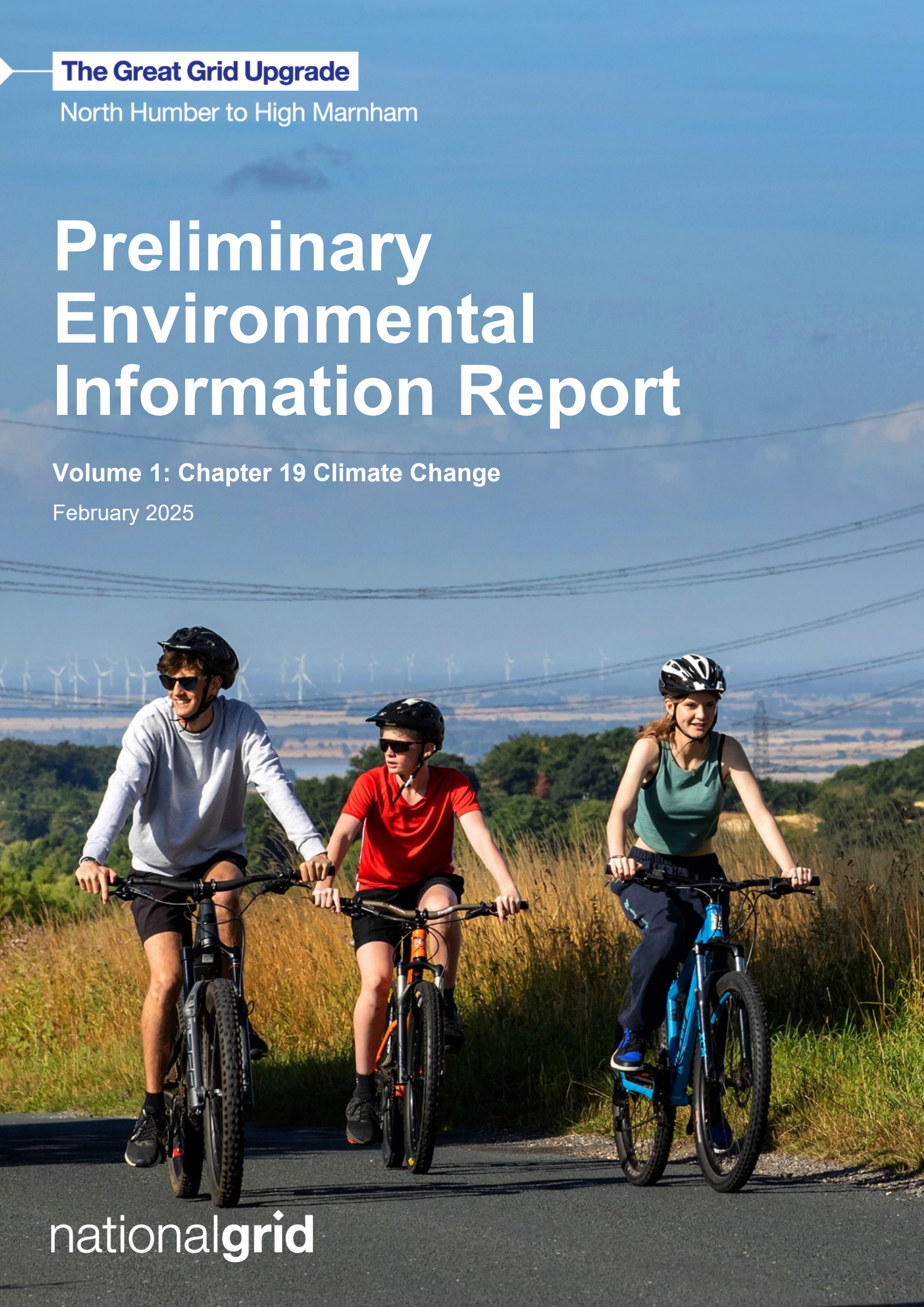
The Great Grid Upgrade

North Humber to High Marnham

Preliminary Environmental Information Report

Volume 1: Chapter 19 Climate Change

February 2025



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Contents

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19. Climate Change

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19. Climate Change

19.1 Introduction

19.1.1 This chapter of the Preliminary Environmental Information Report (PEIR) presents information about the preliminary environmental assessment of the likely significant climate change effects identified to date, that could result from the Proposed Overhead Line between the proposed Birkhill Wood Substation and the proposed High Marnham Substation as described in **Chapter 4 Description of the Project**.

19.1.2 **Chapter 1 Introduction** explains that the proposed Birkhill Wood Substation and proposed High Marnham Substation are proposed to be authorised through separate consenting procedures, however, they have also been included as part of the Project. As explained in **Chapter 5 Approach to Preparing the PEIR**, the environmental effects of these two substations including their associated overhead line reconfigurations, hereafter referred to as the Proposed Substation Works, have accordingly been considered within **Chapter 20 Substations and Associated Works**. For the purpose of this chapter the Proposed Overhead Line between the proposed Birkhill Wood Substation and the proposed High Marnham Substation is hereafter referred to as the Proposed Overhead Line.

19.1.3 To ensure that the Project as a whole has been assessed a summary has been included within this preliminary assessment of the likely significant effects on climate change which brings together the assessment of the Proposed Overhead Line and Proposed Substation Works for climate change.

19.1.4 This chapter covers effects on the following during construction, operation and maintenance noting that decommissioning has been scoped out (Ref 19.26). In line with the requirements of The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (Ref 19.1) (hereafter the 'EIA Regulations'), consideration has been given to the following aspects within the climate assessment:

- Lifecycle greenhouse gas (GHG) impact assessment: the impact of GHG emissions arising from the Project on the climate over its design life (Section 5(2)(c) and Schedule 4, clauses 4 and 5 of the EIA Regulations (Ref 19.1);
- In-combination Climate Change Impact (ICCI) assessment: the combined impact of future climate conditions and the Project on receptors in the surrounding environment (Section 5(2) of the EIA Regulations (Ref 19.1). The receptors have been identified by the relevant technical disciplines and includes receptors such as soil resources; and
- Climate Change Risk Assessment (CCRA): the resilience of the Project to future climate change impacts, including damage to the Project as a result of climate change (Section 5(2) of the EIA Regulations (Ref 19.1).

19.1.5 This chapter should be read in conjunction with:

- **Chapter 4 Description of the Project**;
- **Chapter 5 Approach to Preparing the PEIR**; and
- **Chapter 20 Substations and Associated Works**.

19.1.6 There are interrelationships related to the potential significant effects with climate change, as detailed in this chapter, and other environmental topics. Therefore, please also refer to the following chapters:

- **Chapter 6 Landscape**;
- **Chapter 11 Water Environment**;
- **Chapter 12 Geology and Hydrogeology**;
- **Chapter 13 Agriculture and Soils**;
- **Chapter 14 Traffic and Transport**;
- **Chapter 15 Air Quality**; and
- **Chapter 18 Health and Wellbeing**;

19.1.7 This chapter is supported by the following appendices in Volume 3:

- **Appendix 4.1 Draft Outline Code of Construction Practice CoCP**
- **Appendix 19.1 Climate Change Risk Assessment (CCRA)**
- **Appendix 19.2 In-Combination Climate Impact Assessment (ICCI)**

19.2 Regulatory and Planning Context

19.2.1 **Chapter 2 Regulatory and Planning Context** describes the overall regulatory and planning policy context for the Project. Key legislation, policy and planning guidance relevant to the assessment of potential climate effects associated with the construction, operation and maintenance of the Project is presented below.

19.2.2 This section identifies the legislation, planning policy which is the basis of technical guidance that has informed the preliminary assessment of effects with respect to climate change. A full review of compliance with relevant national and local planning policy will be provided within the Planning Statement that will be submitted as part of the application for Development Consent.

Legislation

19.2.3 The legislation listed below has been considered when identifying potential constraints to the Project, design options and mitigation technical guidance in the form of legislation to inform the preliminary assessment of effects with respect to climate change.

- The Infrastructure Planning (Environmental Impact Assessment Regulations 2017: Section 5(2) and Schedule 4, clauses 4 and 5 (Ref 19.1);
- UK Nationally Determined Contribution (2020, updated September 2022) (
- Ref 19.12) and the voluntary United Nations Paris Agreement (2015) (Ref 19.17);
- The Climate Change Act 2008 (Ref 19.11) and The Climate Change Act (2050 Target Amendment) Order 2019 (Ref 19.11): set a legally binding target for the UK to reduce its GHG emissions from 1990 levels by at least 80% by 2050. This target is supported by a legally binding five-year ‘Carbon Budgets’ system and an independent body to monitor progress, the Climate Change Committee (CCC). The UK Carbon Budgets restrict the amount of GHG emissions the UK can legally emit in

a defined five-year period. The Climate Change Act (2008) has since been amended in 2019 to revise the existing 80% reduction target and legislate for Net Zero emissions by 2050 (through The Climate Change Act 2008 (2050 Target Amendment) Order 2019) (Ref 19.18). The following Carbon Budgets apply to this chapter:

  - The Carbon Budgets Order 2009 (Ref 19.13), this sets the carbon budget totals for the First (2008-2012), Second (2013-2017) and Third (2018-2022) Carbon Budget periods;
  - The Carbon Budget Order 2011 (Ref 19.14), this Order sets the carbon budget total for the Fourth (2023-2027) Carbon Budget period;
  - The Carbon Budget Order 2016 (Ref 19.15), this Order sets the carbon budget total for the Fifth (2028-2032) Carbon Budget period; and
  - The Carbon Budget Order 2021 (Ref 19.16), this sets the carbon budget total for the Sixth (2033-2037) Carbon Budget period which is inclusive to the scenarios for a 'Balanced Net Zero Pathway' model.
  - The Seventh Carbon Budget is expected to be released in early 2025.

- UK Nationally Determined Contribution (2020, updated September 2022) (
- Ref 19.12) and the voluntary United Nations Paris Agreement (2015) (Ref 19.17).

National Policy Statements

19.2.4 National Policy Statements (NPS) set out the primary policy tests against which the application for a Development Consent Order (DCO) for the Project would be considered. **Chapter 2 Regulatory and Planning Context** sets out the overarching policy context relevant to the Project, including the Overarching NPS for Energy (EN-1) (Ref 19.2). This is supported by the NPS for Electricity Networks Infrastructure (EN-5) (Ref 19.3). Relevant requirements from EN-1and EN-5 in relation to climate are listed below.

19.2.5 Paragraph 4.10.5 of EN-1 (Ref 19.2) states:

> '*In certain circumstances, measures implemented to ensure a project can adapt to climate change may give rise to additional impacts, for example as a result of protecting against flood risk, there may be consequential impacts on coastal change. In preparing measures to support climate change adaptation applicants should take reasonable steps to maximise the use of nature-based solutions alongside other conventional techniques*.'

19.2.6 Paragraphs 4.10.8 to 4.10.13 of EN-1 (Ref 19.2) states:

- *'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.*

- *The ES should set out how the proposal will take account of the projected impacts of climate change, using government guidance and industry standard benchmarks such as the Climate Change Allowances for Flood Risk Assessments, Climate Impacts Tool, and British Standards for climate change adaptation, in accordance with the EIA Regulations.*
- *Applicants should assess the impacts on and from their proposed energy project across a range of climate change scenarios, in line with appropriate expert advice and guidance available at the time.*
- *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.*
- *Where energy infrastructure has safety critical elements, the applicant should apply a credible maximum climate change scenario. It is appropriate to take a risk-averse approach with elements of infrastructure which are critical to the safety of its operation.*
- *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 (such as the EA's Climate Change Allowances for Flood Risk Assessments or the Welsh Government's Climate change allowances and flood consequence assessments) 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'.*

19.2.7 Paragraphs 4.10.15 to 4.10.17 of EN-1 (Ref 19.2) states:

- *The Secretary of State should be satisfied that there are not features of the design of new energy infrastructure critical to its operation which may be seriously affected by more radical changes to the climate beyond that projected in the latest set of UK climate projections, taking account of the latest credible scientific evidence on, for example, sea level rise (for example by referring to additional maximum credible scenarios – i.e. from the Intergovernmental Panel on Climate Change or EA) and that necessary action can be taken to ensure the operation of the infrastructure over its estimated lifetime.*
- *If any adaptation measures give rise to consequential impacts (for example on flooding, water resources or coastal change) the Secretary of State should consider the impact of the latter in relation to the application as a whole and the impacts guidance set out in Part 5 of this NPS.*
- *Any adaptation measures should be based on the latest set of UK Climate Projections, the government's latest UK Climate Change Risk Assessment, when available, and in consultation with the EA's Climate Change Allowances for Flood Risk Assessments or the Welsh Government's Climate change allowances and flood consequence assessments.*

19.2.8 Paragraph 4.10.19 of EN-1 (Ref 19.2) states:

> '*Adaptation measures should be required to be implemented at the time of construction where necessary and appropriate to do so. However, where they are necessary to deal with the impact of climate change, and that measure would have an adverse effect on other aspects of the project and/or surrounding environment (for example coastal processes), the Secretary of State may consider requiring the applicant to keep the need for the adaptation measure under review, and ensure that the measure could be implemented should the need arise, rather than at the outset of the development (for example increasing height of existing, or requiring new, sea walls).'*

19.2.9 Paragraph 5.3.2 of EN-1 (Ref 19.2) states that:

> '*In considering this section, applicants should also have regard to Part 2 of this NPS, which explains the current policy on climate change and how this NPS interacts with that policy, and Section 4.10 of this NPS, which deals with climate change adaptation*'.

19.2.10 Paragraphs 5.3.4 to 5.3.7 of EN-1 (Ref 19.2) state:

- *All proposals for energy infrastructure projects should include a GHG assessment as part of their ES (See Section 4.3). This should include:*
  - *'A whole life GHG assessment showing construction, operational and decommissioning GHG impacts, including impacts from change of land use.'*
  - *'An explanation of the steps that have been taken to drive down the climate change impacts at each of those stages.'*
  - *'Measurement of embodied GHG impact from the construction stage.'*
  - *'How reduction in energy demand and consumption during operation has been prioritised in comparison with other measures.'*
  - *'How operational emissions have been reduced as much as possible through the application of best available techniques for that type of technology.'*
  - *'Calculation of operational energy consumption and associated carbon emissions.'*
  - *'Whether and how any residual GHG emissions will be (voluntarily) offset or removed using a recognised framework.'*
  - *'Where there are residual emissions, the level of emissions and the impact of those on national and international efforts to limit climate change, both alone and where relevant in combination with other developments at a regional or national level, or sector level, if sectoral targets are developed.'*
- *'A GHG assessment should be used to drive down GHG emissions at every stage of the proposed development and ensure that emissions are minimised as far as possible for the type of technology, taking into account the overall objectives of ensuring our supply of energy always remains secure, reliable and affordable, as we transition to net zero.'*
- *'Applicants should look for opportunities within the proposed development to embed nature-based or technological solutions to mitigate or offset the emissions of construction and decommissioning.'*

- *'Steps taken to minimise and offset emissions should be set out in a GHG Reduction Strategy, secured under the Development Consent Order. The GHG Reduction Strategy should consider the creation and preservation of carbon stores and sinks including through woodland creation, hedgerow creation and restoration, peatland restoration and through other natural habitats.'*

19.2.11 EN-5 (Ref 19.3), paragraphs 2.3.2 to 2.3.3 state:

- *'As climate change is likely to increase risks to the resilience of some of this infrastructure, from flooding for example, or in situations where it is located near the coast or an estuary or is underground, applicants should in particular set out to what extent the proposed development is expected to be vulnerable, and, as appropriate, how it has been designed to be resilient to:*
  - *flooding, particularly for substations that are vital to the network; and especially in light of changes to groundwater levels resulting from climate change;*
  - *the effects of wind and storms on overhead lines;*
  - *higher average temperatures leading to increased transmission losses;*
  - *earth movement or subsidence caused by flooding or drought (for underground cables); and*
  - *coastal erosion – for the landfall of offshore transmission cables and their associated substations in the inshore and coastal locations respectively.'*
- *'Section 4.10 of EN-1 (*Ref 19.2*) advises that the resilience of the project to the effects of climate change must be assessed in the Environmental Statement (ES) accompanying an application. For example, future increased risk of flooding would be covered in any flood risk assessment (see Sections 5.8 in EN-1). Consideration should also be given to coastal change (see sections 5.6 in EN-1).'*

Other National Policy

19.2.12 Although the Project will be tested in line with the National Policy stated above, the preliminary assessment has also been undertaken in accordance with, and with reference to, other national legislation and policy.

19.2.13 The National Planning Policy Framework (NPPF) (December 2024), (Ref 19.8 summarises the Government's planning policies for England and how these are expected to be applied. While the NPS are the primary policy for new NSIPs like this Project, the NPPF is still referred to as a broader context of the Government's expectations in respect of planning applications. Paragraphs 87, 161-169 address the reduction of carbon dioxide (CO_2) emissions through design and reduced energy consumption; and Paragraphs 170 to 186 address climate projections, associated flood risk and adaptation. Additional national policies that have been considered includes:

- UK Climate Change Risk Assessment (2022) (Ref 19.4);
- Net Zero Strategy: Build Back Greener (2020) (Ref 19.5);
- Energy white paper: Powering our Net Zero future (2020) (Ref 19.6);
- National Infrastructure Strategy (2020) (Ref 19.7);
- Powering Up Britain: Net Zero Growth Plan (2023) (Ref 19.9).

Regional and Local Policy

19.2.14 **Chapter 2 Regulatory and Planning Context** lists relevant regional and local policy. Key local policy relevant to climate, that has informed this preliminary assessment and will inform the assessment within the ES, comprises:

- East Riding Local Plan 2012-2029, Adopted 2016 (Ref 19.19) which under Policy S2 supports meeting a reduction in greenhouse gas emissions and adaptation to the expected impacts of climate change. Some of the consequences of a changing climate for the East Riding have been identified in S2 and in the Yorkshire and Humber Climate Change Adaptation Study (2009) (Ref 19.22);
- East Riding of Yorkshire Local Plan Update 2020 – 2039 (Ref 19.20), which presents updates to Policy S2 addressing local targets for Sustainable development, Climate Mitigation and adaptation inclusive to the following:
  - Efficiently using land, mineral, energy and water resources
  - Incorporating high standards of sustainable design and construction which involve design approaches minimising energy demands, the prudent and efficient use of natural resources and built-in resilience to the impacts of climate change (e.g., overheating, flood risk)
  - Incorporating renewable, low carbon and decentralised energy generation in appropriate locations and schemes where possible.
- Yorkshire and Humber Climate Action Plan, 2021 (Ref 19.22) sets out a regional action plan framework on behalf of the Yorkshire and Humber Climate Commission, following public stakeholder consultation to address key principles of cutting emissions and building climate resilience. This action plan presents a regional target of a 68% reduction on the 2000 level regional baseline emissions assessment, followed by an 84% reduction by 2030, and a 92% reduction by 2035, with the aim for a 100% reduction by 2038. A broader set of 15 targets addresses climate risks and aims to enhance climate resilience;
- North Lincolnshire Local Development Framework Core Strategy 2006 – 2026 Adopted 2011 (Ref 19.23) which presents the regional strategy and ambition for enhancing and protecting North Lincolnshire's natural environment, built heritage and natural assets. The environmental components of the strategy address climate change, sustainable resources (including renewable energy), and flood risk, with the aim of reducing carbon emissions in the context of required efficient non-renewable energy by the use of the best available clean technologies;
- North Lincolnshire Local Plan Publication Draft Addendum Plan, May 2022
- (Ref 19.24), with specific reference to Policy RD1: Supporting Sustainable Development in the Countryside;
- Bassetlaw Local Plan, 2024, and associated Bassetlaw District Council, (Ref 19.25), Sustainability Appraisal of the Bassetlaw Local Plan Publication Version Second, May 2022, (Ref 19.26; and
- The Bassetlaw District Council Climate Change Strategy, 2024 (Ref 19.27).

19.2.15 North Lincolnshire Council submitted the New Local Plan for Examination in November 2022. The Examination progressed however the authority took the decision to formally withdraw the New Local Plan from the Examination in September 2024. The Saved Policies in the Local Plan (2003) as updated in October 2024 (Ref 19.51), North

Lincolnshire Local Development Framework Core Strategy (2011) (Ref 19.23) from the adopted Development Plan and have been considered in the PEIR where relevant

19.2.16 Where required, relevant Neighbourhood Plans and Supplementary Planning Documents (SPDs)/Guidance (SPGs) will be considered. The local policies identified above in the in the 19.2.14 above, need to consider and, where appropriate, mitigate lifecycle GHG emissions and climate change impacts associated with new development. They specify that new development should aim for reduced or zero-carbon development and maximising energy efficiency where practicable and should build in resilience to projected climate change impacts.

19.3 Scoping Opinion and Consultation

Scoping Opinion

19.3.1 The scope of the assessment has been informed by the Scoping Opinion (Ref 19.26) provided by the Planning Inspectorate on behalf of the Secretary of State, following submission of the Environmental Impact Assessment (EIA) Scoping Report (Ref 19.29). The scope has also been informed through consultation and engagement with relevant stakeholders.

19.3.2 The Scoping Opinion (Ref 19.26) did not provide specific feedback in regard to climate change.

Project Engagement and Consultation

19.3.3 Stakeholder engagement will be undertaken as the Project progresses with relevant statutory bodies, including the Environment Agency and the relevant Local Planning Authorities. Such statutory bodies will be engaged with addressing and reviewing relevant climate change targets, aims, commitments as well as the potential impact imposed by other projects, plans and policy that may affect climate and baseline data, as well as any known future developments in close proximity to the Project.

19.4 Assessment Approach and Methods

19.4.1 **Chapter 5 Approach to Preparing the PEIR** sets out the overarching approach which has been used in developing the preliminary environmental information. This section describes the technical methods used to determine the baseline conditions, sensitivity of receptors and magnitude of effects and sets out the criteria that have been used for the preliminary climate assessment. This section also identifies further assessment needed to be undertaken and reported within the ES.

Guidance Specific to the Climate Change Assessment

19.4.2 Relevant guidance specific to climate change, that has informed this preliminary assessment and will inform the assessment reported within the ES, comprises of the following good practice guidance documents:

- Institute of Environmental management and Assessment (IEMA) (2022) Environmental Impact Assessment Guide to: Assessing Greenhouse Gas Emissions and Evaluating their Significance (Ref 19.34);

- Institute of Environmental management and Assessment (IEMA) (2020) Environmental Impact Assessment Guide to: Climate Change Resilience and Adaptation (Ref 19.35);
- The GHG Protocol (World Resources Institute and World Business Council for Sustainable Development (WRI & WBCSD) GHG Protocol guidelines (Ref 19.26);
- Ministry of Housing, Communities and Local Government, Planning Practice Guidance, Climate Change (Ref 19.31);
- Department of Business, Energy and Industrial Strategy, BEIS, Net Zero Strategy (2021) (Ref 19.32) and;
- Publicly Available Standard (PAS) 2080:2023 - Carbon management in buildings and infrastructure, updated Guidance document (2023) (Ref 19.33).

19.4.3 Due to the complex nature of climate change, effects are assessed differently to other environmental disciplines in an EIA. The IEMA guidance (Ref 19.34) for assessing climate impacts (Section 1.4.3 of that guidance) has been followed for this assessment. It should be noted that this chapter may present deviations from the terminologies and methods set out in the overarching PEIR Chapter approach, for example this may occur where there is limited data availability to complete certain assessments. In this respect, all deviations are clearly outlined in this chapter within the methodology for the climate change assessment.

19.4.4 The PEIR does not make use of the 'Inventory of Carbon and Energy' and the 'BEIS Emissions Factors' as otherwise identified in the EIA Scoping Report, (Ref 19.29).

Study Area

Lifecycle GHG Impact Assessment

19.4.5 The study area for the GHG impact assessment covers all direct GHG emissions arising from activities undertaken within the draft Order Limits during the construction, operation and maintenance phases of this Project. It also includes indirect emissions arising outside the draft Order Limits, for example emissions embedded within the construction materials arising because of the energy used for their production, as well as emissions arising from the transportation of materials, waste, and construction workers.

19.4.6 The study area also considers how the Project contributes to wider grid decarbonisation in the UK.

Climate Change Risk Assessment

19.4.7 The study area for the CCRA (**Appendix 19.1 Climate Change Risk Assessment (CCRA**) is the area within the draft Order Limits, i.e. it covers the construction, operation and maintenance of all assets and infrastructure which constitute the Project.

In-Combination Climate Change Impact assessment

19.4.8 The study area for the ICCI assessment (**Appendix 19.2 In-combination Climate Change Impact Assessment (ICCI**) is as defined for the other environmental assessments reported within the PEIR. The sensitive receptors for the ICCI assessment are the receptors identified by each discipline in their assessment.

19.4.9 The methodology used by the environmental disciplines to identify ICCIs is described in section 19.4. and the ICCIs identified by other environmental disciplines are summarised in **Appendix 19.2 In-combination Climate Change Impact Assessment (ICCI)**.

Aspects scoped out of the assessment

19.4.10 The design life of the Project is 80 years, but with regular maintenance it is likely to extend further. At the end of design life, the Project may be decommissioned or remain in an idle state, (refer to **Chapter 4 Description of the Project)**.

19.4.11 If the Project is required to be decommissioned, activities associated with the decommissioning phase may result in GHG emissions, including use of on-site equipment, transport, and waste disposal. However, due to the unpredictability of the decommissioning phase at this stage, these emissions cannot be meaningfully quantified. In addition, should decommissioning occur and design life extend beyond the 80-year period, the design life would be well beyond the timeline of alignment to the UK Net Zero by 2050 targets. Therefore, any emissions associated with decommissioning would be assumed as negligible in alignment to this regulation.

19.4.12 Furthermore, GHG emissions associated with decommissioning are anticipated to be immaterial. Emission factors for the disposal of wastes are typically significantly lower than the emission factors for the production of the same materials (the embodied carbon). Decommissioning activities are also envisaged to take place over a much shorter period of time compared to the construction phase.

19.4.13 The decommissioning phase has therefore been scoped out of the CCRA and ICCI. It is deemed that the risks assessed over the construction and operational period will provide a sufficient risk profile for the Project, and including decommissioning would not meaningfully impact the results of this assessment.

19.4.14 As also indicated in **Chapter 4 Description of the Project** - at the point where the Project requires decommissioning, National Grid would consider and implement an appropriate decommissioning strategy taking account of good industry practice, its obligations to landowners under the relevant agreements and all relevant statutory requirements.

Baseline Data Gathering and Forecasting Methods

Data sources

19.4.15 This section presents the sources of published information and data gathering which has been undertaken in order to complete the relevant environmental assessments included in this chapter.

Lifecycle Greenhouse Gas (GHG) Impact Assessment

19.4.16 To provide an assessment of the significance of GHG emissions to the Project (in terms of climate change), it is necessary to identify and understand the baseline greenhouse gas emission conditions in and around the study area.

19.4.17 The GHG baseline conditions are defined as a scenario whereby the Project does not go ahead, and the existing site within the draft Order Limits is considered to emit zero emissions. This represents a worst-case scenario in terms of GHG emissions since all emissions resulting from the Project are deemed to be additional to the baseline.

19.4.18 The baseline comprises existing carbon stocks and future sources of GHGs within the draft Order Limits of the Project. The methodology for calculating GHG emissions and removals is consistently used across the construction and operational phases of the Project.

19.4.19 As it is not possible to meaningfully calculate these baseline GHG emissions, a conservative approach has been taken in line with best practice guidance whereby the baseline is assumed to be zero.

19.4.20 Where available, data required to undertake the lifecycle GHG impact assessment was provided by the project team and analysed using the methodology outlined below. Where data was unavailable, reasonable assumptions have been made based on professional judgement.

Climate Change Risk Assessment and In-combination Climate Change Impact Assessment

19.4.21 Historic climate data obtained from the Met Office website (Ref 19.37) has been used to determine the current baseline conditions for the region of the Project, across East Riding of Yorkshire, Nottinghamshire and Lincolnshire. Data has been obtained according to the nearest Met Office stations to the Project site and within the draft order limits (i.e. Birkhill Wood Substation and High Marnham Substation to the south).

19.4.22 In line with EN-1 (Ref 19.2), data to determine the future baseline conditions was obtained from UK Climate Projections 2018 (UKCP18) (Ref 19.38).

19.4.23 The Intergovernmental Panel on Climate Change (IPCC) AR6 Sea Level Projection Tool (Ref 19.40 and Think Hazard (Ref 19.41) were also used for other projected trends/impacts, and the UK Climate Change Risk Assessment analysed (per the direction in Paragraph 4.10.17 of EN-1 (Ref 19.2) for the current state of nationwide climate change risks (Ref 19.2).

Assessment Methods and Criteria

19.4.24 This section sets out the scope and methodology for the assessment of climate effects on the Project and of effects on the climate associated with the Project. It builds on the general assessment methodology presented in **Chapter 5 PEIR Approach and Methodology**.

19.4.25 All conclusions and assessments are preliminary. All assessment work has applied, and continues to apply, a precautionary principle, in that where limited information is available (in terms of the proposals for the Project), a realistic worst-case scenario is assessed.

19.4.26 The identification of climate effects is the result of applying professional judgement within an evidence-based assessment process.

19.4.27 The assessment of climate effects first considers potential sources of affects, during both construction and operation (and maintenance).

General Methodology

Lifecycle Greenhouse Gas Impact Assessment Methodology

19.4.28 The lifecycle GHG assessment follows a project lifecycle approach to calculate estimated GHG emissions arising from the construction, operation and maintenance phases of the Project. The calculation outputs are used to identify GHG 'hot spots' (i.e. emissions sources likely to generate the largest amount of GHG emissions). This will enable the identification of priority areas for mitigation where adverse climate effects are identified, in line with the principles set out in IEMA guidance (Ref 19.34).

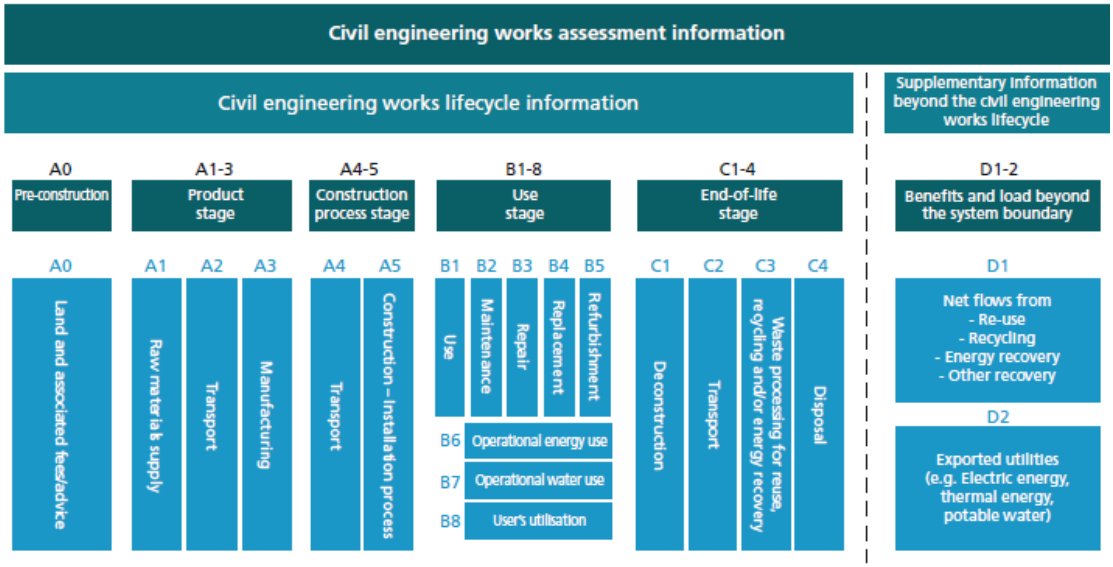
19.4.29 In line with the World Business Council for Sustainable Development and World Resources Institute GHG Protocol guidelines (Ref 19.26), the GHG assessment is reported as tonnes of carbon dioxide equivalent (tCO_2e) and will consider the seven Kyoto Protocol gases:

- Carbon dioxide (CO_2);
- Methane (CH_4);
- Nitrous oxide (N_2O);
- Sulphur hexafluoride (SF_6);
- Hydrofluorocarbons (HFCs);
- Perfluorocarbons (PFCs); and
- Nitrogen trifluoride (NF_3).

19.4.30 These GHGs are broadly referred to in this chapter under an encompassing definition of 'GHG emissions', with the unit of tCO_2e (tonnes CO_2 equivalent) or $MtCO_2e$ (Mega tonnes of CO_2 equivalent).

19.4.31 GHG emissions have been calculated according to Publicly Available Specification (PAS) 2080:2023 Carbon management in buildings and infrastructure (Ref 19.33) PAS 2080 sets out lifecycle modules for assessing GHG emissions across the Project lifecycle. The PAS 2080 lifecycle modules are illustrated in Image 19.1.

Image 19.1- PAS 2080:2023 lifecycle models



19.4.32 Table 19.1 summarises the key anticipated GHG emissions sources associated with the Project by lifecycle stage, in accordance with PAS2080 lifecycle modules.

Table 19.1- Anticipated lifecycle GHG emissions sources associated with the Project by lifecycle stage

Phase	Activity	Primary Emission Sources
Production phase A1-A3	A1-3: Raw material extraction and manufacturing of products required to build the equipment for the Project; Transportation of materials for processes/manufacturing (where available).	Embodied GHG emissions from energy use in the extraction of materials and manufacture of components and equipment. GHG emissions from the transportation of products and materials during their processing and manufacture. Due to the nature of the equipment, this could require shipment of certain aspects over significant distances. Transport of materials to the site is included under construction phase where it is not included in embodied GHG emissions.
Construction phase A4-5	A4: Transportation of construction materials to the site.	GHG emissions from the transportation of materials to and from the site.
	A4: Transportation of construction workers to and from the site.	GHG emissions from transportation of workers to and from the site.
	A5: On-site construction activity including emissions from construction compounds.	Energy (electricity, fuel, etc.) consumption from plant and vehicles, generators on-site, and construction worker commuting.
	A5: Disposal of any waste generated by the construction phase.	GHG emissions from disposal and transportation of waste.
	A5: Land use change.	GHG emissions from net loss/gain of carbon sink.
	A5: Water use.	Provision of potable water, and treatment of wastewater.
Operation and Maintenance phase B1-7	B2-4: Maintenance, repair and replacement	GHG emissions from energy consumption, transportation of maintenance workers and materials, material use and waste generation as a result of site maintenance.
	B6: Operational energy use	GHG emissions from energy consumption, provision of potable water, treatment of wastewater, and transportation effects for worker travel.

19.4.33 All together the total expected lifecycle GHG emissions across construction, (namely inclusive to the embodied carbon in materials), as well as at the operation and maintenance stages of the Project, have been quantified using a calculation-based methodology as per the following equation, and aligned with the GHG Protocol (Ref 19.44):

Activity data x GHG emissions factor = GHG emissions

19.4.34 Due to limited data availability at this preliminary stage, a high-level assessment has been undertaken to estimate the lifecycle GHG emissions of the Project. This has been achieved by undertaking a comparative benchmark assessment against GHG emissions from the Yorkshire Green Energy Enablement Project, (otherwise referred to as Yorkshire GREEN).

19.4.35 This project was recently granted development consent (as of March 2024 by the UK Secretary of State for Energy Security and Net Zero) (Ref 19.45). The Yorkshire Green Energy Enablement Project is another National Grid project, which similar to the Project, has a scope for the installation of new overhead line. Due to the similar nature and scope of both projects, it is considered that the carbon intensity is comparative. The Environmental Statement for the Yorkshire Green Energy Enablement Project is available on the Planning Inspectorate's website (Ref 19.45).

19.4.36 This assessment has involved a thorough comparative review of the GHG emissions estimated during the whole lifecycle of the Yorkshire Green Energy Enablement Project as indicated in Table 3 of the relevant ES Scoping report (Ref 19.45). From this, our assessment approach has been to derive a benchmark whole lifecycle carbon intensity factor from the Yorkshire Green Energy Enablement Project, according to the electricity generated per length and the capacity of the Overhead line (tCO_2e/(Total kVA x km)), (with exclusion to decommissioning phases). By multiplying the appropriate length and capacity of the Project with this carbon intensity benchmark factor, it has been possible to generate a comparative high-level estimate of the total GHG emissions during the lifecycle of the Project, (with exception to the decommissioning phase).

19.4.37 When evaluating the significance of the GHG emissions, all new GHG emissions contribute to a negative environmental impact in line with IEMA GHG Assessment Guidance (Ref 19.34). The significance of a project's emissions should therefore be based on its net impact over its design life, which may be positive, negative or negligible. The crux of significance therefore is not whether a project emits GHG emissions, nor even the magnitude of GHG emissions alone, but whether it contributes to reducing GHG emissions relative to a comparable baseline consistent with a trajectory towards net zero by 2050.

19.4.38 The Project is anticipated to support the UK transition to net zero by 2050 by increasing the capability of the UK national electricity grid to transmit low carbon energy. The GHG benefits associated with this are outside of the system boundary and fall under Module D as per PAS 2080 lifecycle modules. Module D is not within the scope of this assessment and, therefore will not be formally assessed. However, the potential benefits of the Project associated with the UK transition to net zero will be discussed indicatively to inform the evaluation of significance of impact.

19.4.39 The sensitivity of the receptor (i.e. the global climate) to increases in GHG emissions is always defined as high as any additional GHG impacts could compromise the UK's ability to reduce its GHG emissions and therefore meet its future 5-year carbon budgets. Also, the extreme importance of limiting global warming to below 2°C this century is broadly asserted by the International Paris Agreement (Ref 19.17) and the climate science community.

Significance criteria

19.4.40 For the GHG impact assessment, the magnitude of impact considers the output of the GHG quantification process i.e. the Project's GHG lifecycle footprint, in the context of its contribution to the UK's carbon budgets and the possible impact of the Project on the UK meeting its net-zero target. Emissions from the Project will be presented as a percentage of the carbon budget period under which they fall.

19.4.41 According to the IEMA guidance on assessing GHG emissions in EIA (Ref 19.34), '*GHG emissions have a combined environmental effect that is approaching a scientifically defined environmental limit, as such any GHG emissions or reductions from a project might be considered to be significant*'.

19.4.42 As discussed, the significance of a Projects impact on the climate is not based solely on the magnitude of emissions. IEMA guidance describes five distinct levels of significance, which are not solely based on whether a project emits GHG emissions alone, but how the project makes a relative contribution towards achieving a science-based 1.5°C aligned transition towards Net Zero.

19.4.43 A 'minor adverse' or 'negligible' non-significant effect conclusion does not necessarily refer to the magnitude of GHG emissions being carbon neutral (i.e. zero on balance); but refers to the likelihood of avoiding severe Climate Change, aligning Project emissions with a science-based 1.5°C compatible trajectory and achieving Net Zero by 2050.

19.4.44 A project's impact can shift from significant adverse to non-significant adverse effects by incorporating mitigation measures that substantially improve on the baseline, otherwise known as the 'business-as-usual' scenario whereby if the Project where not to occur and meet or exceed the science-based emissions trajectory of ongoing but declining emissions towards Net Zero.

Table 19.2 - Definition of levels of significance

Significance level	Effects	Description
Significant adverse	Major adverse	The project's GHG impacts are not mitigated or are only compliant with do-minimum standards set through regulation, and do not provide further reductions required by existing local and national policy for projects of this type. A project with major adverse effects is locking in emissions and does not make a meaningful contribution to the UK's trajectory towards net zero.
	Moderate adverse	The project's GHG impacts are partially mitigated and may partially meet the applicable existing and emerging policy requirements but would not fully contribute to decarbonisation in line with local and national policy goals for projects of this type. A project with moderate adverse effects falls short of fully contributing to the UK's trajectory towards net zero.

Significance level	Effects	Description
Not significant	Minor adverse	The project's GHG impacts would be fully consistent with applicable existing and emerging policy requirements and good practice design standards for projects of this type. A project with minor adverse effects is fully in line with the measures necessary to achieve the UK's trajectory towards net zero.
	Negligible	The project's GHG impacts would be reduced through measures that go well beyond existing and emerging policy and design standards for projects of this type, such that radical decarbonisation or net zero is achieved well before 2050. A project with negligible effects provides GHG performance that is well 'ahead of the curve' for the trajectory towards net zero and has minimal residual emissions.
Significant	Beneficial	The project's net GHG impacts are below zero and it causes a reduction in atmospheric GHG concentration, whether directly or indirectly, compared to the without-project baseline. A project with beneficial effects substantially exceeds net zero requirements with a positive climate impact.

19.4.45 IEMA guidance (Ref 19.34) also states it is down to the professional judgement of the practitioner to determine how best to contextualise a project's GHG impact and assign the level of significance. It is suggested that sectoral, local, or national carbon budgets can be used, as available and appropriate, to contextualise the magnitude of a project's GHG impact. To determine the level of significance the magnitude of impact against carbon budgets, alignment with the UK's trajectory to net zero, and how the Project aligns and contributes to UK policy is considered. The approach adopted for the purposes of this assessment is outlined below.

19.4.46 Where available, UK national carbon budgets (Ref 19.13, Ref 19.14 , Ref 19.15, and Ref 19.16), have been used for the purposes of this assessment to represent future emissions inventory scenarios for the UK. These legally binding targets, which outline the total amount of GHGs that the UK can emit over a 5-year period, are currently available for the Sixth carbon budget period (2033-2037). The UK is currently in the fourth Carbon Budget period, which runs from 2023 to 2027. The third, fourth and fifth Carbon Budgets reflect the previous 80% reduction target by 2050. The 6th Carbon Budget aligns with the legislated 2050 net zero target.

19.4.47 The construction programme of the Project (anticipated to be 2028 to 2033 spans the 5th Carbon Budget (2028 to 2032). The annual average GHG impact of the Project has been compared against the annualised Carbon Budget for the period in which the emissions arise to allow separate assessment of each lifecycle stage.

19.4.48 Operation and maintenance GHG emissions as a result of the Project (assumed to be fully operational by 2031) have been compared to all the appropriate and available Carbon Budgets within the design life of the Project: the fourth, fifth and sixth Carbon Budgets (2023 to 2027, 2028 to 2032 and 2033 to 2037, respectively).

19.4.49 In order to illustrate the Project trajectory towards net-zero by 2050, the Climate Change Committee's (CCC) balanced net zero pathway is utilised post-2037 (Ref 19.16), in the absence of any nationally legally binding Carbon Budgets after the Sixth Carbon Budget. The CCC is expected to advise the UK Government on the level of its 7th Carbon Budget in early 2025. Beyond 2050, it is implied that the UK will remain at net zero.

19.4.50 The CCC balanced net-zero pathway, a part of the Sixth Carbon Budget, (Ref 19.16), is divided into 5-year periods between 2037 and 2050 to match the time period of the legally binding UK National Carbon Budgets. The proposed budgets up to 2050 are in line with the UK's 1.5-degree trajectory (as detailed in Ref 19.46).

19.4.51 However, it should be noted that the CCC's proposed Budgets beyond 2037 have not been formally adopted by the government or legislated for by parliament and can therefore only be used as an indicative measure to contextualise the Project's progress toward the national net-zero trajectory.

Table 19.3 - UK carbon budgets and indicative carbon budgets based upon the CCC's balanced Net Zero Pathway

Carbon budget	Cumulative UK carbon budget ($MtCO_2e$)	Cumulative indicative carbon budget totals Based upon the CCC's balanced Net-Zero Pathway ($MtCO_2e$)
4th (2023-2027)	1,950	-
5th (2028-2032)	1,725	-
6th (2033-2037)	965	-
7th (2038-2042)	-	526
8th (2043-2047)	-	195
9th (2048-2050)		17

19.4.52 In addition to providing advice that underpins the setting of National Carbon Budgets, the CCC also provides sector-specific decarbonisation pathways (Ref 19.46). This presents the electricity generation sector specific Carbon Budgets as further context to the GHG emissions assessment; however, it should be noted that these are not legislated like the national-level budgets.

Table 19.4 - Sector specific electricity generation carbon budgets based upon the CCC's balanced Net Zero Pathway

Carbon budget period	Recommended carbon budget ($MtCO_2e$)
2023 - 2027	189.16
2028 - 2032	92.56
2033 - 2037	35.74
2038 - 2042	23.22
2043 - 2047	12.36
2048 - 2050	4.03

Climate Change Risk Assessment Methodology

19.4.53 A CCRA has been undertaken to identify potential climate change impacts on the Project and associated receptors. It considers the potential consequence and likelihood of climate impacts, taking account of the adaption measures embedded into the design of the Project.

19.4.54 The current baseline for the CCRA is based on historical climate data obtained from the Met Office (Ref 19.37) recorded by the closest meteorological stations to each end of the Proposed Overhead Line and connection points (i.e. the proposed Birkhill Wood Substation within the draft order limits, and the proposed High Marnham Substation to the south). The metrological stations of which accurate historic climate data have been selected include the following: Hull (Kingston upon Hull) Station, located approximately 12.6 km away from the proposed Birkhill Wood Substation to the North of the Project; Cranwell (Lincolnshire) located approximately 40 km from High Marnham Substation, the nearest station to the south of the project; as well as an additional station located in the middle of the previously noted stations, this is located at Scampton (Lincolnshire).

19.4.55 The CCRA has included all infrastructure and assets associated with the Project. It covers resilience against both gradual climate change, and the risks associated with an increased frequency of extreme weather events as per the UK Climate Projections 2018 (UKCP18) projections (Ref 19.38).

19.4.56 The future baseline for the CCRA assessment is based on future UKCP18 (Ref 19.38). This projection data provides probabilistic indications of how global climate change is likely to affect areas of the UK using pre-defined climate variables and time periods.

19.4.57 For the purpose of the assessment, UKCP18 probabilistic projections for pre-defined 20-year periods for the following average climate variables have been obtained and will be further analysed in this PEIR chapter:

- mean annual temperature;
- mean Summer temperature;
- mean Winter temperature;
- maximum Summer temperature;
- minimum Winter temperature;
- mean annual precipitation;
- mean Summer precipitation;
- mean Winter precipitation

19.4.58 UKCP18 probabilistic projections have been analysed across the relevant grid squares within which the Project is located. These figures are expressed as temperature/ precipitation anomalies in relation to the 1981-2010 baseline. This baseline was selected as it provides projections for 20-year time periods (e.g., 2020- 2039) for the parameters analysed within the assessment compared to the 30-year land-based projections that would be generated from the 1981–2010 baseline.

19.4.59 UKCP18 uses a range of possible scenarios, classified as Representative Concentration Pathways (RCPs), to inform differing future emission trends. These RCPs *'specify the concentrations of greenhouse gases that will result in total radiative forcing increasing by a target amount by 2100, relative to preindustrial levels'*. RCP8.5 is considered to be the worst-case global scenario with the greatest concentration of GHGs in the atmosphere and has been used as the purposes of this assessment as a worst-case scenario.

19.4.60 The CCRA considers the potential consequence and likelihood of occurrence for climate change impacts on the Project and associated receptors whilst taking account of the adaption measures embedded into the design of the Project (see **Appendix 19.1 – Climate Change Risk Assessment**).

19.4.61 Receptors identified at the construction phase include the workforce, plant, machinery, and materials. For the operation and maintenance phase, receptors include the assets (i.e. all major assets inclusive to the new overhead line) and any workforce on site.

19.4.62 The following key terms and definitions relating to the CCRA have been adopted:

- Climate risk – a weather or climate related event, which has the potential to do harm to environmental or community receptors or assets, for example, increased Winter precipitation;
- Climate change impact – an impact from a climate hazard which affects the ability of the receptor or asset to maintain its function or purpose; and
- Consequence – any effect on the receptor or asset resulting from the climate hazard having an impact.

19.4.63 A stepped approach is used to assess the impacts of climate change on the Project:

- Identify potential climate hazards;
- Identify likelihood of climate impact occurring on the Project;
- Identify consequence of impact on the Project; and
- Identify significance of effect (likelihood of impact occurring x consequence of impact).

19.4.64 Once potential climate impacts have been identified (e.g., heatwaves), the likelihood of an impact occurring during the construction and operation phases is categorised.

19.4.65 The criteria which have been used to determine the likelihood of a climate change impact occurring are detailed in Table 19.5. For example, a climate hazard could be a heatwave, while the climate impact is the impact on the Project, e.g., overheated electrical equipment.

Table 19.5 - Level of likelihood of a climate change impact occurring

Likelihood category	Qualitative description (frequency of occurrence)	Quantitative description (probability of occurrence)
Rare	Highly likely to occur	5%
Unlikely	Unlikely to occur	20%
Moderate	As likely to occur as not	50%
Likely	Likely to occur	80%
Almost certain	Very likely to occur	95%

19.4.66 After identifying the likelihood of climate impacts, the consequences of the climate impacts have been evaluated in accordance with the criteria outlined in (Ref 19.34). For instance, the permanent damage to electrical equipment caused by heatwaves may lead to a complete loss of operation. The categories and descriptions provided below are based on the EU Technical Guidance on the climate proofing of infrastructure in the period 2021-2027 (Ref 19.39).

Table 19.6 - Level of consequence of a climate change impact occurring

Risk areas	Insignificant	Minor	Moderate	Major	Catastrophic
Asset damage / Engineering / Operational	Impact can be absorbed through normal activity	An adverse event that can be absorbed by taking business continuity actions	A serious event that requires additional emergency business continuity actions	A critical event that requires extraordinary/emergency business continuity actions	Disaster with the potential to lead to shut down or collapse or loss of the asset / network
Safety and Health	First aid case	Minor injury, medical treatment	Serious injury or lost work	Major or multiple injuries, permanent injury, or disability	Single or multiple fatalities
Environment (*)	No impact on baseline environment. Localised in the source area. No recovery required	Localised within site boundaries. Recovery measurable within one month of impact	Moderate harm with possible wider effect. Recovery in one year	Significant harm with local effect. Recovery longer than one year. Failure to comply with environmental regulations / consent	Significant harm with widespread effect. Recovery longer than one year. Limited prospect of full recovery
Social	No negative social impact	Localised, temporary social impacts	Localised, long-term social impacts	Failure to protect poor or vulnerable groups (1). National, long-term social impacts	Loss of social licence to operate. Community protests
Financial (for single extreme event or annual average impact) (**)	x % IRR (***) < 2 % of turnover	x % IRR 2 – 10% of turnover	x % IRR 10 – 25% of turnover	X % IRR 25 – 50% of turnover	x % IRR >50% of turnover

Risk areas	Insignificant	Minor	Moderate	Major	Catastrophic
Reputation	Localised, temporary impact on public opinion	Localised, short-term impact on public opinion	Local, long-term impact on public opinion with adverse local media coverage	National, short-term impact on public opinion; negative national media coverage	National, long-term impact with potential to affect the stability of the Government
Cultural heritage and cultural premises	Insignificant impact	Short term impact. Recovery or repair.	Serious damage with wider impact to tourism industry	Significant damage with national and international impact	Permanent loss with resulting impact on society

(1) Including groups that depend on natural resources for their income/livelihoods and cultural heritage (even if not considered poor) and groups considered poor and vulnerable (and often that have less capacity to adapt) as well as persons with disabilities and older persons.

(*) The ratings and values suggested here are illustrative. The project promoter and climate-proofing manager may choose to modify them.

(**) Example indicators – other indicators that may be used including costs of immediate / long-term emergency measures; restoration of assets; environmental restoration; indirect costs on the economy, indirect social costs.

(***) Internal Rate of Return (IRR).

Significance criteria

19.4.67 The significance of climate change impacts is determined as a function of the likelihood of a climate change impact occurring (Table 19.5 - Level of likelihood of a climate change impact occurring) and the consequence to the receptor if the impact occurs (Table 19.6). The significance is then detailed in Table 19.7. The assessment takes into account confirmed design and mitigation measures (referred to in section 19.6).

Table 19.7 - Significance of effect matrix for climate change risk assessment

		Likelihood of climate-related impact occurring				
		Insignificant	Minor	Moderate	Major	Catastrophic
Level of consequence of a climate impact occurring	Rare	Low (NS)	Low (NS)	Medium (NS)	Medium (NS)	Medium (NS)
	Unlikely	Low (NS)	Low (NS)	Medium (NS)	High (S)	High (S)
	Moderate	Low (NS)	Medium (NS)	High (S)	High (S)	Extreme (S)
	Likely	Medium (NS)	High (S)	High (S)	Extreme (S)	Extreme (S)

	Likelihood of climate-related impact occurring				
	Insignificant	**Minor**	**Moderate**	**Major**	**Catastrophic**
Almost certain	Medium (NS)	High (S)	Extreme (S)	Extreme (S)	Extreme (S)

Note: S= significant; and NS = not significant

In-combination Climate Change Impact Assessment Methodology

19.4.68 The ICCI assessment has considered the ways in which projected climate change will influence the significance of the impact of the Project on receptors in the surrounding environment.

19.4.69 The ICCI assessment has considered the existing and projected future climate conditions for the geographical location and assessment timeframe. It identifies the extent to which identified receptors in the surrounding environment are potentially vulnerable to (and affected by) these factors. The receptors for the ICCI assessment are those that will be impacted by the Project. These impacts have been assessed in liaison with the technical specialists responsible for preparing the applicable technical chapters, listed below:

- **Chapter 6 Landscape;**
- **Chapter 7 Visual;**
- **Chapter 8 Ecology;**
- **Chapter 9 Water Environment;**
- **Chapter 10 Cultural Heritage;**
- **Chapter 11 Water Environment;**
- **Chapter 12 Geology and Hydrogeology;**
- **Chapter 13 Agriculture and soils;**
- **Chapter 14 Traffic and Transport;**
- **Chapter 15 Air Quality;**
- **Chapter 16 Noise and Vibration**; and
- **Chapter 18 Health and Wellbeing.**

19.4.70 Climate hazards and the likelihood of their impact on identified receptors is determined using the same approach as set out for the CCRA, using the criteria presented in Table 19.8. Once the likelihood of an impact occurring has been determined, the consequence of the impact on the receptor is determined using the criteria defined in Table 19.8. To assess the consequence of an ICCI, each discipline has assigned a level of consequence to an impact based on the criteria description and their discipline-specific assessment methodology.

Table 19.8 - Consequence criteria for ICCI assessment

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

Significance criteria

19.4.71 The significance of potential effects is determined using the matrix in Table 19.9. Where an effect has been identified as moderate or high against the matrix in Table 19.9, these have been classed as a significant ICCI effect. If significant ICCI effects are assessed, then appropriate additional mitigation measures (secondary mitigation) are identified.

Table 19.9 - ICCI Significant criteria

		Likelihood of climate-related impact occurring			
		Negligible	Low	Moderate	High
Level of consequence	Negligible	NS	NS	NS	NS
	Low	NS	NS	NS	S
	Moderate	NS	NS	S	S
	High	NS	S	S	S

Note: S= significant; and NS = not significant

Approach to defining significance in the PEIR

19.4.72 As set out in **Chapter 5 Approach to Preparing the PEIR** the general approach taken to determining the significance of effect in this preliminary assessment is only to state whether effects are likely or unlikely to be significant, rather than assigning a significance level.

19.4.73 Following on from the identification of whether an effect is considered likely to be significant or not significant, a confidence in the prediction is given a rating of high, moderate or low in line with the confidence level definitions presented in **Chapter 5 Approach to Preparing the PEIR**.

Preliminary Assessment Assumptions and Limitations

Lifecycle Greenhouse Gas Assessment

19.4.74 The assessment has been undertaken based on preliminary design information for the Proposed Overhead Line as described in Chapter 4 Description of the Project. This information is likely to develop further in response to ongoing design, assessment and stakeholder feedback, and will be updated for the ES as the design evolves.

19.4.75 The data available is considered appropriate for undertaking the GHG assessment at the current stage of Project design.

19.4.76 For this preliminary assessment, the lifecycle GHG assessment has been based on a benchmark project, namely the Yorkshire Green Energy Enablement Project, (Ref 19.45).

19.4.77 GHG emissions associated with the decommissioning phase are scoped out of the assessment, as previously identified in this PEIR.

Climate Change Risk Assessment

19.4.78 The assessment has been undertaken based on preliminary Project design information. This information is iterative and will be updated for the ES as the design evolves and relevant changes are accounted for in the assessment.

19.4.79 All conclusions and assessments are preliminary. All assessment work has applied, and continues to apply, a precautionary principle, where limited information is available (in terms of the proposals for the Project).

19.4.80 The key parameters and assumptions will be reviewed based on the design presented in the DCO application and, where required, updated, or refined. The ES will present the final key parameters and assumptions used within that assessment, particularly drawing attention to any areas that may have changed from what is presented in this preliminary assessment.

19.4.81 The decommissioning phase is scoped out of the CCRA.

In-combination Climate Change Impact Assessment

19.4.82 The ICCI assessment will be updated for the ES once ongoing surveys and monitoring by the contributing technical disciplines are complete.

19.4.83 The decommissioning phase is scoped out of the ICCI.

Further Assessment within the ES

19.4.84 The ES will present a full, detailed assessment in accordance with industry good practice guidance as detailed in the methodology. The following assessments will be conducted and presented within the ES:

- Lifecycle GHG Impact Assessment.
- Climate Change Risk Assessment, (CCRA).
- In-Combination Climate Change Assessment, (ICCI).

19.4.85 The ES will provide final details of embedded, standard and additional mitigation measures which will be informed by the findings of the preliminary assessment and feedback from statutory consultation.

19.4.86 The GHG Reduction Strategy will be developed further alongside the ES process, beyond this PEIR whereby it is likely to be able to obtain a more accurate GHG assessment reflective of the suggestive availability of detailed design data.

19.5 Baseline Conditions

19.5.1 This section provides a description of the existing and future climate change conditions relevant to the study areas as defined in section 19.4.

Lifecycle Greenhouse Gas Impact Assessment

19.5.2 This includes the bassline for the Proposed Substation Works.

19.5.3 The current (existing) and future baseline for the GHG assessment of the impact of the Project on climate is a 'business as usual' scenario where the Project is not constructed and operated. The baseline comprises existing carbon stock and sources of GHG emissions within the boundary of the existing site activities.

19.5.4 Based on initial assessment the current land use within the draft Order Limits consists of the existing 400 kV Overhead Line. The surrounding landscape of the existing Overhead Line is predominantly arable land, intersected by the River Ouse, and is surrounded by the Thorne and Hatfield Moors and National Nature Reserve, as well as nearby infrastructure including West Burton, Cottam and Keadby Power Station and Keadby Windfarm, among other power related infrastructure as identified in **Chapter 4 Description of the Project**. Trees are present individually in some areas, as well as in rolling ridges and within small woodland areas. The vegetation within the draft Order Limits suggests a carbon sink potential.

19.5.5 Current land use within the draft Order Limits has minor levels of associated GHG emissions as the land use is largely agricultural. Baseline agricultural GHG emissions are dependent on soil and vegetation types that are present, as well as the fuel used for the operation of vehicles and machinery.

19.5.6 Baseline emissions are anticipated to be immaterial, whereby the Project does not go ahead, and the existing site within the draft Order Limits is considered to emit zero emissions.

19.5.7 As it is not possible to accurately calculate a GHG baseline, in line with IEMA guidance the baseline is assumed to be zero as per the rationale in Section 19.5. This approach represents a worst-case scenario as all GHG emissions associated with the Project are additional to the baseline.

Climate Change Risk Assessment & In Combination Climate Change Assessment

Current Baseline

19.5.8 This section describes the baseline climate environment in the study area where it relates to the Proposed Overhead Line. The baseline climate change in the study area in relation to the Proposed Substation Works is presented in **Chapter 20 Substations and Associated Works**.

19.5.9 The current baseline for the CCRA and ICCI assessments are based on historical climate data from the nearest weather stations to the Project site obtained from the Met Office website. Given the geographical extent of the Project this assessment undertakes an average of the climate data across three points of the new Overhead Line route, (i.e. the north end, south end and a central location) Historic climate data has been taken as an average across the following three stations for this assessment, given the length of the Project. The selected stations are; Hull (Kingston upon Hull) Station, Scampton (Lincolnshire) and Cranwell (Lincolnshire). The average historic climate data for these three locations is presented in Table - 19.10.

Table - 19.10 Met Office historic climate data with an average of values taken between the north and south end of the Project.

	Hull (Kingston upon Hull) Station	Scampton (Lincolnshire)	Cranwell (Lincolnshire)	Average
Climate Variable		**Baseline (1991-2020)**		
Mean annual maximum daily temperature (°C)	14.45	13.84	14.06	14.12
Mean Summer maximum daily temperature (°C)	21.13	20.71	21.08	20.97
Mean Winter maximum daily temperature (°C)	8.07	7.21	7.34	7.54
Highest temperature for baseline period (°C)	22.02 (July)	21.62 (July)	22.0721.62 (July)	21.90
Lowest temperature for baseline period (°C)	7.74 (Jan)	6.86 (Jan)	6.98 (Jan)	7.19
Mean annual rainfall (mm)	693.45	619.40	612.61	641.82

	Hull (Kingston upon Hull) Station	Scampton (Lincolnshire)	Cranwell (Lincolnshire)	Average
Mean Summer rainfall (mm)	65.19	60.38	21.08	48.88
Mean Winter rainfall (mm)	54.13	47.02	7.34	36.16
Wettest month on average (mm)	68.29 (November)	58.79 (July)	62.37 (October)	63.15
Driest month on average (mm)	43.30 March	35.87	36.33 March	38.50
Mean monthly wind speed at 10m (knots)	8.92 (England E & NE)	9.72 (England E & NE)	10.28 (England E & NE)	9.64

Future Baseline

19.5.10 The future baseline for the CCRA and ICCI assessments is based on future UK Climate Projections 2018 (UKCP18). This projection data provides probabilistic indications of how global climate change is likely to affect areas of the UK using pre-defined climate variables and time periods.

19.5.11 The future baseline is expected to differ from the present-day baseline. UKCP18 (Ref 19.38) has been developed by the UK Climate Impacts Programme (UKCIP) to provide projections for future climate scenarios and trends.

19.5.12 Projected temperature and precipitation variables presented in UKCP18 probabilistic projections have been analysed for the 25 km^2 grid square within which the Project is located. These figures are expressed as temperature/precipitation anomalies in relation to the 1981 to 2010 baseline.

19.5.13 UKCP18 uses a wide range of possible scenarios, classified as (RCPs, to inform differing future emission trends. These RCPs "… *specify the concentrations of greenhouse gases that will result in total radiative forcing increasing by a target amount by 2100, relative to preindustrial levels*." RCP8.5 has been used for the purposes of this assessment as a worst-case as this predicts a high-emissions or 'business-as-usual' scenario.

19.5.14 UKCP18 provides probabilistic projections for pre-defined 30-year time periods (such as 2020s (2010 - 2039), 2050s (2040 - 2069) and 2080s (2070 - 2099)) at annual and seasonal levels for changes to mean climatic conditions over land areas. For the purpose of the Project, UKCP18 projections to assess climate variables as listed earlier in the PEIR, which have been obtained and analysed for this Project's draft Order Limits.

19.5.15 IPCC provides evidence to suggest that current global population and urbanisation trends, slow uptake of renewable energy sources, delay in nuclear power growth, and slow development of international climate change policy means that it is most likely that global emissions will follow the predicted RCP8.5 pathway The RCP8.5 pathway is defined by UKCP18 as a scenario whereby GHG emissions continue to grow unmitigated, leading to a best estimate global average temperature rise of 4.3°C by 2100 compared to the pre-industrial period, (Ref 19.38).

19.5.16 UKCP18 allows for future climate projections across a range of probability levels to be assessed, ranging from 10% probability to 90% probability:

- 10% probability level – this demonstrates that the future change is unlikely to be less than. There is a 90% chance the projected change will be more than this.
- 50% probability level – this is known as the central estimate, with an even chance of it occurring and not occurring.
- 90% probability level – this demonstrates what the future change is unlikely to be more than. There is a 10% chance the projected change will be more than this.

19.5.17 Climate variables impacting the construction, operation and maintenance, and decommissioning phases of the Project have been assessed in Table 19.11 below against RCP8.5 2010-2039 and 2070-2099 projection data.

Table 19.11 - Projected changes in temperature and precipitation variables, 50% probability (10% and 90% probability in Parenthesis)

Climate variable	Time period				Projected trend	Climate projection Source
	Baseline (1981-2000)	2010-2039	2040-2069	2070-2099		
Mean annual air temperature anomaly at 1.5 m (°C)	14.155	+0.77 (+0.32 to +1.23)	+1.86 (+0.97 to +2.79)	+3.57 (+2.09 to +5.14)	↑	UKCP RCP8.5
Mean Summer air temperature anomaly at 1.5 m (°C)	20.92	+0.94 (+0.31 to +1.56)	+2.29 (+1.01 to +3.56)	+4.52 (+2.32 to +6.79)	↑	UKCP RCP8.5
Mean Winter air temperature anomaly at 1.5 m (°C)	7.685	+0.67 (+0.038 to +1.34)	+1.63 (+0.49 to +2.84)	+2.99 (+1.19 to +4.97)	↑	UKCP RCP8.5
Maximum Summer air temperature anomaly at 1.5 m (°C)	21.82 (July)	+1.41 (+1.16 to +1.23)	+2.11 (+2.36 to +2.15)	+3.55 (+2.82 to +2.83)	↑	UKCP RCP8.5
Minimum Winter air temperature anomaly at 1.5 m (°C)	7.36 (Jan)	+0.67 (+0.45 to +0.38)	+1.81 (+1.08 to +1.09)	+3.54 (+1.18 to +1.51)	↑	UKCP RCP8.5
Annual precipitation rate anomaly (mm)	654.13	+4.45 (-5.87 to -3.58)	+6.29 (-7.52 to -2.41)	+8.09 (-2.04 to -0.60)	↓	UKCP RCP8.5
Summer precipitation rate anomaly (mm)	62.415	-1.77 (-1.68 to -10.23)	+5.76 (-25.06 to -18.45)	+11.34 (-8.65 to -3.72)	↓	UKCP RCP8.5
Winter precipitation rate anomaly (mm)	50.035	+2.54 (-10.20 to -0.14)	+9.98 (+3.12 to +23.88)	+15.77 (+40.93 to +5.33)	↑	UKCP RCP8.5

Climate variable		Time period			Projected trend	Climate projection Source
Sea level rise (m)	n/a	0.19	0.43	0.78		IPCC AR6 Sea Level Projection Tool SSP8.5
Number of heat waves		Think Hazard has classified that the projections of extreme heat in the region of Humberside and Lincolnshire as low, according to currently available information. This means that there is less than a 5% chance that at least one period of prolonged exposure to extreme heat, resulting in heat stress, will occur in the next five years.				Think Hazard
Wildfires		In the northern region of the project site towards Humberside, Think Hazard has classified the wildfire hazard in Humberside as medium, according to currently available information. This means that there is between a 10% and 50% chance of experiencing weather that could support a hazardous wildfire that may pose risk to life and property loss in any given year. However, towards the southern region of the project site towards Lincolnshire, Think Hazard has classified the wildfire hazard as high, according to currently available information. This means that there is greater than a 50% chance of encountering weather that could support a significant wildfire that is likely to result in both life and property loss in any given year.				Think Hazard
Drought		Think Hazard has classified the occurrence of drought in Humberside and Lincolnshire as low, according to currently available information. This means that there is a 1% chance drought will occur in the coming 10 years.				Think Hazard

19.6 Mitigation

19.6.1 As set out in **Chapter 5 Approach to Preparing the PEIR**, mitigation measures fall into one of three categories: embedded measures; control and management measures; and additional mitigation measures. Those measures relevant to the assessment of climate effects are set out below.

Embedded Mitigation Measures

19.6.2 Environmental appraisal has been an integral part of the Project design from the outset, which has meant that the Project has been able to avoid environmentally sensitive features as far as reasonably practicable.

19.6.3 National Grid has also embedded measures into the design of the Project to avoid or reduce significant effects that may otherwise be experienced during the construction and operation (and maintenance) of the Project. There will be ongoing consideration of the contributions that this Project can make towards National Grid's overarching ambitions for net zero emission by 2050, aligned with the Science Based Targets initiative (SBTi).

19.6.4 Embedded measures are those that are intrinsic to, and built into, the design of the Project; these are presented in Table 4.2 in **Chapter 4 Description of the Project**. Measures of relevance to the climate change chapter include:

- Sensitive Routeing and Siting to develop the draft overhead line alignment, siting of substations and draft Order Limits. Avoids and reduces, as far as practicable, impacts on identified receptors, in line with the National Policy Statements EN-1 (Ref 19.54) and EN-5 (Ref 19.3) as well as the Holford Rules (Ref 19.53) and the Horlock Rules (Ref 19.52). Further information on options appraisal and the alternative options considered is set out in Chapter 3 Project Need and Alternatives.
- The Project would require the use of new materials during construction such as galvanised steel for the pylons, reinforced concrete for the foundations, insulator sets (typically glass, porcelain or polymeric) and aluminium conductors. Further information regarding materials will be provided within the project description within the ES.
- The Project would consume energy during manufacture and construction. The Project will consider a range of measures to reduce energy consumption during construction, such as the use of energy efficient plant and tools. The Project will aim to use a local grid connection for temporary site power, where viable. Where not viable an alternative sustainable option should be used, such as appropriately sized alternatively fuelled or hybrid generators, where practicable.

Control and Management Measures

19.6.5 Control and management measures, comprising management activities and techniques, will be implemented during construction of the Project to limit effects through adherence to good site practices and achieving legal compliance.

19.6.6 A Draft Outline Code of Construction Practice (CoCP) is provided in **Appendix 4.1: Draft Outline Code of Construction Practice CoCP in Volume 3**. Measures contained in the Draft Outline CoCP that are relevant to the control and management of impacts that could affect the climate assessment are.

- GG03: The following environmental management plans will be produced prior to construction.
  - Code of Construction Practice (CoCP);
  - Register of Environmental Actions and Commitments (REAC);
  - Construction Traffic Management Plan (CTMP);
  - Soil Management Plan (SMP);
  - Public Rights of Way Management Plan;
  - Materials and Waste Management Plan (MWMP);
  - Noise and Vibration Management Plan;
  - Landscape and Ecology Management Plan (LEMP) including an Outline Landscape Maintenance and Management Plan; and
  - Archaeological Written Scheme of Investigation (WSI).
- GG05: A suitably experienced Environmental Manager will be appointed for the duration of the construction phase. In addition, a qualified and experienced EnvCoW will be available during the construction phase to advise, supervise and report on the delivery of the mitigation methods and controls outlined in the CoCP. The EnvCoW will monitor that the works proceed in accordance with relevant environmental DCO requirements and adhere to the required good practice and mitigation measures. The EnvCoW will be supported as necessary by appropriate technical specialist advisors, including archaeologists, ecologists, soil scientists, and arboriculturists.
- GG06: Construction workers will undergo training to increase their awareness of environmental issues as applicable to their role on the Project. Topics will include but not be limited to:
  - Working hours;
  - Ecology: working in or adjacent to protected sites and priority habitats, protected species, management, mitigation and controls;
  - Water management: legislation, buffer zones, control mechanisms, flood risks and emergency response procedures;
  - Waste management: legislation, segregation, contamination, best practice;
  - Agreed traffic routes and access points;
  - Nuisance: dust, behaviour, noise, vibration, management and controls;
  - Working around trees: tree and root protection;
  - Contaminated land: recognising and dealing with contaminated material;
  - Pollution prevision and incident response; and
  - Spill and emergency response.
- GG13: Vehicles will be correctly maintained and operated in accordance with manufacturer's recommendations and in a responsible manner. The operators of plant and vehicles will be required to switch off their engines when not in use and when it is safe to do so. Electric, or other low carbon plant and equipment should be used where available and where practicable.

- TT01: The CTMP will set out measures to reduce route and journey mileage to and from, and around, the site, and to prevent potential nuisance to residents, businesses and the wider community associated with parking, vehicle movements and access restrictions. It will also provide suitable control for the means of access and egress to the public highway and set out measures for the maintenance and upkeep of the public highway. The CTMP will also identify access for emergency vehicles. It will also set out measures to reduce safety risks through construction vehicle and driver quality standards and measures to manage abnormal loads.

19.6.7 The mechanisms by which mitigation measures will be secured and delivered will be set out further along the ES process. This is inclusive to embedded mitigation measures to support mitigation of GHG emissions, Climate Change Risks as well as any of the identified in-combination climate change impacts.

Additional Mitigation Measures

19.6.8 No additional mitigation measures are identified beyond the embedded measures and control and management measures detailed above Additional mitigation comprises measures over and above any embedded and standard mitigation measures, for which assessment within this PEIR has identified a requirement to further reduce significant environmental effects.

19.6.9 The preliminary assessment reported in this PEIR has not identified any requirements for additional mitigation at this stage, over and above the embedded or control and management measures identified. This will continue to be reviewed as the assessment progresses and the preliminary design develops further.

19.7 Preliminary Assessment

19.7.1 This section first identifies the potential effects that could occur as a result of the construction, operation and maintenance of the Proposed Overhead Line and Proposed Substation Works where effects relate to the Lifecycle Greenhouse Gas assessment. The preliminary assessment of Climate Change Risk Assessment & In Combination Climate Change Assessment for the Proposed Substation Works is presented in **Chapter 20 Substations and Associated Works**.

19.7.2 The preliminary assessment takes into account the embedded, control and management and additional mitigation measures (where relevant) as set out in section 19.6.

19.7.3 This is in accordance with guidance from the IEMA as part of preparing a proportional assessment (Ref 19.35).

Potential Effects

19.7.4 The potential for the Project to result in likely significant effects on climate was determined through the EIA Scoping process. This section lists those potential effects that have been scoped into the assessment within the EIA Scoping Report (Ref 19.29 taking into account the comments received within the Scoping Opinion (Ref 19.26Where the scope has been amended since the Scoping Report (Ref 19.27), explanatory text has been included to provide justification for this change.

Lifecycle Greenhouse Gas Impact Assessment

19.7.5 At the time of developing this PEIR, the Project design is still in the early stages, and sufficient data is not yet available for a detailed quantitative GHG assessment. Therefore, a high-level estimate of GHG emissions has been conducted using a similar project as a benchmark to indicate the potential magnitude of impact.

19.7.6 The Project has the potential to affect, and be affected by, climate change (Adversely or beneficially), during construction and operation in the following ways:

- Impact of GHG emissions arising over the lifetime of the Project on the climate;
- Resilience of the Project to projected future climate change impacts, including damage to the Project resulting from climate change; and
- How the resilience of receptors in the surrounding environment are affected by the combined impact of future climate conditions and the Project.

19.7.7 Table 19.12 below provides a comparative review of the project details across both the Project and the Yorkshire Green Energy Enablement (Yorkshire GREEN) Project.

Table 19.12 – Whole Lifecycle GHG Impact Assessment, Comparative benchmark review and Carbon Intensity evaluation.

Project:	**North Humber to High Marnham**	**Yorkshire Green Energy Enablement Project**
Main components	• Installation of new 400 kV overhead line. • Modifications to existing 400 kV overhead lines. • Facilitation of new overhead line connections	• Construction of two new substations to serve as connection points at either end of the overhead line. • Strengthening 28 km of the existing overhead line, installing approximately 10 km of new overhead line at 275 kV. • Installing approximately 1 km of new underground cables at 400 kV. • Installing 33 new pylons.
Total electricity supplied, kVA	400	400
Total length of proposed route/works, km	90	39
Total Capacity (kVA x km)	36,000 (kVA x km)	15,600 (kVA x km)

19.7.8 Table 19.13 presents the Carbon Intensity Benchmark assessment for the Yorkshire Green Energy Enablement Project and the Project. This assessment involves deriving the carbon intensity factor for the reported whole lifecycle GHG emissions, (at each PAS 2080 lifecycle stage), of the benchmark Yorkshire Green Energy Enablement Project. The carbon intensity factor represents the total tonnes of CO_2 per kilowatt hour (kWh) of electricity, per km of the overhead line. The carbon intensity is calculated at each PAS 2080 lifecycle stage by dividing by the total capacity of the Overhead Line. As seen in Table 19.13, the carbon intensity factor for the Yorkshire Green Energy Enablement Project is 7,256.15 tCO_2e/ km. This is associated with a total capacity of the Overhead Line, (indicating the electricity supplied per length of line), as 15,600 (km x Kv) which is seen earlier in Table 19.12.

19.7.9 Although the Yorkshire Green Energy Enablement Project has a shorter length, this comparative assessment provides a benchmark carbon intensity factor per length and kV, for each PAS 2080 lifecycle stage, to evaluate the likely emissions for Project, because of the similar nature of the scope.

19.7.10 The GHG emissions of this project, together with the capacity of the Project (KVa) and distance of the overhead line (km), have been used to calculate benchmark emissions for the Project, as detailed below in Table 19.13. The benchmark used for the Project is displayed in Table 19.13 below and is estimated to account for 18.4 tCO_2e/KVA/km.

Table 19.13 – Carbon intensity benchmark assessment

PAS 2080 Lifecycle Stage	Total emissions (as reported in the Yorkshire Green Energy Enablement Project) (tCO_2e)	Carbon intensity benchmark factors (derived from the Yorkshire Green Energy Enablement Project), (tCO_2e/KVa/km)
A1-3 Raw materials supply and manufacture	67,150	4.30
A4 Material transport	10,800	0.69
A5 Construction Process (5.1 Pre-construction demolition, 5.2Construction activities, 5.3 Construction waste, 5.4 Worker transport).	29,220	1.87
B1 - Boundary of use stage: installed products and	31,030	1.99

PAS 2080 Lifecycle Stage	Total emissions (as reported in the Yorkshire Green Energy Enablement Project) (tCO_2e)	Carbon intensity benchmark factors (derived from the Yorkshire Green Energy Enablement Project), (tCO_2e/KVa/km)
materials"		
B2-5 Maintenance, Repair, Replacement	64,820	4.16
Total	**282,990**	**18.14**
tCO_2e/km	**7,256.15**	

19.7.11 As seen in Table 19.14 an estimation of the total whole lifecycle GHG emissions (tCO_2e) for the Project is indicated as 468,508 tCO_2e.

19.7.12 As detailed earlier in section 19.4, this assessment involves multiplying the carbon intensity factor derived by the appropriate length and capacity of the Project in order to generate a comparative high-level estimate of the total GHG emissions during the lifecycle of the Project, (with exception to the decommissioning phase). The results of which are identified below in Table 19.14.

19.7.13 The GHG assessment considers the construction phase of the Project is currently anticipated to be 5 years from 2028 to 2031. The operational and maintenance phase is considered from 2032 and beyond until the end of design life, approximated as 80 years, until 2112.

Table 19.14 – High level comparative GHG impact assessment

Project:	Benchmark project: Yorkshire Green Energy Enablement Project	Project: North Humber to High Marnham
Construction GHG emissions (tCO_2e)		
A1-3 Raw materials supply and manufacture	67,150	154,962
A4 Material transport	10,800	24,923
A5 Construction Process *(5.1 Pre-construction demolition, 5.2Construction activities, 5.3 Construction waste, 5.4 Worker transport).*	29,220	67,430

Project:	Benchmark project: Yorkshire Green Energy Enablement Project	Project: North Humber to High Marnham
Operational GHG emissions (tCO_2e)		
B1 - Boundary of use stage: installed products and materials	31,030	71,608
B2-5 Maintenance, Repair, Replacement	64,820	149,584
TOTAL GHG emissions (tCO_2e)	**282,990**	**468,508**

GHG Assessment – construction

19.7.14 The GHG emissions associated with the construction phase of the Project are estimated to be approximately 247,315 tCO_2e. Based on the benchmark project, the majority of these construction phase emissions are likely to be embodied carbon in construction materials, such as for the new and temporary overhead lines, pylons and substations (refer to **Chapter 4 Description** of the Project and **Chapter 20 Substations and Associated Works**). Other construction emission sources are likely to include emissions associated with transport, on-site plant activities, and construction waste.

19.7.15 To contextualise this impact, these estimated construction emissions are compared to the respective UK carbon budgets, which coincide with the construction period. This comparison is presented in Table 19.15. For the sake of this comparison, the estimated construction emissions are assumed to be distributed evenly across the years of the construction period.

Table 19.15 - Comparison of potential construction phase GHG emissions with UK carbon budgets

UK carbon budget period	UK carbon budget $MtCO_2e$	Potential construction emissions ($MtCO_2e$)	Percentage contribution of potential construction emission to the UK carbon budget
Fourth (2023-2027)	1,950	0.049	0.0025%
Fifth (2028-2032)	1,725	0.198	0.011%

19.7.16 The potential GHG emissions related to the operational and maintenance phase of the Project are estimated to contribute less than 0.2% of the respective fourth and fifth UK carbon budgets. In accordance with the IEMA guidance (see Section 1.4), the effect of GHG emissions associated with the construction of the Project is deemed to be not significant, when considering the mitigation measures detailed earlier in Section 19.6.

GHG Assessment – operation and maintenance phase

19.7.17 The operational phase of the Project is currently anticipated to begin in 2031. The GHG emissions associated with the operational phase of the Project is estimated to be approximately 221,192 tCO_2e, assuming a reference lifespan of 80 years. Based on the benchmark project, these emissions are likely associated with maintenance, repair and replacement; electricity and fuel use; transmission losses; and fugitive gases.

19.7.18 To contextualise this impact, these estimated operational emissions are compared to the respective UK carbon budgets, which coincide with the operational period. This comparison is presented in Table 19.16. For the sake of this comparison, the estimated operational emissions are assumed to be distributed evenly across the years of the operational period. To improve the robustness of the assessment and allow for temporal flexibility, the annual operational emissions have also been compared to the sector specific carbon budgets for electricity generation based on the CCC's Balanced Net Zero Pathway, as identified in the Sixth Carbon Budget, (Ref 19.16).

Table 19.16 - Comparison of potential operation phase GHG emissions with overall UK Carbon Budget, as well as sector specific ("electricity generation") carbon budgets

UK Carbon Budget Period	UK Carbon Budget $MtCO_2e$	Potential Operational Emissions ($MtCO_2e$)	Percentage Contribution of Potential Operational and maintenance emissions to the overall UK Carbon Budget (%)
Fifth (2028-2032)	1,725	0.0138	0.0008
Sixth (2033-2037)	965	0.0138	0.0014
Seventh (2038-2042)	526	0.0138	0.0026
Eight (2043- 2047)	195	0.0138	0.0071
Ninth (2048-2050)	17	0.0138	0.0813

19.7.19 The potential GHG emissions related to the operational and maintenance phase of the Project is estimated to contribute to less than 0.1% of each respective UK carbon budget.

19.7.20 To improve the robustness of the assessment and allow for temporal flexibility, the annual operational emissions have also been compared to the sector specific carbon budgets for electricity generation based on the CCC's Balanced Net Zero Pathway, these are detailed below in Table 19.17.

Table 19.17 - Sector specific electricity generation carbon budgets relevant to the operational period of the Project.

UK Carbon Budget Period	UK Sectorial Carbon Budget $MtCO_2e$	Potential Operational Emissions ($MtCO_2e$)	Percentage Contribution of Potential Construction Emission to the UK Carbon Budget
5th (2028-2032)	92,560,000	0.0262	0.0283
6th (2033-2037)	35,740,000	0.0262	0.0734
7th (2039-2042)	23,330,000	0.0262	0.1124
8th (2043- 2047)	12,360,000	0.0262	0.2121
9th (2048-2050)	4,030,000	0.0262	0.6505

Overall GHG impact and significance

19.7.21 The overall significance of GHG emissions in the context of the UK carbon budgets and the national policy environment is assessed below.

19.7.22 As identified earlier in this assessment, the overall estimated GHG emissions of the Project contribute to less than 0.1% of each respective UK carbon budget.

19.7.23 Although the construction and operation of the Project will directly result in increased GHG emissions, to provide context, consideration also needs to be given to its role in wider UK policy to decarbonise the electricity grid. Over its lifetime, the Project will provide a key contribution to the UK, fulfilling its net zero policy and transition away from fossil fuels. By reinforcing the electricity transmission network, the Project will facilitate the connection of new renewable and low-carbon energy generation and transmission. Without Projects such as this, that facilitate the connection of low-carbon energy generation projects to the network, GHG intensity will not decrease as projected, thereby adversely affecting the UK's ability to meet its carbon reduction targets. This statement is consistent with the position taken in paragraph 150 of the Supreme Court Judgement in the case of Finch, on behalf of the Weald Action Group) (Appellant) v Surrey County Council and others (Respondents) (Ref 19.50).

19.7.24 In this there is a need for the relevant planning authority to consider the beneficial indirect effects of a project on the climate, as well as adverse effects, as a material planning consideration: *"Just as beneficial indirect effects of a project on climate - for example, the "green" energy that would be generated by a project to develop a wind farm or solar farm - are clearly a relevant matter for the planning authority to consider, so corresponding adverse effects are also a material planning consideration"* (paragraph 150, Ref 19.50).

19.7.25 It has been estimated that there is the greatest degree of emissions associated with the construction phase of the Project. However, it is anticipated that the potential benefits of improving efficiency and enabling greater renewable energy connections from the Project will far outweigh the associated emissions.

19.7.26 In accordance with the IEMA guidance (see section 19.4), the effect of GHG emissions associated with the Project is deemed to be **minor adverse** and therefore not significant, because the Project's GHG impacts would be fully consistent with applicable existing and emerging policy requirements and good practice design standards for projects of this type. A project with **'not significant'** effects is fully in line with measures necessary to achieve the UK's trajectory towards net zero. The Project will support the ambitions for UK policy to decarbonise the electricity grid and transition to net zero by 2050.

19.7.27 The GHG savings achieved throughout the lifetime of the Project reflect how the increased capacity to be provided by the Project, can provide greater opportunities for future renewable energy connections by way of increasing the capacity of the National electricity transmission system (NETS). In turn this indicates the potential for the Project to support the transition to, and longer-term maintenance of, a low carbon economy.

19.7.28 The GHG calculations presented in this PEIR are based on a benchmark and therefore only a high-level estimate subject to uncertainty. However, the conclusion of the significance level for GHG effects associated with the Project (i.e. **not significant**) is deemed high as per the confidence definitions in section 19.4 of this chapter. Although the GHG numbers are subject to change, when a refined GHG calculation is conducted during environmental statement assessment, the conclusion of significance is not likely to change since the Project still enables decarbonisation of the UK's national electricity transmission grid.

19.7.29 In accordance with the IEMA guidance (Ref 19.34) the effect of GHG emissions associated with the Project is deemed to be not significant, because the Project's GHG impacts would be fully consistent with applicable existing and emerging policy requirements and good practice design standards for projects of this type. A project with no significant effects is fully in line with measures necessary to achieve the UK's trajectory towards net zero. The Project is part of UK policy to decarbonise the electricity grid and transition to net zero by 2050.

19.7.30 Table 19.18 below summarises the preliminary assessment of increased GHG emissions.

Table 19.18 - Preliminary assessment of increased GHG emissions

	Preliminary assessment
Receptor	Global climate
Potential Impact	Initial increase of GHG emissions because of construction and operation however, over its lifetime, the scheme is key in enabling the UK to fulfil its net zero policy and move away from fossil fuels
Project Phase	Construction and Operation
Duration	Entire project lifespan
Mitigation	Several current and proposed mitigation measures are set out in section 19.6 of this report regarding reducing construction and operational emissions.

	Preliminary assessment
Preliminary sensitivity	The sensitivity of the receptor (global climate) to increases in GHG emissions is always defined as high as any additional GHG impacts could compromise the UK's ability to reduce its GHG emissions and therefore meet its future 5-year carbon budgets.
Preliminary magnitude	Construction and operation of the Project will result in GHG emissions. There will be embodied carbon in the materials used for the construction of the Project while fuel use during construction will result in GHG emissions. They will be some GHG emissions arising during the operation of the Project
Preliminary likely significance of effect	In accordance with the IEMA guidance (Ref 19.34) the effect is deemed to be minor adverse and therefore likely deemed to be not significant, because the Project's GHG impacts would be fully consistent with applicable existing and emerging policy requirements and good practice design standards for projects of this type. A project with minor adverse effects is fully in line with measures necessary to achieve the UK's trajectory towards net zero. The Project is part of UK policy to decarbonise the electricity grid and transition to net zero by 2050.
Confidence in prediction	**Medium** confidence level.

Climate Change Risk Assessment

19.7.31 The potential climate risks associated across the construction, and operation and maintenance stages of the Proposed Overhead Line have been recorded in the PEIR **Appendix 19.1 CCRA**, with the results summarised below. The assessment measures the risks on the basis of the likelihood, consequence and significance of its effects to the Project.

19.7.32 Future climate change projections have been examined before commenting on the adequacy of the embedded climate change mitigation measures built into the Project.

Construction effects

19.7.33 The risks assessed as part of the CCRA are available in Table 1.1 in **Appendix 19.1 Climate Change Risk Assessment, CCRA**, many of which are also outlined in **Appendix 4.1 Draft Outline Code of Construction Practice CoCP**.

19.7.34 The CCRA reviewed across the construction phase of the Proposed Overhead Line predominantly covers workforce exposure to dangerous working conditions and damage to physical structures.

19.7.35 Major climatic variables contributing to these risks include but are not limited to increased amounts of extreme weather conditions (e.g., flooding and heatwaves) as well as increased temperatures due to climate change.

19.7.36 During the construction phase under the RCP8.5 scenario, there is likely to be an increase in daily temperatures. Furthermore, under the RCP8.5 it is likely that the

overall rainfall is likely to decrease and lead to more drought risk in Summer. However, Winter rainfall is likely to increase, which could cause greater risks of flooding.

19.7.37 As a result of the embedded climate change mitigation measures highlighted in Section 19.6 and **Appendix 19.1 CCRA**, it is concluded that all climate change risks during the construction phase have been identified to be negligible to low and not significant.

19.7.38 Notable drainage and flooding effects consider measures such as attenuation, surface water runoff in order to minimise flood risk as relevant to the Project location, drainage and flood risk mitigation measures are to be further defined later during full assessment. Such measures to be further considered will include flood resilience measures for infrastructure during construction. As noted in **Appendix 4.1 Draft Outline Code of Construction Practice CoCP,** *the contractor(s) will subscribe to the Environment Agency's Floodline service, which provides advance warning of potential local flooding events, and subscribe to the Met Office's Weather Warnings email alerts system and any other relevant flood warning information. The contractor(s) will implement a suitable flood risk action plan, which will include appropriate evacuation procedures should a flood occur or be forecast*.

Operation and maintenance effects

19.7.39 The risks assessed as part of the Operational and Maintenance phase of the Project are demonstrated in Table 1.1 in **Appendix 19.1 Climate Change Risk Assessment, CCRA**.

19.7.40 The CCRA at the operation and maintenance phase of the Proposed Overhead Line predominantly encapsulates asset damage from extreme weather conditions (e.g., flooding and heatwaves) and changes in annual precipitation and temperatures (decrease in overall rainfall and increase in temperature), as well as workforce exposure to dangerous working conditions (e.g., risks to worker health and safety).

19.7.41 During the operation and maintenance phase under the RCP8.5 scenario (Ref 19.38), it is predicted that there will be an increase in average daily temperatures and an average decrease in the amount of rainfall the Project's location will receive.

19.7.42 Major climatic variables contributing to these risks are temperatures, precipitation and, extreme weather conditions and changes in annual precipitation and temperatures, as well as workforce exposure to dangerous working conditions.

19.7.43 Summary of CCRA as a result of the embedded climate change mitigation measures highlighted above and **Appendix 19.1 Climate Change Risk Assessment, CCRA**, it has been concluded that all climate change risks during the operation and maintenance phase have been identified as negligible to low and **not significant**.

19.7.44 As noted in **Appendix 4.1 Draft Outline Code of Construction Practice CoCP**, various plans are to be produced prior to construction inclusive of a Landscape and Ecological Management Plan (LEMP), a Soil Management Plan (SMP). These plans will help to inform future operational controls, as the plans have long-term implications (e.g., operational drainage, vegetation resilience, soil erosion). As a result, these plans may further support the operational CCRA assessment, which will be updated in the following ES review.

19.7.45 In addition, as noted in **Appendix 4.1 Draft Outline Code of Construction Practice CoCP, '***the contractor(s) will subscribe to the Environment Agency's Floodline service, which provides advance warning of potential local flooding events, and subscribe to the Met Office's Weather Warnings email alerts system and any other relevant flood*

warning information. The contractor(s) will implement a suitable flood risk action plan, which will include appropriate evacuation procedures should a flood occur or be forecast'.

19.7.46 Although climate change projections are subject to uncertainty, the worst-case climate change scenario has been considered to account for this. The conclusion of significance for this CCRA assessment is deemed confidence level Medium.

In-Combination Climate Change Impact Assessment

19.7.47 Potential ICCI's, including the likelihood, consequence, and significance are detailed in **Appendix 19.2 ICCI Assessment**. The results of the ICCI assessment are also summarised in the review of the construction and operation (and maintenance) of the Project.

19.7.48 Inclusive to this assessment, future climate projections have been reviewed, and the sensitivity of receptors to both climate change and the Proposed Overhead Line have been examined before commenting on the adequacy of the climate change resilience measures included in each phase of the Project.

Construction Impacts

19.7.49 Potential ICCI''s with regard to the construction phase of the Project, as well as associated mitigation measures have been assessed and are fully recorded in **Appendix 19.2 ICCI Assessment**, Table 1.1, many of which are also outlined in **Appendix 4.1 Draft Outline Code of Construction Practice CoCP**. The results of the ICCI, are also summarised below:

- Air Quality is to be monitored during construction to mitigate dust impacts, and otherwise using temporary covering for assets, or earlier seeding where this would deliver a benefit.
- The Soil Management Plan to be developed prior to construction is to consider mitigation measures for Soil erosion, surface water runoff and reducing these impacts which may arise as a result of increased precipitation.
- A BNG Assessment is to be undertaken at ES to identify habitat management and vegetation cover.
- Any Attenuation storage required will be designed to take account of climate change and flood risk. Further details are available in **Chapter 11 Water Environment**, and associated Drainage Strategy to be further developed prior to construction.
- Following consultation with other disciplines, the following areas were identified as being aspects of which no significant ICCI's were identified: Ecology; Geology and Hydrogeology; Noise and Vibration; Socioeconomics, Recreation and Tourism; and Traffic and Transport.

19.7.50 Further mitigation measures will be outlined and identified in the production of a SMP and LEMP – all of which are to be developed prior to construction.

Operation and maintenance impacts

19.7.51 Potential ICCI's with regard to the Operation and Maintenance phase of the Proposed Overhead Line, as well as associated embedded mitigation measures have been assessed and are fully recorded in **Appendix 19.2: ICCI Assessment**, Table 1.1.

19.7.52 These results detail the outcome of a review undertaken with each discipline as a part of this PEIR report, and this chapter section provides a summary of these results listed below:

- Air Quality is to be monitored on-site as part of regular maintenance, and otherwise using temporary covering for assets.

19.7.53 The Soil Management Plan (SMP), to be developed prior to construction will consider mitigation measures for Soil erosion, surface water runoff and reducing these impacts which may arise because of increased precipitation. The SMP may also help to inform future operational controls, given long-term implications (e.g., vegetation resilience, soil erosion). As a result, these plans may further support the operational CCRA assessment, which will be updated in the following ES review.

- A Biodiversity Net Gain (BNG) Assessment is to be produced at ES to identify habitat management and maintenance of vegetation cover.
- Any Attenuation storage will be designed to take account of climate change. Further details are available in Chapter 11 Water environment, and associated Drainage Strategy to be further developed at ES.

Summary of ICCI assessment

19.7.54 With review of the embedded mitigation measures outlined in **Appendix 19.2: ICCI Assessment,** the outcome of this assessment presents no significant ICCIs during construction, operation and maintenance phases.

19.7.55 Following consultation with other design discipline leads, some areas were identified as having no significant ICCI's at either phase of the Project. This includes the following disciplines: Ecology; flood risk; Geology and Hydrogeology; Noise and Vibration; Socioeconomics, Recreation and Tourism; and Traffic and Transport.

19.7.56 Although climate change projections are subject to uncertainty, the worst-case climate change scenario has been considered to account for this. The conclusion of significance for this ICCI assessment is deemed a Medium confidence level for this PEIR.

Summary of the Preliminary Assessment of the Proposed Overhead Line with the Proposed Substation Works.

19.7.57 The preliminary assessment of Climate Change Risk Assessment & In Combination Climate Change Assessment for the Proposed Substation Works is presented in **Chapter 20 Substations and Associated Works**. The Lifecycle Greenhouse Gas impact assessment has been presented within this chapter.

19.7.58 Shared receptors between the Proposed Overhead Line and Proposed Substation Works at Birkhill Wood include;

- Existing arable land;
- Dogger Bank Wind Farm Substation;

- existing Creyke Beck Substation;
- existing overhead lines; and
- the wider climate affected environment.

19.7.59 Shared receptors between the Proposed Overhead Line and Proposed Substation Works at High Marnham include;

- Existing arable land;
- existing High Marnham Power Substation;
- existing overhead lines; and
- the wider climate affected environment.

19.7.60 Taking account of the embedded measures set out in **Chapter 4 Description of the Project** and the control and management measures as set out in **Appendix 4.1 Draft Outline Code of Construction Practice CoCP** any potential effects on Climate Change Risk Assessment (CCRA), In Combination Climate Change Assessment (ICCA) or Lifecycle Greenhouse Gas impact assessment from the Proposed Substation Works are not likely to be significant, and, when considered together are unlikely to change the preliminary significance that is presented in this Chapter.

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