Immingham Green Energy Terminal

Environmental Impact Assessment

Preliminary Environmental Information Report

Volume II – Main Report

Chapter 19: Climate Change

Associated British Ports

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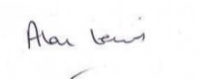
Signed		Date	20/12/2022
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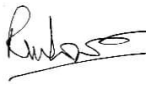
Signed		Date	20/12/2022
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19.1 Introduction

19.1.1 This chapter presents the preliminary findings of the assessment of the likely significant effects of the Project in relation to climate change.

19.1.2 To align with the requirements of the 2017 EIA Regulations (Ref 19-1) and Institute of Environmental Management and Assessment (IEMA) guidance on assessing climate change mitigation (Ref 19-2) and adaptation (Ref 19-3) consideration of climate change effects is covered by the following three aspects:

a. Lifecycle greenhouse gas (GHG) impact assessment - Impact of GHG emissions arising from the Project on the climate, including how it would affect the ability of the UK government to meet its planned carbon reduction targets (19-4).

b. Climate change resilience (CCR) assessment - The resilience of the Project to climate change impacts, including how the design would consider projected impacts of climate change.

c. In-combination climate change impact (ICCI) assessment - The combined impact of the Project and potential climate change on the receiving environment.

19.1.3 The ICCI assessment will be addressed through identification of in-combination climate change impacts in the relevant chapters of the ES, namely:

a. **Chapter 18: Water Quality, Coastal Protection, Flood Risk and Drainage**

19.1.4 When considering the GHG impacts of the Project, consideration has been given in this chapter not only to the direct impacts of the Project – which are assessed - but also to the Project in the wider context of its role in helping to meet the UK's target to achieve net zero emissions by 2050. The Project is anticipated to produce 300 MW of green hydrogen per annum, once fully operational at full capacity, the equivalent of up to 9.5 billion MJ per annum. Depending on market demand, it is estimated that this will meet up to 3% of Government's hydrogen production capacity target.

19.1.5 Based on these assumptions the hydrogen produced by the Project could reduce annual emissions of CO_2 associated with HGV truck movements by up to 578,000 tonnes per year from 2030 as a result of fuel switching from diesel to hydrogen.

19.1.6 There are no figures or appendices associated with this chapter.

19.2 Approach to Assessment

Scope and Methods

19.2.1 A scoping exercise was undertaken in August 2022 to establish the form and nature of the climate change assessment, and the approach and methods to be followed.

19.2.2 The Scoping Report (**Appendix 1.A** of the PEI Report, Volume IV) records the findings of the scoping exercise and details the technical guidance, standards, best practice and criteria being applied in the assessment to identify and evaluate the likely significant effects of the Project on climate change.

19.2.3 Following receipt of the Scoping Opinion (**Appendix 1.B** of the PEI Report, Volume IV) as to the information to be provided in the Environmental Statement (ES), the requirements set out in **Table 19.1** have been agreed with the Planning Inspectorate to be taken into account as part of the ongoing climate change assessment.

Table 19.1 Scoping opinion comments on climate change

Consultee	Summary of Response	How comments have been addressed in this chapter
Planning Inspectorate	The Scoping Report proposes to scope out GHG emissions arising from operational maintenance activities on the grounds that emissions from maintenance works are likely to be minimal in relation to the overall GHG emissions from the Proposed Development. However, the Scoping Report does not provide any supporting evidence for this statement. In the absence of such evidence, and particularly given the uncertainty around dredging requirements, Inspectorate is not in a position to agree to scope these matters from the assessment. Accordingly, the ES should include an assessment of these matters or further justification that the works are likely to give rise to minimal GHG emissions.	Emissions from operational maintenance works will be considered in the GHG assessment. (**Table 19.3**) Note the GHG assessment has considered the seven Kyoto Protocol gases: Carbon dioxide (CO_2), Methane (CH_4), Nitrous oxide (N2O), Sulphur hexafluoride (SF_6), Hydrofluorocarbons (HFCs), Perfluorocarbons (PFCs); and Nitrogen Trifluoride (NF_3).
	The Scoping Report proposes to scope out the impacts of wind from both the climate change resilience (CCR) assessment and the in-combination climate change impact (ICCI) assessment, on the basis that there is no evidence to suggest that climate change is increasing high wind events (referencing the Met Office (2020) State of the UK Climate report). The Inspectorate notes that Environment Agency guidance (2021) Refineries and fuel: examples for your adapting	Mitigation measures against wind storms have been included in this assessment (see **Table 19.18**)

Consultee	Summary of Response	How comments have been addressed in this chapter
	to climate change risk assessment, specifically considers wind stating *"there is risk to: jetties with higher sideways loadings due to wave and wind action"*. In light of this guidance and in absence of agreement with the relevant statutory body, the Inspectorate is not in a position to agree to scope this matter from the assessment.	
	The ES should state which emissions scenario will be applied from the UK Climate Projection 2018 (UKCP18) data as this is not currently clear from the Scoping Report. The ES should be based on up-to-date climate projections at the point of submission.	This has been explicitly stated in the assessment (see **Paragraph 19.3.10**).
	The transportation and disposal of waste is listed as source of emissions but dredging and disposal of dredged material is not explicitly included within this. The ES should consider emissions from these activities.	Data to calculate emissions from dredging was not available for the PEI Report assessment. It will be updated for the GHG assessment for the Environmental Statement.
Environment Agency	Paragraph 18.3.7 advises that wind change has been ruled out for the climate change resilience review. Environment Agency guidance on climate change adaption for refineries specifically considers wind stating *"there is risk to: jetties with higher sideways loadings due to wave and wind action".* Accordingly, we would suggest it may be relevant to scope in this issue.	Mitigation measures against wind storms have been included in this assessment (see **Table 19.16**).
	The Applicant may also find it useful to refer to government guidance on Adapting to climate change: industry sector examples for your risk assessment - GOV.UK (www.gov.uk), with specific consideration to the guidance for the 'Chemical' and 'refineries and fuel' sectors, as the closest relevant sectors.	This has been reviewed, and any relevant guidance included in this assessment.

Consultee	Summary of Response	How comments have been addressed in this chapter
	We would also ask that the EIA is clear about which emissions scenario will be used from the UKCP18 data as this is not currently clear from the Scoping Report	This has been explicitly stated in the assessment (see **Paragraph 19.3.10**).

Legislation, Policy and Guidance

19.2.4 **Table 19.2** presents the legislation, policy and guidance relevant to the climate change assessment and details how their requirements will be met.

Table 19.2 Relevant legislation, policy and guidance regarding climate change

Legislation / Policy / Guidance	Consideration within the PEI Report
United Nations Framework Convention on Climate Change Paris Agreement (Ref 19-5)	
The Framework requires all signatories to strengthen their climate change mitigation efforts to keep global warming to below 2°C this century and to pursue efforts to limit global warming to 1.5°C.	Since its withdrawal from the EU, the UK Government declares its own Nationally Determined Contribution (NDC) setting out its climate change obligations under the Paris Agreement and the climate change target and budgets set under the Climate Change Act 2008 (Ref 19-6). **Section 19.6** presents an assessment to identify the impact of the Project on the UK meeting its climate change target and five-yearly carbon budgets. In support of this the embedded and additional mitigation measures of the Project are set out in the **Section 19.5**.
Climate Change Act 2008 and **Climate Change Act (2050 Target Amendment) Order 2019** (Ref 19-6)	
The Climate Act 2008 was 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). This target is supported by a system of legally binding five-year 'carbon budgets' and an independent body, the Committee on Climate Change (CCC), is to advise on budgets and monitor progress. The UK carbon budgets restrict the amount of GHG emissions the UK can legally emit in a defined five-year period. The 6th Carbon Budget (Ref 19-7) is the first budget to reflect the amended trajectory to Net Zero by 2050 and came into force in June 2021.	An objective of the Project is to deliver the port infrastructure needed to support the future transportation of bulk liquids associated with the energy sector that would support the transition to net zero. The new jetty would further support sustainable development by providing additional capacity for the development of the renewable energy and carbon capture sectors. An assessment of the impact of the Project against the Government's carbon target and budgets is set out in **Section19.6**. Embedded and good practice mitigation measures have been identified in **Section 19.5**.

Legislation / Policy / Guidance	Consideration within the PEI Report
The Infrastructure Planning (Environmental Impact Assessment) Regulations ('the EIA Regulations') (Ref 19-8)	
The EIA Regulations state that an EIA (where relevant): *"must include a description of the likely significant effects of the development on the environment resulting from… the impact of the project on climate (for example the nature and magnitude of greenhouse gas emissions) and the vulnerability of the project to climate change".*	Likely significant effects as a result of the vulnerability of the Project to climate change, following the inclusion of embedded and good practice mitigation measures, are presented in **Sections 19.6** and **19.7**. Likely significant effects on the climate as a result of the Project are assessed in **Section 19.6**.
The National Policy Statement for Ports (NPSfP) (Ref 19-9)	
The NPSfP is one of a number of national policy statements (NPS) established under the 2008 Act (Ref 19-6) to deal with different NSIPs. It provides the framework for decisions on proposals for harbour facility NSIPs and is the relevant NPS for determining the IGET application. It states that: *"information sought from applicants should be proportionate to the scale of proposed development and associated impacts, including its likely impact on and vulnerability to climate change, as well as all other aspects of conformity with this NPS".*	The climate change assessment presented in this chapter considers impact of GHG emissions arising from the Project on the climate, and the resilience of the Project to climate change impacts which are presented in **Section 19.6**.
The National Planning Policy Framework (NPFF) (Ref 19-10)	
The Framework sets out the Government's planning policies for England. While the NPPF does not set specific policies for Nationally Significant Infrastructure Projects (NSIP), its policies may be of relevance to the decision-making process. Policies of relevance to climate change and sustainability assessment include those aimed at achieving sustainable development and meeting the challenge of moving to a low carbon economy, climate change, flooding and coastal change. The NPPF states that the planning system should support this transition by supporting low carbon energy and associated infrastructure.	The GHG emissions methodology and assessment described in the Scoping Report (**Appendix 1.A** of the PEI Report, Volume IV) respectively have been developed in line with the NPPF guidance. Mitigation measures to minimise and mitigate the impacts of GHG emissions on climate change from the Project and embedded adaptation measures to minimise effects of climate change are set out in **Section 19.5**.
National Planning Policy Guidance on Climate Change (Ref 19-11)	
The guidance describes how to identify suitable mitigation and climate adaptation measures to incorporate into the planning process, stating that: *"Effective spatial planning is an important part of a successful response to climate change as it can influence the emission of greenhouse gases…*	The guidance sets climate change allowances to be included in flood risk assessments, which have been considered as part of the design as outlined in **Section 19.5**.

Legislation / Policy / Guidance	Consideration within the PEI Report
Planning can also help increase resilience to climate change impact through the location, mix and design of development."	
Our Green Future: Our 25-year Plan to Improve the Environment (Ref 19-20)	
The plan sets out the Government proposed action to help the natural world regain and retain good health. It aims to deliver cleaner air and water in our cities and rural landscapes, protect threatened species and provide richer wildlife habitats.	Embedded adaptation measures to minimise effects of climate change are set out in **Section 19.5**.
Decarbonising Transport: A Better Greener Britain (Ref 19-12)	
The plan sets out the Government's commitments and actions needed to decarbonise the transport system in the UK before 2050. The plan proposes to plot a course to net zero for the UK domestic maritime sector, with indicative targets from 2030 and net-zero as early as is feasible – public consultation is planned in 2022, followed by strategy 'Course to Zero'; there is also a planned review and refresh of Clean Maritime Plan.	The objective of the Project is to deliver the port infrastructure needed to support the future transportation of liquid bulks associated with the energy sector that would support the transition to net zero. The new jetty would further support sustainable development by providing additional capacity for the development of the renewable energy and carbon capture sectors. Mitigation measures to minimise and mitigate the impacts of GHG emissions on climate change from the Project and embedded adaptation measures to minimise effects of climate change are set out in **Section 19.5**.
North East Lincolnshire Council (NELC) Environmental Policy Statement (Ref 19-13)	
The statement sets out NELC's priorities in taking action towards consuming resources more efficiently, eliminating waste and supporting & developing the green economy & infrastructure, including a commitment to support environmentally responsive local economic growth.	The Project supports the priorities of developing the green economy and infrastructure. It responds to the requirements set out in policy SO2 Climate Change in the NELC Plan which requires development to address the causes and effects of climate change for example by minimising energy and natural resource use and encouraging opportunities for sustainable transport. Mitigation measures to minimise and mitigate the impacts of GHG emissions on climate change from the Project and embedded adaptation measures to minimise effects of climate change are set out in **Section 19.5**.
North East Lincolnshire Council (NELC) Carbon Roadmap (Ref 19-14)	
The roadmap sets out how the Council plans to achieve its aim to cut its carbon emissions to net zero by 2040 and for North East Lincolnshire to be carbon net zero by 2050.	Mitigation measures incorporated into the Project design, construction and operation to minimise and mitigate the impacts of GHG emissions on climate change from the Project are set out in **Section 19.5**.

Legislation / Policy / Guidance	Consideration within the PEI Report
North East Lincolnshire Council (NELC) Natural Assets Plan (Ref 19-15)	
The plan sets out how the Council and its partners can improve the area's unique natural environment for the benefit of everyone. The plan sets out eight areas that the Council wants to focus on that will help to adapt and mitigate effects of climate change.	Embedded adaptation measures to minimise effects of climate change are set out in **Section 19.5**. Measures to address the eight areas of the plan are still under consideration and will be updated in the Environmental Statement. In relation to 'biodiversity and special sites' a Habitats Regulations Assessment for impacts on the Humber Estuary European Marine Site is being undertaken see **Chapter 9: Nature Conservation (Marine Ecology)**. Measures to address Water Management are covered in **Chapter 18: Water Quality, Coastal Protection, Flood Risk and Drainage.**
IEMA: Environmental Impact Assessment Guide to: Assessing Greenhouse Gas Emissions and Evaluating their Significance (Ref 19-2)	
The guidance aids with the identification, assessment and subsequent mitigation of life cycle impacts of GHG emissions throughout the Environmental Impact Assessment (EIA) process.	The approach to assessing the significance of GHG emissions from construction and operation of the Project has been undertaken in accordance with this guidance.
IEMA: Environmental Impact Assessment Guide to: Climate Change Resilience and Adaptation (Ref 19-3)	
The guidance aids with the assessing of the impacts of climate change within project design.	The approach for assessing the significance of climate change risks on the Project has been undertaken in accordance with this guidance.

Limitations and Assumptions

19.2.5 The information presented in this preliminary assessment reflects that obtained and evaluated at the time of reporting and is based on an emerging design for the Project and the maximum likely extents of land required for its construction and operation to define a reasonable worst case for assessment.

19.2.6 The findings of this preliminary assessment may be subject to change as the design of the Project is developed and refined further through the assessment and consultation processes, and as further research and investigative surveys are completed to fully understand its potential effects.

Study Area

19.2.7 The Study Area for the Lifecycle GHG impact assessment includes:

a. Direct GHG emissions arising within the Site boundary; and

b. Indirect GHG emissions occurring offsite such as embodied carbon in construction materials. It is not known where the materials are sourced therefore this could be global.

19.2.8 The Study Area for the CCR assessment comprises the Site boundary (temporary and completed works).

19.2.9 The Study Area for the ICCI assessment will be set out in the ES.

Assessment Methodology GHG Assessment

Methodology for Determining Baseline Conditions and Sensitive Receptors

19.2.10 The receptor for GHG emissions is the global climate as the effects of GHG emissions are not geographically constrained. All GHG emissions have the potential to result in a cumulative effect in the atmosphere.

19.2.11 For the GHG assessment, the current and future baseline is the 'business as usual' scenario where the Project is not implemented. The baseline typically considers the GHG emissions from the existing site operations and the existing carbon stock within the soil and the above- and below-ground vegetation within the Site. The Site description in **Chapter 2: The Project** has been used to determine the baseline conditions.

Methodology for Determining Demolition, Construction and Operation Effects

19.2.12 The assessment has adopted a project lifecycle approach to identify 'hot spots' of GHG emissions (i.e. the project stage(s) likely to generate the largest amount of GHG emissions) and enable priority areas for mitigation to be identified. This approach is consistent with the principles set out in IEMA guidance (Ref 19-2) and PAS: 2080 (Ref 19-18).

19.2.13 In line with the World Resources Institute (WRI) and World Business Council for Sustainable Development (WBCSD) GHG Protocol guidelines (Ref 19-20), the lifecycle GHG impact assessment has been reported as tonnes of carbon dioxide equivalent (tCO_2e) and has considered the seven Kyoto Protocol gases:

i. Carbon dioxide (CO_2);
ii. Methane (CH_4);
iii. Nitrous oxide (N_2O);
iv. Sulphur hexafluoride (SF_6);
v. Hydrofluorocarbons (HFCs);
vi. Perfluorocarbons (PFCs); and
vii. Nitrogen Trifluoride (NF_3).

19.2.14 Expected GHG emissions arising from site preparation and construction activities, embodied carbon in materials and operational emissions of the Project have been quantified using a calculation-based methodology as per the following equation and aligned with the GHG Protocol (Ref 19-20):

Activity data x GHG emissions factor = GHG emissions

19.2.15 A set of standard data quality principles have been applied so that the results from the GHG assessment are as accurate and representative as possible. This has included the selection of emission factors that are representative of the UK

construction industry. GHG activity data has been gathered directly from the Project's engineering and design teams to enable consistency and completeness of data collection.

19.2.16 The Department for Business, Energy and Industry Strategy (BEIS) 2022 emissions factors (Ref 19-21) and embodied carbon data from the Inventory of Carbon and Energy V3.0 (ICE) (Ref 19-22) have been used as the source of emissions factors for calculating GHG emissions. The resulting carbon footprint has been compared to the existing baseline condition, details of which are provided in **Section 19.3**, to identify the impact of the Project.

19.2.17 Where GHG activity data was unavailable, assumptions and estimations have been developed. Any assumptions, inclusions and exclusions that inform the GHG emissions calculation have been clearly described in the sections below.

19.2.18 In order to assess the potential impacts of GHG emissions arising from the Project, likely activities have been identified and their associated GHG emissions sources have been estimated. Potential activities related to the Project that could cause GHG emission impacts are presented in **Table 19.3**.

Table 19.3 Potential sources of GHG emissions

Lifecycle Stage	Activity	Primary Emission Sources
Pre-construction	On-site pre-construction activity i.e., enabling works, etc.;	GHG emissions from fuel consumption by construction plant and vehicles, generators on-site, and worker commuting
	Transportation and disposal of earthworks/ waste	GHG emissions from transportation and disposal of earthworks/ pre-construction waste
	Land clearance	GHG emissions associated with the loss of carbon stock
Product manufacture	Raw material extraction and manufacturing of products/ materials	Embodied GHG emissions associated with product and material manufacture
	Transport of products/ materials to Site	GHG emissions from fuel consumption of transportation of products and materials to Site
Construction	On-site construction activity	Energy (electricity, fuel, etc.) consumption from plant and vehicles, generators on-site, and material consumption
	Transport of construction workers	Energy (electricity, fuel, etc.) consumption from worker commuting

Lifecycle Stage	Activity	Primary Emission Sources
	Transportation and disposal of earthworks/ waste	GHG emissions from transportation and disposal/treatment of earthworks/ construction waste/. This includes vessel movements associated with dredging and waste disposal in the marine environment.
Operations	Operation of the Project	GHG emissions from energy use, process operations, additional traffic, provision of potable water, and treatment of wastewater
	Transportation and disposal of waste	GHG emissions from transportation and disposal of waste
	Building and grounds maintenance /maintenance of marine environment	GHG emissions associated with replacement materials/products. This includes vessel movements associated with dredging and waste disposal in the marine environment.
	Emissions displacement	Avoided or displaced emissions through use of any renewable energy systems or offsetting
	Landscaping	Changes in GHG emissions/sinks from landscaping and re-vegetation
Decommissioning (of the hydrogen production facility)	Removal and or renewal of the hydrogen production facility part of the Project	GHG emissions arising from fuel consumption for plant and vehicles and disposal of materials.

Lifecycle GHG Impact Assessment Significance Criteria

Sensitivity of receptor

19.2.19 The sensitivity of the climate to GHG emissions is considered to be ‘high’. The rationale is as follows:

a. GHG emission impacts could compromise the UK’s ability to reduce its GHG emissions and therefore the ability to meet its future legally binding carbon budgets;

b. The importance of limiting global warming to below 2 °C above industrial levels, while pursuing efforts to limit such warming to 1.5 °C as set out in the Paris Agreement (Ref 19-23) and a recent report by the Intergovernmental Panel on Climate Change (IPCC) (Ref 19-24) highlighted the importance of limiting global warming below 1.5 °C; and

c. Disruption to the global climate is already having diverse and wide-ranging impacts to the environment, society, economic and natural resources. Known effects of climate change include increased frequency and duration of extreme weather events, temperature changes, rainfall and flooding, and sea level rise and ocean acidification. These effects are largely accepted to be negative, profound, global, likely, long-term to permanent, and are transboundary and cumulative from many global actions.

Magnitude of impact

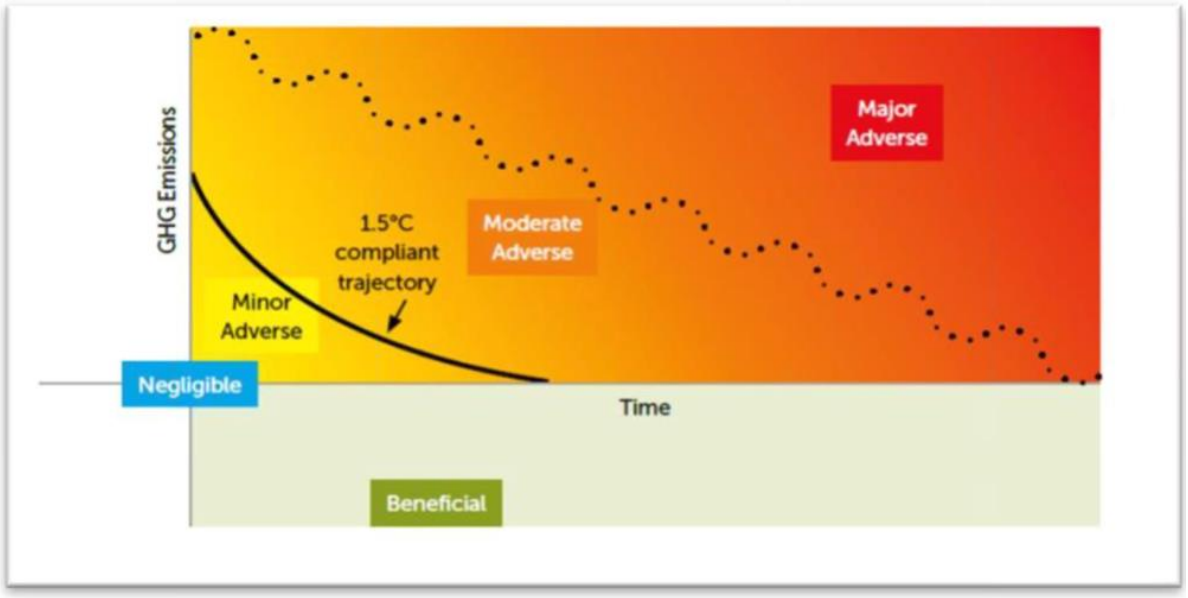
19.2.20 On 28th February 2022, IEMA (Ref 19-2) published a revision of the 2017 IEMA guidance on Assessing Greenhouse Gas Emissions and Evaluating their Significance. The revision of the guidance has been driven by changes arising from legislation and policy since 2017.

19.2.21 IEMA's publication provides updated and improved guidance, developed by leading practitioners from the past five years of practice on complex projects. The guidance builds on the previous IEMA guidance and reinforces the need to use competent experts for specialist topics such as GHG assessment.

19.2.22 In the revised guidance, mitigation is no longer an element to be considered towards the later stage of EIA process. Instead, mitigation should be considered from the outset and throughout the project's lifetime whilst also helping to deliver proportionate EIAs. Once the magnitude of emissions has been determined, mitigation measures should be proposed. Any mitigation measures that are committed to within a proposed development need to be included within the assessment.

19.2.23 The updated guidance describes five distinct levels of significance which are not solely based on whether a project emits GHG emissions, but also how the project makes a relative contribution towards achieving a science-based 1.5°C aligned transition towards net zero. The different levels of significance are plotted against the UK's net zero compatible trajectory as presented in **Plate 19-1** to determine the Project’s significance.

Plate 19-1 Different levels of significance plotted against the UK's net zero compatible trajectory



19.2.24 **Table 19.4** presents the different significance levels as per the latest version of IEMA guidance. The guidance emphasises that *"a project that follows* a *'business-as-usual' or 'do minimum' approach and is not compatible with the UK's net zero trajectory, or accepted aligned practice or area-based transition targets, results in a significant adverse effect. It is down to the practitioner to differentiate between the 'level' of significant adverse effects e.g. '**moderate'** or '**major'** adverse effects."* Moderate and Major adverse impacts are considered to be significant, while all other significance levels are deemed to be not significant.

19.2.25 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.

19.2.26 A project's impact can shift from significant adverse to non-significant effects by incorporating mitigation measures that substantially improve on business-as-usual and meet or exceed the science-based emissions trajectory of ongoing but declining emissions towards net zero.

Table 19.4 Definition of levels of significance (Ref 19-2)

Effects	Significance Level	Description	Example in the guidance
Significant adverse	Major adverse	A project that follows a 'business-as-usual' or 'do minimum' approach and is not compatible with the UK's net zero	The project's GHG impacts are not mitigated or are only compliant with do-minimum standards set

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

Effects	Significance Level	Description	Example in the guidance
		reduction by 2035 and thereby potentially avoiding significant adverse effects.	
	Negligible	A project that achieves emissions mitigation that goes substantially beyond the reduction trajectory, or substantially beyond existing and emerging policy compatible with that trajectory and has minimal residual emissions. This project is playing a part in achieving the rate of transition required by nationally set policy commitments.	The project's GHG impacts would be reduced through measures that go well beyond existing and emerging policy and design standards for projects of this type, such that radical decarbonisation or net zero is achieved well before 2050. A project with negligible effects provides GHG performance that is well 'ahead of the curve' for the trajectory towards net zero and has minimal residual emissions.
Beneficial	Beneficial	A project that causes GHG emissions to be avoided or removed from the atmosphere. Only projects that actively reverse (rather than only reduce) the risk of severe climate change can be judged as having a beneficial effect.	The project's net GHG impacts are below zero and it causes a reduction in atmospheric GHG concentration, whether directly or indirectly, compared to the without-project baseline. A project with beneficial effects substantially exceeds net zero requirements with a positive climate impact.

19.2.27 As noted previously, it is down to the practitioner's professional judgement on how best to contextualise a project's GHG impact. In GHG accounting, it is considered good practice to contextualise emissions against pre-determined carbon budgets. The UK has defined national carbon budgets, which have been determined as being compatible with net zero and international climate commitments.

19.2.28 To assess the impact of GHG emissions from the Project, the UK carbon budgets (Ref 19-25) have been used as a proxy for the climate (**Table 19.5**). As this is a NSIP, placing the Project into this context is deemed appropriate. UK carbon

budgets are in place to restrict the amount of GHG emissions the UK can legally emit in a five-year period. The UK is currently in the 3rd carbon budget period, which runs from 2018 to 2022. The 3rd, 4th and 5th Carbon Budgets reflect the previous 80% reduction target by 2050. The 6th carbon budget aligns with the legislated 2050 net zero commitment.

19.2.29 To put future emissions from the Project into context with UK's trajectory to net zero by 2050, the Climate Change Committee's (CCC) balanced net zero pathway is utilised post-2037, in the absence of any nationally legally binding Carbon Budgets after the subsequent 6th Carbon Budget.

19.2.30 The CCC balanced net-zero pathway is divided into 5-year periods post-2037 to match the previous six legally binding UK National Carbon Budgets. The proposed Carbon Budget periods derived from the net-zero pathway encompass the 7th, 8th and 9th indicative budget periods up to 2050 in line with the UK's 1.5-degree trajectory as detailed in **Table 19.5**.

19.2.31 However, it should be noted that the supplementary Carbon Budgets beyond 2037 have not been formally adopted by the Government or ratified by parliament and can only be used as an indicative measure to contextualise the Project's progress compared to the national net-zero trajectory.

19.2.32 While national carbon budgets can provide context on the scale of the Project's GHG emissions, this assessment appraises significance of effects based on the combined measures of embedded mitigation, the emissions trajectory, and policy alignment of the Project (**Table 19.10**).

Table 19.5: UK Carbon Budgets and indicative UK carbon budgets based upon the CCC's balanced net-zero pathway

Carbon budget	UK Carbon Budget ($MtCO_2e$)	Indicative Carbon Budgets based upon the CCC's balanced net-zero pathway ($MtCO_2e$)
3rd (2018-2022)	2,544	-
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

Limitations of the Lifecycle GHG Impact Assessment

19.2.33 The information gathered to date is considered sufficient to provide the basis for an EIA. However, the assessment has taken into consideration assumptions and

limitations, as outlined in **Table 19.6**. For each limitation, an explanation of the possible impact of the limitation has been provided, as well as a description of any corrective actions that will be taken to adjust for any limitations.

Table 19.6 Limitations within the Lifecycle GHG Impact Assessment

Limitation	Impact of limitation	Correction for limitation
The GHG impact assessment is taking place before detailed design is completed and construction has begun. There will be some uncertainty regarding the types and quantities of materials to be used in construction, which will require assumptions to be agreed.	The construction emissions estimate may not reflect the final detailed design. Planning for the construction phase will continue to develop, and some items may not be included within the final data, which will be used for the assessment presented in the ES.	Some items may not be included within the assessment if these materials and their volumes have not been quantified at this stage of the design process. However, professional judgement and a precautionary approach to emissions quantification has been used.
There is currently no specific guidance specifying a quantified threshold of carbon emissions, which if exceeded, is considered significant.	Assessment of significance of emissions cannot be judged objectively.	The assessment has used a combination of approaches. The GHG emissions will be put into context using the national carbon budgets. In addition to this, using the latest version of IEMA guidance (Ref 19-2) the significance of emissions will be assessed based on "*whether the Proposed Development contributes to reducing GHG emissions relative to a comparable baseline consistent with a trajectory towards net zero by 2050"*.

19.2.34 Some details of the construction methodology of the Project have not been finalised at this stage. As a result, some data is not available to provide a fully quantified assessment of the GHG emissions from the enabling / construction and operation of the Project. Accordingly, appropriate industry estimates and averages have been used for the purposes of this preliminary assessment, all of which are detailed below. These preliminary values will be reviewed and updated accordingly in the ES.

19.2.35 Data was not available for the enabling works and construction works separately. Instead, the GHG emissions presented represent both the enabling and construction work phases.

Assumptions made in the Lifecycle GHG Impact Assessment

19.2.36 The following assumptions, inclusions and exclusions, made on a precautionary basis, have been used in the calculation of GHG emissions for the enabling works and construction phase:

a. Materials quantities were provided by the design team to inform the quantified GHG assessment for the Project. Included in these quantities were a number of assumptions (e.g., mileage incurred by worker transport, energy usage for buildings) which were incorporated into the GHG assessment. These assumptions were based on the design information at the time this assessment was undertaken.

   i. The assumed distance for worker transport for the jetty construction is 50km round-trip per worker. Assumptions for worker transport for the hydrogen production facility have been made in respect of total number of workers per phase, local-non-local split, distance travelled; it is assumed all transport for all workers would be by an average petrol car.

   ii. The assumption for operational workers commuting is that half of workers would be local (25 miles round-trip) and half would be distant (50 miles round trip). Transportation mode is assumed to be by an average petrol car.

   iii. The central assumption for shipping transport is that the total annual volume of imports would be the jetty capacity of approximately 15,000,000 tonnes. For the purposes of this assessment and based on the likely import and re-export profiles for Air Products, it is assumed in this assessment that imports would be from three origins (Saudi Arabia, Oman, and Rotterdam) with domestic (UK) re-export likely to occur to three port destinations (Teesport, Port Talbot, Cardiff) with an assumed 5,000,000 re-exported to the furthest distance port (Cardiff). All distances travelled are assumed as one-way only, with ship fuel type assumed as Liquefied Petroleum Gas. The future origins and destinations are however likely to vary substantially based on individual future jetty users and their patterns of operation and this will be further considered in the ES, if more information on future users becomes available.

   iv. Road transport: assumptions are based on the distance construction materials are likely to be transported to the site on estimates provided by Air Products. Specific distances were provided for different types of materials ranging from 10km (e.g. pipe supports, gravel) to 3000km (shipping equipment).

b. These assumptions will be revisited and reported within the ES as the design of the Project develops.

Assessment Methodology CCR Assessment

Methodology for Determining Baseline Conditions and Sensitive Receptors

19.2.37 The receptor for the CCR review is the Project itself, including workers and infrastructure.

19.2.38 The current baseline has been established by understanding the historic/current climate in the location of the Project by reviewing climate data obtained from the Met Office website. The climate baseline has been developed using Met Office

data obtained from a meteorological station closest to the Site (Cleethorpes) (Ref 19-16).

19.2.39 The future baseline has been established using 2018 United Kingdom Climate Change Projections (UKCP18) (Ref 19-19). UKCP18 data for the 25km grid cell where the Project is located have been used to examine future climate parameters. This climate projection data provides a probabilistic indication of how global climate change is likely to affect the site of the Project using defined climate variables and time periods.

Methodology for Determining Demolition, Construction and Operation Effects

19.2.40 Climate parameters to be considered in the CCR assessment during the demolition, construction and operation of the Project include the following:

a. Extreme weather events;
   i. Flood risk;
   ii. Sea level rise (SLR);
   iii. Temperature change; and
   iv. Rainfall change.

19.2.41 The CCR assessment has qualitatively reviewed the Project resilience to climate change considering the UKCP18 projections (Ref 19-17) for the geographical location and timeframe of the Project (including demolition, construction and operation).

19.2.42 The CCR assessment has been undertaken for the Project to identify potential climate change impacts on the Project and associated receptors, and to consider their potential consequence and likelihood of occurrence, taking account of the measures incorporated into the design of the Project.

19.2.43 Climate change projections for the Site during the enabling works and construction phase have been examined against receptors during this stage. Construction phase receptors of the Project include the workforce, plant, machinery and materials.

19.2.44 As the enabling works and construction phase is relatively short from a climatic perspective and is expected to occur in the immediate future, it is not anticipated that there will be any significant impacts during the enabling works and construction, the CCR review therefore focusses on the operational phase.

19.2.45 For the operational phase of the Project, potential climate change impacts have been identified using relevant projections from UKCP18 and the CCR assessment considers their potential consequence to receptors and likelihood of occurrence, taking account of the measures incorporated into the design of the Project. Receptors when the Project is complete may include the Project assets and their operation, maintenance and refurbishment.

19.2.46 The following key terms and definitions relating to the CCR assessment have been used:

a. Climate hazard – a weather or climate related event, which has potential to do harm to environmental or community receptors or assets, for example, increased winter precipitation;

b. 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

c. Consequence – any effect on the receptor or asset resulting from the climate hazard having an impact.

19.2.47 A stepped approach is used to assess the impacts of climate change on the Project.

a. Identify climate hazard;

b. Identify likelihood of climate impact occurring;

c. Identify consequence of impact on the Project; and

d. Identify significance of impact (likelihood of impact occurring x consequence of impact).

19.2.48 Potential climate hazards are identified based on data extracted from UKCP18 for the climate parameters identified in **Paragraph 19.2.40**.

19.2.49 The criteria which have been used to determine the likelihood of a climate change hazard occurring are detailed in **Table 19.7** and **Table 19.8.** The event is defined as the climate event (such as heatwave), while the hazard is defined as an impact on the Project caused by the climate event (such as overheated electrical equipment).

Table 19.7 Probability of Likelihood of Climate Change Hazard Occurring

Likelihood of event	Description (probability of occurrence)
High	90-100% probability that the hazard will occur.
Moderate	33-90% probability that the hazard will occur.
Low	10-33% probability that the hazard will occur.
Negligible	0-10% probability that the hazard will occur.

Table 19.8 Description for the likelihood of the climate-related impact occurring

Likelihood category	Description
High	Likelihood of climate hazard occurring is high and impact is always/ almost always going to occur.
Moderate	Likelihood of climate hazard occurring is moderate and impact of the climate hazard is as unlikely as it is likely to occur.
Low	Likelihood of climate hazard occurring is low, impact rarely occurs.

Likelihood category	Description
Negligible	All other eventualities - highly unlikely but theoretically possible.

19.1.50 Following identification of the likelihood of the climate impact occurring, the consequences of the impact have been assessed according to **Table 19.9.** The categories and descriptions provided below are based on the IEMA climate change resilience and adaptation guidance (Ref 19-3).

19.1.51 The PEI Report presents mitigation measures (based on those identified by each technical discipline) to demonstrate how the Project will be adapted to increase its resilience to future climate conditions.

Table 19.9 Description of consequences

Consequence of impact	Description
High	Significant disruption to construction and operations, unable to deliver services, resulting in high financial losses.
Moderate	Disruption to construction and operations and ability to deliver services, resulting in some financial losses/ cost implications.
Low	Minor disruption to construction and operations but does not significantly impact ability to deliver services.
Negligible	Negligible disruption to construction and operations, does not impact ability to deliver services.

CCR Assessment Significance Criteria

19.1.52 The CCR Review has assessed the significance of effects by evaluating the combination of the likelihood of the climate-related impact occurring, and the consequence, as per the risk assessment matrix in **Table 19.10**. The assessment has taken into account confirmed design and mitigation measures (referred to as embedded mitigation).

19.1.53 Following identification of climate hazards, the likelihood and consequences have been assessed according to **Table 19.8** and **Table 19.9** respectively. The categories and descriptions provided below are based on the IEMA climate change resilience and adaptation guidance (Ref 19-3).

Table 19.10 Significance of effect matrix (where 'S' is significant and 'NS' is not significant)

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

Limitations of the Lifecycle CCR Assessment

19.1.54 The information gathered to date is considered sufficient to provide the basis for an EIA. However, the assessment has taken into consideration assumptions and limitations, as outlined in **Table 19.11**. For each limitation, an explanation of the possible impact of the limitation has been provided, as well as a description of any corrective actions that will be taken to adjust for any limitations.

Table 19.11 Limitations within the CCR Assessment

Limitation	Impact of limitation	Correction for limitation
The CCR assessment is taking place before detailed design is completed and construction has begun. There will be some uncertainty regarding the selection of materials and design to be used for the Project, which will require assumptions to be agreed.	A full assessment based on final designs will not be possible for the PEIR. However, it is possible to consider the impacts of climate change taking into account the location and type of Project.	The impact of climate change on the Project will continue to be evaluated as the design progresses. The climate resilience assessment will be updated for the final assessment presented in the ES.

19.1.55 Data was not available for the enabling works and construction works separately. Instead, the CCR emissions presented represent both the enabling and construction work phases.

19.2 Baseline Conditions

Current Baseline

Lifecycle greenhouse gas (GHG) impact assessment

19.2.1 The current baseline for the lifecycle GHG impact assessment is a 'business as usual' scenario where the Project does not go ahead.

19.2.2 The existing site conditions are explained in **Chapter 2: The Project.** The terrestrial parts of the Site are a mosaic of brownfield uses and former arable land. There is also woodland present, at least some of which will need to be

removed to form the jetty access road and the pipeline to the jetty. Data to assess the carbon sequestration loss (such as from tree loss) was not available for the PEI Report. This will be considered further in the ES.

19.2.3 Emissions from the operation of the existing site are negligible. The current operational baseline has assumed zero emissions.

CCR Assessment

19.2.4 The baseline for the CCR assessment considers how resilient the Project is to current and projected future climate hazards.

19.2.5 The existing baseline for the CCR assessment is based on climate data obtained from the Met Office recorded by the closest meteorological station to the Project (namely Cleethorpes, located approximately 10 miles from the Project) for the period 1981-2010 (Ref 19-16) (refer to **Table 19.12**).

Table 19.12 Climate Data for the Climate Station: Cleethorpes (1981-2010) (Ref 19-16)

Climatic Variable	Month	Value
Average annual maximum daily temperature (°C)	-	13.6
Warmest month on average (°C)	July, August	20.7
Coldest month on average (°C)	January	7.4
Mean annual rainfall levels (mm)	-	587.9
Wettest month on average (mm)	November	60.2
Driest month on average (mm)	February	38.0

ICCI Assessment

19.2.6 The baseline for the ICCI assessment is founded upon the climate data detailed in the CCR assessment combined with the baseline for topic assessments.

Future Baseline

Lifecycle GHG impact assessment

19.2.7 The future baseline for the lifecycle GHG impact assessment is a ‘business as usual’ scenario where the Project does not go ahead. As described under current baseline above, emissions from the Site are currently negligible. The future GHG baseline has therefore been assumed to be zero.

CCR Assessment

19.2.8 The future baseline is based on future UK Climate Projection 2018 (UKCP18) data from the Met Office (Ref 19-19). 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.

19.2.9 For the purpose of the assessment, UKCP18 probabilistic projections for pre-defined 30-year periods for the following average climate variables have been obtained and analysed:

a. Mean annual temperature;
b. Mean summer temperature;
c. Mean winter temperature;
d. Maximum summer temperature;
e. Minimum winter temperature;
f. Mean annual precipitation;
g. Mean summer precipitation;
h. Mean winter precipitation; and
i. Sea Level Risk (SLR).

19.2.10 Projected temperature and precipitation variables are presented in **Table 19.13**, **Table 19.14** and **Table 19.15**, respectively. UKCP18 probabilistic projections (RCP 8.5) have been analysed for the 25km grid square in which the Project is located. These figures are expressed as temperature/precipitation anomalies in relation to the 1981-2000 baseline.

Table 19.13 Projected Changes in Temperature Variables (°C), 50% Probability (10% and 90% probability in parentheses)

Climate Variable	Time Period	
	2020-2049	2040-2069
Mean annual air temperature anomaly at 1.5 m (°C)	1.04 (0.49, 1.61)	1.82 (0.95, 2.73)
Mean summer air temperature anomaly at 1.5 m (°C)	1.25 (0.45, 2.02)	2.20 (0.99, 3.41)
Mean winter air temperature anomaly at 1.5 m (°C)	0.92 (0.17, 1.72)	1.62 (0.49, 2.82)
Maximum summer air temperature anomaly at 1.5 m (°C)	1.37 (0.28, 2.37)	2.39 (0.85, 3.95)
Minimum winter air temperature anomaly at 1.5 m (°C)	0.94 (0.11, 1.87)	1.72 (0.42, 3.14)

Table 19.14 Projected Changes in Precipitation Variables (%), 50% Probability (10% and 90% probability in parentheses)

Climate Variable	Time Period	
	2020-2049	2040-2069
Annual precipitation rate anomaly (%)	0.50 (-6.63, 7.52)	-2.36 (-11.3, 6.73)
Summer precipitation rate anomaly (%)	-4.04 (-21.43, 14.36)	-14.31 (-36.47, 8.49)
Winter precipitation rate anomaly (%)	4.13 (-4.29, 13.37)	7.32 (-4.23, 20.52)

Table 19.15 Projected Changes in Sea Level Variables, 50% Probability (10% and 90% probability in parentheses)

Climate Variable	Time Period	
	2020-2049	2040-2069
Time mean sea level anomaly (m)	0.18 (0.13, 0.23)	0.29 (0.22, 0.41)

19.2.11 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 has been used for the purposes of this assessment as a worst-case scenario.

19.2.12 Total radiative forcing is the difference between the incoming and outgoing radiation at the top of the atmosphere. Radiative forcing targets for 2100 have been set at 2.6, 4.5, 6.0 and 8.5 watts per square metre (W m-2) to span a wide range of plausible future emissions scenarios and these targets are incorporated into the names of the RCPs; RCP2.6, RCP4.5, RCP6.0 and RCP8.5. Each pathway results in a different range of global mean temperature increases over the 21st century.

19.2.13 The CCR assessment has considered scenarios that reflect a high level of GHG emissions at the 10%, 50%, and 90% probability levels of the climate variables up to 2069 to assess the impact of climate change over the lifetime of the Project.

19.2.14 It is generally concluded that extreme weather events, including intense and / or prolonged precipitation, storm events and poor sea conditions, will increase in frequency, but the low confidence in the climate change projections means that it is difficult to predict the likely changes with confidence (Ref 19-17). Under the

assumptions adopted for this assessment, it is considered that extreme weather will become more frequent.

19.3 Design, Mitigation and Enhancement Measures

Lifecycle GHG impact assessment

Embedded Mitigation Measures

19.3.1 The Project has been designed, as far as possible, to avoid and minimise impacts and effects to population and health through the process of design development, and by embedding mitigation measures into the design. One of the key drivers for the Project is to assist the UK in meeting its net zero targets through the production and distribution of green hydrogen to help decarbonise the transportation sector and to help facilitate the use of carbon capture and storage.

Additional Mitigation Measures

19.3.2 Use of mitigation measures to avoid or minimise operational emissions could include the following listed below. The appropriate measures will be developed and assessed further and included in the ES as relevant:

a. Future transition of Very Large Gas Container (VLGC) fleet to sustainable low carbon fuels over time (over the long term, a similar transition can be expected across the wider marine fleet, to include similar vessels in the carbon capture sector);

b. Energy and heat/ cold integration measures including potential reuse of process tail gas as fuel;

c. Use of best available techniques for energy management as part of the Environmental permit including:

   i. Plant advanced control and optimisation;

   ii. Use of insulation and superinsulation to minimise heat leak into the system;

   iii. Predictive maintenance systems to ensure optimal compressor and equipment running;

   iv. All plant at the installation will be subject to the preventative maintenance programme which ensures that operational efficiency is maintained;

   v. High integrity plan to minimise fugitive emissions; and

   vi. High plant reliability for optimal plant performance reducing start up and shut down;

d. Use of energy efficient lighting;

e. Future use of biogas and or hydrogen to replace natural gas fuel; and

f. Use of Advanced fleet scheduling and supply chain optimisation for distribution will reduce the impact of vehicle movements.

CCR assessment

Embedded Mitigation Measures

19.3.3 The Project has been designed, as far as possible, to avoid and minimise impacts and effects of climate change through the process of design development, and by embedding mitigation measures into the design.

19.3.4 The following embedded mitigation measures are currently being considered as part of the design development of the Project and will be confirmed as part of the Flood Risk Assessment (FRA) (to be prepared and submitted with the DCO Application):

a. Finished floor levels set in line with the Strategic Flood Risk Assessment (SFRA) at 300mm above the Critical Flood Level (i.e. above a level that doesn't result in additional loss of life or damage to property);

b. Flood resilient and resistant design measures; and

c. Ensuring the Site receives Environment Agency Flood Warning Service announcements.

Additional Mitigation Measures

19.3.5 All new assets, structures and buildings will either be designed for projected climatic conditions e.g. increased average temperatures using appropriate design guidance where available, or adaptive capacity will be built into the designs.

19.3.6 Additional mitigation measures are being considered as part of the design development of the Project:

a. Storm-proof infrastructure will be incorporated where possible (e.g., underground power supplies); and

b. Use of materials with superior properties which offer increased tolerance to high temperatures to be considered.

Standard Mitigation Measures

19.3.7 A risk assessment of severe weather impacts on the construction process will, in due course, be produced by the main contractor to inform the need for construction mitigation measures. Any receptors and/or construction-related operations and activities potentially sensitive to severe weather events will be considered in the assessment. Climate change projections will be considered in the risk assessments.

19.3.8 The main contractors' Environmental Management System (EMS) will consider all measures deemed necessary and appropriate to manage severe weather events and should as a minimum cover training of personnel and prevention and monitoring arrangements. These could include:

a. Use of storm defences (e.g., walls, riprap);

b. Design site with refuges, storm-resilient materials and form; and

c. Ensure appropriate storage of plant and materials.

19.3.9 As appropriate, construction method statements will also consider severe weather events where risks have been identified.

19.3.10 Prevention measures and health and safety plans will be developed to prevent worker exhaustion due to heat, manage flood risk during construction.

19.3.11 Regular maintenance of assets will be undertaken to detect deterioration and damage.

19.4 Preliminary Assessment of Effects and Significance

Lifecycle GHG Impact Assessment

19.4.1 When assessing the GHG impacts of the Project consideration has been given only to the direct impacts of the Project. The preliminary assessment has identified that construction and operation will potentially result in **minor adverse**, **not significant**, impacts on the climate.

19.4.2 While the preliminary assessment has only quantified the direct GHG impacts from the construction and operation of the Project, these effects need to be considered in the context of the wider benefits of the Project over its lifetime in helping the UK to achieve its net zero ambitions. The impact of constructing and operating the Project will be far outweighed by the carbon reduction benefits the Project will bring in its contribution to the UK achieving its net zero targets by 2050.

Effects during Construction

19.4.3 The construction works are divided into two parts, terrestrial and marine anticipated to last a total of 11 years. The terrestrial components are anticipated to be constructed in phases and comprise land-side infrastructure (pipeline areas, liquid storage tanks, converters and other supporting infrastructure). The marine components include a jetty of up to two berths, to be constructed over four years. Details of the construction plans can be found in **Chapter 2: The Project** (PEI Report Volume II).

19.4.4 In order to assess the magnitude of the impact of the Project on the climate, GHG emissions associated with the construction of the Project have been calculated based on the methodologies discussed in **Section 19.2**.

19.4.5 As detailed in **Table 19.16**, the total GHG emissions estimated to be emitted from the 11-year construction period associated with the Project have been calculated to be 551,095 tCO_2e. The construction programme is set out in **Chapter 2: The Project** and it is assumed all of the phases, both marine and terrestrial, are built out in accordance with that programme. For the purpose of putting emissions into context with carbon budget periods, construction emissions have therefore been averaged out per annum. Average annual emissions are expected to be 42,811tCO_2e for terrestrial construction and 26,723tCO_2e for marine construction.

19.4.6 All these emissions are considered 'additional' and are included in the impact assessment of the Project. They are defined as additional as they are considered new and would not occur if the Project did not go ahead.

19.4.7 The majority of both terrestrial and marine component GHG emissions (approximately 78% and 77% respectively) are associated with embodied carbon in construction materials.

Table 19.16 Enabling Works and Construction Estimated GHG Emissions

Emission Source	Terrestrial		Marine	
	GHG Emissions (tCO2e)	GHG Emissions as a proportion of emissions generated throughout the construction (11 years)	GHG Emissions (tCO2e)	GHG Emissions as a proportion of emissions generated throughout the construction (3 years)
Preconstruction (A0)	16,797	3.6%	N/A	-
Construction Materials (A1-A3)	366,727	78%	61,627	77%
Transportation of Materials (A4)	12,137	2.6%	1,205	2%
Worker Transport (A4)	13,003	2.8%	846	1%
Waste (A4-A5)	84	0%	6,636	8%
Construction Activities (A5)	62,178	13%	9,856	12%
Total GHG emissions over construction period (tCO2e)	470,926	-	80,170	-
Average annualised GHG emissions during construction (tCO2e)	**42,811**	-	**26,723**	-

Significance of GHG Emissions during Construction

19.4.8 As stated in **Section 19.3**, all GHG emissions are considered to contribute to climate change. To contextualise the level of significance for the Project the total estimated annual GHG emissions during the construction period for both the terrestrial and marine components is compared to the percentage contribution of the annual budget within each Carbon Budget period. With reference to the UK national carbon budgets, the construction programme falls within three carbon

budgets (4th, 5th and 6th), and equates to a small fraction of less than 0.01% for each budget (**Table 19.17**).

Table 19.17 Contribution of Construction GHG Emissions to the UK Carbon Budgets

Carbon Budget	UK Carbon Budget (tCO2e)	Potential Project Emissions (tCO2e)	Percentage Contribution of Construction Emissions to the UK Budget
4th (2023-2027)	2,544,000,000	294,224	0.01%
5th (2028-2032)	1,950,000,000	214,055	0.01%
6th (2033-2037)	1,725,000,000	42,811	0.002%

19.4.9 As discussed in **Section 19.2**, the updated guidance from IEMA should be used when assessing the significance of GHG emissions from the Project. This takes into account the embedded mitigation, the carbon emissions trajectory, and the policy alignment of the Project to gauge overall impact. As noted previously, it is down to the practitioner's professional judgement on how best to contextualise a project's GHG impact.

19.4.10 Based on **Table 19.17**, the significance of construction GHG emissions is considered to be **Minor Adverse** and therefore **not significant**. This means that 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.

19.4.11 A project with minor adverse effects is in line with measures necessary to achieve the UK's trajectory towards net zero. Given the significant role the Project will play in decarbonising heavy freight transport in the UK, it supports the UK's trajectory towards net zero.

Effects During Operation of Project

19.4.12 Operational energy data was provided by the design team for inclusion in this assessment relating to utilities use during operation of the Project, calculated to be a total of 876,727tCO_2e over an assumed 25-year operating lifespan (see **Table 19.18**).

19.4.13 Additional data was provided for the calculation of emissions from shipping and road transport associated with the Project (see **Table 19.18**). Reasonable assumptions have been used to calculate worker emissions for the Project once it becomes operational.

19.4.14 The majority of emissions (58%) are associated with shipping received by the Project from abroad. For the assessment, the use is assumed of standard petroleum-based fuels to power the delivery tankers. In the future, a gradual switch in the shipping fleet to the use of decarbonised fuel is expected however this has not been included in the GHG assessment. Therefore, this is assumed to

be a worst case scenario, and actual operational emissions are expected to decrease in line with UK policy to decarbonise towards net zero by 2050.

19.4.15 Tonnes of CO_2e emissions reported for Sea Freight Transport imports presented in **Table 19.18** account for total potential shipping use for the proposed terminal over the Project assessment period. This is for all shipping arrivals per annum which is based on the assumption in **Paragraph 19.2.36**. It should be noted however that only 12 ship arrivals per annum will be required for the operation of the proposed hydrogen production facility included in the DCO Application.

Table 19.18 Estimated emissions from operational energy use of Project (25 year period)

Emissions Source	Emissions (tCO_2e)	% of Operation Emissions
B1 - Use		
Sea Freight Transport (Imports) (B1)	1,618,746	33%
Sea Freight Transport (Exports) (B1)	2,153,095	44%
Road Transport (B1)	248,374	5%
B6 – Operational Energy Use		
Operational Energy Use – Port Facilities (Electricity, Gas, Water) (B6) and hydrogen production facility	876,727	17.8%
B9 – Utilisation of infrastructure		
Worker Commuting	12,409	0.2%
Total GHG Emissions (tCO_2e)	**4,909,351**	-
Total GHG Emissions Annualised (tCO_2e)	**196,374**	-

19.4.16 There will be emissions from operational energy use from ships when in port, ammonia processing and maintenance (dredging), however data to calculate these emissions was not available for the PEI Report. This information will be included and assessed in the ES.

Significance of GHG Emissions from Operation

19.4.17 As stated in **Section 19.3**, all GHG emissions are considered to contribute to climate change. To contextualise the level of significance for the Project, these emissions have been compared to UK national carbon budgets (**Table 19.19**).

19.4.18 The total estimated annual GHG emissions during the operational period for both the terrestrial and marine components is compared to the percentage contribution of the annual budget within each Carbon Budget period and assumes all phases of both the NSIP and the hydrogen production facility are

operational in 2035. With reference to the UK national carbon budgets, the period of operation falls within one carbon budget (6th) and equates to a small fraction (of less than 0.1%) of the relevant budget (**Table 19.19**).

Table 19.19 Contribution of Operation GHG Emissions to the UK Carbon Budgets

Carbon Budget	UK Carbon Budget (tCO2e)	Potential Project Emissions (tCO2e)	Percentage Contribution of Construction Emissions to the UK Budget
6th (2033-2037)	1,725,000,000	445,904	0.026%

19.4.19 As discussed in **Section 19.2**, the updated guidance from IEMA should be used when assessing the significance of GHG emissions from the Project. This takes into account the embedded mitigation, the carbon emissions trajectory, and the policy alignment of the Project to gauge overall impact. As noted previously, it is down to the practitioner's professional judgement on how best to contextualise a project's GHG impact.

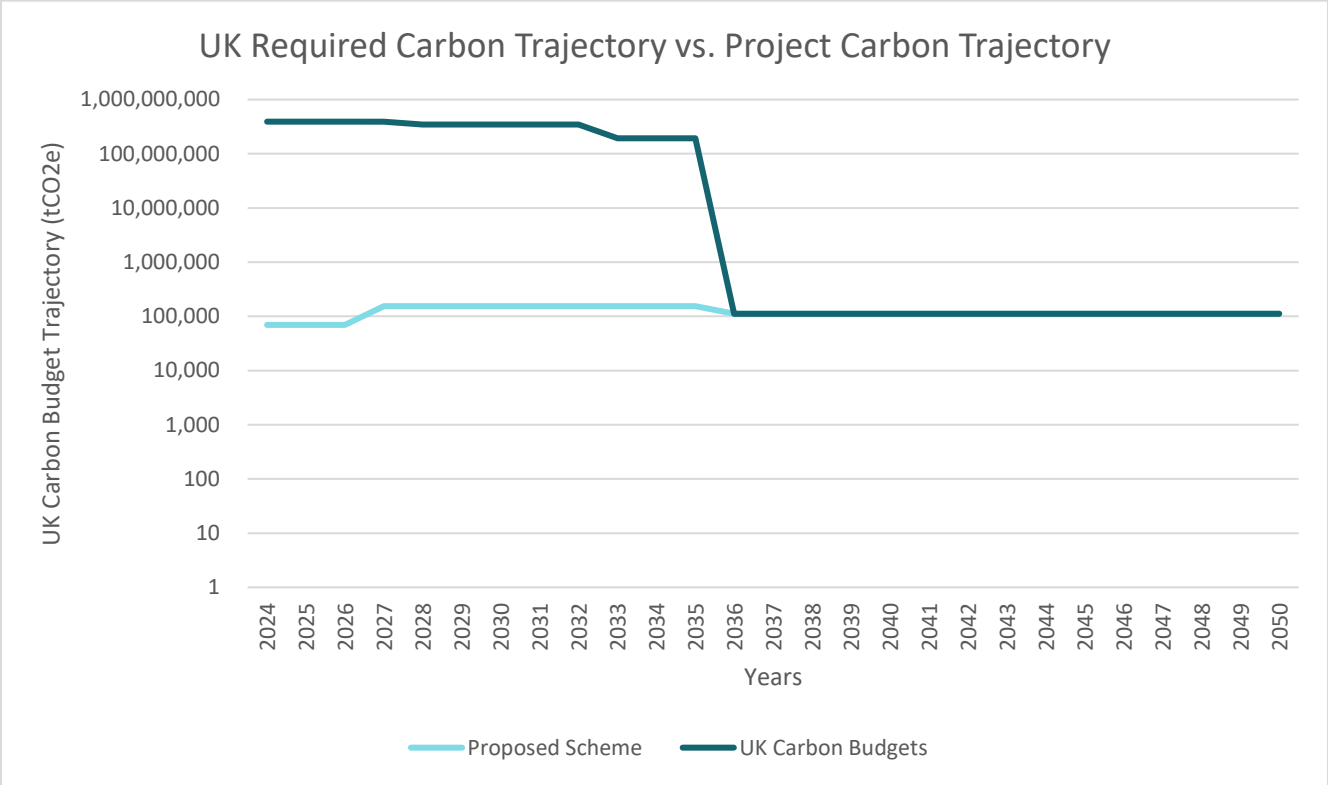
19.4.20 In line with the latest IEMA guidance, the Project emissions trajectory during construction and operation is plotted against the UK's carbon budgets in **Plate 19-2**. The Project demonstrates a decrease in operational emissions over its lifespan, which will likely be greater than indicated if the Project includes adoption of sustainable, low-carbon fuels and other low carbon measures.

19.4.21 Based on **Table 19.4**, it is assessed that the significance of operation GHG emissions is **Minor Adverse** and therefore **not significant**. This appraisal is based on the information available to date and will be updated further once outstanding emissions sources are more fully defined. The updated assessment will be included in the ES.

19.4.22 Project emissions also need to be considered in the context of the potential national emissions reductions the Project will facilitate through decarbonisation of UK transport. The green hydrogen the Project is producing for distribution and use in the UK would contribute towards the UK achieving net zero emissions by 2050, by providing fuel for heavy transport vehicles including HGVs and buses (see **Section 19.6** below). It is considered that the net impacts resulting from the operation-related emissions are minimal and can be further reduced with implementation of appropriate mitigation as outlined in **Section 19.4** , noting also the overall role the project will play in reducing the UK carbon emissions as set out in **Paragraph 19.1.4**.

19.4.23 Further use of the terminal for import of CO_2 for example will also contribute to the UK's net zero aims, as that CO_2 can be captured at source and fed into a carbon capture network for permanent storage.

Plate 19-2 GHG Emissions produced from the Project during construction, plotted against the UK carbon budgets (2024-2035)



Decommissioning

19.4.24 Decommissioning of the NSIP (the jetty) has been scoped out from this assessment. The Project does not make any provision for the decommissioning of the marine facilities of the Project. This is because the marine facilities would, once constructed, become part of the fabric of the Port estate and would, in simple terms, continue to be maintained so that it can be used for port-related activities to meet a long-term need. All plant or equipment on the Jetty topside that is associated with the landside element of the Project would likely remain in situ and repurposed, if possible, to transport other liquid bulks. While it is likely that some GHG emissions would arise as part of the decommissioning of the landside hydrogen production facilities, it is not possible to say with any certainty what they are likely to be. Methods of deconstruction and disposal are not known at this time. It should also be noted that by the time the hydrogen production facilities are decommissioned, the UK will be achieving net zero emissions and therefore any impacts are likely to be reduced.

CCR Review

19.4.25 The preliminary assessment has identified that before adaption measures are introduced, construction and operation of the Project will potentially be subject to adverse impacts from climate change which will arise in any event.

19.4.26 These impacts on the Project are associated with:

a. Increased frequency and severity of extreme weather events;
b. Increased frequency and intensity of heavy precipitation events;
c. Increased summer temperatures; and
d. Sea level rise.

Construction

19.4.27 During enabling works and construction, unless appropriate measures are applied, receptors such as the construction work force, construction plant, vehicles, materials and the construction programme may be vulnerable to a range of climate risks. These could include:

a. Extreme weather events (severe flooding, storms, snow, wind and ice) could impact the site's accessibility, restricting working hours and delaying the construction schedule;
b. Health and safety could be at risk during extreme weather events, potentially resulting in severe injury and/ or death;
c. The higher peak temperatures and increased frequency and intensity of heatwaves, particularly in the summer, could create unsuitable working conditions for construction site workers, plant, and equipment use; and
d. Increased risk of extreme weather events could potentially damage construction materials, plant equipment, assets, and infrastructure.

Operation

19.4.28 During the operation, unless appropriate measures are applied, the Project may be vulnerable to a range of climate risks. These could include:

a. Extreme weather events could impact the site's accessibility, restricting working hours and interrupting the operational schedule;
b. Operational workers' health and safety could be at risk, potentially resulting in severe injury and/ or death from adverse weather;
c. The higher peak temperatures and increased frequency and intensity of heatwaves, particularly in the summer, could create unsuitable working conditions for operational site workers, plant and equipment use;
d. Increased risk of extreme weather events could potentially cause damage to structures (e.g., jetties, buildings) and damage to land-based infrastructure, transport, and floating assets;
e. Extreme weather events could cause disruption to power and water services which may impact the operation of the Project;
f. The increased frequency of extreme weather events might increase the requirement for dredging and maintenance, leading to additional costs;
g. The increased risk in frequency and intensity of heatwaves could potentially result in damaging infrastructure and services through the increased risk of thermal expansion beyond the design tolerance of the materials;

h. Damage to drainage systems, gutters and downpipes due to flooding from intense rainfall; and

i. Potential damage to equipment and infrastructure due to prolonged exposure to high intensity temperatures resulting in overheating of equipment/machinery.

ICCI Assessment

19.4.29 The ICCI assessment identifies how the resilience of various receptors in the surrounding environment (such as local waterways or local heritage assets etc.) are affected by the Project in combination with the future climatic conditions.

19.4.30 The impacts are assessed for the construction and operation of the Project. UKCP18 projections (Ref 19-19) for the geographical location and lifetime of the Project, and the receptors identified by technical specialists, would be used when undertaking this assessment. See **Chapter 18: Water Quality, Coastal Protection, Flood Risk and Drainage**.

19.5 Summary of Preliminary Assessment

GHG assessment

19.5.1 **Table 19.20** and **Table 19.21** provide a summary of the identified construction and operational phase GHG impacts on the climate. IEMA criteria has been used to assess the significance of the impact of GHG emissions from the Project. The assessment concluded that the Project has a **minor adverse, not significant** impact. This aligns with IEMA guidance where emissions from a Project can be considered minor adverse where they are compatible with the budgeted, science based 1.5ºC trajectory and comply with up-to-date policy and good practice. This Project is a part of Government Plans to decarbonise the UK economy and therefore in alignment with policy and good practice.

19.5.2 The Project has a wider context of its role in helping meet the UK's target to achieve net zero emissions by 2050. The Project is anticipated to produce up to 300 MW of hydrogen per annum once fully operational at full capacity, the equivalent of up to 9.5 billion MJ per annum. Depending on market demand, it is estimated that this will meet up to 3% of Government's hydrogen production capacity target.

19.5.3 For context, the use of diesel in road transport results in the emission of approximately 94g CO_2 per MJ, therefore the green hydrogen produced by the Project and used in road transport applications could facilitate a reduction in annual emissions of CO_2 from road traffic emissions by up to 578,000 tonnes from 2030 as a result of fuel switching. An additional benefit of this switch in fuel would be a reduction in emissions of other atmospheric pollutants – namely cutting emissions of particulate (PM_{10}) (26 tonnes /year) and NOx emissions (1050 tonnes/ year), based on replacing vehicles to the latest Euro VI standards. In practice the actual savings could be substantially greater as cleaner engine technologies are developed.

CCR Assessment

Construction

19.5.4 **Table 19.22** provides a summary of the identified construction phase impacts, the adaptation methods to increase the resilience of the Project and likely effects of climate change on the Project.

19.5.5 While the majority of impacts of climate change on the construction of the Project are considered to have a low to moderate impact prior to the inclusion of mitigation measures, following the addition of mitigation, all impacts from climate change on construction are considered to be low and not significant**.**

Operation

19.5.6 **Table 19.23** provides a summary of the identified operational phase impacts, the adaptation methods to increase the resilience of the Project and likely effects of climate change on the Project.

19.5.7 While the majority of impacts of climate change on the operation of the Project are considered to have a low to moderate impact prior to the inclusion of mitigation measures, following the addition of mitigation, all impacts from climate change on operations are considered to be low and not significant.

Table 19.20: GHG Assessment mitigation and significance summary – Construction phase*

Potential impacts on the Climate	Mitigation measures
Increased emissions contributing to climate change	Measures to reduce embodied carbon in construction materials. Examples include: - Prioritising sourcing secondary / recycled materials, particularly for materials with energy-intensive processing (e.g., green steel) - Utilise locally-sourced products and those with higher recycled content wherever feasible - Incorporating recycled content into concrete / replacing cementitious materials with secondary materials (e.g., PFA, GGBS, silica, limestone fines) - Design for minimal waste creation - Reuse site-won materials wherever possible, to minimize the use of natural resources and unnecessary materials (e.g., reclaim waste from enabling works as aggregates/ sub-base) Other measures that would reduce construction-related emissions include: - Liaising with construction personnel to implement staff minibuses and/or car sharing options - Implementing a travel plan to reduce the volume of construction staff trips to the Project, and identify efficiencies to reduce single-person trips - Switching vehicles and plant off when not in use and ensuring all vehicles conform to current EU emissions standards - Pursuing alternatively / renewably powered plant (e.g., biodiesel, hydrogen-powered, battery-powered) - Conducting regular planned maintenance of all operating plant and machinery to optimize efficiency

***Significance criteria not included. IEMA Guidance specifies for Project to achieve Minor Adverse / Not Significant, it must apply good practice measures as presented in this table.**

Table 19.21: GHG Assessment mitigation and significance summary – Operational phase*

Potential impacts on the Climate	Mitigation measures
Increased emissions contributing to climate change	Measures to reduce carbon emissions during operation of the Project could include: - Encouraging the use of lower carbon modes of transport by identifying and communicating local bus connections and pedestrian and cycle access routes to/from the Project to all site staff, as well as providing appropriate facilities for safe storage of cycles - Liaising with relevant personnel to implement staff minibuses and/or car sharing options - Implementing a travel plan to reduce the volume of staff trips to the Project, and identify efficiencies to reduce single-person trips - Switching vehicles and plant off when not in use and ensuring all vehicles conform to current EU emissions standards - Pursuing alternatively / renewably powered plant (e.g., biodiesel, hydrogen-powered, battery-powered) - Conducting regular planned maintenance of all operating plant and machinery to optimize efficiency

***Significance criteria not included. IEMA Guidance specifies for Project to achieve Minor Adverse / Not Significant, it must apply good practice measures as presented in this table.**

Table 19.22 Climate Change Resilience Review Summary: Construction Phase

Potential climate changes	Potential impacts on the Project	Likelihood of climate related impact occurring) (pre mitigation)	Measure of Consequence occurring (Pre mitigation	Significance Level (Pre-Mitigation)	Adaptation / Resilience measures	Likelihood of climate related impact occurring	Measure of Consequence occurring	Significance Level (Post-Mitigation)
Increased frequency and severity of weather events	Limit access to site Restrict working hours Delay construction program Damage to construction materials, plant and equipment	Moderate	Low	Not significant	A risk assessment of severe weather impacts on the construction process will be produced by the main contractor to inform mitigation. Any receptors and/or construction-related operations and activities potentially sensitive to severe weather events will be considered in the assessment. Climate change projections will be considered in the risk assessments. The main contractors' EMS will consider all measures deemed necessary and appropriate to manage severe weather events and will as a minimum cover training of personnel and prevention and monitoring arrangements. As appropriate, construction	Low	Low	Not significant

Potential climate changes	Potential impacts on the Project	Likelihood of climate related impact occurring) (pre mitigation)	Measure of Consequence occurring (Pre mitigation	Significance Level (Pre-Mitigation)	Adaptation / Resilience measures	Likelihood of climate related impact occurring	Measure of Consequence occurring	Significance Level (Post-Mitigation)
					method statements will also consider severe weather events where risks have been identified. Use of storm defenses (e.g., walls, riprap). Design site with refuges, storm-resilient materials and form. Ensure appropriate storage of plant and materials. Addition of wind protection defenses (e.g., storm pin and tie-down procedures, crane buffers) across site. Specific measures to ensure safe storage of larger infrastructure (e.g. quay cranes) Regular maintenance of assets to be undertaken to detect deterioration and damage.			

Potential climate changes	Potential impacts on the Project	Likelihood of climate related impact occurring) (pre mitigation)	Measure of Consequence occurring (Pre mitigation	Significance Level (Pre-Mitigation)	Adaptation / Resilience measures	Likelihood of climate related impact occurring	Measure of Consequence occurring	Significance Level (Post-Mitigation)
Increased summer temperatures	Restrict working hours Delay construction program Weather may create site conditions unsuitable for plant operation (damage,	Moderate	Low	Not significant	Prevention measures and health and safety plans to be developed to prevent worker exhaustion due to heat such as monitoring of the weather to advise on requirements to stop work.	Low	Low	Low (Not significant)
Increased winter precipitation	Viability of and access to construction sites (such as heavy rain resulting in surface water flooding of local roads, sources of power supply or inundation of construction sites).	Moderate	Low	Not significant	Prevention measures and health and safety plans to be developed to manage flood risk during construction such as monitoring of the weather to advise on requirements to stop work.	Low	Low	Not significant

Table 19.23 Climate Change Resilience Review Summary: Operational Phase

Potential climate changes	Potential impacts on the Project	Likelihood of climate related impact occurring (Probability of Occurrence)	Measure of Consequence occurring	Significance Level (Pre-Mitigation)	Adaptation / Resilience measures	Likelihood of climate related impact occurring (Probability of Occurrence)	Measure of Consequence occurring	Significance Level (Post-Mitigation)
Increased frequency and severity of extreme weather	Potentially cause damage to structures and infrastructure.	Moderate	Moderate	Significant	All new structures will either be designed for the climatic conditions using appropriate design guidance where available, or adaptive capacity will be built into the designs.	Moderate	Low	Not Significant
Sea Level Rise	Potentially cause damage to structures and infrastructure	Moderate	Moderate	Significant	All new structures will either be designed for the climatic conditions using appropriate design guidance where available, or adaptive capacity will be built into the designs. Additional design measures to cope with flood / high water level conditions on site	Moderate	Low	Not significant

Potential climate changes	Potential impacts on the Project	Likelihood of climate related impact occurring (Probability of Occurrence)	Measure of Consequence occurring	Significance Level (Pre-Mitigation)	Adaptation / Resilience measures	Likelihood of climate related impact occurring (Probability of Occurrence)	Measure of Consequence occurring	Significance Level (Post-Mitigation)
					will be implemented (see Section 19.6).			
Increased frequency and severity of extreme weather events (e.g. flooding, snow and ice, storms	Potential damage to land-based infrastructure. Disruption to power and water services which may impact the operation of the Project	Moderate	Moderate	Significant	All new assets and buildings will either be designed for the climatic conditions using appropriate design guidance where available, or adaptive capacity will be built into the designs. Storm-proof infrastructure will be incorporated where possible (e.g., underground power supplies). Addition of wind protection defenses (e.g., storm pin and tie-down procedures, crane buffers) across site. Specific measures to ensure safe	Moderate	Low	Not significant

Potential climate changes	Potential impacts on the Project	Likelihood of climate related impact occurring (Probability of Occurrence)	Measure of Consequence occurring	Significance Level (Pre-Mitigation)	Adaptation / Resilience measures	Likelihood of climate related impact occurring (Probability of Occurrence)	Measure of Consequence occurring	Significance Level (Post-Mitigation)
					storage of larger infrastructure (e.g. quay cranes) Regular maintenance of assets to be undertaken to detect deterioration and damage.			
Increased Summer Temperatures	Interrupted power supplies (e.g., overheating, damage to power provision infrastructure). Higher year-round temperatures could increase operational cooling requirements for the equipment and infrastructure.	Low	Low	Not significant	Use of materials with superior properties which offer increased tolerance to high temperatures to be considered.	Low	Low	Not significant

Potential climate changes	Potential impacts on the Project	Likelihood of climate related impact occurring (Probability of Occurrence)	Measure of Consequence occurring	Significance Level (Pre-Mitigation)	Adaptation / Resilience measures	Likelihood of climate related impact occurring (Probability of Occurrence)	Measure of Consequence occurring	Significance Level (Post-Mitigation)
	Potential damage to infrastructure and services through the increased risk of thermal expansion beyond the design tolerance of the materials.							
Increase temperatures	Risk of destabilising chemicals / substances stored on site during operation.	Moderate	Moderate	Significant	Storage and transfer of chemicals/ substances in line with safety regulations.	Moderate	Low	Not significant

ICCI Assessment

19.5.8 The inclusion of a separate ICCI assessment has been scoped out of the Climate Change chapter on the basis that any identified in-combination climate change impacts is addressed, as relevant, in other relevant technical chapters.

19.5.9 The final outcomes of the likely significant effects of the Project on climate change will be reported within the ES.

19.6 References

Ref 19-1 The Town and Country Planning (Environmental Impact Assessment) Regulations 2017.

Ref 19-2 IEMA (2022). Environmental Impact Assessment Guide to: Assessing Greenhouse Gas Emissions and Evaluating their Significance.

Ref 19-3 IEMA (2020). Environmental Impact Assessment Guide to: Climate Change Resilience and Adaptation.

Ref 19-4 UK Government (2021). The Carbon Budget Order 2021.

Ref 19-5 UNFCCC (2016). Conference of the Parties, Report of the Conference of the Parties on its twenty-first session, held in Paris from 30 November to 13 December 2015.

Ref 19-6 Climate Change Act 2008.

Ref 19-7 Climate Change Committee (2020) The Sixth Carbon Budget - The UK's path to Net Zero.

Ref 19-8 The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (as amended by The Town and Country Planning and Infrastructure Planning (Environmental Impact Assessment) (Amendment) Regulations 2018).

Ref 19-9 Department for Transport (2012). National Policy Statement for Ports.

Ref 19-10 Ministry of Housing, Communities and Local Government (MHCLG) (2021). National Planning Policy Framework (NPPF).

Ref 19-11 MHCLG (2014, updated March 2019). National Planning Practice Guidance: Climate Change.

Ref 19-12 Department for Transport. (2021b). Decarbonising transport: a better, greener Britain.

Ref 19-13 North East Lincolnshire Council (2016). Environmental Policy Statement.

Ref 19-14 North East Lincolnshire (2021). Net Zero Carbon Roadmap.

Ref 19-15 North East Lincolnshire Council (2021). Natural Assets Plan.

Ref 19-16 Met Office (2020). Historic Climate Data.

Ref 19-17 Met Office (2018b). UKCP18 Guidance: Caveats and limitations.

Ref 19-18 BSI (2016). Guidance Document for PAS 2080.

Ref 19-19 Met Office (2018). UK Climate Projections (UKCP) 2018.

Ref 19-20 World Resources Institute (WRI) & World Business Council for Sustainable Development (WBCSD) (2004). The GHG Protocol: A Corporate Accounting and Reporting Standard.

Ref 19-21 Department for Business, Energy and Industrial Strategy (2021). Greenhouse gas reporting: conversion factors 2021.

Ref 19-22 ICE Database (2019). Embodied Carbon.

Ref 19-23 UNFCC (2015). Paris Agreement.

Ref 19-24 IPCC (2018). Global warming of 1.5°C - Special Report.

Ref 19-25 Committee on Climate Change (2017). UK Carbon Budgets.

Ref 19-26 Associated British Ports (2022). Immingham Green Energy Terminal ("IGET") Briefing Note.

19.7 Abbreviations and Glossary of Terms

Table 19.24 Glossary and Abbreviations

Term	Acronym	Meaning
Carbon budgets	n/a	UK greenhouse gas targets over defined periods of time.
Carbon Dioxide	CO_2	A colourless, odourless gas produced by burning carbon and organic compounds and by respiration.
Carbon emissions equivalent	CO_2e	Shorthand for emissions of any of the seven greenhouse gases that contribute to climate change.
Carbon footprint	n/a	The total greenhouse gas emissions associated with a particular policy or development.
Celsius	°C	A scale of temperature.
Climate	n/a	Long-term weather conditions prevailing over a region.
Climate change	n/a	This refers to a change in the state of the climate, which can be identified by changes in average climate characteristics which persist for an extended period, typically decades or longer.
Climate Change Resilience	CCR	The resilience of the Project to climate change impacts, including how the design would consider projected impacts of climate change.
Committee on Climate Change	CCC	An independent, statutory body established under the Climate Change Act 2008.
Development Consent Order	DCO	The consent for a Nationally Significant Infrastructure Project required under the Planning Act 2008.
Embodied carbon	n/a	Carbon emissions associated with energy consumption and chemical processes during the extraction, transport and/or manufacture of construction materials or products.
Environmental Impact Assessment	EIA	The statutory process through which the likely significant effects of a development project on the environment are identified and assessed.
Environmental Statement	ES	A statutory document which reports the EIA process, produced in accordance with the EIA Directive as transposed into UK law by the EIA Regulations.
Environmental Management System	EMS	A framework for managing and reporting environmental impacts on a Project.
Extreme weather	n/a	A weather event which is significantly different from the average or usual weather pattern.

Term	Acronym	Meaning
Flood Risk Assessment	FRA	The process of assessing potential flood risk to a site and identifying whether there are any flooding or surface water management issues that may warrant further consideration or may affect the feasibility of a project.
Greenhouse Gas	GHG	Atmospheric gases that absorb and emit infrared radiation emitted by the Earth's surface, the atmosphere and clouds.
Heavy Goods Vehicle	HGV	A large truck for transporting goods.
Hydrofluorocarbon	HFC	Hydrofluorocarbons (HFCs) are man-made organic compounds that contain fluorine and hydrogen atoms.
In-Combination Climate Change Impact Assessment	ICCI	The assessment of the combined impact of the Project and potential climate change on the receiving environment.
Institute of Environmental Management and Assessment	IEMA	A professional body for practitioners working in the fields of environmental management and assessment.
Intergovernmental Panel on Climate Change	IPCC	An intergovernmental body of the United Nations, dedicated to providing the world with an objective, scientific view of climate change, its natural, political and economic impacts and risks, and possible response options.
Inventory of Carbon and Energy	ICE	The Inventory of Carbon and Energy is an embodied carbon database for building materials.
Met Office	n/a	The United Kingdom's national weather service.
Methane	CH_4	The main constituent of natural gas, and the second most important greenhouse gas.
Nationally Determined Contribution	NDC	A climate action plan to cut emissions and adapt to climate impacts.
National Planning Policy Framework	NPPF	A planning framework which sets out the Government's planning policies for England and how these are expected to be applied.
National Policy Statement for Ports	NPSfP	The National Policy Statement for Ports provides the framework for decisions on proposals for new port development.
North-East Lincolnshire Council	NELC	Local authority of North-East Lincolnshire.
Nitrous Oxide	N_2O	A gas produced when fuels are burned and is often present in motor vehicle and boiler exhaust fumes. It is an irritant to the respiratory system.

Term	Acronym	Meaning
Nitrogen Trifluoride	NF_3	Nitrogen trifluoride is an extremely strong and long-lived greenhouse gas.
Pressure swing adsorption	PSA	Pressure swing adsorption units use beds of solid adsorbent to separate impurities from hydrogen streams leading to high-purity high-pressure hydrogen and a low-pressure tail gas stream containing the impurities and some of the hydrogen. The beds are then regenerated by depressurizing and purging. Part of the hydrogen (up to 20%) may be lost in the tail gas
Perfluorocarbon	PFC	Perfluorocarbons are man-made compounds containing fluorine and carbon.
Preliminary Environmental Information Report	PEIR / PEI Report	A report that compiles and presents the Preliminary Environmental Information gathered for a project.
Renewable Transport Fuel Obligation	RTFO	The Renewable Transport Fuel Obligation guidance is for fuel suppliers, independent verifiers and others involved in the supply of biofuels in the UK.
Representative Concentration Pathway	RCP	A greenhouse gas concentration (not emissions) trajectory adopted by the IPCC for its fifth Assessment Report in 2014.
Sea Level Rise	SLR	Sea Level Rise is the increase in level of the world's oceans due primarily because of the effects of global warming.
Strategic Flood Risk Assessment	SFRA	A Strategic Flood Risk Assessment looks at flood risk at a strategic level on a local planning authority scale.
Sulphur hexafluoride	SF6	Sulphur hexafluoride is an extremely potent and persistent greenhouse gas that is primarily utilized as an electrical insulator and arc suppressant.
United Kingdom	UK	-
UK Climate Projections	UKCP	The name given to the UK Climate Projections.
Very Large Gas Carrier	VLGC	These carriers are a sub-class of generic gas carriers that target a considerably higher volume of gas transport.
World Business Council for Sustainable Development	WBCSD	A CEO-led community of over 200 of the world's leading sustainable businesses working collectively to accelerate the system transformations needed for a net zero, nature positive, and more equitable future.
World Resources Institute	WRI	A global research organization that turns big ideas into action at the nexus of environment, economic opportunity and human well-being.