0.30 – 1.90	0.30 – 4.80
Loggerheads Limestone Formation	Highly weathered or weak to strong grey LIMESTONE which alternates with subordinate layers of weak thinly laminated	1.20 – 77.07	0.60 – >90.00

Table 11.17: Summary of Stratigraphy			
Geological Unit	Typical Description	Range of depths to top of stratum (mbgl)	Range of thickness (m)
	dark grey fresh SILTSTONE and weak thinly laminated grey fresh MUDSTONE. Can also include layers of conglomaritic SANDSTONE		
Padarn Tuff Formation	Weak to medium strong medium to thin laminated grey to dark grey to brownish pink fine grained TUFF	2.00 – 52.05	0.74 –>46.10
Nant Ffrancon Subgroup Siltstone (only encountered in BH206)	Weak thinly laminated grey slightly weathered SILTSTONE	8.00	13.35
Dolerite (only encountered in BH208)	Strong massive grey fine grained slightly weathered DOLERITE	18.14 – 51.12	0.64 – 0.93
Tŷ Fodol THH/CSEC			
Topsoil	Brown slightly gravelly sandy CLAY / Brown slightly gravelly, clayey SAND	0.00	0.30 – 0.50
Head Deposits	Very dense brown slightly clayey gravelly SAND	0.30 – 2.00	0.15 – 2.00
Glacial Till	Soft to stiff brown sandy gravelly CLAY	0.30 – 4.00	0.20 – 2.60

Table 11.17: Summary of Stratigraphy			
Geological Unit	Typical Description	Range of depths to top of stratum (mbgl)	Range of thickness (m)
Padarn Tuff Formation	Weak to extremely strong medium to thin laminated grey to dark grey to brownish pink fine grained TUFF	2.30 – 4.90	0.70 – >95.00
Minffordd Formation (only encountered in BH210A)	Strong thinly laminated grey SANDSTONE or weak black highly weathered SILTSTONE	4.35 – 4.55	0.20
Overhead Line Alignment			
Tidal Flat Deposits	Very soft brown CLAY or slightly sandy slightly gravelly SILT	0.50 – 2.30	0.20 – 2.50
Alluvium	Soft to firm grey or brown slightly gravelly slightly sandy CLAY	0.00 – 3.00	0.50 – 2.50
Glacial Till	Firm to very stiff brown slightly sandy slightly gravelly CLAY	0.00 – 2.50	0.30 – 1.70
Glaciofluvial Deposits	Medium dense to dense slightly clayey gravelly SAND or medium dense sandy GRAVEL	0.40 – 6.50	0.50 – 1.50
New Harbour Group	Strong light grey SILTSTONE or strong light bluish green GNEISS	1.00 – 7.50	0.70 – 1.80
Ordovician Rocks	Very weak or weak dark grey MUDSTONE	7.00 – 9.44	0.50 – 6.16

Table 11.17: Summary of Stratigraphy			
Geological Unit	Typical Description	Range of depths to top of stratum (mbgl)	Range of thickness (m)
Lligwy Sandstone Formation	Strong light grey CONGLOMERATE	3.00 – 7.50	0.20 – 2.20
Clwyd Limestone Group	Weak to medium strong grey LIMESTONE	2.70 – 29.70	0.15 – 2.20
Millstone Grit	Extremely weak or weak grey MUDSTONE or weak grey SANDSTONE	4.50 – 5.85	0.40 – 0.75

Table 11.18: Summary of Groundwater Strikes and Seepages				
Exploratory Hole Reference	Hole Depth	Initial Water Strike (mbgl)	Level After 20 Minutes (mbgl)	Strata in which strike occurred
Braint THH/CSEC				
BH101	20.60	2.00	1.19	Glacial Till
		5.00	4.60	Central Anglesey Shear Zone / Berw Shear Zone (Undifferentiated)
BH102	20.50	No water strike recorded		

Table 11.18: Summary of Groundwater Strikes and Seepages

Exploratory Hole Reference	Hole Depth	Initial Water Strike (mbgl)	Level After 20 Minutes (mbgl)	Strata in which strike occurred
BH103	81.80	1.10	0.80	Glacial Till
BH103A	11.00	No water strike recorded		
TP101	4.50	Seepage at 1.20		Glacial Till
TP101A	1.20	No water strike recorded		
TP102	2.20	Seepage at 1.10		Glacial Till
TP102A	1.20	1.20	1.10	Glacial Till
TP103	4.20	Seepage at 2.40		Glacial Till
TP103A	2.70	No water strike recorded		
Braint THH/CSEC to the northern bank of the Menai Strait				
BH3	77.50	3.00	2.50	Glacial Till
BH104	75.55	2.00	1.30	Glacial Till
		3.50	3.27	Glacial Till
		4.70	3.42	Glacial Till
BH105	77.30	No water strike recorded		
BH106	70.00	2.00	1.22	Glacial Till
Southern bank of the Menai Strait to Tŷ Fodol THH/CSEC				

Table 11.18: Summary of Groundwater Strikes and Seepages

Exploratory Hole Reference	Hole Depth	Initial Water Strike (mbgl)	Level After 20 Minutes (mbgl)	Strata in which strike occurred
BH4	77.20	No water strike recorded		
BH201	67.20	No water strike recorded		
BH202	77.10	1.90	1.40	Glacial Till
BH203	76.00	No water strike recorded		
BH204	97.00	No water strike recorded		
BH205	73.00	No water strike recorded		
BH206	92.00	3.60	3.60 (no rise)	Glacial Till
BH0207	4.50	2.10	2.10 (no rise)	Alluvium
BH207A	57.10	1.20	1.20 (no rise)	Alluvium
BH207B	40.00	No water strike recorded		
BH208	59.50	No water strike recorded		
BH212	43.50	2.40	2.09	Glacial Till
BH212A	43.00	No water strike recorded		
BH212B	51.40	No water strike recorded		
TP204	3.30	Seepage at 2.05		Glacial Till
Tŷ Fodol THH/CSEC				

Table 11.18: Summary of Groundwater Strikes and Seepages

Exploratory Hole Reference	Hole Depth	Initial Water Strike (mbgl)	Level After 20 Minutes (mbgl)	Strata in which strike occurred
BH209	0.90	No water strike recorded		
BH209A	99.60	4.60	2.80	Glacial Till
BH210	0.80	No water strike recorded		
BH210A	20.40	No water strike recorded		
BH211	19.95	No water strike recorded		
BH301	15.00	No water strike recorded		
BH302	15.00	0.90	0.80	Glacial Till
TP201	2.70	Seepage at 2.40		Glacial Till
TP201A	1.20	No water strike recorded		
TP202	2.70	No water strike recorded		
TP202A	1.20	No water strike recorded		
TP203	3.60	Seepage at 2.80		Glacial Till
TP203A	1.20	No water strike recorded		
Overhead Line Alignment				
4AP020	9.20	No water strike recorded		
4AP033	15.60	No water strike recorded		

Table 11.18: Summary of Groundwater Strikes and Seepages

Exploratory Hole Reference	Hole Depth	Initial Water Strike (mbgl)	Level After 20 Minutes (mbgl)	Strata in which strike occurred
4AP060	7.70	No water strike recorded		
4AP074	30.00	No water strike recorded		
4ZA08	1.70	Seepage at 1.50		Glacial Till
4ZA15	3.10	No water strike recorded		

Table 11.19: Summary of Groundwater Monitoring Results

Exploratory Hole Reference	Ground Level (mAOD)	Installation Details	Response Zone Strata	Units	Water Level		
					27/06/17	17/07/17	01/08/17
Braint THH/CSEC							
BH101	36.48	50mm dia. (6.00 – 20.60mbgl)	Central Anglesey Shear Zone and Berw Shear Zone	Depth (mbgl)	1.17	1.41	1.30
				Level (mAOD)	35.31	35.07	35.18
BH102	39.02	50mm dia. (2.00 – 5.00mbgl)	Glaciofluvial Deposits/ Central Anglesey Shear Zone and Berw Shear Zone	Depth (mbgl)	3.31	3.54	3.38
				Level (mAOD)	35.71	35.48	35.64
BH103A	33.96	50mm dia. (2.00 – 10.15mbgl)	Glaciofluvial Deposits	Depth (mbgl)	0.71	0.77	0.73
				Level (mAOD)	33.25	33.19	33.23

Table 11.19: Summary of Groundwater Monitoring Results

Exploratory Hole Reference	Ground Level (mAOD)	Installation Details	Response Zone Strata	Units	Water Level		
					27/06/17	17/07/17	01/08/17
Braint THH/CSEC to the northern bank of the Menai Strait							
BH105	39.86	50mm dia. (47.00 – 67.00mbgl)	Central Anglesey Shear Zone and Berw Shear Zone	Depth (mbgl)	7.03	7.18	7.11
				Level (mAOD)	32.83	32.68	32.75
Southern bank of the Menai Strait to Tŷ Fodol THH/CSEC							
BH202	47.13	50mm dia. (7.00 – 22.00mbgl)	Loggerheads Limestone Formation	Depth (mbgl)	13.09	16.05	16.64
				Level (mAOD)	34.04	31.08	30.49
BH205 (1)	54.60	50mm dia. (5.00 – 20.00mbgl)	Loggerheads Limestone Formation	Depth (mbgl)	9.65	10.07	9.78
				Level (mAOD)	44.95	44.53	44.82

Table 11.19: Summary of Groundwater Monitoring Results

Exploratory Hole Reference	Ground Level (mAOD)	Installation Details	Response Zone Strata	Units	Water Level		
					27/06/17	17/07/17	01/08/17
BH205 (2)	54.60	50mm dia. (40.00 – 45.00mbgl)	Loggerheads Limestone Formation/ Padarn Tuff Formation	Depth (mbgl)	9.63	10.07	9.75
				Level (mAOD)	44.97	44.53	44.85
BH207B (1)	25.17	50mm dia. (30.00 – 40.00mbgl)	Unknown due to open hole drilling/ described as a possible Tuff	Depth (mbgl)	0.71	0.86	0.77
				Level (mAOD)	24.46	24.31	24.40
BH207B (2)	25.17	32mm dia. (10.00 – 20.00mbgl)	Unknown due to open hole drilling	Depth (mbgl)	0.78	0.81	0.70
				Level (mAOD)	24.39	24.36	24.47
BH212B	22.08	50mm dia. (20.00	Loggerheads Limestone	Depth (mbgl)	10.80	10.91	10.67

Table 11.19: Summary of Groundwater Monitoring Results

Exploratory Hole Reference	Ground Level (mAOD)	Installation Details	Response Zone Strata	Units	Water Level		
					27/06/17	17/07/17	01/08/17
		– 30.00mbgl)	Formation	Level (mAOD)	11.28	11.17	11.41
Tŷ Fodol THH/CSEC							
BH211	82.50	50mm dia. (2.00 – 9.00mbgl)	Glacial Till/ Padarn Tuff Formation	Depth (mbgl)	1.48	1.54	1.52
				Level (mAOD)	81.02	80.96	80.98
BH301	92.63	50mm dia. (2.00 – 15.00mbgl)	Head Deposits/ Padarn Tuff Formation	Depth (mbgl)	4.85	4.95	4.87
				Level (mAOD)	87.78	87.68	87.76

7.7 OTHER INFORMATION PROVIDED BY STATUTORY AUTHORITIES

7.7.1 Other information provided by statutory authorities which is considered to be relevant to these aspects of the Proposed Development is summarised below. Further information and details are provided as Appendix 11.2 (**Document 5.11.2.2**) and Figure 11.5 (**Document 5.11.1.5**) and a copy of correspondence with NRW are included as Appendix 11.3 (**Document 5.11.2.3**).

7.8 POTENTIAL AREAS OF CONTAMINATED LAND

7.8.1 The Study Area for 'Potential Areas of Contaminated Land' is within the 1 km of the Order Limits.

7.8.2 Consultation with the Contaminated Land Officers for the IACC and Gwynedd Council was undertaken to obtain information within 1 km of the Order Limits. Historical Maps and the Groundsure Report have been reviewed to investigate potential interactions between the Proposed Development and historical potentially contaminative land uses. The information and findings of subsequent analysis of the data provided is presented below. Correspondence with both of the Local Authorities is provided as Appendix 11.3 (**Document 5.11.2.3**). Details on potentially contaminated sites are included as Appendix 11.2 (**Document 5.11.2.2**) and Figure 11.7 (**Document 5.11.1.7**).

Contaminated Land Records

7.8.3 There are several examples of potentially contaminative land uses present within 1 km of the Order Limits; these include a sewage works, several infilled pits and quarries and an infilled pond.

Historic Potentially Contaminative Land Uses

7.8.4 The Study Area has generally been in agricultural use during the course of its history. Isolated examples of potentially contaminative land uses are present within 1 km of the Order Limits and these include quarries, pits, refuse heaps, lime kilns, railway sidings, boathouses, docks, smithies, sewage works, electrical substations, disused water works, power stations, gravel pits, lifeboat stations, police stations, graveyards, corn mills, railway/tramway sidings, cuttings, warehouses, petrol stations, garages, and windmills. Further details are included in Appendix 11.2 (**Document 5.11.2.2**) and the locations are shown on Figures 11.7 and 11.8 (**Documents 5.11.1.7 and 5.11.1.8**).

Current Potentially Contaminative Land Uses

7.8.5 Information provided by statutory authorities, site surveys and the Groundsure Report has been reviewed to identify any current potentially contaminative land uses within 1 km of the Order Limits. The significant current potentially contaminative land uses are confined to agricultural uses, with the exception of the Wylfa Nuclear Power Station, Pentir Substation and Nant Y Garth Landfill (which is discussed under 'Landfilling').

Discharge Consents

7.8.6 The Study Area for 'Discharge Consents' is within 1 km of the Order Limits.

7.8.7 Information sourced from NRW, IACC, Gwynedd Council and the Groundsure Report pertaining to discharge consents has been reviewed. One hundred and six records relating to discharge consents are located within 1 km of the Order Limits. Generally, these pertain to consents to allow the discharge of final/treated sewage effluent and unspecified trade discharges. Wylfa Nuclear Power Station holds a number of discharge consents for discharge of process and cooling water. Potentially active discharge consents within 100 m of, or inside the Order Limits are summarised in Table 11.20 below and are shown on Figure 11.5 (**Document 5.11.1.5**).

Table 11.20: Summary of Discharge Consents within 100m of the Order Limits					
Isle of Anglesey County Council Records of Discharges					
Reference on Figure 11.5	Easting	Northing	Section	Distance from Order Limits (m)	Effluent type description
18	237510	391540	A	83	Sewage Discharged - Final / Treated Effluence - Water Company
19	237510	391540	A	83	Sewage Discharged - Final / Treated Effluence - Water Company
20	237510	391540	A	83	Sewage Discharged - Final / Treated Effluence - Water Company
21	237510	391540	A	83	Sewage Discharged - Final / Treated Effluence - Water Company
22	237510	391540	A	83	Unspecified
23	237510	391540	A	83	Sewage Discharged - Final / Treated Effluence - Water Company
24	237518	391549	A	95	Sewage Discharges - Pumping Station - Water Company
25	237518	391549	A	95	Sewage Discharges - Pumping Station - Water Company

Table 11.20: Summary of Discharge Consents within 100m of the Order Limits					
Isle of Anglesey County Council Records of Discharges					
Reference on Figure 11.5	Easting	Northing	Section	Distance from Order Limits (m)	Effluent type description
28	240926	389130	B	57	Sewage Discharged - Final/ Treated Effluent - Not Water Company
29	240927	389141	B	54	Sewage Discharged - Final/ Treated Effluent - Not Water Company
32	241955	387555	B	99	Sewage Discharged - Final/ Treated Effluent - Not Water Company
37	243827	386608	B	30	Sewage Discharged - Final/ Treated Effluent - Not Water Company
40	245440	384360	C	33	Sewage Discharged - Final/ Treated Effluent - Not Water Company
41	245440	384360	C	33	Sewage Discharged - Final/ Treated Effluent - Not Water Company
57	248570	374850	D	20	Unspecified
60	250360	372020	E	1	Unspecified

Table 11.20: Summary of Discharge Consents within 100m of the Order Limits					
Isle of Anglesey County Council Records of Discharges					
Reference on Figure 11.5	Easting	Northing	Section	Distance from Order Limits (m)	Effluent type description
61	250440	372010	E	72	Sewage Discharged - Final/ Treated Effluent - Not Water Company
63	250550	372020	E	85	Sewage Discharged - Final/ Treated Effluent - Not Water Company
64	250580	372020	E	65	Sewage Discharged - Final/ Treated Effluent - Not Water Company
65	250660	371600	E	within Order Limits	Agriculture - Unspecified
66	251000	371800	E	83	Sewage Discharges - Pumping Station - Water Company
67	251000	371800	E	83	Sewage Discharges - Pumping Station - Water Company
70	252260	371720	F	73	Unspecified
71	252240	371650	F	80	Unspecified

Table 11.20: Summary of Discharge Consents within 100m of the Order Limits					
Isle of Anglesey County Council Records of Discharges					
Reference on Figure 11.5	Easting	Northing	Section	Distance from Order Limits (m)	Effluent type description
85	252260	369900	F	within Order Limits	Sewage Discharged - Final/ Treated Effluent - Not Water Company
86	252260	369900	F	within Order Limits	Sewage Discharged - Final/ Treated Effluent - Not Water Company
87	252260	369900	F	within Order Limits	Sewage Discharged - Final/ Treated Effluent - Not Water Company
104	255215	368039	F	9	Sewage Discharged - Final/ Treated Effluent - Not Water Company
105	255858	368047	F	within Order Limits	Sewage Discharged - Final/ Treated Effluent - Not Water Company
106	255858	368047	F	within Order Limits	Unspecified

Integrated Pollution and Prevention Controls

7.8.8 The Study Area for 'Integrated Pollution and Prevention Controls' is within 1 km of the Order Limits.

7.8.9 There are 21 IPCC records within 1 km of the Order Limits. These pertain to intensive poultry farming, combustion of fuel, disposal of hazardous and non-hazardous waste (Wylfa Nuclear Power Station) and landfilling of waste (Nant Y Garth Landfill). None of these records lie within the Order Limits or interact with features of the Proposed Development.

National Incidents and Records of Pollution

7.8.10 The Study Area for 'National Incidents and Records of Pollution' is within 100 m of the Order Limits.

7.8.11 There are 33 records of pollution incidents within 1 km of the Order Limits. All records date to 2016 or before and generally are classified as Category 3 (Minor) or Category 2 (Significant) incidents. No records are classified as Category 1 (Major) incidents. Pollutants include hydraulic oils, diesel, carcasses, general biodegradable materials/wastes, agricultural slurries, fuel oils, tyres and unspecified wastes. Incidents recorded within 100 m or inside of the Order Limits are summarised in Table 11.21 and locations shown on Figure 11.6 (**Document 5.11.1.6**).

Table 11.21: Summary of National Incidents and Records of Pollution within 100m of the Order Limits

Reference on Figure 11.5	Easting	Northing	Section	Distance from Order Limits	Comment
2	235630	393150	A	Within Order Limits	Three occurrences concerning the minor release of insulating and cable oils to land during the period 2003 to 2004.
6	243836	386697	B	45 m	Forty five occurrences concerning the release of slurry and dilute slurry to air (Minor) land (Minor) and water (Significant) during the period 2004 to 2016.
8	247691	378409	C	Within Order Limits	Three occurrences concerning the Minor release of general biodegradable waste to land during the period 2003 to 2004.
10	247793	375788	D	10 m	One occurrence concerning the Minor release of vegetable cuttings and deposits to land during 2004.
16	250331	371909	E	Within Order Limits	Forty six occurrences concerning the Significant release of Commercial Waste to land during the

Table 11.21: Summary of National Incidents and Records of Pollution within 100m of the Order Limits

Reference on Figure 11.5	Easting	Northing	Section	Distance from Order Limits	Comment
					period 2000 to 2016.
17	250858	371906	E	55 m	Three occurrences concerning the minor release of smoke to land and air during the period 2003 to 2004.
28	255630	368220	F	25 m	Forty nine occurrences concerning the release of other specific waste materials to air (Significant), land (Significant) and water (Minor) during the period 2003 to 2016.
29	255660	368140	F	25 m	Forty nine occurrences concerning the release of general biodegradable materials or waste to land (Significant) and water (Minor) during the period 2003 to 2016.
30	255680	368170	F	60 m	Three occurrences concerning the minor release of animal matter to land and water during the period

Table 11.21: Summary of National Incidents and Records of Pollution within 100m of the Order Limits					
Reference on Figure 11.5	Easting	Northing	Section	Distance from Order Limits	Comment
					2003 to 2004.

Registered Radioactive Substances

7.8.12 The Study Area for 'Registered Radioactive Substances' is within 1 km of the Order Limits.

7.8.13 Five records exist within 1 km of the Order Limits, all associated with Wylfa Nuclear Power Station; one of these is currently effective and refers to the disposal of radioactive waste.

7.9 HISTORIC AND CURRENT MINERAL SURFACE GROUND WORKINGS, QUARRYING AND MINING

7.9.1 The Study Area for 'Historic and Current Mineral Surface Ground Workings, Quarrying and Mining' is within the Order Limits.

7.9.2 Information from the Groundsure Report and information held by the BGS, NRW, IACC and Gwynedd Council has been reviewed in relation to ground working, quarrying and mining. The area within 1 km of the Order Limits has been subject to numerous small scale extractive industries over time. No current quarrying or mining activity was identified within 1 km of the Order Limits. Historical surface ground working, quarrying and mining features that directly interact with the Order Limits are summarised in Table 11.22. Further details regarding historical surface ground workings within 1 km of the Order Limits are presented in Figure 11.9 (**Document 5.11.1.9**) and Appendix 11.2 (**Document 5.11.2.2**).

Table 11.22: Summary of Surface Ground Workings within the Order Limits

Reference on Figure 11.9	Feature	Easting	Northing	Section	Comment
20	Unspecified Quarry	236797	392095	A	Historical mapping indicates that an unspecified quarry was located within the Order Limits. Access was not available to investigate this feature when site surveys were undertaken. Current aerial photography does not indicate the presence of a quarry.
23	Sewage Works	237462	391467	A	This feature on historical mapping refers to the Llanfechell Water Treatment Works which is likely to share some access tracks with the Proposed Development
24	Pond	237238	391412	A	A pond is in the vicinity of the Llanfechell Waste Water Treatment Works.
39	Ponds	240480	389550	A	Ponds are shown within the Order Limits in the vicinity east of Hafodol Isaf
42	Unspecified Quarry	239814	389399	A	Historical mapping indicates that a former quarry is located within the Order Limits. Current aerial mapping does not indicate the presence of a quarry in the vicinity of the farm

Table 11.22: Summary of Surface Ground Workings within the Order Limits

Reference on Figure 11.9	Feature	Easting	Northing	Section	Comment
					track which is to be used for future access.
53	Unspecified Pit	241426	388464	B	This feature lies within the Order Limits. Aerial photography does not indicate the presence of a pit.
54	Railway Cuttings	241316	388333	B	The feature is located within the Order Limits. Access was not available to investigate this feature when site surveys were being undertaken.
58	Unspecified Pit/Pond	242241	387823	B	Aerial mapping shows a pit or depression at the location. The unspecified pit or pond may have been partially infilled or if a natural pond perhaps has silted up or is dry at the time of the photograph being taken.
61	Unspecified Pit	242489	387299	B	The unspecified pit lies within the Order Limits. Access was not available to investigate this feature when site surveys were being undertaken. Aerial mapping shows a pit or depression at the location. The unspecified pit may have been partially infilled.

Table 11.22: Summary of Surface Ground Workings within the Order Limits

Reference on Figure 11.9	Feature	Easting	Northing	Section	Comment
85	Unspecified Quarry	244136	385777	B	The unspecified quarry is located within the Order Limits. Aerial photography of the location shows a pit or depression.
114	Pond	245722	383562	C	The pond is located within the Order Limits. It is possible that the pond has been infilled.
143	Unspecified Old Quarry	247925	377642	D	This unspecified old quarry is located within the Order Limits. It is possible that it has been infilled.
147	Unspecified Quarry	248438	377410	D	The unspecified quarry is located within the Order Limits. It is possible that it has been infilled.
152	Unspecified Quarry	247926	377640	D	The unspecified quarry is located within the Order Limits. It is possible that it has been infilled.
158	Unspecified Old Quarries	248077	376195	D	Old quarries are shown within the vicinity of Gylched Covert east of Llangefni, aerial photography does not indicate there current presence, they may be covered with vegetation or have been infilled.

Table 11.22: Summary of Surface Ground Workings within the Order Limits

Reference on Figure 11.9	Feature	Easting	Northing	Section	Comment
165	Historical Quarry 'Ty'n-y-felin'	248288	375190	D	The historical quarry is located within the Order Limits. A site survey determined that the quarry had for the most part been infilled with organic waste, soils, building refuse, tarmacadam and plastic.
167	Unspecified Quarry	248077	376190	D	The unspecified quarry is located within the Order Limits. It is possible that it has been infilled.
178	Unspecified Quarry	248295	375167	D	The unspecified quarry is located within the Order Limits. It is possible that it has been infilled.
184	Pond or Unspecified Quarry	249216	373555	E	The feature is located within the Order Limits. No pond was located during a site survey. It is possible that it has been infilled.
186	Unspecified Quarry	249353	373356	E	The unspecified quarry is located within the Order Limits. A quarry was identified during a site survey. It is possible that the quarry has been partially infilled. Soft ground conditions were also encountered.

Table 11.22: Summary of Surface Ground Workings within the Order Limits

Reference on Figure 11.9	Feature	Easting	Northing	Section	Comment
202	Railway Cuttings	250737	371834	E	The feature is located within the Order Limits.

Coal Mining

7.9.3 The Study Area for 'Coal Mining' is within 500 m of the Order Limits.

7.9.4 Records held by the Coal Authority show that the Order Limits are inside of a Coal Mining Reporting Area, Surface Coal Resource Area and Development High Risk Area to the east of Llangefni. The Non-Residential Coal Mining Report is provided as Appendix 11.4 (**Document 5.11.2.4**). Further details regarding the interactions of coal mining with the Proposed Development are shown as Figure 11.10 (**Document 5.11.1.10**). The findings of the Coal Authority Report are summarised as follows:

- The Proposed Development would not be within a surface area that could be affected by past underground coal mining. However the Proposed Development would be within an area where it is possible that there is coal at or close to the surface and as such may have been worked at some time in the past. The area east of Llangefni is therefore classified as a development high risk area;
- The Proposed Development would not be within a surface area that could be affected by present underground coal mining;
- The Proposed Development would not be in an area where the Coal Authority has plans to grant a licence, has granted a licence or is likely to be affected from any planned future underground coal mining;
- However part of the Proposed Development is located within a Surface Coal Resource Area, suggesting reserves of coal do exist which, could be worked at some time in the future;
- No notices have been given, under Section 46 of the Coal Mining Subsidence Act 1991, stating that the land is at risk of subsidence;
- Two historical mine shafts are present approximately 450 m west of the Order Limits. There is no record of what steps if any have been taken to treat the mine entries. The Coal Authority does not hold Mine Abandonment plans for the mine shafts. The locations of the mine shafts are presented in Figure 11.10 (**Document 5.11.1.10**);
- The Coal Authority is not aware of any damage due to geological faults or other lines of weakness that have been affected by coal mining;
- The Proposed Development would neither be within the boundary of, nor within 200 m of the boundary of, an opencast site from which coal has been removed by opencast methods; and

- The Coal Authority has no record of a mine gas emission requiring action.

Mineral Planning Policy

7.9.5 Both the Joint Local Development Plan (JLDP) Proposals Map and the online interactive mapping portal, which forms part of the JLDP, have been reviewed to identify areas subject to minerals safeguarding policies. There are no crushed rock or sand and gravel Preferred Areas within the Order Limits. The Parys Mountain Metalliferous Safeguarding Area is also not within the Order Limits. There is a Category 1 Limestone Bedrock safeguarding area in the Order Limits between the B5110 and the B5420. Another two Category 1 Limestone Bedrock safeguarding areas are also located within the Order Limits on the northern and southern banks of the Menai Strait, though these only coincide with the below ground tunnel LOD. According to the BGS Geoindex Mapping Service, the minerals within the safeguarding areas described above are classified as Carboniferous Limestone in the vicinity of the B5110 and on the Anglesey side of the Menai with the Gwynedd side of the Menai being classified as high purity Carboniferous Limestone. Temporary works are not considered to be a risk, as they would not involve any activity that could adversely affect the underlying mineral deposits. During construction of the tunnel, if any category 1 limestone were encountered this would be recycled where possible. During operation, sterilisation would be restricted to a small number of working stand-offs around pylons; the TTH/CSECs and substation extensions are outside of these safeguarding areas. Upon decommissioning, any mineral resources sterilised by the working stand-offs around pylons would be available again.

7.10 LANDFILLING

7.10.1 The Study Area for ‘Landfilling’ is within 1 km of the Order Limits.

7.10.2 Information from the Groundsure Report, and information held by the BGS, NRW, IACC and Gwynedd Council has been reviewed in relation to past and present landfilling operations within 1 km of the Order Limits. For the majority of the study area landfilling appears small scale and confined to the historic infilling of ponds, pits and quarries. The only currently active landfill/waste management site within 1 km of the Proposed Development would be the Nant Y Garth Landfill site which is located approximately 300 m south of the Tŷ Fodol THH/CSEC. The landfill has been in operation with its current operator since 1993 and has only been recorded as accepting Inert Waste. Correspondence with NRW regarding the nature of

Nant Y Garth Landfill and a copy of the operator's Environmental Permit is included in Appendix 11.3 (**Document 5.11.2.3**).

7.11 WASTE SITES

7.11.1 The Study Area for 'Waste Sites' is within 1 km of the Order Limits.

7.11.2 Information from the Groundsure Report, and information held by the BGS, NRW, IACC and Gwynedd Council has been reviewed in relation to waste handling sites. Two sites are evident within the reviewed information:

- Nant Y Garth Landfill which is discussed under Landfilling above; and;
- A site named "Railway" listed within the Groundsure Report (2016) under IACC registered Waste Disposal Sites which is located approximately 430 m from the Order Limits. Details on the nature of the site and waste deposited are not listed. The closure date of this site is listed at 1968.

7.12 GROUND GAS

7.12.1 No significant potential sources of ground gas have been identified with the exception of potential shallow mine workings to the east of Llangefni and the Nant Y Garth Landfill. Other less significant potential sources of ground gas such as Alluvium, Peat, Marine Beach Deposits and Tidal Flat Deposits, along with isolated areas of Made Ground, have been identified.

7.12.2 Ground gas monitoring wells have been installed to investigate ground gas conditions in the vicinity of both the THH/CSECs, with particular focus on the potential migration of ground gas from the Nant Y Garth Landfill in the vicinity of the Tŷ Fodol THH/CSEC. These are discussed above in section 7.6.

7.13 RADON

7.13.1 The online interactive map of indicative radon potential supplied by UKRadon indicates that the Radon potential generally ranges from Low (1-3% homes above the Action level) to Moderate (3-5% of homes above the Action Level) within the Order Limits. However areas of the Order Limits underlain by the Clwyd Limestone Group in sections D and F are indicated to have a High Radon potential (>30% of homes above the Action Level).

7.14 GEOLOGICAL LANDSCAPE CLASSIFICATION

7.14.1 LANDMAP data freely provided by NRW in relation to geological landscape classifications of geological features and units within the Order Limits has been reviewed. Areas within the Order Limits holding LANDMAP Geological Landscape classifications are summarised below in Table 11.23 and presented as Figure 11.12 (**Document 5.11.1.12**).

Table 11.23: Summary of NRW LANDMAP Geological Landscape Classifications
Section A
Geological Landscape classification within Section A is approximately equal parts Low and High. Areas with High Geological Landscape classification within this section include the lowland hills and valleys of Llanfechel.
Section B
Geological Landscape classification within Section B is almost entirely High. Areas with High Geological Landscape classification within this section include the lowland hills and valleys of Llanfechel and lowland hills and valleys of Llanerchymedd.
Section C
Geological Landscape classification within Section C is predominantly High with the area in the south of Capel Coch to the Section C/D divide being classified as Low. Areas with High Geological Landscape classification within this section include the lowland hills and valleys of Benllech and lowland hills and valleys of Llanerchymedd.
Section D
Geological Landscape classification within Section A is approximately equal parts Low and High. The Geological Landscape within the Order Limits from the Section C/D divide to Cefn Poeth Bach is classified as High and Low from Cefn Poeth Bach to the Section D/E divide. Areas of high Geological Landscape classification within this section include the lowland hills and valleys of Benllech.
Section E
Geological Landscape classification within Section E is Low.

Table 11.23: Summary of NRW LANDMAP Geological Landscape Classifications
Section A
Section F
Geological Landscape classification within Section F is predominantly Low with the area from the immediate vicinity of the Menai Strait to Capel-y-graig being classified as High. Areas of high Geological Landscape classification within this section include the soft sediment cliff and shore of the Menai Straits as well as the lowland hills and valleys of Vaynol Park.

7.15 FUTURE BASELINE PREDICTIONS

7.15.1 There is unlikely to be any change in the majority of the baseline conditions between the time of assessment and the commencement of construction.

7.15.2 There would, however, be a new receptor introduced during construction, which is the construction workforce. Construction activity would bring the workforce into contact with soils and groundwater throughout the construction period. If there were any contaminated soils or groundwater encountered there is the potential for health effects, unless appropriate mitigation is in place. The presence of construction workers is therefore considered in the assessment of potential and residual effects (sections 8 potential effects and section 9 mitigation and residual effects).

8 Potential Effects

8.1 INTRODUCTION

8.1.1 The following section provides a description of the potential effects that could result from the Proposed Development, in the absence of avoidance or mitigation measures.

8.1.2 The potential effects identified in Table 11.23 below are relevant to all areas of the Proposed Development unless specifically stated.

Table 11.23: Potential Effects of the Proposed Development

Potential Effect	Description	Receptor	Phase			
			C	O	M	D
C = Construction Phase; O = Operation Phase; M = Maintenance works; D = Decommissioning Phase.						
Groundwater and ground pollution due to chemical spillages and leaks.	Potential for plant to leak or spill oil and/or fuel. Leaks and spillages could occur in any area of the Order Limits in which the plant is operating and during refuelling. Additionally, the potential exists for spills and drips to occur associated with stored fuels and chemicals brought onto the site to facilitate construction. There is potential that such spillages could enter the underlying uncontaminated strata and contaminate shallow groundwater.	Soils	✓		✓	✓
		Geology	✓		✓	✓
		Groundwater	✓		✓	✓
		Human Health	✓		✓	✓

Table 11.23: Potential Effects of the Proposed Development						
Potential Effect	Description	Receptor	Phase			
			C	O	M	D
C = Construction Phase; O = Operation Phase; M = Maintenance works; D = Decommissioning Phase.						
Reduction of soil quality during handling and storage.	During the excavation and storage of soils minor changes to soil characteristics, such as soil hydrology and soil structure, could occur due to handling and storage of topsoil and subsoil in inappropriate conditions. Soils stored in bunds are also susceptible to erosion from run-off during heavy rainfall or wind erosion during dry periods. The reduction in the quality of the soils could lead to the loss or alteration to one or more key important features.	Soils	✓		✓	✓
Reduction of soil quality due to construction traffic.	The tracking of heavy plant across the site during construction could compact the ground surface causing degradation of soil quality. In addition compaction could lead to a decrease in infiltration and, therefore, potential water logging and increase of surface water runoff, and a reduction of local groundwater levels.	Soils	✓		✓	✓
		Groundwater	✓		✓	✓

Table 11.23: Potential Effects of the Proposed Development						
Potential Effect	Description	Receptor	Phase			
			C	O	M	D
C = Construction Phase; O = Operation Phase; M = Maintenance works; D = Decommissioning Phase.						
Disturbance of potentially contaminated soils, sediments and waters posing a risk to construction workers, groundwater, soils and geology.	The excavation and disturbance of the soils during construction could lead to a number of effects associated with contaminated soils: • Vehicles tracking over potentially contaminated soils have the potential to spread contamination and carry it off-site; • Construction workers may be exposed during the excavation of material to potentially harmful contaminants and ground gases; • Disturbance of soils may alter the chemical conditions within the site soils resulting in mobilisation of potential contaminants; • The surfaces of contaminated material may be exposed in excavations, which could cause dissolution and/ or mobilisation of contaminants by percolating rainwater; nd • Arisings from the excavation of soil could potentially result in the stockpiling of contaminated soils on the site, and reuse on-site. The exposed soils could lead to increased migration of	Soils	✓			
		Geology	✓			
		Groundwater	✓			
		Human Health	✓			

Table 11.23: Potential Effects of the Proposed Development						
Potential Effect	Description	Receptor	Phase			
C = Construction Phase; O = Operation Phase; M = Maintenance works; D = Decommissioning Phase.			C	O	M	D
	potential contaminants both on-site and off the site through dust generation and to underlying soils and Controlled Waters through leaching and surface water runoff.					
Importation of contaminated aggregates posing a potential risk to human health and underlying soils and geology.	Without controls in place natural or recycled stone imported to create access tracks and other working areas could be contaminated and pose a risk to construction workers, and underlying uncontaminated strata and groundwater.	Soils	✓		✓	✓
		Geology	✓		✓	✓
		Groundwater	✓		✓	✓
		Human Health	✓		✓	✓
Disturbance of former underground coal mine workings posing a potential risk to construction workers, and groundwater.	Potential that the foundations for the pylons could encounter former shallow coal workings. If foundations were to encounter shallow workings there could be a risk of ground disturbance affecting the integrity of the pylon, the potential for mine gas posing a risk to construction workers, and the potential for contaminated mine waters to migrate to surface and groundwater.	Groundwater	✓			
		Human Health	✓			
Requirement for	In order to excavate below	Soils	✓			✓

Table 11.23: Potential Effects of the Proposed Development						
Potential Effect	Description	Receptor	Phase			
			C	O	M	D
C = Construction Phase; O = Operation Phase; M = Maintenance works; D = Decommissioning Phase.						
dewatering, reducing flow to groundwater abstractions and surface water bodies, and changes to soil hydrology.	groundwater, dry working may be required for the installation of the pylon foundations, and therefore, dewatering could be required within the pylon working areas. Groundwater could likely be extracted from sumps within the excavation and discharged to surrounding ground. Internal dewatering utilising sump pumps is also required during the construction of the shafts. Groundwater levels could be locally affected, and a reduction in levels could lead to reduced baseflow to watercourses and to groundwater abstraction points. In addition the quality of surrounding soils could be affected, through a reduction of soil water changing the soil structure. Groundwater seepage (potentially saline impacted) into the tunnel during operation would also be removed from the tunnel for disposal.	Groundwater	✓	✓		✓
Requirement for dewatering, reducing quality or levels of	In order to excavate below groundwater, dry working may be required for the installation of the pylon foundations, and therefore,	Groundwater	✓			

Table 11.23: Potential Effects of the Proposed Development						
Potential Effect	Description	Receptor	Phase			
			C	O	M	D
C = Construction Phase; O = Operation Phase; M = Maintenance works; D = Decommissioning Phase.						
groundwater supporting sites protected under European and UK habitat legislation, such as a RAMSAR Site or a SSSI.	dewatering could be required within the pylon working areas. Groundwater would be extracted from sumps within the excavation and discharged to surrounding ground. Internal dewatering utilising sump pumps is also required during the construction of the shafts. Groundwater levels could be locally affected, and a reduction in levels and quality could affect designated sites supported by the groundwater.					
Foundations of pylons and other structures creating a preferential pathway for contaminants to migrate.	During the construction and operation of the Proposed Development foundations could create a pathway for contaminants to migrate i.e. from Made Ground/ contaminated water to uncontaminated strata and groundwater. For example piled foundations could create a pathway between Made Ground through impermeable clays into underlying groundwater.	Geology	✓	✓		
		Groundwater	✓	✓		
Requirement to remove spoil from tunnelling	Spoil from the excavation of the tunnel could be generated and reused elsewhere within the	Geology	✓			
		Groundwater	✓			

Table 11.23: Potential Effects of the Proposed Development						
Potential Effect	Description	Receptor	Phase			
			C	O	M	D
C = Construction Phase; O = Operation Phase; M = Maintenance works; D = Decommissioning Phase.						
operations (including tunnel shafts) posing a potential risk to human health and the environment.	Order Limits or require removal from the tunnel head house site that is selected as the launch site.	Human Health	✓			
Requirement to remove spoil from construction of the OHL foundations posing a potential risk to human health and the environment.	Spoil from the excavations for pylon foundations could be generated and be reused elsewhere within the Order Limits or require removal from the site.	Geology	✓			
		Groundwater	✓			
		Human Health	✓			
Importation of backfill material for tunnel shafts posing a potential risk to human health and underlying groundwater.	Without controls in place recycled soil and/or stone imported to backfill the shafts could be contaminated and pose a risk to construction workers, and underlying uncontaminated strata and groundwater.	Groundwater				✓
		Human Health				✓

9 Mitigation and Residual Effects

9.1 INTRODUCTION

9.1.1 The majority of the potential effects and the mitigation required to reduce these effects to acceptable levels are applicable to all elements of the Proposed Development (i.e. the OHL, tunnel, THHs and CSECs and substations). Therefore, the mitigation of these effects is considered jointly below, unless specifically stated.

9.2 MITIGATION MEASURES

Mitigation by Design

9.2.1 These are measures that have been incorporated into the design of the Proposed Development to minimise or prevent potential impacts. These measures include the routeing of the OHL and the site selection for THH/CSECs. There are no mitigation by design measures specific to this chapter.

Control and Management Measures

9.2.2 The main mitigation measure to prevent adverse effects on soils, geology and hydrogeology, during all phases of the development of the Proposed Development would be to ensure good site practice and management. As stated in the CEMP (**Document 7.4**) a range of standard site management and construction methodology techniques have been identified and committed to, via a Requirement to the DCO, to minimise the risk to construction workers, degradation of soil quality and pollution of uncontaminated strata and controlled waters (groundwater and surface waters). The CEMP (**Document 7.4**) also includes details of how tunnel spoil, excavated soils and construction generated wastes would be managed to minimise effects on soils, geology and hydrogeology.

9.2.3 General mitigation measures detailed in the CEMP (**Document 7.4**) that are relevant to potential construction effects on geology, hydrogeology and ground conditions are summarised below in Table 11.24.

Table 11.24: CEMP Measures Relevant to Geology, Hydrogeology and Ground Conditions		
Code	Description	Reason
	Health and Safety on site	
GP42	Contractors will prepare and implement a Construction Phase SHE Plan for each element of the Proposed Development.	Prevention or reduction of potential risks to human health from ground contamination.
GP44	Staff, site visitors and delivery drivers will receive a project induction from the contractors to ensure they are aware of site specific hazards and health, safety and environmental management requirements. Site staff will be briefed daily by the Contractor prior to work commencing. Site-specific risk assessments will be carried out to ensure the risk strategy of the frequently changing workplace remains relevant. The contractors will be required to carry out audits and inspections in line with section 2.8 of this CEMP.	Reduces the potential risks to human health from ground contamination.
GP51	The contractors will undertake inspections on equipment and facilities to reduce to risk of incidents occurring. Inspections will generally be undertaken on a weekly basis unless specified in other plans or licences.	Reduces the potential risks to soils, geology, surface water and groundwater from spillages/releases of fuels, oils, hazardous substances and stockpiled materials.
GP61	Contractors will develop and implement a Pollution Incident Control Plan (PICP) which will detail their control measures and response in the	Manages and mitigates the severity of an incident upon soils, geology, surface waters and/or groundwater

Table 11.24: CEMP Measures Relevant to Geology, Hydrogeology and Ground Conditions		
Code	Description	Reason
	event of any incident onsite.	should an incident occur.
	Construction Site Layout and Good Housekeeping	
GP82	Site accesses, accesses to construction compounds and roads in the vicinity of site access points will be maintained and kept clean as required.	Reduces the potential risk of contaminated soils moving off-site uncontrolled
	Welfare	
GP811	On-site welfare facilities will be provided for all site workers	Prevention and reduction of the potential risks to human health from ground contamination
	Waste Management	
GP814	An Outline Waste Management Plan (**Document 7.11**) has been produced. The OWMP sets the framework for the management of wastes generated during the construction of the Proposed Development. It documents the decisions taken during the planning and design stages to minimise construction waste and sets objectives and targets for the main waste types. The contractors will prepare and submit a Site Waste Management Plan (SWMP) which will be in accordance with the OWMP.	Manages the risks related to the handling of waste materials and reduces the risk of potential environmental impacts.
	Air Emissions	

Table 11.24: CEMP Measures Relevant to Geology, Hydrogeology and Ground Conditions		
Code	Description	Reason
AE13	The DuMP will contain general measures to minimise dust generation, for example appropriate speed limit will be enforced (e.g. 5-20 mph). Where there is visible dust generation from working areas and stockpiles, during prolonged periods of dry weather, local spraying with water will be considered, using bowsers or temporary static sprays, as necessary, to suppress dust generation, where this is not likely to lead to other effects as a result of sediment laden runoff Implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site) where reasonably practicable at construction compounds. Ensure there is an adequate area of hard surfaced road between the wheel wash facility and the site exit, wherever site size and layout permits	Reduces potential risk of contaminants migrating to human health and Controlled Water receptors.
AE14	Hard surfacing will be provided at all bellmouths. The site layout will be planned so that machinery and dust-generating activities, such as soil screening, are located as far away from sensitive receptors as practicable. Where practical materials that have a potential to produce dust will be removed from site as soon as	Reduces potential risk of ground contaminants migrating to human health and Controlled Water receptors.

Table 11.24: CEMP Measures Relevant to Geology, Hydrogeology and Ground Conditions		
Code	Description	Reason
	possible, unless being re-used on site	
AE15	Handing and transfer of soil and dusty material will be controlled to minimise dust generation and handing operations to be kept to a minimum. A water bowser will be used to damp down, where there are visible dust issues.	Reduces potential risk of ground contaminants migrating within and off-site.
	Soil Management	
SM11	Prior to construction, more site/soil specific measures to protect soils will be set out in a detailed Soil Management Plan (SMP), based upon the Outline Soil Management Plan (**Document 7.10**) and supplemented, by additional survey data, where required.	Reduces potential risk of contaminants migrating to human health and Controlled Water Receptors Reduces potential risk of reducing soil quality
SM12	An outline SMP (**Document 7.4.2.2)** has been produced and includes mitigation measures in accordance with Defra guidance.	Reduces potential risk of contaminants migrating to human health and Controlled Water Receptors. Reduces potential risk of reducing soil quality
	Contaminated Land	
CL11	Where required, an appropriate intrusive ground investigation will be	Reduces potential risk of contaminants migrating to

Table 11.24: CEMP Measures Relevant to Geology, Hydrogeology and Ground Conditions		
Code	Description	Reason
	undertaken in accordance with all relevant guidance and legislation including BS 10175:2011, Environment Agency/Defra CLR series of reports. The ground investigation will be undertaken to achieve the following objectives: determine the ground conditions to allow design of foundations and structures; determine the presence, if any, of shallow mine workings; a Coal Mining Risk Assessment Report will be completed once the ground investigation has taken place; determine the groundwater regime and assess the need for dewatering; assess the nature, extent and magnitude of any soil and groundwater contamination present; assess the risks (if any) from potential contaminants to human health and Controlled Waters; and, assess the ground gas regime.	human health and Controlled Water receptors.
CL21	Where required a watching brief will be maintained during construction works to confirm the absence of potential sources of contamination such as Made Ground, visual or olfactory evidence of hydrocarbons. These areas of potentially contaminated ground and/ or water will	Reduces potential risk of contaminants migrating to human health and Controlled Water receptors.

Table 11.24: CEMP Measures Relevant to Geology, Hydrogeology and Ground Conditions		
Code	Description	Reason
	be sampled and undergo appropriate sampling and laboratory analysis	
CL22	Subsequently a risk assessment will be undertaken in accordance with the EA report 'Model Procedures for the Management of Land Contamination (CLR 11) to identify if these areas of potential contaminants pose a risk to construction workers or site operators and Controlled Waters. If areas of the site are shown to pose a risk, any remedial measures required will be implemented. A remediation strategy will be devised and agreed with the regulatory authorities prior to any remedial works. The determination of the risks through ground investigation and risk assessment, and the potential remediation of areas of the site may result in the reduction of the significance, or even removal, of some of the potential effects identified. Should any contaminated material that is considered to pose a risk be identified it will be treated and/ or disposed of appropriately.	Reduces the risk of contaminated land impacting upon soils, geological, human health and Controlled Water receptors.
CL23	A risk assessment will be conducted to assess whether private water supplies could be affected by construction activities. Selected private water supplies will then be monitored before, during and after construction.	Reduces potential risk of contaminants migrating to human health as well as reducing potential risk of affecting the quality of private water supplies.
CL24	Piled foundations will be designed in accordance with the EA guidance	Reduces potential risk of contaminants migrating

Table 11.24: CEMP Measures Relevant to Geology, Hydrogeology and Ground Conditions		
Code	Description	Reason
	document 'Piling and Penetrative Ground Improvement Methods on Land Affected by Contamination: Guidance on Pollution Prevention'	Controlled Water receptors.
CL25	Use of corrosion resistant concrete formulas for pylon foundations; all concrete pours would be contained within shuttering or dry excavations and pre-cast concrete would be used where possible	Reduces potential risk of concrete pours impacting controlled waters
CL26	Any material imported to site, such as stone for access tracks/foundations, will be natural quarried stone or, if recycled, the material will undergo chemical testing. The suite of contaminants and site use criteria will be agreed with regulatory authorities, in order to demonstrate that the material is suitable for use on site and does not pose a risk to construction workers or the environment	Reduces potential risk of contaminants migrating, impacting soils and geology in addition to reducing potential risk of contaminants reaching human health and Controlled Water receptors
	Pollution Control	
WE11	The following three general principles will be adhered to: • prevent siltation and contamination of existing drainage systems and natural water environments; • ensure that surface water discharged to the water environment from construction areas does not exceed pre-development runoff rates (subject	Reduces risk of impacting on the quality of Controlled Water receptors

Table 11.24: CEMP Measures Relevant to Geology, Hydrogeology and Ground Conditions		
Code	Description	Reason
	to a minimum rate of 5 litres per second in order to minimise the risk of blockage of outfall structures); and • ensure the routes of existing flows (groundwater, surface and watercourse flows) are not impacted.	
WE21	Pollution prevention measures will be adopted in general accordance with the existing PPGs where still relevant and the new GPPs	Prevention of spillages of fuels, oils and contaminants limiting potential to impact soils, geology, surface waters and groundwater.
WE22	A Pollution Incident Control Plan will be prepared and implemented. It will include, or cross-refer to, Environmental Emergency and Contingency Procedures. The PICP will be in place prior to the commencement of works, setting out procedures for pollution control and emergency response measures in the event of accidental spillage or leakage.	Reduces the potential impact from spillages of fuels, oils and contaminants to soils, geology, surface waters and groundwater.
WE23	Generic mitigation measures within the Pollution Incident Control Plan will include (as necessary): • fuels and oils at the construction compounds, on site and at work areas to be managed in	Prevention of spillages of fuels, oils and contaminants limiting potential to impact soils, geology, surface waters and groundwater.

Table 11.24: CEMP Measures Relevant to Geology, Hydrogeology and Ground Conditions		
Code	Description	Reason
	accordance with the Control of Pollution (Oil Storage) (Wales) Regulations 2016 and in accordance with the GPP2 Above Ground Oil Storage Tanks; • fuel to be stored within secure bunded fuel tanks with an impermeable bund capacity of 110% of the tank volume; • chemicals to be stored in accordance with the Control of Substances Hazardous to Health (COSHH) Regulations i.e. in a secure COSHH Store including an impermeable storage area with secondary containment for spill management; • suitable quantities of pollution control equipment such as sorbent pads, sorbent granules, booms or similar material to be readily available at the temporary construction compounds, on site and at work areas at all times and to be regularly checked; • spillage kits will be positioned across the site and at vulnerable locations as required and staff will be trained in their use. The kits will be checked regularly and replaced after an event; • “Emergency Grab Packs” or spill kits to be carried in site vehicles and mobile plant and larger kits with fuel bowsers and emergency vehicles;	

Table 11.24: CEMP Measures Relevant to Geology, Hydrogeology and Ground Conditions		
Code	Description	Reason
	• emergency communications (mobile phones or radios) to be carried with relevant personnel; • all plant and equipment to be inspected before use on site and maintenance and servicing records checked; • all static plant, such as pumps and generators, to have integral driptrays (be self bunded) where possible or as a second preference external drip trays that are to be checked daily; • mobile plant are to be maintained in good working order. Larger items of plant such as excavators to undergo daily recorded inspections by a competent person (usually the operator) for any defects such as leaking hoses. Where defects are evident the item of plant shall be removed from site immediately and serviced or replaced as soon as possible; • no refuelling of mobile plant shall be undertaken within 10 m of a watercourse, waterbody, or sites designated for their groundwater dependent habitats, or within 50 m of a known abstraction borehole or within Flood Zone C2 without the prior agreement of the NRW; • fuel and chemical storage to be located a minimum of 10 m away from a watercourse or waterbody, 50 m from an abstraction borehole	

Table 11.24: CEMP Measures Relevant to Geology, Hydrogeology and Ground Conditions		
Code	Description	Reason
	and within Flood Zone A; • where vehicle wash facilities are provided, no chemicals or grit will be used and silt traps/oil interceptors will be installed in accordance with PPG6 Working at Construction and Demolition Sites and GPP13 Vehicle Washing and Cleaning; • appropriate method statements will be in place prior to undertaking maintenance of vehicles at designated areas in the temporary construction compounds only; • for operations using concrete, grout and other cement-based products, mixing of concrete and designated contained concrete washout areas will be provided in accordance with good practice guidance at least 10 m from any watercourse or waterbody or surface water drain to minimise the risk from pollution and located within Flood Zone A. ; • use of corrosion resistant concrete formulas for pylon foundations will aid management of effects associated with changes to water quality through contamination. All concrete pours would be contained within shuttering or dry excavations (with geotextile) and pre-cast concrete will be used where possible; • machinery which remains on site overnight will be kept more than 10	

Table 11.24: CEMP Measures Relevant to Geology, Hydrogeology and Ground Conditions		
Code	Description	Reason
	m from drains/watercourses or waterbodies, and outside Flood Zone C2, to reduce any risk of contamination; • construction waste/debris will be prevented from entering any waterbody or sensitive habitats through observing the appropriate stand-off distances between works and watercourses specified in WE31; and • works in or immediately adjacent to watercourses will be minimised as far as possible, and where not possible, periods of dry weather will be preferred for working. The scope and timing of all in channel works will be agreed with NRW and or LLFA.	
WE31	Stockpiles at construction compounds and construction areas will be located at least 8 m away from watercourses and water bodies.	Prevention of impact from contaminants on groundwater and surface water courses.
WE31	Stockpiles at construction compounds and construction areas will be located at least 8 m away from watercourses and water bodies.	Prevention of impact from contaminants on groundwater and surface water courses.
WE55	If required, water management will be provided (e.g. buffer strips, earth bunds, silt fences, grips, settlement ponds and straw bales, or other	Prevention of impact from contaminants, including suspended solids, on groundwater and surface

Table 11.24: CEMP Measures Relevant to Geology, Hydrogeology and Ground Conditions		
Code	Description	Reason
	proprietary treatment) on a site specific basis. Tools and plant to be washed out and cleaned in designated areas within the site compounds where runoff can be isolated for treatment before discharge to watercourse/ground or sewer under consent from NRW. Construction Sustainable Drainage Systems (SuDS) (such as settlement lagoons or other temporary attenuation) will be used if necessary and where appropriate to do so. Over-pumping will be carefully managed to prevent suspension of sediment or contamination. Discharges to watercourses will only be carried out under consent from NRW.	watercourses.
WE59	A surface water management plan would be developed for the construction activities at the tunnel head locations. This would specify measures to manage discharges from dewatering required during tunnel construction, and from the associated works adjacent to the tunnel heads (slurry and concrete batching) and shafts.	Prevention of impact and reduction of potential risks from contaminants on surface water courses.
	Drainage Management	

Table 11.24: CEMP Measures Relevant to Geology, Hydrogeology and Ground Conditions		
Code	Description	Reason
WE41	Groundwater dewatered from excavations e.g. pylon foundation excavations would be discharged to adjacent grassed/vegetated agricultural land within the same catchment and away from watercourses as far as possible.	Minimuse impact of reducedgroundwater levels and management of risk to surface water courses.
WE52	Pollution prevention measures will be employed such as hydrocarbon interceptors, packaged water treatment works for dewatering arisings, provision for water treatment measures for treating suspended solids should particle sizes be too small for gravity settlement to be effective.	Prevention of impact from contaminants on groundwater and surface water courses.
WE53	Work areas will be constructed from semi-permeable aggregate to allow infiltration. Utilisation of Sustainable Drainage Systems (SuDS) principles for any areas requiring new systems.	Reducing effects on baseflow and groundwater recharge and minimise surface water runoff
	Post-construction reinstatement	
R1	Any land temporarily used for the construction of the Proposed Development will be fully reinstated, in agreement with the relevant landowner.	Prevention of long-term impacts on soils, geology and groundwater.
R3	Reinstatement will include making good damage or disturbance to any	Prevention of long-term

Table 11.24: CEMP Measures Relevant to Geology, Hydrogeology and Ground Conditions		
Code	Description	Reason
	soil structure, native or ornamental planting, grass, fencing, hard landscaping or structures, where in-situ reinstatement is possible.	impacts on soils.

Mitigation Measures

9.2.4 The following CEMP measures are specific to land contamination and the sources of effects, pathways and receptors covered in this chapter.

9.2.5 CL11 requires that where required further investigations may be required where contaminated ground is anticipated. These would be undertaken once a Contractor has been appointed, and there is greater certainty regarding the final locations of all temporary and permanent infrastructure. An appropriate intrusive ground investigation would be undertaken in accordance with all relevant guidance and legislation including BS 10175:2011, Environment Agency/DEFRA CLR series of reports. The ground investigation would be undertaken to achieve the following objectives:

- Determine the ground conditions to allow design of foundations and structures;
- Determine the presence, if any, of shallow mine workings in the area to the east of Llangefni; a Coal Mining Risk Assessment Report will be completed once the ground investigation has taken place;
- Confirm the groundwater regime and assess the need for dewatering;
- Assess the nature, extent and magnitude of any soil and groundwater contamination present within the Order Limits and particularly where ground disturbance for construction is proposed;
- Assess the risks (if any) from potential contaminants to human health and Controlled Waters; and,
- Assess the ground gas regime and potential impacts during construction as well as to allow appropriate design of foundations and structures.

9.2.6 Where required a watching brief would be maintained by the Contractor during any construction works to confirm the presence/absence of potential sources of contamination such as Made Ground, or visual or olfactory evidence of hydrocarbons. These areas of potentially contaminated ground and/ or water would be sampled and undergo appropriate sampling and laboratory analysis (CL21).

9.2.7 Subsequently a risk assessment would be undertaken by the Contractor in accordance with the Defra and Environment Agency report 'Model Procedures for the Management of Land Contamination (CLR 11) (Ref 11.25) to identify if these areas of potential contaminants pose a risk to construction workers, site operators and/or Controlled Waters. If areas of the site are shown to pose a risk, if feasible, the pylon, access track etc would be moved to a different location. However, if it is not possible to move the infrastructure in contact with the ground remedial measures would be implemented. A remediation strategy would be devised and discussed with the regulatory authorities (IACC, Gwynedd Council and NRW) prior to any remedial works. Contaminated material that is considered to pose a risk would be remediated in line with the remediation strategy or disposed of appropriately. Remediation of areas of the site may result in the reduction of the significance, or even removal, of some of the potential effects identified (CL22).

9.2.8 A risk assessment would be conducted by the Contractor to assess whether private water supplies could be affected by construction activities. Selected private water supplies will then be monitored for water quality and water levels before, during and after construction works. The risk assessment and monitoring strategy will be discussed with IACC before commencement (CL23).

9.2.9 Where piled foundations are used they would be designed in accordance with the EA guidance document 'Piling and Penetrative Ground Improvement Methods on Land Affected by Contamination: Guidance on Pollution Prevention' (Ref 11.28) (CL24).

9.2.10 Any material imported to site, such as stone for access tracks/foundations or backfilling of the tunnel shafts would be natural quarried stone or, if recycled, the material would undergo chemical testing. The suite of contaminants and site use criteria would be discussed with the regulatory authorities, in order to demonstrate that the material is suitable for use on-site and does not pose a risk to construction workers or the environment (CL26).

9.3 ASSESSMENT OF EFFECTS

9.3.1 A number of the potential effects are associated with an assumed worst case relating to potential soil and groundwater contamination for the Proposed Development, which, with the exception of the Braint and Tŷ Fodol Construction Compounds, have been derived by a qualitative assessment based on a desk study. In order to accurately mitigate the impacts of potential contaminants, the actual nature, extent and magnitude of the presence of any significant potential contamination needs to be assessed through ground investigation.

9.3.2 Given that there is some flexibility in relation to the eventual location of temporary and permanent infrastructure, in particular in relation to the OHL, based on the ground information from the baseline, there is no evidence of there being extensive areas of highly contaminated land which potentially could be impacted by the Proposed Development. Accordingly, it is not considered proportionate to further undertake ground investigations at this stage.

9.4 EFFECTS ON SOILS

9.4.1 Potential effects on soils across the Proposed Development include:

- Pollution of soils due to chemical spillages and leaks;
- Reduction of soil quality during handling and storage;
- Reduction of soil quality due to construction traffic;
- Disturbance of potentially contaminated soils, sediments and waters posing a risk to soils;
- Importation of contaminated aggregates posing a risk to underlying soils; and
- Dewatering leading to changes to soil hydrology.

9.4.2 The nature and type of the soils identified within the Order Limits are considered to be of less than local importance (**low** sensitivity). Therefore although there remains some potential for significant effects in relation to existing soil as a source of contamination, there is considered to be no potential for significant effects on soil as a receptor.

9.4.3 Mitigation measures required to address these potential effects are set out below:

- CEMP Measures GP51, GP61, GP814, CL11, CL21 CL26, AE15, WE21, WE22, WE23, WE53, R1, R3 and Soil Management Plan (SM12)

9.4.4 The residual effect from chemical spillages and leaks during construction, maintenance and decommissioning would be a **Negligible** effect (**not significant**) as spillages would be unlikely and if they did occur would be managed in accordance with the CEMP and localised effects on soils would minimal.

9.4.5 With the mitigation in place, including the Soil Management Plan (Document 7.10), there would no measurable reduction of soil quality during handling and storage resulting in an effect of low magnitude. As the sensitivity of the soils is low, the significance would be a **Negligible** effect (**not significant**).

9.4.6 Residual effects relating to compaction of soils are likely to be limited to temporary access tracks and the working areas and be short-term. With the mitigation in place, including the Soil Management Plan (**Document 7.10**), there would not be a measurable reduction of soil quality so the magnitude would be **low**. As the sensitivity of the soils is **low** the significance would be a **Negligible** effect **(not significant)**.

9.4.7 The baseline assessment has identified a number of potential contaminative land uses in the study area and a number of effects associated with the presence of potentially contaminated soils have been identified. However, the baseline has demonstrated that the potential scale and type of ground contamination within the Order Limits is a low risk with the majority of potential contamination sources being associated with infilled former pits and small quarries that are likely to be very localised. The vast majority of these sources are within the Order Limits relating to the OHL and are not directly beneath proposed works that would disturb the ground. No ground contamination has been identified by ground investigation works at the tunnel head house sites. There is potential for ground contamination within areas of the Wylfa and Pentir Substation where ground works are proposed for the construction and placement of new infrastructure. Areas of contaminated soils would be avoided, where possible. Where this is not possible, remediation would be undertaken to either remove the source or prevent the creation of pathways to receptors as described in the CEMP. Therefore, there would be no significant residual adverse effects.

9.4.8 As access tracks and working areas would follow those used during construction there is not considered to be a risk from ground contamination during maintenance or decommissioning, as contamination would have been avoided, removed and/or mitigated during construction.

9.4.9 The use of imported aggregates during construction, maintenance and decommissioning, for example for the construction of access tracks, may pose a risk to underlying soils, if the aggregates were to be contaminated. However, the mitigation measures outlined in the CEMP would mean that only materials suitable for use would be imported. As a result, the residual effects of the importation of aggregates would be at worst minimal. The significance would be a **Negligible** effect (**not significant**).

9.4.10 It is considered likely that the water table is relatively shallow, beneath many areas within the Order Limits, particularly within the superficial deposits of Alluvium and Tidal Flat deposits. In order to excavate below groundwater, dry working may be required for the installation and decommissioning of the pylon foundations, and therefore, dewatering would be required at the pylon locations. It is assumed that the maximum depth of shallow pad foundations of a pylon would be 3.5 m and any pumping to allow the construction of the pylon footings would typically continue for a short period of approximately 3 to 6 days. The placement of Third Party cables underground would be unlikely to require dewatering as excavations would be 300 mm wide and up to 600 mm deep, and excavations would only be required to be open for short periods.

9.4.11 It is considered that the impact of any dewatering would reduce considerably with the distance from the abstraction point. Under normal conditions it is unlikely that significant effects would be recorded more than 50 m from the point of abstraction, although effects may be recorded more than 100 m from the excavation. It is assumed that the maximum depth of shallow pad footings for the majority of the pylons would be approximately 3.5 m, the maximum drawdown required to provide a dry working area would be less than 3.5 m. Due to the limited drawdown and the short duration of dewatering required, any short-term changes to the quality of the surrounding soils due to lowering of the groundwater levels, would be of **medium** magnitude and given the **low** sensitivity of the soils the significance would be a **Negligible** effect (**not significant**).

9.4.12 During construction of the tunnel shafts external dewatering would not be necessary. Groundwater in the superficial deposits would be isolated from the shaft by caisson rings, restricting impacts on the shallow groundwater level. Internal dewatering would be undertaken using a sump pump to

maintain dry conditions in the shaft from the ingress of groundwater from the bedrock. Given presence of the groundwater cut-off in the superficial deposits, it is considered that the impact on surrounding soils would be of **low** magnitude. As the soils are of **low** sensitivity the significance would be a **Negligible** (**not significant**).

9.5 EFFECTS ON GEOLOGY

9.5.1 Potential effects that could affect the geology across the Proposed Development include:

- Ground pollution due to chemical spillages and leaks;
- Disturbance of potentially contaminated soils, sediments and waters posing a risk to geology;
- Importation of contaminated aggregates posing a potential risk to underlying geology;
- Foundations of pylons and other structures creating a preferential pathway for contaminants to migrate;
- Requirement to remove spoil from tunnelling operations posing a potential risk to geology; and
- Requirement to remove spoil from construction of new pylons and OHL.

9.5.2 The nature and type of the geology identified in the baseline within the Order Limits are considered to be of less than local importance (**low** sensitivity) to regional importance (**high** sensitivity). As such, without mitigation the effects on geology would have some potential to be significant dependant on the magnitude of the impact.

9.5.3 Mitigation measures required are set out below:

- CEMP Measures GP51, GP61, GP814, CL11, CL21, CL22, Cl23 CL26, AE15, WE21, WE22, WE23, WE53, R1, R3 and Soil Management Plan (SM12)

9.5.4 The residual effect from chemical spillages and leaks during construction, maintenance and decommissioning would be a **Negligible** effect (**not significant**) as spillages would be unlikely and if they did occur would be managed and localised effects on geology would minimal.

9.5.5 The baseline assessment has identified a number of potential contaminative land uses in the study area and a number of potential effects associated with the presence of contaminated materials on geology have been identified. However, the baseline has demonstrated that the potential scale and type of ground contamination within the Order Limits is a low risk with the majority of potential contamination sources being associated with infilled former pits and small quarries that are likely to be very localised. The vast majority of these sources within the Order Limits and are not directly beneath proposed works that would disturb the ground. No ground contamination has been identified by ground investigation works at the Braint or Tŷ Fodol Construction Compounds. There is potential for ground contamination within areas of the Wylfa and Pentir Substation where ground works are proposed for the construction and placement of new infrastructure. Areas of contaminated ground would be avoided, where possible. Where this is not possible, remediation would be undertaken to either remove the source or prevent the creation of pathways to receptors as described in the CEMP. Therefore, there would be no significant residual effects.

9.5.6 As access tracks and working areas would follow those used during construction there is not considered to be a risk from ground contamination during maintenance or decommissioning, as contamination would have been avoided, removed and/or mitigated during construction.

9.5.7 The use of imported aggregates during construction, maintenance and decommissioning, for example for the construction of temporary access tracks, may pose a risk to underlying geology, if the aggregates were to be contaminated. However, the mitigation measures outlined in section 9.2 would mean that only materials suitable for use would be imported. As a result, the residual effects on uncontaminated strata would be at worst minimal. The significance would be a **Negligible** effect (**not significant**).

9.5.8 The OHL, tunnel, and THHs/CSECs would be unmanned and not involve the use of hazardous chemicals. Therefore, no operational effects have been identified with the exception of the potential for foundations of the tunnel head houses and pylons or gantry, particularly where piled foundations have been used, posing a preferential pathway for contaminants to migrate to non-contaminated strata. The gantries would be piled while the vast majority of pylon foundations are expected to be columns/ pads. Utilising the mitigation measures outlined in section 9.2 would either remove the source of contamination and/or mitigate its migration through foundations to underlying uncontaminated strata. There would not be a measurable change to the underlying geology resulting in an

effect of **low** magnitude. As the sensitivity of the geology is **high** the impact significance would be a **Negligible** effect (**not significant**).

9.5.9 Potential waste material would be generated from shaft and tunnel arisings, material to be excavated for the new pylon foundations, and soil removal to allow removal of existing pylons. The nature of the material and approximate estimated volumes of arisings are discussed in detail in sections 4 and 5 of the Outline Waste Management Plan (**Document 7.11**) and are summarised in Table 11.25 below.

Table 11.25: Forecast of Likely Arisings

Proposed Development	Materials and excavation method	Estimated volume (m^3)	Estimated Tonnage	Anticipated use of materials
Braint shaft site preparation	Topsoil removal	15,000	30,000	Re-used on site for re-instatement
	Access track and site aggregate	17,000	30,600	Recycled as aggregate
Braint shaft excavation	Excavated superficial deposits (glacial till)	2,000	4,000	Used on site for landscaping
	Blasted rock	18,000	46,800	Either used on site for landscaping or recycled as aggregate
Ty Fodol shaft site preparation	Topsoil removal	15,000	30,000	Re-used on site for re-instatement
	Access track aggregate	19,000	34,200	Recycled as aggregate

Table 11.25: Forecast of Likely Arisings

Proposed Development	Materials and excavation method	Estimated volume (m^3)	Estimated Tonnage	Anticipated use of materials
Ty Fodol shaft excavation	Excavated superficial deposits (glacial till)	4,000	8,000	Used on site for landscaping
	Blasted rock	15,000	39,000	Either used on site for landscaping or recycled as aggregate
Menai Tunnel Crossing (TBM)	TBM option arisings	76,000	197,600	Recycled as aggregate
Menai Tunnel Crossing (D&B)	Drill and blast option arisings	109,000	283,400	Either used on site for landscaping or recycled as aggregate
New pylons and overhead lines	Topsoil removal	221,200 m^3	376,300 tonnes	Re-used on site for re-instatement
	Access track and working areas aggregate	248,600 m^3	477,500 tonnes	Recycled as aggregate
Removal of dismantling and temporary	Crane pads topsoil removal	1,350 m^3	2,375 tonnes	Re-used on site for compound and working area re-instatement

Table 11.25: Forecast of Likely Arisings				
Proposed Development	Materials and excavation method	Estimated volume (m^3)	Estimated Tonnage	Anticipated use of materials
pylons and overhead lines, and 4ZB overhead line	Crane pad and working area aggregate	2,010 m^3	3,860 tonnes	Recycled as aggregate

9.5.10 Topsoil and superficial clays would be excavated from the shafts along with excavated topsoil and superficial deposits from the foundations of new pylons, new access tracks and the removal of pylons on the OHL. These materials would be reused on-site for access track/ working areas re-instatement, backfill for the voids created from the removal of foundations of pylons, and landscaping during the construction phase. Materials would be reused under the Outline Materials Management Plan (OMMP) (**Document 7.12**) to ensure they would be physically and chemically (and radiologically, where necessary) suitable for re-use. The natural composition of the material in relation to the placement location will also be assessed for suitability for reuse. If material were to be unsuitable they would be disposed off site to a suitable site in accordance with the Outline Waste Management Plan (**Document 7.11**).

9.5.11 As a result, the residual effects on geology would be of **low** magnitude as the reuse of material in suitable locations within the Order Limits would mean that changes from the baseline conditions would be barely distinguishable. With the geology being of **high** sensitivity the significance would be a **Negligible** effect (**not significant**).

9.5.12 Rock spoil from excavation of the shafts would consist of a mixture of a natural none contaminated material comprising Padarn Volcanic Tuffs, Schist and Mica Schist. Rock spoil from the excavation of the tunnel excavations would consist of Menai Strait Formation, Carboniferous Limestone, Allt Lwyd Formation, and the Minfordd Formation.

9.5.13 It is anticipated that most of the excavated rock spoil would be suitable for recycling and re-use as outlined in the Outline Waste Management Plan **(Document 7.11).** Stronger and coarser rock materials would be suitable

for aggregate production. Weaker and finer rock materials would be more suitable for recycling as general fill or for disposal. The volumes of material would represent a significant proportion of the overall recycled aggregate production in the region.

9.5.14 The TBM arisings would be separated from the bentonite slurry through screening processes. The bentonite slurry would be recycled to the TBM for re-using in the tunnelling process. The bentonite content on the arising would be reduced to trace amounts following separation. Similarly, if polymers, foaming agents and other additives are used at the tunnel face, the spoil could contain traces of these additives. These would be non-toxic and non-damaging to the environment, however, the spoil would need to be tested for its environmental properties to confirm its suitability for potential end uses.

9.5.15 The TBM arisings would be likely to be too small for optimal end use as a compacted engineered fill. However, the arisings could be blended with coarser shaft arisings to increase the size range and improve its engineering characteristics at the receiving facility. The drill and blast tunnelling method is expected to produce a coarser spoil overall and would be more suitable for producing an engineered fill. The arisings could be re-used for landscaping or as an aggregate within the Order Limits under the OMMP (**Document 7.12**). If they are unsuitable they would be recycled, recovered and/ or disposed of offsite to a suitable site in accordance with the Outline Waste Management Plan (**Document 7.11**).

9.5.16 As a result, the residual effects on geology would be of **low** magnitude as the recycling and/or reuse of material in suitable locations within the Order Limits would mean that changes from the baseline conditions would be barely distinguishable. With the geology being of **high** sensitivity the impact significance would be **Negligible** (**not significant**).

9.6 EFFECTS ON GROUNDWATER

9.6.1 Potential activities related to the Proposed Development that could affect groundwater across the Proposed Development include:

- Groundwater pollution due to chemical spillages and leaks;
- Reduction of groundwater levels due to construction traffic;
- Disturbance of potentially contaminated soils, sediments and waters posing a risk to groundwater quality;

- Importation of contaminated aggregates posing a potential risk to underlying groundwater quality;
- Disturbance of former underground coal mine workings posing a potential risk to groundwater quality;
- Requirement for dewatering, reducing flow to groundwater abstractions and surface water bodies;
- Requirement for dewatering, reducing quality or levels of groundwater supporting sites protected under European and UK habitat legislation, such as a RAMSAR Site or a SSSI;
- Foundations of pylons and other structures creating a preferential pathway for contaminants to migrate into groundwater during operation;
- Requirement to remove spoil from tunnelling operations posing a potential risk to groundwater quality;
- Requirement to remove spoil from construction of new pylons and OHL; and
- Importation of backfill material for tunnel shafts during decommissioning posing a potential risk to groundwater quality.

9.6.2 The sensitivity/importance of the groundwater identified in the baseline within the Order Limits are considered to be of **low** (for example unproductive strata), **medium** (for example Secondary A & B aquifer), **high** (for example Principal aquifers), and **very high** (SPZ1 50 m around abstractions wells) (Table 11.4). As such, without mitigation, the effects on groundwater would have some potential to be significant, dependent on the magnitude of the impact.

9.6.3 Mitigation measures required are set out below:

- CEMP Measures GP51, GP61, GP814, AE13, AE14, AE15, CL11, CL21, CL22, CL23, CL24, CL25, CL26, WE11, WE21, WE23, WE31, WE41, WE52, WE55, R1 and Soil Management Plan SM12

9.6.4 The magnitude of effect of chemical spillages and leaks is considered to be **low**, as spillages or leaks are highly unlikely to occur due to the construction management measures in place, and if they did they would be very unlikely to be widespread, given the CEMP measures described above. The residual effect of chemical spillages and leaks during construction,

maintenance and decommissioning would be of **low** magnitude. Although the sensitivity of the groundwater is **medium** to **very high** the impact significance would be **Negligible** (**not significant**) due to the low magnitude. It is primarily the low risk of a leak or spillage that limits the impact significance, although it is recognised that the risk is not zero.

9.6.5 Effects relating to soil compaction creating a decrease in infiltration are likely to be limited to access tracks and the working areas and would be short-term. With the mitigation in place, including the Soil Management Plan (**Document 7.10**)**,** there would not be a measurable effect on infiltration and the impact magnitude would be **low**. Although the sensitivity of the groundwater is **medium to very high** the impact significance would be **Negligible** (**not significant**).

9.6.6 The baseline assessment has identified a number of potential contaminative land uses in the study area and a number of potential effects associated with the presence of any contaminated materials on groundwater quality have been identified. However, the baseline has demonstrated that the potential scale and type of ground contamination within the Order Limits is a low risk with the majority of potential contamination sources being associated with infilled former pits and small quarries that are likely to be very localised. The vast majority of sources within the Order Limits would not be directly beneath proposed works that would disturb the ground. No ground or groundwater contamination has been identified by ground investigation works at the Braint or Tŷ Fodol Construction Compounds. There is potential for ground and/or groundwater contamination within areas of the Wylfa and Pentir Substation where ground works are proposed for the construction and placement of new infrastructure. Areas of contaminated ground would be avoided, where possible. Where this is not possible, remediation would be undertaken to either remove the source or prevent the creation of pathways to receptors as described in the CEMP. Therefore, there would be no significant residual effects

9.6.7 As access tracks and working areas would follow those used during construction there is not considered to be a risk to groundwater from ground contamination during maintenance or decommissioning, as contaminated ground would have been avoided, removed and/or mitigated during construction.

9.6.8 The use of imported aggregates during construction, for example for the construction of temporary access tracks, may pose a risk to groundwater quality, if the aggregates were to be contaminated. However, the mitigation measures outlined in the CEMP measures would mean that only materials

suitable for use would be imported. As a result, the residual effects on groundwater would be at worst minimal. The impact significance would be **Negligible** (**not significant**).

9.6.9 To the east of Llangefni, parts of the Order Limits are located within a Coal Mining Reporting Area, Surface Coal Resource Area and Development High Risk Area as shown on Figure 11.10 (**Document 5.11.1.10**). Pylons and working areas are directly adjacent to the Development High Risk Area, and one access track crosses the High Risk Area. Whilst the Coal Authority Report did not identify that the ground is currently affected by former mining there is a limited potential that foundations for pylons could encounter former historical shallow workings. The presence or absence of shallow workings in pylon locations in this high risk area (as well as along the line of any access tracks or other working areas) would need to be confirmed by ground investigation. Assuming a worst case where shallow workings are encountered and pylon locations cannot be moved, there would be a risk of ground disturbance of the workings, through excavation, piling etc., potentially causing contaminated mine waters to migrate to deeper or adjacent groundwater.

9.6.10 These effects would be mitigated by appropriate design of foundations as outlined in the CEMP resulting in a **low** magnitude impact due to potential minimal but no material residual effects of groundwater quality. With groundwater in this location being of **high** sensitivity the significance would be **Negligible** (**not significant**).

9.6.11 It is considered likely that the water table is relatively shallow, beneath many areas within the Order Limits, particularly within the superficial Alluvium and Tidal Flat deposits. In order to excavate below groundwater, dry working may be required for the installation of the pylon foundations, and therefore, dewatering would be required at the pylon locations. The maximum depth of foundations for the majority of the pylons shallow pad foundations would be 3.5 m and any pumping to allow the construction of the pylon footings would typically continue for a short period of approximately 3 to 6 days. The placement of Third Party cables underground would be unlikely to require dewatering as excavations would be 300 mm wide and up to 600 mm deep, and excavations would only be required to be open for short periods.

9.6.12 It is considered that the impact of any dewatering would reduce considerably with the distance from the pumping point. Under normal conditions is unlikely that significant effects would be recorded more than 50 m from the point of abstraction, although effects may be recorded more than 100 m from the excavation. As it is assumed the maximum depth of the shallow

pad footings for the majority of the pylons would be approximately 3.5 m, the maximum drawdown required to provide a dry working area would be less than 3.5 m. Due to the limited drawdown and the short period of pumping required, any short-term changes to the resource and/ or quality of the surrounding groundwater or surface water due dewatering would be of **medium** magnitude. Given the **medium to high** sensitively of the majority of the groundwater the impact significance would be **Negligible** (**not significant**).

9.6.13 The majority of the pylons would be remote from properties and hence it is unlikely that dewatering of the excavations for the foundations would impact on existing wells and boreholes. Where it is necessary to dewater during construction, a water well survey would be carried out over an area approximately 300 m from the pylon location. Should an assessment show that there is an unacceptable risk of derogation of existing water supply sources a replacement supply would be provided. This would consist of the provision of a temporary supply, such as a water bowser to ensure a continued water supply to the property during the construction period.

9.6.13.1 One private/public water supply has been identified within 50 m of pylon 4AP048, namely IPW011 (see Table 11.17 for details). It is anticipated that the abstraction is from the Old Red Sandstone Secondary A Aquifer which geological mapping indicates is overlain by Glacial Till. It is considered unlikely that dewatering would be required in the Old Red Sandstone to facilitate pylon foundation formation. However, should dewatering be required in the bedrock at Pylon 4AP048 further assessment of the potential impact on PWS would be undertaken which may lead to a recommendation for a foundation design that does not require dewatering such as piling or the discharge of any pumped water to a soak away between the pylon and the water supply. Should use be made of the horizontal flexibility, it is confirmed that up to seven supplies namely IPW008, IPW010, IPW017, DPWS008, DPW019, DPWS022, DPWS027 would potentially be within 50m of a pylon foundation. Should pylon locations move within 50 m of these supplies, further risk assessment on the interaction between each pylon and PWS would be undertaken to quantify the risk to the supply, and if required specify foundation design and construction methodology to limit the risk to the supply. The residual impact on groundwater in the PWSs would be of **low** magnitude. The PWSs are a receptor of **very high** sensitivity resulting in a **Negligible** effect (**not significant**).

9.6.14 The Tre'r Gof SSSI is located approximately 50 m to the east of the Order Limits and approximately 170 m from the nearest pylon location. Tre'r Gof SSSI is a lime rich wetland basin which is predominately fed by surface

water features although groundwater within the superficial aquifer also provides a water source. It is considered unlikely that significant effects would be recorded more than 50 m from the point of abstraction, although effects may be recorded up to 100 m from the excavation. If it is assumed that the maximum depth of the shallow pad footings for the majority of the pylons would be approximately 3.5m, the maximum drawdown required to provide a dry working area would be less than 3.5 m. Due to distance from the closest pylon, the limited drawdown, short duration of pumping and the relatively small area of catchment affected any impact to Tre'r Gof SSSI would be of a **low** magnitude and the impact significance is considered to be **Negligible** (**not significant**). Should use be made of the horizontal flexibility, it is possible that the pylon could be located within 50 m of the SSSI; should this occur it still deemed that due to the limited drawdown, short duration of pumping and small area of the catchment affected the impact significance would not change.

9.6.15 The Cors Erddreiniog, part of the Anglesey Fens SAC/SSSI/Ramsar/NNR, site comprises of a wetland environment partially located in the Order Limits. Pylon 4AP051 is located 20 m outside of the designated sites but in the same superficial aquifer as Cors Erddreiniog. The depth of the footings for Pylon 4AP051 would be 3.4 m, hence the maximum drawdown required to provide a dry working area would be less than 3.4 m. Due to the limited drawdown, short duration of pumping, discharge of treated pumped water to a soak away in the original catchment, and relatively small area of catchment affected any impact to the Cors Erddreiniog designated site would be of a **low** magnitude and the impact significiance is considered to be **Negligible** (**not significant**).

9.6.16 It is considered that there would be a potential impact on groundwater flow and quality associated with the construction of the tunnel access shafts. The potential inflow of groundwater into the shafts and the need for dewatering is discussed in greater detail in Appendix 11.8 (**Document 5.11.2.18**). The superficial deposits at both shafts have been identified through ground investigation as Glacial Till (Secondary Undifferentiated Aquifers), with an anticipated thickness of 11 m at the Braint shaft site and 4 m at the Ty Fodol shaft site. The underlying bedrock at the Braint site, consists of the Central Anglesey Berw and Shear Zone (Mica Schist), to a depth of 75 mbgl. At the Ty Fodol site the bedrock consists of Padarn Tuff Formation (Tuff Felsic) to a depth of 90 mbgl.

9.6.17 During the construction of the shafts external dewatering would unlikely to be required, as groundwater cut off through the superficial deposits and weathered bedrock would be provided by caisson rings, isolating the

groundwater external to the shafts from the shaft construction. The shafts would then be excavated using drill and blast (D&B) to the final depth with a concrete primary lining made up of sprayed concrete and rock bolts. Following completion of the tunnelling works a secondary "waterproof" lining will be installed. There could be groundwater inflow into the shaft base though drainage of the residual water pressure behind the secondary lining. Groundwater trapped within the cessation rings and from the ingress of groundwater from the bedrock would be removed using a sump pump (internal dewatering) and discharged to surface water in accordance with the measures outlined in the CEMP.

9.6.18 As described in section 4 of Appendix 11.8 (**Document 5.11.2.8**) it is considered that the groundwater drawdown within the bedrock during shaft construction locally around the shafts would be conceptually unlikely to transmit upwards through the bedrock to the overlying superficial deposits. Accordingly, it is considered that the construction of the shafts will have no significant impacts on the groundwater conditions in the superficial deposits and the significance of any impact is considered to be **Negligble** (**not significant**).

9.6.19 The estimated, groundwater inflow to the access shafts would be approximately 30 m^3/day to each shaft with a drawdown of 34 m and 46 m, and an estimated radius of influence of approximately 23 m and 36 m at the Braint and TyFodol shafts, respectively. As such the impact on groundwater level would be of **low** magnitude as there would be very little change from the baseline conditions. Given the surrounding groundwater in the bedrock at both shafts is of **medium** sensitivity the impact significance would be **Negligible** (**not significant**). The impact of the discharge to surface water is covered in Chapter 12, Water Quality Resources and Flood Risk (**Document 5.12**).

9.6.20 No Private Water Supplies have been identified within 220 m of the shafts. Therefore, with an estimated radius of influence of approximately 23 m and 36 m at the Braint and TyFodol shafts, respectively, there will be no effect on Private Water Supplies.

9.6.21 The tunnel shafts lining may allow pressure relief. Therefore, during operation groundwater inflow into the shafts would be as per the construction stage with approximately 30 m^3/day groundwater inflow into each shaft that would be removed using a sump pump (internal dewatering) and discharged to surface water. Like the construction phase it is considered that the effect on groundwater from inflow into the shafts would be of **low** magnitude as there would be very little change from baseline

conditions. Therefore the impact significance would be **Negligible (not significant)**. The impact of the discharge to surface water is covered in Chapter 12, Water Quality Resources and Flood Risk (**Document 5.12**).

9.6.22 The construction and operation of the tunnel also has the potential to have an impact on groundwater level and quality through groundwater inflow into the tunnel. If the tunnel is constructed by Tunnel Boring Machine (TBM) the permanent tunnel lining would be installed as the TBM progresses and the allowable groundwater leakage rate through the tunnel lining would be 0.1 litres/m^2/day (British Tunnelling Society Specification for 'Capillary Dampness'). For the 4 km tunnel with an internal diameter of 4 m, the groundwater inflow rate would be approximately 5 m^3/day. There would be potential for saline water inflow to the tunnel during construction from the section below the Menai Strait. It is assumed that saline groundwater would only be encountered within the tunnel over a 900 m length, which is greater than 150 m horizontally from the mean high-water mark of the Menai Strait. Temporary sumps and groundwater pumping would be used within the tunnel during construction to separate saline and fresh water inflows.

9.6.23 The groundwater leakage into the tunnel would be pumped to the surface into settlement ponds at the tunnel construction compound and then discharged to surface water. It is considered that the effect on groundwater resources from inflow into the tunnel during construction would be of **low** magnitude as there would be very little change from baseline conditions. Therefore the impact significance would be **Negligible** (**not significant**). The impact of the discharge of water pumped from the tunnel is covered in Chapter 12, Water Quality Resources and Flood Risk (**Document 5.12**).

9.6.24 If the tunnel were constructed by drill and blast open-face excavation for the entire length of the tunnel would be dewatering would be undertaken prior to the installation of the secondary tunnel lining. The estimated groundwater inflow rates are estimated to be a maximum of 900 m^3/day to the Braint THH and 650 m^3/day to the Ty Fodol THH, and are described in section 4 of Appendix 11.8 (**Document 5.11.2.8**). It is assumed that saline groundwater (derived from the Menai Strait) would only be encountered within the tunnel over a 900 m length, which is greater than 150 m horizontally from the mean high-water mark of the Menai Strait. Of the estimated maximum groundwater inflow of 900 m^3/day to the Braint THH and 650 m^3/day to the Ty Fodol THH it is estimated that 250 m^3/day could be saline to each THH. Temporary sumps and groundwater pumping would be used within the tunnel during construction to separate saline and fresh water inflows.

9.6.25 The groundwater leakage into the tunnel would be pumped to the surface into settlement ponds at the Ttunnel construction compounds and then discharged to surface water. It is considered the effect on groundwater from inflow into the tunnel during construction would be of **medium** magnitude as changes in groundwater levels would be detectable but not material and the post construction situation would be similar to the baseline condition. The bedrock aquifers along the tunnel alignment include Principal Aquifers of **high** sensitivity. Therefore the impact significance would be **Minor Adverse** (**not significant**). The impact of the discharge of water pumped from the tunnel is covered in Chapter 12, Water Quality Resources and Flood Risk (**Document 5.12**).

9.6.26 During operation, using either construction method, the tunnel would have an allowable groundwater leakage rate through the tunnel lining would be 0.1 litres/m^2/day (British Tunnelling Society Specification for 'Capillary Dampness'). For a 4 km tunnel with internal diameter of 4 m, the groundwater inflow rate would be estimated to be approximately 5 m^3/day.

9.6.27 The groundwater leakage into the tunnel would be pumped to the surface into settlement ponds at the Tunnel Head Houses and Sealing End Compounds and then discharged to surface water. It is considered that the effects on groundwater from the small inflows into the tunnel during operation would be of **low** magnitude as there would be very little change from baseline conditions. Therefore the impact significance would be **Negligible** (**not significant**). The impact of the discharge of water pumped from the tunnel is covered in Chapter 12, Water Quality Resources and Flood Risk (**Document 5.12**).

9.6.28 Topsoil and superficial clays would be excavated from the shafts along with excavated topsoil and superficial deposits from the foundations of new pylons, new access tracks and the removal of pylons on the OHL. These materials would be reused on-site for access track/ working areas re-instatement, backfill for the voids created from the removal of foundations of pylons, and landscaping during the construction phase. Materials would be reused under the Outline Materials Management Plan (OMMP) (**Document 7.12**) to ensure they would be physically and chemically (and radiologically, where necessary) suitable for re-use. The natural composition of the material in relation to the placement location will also be assessed for suitability for reuse. If material were to be unsuitable they would be disposed off site to a suitable site in accordance with the Outline Waste Management Plan (**Document 7.11**). As a result, the residual effect on groundwater would be **Negligible** (**not significant**) as there would be no measurable effect.

9.6.29 It is anticipated that most of the excavated rock spoil from the access shafts and tunnel would be suitable for recycling and re-use as outlined in the Outline Waste Management Plan (**Document 7.11**).

9.6.30 As a result, the residual effects on groundwater would be of **low** magnitude as the recycling and/or reuse of material in suitable locations within the Order Limits would mean there would be barely distinguishable changes in the baseline conditions. With the groundwater being of **medium to very high** sensitivity the impact significance would be **Negligible** (**not significant**).

9.6.31 No operational effects on groundwater for the Proposed Development have been identified with the exception of the potential for foundations of the THHs and pylons or gantry, particularly if piled foundations, creating a potential preferential pathway for contaminants to migrate to groundwater. In the absence of any significant contamination at any of the proposed structures and the mitigation measures outlined in the CEMP, which would either remove any source of contamination and/ or mitigate its migration to the underlying groundwater, it is concluded that such effects are unlikely and that any residual effects would be of **low** magnitude. Although the sensitivity of the groundwater is **high** the impact significance would be **Negligible** (**not significant**).

9.6.32 The use of imported recycled aggregates/soils to fill and/or cap the shafts on decommissioning may pose a risk to groundwater quality, if the aggregates were to be contaminated. However, similar mitigation measures to those outlined in the CEMP would mean that only materials suitable for use would be imported. As a result, the residual effects would have no or minimal adverse effects on groundwater, and the impact significance of the residual effects would be **Negligible** (**not significant**).

9.7 EFFECTS ON HUMAN HEALTH

9.7.1 Potential activities associated with the Proposed Development that could impact on human health across the Proposed Development include:

- Pollution due to chemical spillages and leaks posing risk to construction workers;
- Disturbance of potentially contaminated soils, sediments and waters posing a risk to construction workers;
- Importation of contaminated aggregates posing a potential risk to human health;

- Disturbance of former underground coal mine workings posing a potential risk to construction workers;
- Requirement to remove spoil from tunnelling operations posing a potential risk to human health;
- Requirement to remove spoil from construction of new pylons and OHL; and
- Importation of backfill material for tunnel shafts posing a potential risk to human health during decommissioning.

9.7.2 Mitigation measures required are set out below:

- CEMP Measures GP42, GP44, GP82, GP811, AE13, AE4, AE15, CL11, CL21, CL23, CL24, CL26 and Soil Management Plan SM12.

9.7.3 The residual effect from chemical spillages and leaks during construction, maintenance and decommissioning would be **Negligible** (**not significant**) as spillages would be unlikely and if they did occur would be managed to have no measurable impact on human health through appropriate incident response procedures.

9.7.4 The baseline assessment has identified a number of potential contaminative land uses. However, the baseline has demonstrated that the potential scale and type of ground contamination within the Order Limits is a low risk with the majority of potential contamination sources being associated with infilled former pits and small quarries that are likely to be very localised. The vast majority of sources within the Order Limits would not be directly beneath proposed works that would disturb the ground. No ground or groundwater contamination has been identified by ground investigation works at the Braint or Tŷ Fodol Construction Compounds. There is potential for ground and/or groundwater contamination within areas of the Wylfa and Pentir Substation where ground works are proposed for the construction and placement of new infrastructure. Areas of contaminated ground would be avoided, where possible. Where this is not possible, remediation would be undertaken to either remove the source or prevent the creation of pathways to receptors as described in the CEMP. Therefore, there would be no residual effects to end users or adjacent users. In relation to radon with the exception of maintenance visits in the Tunnel there would be no enclosed structures that would be occupied so workers are unlikely to be exposed to radon. During the construction and operation of the tunnel when the tunnel is occupied it would be ventilated, as discussed in Chapter 4, Construction, Operation, Maintenance and Decommissioning (**Document 5.4**), so there

would unlikely to be a significant accumulation of radon. Therefore, there would be no effect on construction or maintenance workers. The risks posed to construction workers during remediation works would be mitigated by design and adherence to health and safety procedures as detailed in the CEMP (**Document 7.4**). As these measures would prevent measurable adverse health effects on construction workers, the impact significance of the residual effects would be a **Negligible** effect (**not significant**).

9.7.5 The use of imported aggregates during construction, maintenance and decommissioning, for example for the construction of temporary access tracks, may pose a risk to construction workers and adjacent users, if the aggregates were to be contaminated. However, the mitigation measures outlined in the CEMP would mean that only materials suitable for use would be imported. As a result, the residual effects would have no measurable adverse health effects on construction workers, and the impact significance of the residual effects would be **Negligible** (**not significant**).

9.7.6 The OHL construction could cause the disturbance of former underground coal mine workings posing a potential risk to construction workers. The presence, or absence, of shallow workings in pylon locations in the area to the east of Llangefni would need to be confirmed by ground investigation as discussed in the CEMP. Assuming a worst case situation where foundations encounter shallow workings and the pylon could not be moved there would be a risk of ground disturbance affecting the integrity of the pylon foundation, and the potential for mine gas posing a risk to construction workers. These effects would be mitigated by appropriate design of foundations and health and safety procedures during construction as outlined in the CEMP resulting in residual effects that would be **Negligible** (**not significant**).

9.7.7 Topsoil and superficial clays would be excavated from the shafts along with excavated topsoil and superficial deposits from the foundations of new pylons, new access tracks and the removal of pylons on the OHL. These materials would be reused on-site for access track/ working areas re-instatement, backfill for the voids created from the removal of foundations of pylons, and landscaping during the construction phase. Materials would be reused under the Outline Materials Management Plan (OMMP) (**Document 7.12**) to ensure they would be physically and chemically (and radiologically, where necessary) suitable for re-use. The natural composition of the material in relation to the placement location will also be assessed for suitability for reuse. If material were to be unsuitable they would be disposed off site to a suitable site in accordance with the Outline Waste Management Plan (**Document 7.11**). As a result, the residual effect on

human health would be **Negligible** (**not significant**) as there would be no measurable effect.

9.7.8 It is anticipated that most of the excavated rock spoil from the access shafts and tunnel would be suitable for recycling and re-use as outlined in the Outline Waste Management Plan (**Document 7.11**). As a result, the residual effects on human health would be **Negligible** (**not significant**).

9.7.9 The use of imported recycled aggregates/soils to fill the shafts on decommissioning may pose a risk to construction workers, if the aggregates were to be contaminated. However, the mitigation measures outlined in the CEMP would mean that only materials suitable for use would be imported. As a result, there would have to be no measurable residual adverse health effects on construction workers, and the impact significance of the residual effects would be **Negligible** (**not significant**).

10 Cumulative Effects

10.1 INTRODUCTION

10.1.1 This section of the assessment considers the cumulative effects of the various elements of the Proposed Development and the accumulated effects of the proposals with other developments proposed in the vicinity.

10.2 INTRA PROJECT CUMULATIVE EFFECTS

10.2.1 Intra-project effects are reported in Chapter 19, Intra-Project Effects (**Document 5.19**).

10.3 INTER PROJECT CUMULATIVE EFFECTS

10.3.1 Inter-project cumulative effects occur when two or more planned developments have an effect on the same receptor leading to an overall effect of greater significance. Note that these 'other developments' are developments that have not yet been constructed and are not operational; where developments are constructed and operational they are considered to form part of the existing baseline.

10.3.2 Chapter 20 Inter-Project Cumulative Effects (**Document 5.20**) presents a methodology for determining whether inter-project cumulative effects could occur as a result of these 'other developments' being built and/or operated at the same time as the Proposed Development. This methodology is based upon the Planning Inspectorate Advice Note 17, which deals with cumulative effects assessment. A long list of other developments needs to be developed and agreed initially. Once this is agreed, the methodology consists of four main stages as follows:

- Stage 1: a long list of other developments is identified and outline information gathered. Consideration is given to whether the other development is within the zone of influence (ZOI) for each topic; if it is, then the assessment progresses to stage 2.

- Stage 2: consideration is given to the potential temporal overlap i.e. whether the construction or operational effects of the other development could coincide with those of the Proposed Development. Consideration is also given to the scale and nature

of the other development, the nature of the receiving environment and whether there are shared receptors, and whether there is a 'pathway' for a cumulative effect to occur. At the end of stage 2 a shortlist of other developments is considered in stages 3 and 4.

- Stage 3: detailed information is gathered about each of the shortlisted other developments, typically in the form of ESs or Scoping Reports.
- Stage 4: cumulative effects are assessed and mitigation identified, and apportioned, where necessary. The securing mechanism for any necessary mitigation is identified.

10.3.3 The potential for cumulative effects to occur is considered for any effects that are minor, moderate or major. However, where the residual effects on a shared receptor are concluded to be negligible for either the Proposed Development or the other development, it is not considered possible for there to be a resulting inter-project cumulative effect. Where all effects related to a particular topic are negligible, for either the proposed Development or other development, the other development is screened out at stage 2.

10.3.4 Details about the 'other developments' on the long list considered at stage 1 are provided in Chapter 20 Inter-Project Cumulative Effects (**Document 5.20**) and its appendices.

Stage 1 and Stage 2

10.3.5 Table 11.26 provide a summary of Stage 1 and Stage 2 of the inter-project cumulative effects assessment on soil, geology, hydrogeology and human health receptors. Where the effects of other developments are either outside the ZOI or outside the temporal scope of the Proposed Development, they have not been included in this table.

Table 11.26 Summarising Stage 1 and Stage 2 of the Inter-Project CEA

Development Name	Stage 1		Stage 2		
	Within ZOI?	Progress to Stage 2?	Overlap in Temporal Scope?	Is the Scale and Nature of Development likely to have a Significant Cumulative Effect? Relevant Shared Receptors and/or Pathways?	Progress to Stage 3/4?
Wylfa Newydd Nuclear Power Station	Yes	Yes	Potential overlap between construction phases.	Shared receptors: groundwater and soil. Potential to require dewatering during construction phase with subsequent short-term depletion of groundwater levels within localised aquifers and short-term change to soil quality. **Negligible** effects have been predicted on the potential shared receptors by the Proposed Development therefore potential significant cumulative effects are considered unlikely and these receptors are not considered further in this assessment.	No
Wylfa Nuclear Power Station Decommissioning	No	No			
Penrhos Leisure Village	No	No			
Anglesey Eco Park	No	No			
Parc Cybi	No	No			
Rhyd-y-Groes Re-power	No	No			
Holyhead Waterfront Redevelopment	No	No			
Glyn Rhonwy Pumped Storage	No	No			
Underground Grid Connection between Glyn Rhonwy	Yes	Yes	The connection is expected to take less than a year however as	Shared receptors: groundwater and soil. There is the potential to require dewatering during construction phase with subsequent short-	No

Table 11.26 Summarising Stage 1 and Stage 2 of the Inter-Project CEA

Development Name	Stage 1		Stage 2		
	Within ZOI?	Progress to Stage 2?	Overlap in Temporal Scope?	Is the Scale and Nature of Development likely to have a Significant Cumulative Effect? Relevant Shared Receptors and/or Pathways?	Progress to Stage 3/4?
Pumped Storage Development and Pentir Substation			the start date is not currently known, it is assumed there could be overlap in the construction phases.	term depletion of groundwater levels within localised aquifers and short-term change to soil quality. **Negligible** effects are predicted on the potential shared receptors as a result of the Proposed Development therefore significant cumulative effects are unlikely.	
West Anglesey Demonstration Project	No	No			
Holyhead Deep	No	No			
A487 Caernarfon to Bontnewydd Bypass	No	No			
Menai Science Park	No	No			
Third Menai Crossing	No	No			
A55 - Junction 15 & Junction 16 Improvement	No	No			
A55 Abergwyngregyn to Tai'r Meibion Improvement	No	No			
Nant y Garth Landfill Site	Yes	Yes	Overlap of operation of landfill (time-limited to the end of July 2021) and construction of the Proposed Development.	Shared receptors: none.	No

Table 11.26 Summarising Stage 1 and Stage 2 of the Inter-Project CEA

Development Name	Stage 1		Stage 2		
	Within ZOI?	Progress to Stage 2?	Overlap in Temporal Scope?	Is the Scale and Nature of Development likely to have a Significant Cumulative Effect? Relevant Shared Receptors and/or Pathways?	Progress to Stage 3/4?
Caernarfon Brickworks Quarry	No	No			
Amlwch Liquid Natural Gas (LNG)	No	No			
Green Wire	No	No			
Llanbadrig Solar Farm	No	No			
Codling Wind Park	No	No			
Grŵp Llandrillo Menai Llangefni Campus	No	No			
Dinorwig Cables	Yes	Yes	Potential overlap between construction phases (cable installation is programmed for between 2019 and 2025) along with overlap in the operational phases.	Shared receptors: groundwater and soil. Potential to require dewatering during construction phase with subsequent short-term depletion of groundwater levels within localised aquifers and short-term change to soil quality. Negligible effects predicted on the potential shared receptors by the Proposed Development therefore there is no potential for significant cumulative effects.	No
Holyhead Port Expansion	No	No			

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Stage 3 and Stage 4

10.3.6 At the end of Stage 2 the original long list of other developments was reduced to a short list of other development where there would be potential for a significant cumulative effect to occur. No developments were identified as having a potential significant cumulative effect therefore none were progressed to stage 4 assessment.

10.3.7 Stage 3 requires the gathering of detailed information; however, a substantial amount of information about the other developments had already been gathered to support stages 1 and 2.

Conclusion

10.3.8 Taking into consideration all of the other developments for which a potential cumulative effect has been identified, the overall effects are considered to be not significant.

11 Summary

11.1.1 This chapter has assessed the potential effects of the Proposed Development on the soils, geology and groundwater characteristics within the Study Area. The potential for effects of ground and groundwater contamination materials on human health has also been considered.

11.1.2 The assessment has shown that the Proposed Development would be underlain by varied superficial geological strata and associated groundwater receptors from Secondary (Undifferentiated) strata (Glacial Till), to Secondary A Aquifers (Alluvial, Glaciofluvial and Tidal Flat deposits), and Secondary B Aquifers (Coastal Zone Deposits). The bedrock geology is also very varied from Schist (Secondary B Aquifer), to Sandstones and Mudstones (Secondary A and B Aquifers) to Limestone (Principal and Secondary A Aquifers). In addition an area to the east of Llangefni, within the Order Limits, is shown to be underlain by Coal Measures and potentially former coal mine workings.

11.1.3 No designated geological or geomorphological features or sites have been identified in the Study Area.

11.1.4 A number of public and private water abstractions have been identified within the Study Area.

11.1.5 The review of a range of sources including environmental database information, NRW, IACC and Gwynedd Council, has identified the location of potential contaminated land sites, mining and quarrying sites, waste sites, potentially contaminative historical and current land uses, and public and private groundwater abstractions. All of these features are considered to be of a small scale and very localised in nature, with the vast majority located in the vicinity of the OHL route. None are located directly within the THH/CSEC, or Substation extension areas.

11.1.6 The principal potential effects identified that could occur during the construction phase are those associated with spillages and leaks of fuel and chemicals during the operation of construction plant, degradation of soil quality during the handling and movement of soils, as well as dewatering affecting groundwater levels. In addition there would be potential limited effects on human health and pylon stability from historical shallow mine

workings. All of these effects would be effectively controlled through standard mitigation measures and the residual effects are mostly considered to be of negligible significance, with the exception being effects on groundwater which could reach minor significance.

11.1.7 In terms of potential effects during operation there would be no requirement to use hazardous chemicals, or for permanent dewatering systems, with the exception of very low volumes of water seepage in the tunnel and access shafts that would be discharged to surface water. The only operational effect identified is therefore the potential for piled foundations of pylons, tunnel head houses, and equipment within substations to act a preferential pathway for any contaminants present to migrate to uncontaminated strata and groundwater. Through appropriate design this would be of negligible significance.

11.1.8 The general maintenance of the Proposed Development would involve infrequent site visits for visual inspections and minor maintenance to equipment. There would be no plausible impacts on soils, geology and groundwater. If refurbishment works were required the main effects are related to providing access and working areas, and reflect those of the construction phase.

11.1.9 Potential effects during decommissioning would generally reflect those for construction as similar access and working areas would be required. There would also be the potential effect if contaminated imported material were used to backfill the tunnel shafts. This could pose a risk to human health, and groundwater.

11.1.10 Mitigation of these effects would mainly consist of good site practice and management through measures committed to in the CEMP (**Document 7.4**) and Outline Waste Management Plan (**Document 7.11**). In addition, the potential effects due to land contamination, coal workings and piled foundations are currently based on a worst case scenario and would be further investigated through intrusive ground investigation, chemical testing and risk assessment prior to construction. If risks are confirmed they would be mitigated through appropriate design and/ or remedial works discussed with Gwynedd Council and/or IACC and NRW.

11.1.11 The mitigation measures required to address these effects require no bespoke solutions to be implemented. As a result all of the residual effects in relation to soils, geology and human health identified in this assessment can be predicted to be of **Negligible significance**, and the residual effects on groundwater to be **Negligible to Minor Adverse significance**.

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Table 11.27: Geology, Hydrogeology and Ground Conditions Residual Effects

Resource/ Receptor	Value	Potential effects and sensitivity	Mitigation	Residual Magnitude	Significance
Soils	Low	Pollution of soils due to chemical spillages and leaks	GP51, GP61, AE15, WE21, WE23, WE55, R1, R3	Low	Negligible (Not Significant)
Soils	Low	Reduction of soil quality during handling and storage	Soil Management Plan (SM12) (**Document 7.10**) –	Low	Negligible (Not Significant)
Soils	Low	Reduction of soil quality due to construction traffic	Soil Management Plan (SM12) (**Document 7.10**)	Low	Negligible (Not Significant)
Soils	Low	Importation of contaminated aggregates posing a risk to underlying soils	GP814 Outline Waste Management Plan (**Document 7.11**), CL26	Low	Negligible (Not Significant)
Soils	Low	Dewatering leading to changes to soil hydrology	CL11 & WE23	Medium	Negligible (Not Significant)
Geology	Low to High	Ground pollution due to chemical spillages and leaks	GP51, GP61, AE15, WE21, WE23, WE55, R1, R3	Low	Negligible (Not Significant)
Geology	Low to High	Importation of contaminated aggregates posing a potential risk to underlying geology	GP814 Outline Waste Management Plan (**Document 7.11**) & CL26	Low	Negligible (Not Significant)
Geology	Low to High	Foundations of pylons and other structures creating a preferential pathway for contaminants to migrate	CL11, CL21, CL22 CL24 WE22 & WE23	Low	Negligible (Not Significant)
Geology	Low to High	Requirement to remove spoil from tunnelling operations posing a potential risk to geology	Outline Waste Management Plan (**Document 7.11**), CL21	Low	Negligible (Not Significant)
Geology	Low to High	Requirement to remove spoil from construction of pylons and OHL	GP814 Outline Waste Management Plan (**Document 7.11**)	Low	Negligible (Not Significant)
Groundwater	Medium to very High	Groundwater pollution due to chemical spillages and leaks	GP51, GP61, AE15, WE21, WE23, WE55, R1, R3	Low	Negligible (Not Significant)

Table 11.27: Geology, Hydrogeology and Ground Conditions Residual Effects

Resource/ Receptor	Value	Potential effects and sensitivity	Mitigation	Residual Magnitude	Significance
Groundwater	Medium to very High	Reduction of groundwater levels due to construction traffic	, CL11, WE23, WE55 & Soil Management Plant (SM12)	Low	Negligible (Not Significant)
Groundwater	Medium to very High	Importation of contaminated aggregates posing a potential risk to underlying groundwater	GP814 Outline Waste Management Plan (**Document 7.11**), CL26	Low	Negligible (Not Significant)
Groundwater	High	Disturbance of former underground coal mine workings posing a potential risk to groundwater	CL11, CL21 WE23 & WE55	Low	Negligible (Not Significant)
Groundwater	Medium to High	Requirement for dewatering, reducing flow to groundwater abstractions and surface water bodies	CL11, WE23. WE41 & WE59	Medium	Minor Adverse (Not Significant)
Groundwater	Very High	Requirement for dewatering reducing flow to private water supplies as well as surface run/off, spillages and leaks of fuels, oils or other chemicals during construction affecting quality of Private Water Supplies	CL11, CL22, CL23, CL25, CL26 WE23. WE41 & WE59	Low	Negligible (Not Significant)
Groundwater	Very High	Requirement for dewatering, reducing quality or levels of groundwater supporting sites protected under European and UK habitat legislation, such as a RAMSAR Site or a SSSI.	CL11, WE23, WE41 & WE59	Low	Negligible (Not Significant)
Groundwater	Medium to very High	Requirement to remove spoil from tunnelling operations posing a potential risk to groundwater	CL11, WE23 & WE55	Low	Negligible (Not Significant)
Groundwater	Medium to very High	Requirement to remove spoil from construction of pylons and OHL	GP814 Outline Waste Management Plan (**Document 7.11**), CL11, CL21, CL22. WE23 & WE55	Low	Negligible (Not Significant)
Groundwater	Medium to very High	Foundations of pylons and other structures creating a preferential pathway for contaminants to migrate during operation	CL11, CL21, CL22, CL24 WE23 & WE55	Low	Negligible (Not Significant)

Table 11.27: Geology, Hydrogeology and Ground Conditions Residual Effects

Resource/ Receptor	Value	Potential effects and sensitivity	Mitigation	Residual Magnitude	Significance
Groundwater	Medium	Importation of backfill material for tunnel shafts during decommissioning posing a potential risk to groundwater quality	Outline Waste Management Plan (**Document 7.11**), CL26	Low	Negligible (Not Significant)
Human Health	N/A	Pollution due to chemical spillages and leaks posing risk to construction workers	GP42, GP44, GP51, GP61, AE15	N/A	Negligible (Not Significant)
Human Health	N/A	Disturbance of potentially contaminated soils, sediments and waters posing a risk to construction workers	GP42, GP44, GP82, GP811, AE13, AE14, AE15, CL11, CL21, CL22, CL26 and Soil Management Plan (SM12)	N/A	Negligible (Not Significant)
Human Health	N/A	Importation of contaminated aggregates posing a potential risk to human health	Outline Waste Management Plan (**Document 7.11**) and CL26	N/A	Negligible (Not Significant)
Human Health	N/A	Disturbance of former underground coal mine workings posing a potential risk to construction workers	CL11, CL21 and CL22	N/A	Negligible (Not Significant)
Human Health	N/A	Requirement to remove spoil from tunnelling operations posing a potential risk to human health	Outline Waste Management Plan (**Document 7.11**), CL11 and CL21	N/A	Negligible (Not Significant)
Human Health	N/A	Requirement to remove spoil from construction of pylons and OHL	Outline Waste Management Plan (**Document 7.11**), CL11 and CL21	N/A	Negligible (Not Significant)
Human Health	N/A	Importation of backfill material for tunnel shafts posing a potential risk to human health during decommissioning	Outline Waste Management Plan (**Document 7.11**) and CL26	N/A	Negligible (Not Significant)

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12 References

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