HyNet North West Hydrogen Pipeline

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Chapter 18

Climate Change – Climate Change Resilience

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Contents

18. Climate Change – Climate Change Resilience

18.1 Introduction

18.1.1 The Draft ES has been produced to fulfil the Applicant's consultation duties and enable consultees to develop an informed view of the likely significant effects of the Project.

18.1.2 This chapter presents the assessment of the likely significant effects of the Project with respect to Climate Change Resilience (CCR) based on the information obtained to date. Following the second round of statutory consultation, the assessment will be updated for the final ES that will accompany the DCO application for the Project.

18.1.3 This chapter should be read in conjunction with the Project description provided in **Chapter 2: The Project** and with respect to relevant parts of the following chapters:

- **Chapter 5: Biodiversity;**
- **Chapter 7: Water Environment;**
- **Chapter 8: Landscape and Visual;**
- **Chapter 12: Ground Conditions;**
- **Chapter 13: Agriculture and Soils;** and
- **Chapter 16: Major Accidents and Disasters.**

18.1.4 The interface with CCR and the other Draft ES chapters identified above is captured in the In-Combination Climate Impacts (ICCI) assessment in **Chapter 19**: **Intra-related Effects**. This is the assessment of the potential impact when a projected future climate impact (e.g. increase in temperatures) interacts with an effect identified by another topic and is exacerbated. This also includes whether the implementation of the proposed measures in the Draft ES are affected by climate change.

18.1.5 The assessment of Greenhouse Gas Emissions associated with the Project is contained in **Chapter 17: Greenhouse Gases.**

18.1.6 This chapter describes:

- the legislation, policy and technical guidance that has informed the assessment (**Section 18.2**);
- consultation and engagement that has been undertaken and how comments from consultees relating to climate change resilience have been addressed (**Section 18.3**);
- the methods used for baseline data gathering (**Section 18.4**);

- overall baseline, including existing and future baseline (**Section 18.5**);
- embedded environmental measures relevant to climate change resilience (**Section 18.6**);
- the scope of the assessment for climate change resilience (**Section 18.7**);
- the methodology applied for the assessment (**Section 18.8**);
- the assessment of climate change resilience effects (**Section 18.9**);
- the assessment of cumulative (inter-project) effects (**Section 18.10**); and
- a summary of the significance conclusions (**Section 18.11**).

Project overview

18.1.7 The Project includes the construction operation and eventual decommissioning of approximately 100km of new pipeline to distribute hydrogen to industry in the North West. A number of Hydrogen Above Ground Installations (HAGIs), including Block Valve Installations (BVIs) are required to control the flow and pressure of hydrogen at key points along the proposed pipeline.

18.1.8 The Project connects the Hydrogen Production Plant (HPP) at the Stanlow site, as the source of hydrogen, for onward distribution to the network. The pipeline transports hydrogen to the Central Hub at the centre of the network, which then serves as the connection and onward distribution point to the North, East and South corridors, which would extend to St. Helens, Partington and Northwich respectively. Branching off from each main corridor would be pipeline spurs connecting hydrogen customers to the main pipeline. Infrastructure has also been included which supports the potential blending of hydrogen with methane in the existing gas network. The Project would also link to underground hydrogen storage facilities in Cheshire used to balance supply and demand through the network.

18.1.9 The presently anticipated maximum extent of land in which the Project may take place, which is assessed in this Draft ES, is defined by the ‘Draft Order Limits’, land within which is hereafter referred to as ‘land within the Draft Order Limits’.

18.1.10 A proportionate degree of flexibility has been incorporated into the project design so that unforeseen issues that may be encountered following consent can be sufficiently mitigated. For example, previously unidentified poor ground conditions may require a pipeline section to be re-routed slightly for geotechnical reasons. Therefore, to allow for this, new infrastructure would be constructed within specified Limits of Deviation (LoD) which identify a maximum distance or measurement of variation within which the works must be constructed; further detail is provided on LoD in **Chapter 2: The Project**.

Limitations and assumptions

18.1.11 The inherent limitations of climate change projection data are described in **Section 18.4**; however, the use of this data does not affect the robustness of the assessment of the likely significant effects of the Project. No further limitations relating to the climate change resilience assessment are identified.

18.2 Relevant Legislation, Planning Policy and Technical Guidance

18.2.1 This section identifies the legislation, planning policy and technical guidance that has informed the assessment of effects with respect to climate change resilience. Further information on policies relevant to the Project is provided in **Chapter 4: Legislation and policy overview**.

Legislation

18.2.2 A summary of the relevant legislation is given in **Table 18.1**.

Table 18.1 Legislation relevant to the climate change resilience assessment

Legislation	Legislative context
Climate Change Act 2008[1]	The Climate Change Act 2008 sets out the reporting requirements of the UK Government to produce a UK Climate Change Risk Assessment (CCRA), published every five years, which is the mechanism for gathering and presenting evidence to help understand climate change risks to the UK. The Third CCRA was published in January 2022[2] and draws from the latest evidence prepared by the Adaptation Committee presented in the Independent Assessment of UK Climate Risk 2021.[3] The overall aim of the Evidence Report is to assess the urgency of further action to tackle current and future risks, and realise opportunities, arising for the UK from climate change. The CCRA3 was used to inform risks and opportunities related to the Project.
The Environment Act 2021[4]	The Environment Act (passed in November 2021) translates aspects of the government's "A Green Future: Our 25 Year Plan to

1 HM Government (2008). *Climate Change Act 2008* (Online). Available at: https://www.legislation.gov.uk/ukpga/2008/27/contents (Accessed 31 May 2024).

2 HM Government (2022). *UK Climate Change Risk Assessment 2022* (Online). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1047003/climate-change-risk-assessment-2022.pdf (Accessed 31 May 2024).

3 Betts, R.A. and Brown, K, (2021). Introduction. In: *The Third UK Climate Change Risk Assessment Technical Report* (Betts, R.A.,Haward, A.B. and Pearson, K.V.(eds.)) (Online). Prepared for the Climate Change Committee, London. Available at: https://www.ukclimaterisk.org/wp-content/uploads/2021/06/Technical-Report-The-Third-Climate-Change-Risk-Assessment.pdf (Accessed: 31 May 2024).

4 HM Government (2021). *Environment Act 2021* (Online). Available at: https://www.legislation.gov.uk/ukpga/2021/30/contents/enacted (Accessed 31 May 2024).

Legislation	Legislative context
	Improve the Environment"[5] into legislation. This Plan sets out how the UK Government will tackle the effects of climate change, by ensuring all policies, programmes and investment decisions take into account the possible extent of climate change this century.

Planning policy

18.2.3 There are a number of national policies that may be relevant to the Project. Under Section 105 of the Planning Act 2008 the Secretary of State will decide how much weight to give to the National Policy Statements. Those relevant to the Project are the overarching National Policy Statement for energy (EN-1) and the National Policy Statement for natural gas supply infrastructure and gas and oil pipelines (EN-4).

18.2.4 Other national and local policies may also provide additional guidance on this environmental topic and could be considered material to the consideration of this Project. Policy potentially relevant to the Project and to this environmental topic is summarised within **Table 18.2.**

Table 18.2 Planning policy relevant to the climate change resilience assessment

Policy	Policy context
National planning policy	
National Planning Policy Framework (NPPF)[6]	The NPPF sets out in paragraph 153 that Local Plans: "*should take a proactive approach to mitigating and adapting to climate change, taking into account the long-term implications for flood risk, coastal change, water supply and changes to biodiversity and landscape, and the risk of overheating from rising temperatures*". Paragraph 154 states that: "*New developments should be planned for in ways that:* *a) avoid increased vulnerability to the range of impacts arising from climate change. When new development is brought forward in areas which are vulnerable, care should be taken to ensure that risks can be managed through suitable adaptation*

[5] HM Government (2021). A Green Future: Our 25 Year Plan to Improve the Environment (Online). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/693158/25-year-environment-plan.pdf (Accessed: 31 May 2024).

[6] Department for Levelling Up, Housing & Communities (2023). *National Planning Policy Framework* (Online). Available at: https://assets.publishing.service.gov.uk/media/65a11af7e8f5ec000f1f8c46/NPPF_December_2023.pdf (Accessed 31 May 2024).

Policy	Policy context
	measures, including through the planning of green infrastructure". The CCR assessment will assess how the Project has been planned to avoid increased vulnerability to climate change throughout the construction, operation and decommissioning phases.
Overarching National Policy Statement for energy (EN-1)[7]	EN-1 sets out the Government's policy for delivery of major energy infrastructure and will be the primary basis for decision making. It presents principles for the design of energy projects to be resilient to climate change, by demonstrating that climate resilience has been built-in to projects from conception, whilst seeking nature-based solutions as part of the adaptation measures. Paragraph 4.10.1 states that: *"If new energy infrastructure is not sufficiently resilient against the possible impacts of climate change, it will not be able to satisfy the energy needs as outlined in Part 3 of this NPS."* Paragraph 4.10.8 states that: *"New energy infrastructure will typically need to remain operational over many decades, in the face of a changing climate. Consequently, applicants must consider the direct (e.g. site flooding, limited water availability, storms, heatwave and wildfire threats to infrastructure and operations) and indirect (e.g. access roads or other critical dependencies impacted by flooding, storms, heatwaves or wildfires) impacts of climate change when planning the location, design, build, operation and, where appropriate, decommissioning of new energy infrastructure".* Furthermore, paragraph 4.10.11 states that: *"Applicants should demonstrate that proposals have a high level of climate resilience built-in from the outset and should also demonstrate how proposals can be adapted over their predicted lifetimes to remain resilient to a credible maximum climate change scenario. These results should be considered alongside relevant research which is based on the climate change projections."*

[7] Department of Energy Security and Net Zero (2023). *Overarching National Policy Statement for Energy (EN-1)* (Online). Available at: https://assets.publishing.service.gov.uk/media/65bbfbdc709fe1000f637052/overarching-nps-for-energy-en1.pdf (Accessed 31 May 2024)

Policy	Policy context
	Paragraph 4.10.12 states: *"It is appropriate to take a risk-averse approach with elements of infrastructure which are critical to the safety of its operation".* Paragraph 4.10.13 states that: *"The Secretary of State should be satisfied that applicants for new energy infrastructure have taken into account the potential impacts of climate change using the latest UK Climate Projections and associated research and expert guidance […] available at the time the ES was prepared to ensure they have identified appropriate mitigation or adaptation measures. This should cover the estimated lifetime of the new infrastructure, including any decommissioning period".* The CCR assessment, in conjunction with the FRA, utilises the EA's Climate Change Allowances which is also referenced in EN-1.
National Policy Statement for Gas Supply Infrastructure and Gas and Oil Pipelines (EN-4) [8]	EN-4 builds on EN-1 and states applicants should set out how the proposal would be resilient to: • Increased risk of flooding; • Effects of rising sea levels and increased risk of storm surge; • Higher temperatures; • Increased risk of earth movement or subsidence from increased risk of flooding and drought; and • Any other increased risks identified in the applicant's assessment. Paragraph 2.3.5 states that the resilience of the project to climate change should be assessed in the Environmental Statement. The CCR assessment considers the range of climate change trends identified in EN-4 and forms part of the Draft ES.
United Nations Framework Convention of Climate	The UNFCCC is one of the major international bodies responsible for managing climate change and carbon emissions. In 2015, it adopted the Paris Agreement, of which one of the aims is stated as:

[8] Department of Energy Security and Net Zero (2023). *National Policy Statement for Gas Supply Infrastructure and Gas and Oil Pipelines (EN-4).* (Online). Available at: https://assets.publishing.service.gov.uk/media/65a789a8867cd8000d5ae9be/nps-natural-gas-supply-infrastructure-pipelines-en4.pdf (Accessed 31 May 2024)

Policy	Policy context
Change (UNFCCC) Paris Agreement[9]	*"(b) Increasing the ability to adapt to the adverse impacts of climate change and foster climate resilience and low greenhouse gas emissions development, in a manner that does not threaten food production*" (Article 2(1)). New development should align to the aims of the Paris Agreement to incorporate the ability to adapt to climate change in the design of the Project, measures to do so are detailed within the CCR assessment.
UNFCCC Glasgow Climate Pact[10]	The Glasgow Pact emphasised the urgency of the scaling up of climate action and support to reduce the vulnerability to climate change by enhancing adaptive capacity and strengthening resilience.
Local planning policy	
Greater Manchester Infrastructure Framework 2040[11]	The Greater Manchester Combined Authority (GMCA) recognise the importance of infrastructure and its continued growth despite environmental and climate change. *Key Challenge 11* Resilience refers to ensuring the security of supply of essential infrastructure, for example energy, throughout each day against challenges including those associated with 'shocks' e.g. flooding. New development should incorporate the ability to adapt to climate change shocks in the design of the Project, measures to do so are detailed within the CCR assessment.
GMCA Joint Development Plan 2022 to 2039 'Places for Everyone (PfE)', 2024[12]	The Joint Development Plan was adopted in March 2024 and includes policies for nine of the Greater Manchester boroughs. Climate change is a key theme through all policies of the plan and is not reduced to one individual policy. The Greater Manchester Strategy to achieve sustainable

9 UNFCCC (2015). *Paris Agreement* (Online). Available at: https://unfccc.int/sites/default/files/english_paris_agreement.pdf (Accessed 31 May 2024).

10 UNFCCC (2021). *Glasgow Climate Pact* (Online). Available at: https://unfccc.int/sites/default/files/resource/cma2021_10_add1_adv.pdf (Accessed 31 May 2024)

11 Greater Manchester Combined Authority (2020). *Greater Manchester Infrastructure Framework 2040* (Online) Available at: https://www.greatermanchester-ca.gov.uk/media/1715/greater-manchester-infrastructure-framework-2040.pdf (Accessed 31 May 2024).

12 Greater Manchester Combined Authority (2024). *Joint Development Plan 2022 to 2039* (Online). Available at: https://www.greatermanchester-ca.gov.uk/media/9578/places-for-everyone-joint-development-plan-document.pdf (Accessed 31 May 2024).

Policy	Policy context
	development is ensuring resilience and that "*a significant challenge within this is the ability to respond to future impacts from climate change"* through "*the need to plan to reduce chronic stresses as well as minimise the impact of acute shocks".*
Trafford District Council Local Plan: Core Strategy, 2012[13]	The Core Strategy sets out spatial policies up to 2026 and some policies have been replaced or part replaced by PfE. It highlights that climate risk and vulnerability are at the centre of the planning system. *Strategic Objective 7* Secure sustainable development includes the use of new technologies to combat and adapt to climate change to minimise impact of all new development on the environment.
Cheshire West and Chester Adopted Development Plan, Part One: Strategic Policies 2015[14]	The overall vision for the Development Plan includes positive adaptation to climate change through *Strategic Objective 14* to mitigate and adapt to the effects of climate change by addressing flood risk/water management and supporting the development of new buildings and infrastructure that are resilient, resistant and adapted to the effects of climate change. *Policy ENV 6* High quality design and construction states that "*Development should, where appropriate, mitigate and adapt to the predicted effects of climate change*".
Cheshire West and Chester Local Plan Part Two: Land Allocations and Detailed Policies 2019[15]	Policy DM4 aims to bolster the adaptation requirements of Policy ENV6 in the Local Plan (Part One)[14] to maximise the resilience of new development and improve adaptation to climate change.

[13] Trafford Council (2012). *Trafford Local Plan Core Strategy* (Online). Available at: https://www.trafford.gov.uk/planning/strategic-planning/docs/core-strategy-adopted-final.pdf (Accessed 31 May 2024).

[14] Cheshire West and Chester Council (2015). *The Local Plan (Part 1) Strategic Policies* (Online) Available at: https://consult.cheshirewestandchester.gov.uk/kse/event/24907/section/ID-3252194-629#ID-3252194-629 (Accessed 31 May 2024).

[15] Cheshire West and Chester Council (2015). *The Local Plan (Part 2) Land Allocations and Detailed Policies* (Online). Available at: https://cheshirewestandchester.objective.co.uk/file/5448701 (Accessed 31 May 2024).

Policy	Policy context
Cheshire East Council Local Plan Strategy 2010 - 2030[16]	*Strategic Priority 3* of Cheshire East is to reduce the impact on climate change by avoiding development in land that may be at risk from the effects of climate change. The following policies are of particular relevance: *Policy SD 2* Sustainable Development Principles, which states that development is expected to use appropriate design and construction to create developments that are resilient to climate change. *Policy SE 1* Design which states that design should encourage climate change adaptation features in spaces and detailed design.
Warrington Borough Council Adopted Core Strategy 2014[17]	Warrington Council's strategy vision of the town includes *Strategic Objective W6* to ensure development is energy efficient, safe and resilient to climate change. *Policy CS 1* Overall Spatial Strategy – Delivering sustainable development specifies that development must have regard to the need to address the causes of climate change and be resilient to these effects.
Halton Borough Council Core Strategy 2013[18]	Identifies the challenge to implement adaptation measures to deal with the threat of climate change. This is reflected in *Strategic Objective 9*, which highlights the need to ensure the Borough is resilient to the adverse effects of climate change. *Policy CS19* Sustainable Development and Climate Change encourages development to incorporate climate change resilience measures.

[16] Cheshire East Council (2017). *Local Plan Strategy 2010-2030* (Online). Available at: https://www.cheshireeast.gov.uk/pdf/planning/local-plan/local-plan-strategy-web-version-1.pdf (Accessed 31 May 2024).

[17] Warrington Borough Council (2014). *Local Plan Core Strategy* (Online). Available at: https://www.warrington.gov.uk/sites/default/files/2019-08/local_plan_core_strategy_adopted_2014.pdf (Accessed 31 May 2024).

[18] Halton Borough Council (2013). *Halton's Local Plan Core Strategy April 2013* (Online). Available at: https://www3.halton.gov.uk/Documents/planning/planning%20policy/CoreStrategy.pdf (Accessed 31 May 2024).

Policy	Policy context
St Helens Borough Council Local Plan up to 2037 (2022)[19]	St Helen's Local Plan Spatial Strategy LPA01 and Development Principles LPA02 requires new development proposals to adapt to the impacts of climate change by: *"Assessing and addressing the impact of climate change through mitigation and/or adaptation measures"*.

Technical guidance

18.2.5 A summary of the technical guidance for climate change resilience is given in **Table 18.3**.

Table 18.3 Technical guidance relevant to the climate change resilience assessment

Technical Guidance Document	Context
UKCP18 projections[20]	UK Climate Projections 2018 (UKCP18) has been produced by the Met Office and provides the latest set of climate change projections for the UK. It includes projections of how climate variables could change in the coming decades, as well as forecasts for sea level rise. UKCP18 projections are used in the CCR assessment by defining the future baseline within the CCR assessment (see **Section 18.5**).
UKCP18 technical notes including: **1. Science Overview Report[21]** **2. UKCP18 Land projections: Science Report[22]**	The UKCP18 Climate Projections were issued with a suite of accompanying scientific reports. The Overview Report and the Land Projections report give a summary of the anticipated climate change trends found within the projection data, evaluating the projection pathways, and provide direction on the use of the data in terms of the nature and degree of consistency within the modelling results. The factsheets are available as a short qualitative overview of the

[19] St Helens Council (2022). St Helens Borough Local Plan up to 2037 (Online). Available at: https://www.sthelens.gov.uk/media/4315/St-Helens-Borough-Local-Plan-up-to-2037/pdf/Local_Plan_Written_Statement__FINAL_adoption_version.pdf?m=1658409100420 (Accessed 31 May 2024).

[20] Met Office (2018). *UK Climate Projections 2018*. Available at: https://www.metoffice.gov.uk/research/approach/collaboration/ukcp/ (Accessed 31 May 2024).

[21] Lowe, J. A. et al. (2019). *UKCP18 Science Overview Report* (Online). Available at: https://www.metoffice.gov.uk/pub/data/weather/uk/ukcp18/science-reports/UKCP18-Overview-report.pdf (Accessed 31 May 2024).

[22] Murphy, J. M. et al. (2019). *UKCP18 Land Projections: Science Report* (Online). Available at: https://www.metoffice.gov.uk/pub/data/weather/uk/ukcp18/science-reports/UKCP18-Land-report.pdf (Accessed 31 May 2024).

Technical Guidance Document	Context
3. **UKCP18 Factsheets**[23]	UKCP18 results for the climate parameters. These reports were used to develop the future baseline and climate trends (**Section 18.5**) used in the CCR assessment.
ISO14091:2021 Adaptation to climate change – Guidelines on vulnerability, impacts and risk assessment[24]	This international standard provides guidelines on approaches to assessing climate change-related risks. It highlights the role of risk assessments in improving climate change adaptation planning and informing climate change adaptation activities from their implementation through to monitoring. The methodology for the CCR assessment (**Section 18.8**) draws from the principles within this guidance.
European Commission Notice – Technical guidance on the climate proofing of infrastructure in the period 2021 - 2027[25]	This note gives technical guidance on the climate proofing of infrastructure, which includes the adaptation to climate change (climate resilience). The note contains guidance on the methodology of assessments, include the role within Environmental Impact Assessments (EIAs). The methodology for the CCR assessment detailed in **Section 18.8** draws from principles within this guidance.
Environmental Impact Assessment Guide to Climate Change Resilience and Adaptation[26]	This IEMA guidance provides a framework for the effective consideration of CCR and adaptation in the EIA process. The methodology for the CCR assessment (**Section 18.8**) draws from the principles within this guidance.
UK Climate Risk Independent Assessment 2021[3] **and**	The UK Government Third CCRA fulfils the requirement under the Climate Change Act 2008[1] for the UK Government to produce a five-yearly assessment of the risks for the UK of the current and predicted impacts of climate change. The

[23] Met Office (2018). *UKCP18 Factsheets.* Available at: https://www.metoffice.gov.uk/research/approach/collaboration/ukcp/data/factsheets (Accessed 31 May 2024).

[24] International Organization for Standardization (2021). *ISO14091:2021 Adaptation to climate change — Guidelines on vulnerability, impacts and risk assessment* (Online). Available at: https://www.iso.org/standard/68508.html (Accessed 31 May 2024).

[25] European Commission (2021). *Commission Notice – Technical guidance on the climate proofing of infrastructure in the period 2021 – 2017* (Online). Official Journal of the European Union C 373 1-92. Available at: https://op.europa.eu/en/publication-detail/-/publication/23a24b21-16d0-11ec-b4fe-01aa75ed71a1/language-en (Accessed 31 May 2024).

[26] Institute of Environmental Management and Assessment (2020). *Environmental Impact Assessment Guide to Climate Change Resilience and Adaptation* (Online). Available at: https://www.iema.net/resources/reading-room/2020/06/26/iema-eia-guide-to-climate-change-resilience-and-adaptation-2020 (Accessed 31 May 2024).

Technical Guidance Document	Context
UK Climate Change Risk Assessment 2022[2]	CCRA highlights key climate risks associated with climate change on infrastructure, such as energy and pipelines, which was used to form the basis of the CCR assessment.
Environment Agency Guidance Flood Risk Assessments: Climate Change Allowances	The supporting Environment Agency planning practice guidance, "Flood risk assessments: climate change allowances"[27], contains guidance on how to make allowances for climate change when preparing flood risk assessments to minimise vulnerability of Projects to flooding and coastal change. The allowances are for potential future increases in river flood flows, extreme rainfall intensity and sea level rise. The potential increases in these parameters should be taken in account over the development's expected lifetime. It also provides guidance on sensitivity testing of these assessments.
Climate Change Adaptation Manual (NE751)[28]	Updated in 2020, this manual is designed to support practical and pragmatic decision-making on considering climate change adaptation for impacts on habitats, green infrastructure, geology and geomorphology, and access and recreation. This manual has been used to inform the ICCI assessment with respect to biodiversity and other topics such as geomorphology, as well as help develop measures in the form of Nature-based Solutions.

18.3 Consultation and Engagement

Overview

18.3.1 The assessment has been informed by consultation responses and statutory and technical engagement. An overview of the approach to consultation is provided in **Section 3.7** of **Chapter 3: Approach to preparing the Draft ES**.

Scoping Opinion

18.3.2 A Scoping Opinion was adopted by the Secretary of State, administered by the Planning Inspectorate, on 08 March 2022. A summary of the relevant responses

[27] Environment Agency (2022). *Flood risk assessments: climate change allowances* (Online). Available at: https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances (Accessed 31 May 2024).

[28] Natural England and RSPB (2019). *Climate Change Adaptation Manual - Evidence to support nature conservation in a changing climate, 2nd Edition* (Online). Available at: http://publications.naturalengland.org.uk/publication/5679197848862720 (Accessed 31 May 2024).

received in the Scoping Opinion in relation to climate change resilience and confirmation of how these have been addressed within the assessment is presented in **Table 18.4**.

Table 18.4 Summary of EIA Scoping Opinion responses for climate change resilience

Consultee	Consideration	How this is addressed in this Draft ES
Marine Management Organisation (MMO)	In relation to section 17.6 that states "*embedded mitigation to mitigate the vulnerability of the Project to climate change will be explored within future environmental reporting*" the MMO advises that the time frame for reporting needs to be finalised now and agreed upon. Identifying key areas to be impacted by river and coastal flooding and erosion is important and these areas need to be monitored for any triggers that might indicate need for mitigation.	The embedded measures within the design have been explored and reported in full within the Draft ES. The CCR assessment identifies and considers the impact of river and coastal flooding and erosion on the Project, which will include allowances for climate change. This should be read in conjunction with **Chapter 7: Water Environment.**
Natural England	The ES should identify how the development affects the ability of the natural environment (including habitats, species, and natural processes) to adapt to climate change, including its ability to provide adaptation for people. This should include impacts on the vulnerability or resilience of a natural feature (i.e. what's already there and affected) as well as impacts on how the environment can accommodate change for both nature and people, for example whether the development affects species ability to move and adapt. Nature-based solutions, such as providing green infrastructure on-site and in the surrounding area (e.g. to adapt to flooding, drought and heatwave events), habitat creation and peatland restoration, should be considered. The ES should set out the measures that will be adopted to address impacts.	The ICCI assessment within **Chapter 19: Intra-related effects** provides an assessment of the extent to which climate change exacerbates the effects of the development on the natural environment, in turn affecting the ability of the natural environment to adapt to climate change, and the efficacy of proposed mitigation. It draws upon the available guidance and studies. Opportunities for nature-based solutions are being explored and integrated into the design, where feasible at this stage, and are recorded in **Chapter 19: Intra-related effects.**

Consultee	Consideration	How this is addressed in this Draft ES
Natural England	The Natural England and RSPB Climate Change Adaptation Manual (2020) provides extensive information on climate change impacts and adaptation for the natural environment, plus adaptation focussed nature-based solutions for people. It includes the Landscape Scale Climate Change Assessment Method that can help assess impacts and vulnerabilities on natural environment features and identify adaptation actions. Natural England's Nature Networks Evidence Handbook (2020) also provides extensive information on planning and delivering nature networks for people and biodiversity.	The ICCI assessment assesses the extent to which climate change exacerbates effects of the development on the natural environment, in turn affecting the ability of the natural environment to adapt to climate change. **Chapter 5: Biodiversity** and **Chapter 8: Landscape and Visual** have drawn upon the available guidance and studies, particularly the 2020 Natural England and RSPB Climate Change Adaptation Manual.[28] The ICCI assessment is reported in **Chapter 19: Intra-related effects**.

Statutory Consultation

18.3.3 Statutory consultation took place between 12 September and 10 November 2022 in accordance with the Planning Act 2008. Prescribed and non-prescribed consultees and members of the public were consulted. Various methods of consultation and engagement were used in accordance with the Statement of Community Consultation (SoCC) including letters, website, public exhibitions, publicity and advertising in newspapers and webinar briefings.

18.3.4 Cadent Gas Ltd ("the Applicant") prepared a Preliminary Environmental Information Report (PEIR) which was publicised at this consultation stage. The Applicant sought feedback on the environmental information presented in that report. Feedback received during statutory consultation was considered by the Applicant and incorporated, where relevant into the design of the Project and its assessment and is presented in this Draft ES.

18.3.5 A summary of the relevant responses received in response to statutory consultation, together with any subsequent discussions held in relation to climate change resilience and confirmation of how these have been considered within the assessment to date is presented in **Table 18.5**.

18.3.6 Technical engagement with consultees in relation to climate change resilience is ongoing.

Table 18.5 Summary of Section 42 Consultation responses for climate change resilience

Consultee	Consideration	How addressed in this Draft ES
Cheshire West and Chester LPA	Planning policy relevant to the CCR assessment could also helpfully refer to Cheshire West and Chester Local Plan Part Two: Land Allocations and Detailed Policies 2019.	The policies within the Cheshire West and Chester Local Plan Part Two has been updated into **Table 18.2** of this Draft ES.
	Cheshire West and Chester Council endorse Natural England comments on the EIA Scoping Opinion around the ES identifying how the development affects the ability of the natural environment to adapt to climate change, and that Nature-based Solutions should be explored, especially in relation to their peatland restoration.	The ICCI assessment within **Chapter 19: Cumulative** provides an assessment of the extent to which climate change exacerbates the effects of the development on the natural environment, in turn affecting the ability of the natural environment to adapt to climate change, and the efficacy of proposed mitigation. It draws upon the available guidance and studies. Opportunities for nature-based solutions are being explored and integrated into the design, where feasible at this stage, and are recorded in **Chapter 19: Cumulative.**

18.4 Data Gathering Methodology

Study Area

18.4.1 The Study Area for the CCR assessment is informed by the spatial extent of the Project. The desk-based study and the baseline information (see **para 18.4.5**) reflect the spatial extent of the Draft Order Limits as defined in **Chapter 2: The Project**. The assessment considers the temporary and permanent assets associated with the Project within the Draft Order Limits. However, the resilience of the Project is also assessed by its interdependencies on external infrastructure beyond the spatial scope of the Project, for example, the resilience of the UK electricity network to ensure a consistent supply to operate the assets. This does not have a defined spatial extent.

18.4.2 The climate change data gathered as part of this assessment is on a regional basis due to the large area within the Draft Order Limits, and therefore any alterations within this will not affect the data gathered.

Desk study

18.4.3 A summary of the organisations that have supplied data, together with the nature of that data is outlined in **Table 18.6**.

Table 18.6 Data sources used to inform the CCR assessment

Source	Date	Summary
Met Office Climate Averages Data[29]	No date.	The Met Office collect data from climate stations around the UK for a number of climate parameters. Woodford was the climate station chosen as the most representative of the Project location, as shown in **Figure 18.1**. Data was collected for the Model Baseline (1981 – 2010) and the Current Baseline (1991 – 2020).
State of the UK Climate Report 2022[30]	2022	Provides a summary of climate change applicable to the UK of the most recent decade (2013 – 2022) against historic 30-year averages.
Met Office North West England & Isle of Man: Climate[31]	2022	This document describes the main features of the climate for the region over a 30-year average period of 1981 – 2010.
Met Office UKCP18 User Interface[32]	2018	UKCP18 data for the 2030s, 2050s and 2070s have been obtained from the Met Office UKCP18 User Interface and the UK Climate Risk Indicators and have been presented for the location of the Project, as shown in **Graphic 18.1**.
UK Climate Risk Indicators[33]	2021	

[29] Met Office. (2021). UK Climate Averages – Woodford (Greater Manchester) (Online). Available at: https://www.metoffice.gov.uk/research/climate/maps-and-data/uk-climate-averages/gcqrqyr80 (Accessed 07 June 2024)

[30] Kendal et al., (2023). State of the UK Climate 2022. International Journal of Climatology, 43(S1), 1-82. https://doi.org/10.1002/joc.8193

[31] Met Office (2016). North West England & Isle of Man: Climate (Online). Available at: https://www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/weather/learn-about/uk-past-events/regional-climates/north-west-england--isle-of-man_-climate---met-office.pdf (Accessed 7 June 2024).

[32] Met Office. (2021). UK Climate Projections User Interface. Available at: https://ukclimateprojections-ui.metoffice.gov.uk/ (Accessed 7 June 2024).

[33] Nigel Arnell et. al., (2021). The Climate Risk Indicators (Online). Available at: https://ukcri.org/ (Accessed 2 July 2024).

Source	Date	Summary
National Tidal and Sea Level Facility[34]	2024	Used to infer the current baseline sea level data from Liverpool Gladstone Dock as the closest location providing current data.

Survey work

18.4.4 No survey work is required to inform the CCR assessment. Survey work required for the chapters referenced in **Section 18.1,** which may inform the CCR assessment, are detailed in the respective chapters.

Data limitations

18.4.5 UKCP18 is the result of a programme of work by the Met Office's Hadley Centre Climate Programme and contributing organisations. UKCP18 provides the most up-to-date assessment of how the climate of the UK may change over the 21st Century. However, climate change, by its very nature, is associated with a range of assumptions and limitations.[35] For example, there is uncertainty in climate models regarding how global climatic trends will be reflected at the regional and local scale. The future baseline represents projections under a single 'high emissions' future scenario (RCP8.5) and cannot be treated as a prediction. Data for the 10%, 50% and 90% probability levels for the high emissions scenario (RCP8.5) have been used in the assessment to highlight uncertainty and ensure a conservative assessment of risk. The 10%, 50% and 90% probability levels correspond to the low, central and high changes in the probabilistic projections.[21] Leading climate change data from the UKCP18 programme has been used to explore trends and magnitude of change at the regional scale.

18.4.6 In most cases, the UKCP18 probabilistic projections over land have been used which consists of 3000 model scenarios. These projects have been collated at the coarse scale of 'Region' due to the extent of the Project area.

[34] National Tidal and Sea Level Facility (2024). Sea Level Trends (Online) Available at: https://ntslf.org/products/sea-level-trend-charts?name=Liverpool+%28Gladstone+Lock%29 (Accessed 2 July 2024).

[35] Fung et al., (2018). UKCP18 Guidance: Caveats and Limitations (Online). Available at: https://wwwpre.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/research/ukcp/ukcp18-guidance---caveats-and-limitations.pdf (Accessed 22 June 2024).

18.5 Overall Baseline

Current baseline

18.5.1 The baseline for the CCR assessment is the current climatic conditions representative of the Draft Order Limits. Due to the size and scale of the area, the current climate conditions are considered for the north-west of England, where the Project is located. They are used to provide context for the climate change impacts throughout the construction, operation and decommissioning of the Project.

18.5.2 The north-west has a wide range of climate variability, due to its topography and altitude, and this region contains both the coldest place and wettest place in England. Temperatures in this region are generally affected by altitude and proximity to the coast. The exposure of the region to westerly maritime air masses, in addition to the areas of high altitude, results in the region containing some of the wettest places in the UK.[31]

18.5.3 Key features of the climate that have defined the area over the last 30-year period (1981-2010) include:

- Temperatures in the coldest month of January have typically ranged from 0°C to 2 - 2.5°C along the coasts and in Merseyside. The warmest month is typically July with mean daily maximum temperatures of around 21°C in Cheshire. This varies for the upland areas which is typically around 17°C. Extreme temperatures have been experienced in the region in this period, which include a temperature of 34.5°C recorded in Knutsford, Cheshire in 1990 and a heatwave in July 2006 where 34.3°C was experienced in Crosby, Merseyside.
- Rainfall has been generally well-distributed throughout the year with a seasonal pattern. Across the region as a whole, the average total number of days with rainfall of 1mm or more ('wet days') can reach 50 – 60 days within winter, decreasing to 40 - 45 days in summer. Cheshire and Merseyside are typically drier with 35 - 40 days in winter and about 30 days in summer.
- The region is prone to widespread flooding, especially in winter and early spring. There have been a number of severe flooding events over this period.
- The occurrence of thunderstorms correlates with the heaviest falls of rain, often associated with summer thunderstorms. In North West England, it is typical that there will be 8 - 12 thunderstorm days per year.
- The north-west region is also amongst the most exposed parts of the UK due to the coastal areas of the Atlantic and the large upland areas. Mean wind speeds and gusts are the strongest between December to February. Wind exposure can also be measured in the number of days gale force is reached; if wind reaches a mean speed of 34 knots or more over any ten consecutive minutes, this is classed as a gale day. In North West England, gales occur along the coast for around 5 – 10 days and less than 5 days in inland areas.

18.5.4 The current baseline uses the observable data available through the Met Office from the climate station at Woodford, Greater Manchester[29]. The Hawarden Airport climate station is also within range of the Project; however, Woodford was chosen as it is within the administrative boundary of the UKCP18 data shown in **Graphic 18.1**. The location of the Woodford climate station is shown on **Figure 18.1.**

18.5.5 The local baseline data presented in this section is from the nearest climate station, Woodford, in comparison with the wider district of north-west England and North Wales. This is contextualised against the national data for England. This data also provides an understanding of how recent climate trends have impacted the Study Area. Qualitative data has been used where appropriate.

Precipitation

18.5.6 Table 18.7[29] presents key precipitation data from the current baseline period (1991 – 2020).

Table 18.7 Baseline climate data 1991 – 2020 for rainfall

	Nearest climate station: Woodford, England	Regional: north-west England and North Wales	National: England
Average Summer rainfall (June, July, August) (mm)	224.53	296.72	219.17
Average Winter rainfall (December, January, February) (mm)	234.46	398.74	269.85

18.5.7 Precipitation falling as snowfall is closely linked with temperature, with snowfalls rarely occurring if the temperature is higher than 4°C. In the local area, snowfall is normally confined to the months including and between November to April.

Temperature

18.5.8 Table 18.8 presents key temperature data from the current baseline period (1991 – 2020).

Table 18.8 Baseline climate data 1991 – 2020 for average seasonal temperatures

	Nearest climate station: Woodford, England	Regional: north-west England and North Wales	National: England
Average Summer temperature (June, July, August) (°C)	15.47	14.6	15.7

	Nearest climate station: Woodford, England	Regional: north-west England and North Wales	National: England
Average Winter temperature (December, January, February) (°C)	4.35	4.2	4.6

Other trends

18.5.9 The Study Area is one of the more sheltered parts of the UK, as reflected in the current baseline data in **Table 18.9**. In general, the strongest winds are associated with the passage of deep depressions across or close to the UK. The frequency and strength of these depressions is greatest in the Winter half of the year, especially from December to February, and this is when mean speeds and gusts (short duration peak values) are strongest.

Table 18.9 Baseline climate data 1991 – 2020 – other climate variables

	Nearest climate station: Woodford, England	Regional: north-west England and North Wales	National: England
Mean wind speed at 10m (knots)	7.6	9.4	8.5

18.5.10 The National Tidal and Sea Level Facility at the nearest tide gauge station at Liverpool Gladstone Lock has been recording sea level data since 1991, with the last update in February 2024[34]. The annual average data shows that sea level has risen from 7,017mm in 1992 to 7,202mm in 2015, the last year of complete data. Annual average data can be inferred from the monthly data points in 2023 which concludes that sea level was approximately 7,213mm on average in 2023.

Past major events

18.5.11 During the current baseline period, the Project area has experienced numerous storms which have brough widespread strong winds, heavy rain, flooding and disruptions to power supply.

18.5.12 In July 2022, the UK experienced a brief but unprecedented extreme heatwave from 16 to 19 July 2022 which marked a milestone in UK climate history as 40°C was recorded for the first time in the UK. Hawarden Airport, the Climate Station near to the Study Area, recorded the highest national record in Wales of 37.1°C. There were several fatalities associated with open water swimming. Several fire services declared major incidents after multiple fires broke out[36]. The UK Health

[36] Met Office (2022) Unprecedented extreme heatwave, July 2022. (Online) Available at: https://www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/weather/learn-about/uk-past-events/interesting/2022/2022_03_july_heatwave_v1.pdf

Security Agency (UKHSA) published analysis of deaths during heat-periods in 2022 and which suggests that the 5-heat periods in the Summer of 2022 resulted in a total of 2,803 excess deaths (excl. COVID-19) in people aged 65 and over across England as a whole.

Future baseline

18.5.13 **Table 18.6** details the data sources and technical guidance used in the desk study for the CCR assessment, including UKCP18 climate data used to form the future baseline.

18.5.14 UKCP18 provides probabilistic projection data on climate variables for the UK. The data provides projections until the end of the 21st Century for different emissions scenarios, known as Representative Concentration Pathways (RCP).

18.5.15 RCP8.5 is a potential future pathway which is slow to transfer to a low-carbon energy provision. It is considered a possible, but conservative, emission scenario suitable for evaluating the climate resilience of infrastructure projects. Data from UKCP18 for the RCP8.5 scenario has been obtained for the 2030s (2020-2039), 2050s (2040-2059), and 2070s (2060-2079) projections (as informed by the temporal scope in **Section 18.7**) at the 10%, 50% and 90% probability level and has been used to determine the future baseline.

18.5.16 UKCP18 provides a range of different climate data available at different scales. For all climate variables, preference has been given to the UKCP18 probabilistic projections at 25km as these have more limited sampling of uncertainties and are therefore the preference for future risk assessments. The spatial scope of the data collection is for the North West England administrative boundary, as shown in **Graphic 18.1**, which is an aggregated regional average created from the 25km probabilistic projections.[37]

[37] Fung et al., (2018). UKCP18 Guidance: Data availability, access and formats (Online). Available at: https://www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/research/ukcp/ukcp18-guidance-data-availability-access-and-formats.pdf (Accessed 24 July 2024).

Graphic 18.1 Administrative boundary used within UKCP18 data extraction

18.5.17 For some climate variables (notably wind and snowfall), climate data is not available within the 25km probabilistic projections. Regional data (12km) is available which better represents local effects and therefore wind and snowfall data can be extracted. However, for the purposes of this assessment, qualitative literature has been utilised, due to the uncertainties mentioned in **Section 18.4**. Namely, the factsheets have provided this information[23].

18.5.18 The future baseline is used to set out general climatic conditions that would be experienced over the project lifetime based on the temporal scope detailed in **Section 18.7. Table 18.10** shows the projected changes in future climate variables across the chosen time periods.

Table 18.10 Future climate projections (probabilistic) for the north-west of England from UKCP18

Climate variable	Model Reference (1981 – 2010)	Current Baseline (1991 – 2020)	Time period and projected change RCP8.5 50th (*10th – 90th percentile*)[38]			Trend[39]
			2030s (2020 – 2049)	2050s (2040 – 2069)	2070s (2060 – 2089)	
Average Summer temperature (°C change)	15.13	15.47	1.2 *(0.4 – 1.9)*	2.1 *(0.9 – 3.3)*	3.5 *(1.7 – 5.3)*	↑
Average Winter temperature (°C change)	3.93	4.35	0.9 *(0.2 – 1.6)*	1.5 *(0.6 – 2.6)*	2.4 *(0.9 – 3.9)*	↑
Maximum Summer temperature (°C change)	19.59	19.94	1.2 *(0.3 – 2.1)*	2.2 *(0.8 – 3.7)*	3.7 *(1.6 – 6.0)*	↑
Minimum Winter temperature (°C change)	0.79	1.21	0.9 *(0.1 – 1.8)*	1.6 *(0.5 – 2.9)*	2.5 *(0.8 – 4.3)*	↑
Average Winter rainfall (% change)	222.80	234.46	5.4 *(-3.3 – 15.2)*	10.8 *(-1.4 – 25.2)*	18.4 *(1.8 – 37.3)*	↑

[38] UKCP18 science reports, key messages, maps and graphs uses a 20-year baseline period of 1981 – 2000 to present the projected change in climate variables. Due to the forma of publicly available historic climate data, the model reference is presented as 1981 – 2010.

[39] Trendline is indicative of direction of travel but is not indicative of magnitude of change or confidence in the trend. ↑ shows an increasing trend, ↓ shows a decreasing trend, ⇔ illustrates a minor change in direction of the trend.

Climate variable	Model Reference (1981 – 2010)	Current Baseline (1991 – 2020)	Time period and projected change RCP8.5 50th (*10th – 90th percentile*)[38]			Trend[39]
			2030s (2020 – 2049)	2050s (2040 – 2069)	2070s (2060 – 2089)	
Average Summer rainfall (% change)	211.14	224.53	-7.0 *(-20.7 – 6.0)*	-14.8 *(-31.8 – 1.6)*	-24.0 *(-43.0 – -4.1)*	↓

18.5.19 It is anticipated that there will be an **increase in mean temperatures** across all seasons but especially in the summer. For example, average summer temperatures are expected to be 3.5°C higher than the model reference period. The extremes are greater than the mean values, with average maximum temperatures increasing throughout the time periods. This is anticipated to lead to an **increased frequency and intensity of heatwave events** by the 2070s[40]. This is shown in **Table 18.11** which contains climate change indicators based on the UKCP18 data. These provide an indication of sector specific thresholds which are projected to change in the future. The indicators presented in **Table 18.11** are provided against the model reference period of 1981-2010. These indicators are unavailable for the current baseline period (1991-2020).

Table 18.11 Future projections (absolute) of climate risk indicators from UKCP18

Climate variable	Model Reference (1981 – 2010)	RCP8.5 50th percentile *(10th-90th percentile)*		
		2030s (2020 – 2049)	**2050s** (2040 – 2069)	**2070s** (2060 – 2089)
Met office heatwaves (events per year)[41]	0.8	1.5 *(1.0 – 2.2)*	2.4 *(1.3 – 3.9)*	3.7 *(1.8 – 5.2)*
Heat stress (days per year)[42]	0.0	0.2 *(0.1 – 0.4)*	0.6 *(0.2 – 1.9)*	2.4 *(0.4 – 7.0)*
Wildfire Fire Danger Index (days per year)[43]	4.5	7.2 *(3.9 – 13.2)*	11.2 *(4.6 – 25.1)*	20.9 *(6.6 – 45.9)*

18.5.20 It is anticipated that there will be an increase in winter precipitation (rainfall), coupled with an increase in intensity of winter rainfall events.

18.5.21 There is a clear shift to drier summers across all time periods as shown by the decrease in summer precipitation. This leads to an **increased risk of wildfire events**. Furthermore, despite this overall trend towards drier summers, new data from UKCP18 Local suggests future **increases in the intensity of heavy**

[40] Met Office (2018). UKCP18 Headline Findings (Online). Available from: https://www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/research/ukcp/ukcp18_headline_findings_v3.pdf (Accessed 07 June 2024).
[41] A UK heatwave threshold is met when a location records a period of at least three consecutive days with daily maximum temperatures meeting or exceeding the heatwave temperature threshold. The threshold for the local area is 25°C.
[42] Days with shade Wet Bulb Globe Temperature (WBGT) above 25°C.
[43] Days with Met Office Fire Danger Index at the Very High Fire Severity level or above.

summer rainfall events[40] and the likelihood of individual wet summers reduces only slightly[44].

18.5.22 The UKCP18 projections by the 2070s show a **significant decrease in falling and lying winter snow** of around 80-100% for the north-west of England in both local (2.2km) and regional (12km) projections.[45]

18.5.23 **Table 18.12** presents sea level extremes data for the nearest coastal location to the Liverpool Dock tidal facility. Extreme sea levels will increase as a result of the **rise in mean sea level**.[46] Sea level rise over the considered time periods is expected to affect tidal characteristics substantially. However, there is no evidence for significant changes in future storm surges, although confidence in this is low. Further details around tidal flooding are presented in **Chapter 7: Water Environment.**

Table 18.12 Sea level rise projections (m)

	RCP8.5 50th percentile (10th-90th percentile)		
	2030	**2050**	**2070**
Sea level rise (m)	0.13 *(0.10 – 0.17)*	0.25 *(0.18 – 0.33)*	0.41 *(0.29 – 0.54)*

18.5.24 Additionally, UKCP18 has found an increase in surface wind speeds over the UK for the second half of the 21st Century during the winter season, where more significant impacts of wind are experienced. It is anticipated that there will be an **increase in the frequency of storms**, however, the increase in mean wind speeds is modest.[47]

18.6 Embedded Environmental Measures

18.6.1 As part of the project design process, a number of embedded environmental measures are proposed to reduce the potential for impacts on CCR. These are broken down into measures that are incorporated into the overall design of the

[44] Met Office (2018). UKCP18 Factsheet: Precipitation (Online). Available from: https://www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/research/ukcp/ukcp18-factsheet-precipitation.pdf (Accessed 07 June 2024).

[45] Met Office (2108). UKCP18 Factsheet: Snow (online). Available from: https://www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/research/ukcp/ukcp18_factsheet_snow_jul-2021.pdf (Accessed 07 June 2024).

[46] Met Office (2018). UKCP18 Factsheet: Sea level rise and storm surge (Online). Available from: https://www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/research/ukcp/ukcp18-fact-sheet-sea-level-rise-and-storm-surge.pdf (Accessed 07 June 2024).

[47] Met Office (2018). UKCP18 Factsheet: Wind (online). Available from: https://www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/research/ukcp/ukcp18-fact-sheet-wind_march21.pdf (Accessed 07 June 2024).

Project, and those that are to be implemented during its construction and operational phases. No measures have been specifically identified for the decommissioning phase of the Project. However, it is anticipated that measures equivalent to those implemented during construction would also be effective in mitigating effects on CCR during decommissioning. **Table 18.13** outlines how these embedded measures will influence the CCR assessment.

18.6.2 The embedded measures as part of other topic assessments listed in **paragraph 18.1.3** are not replicated here. Of particular relevance is **Chapter 7: Water Environment**.

Table 18.13 Summary of embedded environmental measures

Embedded measures	Compliance mechanism
Construction phase	
The Contractor(s) will ensure that the relevant measures within the Outline Construction Environmental Management Plan (CEMP) and health and safety procedures are implemented.	Development Consent Order (DCO) requirement
Construction activities will be planned through use of a Risk Assessment Method Statement (RAMS) alongside safety bulletins as part of the Outline CEMP. The RAMS will put in place procedures in the case of extreme weather (high temperatures, extreme winds, flooding, wildfire risk). This may include altering the construction programme to delaying affected activities, changing shift patterns, Personal Protective Equipment (PPE) and toolbox talks.	Outline CEMP secured via DCO requirement
Operational phase	
Operation and Maintenance (O&M) Procedures The O&M requirements will include for inspection and maintenance of sensitive equipment following extreme weather events associated with climate change as identified in the climate change risk assessment. The O&M Procedures will also set out measures to mitigate for working in hot weather, storm conditions, and other extreme events associated with climate change, including reducing the risk of wildfire.	DCO requirement
Basis of Design (BoD) and Materials specifications As appropriate, the BoD will set out parameters for design which draw on the climate change projections identified (e.g. soil moisture changes, wind events, temperature ranges, driving rain).	DCO requirement
Independencies and cascading failures	DCO requirement

Embedded measures	Compliance mechanism
The design will identify dependencies on the operation of the project which originate outside the boundaries of the Project. The Project will also identify appropriate mitigation measures for these.	
Decommissioning Any decommissioning activities will take place under an updated Climate Change Risk Assessment which will include measures to mitigate for climate change impacts during this activity.	DCO requirement.
Landscape management plans The landscape and biodiversity planting will be selected in light of future climate change parameters and will identify additional maintenance activities, where appropriate.	Draft Landscape and Ecological Management Plan as part of DCO.
Lightning protection Above ground infrastructure will be fitted with lightning protection.	DCO requirement

18.7 Scope of the Assessment

18.7.1 The scope of the assessment has been refined as the Project design has evolved and responds to feedback received to date as set out in **Section 18.3**.

Spatial scope

18.7.2 The spatial extent of the CCR reflect the Study Area described in **Section 18.4** as the CCR assessment considers all Project assets within the Draft Order Limits. To reiterate, the resilience of the Project is also assessed by its interdependencies on external infrastructure beyond the spatial scope of the Project, which cannot be defined.

Temporal scope

18.7.3 The temporal scope of the CCR assessment is consistent with the Project lifetime.

18.7.4 Construction is expected to commence in Q1 2027 ready for commissioning Q1 2030, with minimal expected climate change from the baseline. It is anticipated that the Project would be operational by Q2 2030.

18.7.5 The asset design life of the Project is 40 years, with an anticipated end of design life in approximately 2070. This is considered within the 2070s climate period (2060 – 2079). More significant climate changes are anticipated by the end of the project design life and beyond.

18.7.6 Decommissioning activity will likely entail leaving the asset in-situ and making it safe. The timescales for this activity are currently not defined, as the operational

life of the asset may be much longer than the design life, dependent on an ongoing repair and replace programme. The climate periods chosen, i.e. up to the 2070s, have informed the decommissioning assessment at this stage, although it is likely that any decommissioning activities would be subject to an updated CCR assessment.

Potential receptors

18.7.7 The receptors that are considered as part of the CCR assessment can be grouped into the following categories:

- Building and infrastructure receptors i.e. the Project assets, both temporary and permanent, throughout the lifecycle of the Project.
- Human health receptors i.e. construction workers, maintenance staff.

18.7.8 A description of the CCR receptors that have been identified as being potentially subject to effects are summarised in **Table 18.14**.

18.7.9 The receptors of the ICCI assessment reflect the environmental receptors associated with the technical chapters under consideration and are reported in **Chapter 19: Intra-related Effects**. This includes the proposed landscape and ecological planting as part of the Project design.

Table 18.14 CCR receptors subject to potential effects

Receptor	Reason for consideration
Building and infrastructure including temporary and permanent infrastructure and buildings considered individual Project assets, new and existing access roads, materials plant and equipment, drainage assets, electricity connection, third party assets where the Project is interdependent.	The CCR assessment considers the resilience of the Project as an amalgamation of its temporary and permanent assets. The resilience of the individual Project assets is essential to the resilience of the overall Project.
Human health including site operatives during construction, operation and decommissioning of the Project.	The CCR assessment considers the effects of climate change on the Project and the resilience of the Project to these effects, including the health of the workforce required during the construction, operation and decommissioning activities of the Project.

Likely significant effects

18.7.10 The effects on climate change resilience receptors which have the potential to be significant and have been taken forward for detailed assessment are summarised in **Table 18.15**.

Table 18.15 Climate change resilience receptors scoped in for further assessment

Climate Impact	Receptor	Likely significant effects	Phase
Increased annual mean temperatures, especially in the summer months, and an increase in the frequency and intensity of hot spells	Human health	Increased heat stress or heat exhaustion experienced by staff.	Construction, operation and decommissioning
	Building and infrastructure	Restriction of certain construction activities during hot weather, for example, the pouring of concrete in higher temperatures could reduce the strength and durability of the finished product, and the laying of asphalt could become difficult as it fails to maintain profile during compaction. This could cause programme delay and increased costs.	Construction and decommissioning
	Buildings and infrastructure	Overheating of Mechanical and Electrical (M&E) assets such Local Equipment Rooms within the HAGIs/Block Valve Installations (BVIs), leading to a decrease in asset performance and/or requiring additional electricity demand for mechanical cooling units.	Operation
	Buildings and infrastructure	Increased rate of degradation of the access roads to HAGI/BVIs, such as asphalt, increasing maintenance requirements for the road.	Operation
	Buildings and infrastructure	Risk of cascading failures due to interdependencies on third party assets (such as overheating of IT and telecommunications equipment) leading to loss of HAGI/BVIs monitoring telecommunications.	Operation
Increased annual mean temperatures and frequency	Human health	Increased dust creation from construction activities, leading to impacts on the health of construction workers and the failure of machinery and equipment.	Construction and decommissioning

Climate Impact	Receptor	Likely significant effects	Phase
and intensity of hot spells, coupled with decreased summer precipitation	Buildings and infrastructure	Wildfires restricting access to HAGI/BVIs or causing damage to the equipment.	Construction, operation and decommissioning
	Human health	Risk of wildfires affecting the operational and maintenance workforce.	Construction, operation and decommissioning
Decrease in summer precipitation, leading to drought conditions	Buildings and infrastructure	Drought conditions impacting water available through abstraction licenses to use during construction, e.g. for dust suppression and commissioning.	Construction and decommissioning
	Buildings and infrastructure	River erosion leading to exposure of pipelines and potential scour and damage.	Operation
Fluctuations in mean rainfall across the year, coupled with an increase in mean temperatures, resulting in changes to soil moisture	Buildings and infrastructure	Changes to soil moisture levels causing shrink swell within the soils, leading to deterioration of structure foundations of HAGI/BVIs infrastructure.	Operation
	Buildings and infrastructure	Increased ground temperature and ground movement impacting on the electrical cables as part of the DNO connection through reduced capacity or tensile forces.	Operation
	Buildings and infrastructure	Land instability causing movement of pipelines resulting in damage or failure.	Operation
Increase in precipitation resulting in tidal, fluvial or pluvial flooding	Human health	Wet weather leading to increased possibility of slips, trips and falls.	Construction, operation and decommissioning
	Building and infrastructure	Flooding of construction site access roads causing delays to construction programme.	Construction and decommissioning
	Building and infrastructure	Flooding of M&E equipment resulting in failure through flood damage and/or increased corrosion rate.	Operation

Climate Impact	Receptor	Likely significant effects	Phase
	Building and infrastructure	Increased surface water exceeding the capacity of attenuation and drainage, causing flooding across the site or elsewhere.	Construction and operation
	Buildings and infrastructure	Erosion of soils resulting in exposing or damage to the pipeline.	Operation
	Buildings and infrastructure	Access to the HAGIs/BVIs or compound could be restricted due to flooding, restricting any emergency or routine maintenance works.	Operation and decommissioning
	Buildings and infrastructure	Increased pipeline buoyancy which can exert additional stress causing potential damage. Saline groundwater could also increase corrosion affecting asset integrity.	Operation
	Buildings and infrastructure	Risk of cascading failures due to interdependencies on third party assets such as flooding of electrical substations leading to loss of power to HAGIs/BVIs.	Operation
Increased frequency and intensity of storm events	Building and infrastructure	There is an increased risk of disruption to construction work, such as cranes unable to operate in high winds.	Construction and decommissioning
	Buildings and infrastructure	Increased wind loading on HAGI/BVIs infrastructure and security fencing leading to damage.	Operation
	Buildings and infrastructure	Lightning strikes on HAGI /BVIs infrastructure, causing damage or failure.	Operation
	Buildings and infrastructure	Windblown debris causing damage to HAGI/BVIs infrastructure.	Operation
	Buildings and infrastructure	Cascading failures due to interdependencies on third party assets could become affected by windblown debris, obstructing access to the HAGIs/BVIs.	Operation

Elements scoped out of further assessment

18.7.11 There are no effects that are scoped out of the assessment.

18.8 Assessment Methodology

Introduction

18.8.1 The generic project-wide approach to the assessment methodology is set out in **Chapter 3: Approach to preparing the Draft ES**, and specifically in **Section 3.10**. However, whilst this has informed the approach that has been used in this climate change resilience assessment, it is necessary to set out how this methodology has been applied, and adapted as appropriate, to address the specific needs of this climate change resilience assessment.

Assessment criteria

Likelihood

18.8.2 The likelihood of the climate change impact on the receptor occurring takes into account the climate change trends (see **Section 18.5**) and the anticipated exposure of the receptor to the trend. An indicative scale used for assessing the likelihood of the climate change impact on the receptor is summarised in **Table 18.16**.

Table 18.16 Indicative scale for assessing the likelihood of a climate change impact on the receptor

Likelihood category	Description (probability and frequency of occurrence)
Very likely	The impact is almost certain to occur during the phase of the Project considered or would occur multiple times over the lifetime of the Project stage.
Likely	The impact is considered likely to occur during the phase of the Project considered or would occur several times over the lifetime of the Project stage.
Possible	The impact is as likely as not to occur during the phase of the Project considered or would occur a limited number of times over the lifetime of the Project stage.
Unlikely	The impact is unlikely to occur during the phase of the Project considered, but still could occur at least once.
Very unlikely	The impact is high unlikely to occur during this phase of the Project considered and is considered rare.

Consequence

18.8.3 The consequence if the climate change impact occurs is the magnitude of change felt by the receptor. The vulnerability of the receptor to the climate change impact is considered when assessing the consequence level by incorporating the sensitivity analysis considered during EIA Scoping. An indicative scale used for assessing the consequence of the climate change impact on the receptor is contained within **Table 18.17**.

Table 18.17 Indicative scale for assessing the consequence (magnitude of change) of a climate change impact on the receptor

Consequence category	Consequence criteria
Catastrophic	The impact could lead to complete shutdown of operations, loss of the asset, or collapse. There could be single or multiple fatalities and significant harm to the environment with limited prospect of full recovery. Social implications could lead to community protests and high financial implications.
Major	The impact could lead to disruption to activities lasting more than 1 week. There could be major or multiple injuries which could be permanent. Environmental damage could be significant with recovery times over a year and non-compliance with regulations and consents. National and long-term social impacts could be endured. The impact would require extensive mitigation actions.
Moderate	The impact could lead to disruption to activities lasting more than 1 day but less than 1 week. There could be moderate environmental damage with wider effects and recovery of up to a year. Moderate cost and social implications which are localised yet long-term. This could lead to a serious injury requiring lost time. The impact would require emergency mitigation actions to be in place.
Minor	The impact could lead to disruption to activities lasting less than 1 day. There could be localised environmental impact within the site boundary, localised and temporary social or reputational impacts, and a minor cost implication. This could lead to a minor injury requiring medical treatment. The impact could be rectified through additional mitigation actions to be put in place.
Minimal	The impact could lead to disruption to an isolated section of activity with limited social, economic and environmental consequences. It could equate to a minor first aid case. The impact could be rectified through usual activity.

Significance evaluation methodology

18.8.4 The level of the risk of the climate change impacts on the Project is concluded in this risk assessment as a function of the likelihood and magnitude. This will identify any significant potential risks and where further mitigation and adaptation measures will be required, shown as significant effects within the matrix in **Table 18.18**.

Table 18.18 Significance of CCR effects

Likelihood	Magnitude				
	Minimal	**Minor**	**Moderate**	**Major**	**Catastrophic**
Very unlikely	Negligible (NS)	Negligible (NS)	Minor (NS)	**Moderate (S)**	**Moderate (S)**
Unlikely	Negligible (NS)	Minor (NS)	Minor (NS)	**Moderate (S)**	**Major (S)**
Possible	Minor (NS)	Minor (NS)	**Moderate (S)**	**Major (S)**	**Major (S)**
Likely	**Moderate (S)**	**Moderate (S)**	**Major (S)**	**Major (S)**	**Major (S)**
Very likely	**Moderate (S)**	**Major (S)**	**Major (S)**	**Major (S)**	**Major (S)**

Note: (S) denotes a significant or potentially significant effect, (NS) denotes a not significant effect.

18.9 Assessment of CCR Effects

Construction phase

Table 18.19 CCR Assessment: construction phase

				Residual risk and significance		
Climate trend	**Receptor**	**Potential climate change impact**	**Proposed procedures and/or measures**	**Likelihood of Impact**	**Consequence of Impact**	**Significance**
Increased annual mean temperatures, especially in the summer months, and an increase in the frequency and intensity of hot spells.	Human health	Increased heat stress or heat exhaustion experienced by the construction workforce.	**Embedded measure:** The Contractor(s) will ensure that the relevant measures within the Outline Construction Environmental Management Plan (CEMP) and health and safety procedures are implemented.	Unlikely	Minor	**Minor (NS)**
	Building and infrastructure	Restriction of certain construction activities during hot weather, for example, the pouring of concrete in higher temperatures could reduce the strength and durability of the finished product, and the laying	**Embedded measure:** Construction activities will be planned through use of a Risk Assessment Method Statement (RAMS) alongside safety bulletins as part of the Outline CEMP.	Very unlikely	Minimal	**Negligible (NS)**

				Residual risk and significance		
Climate trend	**Receptor**	**Potential climate change impact**	**Proposed procedures and/or measures**	**Likelihood of Impact**	**Consequence of Impact**	**Significance**
		of asphalt could become difficult as it fails to maintain profile during compaction. This could cause programme delay and increased costs.				
Increased annual mean temperatures and frequency and intensity of hot spells, coupled with decreased summer precipitation.	Human health	Increased dust creation from construction activities, leading to impacts on the health of construction workers and the failure of machinery and equipment.	**Embedded measure:** The Contractor(s) will ensure that the relevant measures within the Outline CEMP and health and safety procedures are implemented.	Unlikely	Minimal	**Negligible (NS)**
	Human health	Risk of wildfires affecting the construction workforce.	**Embedded measure:** Construction activities will be planned through use of a RAMS alongside safety bulletins as part of the Outline CEMP.	Very unlikely	Moderate	**Minor (NS)**
Decrease in summer precipitation	Building and infrastructure	Drought conditions impacting water available through	There will be limited requirements for abstraction during	Unlikely	Minor	**Minor (NS)**

				Residual risk and significance		
Climate trend	**Receptor**	**Potential climate change impact**	**Proposed procedures and/or measures**	**Likelihood of Impact**	**Consequence of Impact**	**Significance**
leading to drought conditions		abstraction licenses to use during construction, e.g. for dust suppression and commissioning.	construction and some pre-commissioning water requirements, which will be specified at the detailed design stage. Any abstraction will depend on water availability and consultation with key stakeholders, such as United Utilities and the Environment Agency. Specific requirements will be set out in an Outline Drainage Strategy (see **Appendix 7B**), subject to Local Planning Authority approval. Re-use of water will take place wherever possible e.g. treated runoff for use in activities such as dust suppression.			

				Residual risk and significance		
Climate trend	**Receptor**	**Potential climate change impact**	**Proposed procedures and/or measures**	**Likelihood of Impact**	**Consequence of Impact**	**Significance**
Increase in precipitation resulting in tidal, fluvial or pluvial flooding.	Human health	Wet weather leading to increased possibility of slips, trips and falls.	**Embedded measure:** The Contractor(s) will ensure that the relevant measures within the Outline CEMP and health and safety procedures are implemented.	Unlikely	Minimal	**Negligible (NS)**
	Building and infrastructure	Flooding of construction site access roads causing delays to construction programme.	The embedded measures related to this impact are contained with **Chapter 7: Water Environment:** • C-3 Timing of works • C-22 Preferential siting • C-23 Flood Emergency Response Plan	Unlikely	Minor	**Minor (NS)**
	Building and infrastructure	Water ingress to equipment or machinery related to construction activities or permanent assets in place during construction, leading to	The construction programme accounts for high precipitation events in which groundworks are restricted to outside of the winter months. This will reduce the likelihood of encountering flooding of	Unlikely	Minimal	**Negligible (NS)**

				Residual risk and significance		
Climate trend	**Receptor**	**Potential climate change impact**	**Proposed procedures and/or measures**	**Likelihood of Impact**	**Consequence of Impact**	**Significance**
		equipment failures or damage.	construction sites including of equipment. Weather warning systems will allow for mobile construction equipment to be moved to avoid flood damage in response to any potential flooding events.			
	Building and infrastructure	Overwhelming of the construction site drainage system causing flooding across the site.	The embedded measures related to this impact are contained with **Chapter 7: Water Environment:** • C-2 Drainage and Water Management Plan • C-3 Timing of works • C-6 Temporary provision of surface water drainage for construction areas	Possible	Minor	**Minor (NS)**

				Residual risk and significance		
Climate trend	**Receptor**	**Potential climate change impact**	**Proposed procedures and/or measures**	**Likelihood of Impact**	**Consequence of Impact**	**Significance**
Increased in frequency and intensity of storm events.	Building and infrastructure	There is an increased risk of disruption to construction work, such as cranes unable to operate in high winds.	**Embedded measure:** The Contractor(s) will ensure that the relevant measures within the Outline CEMP and health and safety procedures are implemented.	Unlikely	Minimal	**Negligible (NS)**

Operational phase

Table 18.20 CCR Assessment: operational phase

				Residual risk and significance		
Climate trend	**Receptor**	**Potential climate change impact**	**Proposed procedures and/or measures**	**Likelihood of Impact**	**Consequence of Impact**	**Significance**
Increased annual mean temperatures, especially in the summer months, and an increase in the frequency and intensity of hot spells.	Buildings and infrastructure	Overheating of M&E assets within the HAGI/BVIs, leading to a decrease in asset performance and/or requiring additional electricity demand for mechanical cooling units.	**Embedded measure:** The Basis of Design (BoD) sets out weather parameters, including temperature, to be used in the design of the assets that are inclusive of a range of tolerances which account for climate change. **Embedded measure:** The assets will undergo routine monitoring and maintenance and, if considered to be required, the asset could be retrofitted with mechanical cooling, particularly the IT and communications equipment which are considered the most vulnerable. This incorporates adaptative capacity throughout the asset design life.	Unlikely	Minor	**Minor (NS)**

				Residual risk and significance		
Climate trend	**Receptor**	**Potential climate change impact**	**Proposed procedures and/or measures**	**Likelihood of Impact**	**Consequence of Impact**	**Significance**
	Buildings and infrastructure	Increased rate of degradation of HAGI/BVIs access road surface material, such as asphalt, increasing maintenance requirements for the road.	**Embedded measure:** The material specification of the access roads will be to current design standards incorporating a range of tolerances accounting for climate change. The access roads will experience infrequent use associated with routine monitoring and maintenance and the routine inspections of the access roads will highlight increased degradation. Throughout the asset life, the material specification could accommodate increasing temperatures during maintenance or replacement of the road.	Unlikely	Minimal	**Negligible (NS)**
	Human health	Increased heat stress or heat exhaustion experienced by the operational and	**Embedded measure:** Working procedures for operational and maintenance activities will be planned through use of a Risk Assessment Method Statement	Unlikely	Minor	**Minor (NS)**

				Residual risk and significance		
Climate trend	**Receptor**	**Potential climate change impact**	**Proposed procedures and/or measures**	**Likelihood of Impact**	**Consequence of Impact**	**Significance**
		maintenance workforce.	(RAMS) in line with Cadent's Management and Work Procedures, which specify practices for hot weather. The RAMS will include mitigation for working in hot weather, including altering shift patterns. Weather warnings are issued to all workforce to help with adequate planning. As a result of climate change, works may be interrupted more frequently.			
	Buildings and infrastructure	Increased vegetation growth affecting above ground equipment and requiring increased maintenance requirements.	An Outline Landscape and Ecological Management Plan (LEMP) indicates the frequency and requirements of landscape maintenance. Routine inspection will highlight where frequency of landscaping maintenance will need be revised throughout the asset life.	Unlikely	Minimal	**Negligible (NS)**

				Residual risk and significance		
Climate trend	**Receptor**	**Potential climate change impact**	**Proposed procedures and/or measures**	**Likelihood of Impact**	**Consequence of Impact**	**Significance**
	Buildings and infrastructure	Risk of cascading failures due to interdependencies on third party assets such as overheating of IT and telecommunications equipment leading to loss of HAGI monitoring telecommunications.	The monitoring and telecommunications system within the HAGI will operate with a backup. Due to the continuous recording of data, any loss of connection will be immediately identified.	Unlikely	Minimal	**Negligible (NS)**
Increased annual mean temperatures and frequency and intensity of hot spells, coupled with decreased summer precipitation.	Buildings and infrastructure	Wildfires and uncontrolled vegetation fires restricting access to HAGI/BVIs or causing damage to the equipment.	The design of the compounds will ensure that there are offset distances between the hydrogen equipment and any potential ignition sources and combustible materials in line with legislative requirements (refer to **Chapter 16: Major Accidents and Disasters**). Operations procedures and standards for land management activities set out practices to reduce the risk of wildfire such as vegetation	Very unlikely	Moderate	**Minor (NS)**

				Residual risk and significance		
Climate trend	**Receptor**	**Potential climate change impact**	**Proposed procedures and/or measures**	**Likelihood of Impact**	**Consequence of Impact**	**Significance**
			clearance strip around boundary fences and for overhanging branches close to assets.			
	Human health	Risk of wildfires affecting the operational and maintenance workforce.	Operational and maintenance activities will be planned through use of a Risk Assessment Method Statement (RAMS) which reflect any weather warnings to help with adequate planning, such as those for increased risk of wildfire. As a result of climate change, works may become interrupted more frequently or for prolonged periods.	Unlikely	Moderate	**Minor (NS)**
Fluctuations in mean rainfall across the year, coupled with an increase in mean	Buildings and infrastructure	Changes to soil moisture levels causing shrink swell within the soils, leading to deterioration of structure foundations	The BoD sets out weather parameters for the design of the foundations that are inclusive of a range of tolerances which account for climate change. The civils design of the foundations and supports allow for some	Unlikely	Minimal	**Negligible (NS)**

				Residual risk and significance		
Climate trend	**Receptor**	**Potential climate change impact**	**Proposed procedures and/or measures**	**Likelihood of Impact**	**Consequence of Impact**	**Significance**
temperatures, resulting in changes to soil moisture.		of HAGI/BVIs equipment.	movement and the detailed design will conduct a stress analysis for the soil type and range of change anticipated with climate change.			
	Buildings and infrastructure	Increased ground temperature and ground movement impacting on the electrical cables as part of the DNO connection through reduced capacity or tensile forces.	New electrical cables will be buried with sufficient cover to be insulation from extreme changes in air temperature. The design of the cables includes cable rating calculations which consider dried out soil resulting from prolonged drought conditions. Routine maintenance throughout the asset life will determine whether recalculations are required to improve cable ratings through replacement.	Very unlikely	Minor	**Negligible (NS)**
	Buildings and infrastructure	Land instability causing movement of pipelines resulting in damage or failure.	The topography and soil type of the region in which the Project is situated are such that it is unlikely to be prone to land	Very unlikely	Minor	**Negligible (NS)**

				Residual risk and significance		
Climate trend	**Receptor**	**Potential climate change impact**	**Proposed procedures and/or measures**	**Likelihood of Impact**	**Consequence of Impact**	**Significance**
			instability due to fluctuating soil moisture content, even with changes due to climate change. The design of the pipeline takes into account some movement in soils and routine monitoring and maintenance over the asset life will indicate where additional measures are required.			
Decrease in summer precipitation, leading to drought conditions.	Buildings and infrastructure	River erosion leading to exposure of pipelines and potential scour and damage.	The construction technique for the river crossings will use trenchless techniques which allows for the pipeline to have significant and sufficient ground cover below the riverbed, therefore it is very unlikely that the pipeline will become exposed during drought events.	Very unlikely	Minimal	**Negligible (NS)**

				Residual risk and significance		
Climate trend	**Receptor**	**Potential climate change impact**	**Proposed procedures and/or measures**	**Likelihood of Impact**	**Consequence of Impact**	**Significance**
Increase in precipitation resulting in tidal, fluvial or pluvial flooding.	Human health	Wet weather leading to increased possibility of slips, trips and falls.	Operational and maintenance activities will be planned through use of a RAMS. The RAMS will include mitigation for working in wet weather, including delaying the activity. Weather warnings are issued to all workforce to help with adequate planning. As a result of climate change, works may become delayed or interrupted more frequently.	Unlikely	Minimal	**Negligible (NS)**
	Buildings and infrastructure	Increased incidence of flooding could lead to increased infiltration changing the severity of aggressive ground conditions or ground instability.	Embedded measures for infrastructure to be designed to consider aggressive ground conditions including climate change allowances are detailed in **Chapter 12: Ground Conditions.**	Unlikely	Minor	**Minor (NS)**
	Buildings and infrastructure	Flooding of M&E equipment within HAGIs/BVIs resulting in failure through	The **Flood Risk Assessment (FRA)** produced for the Project sets out how the assessment includes the Environment	Unlikely	Minor	**Negligible (NS)**

				Residual risk and significance		
Climate trend	**Receptor**	**Potential climate change impact**	**Proposed procedures and/or measures**	**Likelihood of Impact**	**Consequence of Impact**	**Significance**
		flood damage and/or increased corrosion rate.	Agency's climate change allowances for peak river flow, peak rainfall intensity and for sea level allowances which have been used to inform the design standards in **Table 2.7** of the **Flood Risk Assessment.**			
	Buildings and infrastructure	Increased surface water exceeding the capacity of attenuation and drainage, causing flooding across the site or elsewhere.	The **Outline Drainage Strategy (Appendix 7B)** sets out how the proposed drainage design includes the Environment Agency's climate change allowances for peak river flow, peak rainfall intensity and for sea level allowances. The sizing of attenuation at the HAGIs and BVIs are designed to the 1% AEP storm even plus 30% climate change allowance.	Very unlikely	Minor	**Negligible (NS)**
	Buildings and infrastructure	Erosion of soils resulting in exposing or damaging the pipeline.	The design of the pipeline is such that there is sufficient ground cover of the pipeline, therefore it is very unlikely that	Very unlikely	Minor	**Negligible (NS)**

				Residual risk and significance		
Climate trend	**Receptor**	**Potential climate change impact**	**Proposed procedures and/or measures**	**Likelihood of Impact**	**Consequence of Impact**	**Significance**
			it would become exposed due to flood events. Routine monitoring and maintenance would highlight any erosion issues to allow for future maintenance planning, if required.			
	Buildings and infrastructure	Access to the HAGI/BVIs or compound could be restricted due to flooding, restricting any emergency or routine maintenance works.	Permanent development design has avoided areas of flood risk wherever possible. Operational and maintenance activities will be planned and will undergo a RAMS. The RAMS will include mitigation for working in wet weather, including delaying the activity. Weather warnings are issued to all workforce to help with adequate planning. As a result of climate change, works may become interrupted more frequently.	Possible	Minimal	**Minor (NS)**
	Buildings and infrastructure	Increased pipeline buoyancy which can	In the event of prolonged groundwater flooding, the	Unlikely	Minimal	**Negligible (NS)**

				Residual risk and significance		
Climate trend	**Receptor**	**Potential climate change impact**	**Proposed procedures and/or measures**	**Likelihood of Impact**	**Consequence of Impact**	**Significance**
		exert additional stress causing potential damage. Saline groundwater could also increase corrosion affecting asset integrity.	density of the soils covering the pipeline would counter any upward movement of the pipe owing to increased buoyancy. In soils such as peat, where the pipeline may require insulation, increasing buoyancy will include engineering solutions, if required, to counter uplift effects such as ground anchors or concrete coating. Further embedded measures related to safety in design for pipelines are found in **Chapter 16: Major Accidents and Disasters**). Routine surveillance, monitoring and maintenance, such as monitoring of the pipe position and cathodic protection system, will indicate whether maintenance is required, which may increase with climate change effects on groundwater levels.			

				Residual risk and significance		
Climate trend	**Receptor**	**Potential climate change impact**	**Proposed procedures and/or measures**	**Likelihood of Impact**	**Consequence of Impact**	**Significance**
	Buildings and infrastructure	Risk of cascading failures due to interdependencies on third party assets such as flooding of electrical substations leading to loss of power to HAGIs.	The HAGIs will continue to operate in the event of failure of power supply due to the provision of battery power which will continue operations. Throughout the asset life, if climate change causes increasing interruption to the electricity supply, additional battery power could be installed to provide adaptive capacity.	Very unlikely	Minor	**Negligible (NS)**
Increased frequency and intensity of storm events.	Buildings and infrastructure	Increased wind loading on HAGI/BVIs equipment and security fencing leading to damage.	The BoD sets out weather parameters, including wind, to design for the appropriate wind loading, including those associated with increasing major storms as a result of climate change. The buildings within the HAGIs do not have large surface areas which would be susceptible to wind loading. RAMS and operational alerts will be in place to inform any planned maintenance following any storm events.	Very unlikely	Minor	**Negligible (NS)**

				Residual risk and significance		
Climate trend	**Receptor**	**Potential climate change impact**	**Proposed procedures and/or measures**	**Likelihood of Impact**	**Consequence of Impact**	**Significance**
	Buildings and infrastructure	Lightning strikes on HAGI/BVIs equipment, causing damage or failure.	Lightning protection will be included in the design for the above ground equipment in the HAGI. Any increase in the frequency of lightning strikes as a result of climate change does not affect the efficacy of the lightning protection.	Very unlikely	Minimal	**Negligible (NS)**
	Buildings and infrastructure	Wind blown debris causing damage to HAGI/BVIs equipment.	The above ground assets are ancillary equipment to the pipeline and therefore any direct damage from wind blown debris will be minimal to the continued operation of the pipeline. Any damage will be detected through the telecommunications system and planned maintenance will occur when safe to do so.	Very unlikely	Minimal	**Negligible (NS)**
	Buildings and infrastructure	Cascading failures due to interdependencies on third party assets such as the National	Operational and maintenance activities will be planned through use of a RAMS where the activity can be delayed in	Unlikely	Minimal	**Negligible (NS)**

				Residual risk and significance		
Climate trend	**Receptor**	**Potential climate change impact**	**Proposed procedures and/or measures**	**Likelihood of Impact**	**Consequence of Impact**	**Significance**
		Highways could become affected by wind blown debris, obstructing access to the HAGIs.	the event of a storm affecting the region.			

Decommissioning phase

Table 18.21 CCR Assessment: decommissioning phase

				Residual risk and significance		
Climate trend	**Receptor**	**Potential climate change impact**	**Proposed procedures and/or measures**	**Likelihood of Impact**	**Consequence of Impact**	**Significance**
Increased annual mean temperatures, especially in the summer months, and an increase in the frequency and intensity of hot spells.	Human health	Increased heat stress or heat exhaustion experienced by the construction workforce.	All decommissioning activities will be planned through use of a RAMS alongside issued safety bulletins such as alerts for upcoming hot spells. The RAMS will identify measures such as altering shift patterns to cooler times of the day, additional rest breaks and Personal Protective Equipment (PPE). All staff will undergo toolbox talks regarding working in hot weather.	Possible	Minor	**Minor (NS)**
	Building and infrastructure	Restriction of certain decommissioning activities during hot weather, for example, the pouring of concrete in higher temperatures	All decommissioning activities will be planned through use of a RAMS alongside issued safety bulletins. The RAMS will set out measures regarding working in hot weather, such as delaying the activity where possible.	Unlikely	Minor	**Minor (NS)**

				Residual risk and significance		
Climate trend	**Receptor**	**Potential climate change impact**	**Proposed procedures and/or measures**	**Likelihood of Impact**	**Consequence of Impact**	**Significance**
		could reduce the strength and durability of the finished product, and the laying of asphalt could become difficult as it fails to maintain profile during compaction. This could cause programme delay and increased costs.				
Increased annual mean temperatures and frequency and intensity of hot spells, coupled with decreased summer precipitation.	Human health	Increased dust creation from decommissioning activities, leading to impacts on the health of decommissioning workers and the failure of machinery and equipment.	All decommissioning activities will be planned through use of a RAMS alongside issued safety bulletins such as working in hot and dry conditions. The RAMS will identify measures such as dust management and dampening down, alongside appropriate PPE. All staff will undergo toolbox talks regarding working in dry weather.	Unlikely	Minor	**Minor (NS)**

				Residual risk and significance		
Climate trend	**Receptor**	**Potential climate change impact**	**Proposed procedures and/or measures**	**Likelihood of Impact**	**Consequence of Impact**	**Significance**
			Plant and machinery will be routinely inspected.			
	Human health	Risk of wildfires affecting the decommissioning workforce.	Decommissioning activities will be planned through use of a RAMS which reflect any weather warnings to help with adequate planning, such as those for increased risk of wildfire.	Unlikely	Moderate	**Minor (NS)**
Decrease in summer precipitation leading to drought conditions	Building and infrastructure	Drought conditions impacting water available through abstraction licenses to use during decommissioning activities, e.g. for dust suppression.	Any abstraction will depend on water availability and consultation with key stakeholders, such as United Utilities and the Environment Agency, has taken place and specific requirements will be set out in a decommissioning Drainage Strategy, subject to Local Planning Authority approval. Re-use of water will take place wherever possible e.g. treated runoff for use in activities such as dust suppression.	Unlikely	Minor	**Minor (NS)**

				Residual risk and significance		
Climate trend	**Receptor**	**Potential climate change impact**	**Proposed procedures and/or measures**	**Likelihood of Impact**	**Consequence of Impact**	**Significance**
Increase in precipitation resulting in tidal, fluvial or pluvial flooding.	Human health	Wet weather leading to increased possibility of slips, trips and falls.	All decommissioning activities will be planned through use of a RAMS alongside issued safety bulletins such as alerts to upcoming rainfall events. The RAMS will identify measures such as signing up to the Environment Agency's flood risk warning system, appropriate PPE, and delaying the activity.	Unlikely	Minimal	**Negligible (NS)**
Increased in frequency and intensity of storm events.	Building and infrastructure	There is an increased risk of disruption to decommissioning activities, such as cranes unable to operate in high winds.	All decommissioning activities will be planned through use of a RAMS alongside issued safety bulletins such as alerting to upcoming high winds or storm events. The RAMS will identify measures such as identifying wind speeds in which cranes will not operate or are restricted, delaying the activity and making the site safe ahead of storm events.	Possible	Minimal	**Minor (NS)**

18.10 Assessment of Cumulative (Inter-project) Effects

18.10.1 The CCR assessment is an assessment of the resilience of the Project to projected climate change. The resilience of the Project assets is unaffected by other developments.

18.10.2 The ICCI assessment can be found in **Chapter 19: Intra-related effects.**

18.11 Significance Conclusions

18.11.1 The CCR assessment has concluded that there are likely to be **no significant effects** remaining following the assessment of climate change impacts on the construction (**Table 18.19**), operational (**Table 18.20**) and decommissioning (**Table 18.21**) phases of the Project. This is because all relevant and implementable measures have been embedded into the proposals and are likely to be effective and deliverable to address the likely significant effects of the Project.

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