Connah's Quay Low Carbon Power

Preliminary Environmental Information Report
Volume II, Chapter 20: Climate Change

Uniper

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Delivering a better world

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20.1 Introduction

Overview

20.1.1 This chapter of the Preliminary Environmental Information Report (PEIR) presents a preliminary assessment of the likely significant environmental effects of the Proposed Development with respect to Climate during the construction, operation (including maintenance), and decommissioning phases of the Proposed Development.

20.1.2 This Climate Change chapter includes three sub-assessments which are presented in turn:

a. Lifecycle Greenhouse Gas (GHG) assessment – to identify the impacts of GHG emissions from the Proposed Development on the climate.

b. Climate Change Resilience (CCR) assessment – to understand the vulnerability of the Proposed Development to the impacts of future climate change.

c. In-Combination Climate Change Impact (ICCI) assessment – to identify the combined impacts of climate change and the Proposed Development on receptors in the surrounding environment.

20.1.3 This chapter is supported by the following appendices in PEIR Volume IV:

- **Appendix 1-B: Scoping Opinion**;
- **Appendix 7-A: Legislative, Policy and Guidance Framework for Technical Topics**;
- **Appendix 20-A: Greenhouse Gas Baseline Data and Methodology Report**;
- **Appendix 20-B: Climate Change Resilience Baseline Data and Methodology Report**;
- **Appendix 20-C: Climate Change Resilience Assessment;** and

  Appendix 20-D: In-combination Climate Change Assessment

Legislation, Policy and Guidance

20.1.4 Legislation, planning policy, and guidance relating to Climate Change and pertinent to the Proposed Development are listed in **Table 20-1**. Further detail regarding these can be found in **Appendix 7-A: Legislative, Policy and Guidance Framework for Technical Topics** (**PEIR Volume IV**).

Table 20-1: Legislation, Planning Policy, and Guidance relating to Climate Change

Type	Legislation, Policy, and Guidance
International	• United Nations Framework Convention on Climate Change (UNFCCC) Paris Agreement (2016) (Ref 20-1); and • Kyoto Protocol (1997) (Ref 20-2).
Legislation	• Infrastructure Planning (Environmental Impact Assessment (EIA)) Regulations 2017 (Ref 20-3); • Climate Change Act 2008 (Part 1) (Ref 20-4); • The Climate Change Act 2008 (2050 Target Amendment) Order 2019 (Article 2) (Ref 20-5); • The Carbon Budget Order 2021 (Article 2) (Ref 20-6); • The Sixth Carbon Budget: The UK's Path to Net Zero (2020) (Ref 20-7); • The Climate Change (Interim Emissions Targets) (Wales) Regulations 2018 (Ref 20-8) • The Climate Change (Interim Emissions Targets) (Wales) Regulations 2021 (Article 2) (Ref 20-9); • Net Zero Wales Carbon Budget 2 (2021-25) (2021) (Ref 20-10); • Environment (Wales) Act 2016 (Part 2) (Ref 20-11); and • Well-being of Future Generations (Wales) Act 2015 (Part 2) (Ref 20-12).
National Planning Policy	• The Overarching National Policy Statement (NPS) for Energy (EN-1) (Ref 20-13); • The NPS for Natural Gas Electricity Generating Infrastructure (EN-2) (Ref 20-14); • The NPS for Natural Gas Supply Infrastructure and Gas and Oil Pipelines (EN-4) (Ref 20-15); • The NPS for Electricity Networks Infrastructure (EN-5) (Ref 20-16); • Planning Policy Wales (PPW) (Ref 20-17); • Our Green Future: Our 25-year Plan to Improve the Environment (2018) (Ref 20-18); • Net Zero Strategy: Build Back Greener (2021) (Ref 20-19); • British Energy Security Strategy (2021) (Ref 20-20); • Clean Growth Strategy (2017) (Ref 20-21); and • Clean Growth Strategy: The UK CCUS Deployment Pathway - An Action Plan (2018) (Ref 20-22). • Welsh Climate Change Adaptation Plan (2019) (Ref 20-45)
Local Planning Policy	• Flintshire County Council (FCC) Local Development Plan (LDP) (2015-2030) (Ref 20-23); • FCC Climate Change Strategy 2022/23 – 2029/30 (Ref 20-24); •

Type	Legislation, Policy, and Guidance
National Guidance	• IEMA: Environmental Impact Assessment Guide to: Assessing Greenhouse Gas Emissions and Evaluating their Significance (2022) (IEMA Guidance (Climate Change)) (Ref 20-25); • IEMA: Environmental Impact Assessment Guide to: Climate Change Resilience and Adaptation (2020) (Ref 20-26); • GHG Protocol (2015) (Ref 20-27); • Carbon Management in Infrastructure (PAS 2080) (2023) (Ref 20-28); • Department for Energy Security and Net Zero (DESNZ) Emission Factors (2024) (Ref 20-29); • Inventory of Carbon and Energy (ICE) Database Version 3.0 (2019) (Ref 20-30); and • Think Hazard (last updated 2020) (Ref 20-31).

20.2 Consultation and Scope of Assessment

Consultation

20.2.1 A request for an EIA Scoping Opinion was sought from the Secretary of State for Energy Security and Net Zero (SoS) through the Planning Inspectorate (PINS) in February 2024 as part of the EIA Scoping Process. The EIA Scoping Opinion was adopted on 20 March 2024 (**Appendix 1-B: Scoping Opinion PEIR Volume IV**).

20.2.2 Key issues raised in the Scoping Opinion are summarised and responded to in **Appendix 2-B: Matters Raised in the Scoping Opinion** (**PEIR Volume IV**). All issues are being considered during the EIA process.

20.2.3 No further engagement has been undertaken outside of the Scoping Opinion at this stage

20.3 Lifecycle Greenhouse Gas Assessment – Scope and Methodology

Scope of the Assessment

20.3.1 Following the scoping process that has been undertaken, the scope of the assessment considered in this chapter of the PEIR is as follows:

Construction

- any site enabling works;
- land use change;
- raw material extraction and manufacturing of products/ materials;
- transport of products/ materials to site;

- on-site construction activity;
- transport of construction workers;
- transportation and disposal of construction waste; and
- provision and treatment of water.

Operation

- consumption of natural gas in the Proposed Development, including Well to tank (WTT) emissions from the upstream natural gas supply chain;
- use of vehicles (i.e. cars and motorcycles);
- disposal and transportation of operational waste;
- provision and treatment of wastewater; and
- building/infrastructure maintenance.

Decommissioning

- on-site decommissioning activity;
- transport of decommissioning workers; and
- transportation and disposal of waste; and
- provision and treatment of water.

20.3.2 A detailed breakdown of the GHG assessment scope is given in **Table 20-1** in **Appendix 20-A: Greenhouse Gas Baseline and Methodology Report (PEIR Volume IV)**.

20.3.3 When considering the scope and boundary for inclusion of emissions within a GHG assessment it is standard accounting practice (i.e., PAS 2080) to exclude emissions sources that contribute or remove less than 1% to the total inventory as 'immaterial' (Ref 20-28).

Assessment Methodology

20.3.4 This section provides a summary of the Lifecycle GHG Assessment methodology. The scope of assessment considers the impacts and resultant effects during all phases of the Proposed Development.

20.3.5 A detailed breakdown of the Lifecycle GHG Assessment methodology can be found within **Appendix 20-A: Greenhouse Gas Baseline Data and Methodology Report (PEIR Volume IV).**

Impact Assessment

20.3.6 In alignment with the NPS EN-1 (paragraph 5.3.4) (Ref 20-13), this GHG assessment adopts a whole life approach to quantifying GHG emissions, showing construction, operational and decommissioning GHG impacts, including impacts from change of land use.

20.3.7 The output of this assessment is used to identify GHG emissions hotspots (i.e. sources likely to generate the largest impact in terms of GHG emissions). This enables priority areas for mitigation to be identified. This methodological approach is consistent with the assessment principles set out in IEMA Guidance (GHG Assessment) and PAS 2080 guidance (Ref 20-25; Ref 20-28).

20.3.8 Any assumptions, inclusions and exclusions that inform the GHG emissions calculation have been clearly described in the sections below.

Sensitive Receptors

20.3.9 The identified receptor for GHG emissions is the global climate. As the effects are not geographically constrained, all development has the potential to result in a cumulative effect on GHG emissions.

20.3.10 As stated below, both the UK and Welsh five-year Carbon Budget will be used as a proxy for the global climate. These Carbon Budgets are described within Table 2 and Table 3 of **Appendix 20-A: Greenhouse Gas Baseline Data and Methodology (PEIR Volume IV)**.

Classification of Effects

20.3.11 In line with IEMA Guidance (GHG Assessment) (Ref 20-25), lifecycle GHG emissions from the Proposed Development have been contextualised against both the UK (Ref 20-6) and Welsh Carbon Budgets (Ref 20-9).

20.3.12 In addition, this aligns further with the NPS EN-1 requirements for GHG emissions (paragraph 5.3.4) (Ref 20-13), in which the impact of estimated lifecycle emissions from the Proposed Development on regional and national targets to limit climate change is assessed.

20.3.13 Both the UK and Welsh Carbon Budgets are described in greater detail within section 2.2 of **Appendix 20-A: Greenhouse Gas Baseline Data and Methodology (PEIR Volume IV)**.

20.3.14 It is essential to note that supplementary carbon budgets have not been formally adopted by the UK Government beyond 2037. Therefore, to illustrate the Proposed Development's progress towards the UK's net-zero target by 2050, the GHG Assessment has utilised the Committee on Climate Change's (CCCs) balanced net-zero pathway (as outlined within the UK's Sixth Carbon Budget, Ref 20-7) to contextualize GHG emissions post-2037.

20.3.15 Beyond 2050, it is expected that the UK will remain at net zero. This has been illustrated in Table 2 of **Appendix 20-A: Greenhouse Gas Baseline Data and Methodology (PEIR Volume IV)**.

Significance of Effects

20.3.16 The criteria used to determine the significance of GHG emissions is summarised in **Table 20-2** below.

Table 20-2: Definition of Levels of Significance (Ref 20-25)

Significance	Effects	Description	Example in the IEMA Guidance (Climate Change)
Significant	Major adverse	A project that follows a 'business-as-usual' or 'do minimum' approach and is not compatible with the UK's net zero trajectory or accepted aligned practice or area-based transition targets. It is down to the practitioner to differentiate between the 'level' of significant adverse effects e.g. 'moderate' or 'major' adverse effects.	The project's GHG impacts are not mitigated or are only compliant with do-minimum standards set through regulation, and do not provide further reductions required by existing local and national policy for projects of this type. A project with major adverse effects is locking in emissions and does not make a meaningful contribution to the UK's trajectory towards net zero.
	Moderate adverse		The project's GHG impacts are partially mitigated and may partially meet the applicable existing and emerging policy requirements but would not fully contribute to decarbonisation in line with local and national policy goals for projects of this type. A project with moderate adverse effects falls short of fully contributing to the UK's trajectory towards net zero.
Not significant	Minor adverse	A project that is compatible with the budgeted, science based 1.5 °C trajectory (in terms of rate of emissions reduction) and which complies with up-to-date policy and 'good practice' reduction measures to achieve that. It may have residual emissions but is doing enough to align with and contribute to the relevant transition scenario, keeping the UK on track towards net zero by 2050 with at least a 78% reduction by 2035, thereby potentially avoiding significant effects.	The project's GHG impacts would be fully consistent with applicable existing and emerging policy requirements and good practice design standards for projects of this type. A project with minor adverse effects is fully in line with measures necessary to achieve the UK's trajectory towards net zero.

Significance	Effects	Description	Example in the IEMA Guidance (Climate Change)
	Negligible	A project that achieves emissions mitigation that goes substantially beyond the reduction trajectory, or substantially beyond existing and emerging policy compatible with that trajectory and has minimal residual emissions. This project is playing a part in achieving the rate of transition required by nationally set policy commitments.	The project's GHG impacts would be reduced through measures that go well beyond existing and emerging policy and design standards for projects of this type, such that radical decarbonisation or net zero is achieved well before 2050. A project with negligible effects provides GHG performance that is well 'ahead of the curve' for the trajectory towards net zero and has minimal residual emissions.
Significant	Beneficial	A project that causes GHG emissions to be avoided or removed from the atmosphere. Only projects that actively reverse (rather than only reduce) the risk of severe climate change can be judged as having a beneficial effect.	The project's net GHG impacts are below zero and it causes a reduction in atmospheric GHG concentration, whether directly or indirectly, compared to the without-project baseline. A project with beneficial effects substantially exceeds net zero requirements with a positive climate impact.

Rochdale Envelope

20.3.17 The setting of design parameters using the 'Rochdale Envelope' approach is described in **Chapter 2: Assessment Methodology and Consultation.** Table 4-1 of **Chapter 4: The Proposed Development** sets out the maximum parameters currently envisaged for the principal components of the Proposed Development. These parameters have been used to inform the representative worst-case scenario that has been assessed in this chapter, to provide a robust assessment of the impacts and likely significance of environmental effects of the Proposed Development at its current stage of design.

20.3.18 In particular, the Rochdale Envelope approach has been used to estimate emissions across a single-phased approach for the construction, operation, and decommissioning of the Proposed Development.

20.3.19 In addition, the Rochdale Envelope approach has been used to estimate likely material quantities for the construction of the Proposed Development.

Assessment Assumptions and Limitations

20.3.20 At this stage of the Proposed Development's design, the current GHG assessment is limited to the availability of data and information. Available activity and materials data has been sourced from the Applicant; where

specific data sets are not available, a mix of assumptions and industry benchmarks have been used to fill data gaps.

20.3.21 Assumptions surrounding the inclusions and exclusions of data used to assess the likely impact of GHG emissions across the construction, operational, and decommissioning phases have been detailed in paragraphs 20.6.2, 20.6.10, and 20.6.35 respectively.

20.4 Lifecycle GHG Assessment – Baseline Conditions and Study Area

Study Area

20.4.1 As the GHG assessment considers the impact of the Proposed Development on the climate, where national carbon budgets are used as a proxy for the climate, study area for the GHG assessment are emissions arising within the UK and Wales as a result of the Proposed Development. This includes all direct GHG emissions from within the Indicative Site Boundary area arising during all stages of the construction, operation, and decommissioning of the Proposed Development. It also includes indirect GHG emissions occurring off-site that are related to the Proposed Development, such as embodied carbon in as a result of production of the construction materials, transportation, waste processing and waste disposal.

Existing Baseline

20.4.2 The existing baseline for this GHG assessment is the GHG emissions attributed to the Proposed Development's lifetime energy generation, should this be generated by another existing, unabated CCGT power station within the grid, as a means of balancing the National Grid's generation capacity.

20.4.3 As noted within **Appendix 20-A: Greenhouse Gas Baseline Data and Methodology (PEIR Volume IV)** this is because existing, unabated CCGTs provide similar dispatchable marginal generating capacity to that that will be provided by the Proposed Development, should development be granted.

Future Baseline

20.4.4 The future baseline scenarios are set out in paragraph 2.2.20 of **Chapter 2: Methodology and Consultation (PEIR Volume II)**.

20.4.5 The future baseline for the assessment of the impact of the Proposed Development on climate is a projected 'business as usual' scenario where the Proposed Development is not constructed, and the Proposed Development's projected lifetime generation is provided by an existing, unabated CCGT power station (paragraph 1.3.5, **Appendix 20-A: Greenhouse Gas Baseline Data and Methodology (PEIR Volume IV)**).

20.4.6 For the adopted worst-case project scenario, the existing Connah's Quay Power Station is assumed to remain operational until 2035, as described

within paragraph 2.2.30 of **Chapter 2: Assessment Methodology and Consultation.**

20.4.7 The methodology for calculating GHG emissions and removals is consistently used across the baseline, construction, and operational phases of the Proposed Development, as described below.

20.5 Lifecycle GHG Assessment - Development Design and Embedded Mitigation

20.5.1 EN-1 notes (paragraph 5.3.9) (Ref 20-13) the Secretary of State should be content that the Applicant has taken all reasonable steps to reduce the GHG emissions across the construction and decommissioning stage of a development (**Chapter 7: Planning Policy and Need**). The Proposed Development has been designed, as far as possible, to avoid or minimise impacts and effects on the climate through the process of design development, and by embedding measures into the design of the Proposed Development.

20.5.2 The following embedded mitigation measures have been incorporated into the Proposed Development design, with detailed proposals and locations to be submitted with the Development Consent Order (DCO) Application:

- by overall design, the Proposed Development offers the opportunity to reduce the carbon emissions emitted from the generating station and aid the decarbonisation of the electricity supplied to the national grid. Captured carbon dioxide emissions are proposed to be compressed and conditioned for export to a Transport & Storage (T&S) network operated by a third party (Liverpool Bay CCS Limited).. As described in **Chapter 4: The Proposed Development (PEIR Volume II)**, captured and transported CO_2 is expected to flow into an offshore permanent geological store (depleted oil and gas fields in the Liverpool Bay) and not released to the atmosphere; and
- other embedded measures incorporated in the operational design are described in the PEIR, in particular **Chapter 4: The Proposed Development (PEIR Volume II)**.

20.5.3 The following standard construction practices are relevant to this assessment**:**

- development and implementation of a Construction Environmental Management Plan (CEMP) and the Site Waste Management Plan (SWMP) that controls construction activities through relevant regulations, industry good practice, and specific measures described within this PEIR. The appointed contractor(s) will be required to develop and implement a CEMP to measure, monitor and report energy and water consumption and GHG emissions during construction;
- encouraging the use of construction materials to lower embodied carbon emissions i.e. higher recycled content;

- construction staff are anticipated to travel to the Proposed Development via the existing trunk road and local networks, as described within **Chapter 4: The Proposed Development**. The Applicant will seek to maximize sustainable transport options, such as public transport (including rail), cycling and car sharing in accordance with policy. This will be outlined in the Construction Workers Travel Plan which will be included in the final ES to accompany the DCO application and secured through a requirement in the DCO; and
- where possible, avoiding routing connections through natural habitats. Where this cannot be avoided, landscape management approaches will be developed to deliver net biodiversity benefit and minimise losses of soil and vegetation stores.

20.5.4 The following standard operation practices are relevant to this assessment:

- The purpose of this Proposed Development is to provide low carbon energy using carbon capture and offshore permanent geological carbon dioxide storage;
- The design of the Proposed Development will be based on European Best Available Technique (BAT) reference documents ('BRefs') for CCGT plants and UK Guidance on Emerging Techniques for Post-Combustion Carbon Capture (Ref 20-35), including energy efficiency requirements The Environmental Permit application will include a report setting out how the Proposed Development will meet these BAT requirements. The GHG assessment within this Chapter has been modelled for high levels of thermal efficiency;
- The Environmental Permit will contain provisions requiring the applicant to ensure that energy is used efficiently across all activities, including energy generation and to regularly review and record whether there are opportunities to improve energy efficiency and to take such identified measures where appropriate.
- to reduce emissions associated with operational worker commuting, sustainable forms of travel will be promoted by provision of cycle storage areas; and
- The Proposed Development will implement and maintain an Environmental Management System (EMS) which will be certified to International Organisation for Standardisation (ISO) 14001. This EMS will outline requirements and procedures required to manage operational emissions (e.g., water use, energy use/efficiency, waste) and to ensure that the Proposed Development is operating to the appropriate standard.

20.5.5 The Proposed Development is expected to have a design life of up to 30 years as a reasonable worst-case scenario for this GHG assessment. On this basis, decommissioning activities are currently anticipated to commence after or 2065 (for single phase construction scenario, as the assumed worst case).

20.5.6 At the determined end of its operational life, the Proposed Development would be shut down, with all above ground structures on the Main Site removed, and the ground remediated as required to facilitate future re-use.

20.5.7 As noted above, decommissioning activities will take place after 2050, when the UK is anticipated to be net-zero (Ref 20-6). At this stage of the Proposed Development's design, details regarding these activities have not been developed; therefore, quantifying associated emissions is not possible. However, emissions associated with the decommissioning of the Proposed Development will need to align with the UK and Welsh net-zero requirements, as portrayed within Table 2 and Table 3 of **Appendix 20-A: Greenhouse Gas Baseline Data and Methodology (PEIR Volumes IV)**.

20.5.8 The following standard decommissioning practices are relevant to this assessment:

- at this stage, limited specific additional mitigation measures have been identified for the decommissioning phase of the Proposed Development due to uncertainties in the activities that will be undertaken, future emission factors, and technologies available. A Decommissioning Plan (including Decommissioning Environmental Management Plan) would be produced and agreed to appropriate guidance and legislation at the time, and will likely include measures to reduce GHG emissions, for example encouraging the contractors to re-use or recycle the bulk of the plant, equipment, and materials.

20.6 Lifecycle GHG Assessment - Preliminary Assessment of Likely Impacts and Effects

20.6.1 Taking into account the embedded mitigation measures as detailed in section 20.5 above, the potential impacts and effects of the Proposed Development have been assessed using the methodology as detailed in section 20.4 of this chapter and **Chapter 2: Assessment Methodology and Consultation**.

Construction Phase

20.6.2 To assess the magnitude of the climate change impacts as a result of GHG emissions associated with construction of the Proposed Development, GHG emissions activities have been estimated on the basis of corresponding emissions derived by AECOM to support a DCO application for a similar CCGT project with carbon capture and storage (CCS) capabilities, adjusted for a two CCGT Train operation with a net output capacity of 1,380 MWe.

20.6.3 This is adequate for the purposes of this PEIR assessment, but a comprehensive assessment on the basis of actual quantities and construction activities will be carried out for the GHG assessment to be included within the Environmental Statement.

20.6.4 As noted within paragraph 5.2.2 of **Chapter 5: Construction Management and Programme (PEIR Volume II)**, the worst-case scenario for GHG emissions assume a single-phase construction of both CCGT Trains 1 and 2.

Under this worst-case scenario, site enabling works, construction activities, and the eventual commissioning of the Trains is expected from Q4 2031, at the latest, to 2035. Therefore, this assessment assumes an approximate construction period of five years. This is visualised within the indicative single-phase construction and commissioning programme (see Table 5-2 of **Chapter 5: Construction Management and Programme (PEIR Volume II)**).

20.6.5 As detailed in **Table 20-3**, total construction GHG emissions from the Proposed Development are estimated to be 153,360 tCO_2e. The majority of emissions (~88%) are attributed to the embodied carbon and transport of construction materials and products, with the remaining 12% resulting from construction activities. Assuming that emission-related activities are similar across the Proposed Development's approximate 5-year construction annual emissions are expected to be approximately 30,672 tCO_2e/year (**Table 20-3**). As these activities would not happen without the Proposed Development's construction, these emissions are considered additional to the existing baseline scenario (see section 20.5).

Table 20-3: Construction GHG Emissions

Lifecycle stage	Project activity/ Emission source	Emissions (tCO_2e) over approximate 5-year construction period	Percentage of total
Production	Embodied carbon of material and products	129,466	88%
	Transport of products/materials to site	6,000	
Construction and Commissioning	Electricity use	355	12%
	Fuel use onsite	7,576	
	Waste disposal	131	
	Worker commuting	9,831	
Total GHG emissions over construction period		153,360	
Average annualised GHG emissions during construction		**30,672 tCO2e/year**	

20.6.6 The receptor of the GHG assessment is the global climate. However, in line with IEMA Guidance (Climate Change) and in addition to the NPS EN-1's requirements for GHG emissions, construction emissions from the Proposed Development have been contextualised nationally against the UK and Welsh Carbon Budgets (**Table 20-4**). This is further described in **Appendix 20-A: Greenhouse Gas Baseline and Methodology Report (PEIR Volume IV)**.

Table 20-4: Significance Assessment of Construction Phase Emissions

Year	Potential Construction Phase Emissions Million Tonnes of carbon dioxide equivalent (Mt CO2e)	Welsh Carbon Budget (Mt CO2e)	Percentage Contribution of Emissions to the Welsh Carbon Budget	UK Carbon Budget (Mt CO2e)	Percentage Contribution of Emissions to UK Carbon Budget
2031	0.01	Welsh Carbon Budget 3 (2031-2035) **83 $MtCO_2e$**	0.16%	5th Carbon Budget (2028-2032) **1,725 $MtCO_2e$**	0.002%
2032	0.03				
2033	0.03			6th Carbon Budget (2033-2037) **965 $MtCO_2e$**	0.01%
2034	0.03				
2035	0.03				
2036	0				
2037	0				

20.6.7 During the years that construction emissions are anticipated to occur (2031-2035), construction emissions are estimated to contribute to 0.16% of the total Welsh Carbon Budget 3 (2031-2035) (**Table 20-4**).

20.6.8 Estimated construction emissions are expected to contribute 0.002% and 0.01% of the 5th (2028-2032) and 6th (2033-2037) UK Carbon Budgets respectively (**Table 20-4**).

Significance of GHG Emissions

20.6.9 The impact of construction emissions on the delivery of the Welsh and UK Carbon Budgets, which is of high sensitivity, has been assessed as having a magnitude of minor adverse, which is considered to be **not significant** (**Table 20-2**).

Operation Phase

20.6.10 The earliest year of operation for the Proposed Development is anticipated to be 2030, under a phased construction approach beginning in 2026 for a period of five years. If construction was to be undertaken in a single phased approach, the earliest year of operation is anticipated to be 2035. If a single phased construction approach was undertaken at the latest possible time, five years after DCO Consent, operation would be anticipated to occur in late 2036.

20.6.11 To assess the magnitude of the Proposed Development's operational emissions on climate change, emissions have been calculated on the basis of a number of assumptions.

20.6.12 A key data source for operational emissions is the Heat and Material Balance (HMB) tables for different operating cases. These tables provide a wealth of technical data relating to the operation of the power station under various scenarios, including details of mass flow rates of gases through the power station. The flow rate of CO_2 in kg/hour in the treated flue gases, post-carbon capture plant, is specifically quantified within the HMB across differing operational modes (described below).

Operational Modes

20.6.13 The Proposed Development will operate in dispatchable and load following mode (i.e., being able to export power to match the anticipated intermittency of renewable power in the future power market), as per **Chapter 4: The Proposed Development (PEIR Volume II).**

20.6.14 If the transport and storage (T&S) system for captured carbon has issues downstream in the Liverpool Bay CCS system, it could be necessary to operate the Proposed Development for a short period of time in in unabated mode; this is noted as a worst-case scenario for GHG emissions. Here, exhaust gases from the CCGT will be routed via the Heat Recovery Steam Generator (HRSG) stack.

20.6.15 As noted, the Proposed Development is expected to operate in dispatchable mode. The effect of start-up on short term CO_2 emissions will not be fully understood until the detailed design has been completed and commissioning undertaken. However, when the plant is not operating CO_2 emissions will also cease. It is therefore considered that the worst-case assessment for annual carbon emissions would be the plant running all year round with an average capture rate of approximately 95%. On this basis, the four operating modes used to form the basis of this assessment are summarized below:

- **Reference case**: The Proposed Development will operate for up to c.8,760 hours per year at 100% full load at site reference conditions (13.1°C ambient and 80% relative humidity (RH%)) on the CCGT and approximately 95% carbon capture rate;
- **Minimum load case**: The Proposed Development will operate for up to c. 8,760 hours per year at a minimum load at site reference conditions (12.5°C ambient and 80 RH%) on the CCGT and approximately 95% carbon capture rate;
- **Winter case**: The Proposed Development will operate for up to c. 8,760 hours per year at full load at winter conditions (-9.4°C ambient and 85 RH%) on the CCGT and approximately 95% carbon capture rate; and
- **Summer high case**: The Proposed Development will operate for up to c. 8,760 hours per year at full load at summer high conditions (24.7°C ambient and 50 RH%) on the CCGT and approximately 95% carbon capture rate.

20.6.16 For each operating scenario, the hourly flow rate of CO_2 in treated flue gases can be combined with estimated annual running hours to derive the total direct atmospheric CO_2 emissions. Hourly emissions of CO_2 to the atmosphere, post-carbon capture plant, are shown in **Table 20-5** below.

Table 20-5: Hourly Emissions of CO_2 for Each Operating Mode

Operating Mode	Hourly CO_2 Emissions to Atmosphere (kg/hour) (Two Train Operation)
1 – Reference Case	**25,298.75**
2 – Minimum Load Case	7,126.01
3 – Winter Case	23,111.34
4 – Summer High Case	27,229.71

20.6.17 Indicative lifetime emissions can be quantified for each operating mode, but it is the emissions for **Operating Mode 1 – Reference Case** that can be taken to be representative of the Proposed Development, and which are presented in the GHG assessment (**Table 20-5**). Other operating modes have been developed to validate the design of the Proposed Development when operating under different conditions, but the hourly emissions under these circumstances are not able to inform the GHG assessment presented here as they are not representative of normal operation.

20.6.18 Further to the direct emissions relating to the operational of the Proposed Development under the Reference Case, other operational emissions have been based on a limited number of assumptions; these are listed below:

- Similar to construction, estimates assume a single-phase construction, commissioning, and operation of the Proposed Development (Train 1 and 2); this is based upon a worst-case assumption for operation. For this scenario, the Proposed Development's operation lifetime is anticipated to last 30 years from 2035 to 2065.
- WTT emissions from the upstream natural gas supply chain have been estimated by applying a ratio to the gross unabated CO_2 emissions taken from the above-mentioned HMB tables (paragraph 20.6.12). This ratio has been derived from published emissions factors for direct (Scope 1) and indirect (Scope 3) emissions from natural gas, as published annually by the UK Government (Ref 20-29). The ratio so derived is 0.165, meaning that for every tonne of CO_2, resulting from natural gas combustion in the power station's gas turbines (i.e. prior to entering the integrated carbon capture plant (CCP)), a further 0.165 tonnes will have been emitted through venting, flaring and fugitive emissions in the upstream natural gas supply chain. These are emissions over which the Applicant has no control.
- The Proposed Development is expected to be operational 24 hours a day, 7 days per week for 30 years. Information regarding maintenance

schedules is not currently available, therefore running hours are expected to be approximately 8,760 hours per year.

- CO_2 may be used for purging of the electrical generators for maintenance purposes. The volumes of gas and the frequency of the activity is not known at this stage of design although these are likely to be a minor source of GHG emissions. These are therefore not included in this estimate.
- The abated CCGT units (i.e., Trains 1 and 2) will produce up to a net electrical output of 1,380 megawatts (MWe) (which accounts for the parasitic load of CCGT elements). It is assumed that the CCS system and sequestration technology is operational and functioning as expected. These factors are taken into account within the HMBs.
- The Liverpool Bay CCS system is assumed to have a approximately 95% availability rate across the Proposed Development's operation for the transport and storage (T&S) of captured carbon. To account for additional emissions attributed to potential unavailability of the T&S system, 5% of captured GHG emissions from the Proposed Development are assumed to be released to the atmosphere as a worst-case scenario for GHG emissions. This has been considered as an indirect (Scope 3).
- Electrical circuit breakers and other switchgear historically used sulfur hexafluoride (SF_6) as an arc quencher and noise suppressant. This gas has a very high global warming potential, but suppliers are increasingly producing SF_6-free equipment, or sealed-for-life units with extremely low leakage rates. For the purposes of this assessment, it is assumed that leakage rates will be negligible and is not included.
- The consumption of grid electricity within the Proposed Development has not been considered within this estimate of operational (Scope 2) emissions. This will be clarified for the ES, in which estimates of required grid imports i.e., for CCGT start-ups, and therefore Scope 2 emissions will take full account of projected grid decarbonization leading to 2050. Additional electricity consumption is expected to arise from the use of pumps, compressors and cooling towers. However, during plant operation, this equipment will be a parasitic load that sources its power from the CCGT plant, therefore this will be considered as Scope 1 emissions. Grid electricity will be used for the Site's building and offices when the plant is not running, however this is not expected to be material. The majority of electricity consumption will arise through the use of a CO_2 compressor, which will not be operating during this period.

Operational Emissions (Reference Case)

20.6.19 As detailed in **Table 20-6**, the total operational GHG emissions over the 30-year design life of the Proposed Development are estimated to be 38,237,461 tCO_2e, with the majority (approximately 64%) of operational emissions resulting from the upstream natural gas supply chain, and a significantly smaller proportion resulting from the combustion of fuel onsite. Average annual emissions over the 30-year design life are estimated to be

approximately 1,274,582 tCO_2e/year (**Table 20-6**). At this stage in the Proposed Development's design, this figure is expected to remain constant over the entire operational period, therefore this is the worst case assessment for annual carbon emissions (as noted in paragraph 20.6.15).

Table 20-6: Operational GHG Emissions (Reference Case) (TBC indicates information not available at time of PEIR; this will be incorporated into the ES assessment)

Lifecycle stage	Project activity/ Emission source	Emissions (tCO_2e) over 30-year operation period	Percentage of total
Operation	Electricity usage	TBC	TBC%
	Fuel usage onsite (CCGT emissions and other fuels)	6,648,512	17%
	Indirect emissions from natural gas supply chain	24,503,656	64%
	Emissions from unavailability of Transport and Storage system	7,085,293	19%
	Waste disposal	TBC	TBC%
	Worker commute	TBC	TBC%
	Materials	TBC	TBC%
	Material transport	TBC	TBC%
Total GHG emissions over operation period		**38,237,461 (at current)**	
Average annualised GHG emissions during operation (based on 30-year life)		**1,274,582 tCO2e/year**	

Net Operational Carbon

20.6.20 As described in section 20.4.1, the existing baseline scenario represents GHG emissions from activities that will occur should the Proposed Development not be consented i.e., the continued operation of an existing unabated CCGT power station.

20.6.21 As noted within paragraph 20.6.15, the Proposed Development is assumed to operate for 8,760 hours per year at a maximum net electrical output of 1,380 MWe. From this, the Proposed Development is estimated to have a total energy generation of 362,664,000 MWh over the assessed 30-year operating period.

20.6.22 A carbon intensity value, representing the grams of CO_2 released to produce a MWh of electricity, has been calculated by dividing the total energy generation figure (above) into the lifetime emissions total of 38,237,461 tCO2e (see **Table 20-6**). The operational carbon intensity value for the Proposed Development is estimated to be 0.105 tCO2e/ MWh.

20.6.23 Currently within the UK, the marginal generating capacity (i.e. the generating technology that responds to changes in grid electricity demand) is provided by unabated CCGT power stations. As these existing, unabated CCGTs provide

the balance of generation capacity, it is reasonable to assume that every MWh of electrical energy provided by a low-carbon installation (e.g., the Proposed Development) is a MWh of electrical energy that does not have to be generated by an existing unabated CCGT.

20.6.24 While it is recognised that EN-1 (paragraph 4.9.25, Ref 20-12) requires all new commercial scale combustion power stations (at or over 300 MW generating capacity) to be constructed as Carbon Capture Ready, the comparison presented in this assessment is explicitly with an existing, unabated CCGT technology and not with new installations to reflect that this is the energy generations likely to be displaced. It is existing unabated gas-fired power stations that low-carbon installations such as the Proposed Development must displace in support of the UK's net zero ambitions.

20.6.25 An existing unabated CCGT, currently the most carbon-efficient fossil-fueled technology available, can be assumed to operate with a representative carbon intensity of 0.354 tCO2e/ MWh (Ref 20-34). However, this figure only accounts for direct (Scope 1) emissions attributed to CCGT operation. Therefore, an uplifted figure of 0.412 tCO2e/ MWh has been used to account for emissions from the upstream supply chain (Scope 3) of natural gas[1]. The operational carbon intensity of the Proposed Development is estimated to be approximately 75% lower than that of an existing, unabated CCGT.

20.6.26 This estimated reduction in carbon intensity is further depicted within **Plate 20-1**, in which the lifetime operational emissions attributed to the Proposed Development's total energy generation (362,664,000 MWh) is compared with an existing unabated CCGT, taken as a counterfactual for the same energy production. Direct operational emissions generated from the combustion of natural gas (i.e., Scope 1) within the existing CCGTs are portrayed in blue. For the Proposed Development, operational emissions assume a capture rate of approximately 95%. In addition, emissions produced indirectly across the upstream natural gas supply chain (e.g., from venting, flaring, and leakage) are portrayed in orange (i.e., Scope 3) (**Plate 20-1**).

[1]The carbon intensity of Scope 3 emissions has been estimated applying a ratio derived from published emissions factors for Scope 1 and Scope 3 emissions from natural gas, as published annually by the UK Government (Ref 20-29). The ratio so derived is 0.165, meaning that for every tonne of CO_2 directly emitted to the atmosphere in the power station's flue gases, a further 0.165 tonnes will have been emitted through venting, flaring and fugitive emissions in the upstream natural gas supply chain.

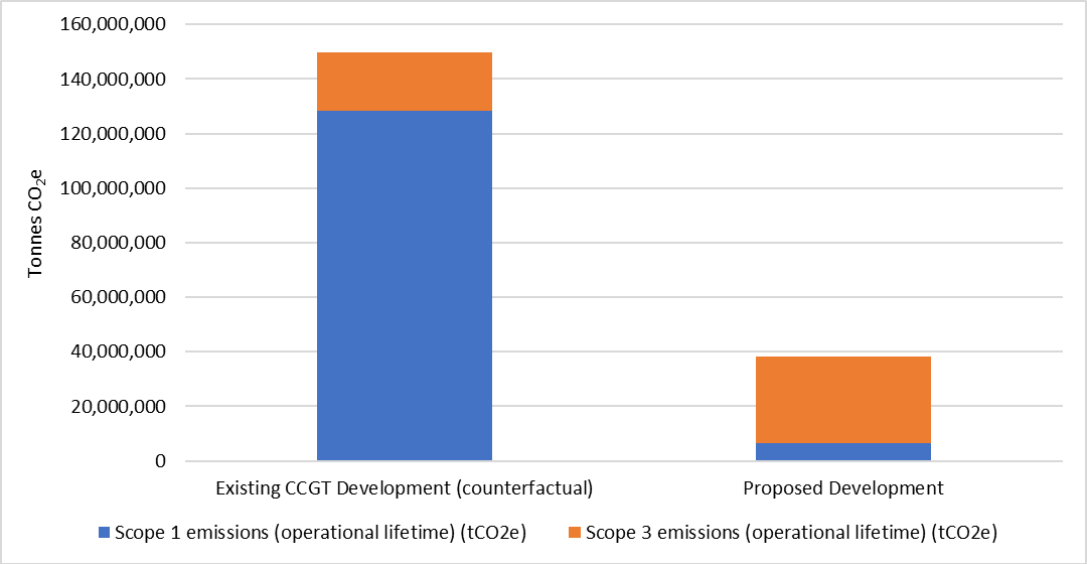


Plate 20-1: Comparison of the lifetime operational emissions across an existing unabated CCGT power plant and the Proposed Development.

20.6.27 The decrease in direct (Scope 1) emissions from the Proposed Development, compared to those from an existing unabated CCGT installation, are as a result of the CCS. However, CCS can only reduce direct emissions from flue gases, and cannot mitigate against indirect (Scope 3) emissions from the natural gas supply chain. **Plate 20-1** shows how these upstream emissions, over which the Applicant has no control, accounts for a large majority of operational emissions from the Proposed Development.

Significance of GHG Emissions

20.6.28 In line with previous IEMA Guidance (Climate Change), and in addition to the requirements of NPS EN-1, the Proposed Development's operational emissions have been contextualised against both the UK and Welsh Carbon Budgets, as described in **Appendix 20-A: Greenhouse Gas Baseline and Methodology Report (PEIR Volume IV)**.

20.6.29 Assuming a 30-year operational life, operational emissions from the Proposed Development will overlap numerous UK and Welsh carbon budgets. Of the remaining 6th UK carbon budget period (2033-2037), operational emissions are estimated to contribute 0.4% to the UK budget (**Table 20-7**). Following this budget, emissions generated during the Proposed Development's operation are expected to contribute 1.21%, 3.27%, and 22.49% of the remaining CCC balanced net-zero pathways (**Table 20-7**). Thereafter, the budget effectively falls to zero making further percentage calculations meaningless. Any residual emissions after the net zero target date of 2050 will require to be balanced at a national level via removals within sectors such as agriculture and land use, land use change and forestry (LULUCF). Within the energy sector, GHG removals may be achieved via bioenergy with carbon capture and storage (BECCS) (Ref 20-32).

20.6.30 Operational emissions are estimated to initially contribute 1.54% to the Welsh Carbon Budget 3 (2031-2035). Following this, emissions generated during the Proposed Development's operational are expected to contribute 13.28%, 23.60%, and 45.52% of the remaining Welsh Carbon Budgets 4, 5, and 6 (**Table 20-7**).

20.6.31 It should be noted that the Welsh carbon budgets are significantly smaller than the shown UK-wide carbon budgets and these have only been included to contextualize emissions on a regional level. Whilst the emissions shown above represent a material proportion of the Welsh carbon budgets, these figures represent an absolute worst case for GHG emissions and do not reflect the wider climatic benefit of the Proposed Development i.e., facilitating the reduction of GHG emissions across other sectors. As per EN-1 (Ref 20-13), this technology is a key part of government's policy to decarbonise both the UK, and more specifically Wales, in line with net zero targets.

Table 20-7: Significance assessment of operational phase emissions

Year	Potential Operational Phase Emissions (Mt CO_2e)	Welsh Carbon Budget (Mt CO_2e)	Percentage Contribution of Emissions to the Welsh Carbon Budget	UK Carbon Budget	Percentage Contribution of Emissions to UK Carbon Budget
20355	1.27	Welsh Carbon Budget 3 (2031-2035) **83 $MtCO_2e$**	1.54%	6th Carbon Budget (2033-2037) **965 $MtCO_2e$**	0.4%
2036	1.27	Welsh Carbon Budget 4 (2036-2040) **48 $MtCO_2e$**	13.28%		
2037	1.27				
2038	1.27			CCC's balanced net-zero pathway (2038-2042) **526 $MtCO_2e$**	1.21%
2039	1.27				
2040	1.27				
2041	1.27	Welsh Carbon Budget 5 (2041-2045) **27 $MtCO_2e$**	23.60%		
2042	1.27				
2043	1.27			CCC's balanced net-zero pathway (2043-2047) **195 $MtCO_2e$**	3.27%
2044	1.27				
2045	1.27				
2046	1.27	Welsh Carbon Budget 6 (2046-2050) **14 $MtCO_2e$**	45.52%		
2047	1.27				
2048	1.27			CCC's balanced net-zero pathway (2048-2050) **17 $MtCO_2e$**	22.49%
2049	1.27				
2050	1.27				

20.6.32 In line with IEMA guidance (Climate Change) (Ref 20-25), which advises considering projects at a holistic level, the overall GHG impact of the Proposed Development has been assessed as beneficial and **significant** (**Table 20-2**). This is provided that the Proposed Development's GHG impact is compared against an alternative counterfactual scenario, in which a similar CCGT operates without CCS (i.e., the existing Connah's Quay Power Station) (e.g., **Plate 20-1**).

20.6.33 The above is consistent with the position taken in paragraph 150 of the Supreme Court Judgement in the case of *Finch* (Ref 20-33), which noted the need for the relevant planning authority to consider the *beneficial* indirect effects of a project on the climate, and not just *adverse* effects, as a material planning consideration:

"Just as beneficial indirect effects of a project on climate - for example, the "green" energy that would be generated by a project to develop a wind farm or solar farm - are clearly a relevant matter for the planning authority to consider, so corresponding adverse effects are also a material planning consideration" (paragraph 150, Ref 20-33).

20.6.34 The wind farm or solar farm mentioned in the *Finch* Ruling provides "green" energy only because it generates electricity with a lower carbon intensity than the existing, higher carbon alternative that it displaces. The same is true of the Proposed Development; a CCGT operating with CCS will clearly reduce emissions relative to an existing CCGT operating without CCS.

Decommissioning Phase

20.6.35 GHG emissions that will impact the climate during decommissioning of the Proposed Development are likely to include those associated with:

- demolition and excavation of all buildings and infrastructure, as required;
- disposal and treatment of all wastes; and
- return of the Site to an industrial brownfield use under hard standing (i.e. no change in land use).

20.6.36 At this stage of the design, details regarding these activities have not been developed, however they are assumed to be commensurate with emissions generated during the construction stage (e.g. of the approximate magnitude of 125,000 tCO_2e). It should be noted that estimates of emissions attributed decommissioning activities are of high uncertainty, given that they are expected take place far into the future i.e., after 2065.

Significance of GHG Emissions

20.6.37 As noted above, the GHG impact of decommissioning activities has been assumed to correspond with those generated during construction. However,

as the Proposed Development's decommissioning phase is set to occur after the expiry of the UK, and more specifically Wales, Carbon Budgets (2050) these emissions cannot be contextualized. Furthermore, given that the UK islegally required to have achieved net zero emissions, the demolition activities, transportation of waste materials, and waste disposal are likely to have been substantially decarbonised.

20.6.38 For the purpose of understanding the significance, decommissioning emissions has been assessed as having a magnitude of minor adverse, which is considered to be **Not Significant** (**Table 20-2**). The overall GHG impact from the decommissioning phase should be noted to be much lower than the impact from the construction phase, therefore the figures presented here represent a worst-case scenario.

20.7 Lifecycle GHG Assessment - Additional Mitigation and Enhancement Measures

20.7.1 The lifecycle GHG assessment assumes that the measures outlined within the Development Design and Embedded Mitigation section of this chapter (section 20.5) would be incorporated into the design of the Proposed Development. These measures are considered standard best practice that are usually applied across construction sites in the UK.

20.7.2 As noted within paragraph 20.6.2, GHG emissions from the construction of the Proposed Development have been estimated against figures contained in DCO applications for similar CCGT projects with CCS. However, it is recognised that the use of benchmark factors means that the full potential of carbon reductions from low-carbon construction materials (e.g., low-carbon concrete and steel) and techniques (e.g., offsite modular construction) have not been accounted for within the current GHG assessment. Therefore, the use and implementation of low-carbon materials and construction techniques is identified as additional mitigation measures for the construction phase of the Proposed Development.

20.8 Lifecycle GHG Assessment - Summary of Likely Significant Residual Effects

20.8.1 The receptor for the GHG assessment is the global climate and the UK and Welsh carbon budgets are used as a proxy to assess the impacts to this receptor.

20.8.2 In line with IEMA Guidance (Ref 20-25) emissions associated with the Proposed Development have been examined for their significance against the UK and Welsh Carbon Budgets. The significance of these lifecycle emissions, against the aforementioned budgets, are detailed in paragraphs 20.6.9, 20.6.28, and 20.6.37 above.

20.8.3 **Table 20-8** summarises the likely residual significant effects of the Proposed Development on Climate Change and receptors following implementation of mitigation.

Table 20-8: Summary of Significant Residual Effects (Operation)

Receptor	Sensitivity (value)	Description of Impact	Classification of Effect (prior to Additional Mitigation)	Additional Mitigation / Enhancement Measure	Magnitude of Impact after Additional Mitigation	Residual Effect after Additional Mitigation
Global Atmosphere	High	Impact of GHG emissions arising during the operation of the Proposed Development on the climate. This will have a Beneficial impact.	Significant	Not required	Beneficial	Significant

20.9 Climate Change Resilience Assessment (CCRA) - Scope and Methodology

Scope of the Assessment

20.9.1 The Climate Change Resilience Assessment (CCRA) has qualitatively assessed the Proposed Development's resilience to climate change. Potential climate hazards are identified using the UK Climate Projections 2018 (UKCP18) (Ref 20-36) for the geographical location and timeframe of the Proposed Development (including its construction, operation, and decommissioning).

20.9.2 The CCRA has been undertaken to identify potential climate change impacts on the Proposed Development, and to consider their potential consequence and likelihood of occurrence, taking account of the measures incorporated into the Proposed Development's design.

Assessment Methodology

20.9.3 This section provides a summary of the CCRA methodology. The scope of assessment considers the resilience of the Proposed Development to climate change impacts, including how the design and construction will consider projected impacts of climate change.

Impact Assessment

20.9.4 The methodology in this chapter has been developed in line with appropriate industry guidance for assessing CCR and adaptation such as IEMA (Ref 20-26) and in accordance with the EU Commission Notice (2021/C 373/01) Technical guidance on the climate proofing of infrastructure in the period 2021-2027 (Ref 20-37).

20.9.5 The assessment includes all infrastructure and assets associated with the Proposed Development. It assesses the resilience against both gradual climate change i.e., chronic climate-related hazards and the risks associated with an increased frequency of severe weather events i.e., acute events.

Asset Components

20.9.6 When conducting a robust CCR and adaptation assessment, it is important to understand the individual components that make up the asset as each may be vulnerable to different climate variables in different ways. The key asset components that have been considered in this climate assessment include:

- exhaust gas cooling and conditioning plant;
- CO_2 cooling and compression plant;
- cooling towers;
- effluent treatment plant;

- chemical and waste storage tanks;
- absorber tower(s) and associated stack(s);
- ducting and pipework;
- pylons;
- equipment;
- internal access roads;
- parking areas (including electric vehicle chargers); and
- electrical control room, administration building, workshops, staff offices, and welfare facilities.

20.9.7 It is important to note that the final technology selection for the CCGT and CCP has not yet been made, and will be determined by various technical, safety, environmental and economic considerations and vendor selection. The assumptions regarding the Proposed Development, therefore, incorporate a necessary degree of flexibility in the choice of technology and design, to allow for the future selection of the preferred technology in the light of prevailing policy and market conditions once a DCO is granted.

Climate Change Data

Climate variables

20.9.8 Given the location of the Proposed Development in Flintshire, North-East Wales, and the classification of the asset as a CCGT Generating Plant fitted with CCP on land, the following climate variables were identified as relevant following the scoping process:

- storms (winds, storm surge, lightning);
- extreme precipitation;
- sea level rise;
- extreme temperatures;
- precipitation change;
- wildfires;
- wind; and
- estuary temperature

20.9.9 A detailed breakdown of scoped in climate variables, including rationale, are given in Table 1 in **Appendix 20-B: Climate Change Resilience Baseline Data and Methodology Report (PEIR Volume IV).**

Climate baseline data

20.9.10 For the purposes of the CCR assessment, the baseline conditions are based upon historic climate change data. This data was obtained from the Met Office,

recorded by the closest meteorological station to the Site with the largest range of historical data. The closest meteorological station is Hawarden Airport, approximately 6.9 km from the Site. Data was collected for the climate variables described previously for the period 1981-2010. This baseline period was chosen as it matches the baseline period the available climate change projections were based on. The historical data collected is provided in **Table 20-11**.

Climate projection data

20.9.11 For this CCR assessment, two climate change timeframes were reviewed to provide decision-makers with a more holistic understanding of the range of potential climate futures possible, which is essential when understanding risk and developing appropriate adaptation measures. These climate change projections were based on Representative Concentration Pathway (RCP) 8.5.

20.9.12 RCP 8.5 was also used as it represents a worst-case scenario, which is useful in risk and contingency planning. This pathway has the highest emissions concentration and is marked by inadequate policy response and increased potential for physical asset damage.

20.9.13 The climate change projection data used was gathered from the Met Office. The data available on this platform is based on UKCP18. The Climate Data Explorer provides climate change projection data for a variety of climate variables for the periods 2020-2049 and 2040-2069 (compared to a 1981-2010 baseline). These periods are relevant as it encompasses most of the construction and design life of the asset. The climate change projection data collected is provided in **Table 20-11**.

Risk Assessment

20.9.14 The CCRA considered the impact of climate on the Proposed Development by identifying likely changes to the climate and potential climate hazards over the life of the Proposed Development. The assessment has considered CCR over the Proposed Development's 30-year lifecycle, including the construction period.

20.9.15 Using the climate change projection data gathered (refer to **Table 20-11**) a series of risks were identified for the climate hazards determined to be relevant to the Proposed Development. For each risk identified, the asset components impacted were noted and the planned or embedded controls identified. In this instance, embedded controls represent measures already included in the design and operation of the Proposed Development that work to mitigate climate risk. With this information, an initial assessment of CCR was undertaken based on an analysis of likelihood and consequence. Adaptation measures were then subsequently identified to further reduce risk and increase resilience, after which a residual assessment of risk was performed.

20.9.16 The CCRA identifies potential climate change impacts and considers their potential consequence and likelihood of occurrence to identify significant risks to the Proposed Development. The following key terms and definitions relating

to the CCRA are used, as derived from the Intergovernmental Panel on Climate Change (IPCC) Glossary (Ref 20-38):

- **Climate hazard** – a weather or climate related event, which has potential to do harm to environmental or community receptors or assets, for example, increased winter precipitation;
- **Climate change impact** – an impact from a climate hazard which affects the ability of the receptor or asset to maintain its function or purpose;
- **Consequence** – any effect on the receptor or asset resulting from the climate hazard having an impact; and
- **Likelihood** - provides calibrated language for describing quantified uncertainty. It can be used to express a probabilistic estimate of the occurrence of a single event or of an outcome such as a climate parameter or an observed trend.

20.9.17 The receptor for the CCRA is the Proposed Development itself, including the assets components identified in section 20.9.6. Sensitive receptors affected by specific climate impacts are detailed in **Appendix 20-C: Climate Change Resilience Assessment (PEIR Volume IV)**.

20.9.18 This assessment was informed by the risk framework and the descriptors of likelihood and consequence adopted from EU Technical guidance (Ref 20-39) (**Table 20-9**). The criteria used to determine the likelihood of the climate risk occurring is detailed within Table 2 in **Appendix 20-B: Climate Change Resilience Baseline Data and Methodology Report (PEIR Volume IV)**. Following identification of the likelihood of the climate impact occurring, the consequences of the impact have been assessed according to Table 3 in **Appendix 20-B: Climate Change Resilience Baseline Data and Methodology Report (PEIR Volume IV).** When assessing the consequence of a specific risk, several categories were considered including:

- asset damage / engineering / operational;
- safety and health;
- environmental;
- social;
- financial (for single extreme event of annual average impact);
- reputation; and
- cultural heritage and cultural premises.

Table 20-9: Risk and Significance Matrix

		Consequence				
		Insignificant	Minor	Moderate	Major	Catastrophic
Likelihood	Rare	Low (NS)	Low (NS)	Medium (NS)	High (S)	Extreme (S)
	Unlikely	Low (NS)	Low (NS)	Medium (NS)	High (S)	Extreme (S)
	Moderate	Low (NS)	Medium (NS)	High (S)	Extreme (S)	Extreme (S)
	Likely	Medium (NS)	High (S)	High (S)	Extreme (S)	Extreme (S)
	Almost certain	High (S)	High (S)	Extreme (S)	Extreme (S)	Extreme (S)

NS – Not significant; S - Significant

20.9.19 Engagement has been undertaken with relevant environmental disciplines and the engineering design team to discuss the CCRA and identify mitigation measures for incorporation into the design of the Proposed Development. Measures to adapt the Proposed Development are identified where potential climate change consequences are identified as being potentially significant.

Rochdale Envelope

20.9.20 The setting of design parameters using the 'Rochdale Envelope' approach is described in **Chapter 2: Assessment Methodology and Consultation**. Table 4-1 of **Chapter 4: The Proposed Development** sets out the maximum parameters currently envisaged for the principal components of the Proposed Development. These parameters have been used to inform the representative worst-case scenario that has been assessed in this chapter, to provide a robust assessment of the impacts and likely significance of environmental effects of the Proposed Development at its current stage of design.

Assessment Assumptions and Limitations

20.9.21 For the purposes of the assessment, the construction phase includes enabling and demolition works required to facilitate the Proposed Development.

20.9.22 It is assumed that the start date of the CCRA assessment will be the start of the construction period.

20.9.23 The temporal scope of the assessment will include construction, operation and decommissioning phases.

20.9.24 The design life of the Proposed Development is at least 30 years from 2035. UK Climate Projection 2018 (UKCP18) data is limited to the projected time period of 2100. The CCRA considered climate variables up to 2069 to assess the impact of climate change over the lifetime of the Proposed Development.

20.9.25 Where it is neither practicable to quantify the required data nor to use reasonable assumptions, a qualitative statement has been made on the environmental impact based on professional experience and expertise.

20.9.26 Good practice methods and guidance have been used in the assessments.

20.10 CCRA - Baseline Conditions and Study Area

Study Area

20.10.1 The study area for the CCRA will be the area of temporary and completed works within the Site and surrounding areas that may impact the Site (e.g. River Dee).

20.10.2 The CCRA has considered how resilient the Proposed Development and surrounding environment are to current and projected future climate hazards by identifying likely changes to the climate and potential climate hazards over the lifecycle of the Proposed Development. For all three phases (construction, operation, and decommissioning) of the Proposed Development, the receptor for the CCRA was the Proposed Development itself and associated users.

Climate Baseline Data

20.10.3 To effectively use climate change projections for the purpose of a risk assessment, it is necessary to first understand the historical climate conditions experienced at the location. The current baseline for the CCRA is based on historic climate data obtained from the Met Office (Ref 20-35) recorded by the closest meteorological station to the Proposed Development's Site (Hawarden Airport weather station, situated approximately 6.9 km away for the maximum temperature, and Royal Airforce (RAF) Shawbury weather station for the remaining climate conditions which is 54.4 km away). Data from this station provides the baseline climate average for 1981-2010, as summarised in **Table 20-11.**

Past Extreme Events

20.10.4 The following events are examples of extreme climatic conditions experienced at the site location in the past:

- highest recorded temperature was 37.1°C in July 2022;
- lowest recorded temperature was -6.9°C in January 1963;
- highest daily rainfall was 158.9 mm in July 1958; and
- other recent extreme climatic events in Connah's Quay include heavy rainfall from Storm Babet in October 2023 (Ref 20-40), and extensive flooding in July 2023 (Ref 20-41).

Future Baseline

20.10.5 The future baselines for construction, operation and decommissioning phases of the Proposed Development are based on future UKCP18 data from the Met Office for the 25 km grid square in which the Proposed Development is located (Ref 20-36). This projection data provides probabilistic indications of how global climate change is likely to affect areas of the UK using pre-defined climate variables and time periods. This data is provided within **Table 20-11**.

Climate Change Projection Data

20.10.6 In understanding how the climate is expected to change in the future it is important to consider broad, qualitative trends as well as location specific, quantitative projection data. Both are presented below (**Table 20-10**; **Table 20-11**).

Qualitative projection data

20.10.7 Future trends for key climate variables in the United Kingdom are summarised in **Table 20-10** using information available from Met Office's 'UK Climate Projections: Headline Findings' (Ref 20-43) and the Committee on Climate Change's 'UK Climate Change Risk Assessment 2017 Evidence Report: Summary for Wales' (Ref 20-44).

Table 20-10: Key Messages – Climate Change Projections United Kingdom

Climate Variable		Key Trend	Key Message
	Surface air temperature	Average surface air temperatures are expected to increase everywhere and across all seasons.	An increase in the intensity and duration of heatwaves is expected.
	Precipitation	An increase in seasonality in precipitation can be expected with significant decreases projected for summer and increases for autumn and winter.	An increase in the occurrence of extreme rainfall events is likely.
	Hydrology	Increasing seasonality in hydrological regimes can be expected with decreased summer and increased winter flows likely.	Flood risk is expected to increase across the UK while increases in the frequency of drought conditions is also expected. However, it is the distribution of rainfall throughout the seasons that will determine UK drought risk.
	Sea level rise	Sea level is expected to continue to rise to 2100 under all emissions pathways in the UK, and for Wales this is predicted to rise across the country by up to 24 cm by 2050.	Sea Level Rise is expected to rise.

Quantitative projection data

20.10.8 The quantitative climate change projection data for the Site is presented in **Table 20-11** alongside the climate baseline data for the study area. The

climate change data used for the assessment covers the whole site. As previously discussed in section 20.9.11 the climate change scenario adopted for this CCR assessment was RCP 8.5.

Table 20-11: Historical and Projection Climate Data for Connah's Quay 1981-2010

Climate Variable	Baseline 1981-2010	Projection (change) across project life cycle 2020-2049	2040-2069	Projected Change in Likelihood	Climate Projection Source
Temperature					
Mean annual maximum daily temperature (°C)	14.0	+0.95 °C (+0.39 °C to +1.52 °C)	+1.14 °C (+0.83 °C to +2.63 °C)	↑	2
Mean annual minimum daily temperature (°C)	6.1	+0.91 °C (+0.35 °C to +1.51 °C)	+1.66 °C (0.76 °C to 2.64 °C)	↑	2
Mean summer maximum daily temperature (°C)	20.2	+1.14 °C (+0.31 °C to +1.97 °C)	+2.09 °C (+0.79 °C to +3.43 °C)	↑	2
Mean winter minimum daily temperature (°C)	1.5	+0.80 °C (+0.04 °C to +1.60 °C)	+1.52 °C (+0.41 °C to +2.68 °C)	↑	2
Number of days of air frost per annum	42.8	Although frost days is depleted at the coast compared to inland, the Met Office has projected a trend towards fewer air frost days.		-	1
Highest temperature for baseline period (°C)	21.0 (July)	+1.27 °C (-0.10 °C to +2.63 °C)	+2.40 °C (+0.40 °C to +4.42 °C)	↑	2
Lowest temperature for baseline period (°C)	1.42 (January)	+0.81 °C (-0.26 °C to +1.94 °C)	+1.61 °C (+0.02 °C to +3.31 °C)	↑	2
Rainfall					
Mean annual rainfall (mm)	726.2	0.14% (-6.04% to +6.47%)	-2.73% (-10.04% to +4.64%)	↓	2
Mean summer rainfall (mm)	57.6	-4.89% (-21.95% to +10.48%)	-17.24% (-39.05% to +3.92%)	↓	2
Mean winter rainfall (mm)	59.8	+2.13% (-3.50% to +8.20%)	+4.56% (-3.59% to +13.69%)	↑	2
Wettest month on average (mm)	81.3 (October)	+5.49% (-6.67% to +19.02%)	+12.64% (-3.08% to +31.33%)	↑	2
Driest month on average (mm)	44.0 (February)	+3.56% (-8.46% to 15.99%)	+6.69% (-9.62% to +23.62%)	↑	2

Climate Variable	Baseline 1981-2010	Projection (change) across project life cycle 2020-2049	2040-2069	Projected Change in Likelihood	Climate Projection Source
Other					
Sea level rise (m) (for SSP scenarios)	0.11	0.17	0.31	↑	3
Storms	The UKCP18 model suggest a small contribution from storm surges; however, it is unclear if the frequency and severity of future storm surges is going to change. Rising sea levels due to climate change are expected to worsen the impacts of storm surges.			↑↓	2
Droughts	The Met Office has projected a trend towards drier summers on average, with the trend being stronger under a high GHG emission scenario compared to a low one; however, it is the distribution of rainfall throughout the seasons that will determine UK drought risk.			↑	1
Wildfires	The wildfire hazard is classified as medium according to the information that is currently available to the Think Hazard tool. This means that there is between a 10% and 50% chance of experiencing weather that could support a hazardous wildfire that may poses some risk of life and property loss in any given year.			↑	4

1 Met Office: https://www.metoffice.gov.uk/research/climate/maps-and-data
2 UKCP18 Tool (8.5 scenario): https://ukclimateprojections-ui.metoffice.gov.uk
3 IPCC AR6 Sea Level Projection Tool: https://sealevel.nasa.gov/data_tools/17
4 ThinkHazard: https://thinkhazard.org/en/report/24966-qatar-al-khawr-administrative-unit-not-available

20.11 CCRA - Development Design and Embedded Mitigation

Embedded Controls

20.11.1 The Proposed Development has been designed, as far as possible, to avoid or minimise impacts and effects on Climate Change through the process of design development, and by embedding measures into the design of the Proposed Development.

20.11.2 As aforementioned, planned or embedded controls represent measures already included in the design and operation of the Proposed Development that work to mitigate the climate risk. These measures are usually included in the design and / or operation of an asset as they represent best practice design or management. **Table 20-12** provides example embedded controls adopted for the Proposed Development, with a complete list included in the risk register in **Appendix 20-C: Climate Change Resilience Assessment (PEIR Volume IV)**. These measures are subject to final agreement and stakeholder engagement. A full list of confirmed embedded controls will be provided in the ES.

Table 20-12: Embedded Controls Adopted for the Proposed Development

Project Phase	Embedded Controls
Construction	Construction equipment used will be designed to operate in the temperatures expected in North Wales.
	The Contractor will monitor weather forecasts and plan works accordingly, protecting workers and resources from any extreme weather conditions, including receive Cyfoeth Naturiol Cymru (Natural Resources Wales) flood alerts and plan works accordingly, protecting workers and resources from any extreme weather conditions such as storms and flooding.
	Risks have been considered within the Flood Risk Assessment and summarised within Chapter 13: Water Environment and Flood Risk, with a Drainage Management Strategy to demonstrate management of surface water run-off from the Proposed Development during construction.
	Construction phase impacts will likely be mitigated through the implementation of standard construction techniques and mitigation measures, as are described in a wide range of good practice publications which will be listed in the ES (e.g. C811 Environmental Good Practice on site (fifth edition)). This involves flood consultations with local flood authorities, in particular in the approach to existing defenses.
Operational Phase	The Applicant has been certified under ISO 45001 for occupational health and safety since 2021, applying best practice for health and safety management. To mitigate potential impacts of extreme high temperatures, cooling provisions for both the plant and the gas turbine will comprise either an air-cooled condenser array or a hybrid cooling

Project Phase	Embedded Controls
	system, in addition to a CO_2 cooling and compression plant, and an exhaust gas cooling and conditioning plant.
	Due to extreme heat events, controls will be incorporated within the engineering design of buildings and structures and the appropriate engineering standards used so operations are unlikely to be interrupted. Controls include cooling provisions for both the plant and the gas turbine will comprise a hybrid cooling system, in addition to a CO_2 cooling and compression plant, and an exhaust gas cooling and conditioning plant.
	Due to extreme cold temperatures, snow loading and freezing liquids will be accounted within the engineering design of buildings and structures and the appropriate engineering standards used so operations are unlikely to be interrupted. The heat output of the plant is over 300 MW, requiring a heat recovery boiler to handle excess heat, so extremely low temperatures are unlikely to impact operations.
	The risks will be considered within the Flood Risk Assessment and summarised within Chapter 13: Water Environment and Flood Risk, with a Surface Water Drainage Strategy to demonstrate management of surface water run-off from the Proposed Development during operation.
	The SuDS Manual Simple Index Approach (CIRIA C753) will be used to inform the design of the surface water drainage system so that it provides adequate treatment of run-off.
	The Design Manual for Roads and Bridges (DMRB) guidance will inform the importance, magnitude and significance of effects to identify the potential impacts of construction and operation on the surface water environment.
	Current wind loadings are incorporated within the engineering design of buildings and structures and the appropriate engineering standards used so operations are unlikely to be interrupted.
	Design engineering standards to be incorporated by the Proposed Development for the provision of lighting protection systems on buildings and structures, such as lightning protections (rods) built into structures, who are also earthed.
	Location of Proposed Development i.e. Industrial area limits risk of wildfire. All employees of the Applicant receive specialist fire prevention training.

20.11.3 Limited specific mitigation measures have been identified for the decommissioning phase of the Proposed Development. A Decommissioning Environmental Management Plan (DEMP) will be produced to appropriate guidance and legislation at the time and will likely be similar to that of the construction phase but reflect future climatic conditions.

20.12 CCRA - Preliminary Assessment of Likely Impacts and Effects

20.12.1 Taking into account the embedded mitigation measures as detailed in section 20.11 above, the potential impacts and effects of the Proposed Development have been assessed using the methodology as detailed in section 20.9 of this chapter and **Chapter 2: Assessment Methodology and Consultation**.

Initial Risk Profile

20.12.2 In the example provided in **Table 20-13**, 'Low' and 'Medium' have been defined as 'Not Significant' whilst, 'High' and 'Extreme' have been defined as 'Significant' (Ref 20-26).

Table 20-13: Risk Rating Definitions

Risk Rating	Definition
Low (Not Significant)	The climate hazard has no (or an insignificant) impact.
Medium (Not Significant)	The climate hazard may have a slight impact on the Proposed Development but it is considered not significant.
High (Significant)	The climate hazard may have a significant impact on the Proposed Development.
Extreme (Significant)	The climate hazard will have a significant impact on the Proposed Development.

20.12.3 The CCRA identified 20 risks, eight related to construction and twelve related to operation. The complete list of CCRs can be found in the risk register presented in **Appendix 20-C: Climate Change Resilience Assessment (PEIR Volume IV),** which details the likelihood of each risk occurring against asset components of the Proposed Development, and the corresponding consequence it will have. **Table 20-14** and **Table 20-15** below highlights the initial risk profile for both climate change scenarios assessed across construction and operation.

20.12.4 Of the eight risks identified for construction, three were related to extreme temperatures, two were related to storms, two were associated with flooding, and one was associated with wildfires. The high risks were associated with tidal/coastal flooding and wildfires.

20.12.5 As seen in **Table 20-14**, the construction period only accounts for the RCP 4.5 2020-2049 scenario, as this is when construction is expected to take place. Therefore, an assessment of the eight risks were not assessed under the RCP8.5 2040-2069 scenario.

Table 20-14: Initial Risk Profile for the Proposed Development (Construction)

Risk Rating	Moderate emissions scenario RCP 4.5 2020-2049
	Initial risk profile
Low (Not Significant)	5
Medium (Not Significant)	1
High (Significant)	2
Extreme (Significant)	0

20.12.6 Of the twelve risks identified for operation, four were related to extreme temperatures, two were related to storms, three were associated with flooding, one was associated with drought and two was associated with wildfires. The high risks were associated with tidal/coastal flooding and wildfires.

Table 20-15: Initial Risk Profile for the Proposed Development (Operation)

Risk Rating	Moderate emissions scenario RCP 4.5 2020-2049	High emissions scenario RCP 8.5 2040-2069
	Initial risk profile	Initial risk profile
Low (Not Significant)	6	3
Medium (Not Significant)	5	8
High (Significant)	1	1
Extreme (Significant)	0	0

20.12.7 The nature of risks during decommissioning are considered similar to those during construction. These should be reviewed and considered in detail as part of the Decommissioning Environmental Management Plan (DEMP); recognising that the DEMP will be developed a number of decades from now when climate conditions for the time period will be better understood and technologies and techniques best to mitigate any risks will have evolved.

20.13 CCRA - Additional Mitigation and Enhancement Measures

Adaptation Principles

20.13.1 Climate change adaptation for infrastructure projects is the process of adjustment to actual or expected climate and its effect to increase resilience, moderate harm and exploit beneficial opportunities. There are a range of measures or options that are available and appropriate for addressing climate change adaptation often described as either Grey, Green or Soft:

- **Grey Actions** - technical or engineering-oriented responses to climate impacts, for example the construction of a sea wall in response to sea level rise or the consideration of climate change projections in the design of drainage structures.
- **Green Actions** - use nature-based solutions to enhance the resilience of human and natural systems, for example the addition of green spaces to infrastructure projects to counteract urban heat island effect, or the use of drought and heat tolerant species in landscaping.
- **Soft Actions** - alterations in behaviour, regulation, or systems of management such as increased monitoring of climate change impacts during operation, or the consideration of climate risk in asset management plans. They are flexible and inexpensive to implement.

20.13.2 In the identification and implementation of adaptation measures, it is critical that early engagement between the relevant internal project stakeholders occurs i.e., engineers, environmental assessment professionals or asset owners. Early and proactive engagement is the most effective way of eliminating and reducing climate change impacts on a project, thereby reducing the need for additional and costly measures late in design or during operation.

Adaptation Measures Identified

20.13.3 A number of adaptation measures have been identified for consideration during the design, construction and operation of the Proposed Development. **Table 20-16** provides example adaptation measures identified for the Proposed Development, with a complete list included in the risk register in **Appendix 20-C: Climate Change Resilience Assessment (PEIR Volume IV)**.

20.13.4 Limited specific mitigation measures have been identified for the decommissioning phase of the Proposed Development. A Decommissioning Environmental Management Plan (DEMP) will be produced to appropriate guidance and legislation at the time and will likely be similar to that of the construction phase but reflect future climatic conditions.

Table 20-16: Adaptation Measures for Consideration for the Proposed Development

Project Phase	Adaptation Measures	Proposed / Implemented
Construction	Use construction materials with superior properties that offer increased tolerance to fluctuating temperatures, heavy precipitation and other extreme weather events such as storms, where feasible.	Proposed
	Develop register of vulnerable construction assets and inspect after a hot day.	Proposed
	Develop a fire management plan and an early warning and detection system.	Proposed

Project Phase	Adaptation Measures	Proposed / Implemented
	As part of a wider Winter Service Plan a section will be prepared on freeze prevention for pipes, and snow and de-icing procedures for access roads during construction. Doing so will help prevent disruption and avoid possible health and safety incidences.	Proposed
	Install a water pump for the areas with critical infrastructure and a key part of construction operations. This will help increase the sites surface drainage capacity during construction.	Proposed
	Raise critical infrastructure to be above PMF (Probable maximum flood).	Proposed
	Install additional attenuation features at key locations or identified flood risk areas, to increase the Proposed Development's drainage capacity.	Proposed
	If applicable undertake regular monitoring of trees and vegetation in the area, pruning as necessary to avoid damage to the construction site or blocking access roads, in the event of a storm with high wind speed.	Proposed
Operational Phase	Ensure all outdoor workers have access to indoor facilities, air conditioning, breaks in shaded areas and water breaks.	Proposed
	Cease outdoor and no essential work if working conditions are too dangerous and could result in injury to workers and damage to equipment.	Proposed
	Monitor frequency and magnitude of the impact of extreme temperature over time and if required incorporate further cooling mechanisms into plant upgrades and increase maintenance requirements.	Proposed
	Select more durable, heat-resistant materials in upgrades.	Proposed
	As part of a wider Winter Service Plan a section will be prepared on Snow and de-icing procedures for when cold temperatures occur, and the roads become impacted by snow/ice during operation. Doing so will help prevent disruption and avoid possible fatalities.	Proposed
	Introduce a drainage maintenance/operation plan so that the drainage system is monitored and kept blockage free.	Proposed
	For paved areas consider the use of permeable materials to allow water to be absorb into the ground and not gather on the surface area.	Proposed
	To mitigate against coastal and fluvial flooding, it is currently anticipated that some targeted ground raising may be required to increase ground levels above the existing average ground height in order to protect critical operational infrastructure from flood events and considering the effects of climate change. This estimated land raise for the Main Site is based upon an earlier Facility Condition Assessment (FCA) undertaken for the indicative site and is therefore subject to further assessment and potential revision.	Proposed

Project Phase	Adaptation Measures	Proposed / Implemented
	Install a water pump for the areas with critical infrastructure. This will help increase surface drainage capacity during operation.	Proposed
	During operation, monitor weather forecasts on drought conditions, lightning storms, and wind patterns, and where appropriate prepare and put in place contingency plans and measure to minimise disruption and damage.	Proposed
	Prepare a wind monitoring plan which establishes procedures and measures that will be instated during period of strong winds.	Proposed
	Workers will avoid any hazards that may increase the risk of being struck by lightning, including open spaces, tall objects, water, open wiring, metal fencing, and other metal objects.	Proposed
	Develop and maintain a Fire Management Plan and an early warning detection system.	Proposed

20.14 CCRA - Summary of Likely Significant Residual Effects

Residual Impacts

20.14.1 Residual risk represents the risk profile resulting from the implementation of adaptation measures. The residual risk ratings for the Proposed Development, (assuming the implementation of the identified adaptation measures), are summarised in **Table 20-17** and **Table 20-18**. The complete list of CCRs can be found in the risk register presented in **Appendix 20-C: Climate Change Resilience Assessment (PEIR Volume IV),** which details the likelihood of each risk occurring against asset components of the Proposed Development, and the corresponding consequence it will have once adaptation measures have been applied.

20.14.2 As seen in **Table 20-17**, the construction period only accounts for the RCP 4.5 2020-2049 scenario, as this is when construction is expected to take place. Therefore, an assessment of the eight risks were not assessed under the RCP8.5 2040-2069 scenario.

Table 20-17: Residual Risk Profile Identified for the Proposed Development (Construction)

Risk Rating	Moderate emissions scenario RCP 4.5 2020-2049	
	Initial risk profile	Residual risk profile
Low	5	5

Risk Rating	Moderate emissions scenario RCP 4.5 2020-2049	
	Initial risk profile	Residual risk profile
(Not significant)		
Medium (Not significant)	1	3
High (Significant)	2	0
Extreme (Significant)	0	0

Table 20-18: Residual Risk Profile Identified for the Proposed Development (Operation)

Risk Rating	Moderate emissions scenario RCP 4.5 2020-2049		High emissions scenario RCP 8.5 2040-2069	
	Initial risk profile	Residual risk profile	Initial risk profile	Residual risk profile
Low (Not significant)	6	7	3	5
Medium (Not significant)	5	5	8	7
High (Significant)	1	0	1	0
Extreme (Significant)	0	0	0	0

20.14.3 As observed, the implementation of the identified adaptation measures results in a reduction in the risk profile. For example, under the moderate emissions scenario RCP 4.5, the high risks are reduced from 3 to 0, whilst under the high emissions scenario RCP 8.5, the number of medium risks is reduced from 8 to 7. This is primarily due to the development of flood risk and temperature-related adaptation measures. The residual risks associated with flooding will likely be revised upon receipt of the information prior to submission of the ES.

20.14.4 The Applicant will support the implementation of the adaptation measures discussed in this report to maintain the residual risk profile presented above.

Significance

20.14.5 Using the risk matrix in **Table 20-9** which includes the significance criteria for CCR, the significance of CCR for the Proposed Development can be assessed.

Construction

20.14.6 The risks assessed in the CCRA at the construction phase of the Scheme predominantly cover workforce exposure to dangerous working conditions and damage to physical structures/asset damage.

20.14.7 Major climatic variables contributing to these risks include, but are not limited to, increased temperatures, flooding, and storms.

20.14.8 Prior to the implementation of adaptation measures, the assessment identified 2 initial high risks associated with climate change (**Table 20-17**). According to the significance criteria in **Table 20-9,** the high risks were associated with coastal flooding and wildfires.

20.14.9 As a result of the adaptation climate change mitigation measures (as presented in **Table 20-16**), it is concluded that all residual climate change risks during the construction phase have been identified to be **not significant**.

Operation

20.14.10 The risks assessed in the CCRA at the operational phase of the Scheme predominantly encapsulate asset damage from extreme weather conditions and changes in annual precipitation and temperatures, as well as workforce exposure to dangerous working conditions.

20.14.11 Major climatic variables contributing to these risks are changes in temperatures and precipitation, as well as an increase in extreme weather events.

20.14.12 Prior to the implementation of adaptation measures, the assessment identified 1 initial high risk associated with climate change (**Table 20-14**). Based on the significance criteria in **Table 20-9,** the high risk was associated with coastal flooding.

20.14.13 As a result of the adaptation climate change mitigation measures (as presented in **Table 20-12**, it has been concluded that all residual climate change risks during the operation phase have been identified to be **not significant.**

Decommissioning

20.14.14 As mentioned in section 20.12.7, the nature of risks during decommissioning will be included in the DEMP, which will be developed a number of decades from now when climate conditions for the time period will be better understood and technologies and techniques best to mitigate any risks will have evolved.

20.14.15 An assessment of cumulative effects with other proposed developments that could interact with the effects of this Proposed Development will be carried out in the final ES, when the short-list of other developments has been finalised, as detailed in **Chapter 24: Cumulative and Combined Effects. Chapter 24: Cumulative and Combined Effects** will also assess the in-

combination effects of multiple aspects on one receptor. For example, other nationally significant infrastructure projects (NSIPs) may affect the climate vulnerability of this Proposed Development, specifically in relation to flooding and urban heat island effect.

Summary

20.14.16 In summary, the CCRA presented in this chapter illustrates that CCR presents no significant risk to the Proposed Development. Considering the identified adaptation measures, the risk profile has been reduced to eliminate high risks associated with coastal flooding and wildfires. As the Proposed Development has no residual 'high' or 'extreme' CCRs, it can be concluded that CCR is **not significant** for the Proposed Development.

20.14.17 The nature of risks during decommissioning are considered similar to those during construction. These will be reviewed and considered in detail as part of the Decommissioning Environmental Management Plan (DEMP); recognising that the DEMP will be developed a number of decades from now when climate conditions for the time period will be better understood and technologies and techniques best to mitigate any risks will have evolve.

20.15 In-combination Climate Change Impact (ICCI) Assessment - Scope and Methodology

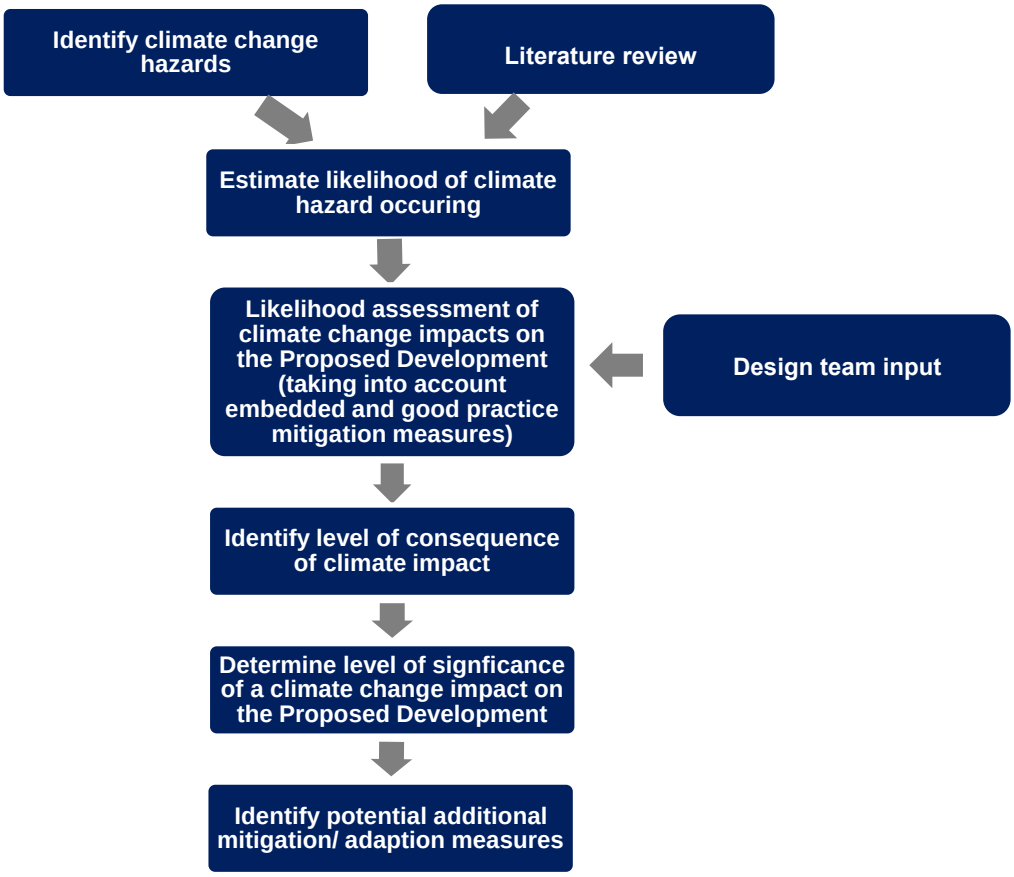
Scope of Assessment

20.15.1 The ICCI assessment considers the combined impacts of climate change and the Proposed Development on receptors in the surrounding environment. It considers the ways in which projected climate change will influence the significance of the effects of the Proposed Development on the identified receptors.

Assessment Methodology

20.15.2 This section provides a summary of the ICCI methodology. An overview of the ICCI assessment methodology applied within this assessment is illustrated in **Plate 20-1**. The overall methodology is in line with IEMA guidance (Ref 20-26).

Plate 20-1 ICCI Assessment Methodology Flow Diagram



Impact Assessment

Study area: Spatial Scope of Assessment

20.15.3 The study area for the ICCI assessment was determined by the EIA topic assessments, as described in other technical sections of this report and to be

reported in the ES. The relevant topic chapters with sensitive receptors include:

- **Chapter 8:** Air Quality;
- **Chapter 9:** Noise and Vibration;
- **Chapter 10:** Traffic and Transport;
- **Chapter 11:** Terrestrial and Aquatic Ecology;
- **Chapter 13:** Water Environment and Flood Risks;
- **Chapter 14:** Geology and Ground Conditions; and
- **Chapter 21:** Human Health

20.15.4 The following disciplines have considered ICCIs but have not identified any at the PEIR stage. This will be reviewed for the Environmental Statement:

- **Chapter 12:** Marine Ecology;
- **Chapter 15:** Landscape and Visual Amenity;
- **Chapter 17:** Terrestrial Heritage;
- **Chapter 18:** Marine Heritage;
- **Chapter 19:** Socio-Economics, Recreation and Tourism;
- **Chapter 22:** Major Accidents and Disasters;
- **Chapter 23:** Materials and Waste; and
- Soils and Agricultural Land (as part of **Chapter 14:** Geology and Ground Conditions).

20.15.5 The ICCI assessment considers the ways in which projected climate change will influence the significance of the effects of the Proposed Development on receptors in the surrounding environment.

20.15.6 The ICCI assessment considers how the resilience of various receptors in the surrounding environment (such as local waterways or local heritage assets) are affected by the Proposed Development in combination with future climatic conditions as identified using UKCP18 projections data from the Met Office for the 25 km grid square in which the Proposed Development is located. The impacts are considered for the construction, operation, and decommissioning phases of the Proposed Development.

Proposed Development Environment

20.15.7 The ICCI considers a ‘do something’ scenario with the delivery of the Proposed Development, including its construction, operation, and decommissioning.

Sensitive Receptors

20.15.8 The ICCI assessment considers the sensitive receptors as identified by each technical discipline in **Chapters 8 to 24** of this PEIR. The ICCI assessment is

undertaken by individual technical disciplines in regard to the identified sensitive receptors in each assessment.

Likelihood of climate change hazard occurring

20.15.9 Once climate hazards are identified for the receptors associated with the Proposed Development, the likelihood of their occurrence and the sensitivity of the receptor is considered to determine the likelihood of a climate impact occurring during the Proposed Development's lifespan is categorized as per **Table 20-19**.

Table 20-19: Level of likelihood of the climate hazard occurring

Level of likelihood of climate hazard	Qualitative description	Quantitative Description
Very likely	Likely that the event will occur many times (reoccurs frequently).	90-100% probability that the hazard will occur during the life of the project
Likely	Likely that the event will occur sometimes (reoccurs infrequently).	66-90% probability that the hazard will occur during the life of the project
Possible, about as likely as not	Possible that the event will occur (has occurred rarely).	33-66% probability that the hazard will occur during the life of the project
Unlikely	Unlikely that the event will occur (not known to have occurred).	10-33% probability that the hazard will occur during the life of the project
Very unlikely	Almost inconceivable that the event will occur.	0-10% probability that the hazard will occur during the life of the project

Likelihood of climate impact occurring

20.15.10 Once climate hazards are identified for the receptors associated with the Proposed Development, the likelihood of their occurrence and the sensitivity of the receptor is considered in order to determine the likelihood of a climate impact occurring during the Proposed Development's lifespan is categorised as per **Table 20-20**. Where an effect has been identified as moderate or high it was classed as a significant ICCI effect.

Table 20-20: Level of Likelihood of the climate-related impact occurring

Level of likelihood of climate impact occurring	Definition of likelihood
High	Likelihood of climate hazard occurring is high and impact is always/ almost always going to occur.
Moderate	Likelihood of climate hazard occurring is high and impact occurs often or the likelihood of climate

Level of likelihood of climate impact occurring	Definition of likelihood
	hazard occurring is moderate and impact is likely to occur always/ almost always.
Low	Likelihood of climate hazard occurring is high but impact rarely occurs or the likelihood of climate hazard occurring is moderate and impact sometimes occurs or the likelihood of climate hazard occurring is low and impact is likely to occur always/ almost always.
Negligible	All other eventualities - highly unlikely but theoretically possible.

20.15.11 Once the likelihood of an ICCI has been identified, the assessment then considers the consequence of the effect on the identified receptors.

20.15.12 The ICCI consequence criteria are defined in **Table 20-21** and are based on the change to the significance of the impact already identified by the environmental discipline. To assess the consequence of an ICCI, each discipline has assigned a level of consequence to an impact based on the criteria description and their discipline assessment methodology.

Table 20-21: Consequence criteria for in-combination climate change impact assessment

Consequence	Consequence criteria
High	The climate change parameter in-combination with the effect of the Proposed Development causes the significance of the impact of the Proposed Development on the resource/receptor, as defined by the topic, to increase from negligible, low, or moderate to major.
Moderate	The climate change parameter in-combination with the effect of the Proposed Development causes the effect defined by the topic to increase from negligible or low, to moderate.
Low	The climate change parameter in-combination with the effect of the Proposed Development, causes the significance of effect defined by the topic, to increase from negligible to low.
Negligible	The climate change parameter in-combination with the effect of the Proposed Development does not alter the significance of the effect defined by the topic.

Significance criteria

20.15.13 The likelihood of a climate hazard occurring and the likelihood of an impact of a receptor is then combined to determine the likelihood of an ICCI occurring. This criterion is illustrated in **Table 20-22**.

Table 20-22: ICCI significance criteria

Consequence	Likelihood			
	Negligible	Low	Moderate	High

Negligible	Not Significant	Not Significant	Not Significant	Not Significant
Low	Not Significant	Not Significant	Not Significant	Significant
Moderate	Not Significant	Not Significant	Significant	Significant
High	Not Significant	Significant	Significant	Significant

20.15.14 The significance of potential effects is determined using the matrix in **Table 20-22**. Where an effect has been identified as Moderate or High is classed as a significant ICCI effect. If significant ICCI effects are assessed, then appropriate additional mitigation measures are identified.

Rochdale Envelope

20.15.15 The setting of design parameters using the 'Rochdale Envelope' approach is described in **Chapter 2: Assessment Methodology and Consultation** and **Chapter 4: The Proposed Development** (**PEIR Volume II**), including Table 4-1 which sets out the maximum, and where relevant minimum, parameters currently under consideration for the main components of the Proposed Development. These parameters have been used to inform the representative worst-case scenario that has been assessed in this chapter, in order to provide a robust assessment of the impacts and likely significance of environmental effects of the Proposed Development at its current stage of design.

Assessment Assumptions and Limitations

20.15.16 For the purposes of the assessment, the construction phase includes enabling and demolition works required to facilitate the Proposed Development.

20.15.17 It is assumed that the start date of the ICCI assessment will be the start of the construction period.

20.15.18 The design life of the Proposed Development is 30 years from 2035. The UK Climate Projection 2018 (UKCP18) data is limited to the projected time period of 2100 (Ref 20-35). While modelled climate change projections represent anticipated changes to average weather conditions, they cannot predict the frequency and severity of acute events such as droughts, heatwaves, and prolonged heavy rainfall, making the UKCP18 the most appropriate database for the assessment (Ref 20-35). The ICCI considered climate variables up to 2069 to assess the impact of climate change over the lifetime of the Proposed Development. Only a high-level assessment of acute events is included in this assessment.

20.15.19 It is assumed that sufficient necessary quantitative data was available to inform the ICCI. Where quantitative data is not available, reasonable assumptions were made.

20.15.20 Where it is neither practicable to quantify the required data nor to use reasonable assumptions, a qualitative statement has been made on the environmental impact based on professional experience and expertise.

20.15.21 The ICCI is limited by the availability of data and Proposed Development design information at the date this assessment was prepared.

20.16 ICCI Assessment - Baseline Conditions and Study Area

Study Area

20.16.1 To effectively use climate change projections for the purpose of a risk assessment, it is necessary to first understand the historical climate conditions experienced at the location. The current baseline for the CCRA is based on historic climate data obtained from the Met Office (Ref 20-35) recorded by the closest meteorological station to the Proposed Development's Site (Hawarden Airport weather station, situated approximately 6.9 km away). Data from this station provides the baseline climate average for 1981-2010, as summarised in **Table 20-11**, in the CCRA section of this report.

Past Extreme Events

20.16.2 To see the past extreme events around Connah's Quay and Flintshire, please refer to section 20.10 of the CCR Assessment.

Future Baseline

20.16.3 The future baselines for construction, operation and decommissioning phases of the Proposed Development are based on future UKCP18 data from the Met Office for the 25 km grid square in which the Proposed Development is located (Ref 20-35). This projection data provides probabilistic indications of how global climate change is likely to affect areas of the UK using pre-defined climate variables and time periods. This data is provided within **Table 20-11** in section 20.10 of this Chapter.

Climate Change Projection Data

20.16.4 In understanding how the climate is expected to change in the future it is important to consider broad, qualitative trends as well as location specific, quantitative projection data. Both are presented below.

Qualitative projection data

20.16.5 Future trends for key climate variables in the United Kingdom are summarised below using information available from Met Office's 'UK Climate Projections: Headline Findings' and the Committee on Climate Change's 'UK Climate Change Risk Assessment 2017 Evidence Report: Summary for Wales'.

Quantitative projection data

20.16.6 The quantitative climate change projection data for the Site is presented in **Table 20-11** in section 20.10, alongside the climate baseline data for the study area. As previously discussed in section 20.9.12, the climate change scenario adopted for both the ICCI and CCR assessments was RCP 8.5.

20.17 ICCI Assessment - Development Design and Embedded Mitigation

20.17.1 The Proposed Development has been designed, as far as possible, to avoid or minimise impacts and effects on receptors in the surrounding environment as a result of the combined impacts of the Proposed Development and Climate Change. This has been achieved through the process of design development, and by embedding measures into the design of the Proposed Development and surrounding environment as necessary.

20.17.2 The embedded controls referred to in section 20.11.1 in the CCR assessment apply for the ICCI assessment. Further embedded mitigation measures are expected to be incorporated into the design and construction of the Proposed Development during later project stages, however, the assessment does not consider these at this stage given there is not currently sufficient information available on these.

20.17.3 The scope for mitigating measures for the ICCI was informed by the design team and other relevant PEIR technical assessments. These focused on measures to increase the resilience of the receptors in the surrounding environment to the combined impacts of the Proposed Development and climate change and were informed by the design team and other relevant ES technical assessments. For example, this may include designing surface water drainage systems to make sure flows up to the 1 in 100-year return period can be contained and managed within the Proposed Development, so as not to impact receptors in the surrounding environment.

20.17.4 Full details of embedded design measures for construction that reduce the likelihood or severity of ICCIs to receptors will be detailed within a CEMP for the Proposed Development.

20.17.5 Technical disciplines have included mitigation measures for construction and operation within their respective chapters (summarised in Table 20-1 in **Appendix 20-D: In-combination Climate Change Assessment (PEIR Volume IV)**), such as that detailed in **Chapter 9: Noise and Vibration, Chapter 13: Water, Environment and Flood Risk and Water Resources, Chapter 15: Landscape and Visual Amenity, and Chapter 21: Human Health.**

20.17.6 Limited specific mitigation measures have been identified for the decommissioning phase of the Proposed Development. A Decommissioning Environmental Management Plan (DEMP) will be produced to appropriate guidance and legislation at the time and will likely be similar to that of the construction phase but reflect future climatic conditions.

20.18 ICCI Assessment - Preliminary Assessment of Likely Impacts and Effects

20.18.1 Taking into account the embedded mitigation measures as detailed in section 20.17, the potential impacts and effects of the Proposed Development combined with climate change on receptors in the surrounding environment

have been assessed using the methodology as detailed in section 20.15 of this chapter and **Chapter 2: Assessment Methodology and Consultation**.

20.18.2 Potential ICCIs, including the likelihood, consequence, and significance are detailed in **Appendix 20-D: In-combination Climate Change Assessment (PEIR Volume IV) of this PEIR.**

20.18.3 Future climate projections have been reviewed and the sensitivity of receptors to both climate change and the Scheme have been examined, before commenting on the adequacy of the climate change resilience measures built into the Scheme.

20.18.4 The table of ICCIs identified at this stage from some technical disciplines can be found in **Appendix 20-D: In-combination Climate Change Assessment (PEIR Volume IV)** of this PEIR. The following disciplines undertook an assessment for ICCIs where likely impacts were identified. **Table 20-23** summarises the embedded and good practice mitigation measures across construction and operation, which are identified by the other disciplines and how these influence the ICCI assessment.

Table 20-23: ICCI embedded and good practice mitigation measures - construction and operation

Discipline	Changes and effects		Embedded and good practice mitigation measures
	Construction	Operation	
Transport and Traffic **(Chapter 10)**	Increases in precipitation may increase the potential for disruption on the wider road network due to increased frequency of transport routes becoming unviable or inaccessible.	N/A	The Construction Traffic Management Plan (CTMP) considers vehicle routing options during the construction phase, including details of any planned road closures / diversions.
Noise and Vibration **(Chapter 9)**	N/A	Increased temperatures may require greater cooling which will increase the number of cooling fans in operation, which could then result in potential increase in noise effects to receptors in the surrounding environment.	The assessment will be based on the worst-case scenario so there will be no further impact on noise effects impacting the surrounding environment.
Noise and Vibration **(Chapter 9)**	N/A	Potential to exacerbate noise effects on communities in terms of individual dwellings and on a wider community, due to windows being open more often due to an increase in high temperatures.	The noise assessment criteria assume windows are open and closing windows is a form of mitigation against noise. Consequently, there is no further impact on noise effects arising from the ICCI.
Noise and Vibration **(Chapter 9)**	N/A	Increases in temperature and humidity of the air reducing the atmospheric attenuation of noise.	Over distances of a few hundred metres, which covers the noise study area, atmospheric effects can be ignored. Consequently, increases in temperature and humidity is unlikely to affect noise sources during the construction phase and operational phase.

Discipline	Changes and effects		Embedded and good practice mitigation measures
	Construction	Operation	
Air Quality **(Chapter 8)**	N/A	Ambient weather conditions, including barometric pressure and temperature can slightly affect the amount of natural gas fuel burned within the combustion process for a given output. The consequence of an increase in fuel consumption would be a corresponding increase in stack mass flow rate and emission rates of trace pollutants in the stack plume.	An increase in stack gas mass flow rates is likely to lead to an increase in the residual CO2 content and mass emission rate in the plume. Warmer conditions result in a slight decrease in fuel consumption, while cooler conditions generally result in a slight increase. The "reference" emissions case used for the air quality assessment considers a conservative scenario with upper range estimates of both stack mass flow and trace pollutant emission rate. The dispersion modelling assessment has used five years of meteorological data, which accounts for the full range of weather conditions experienced in the area around the site.
Aquatic Ecology **(Chapter 11)**	N/A	Increased winter rainfall combined with the Proposed Development could impact on receiving waterbodies' (ponds and drains) flow regime and water quality impacting on the aquatic environment.	Increased surface water runoff and sedimentation. The impact of climate change on expected flows will be accommodated in the design of drainage infrastructure to ensure appropriate treatment and attenuation of anticipated flows, as outlined above.
Aquatic Ecology **(Chapter 11)**	N/A	Reduced water levels as a result of climate change and the Proposed Development could negatively impact on receiving waterbodies' (ponds and drains) flow regime and water quality impacting on the aquatic environment.	Prolonged drought periods in combination with higher temperatures could lead to dissolved oxygen crashes and fish mortalities The impact of climate change on expected flows will be accommodated in the design of drainage infrastructure to

Discipline	Changes and effects		Embedded and good practice mitigation measures
	Construction	Operation	
			ensure appropriate treatment and attenuation of anticipated flows, as outlined above.
Water Environment **(Chapter 13)**	N/A	Increased peak fluvial flows resulting in increased flood risk to the site, impacting the drainage network, and increasing potential loss of floodplain associated with land raising.	Flood consequence assessment will be based on flood risk incorporating estimated climate change over the life of the project
Water Environment **(Chapter 13)**	N/A	Increased precipitation can impact the frequency and duration of flooding from all sources (e.g. tidal, fluvial, surface water, artificial sources, groundwater and infrastructure) – could lead to flooding off-site	Drainage infrastructure (including attenuation) will be designed to accommodate anticipated flows, with an appropriate allowance for increases in rainfall intensity due to climate change. The drainage strategy will consider the Supplementary Planning Guidance LPGN 29 – Management of Surface Water for New Development, adopted by Flintshire County Council (Ref 1). In accordance with this guidance, surface water runoff from the Proposed Development Site in undeveloped (greenfield) areas will be limited to the greenfield runoff rate. For any previously developed (brownfield) areas, surface water discharge will be limited to greenfield rates of runoff (or as close as reasonably practical). The drainage network will be designed so that there is no flooding in the 1 in 30-year Annual Exceedance Probability (AEP) simulated storm event, in accordance with the Supplementary Guidance LPGN 29. Attenuation will be appropriately sized to accommodate the 1 in 100-year AEP event, with a minimum 20% allowance for increases in

Discipline	Changes and effects		Embedded and good practice mitigation measures
	Construction	Operation	
			rainfall intensity due to climate change, in accordance with Welsh Government guidance for climate change allowances. Both the central and upper (20% and 40%) climate change allowances will be assessed to understand the range of impact. The design will also consider the impacts of tide levels on new drainage infrastructure
Water Environment **(Chapter 13)**	N/A	Increased sea levels resulting in flooding to the site and impacts to the drainage network. The Proposed Development requires raising land levels and as it is located in a coastal flood plain, this could have an impact on off-site receptors due to changes to flow pathways.	Flood consequence assessment will be based on flood risk incorporating estimated climate change over the life of the project.
Water Environment **(Chapter 13)**	N/A	Increased precipitation can impact peak discharge rates for surface water runoff, which can impact receiving waterbodies (receptors) if the capacity of the drainage infrastructure is exceeded in extreme events. If this results in the storage capacity of attenuation features being exceeded, then there is potential for the River Dee to receive untreated water. This could lead to a deterioration in water quality.	The impact of climate change on expected flows will be accommodated in the design of drainage infrastructure to ensure appropriate treatment and attenuation of anticipated flows, as outlined above.

Discipline	Changes and effects		Embedded and good practice mitigation measures
	Construction	Operation	
Water Environment **(Chapter 13)**	N/A	Discharge of cooling water with increased sea temperature due to climate change could result in impacts to marine environments.	The operational discharge temperature of cooling water discharges compared to the existing case is not confirmed. Any increases in discharge temperature, in additional to CC increases could result in increased temperatures locally and regionally across the River Dee SSSI, potentially impacting on habitats. The temperature of cooling water has not been confirmed, modelling of potential effects is also still to take place, as such not suitable to provide an impact assessment at this stage.
Water Environment **(Chapter 13)**	N/A	Reduction in water availability for abstraction and impact on nearby existing abstractions	Increases in abstraction from surface water and groundwater sources could reduce availability of water for other users. Currently assumed that there will be no significant change to abstraction for cooling water from the River Dee, and no new abstractions from other sources.
Water Environment **(Chapter 13)**	N/A	Increased peak discharge rates for surface water runoff, impacting receiving waterbodies if the capacity of the drainage infrastructure is exceeded in extreme events. If this results in attenuation storage capacity being exceeded then there is potential for the Dee Estuary WFD water body to receive untreated and polluted water, potentially leading to a deterioration in water quality.	The impact of climate change on expected flows will be accommodated in the design of drainage infrastructure to ensure appropriate attenuation and storage for anticipated flows.

Discipline	Changes and effects		Embedded and good practice mitigation measures
	Construction	Operation	
Water Environment **(Chapter 13)**	Reduction in precipitation could reduce aquifer storage and groundwater levels. Construction: construction activities such as dewatering can reduce groundwater levels. This potential impact will be localised and unlikely to impact the surrounding environment.	N/A	Reduction in groundwater levels could reduce water availability for water dependent receptors and water users (i.e. groundwater abstractions). Dewatering during construction will be kept to a minimum and only undertaken where required to limit any reduction in groundwater recharge.
Water Environment **(Chapter 13)**	Changes in groundwater flow and levels. Construction and operation: An increase in groundwater level may increase the possibility of groundwater levels rising closer to the ground surface/mixing with potential shallower contamination (within Made Ground) which would otherwise not be encountered. This would increase the likelihood of potential impact on groundwater quality locally.		Potential for increase in groundwater levels and associated groundwater flooding. Flood consequence assessment will be based on flood risk incorporating estimated climate change over the life of the project. It is likely that the adjustment to the hydrogeological regime would remain localised and of relatively low magnitude.
Water Environment **(Chapter 13)**	Changes in groundwater flow and levels. And potential to move saline interface landward. Construction and operation: An increase in groundwater level may increase the possibility of groundwater levels rising closer to the ground surface/mixing with potential shallower contamination (within Made Ground) which would otherwise not be encountered. Dewatering activities can lead to the saline interface being drawn in land. This potential impact will be localised and unlikely to impact the surrounding environment.		Potential for saline interface to move landward. Dewatering during construction will be kept to a minimum and only undertaken where required to limit saline intrusion. It is likely that the potential saline intrusion would remain localised and of relatively low magnitude.

Discipline	Changes and effects		Embedded and good practice mitigation measures
	Construction	Operation	
Water Environment **(Chapter 13)**	Changes in groundwater flow and levels. Construction and operation: An increase in groundwater level may increase the possibility of groundwater levels rising closer to the ground surface/mixing with potential shallower contamination (within Made Ground) which would otherwise not be encountered. Dewatering activities can lead to the saline interface being drawn in land. This potential impact will be localised and unlikely to impact the surrounding environment.		Potential for increase in groundwater levels and associated groundwater flooding. Flood consequence assessment will be based on flood risk incorporating estimated climate change over the life of the project. It is likely that the adjustment to the hydrogeological regime would remain localised and of relatively low magnitude.
Water Environment **(Chapter 13)**	Reduction in precipitation could reduce groundwater levels. Summer droughts could also reduce water quality from reduced dilution of pollutants during the summer therefore increasing pollutants when precipitation events occur. This potential impact will be localised and unlikely to impact the surrounding environment.	N/A	Reduction in groundwater levels could reduce water availability for water dependent receptors and water users (i.e. groundwater abstractions). Dewatering during construction will be kept to a minimum and only undertaken where required to limit any reduction in groundwater recharge. Construction works will have a negligible impact on water quality due to mitigation measures implemented through the CoCP.
Geology and Ground Conditions **(Chapter 14)**	An increase in groundwater level may increase the possibility of groundwater levels rising closer to the ground surface / mixing with potential shallower contamination (within Made Ground) which would otherwise not be encountered. This would increase the likelihood of potential impact on groundwater quality		During construction, groundwater quality may be temporarily adversely affected due to potential ground disturbance/dewatering. The potential rise in groundwater level may require additional dewatering considerations, which may decrease groundwater quality through mobilizing existing contamination. However, these would be incorporated into the design works.

Discipline	Changes and effects		Embedded and good practice mitigation measures
	Construction	Operation	
			Contamination which may be encountered during construction will have been removed, remediated or mitigated to some extent. Maintenance and operation of the Proposed Development will be in accordance with environmental legislation and good practice. Therefore, it is unlikely that there will be an increased risk to groundwater quality should levels rise.
Geology and Ground Conditions **(Chapter 14)**	Increase in dust generation which may increase potential exposure to dusts/contaminants impacting human health	N/A	During the construction phase, extended dry spells may cause increased dust production. This consequence is minimized as far as reasonably practicable, through the measures incorporated into the draft CEMP (e.g. reduce dust emissions through the effective transportation and storage of materials).
Human Health **(Chapter 21)**	Increased dust production during construction due to more hot days, impacting human health.	N/A	During construction, an increase in air temperatures may cause increased dust pollution which could affect human receptors suffering from respiratory conditions. This consequence would be minimised as far as is reasonably practicable, through measures required by the Code of Construction Practice (CoCP) (e.g. reduce dust emissions through the effective transportation and storage of materials), including the proposed monitoring regime.

20.18.5 Each discipline identified the likelihood of each ICCI occurring, the consequence, and the overall significance. As a result, **no significant effects** were identified.

20.18.6 Limited specific mitigation measures have been identified for the decommissioning phase of the Proposed Development. A Decommissioning Environmental Management Plan (DEMP) will be produced to appropriate guidance and legislation at the time and will likely be similar to that of the construction phase but reflect future climatic conditions.

20.19 ICCI Assessment - Additional Mitigation and Enhancement Measures

20.19.1 Additional mitigation measures are only required where significant effects are identified following the application of embedded mitigation measures. **No significant effects** have been identified in this assessment therefore no additional mitigation or enhancement measures are proposed.

20.19.2 The Flood Risk assessment accounts for climate change projections and this has been taken into account within **Appendix 13-C: Flood Consequence Assessment (PEIR Volume IV)**. Hydraulic modelling will be undertaken at the ES stage to provide further details on fluvial flood risk and inform mitigation measures.

ICCI Assessment - Summary of Likely Significant Residual Effects

20.19.3 The ICCI Assessment concluded that there are no significant residual ICCIs on receptors in the surrounding environment identified. Further assessment will be undertaken for the Environmental Statement as the design evolves.

20.19.4 An assessment of cumulative effects with other proposed developments that could interact with the effects of this Proposed Development will also be carried out for the final ES, when the short-list of other developments has been finalised, as detailed in **Chapter 24: Cumulative and Combined Effects**. **Chapter 24: Cumulative and Combined Effects** will also assess the in-combination effects of multiple aspects on one receptor, as will **Chapter 13: Water Environment and Flood Risk** following hydraulic modelling during the ES stage, which will inform mitigation measures.

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