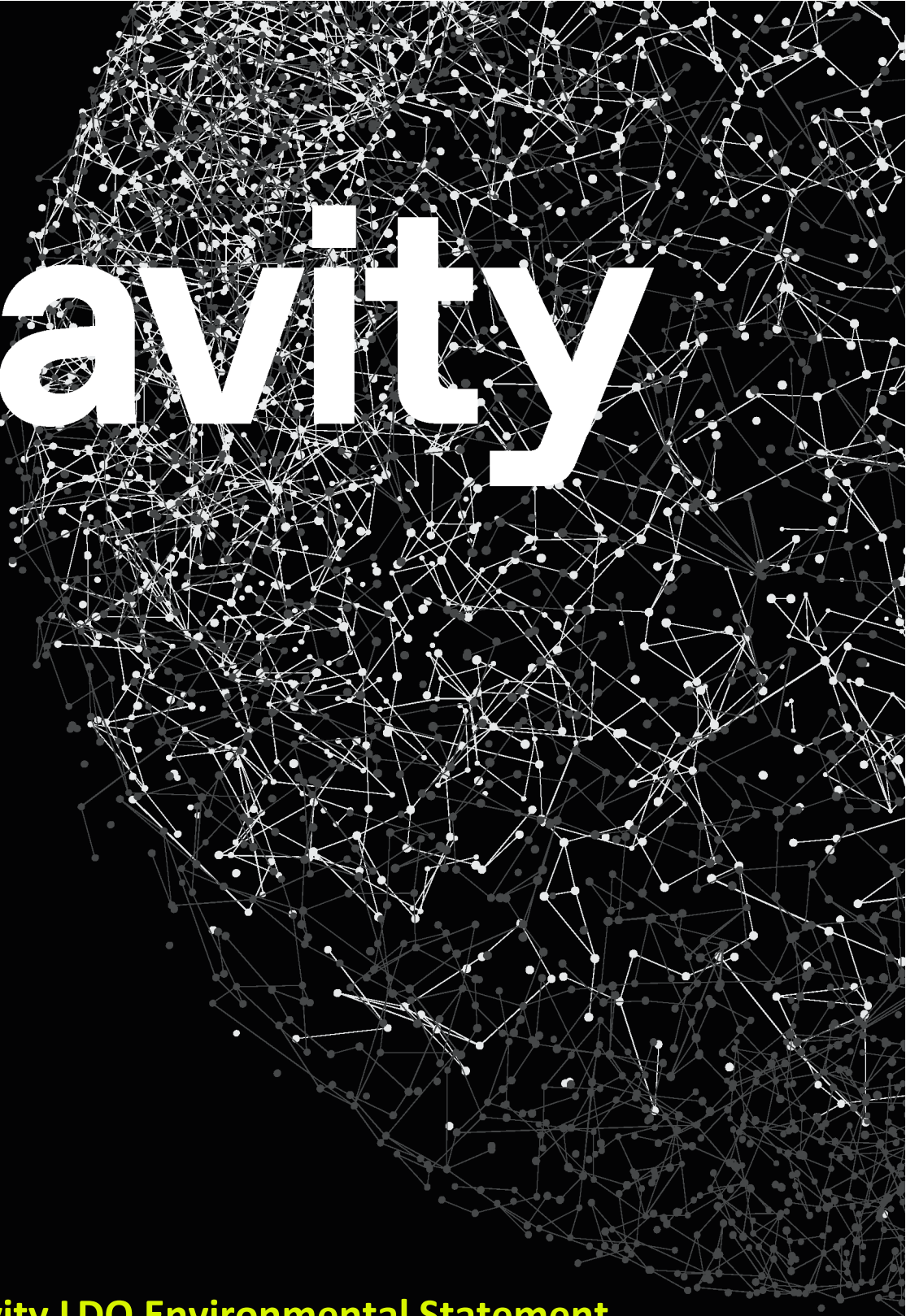
Gravity

Smart Campus



Gravity LDO Environmental Statement

Volume 1 – Chapter 15:
Climate Change

15 Climate Change

15.1 Introduction

15.1.1 This chapter presents the findings of an assessment of the likely significant effects of the Proposed Development on:

- the impact of the Proposed Development on climate change ('Greenhouse Gas Emissions Assessment'); and
- the impact of climate change on the Proposed Development ('Climate Change Risk Assessment').

15.1.2 These assessments have different policy contexts, guidance documents, methodologies, baseline conditions, potential impacts and mitigation measures. This Chapter therefore presents the Greenhouse Gas Emissions Assessment and Climate Change Risk Assessment separately. Following this introduction, this Chapter is structured as follows:

- Part 1: Greenhouse Gas (GHG) Emissions Assessment – a qualitative assessment of the Proposed Development's impacts on climate change by it's potential to emit GHGs. This section also outlines what mitigation measures have been embedded within the Proposed Development to reduce GHG emissions during construction and operation.
- Part 2: Climate Change Risk Assessment (CCRA) – outlines the projected climatic changes in the region, identifies receptors vulnerable to climate change, and the mitigation measures to address climate change, embed adaptation measures and improve resilience.
- Summary and References.

15.1.3 This chapter should be read in conjunction with Chapter 8 Human Health, Wellbeing and Inclusion, Chapter 9 Transport and Access, Chapter 11 Air Quality, Chapter 12 Biodiversity, Chapter 12 Water Environment, Chapter 13 Landscape and Visual, and Chapter 16 Cultural Heritage.

15.1.4 The associated appendices for this chapter are:

- Appendix 15.1: Climate Change Policy and Guidance
- Appendix 15.2: Figures
- Appendix 15.3: Climate Projections Data

15.1.5 This Chapter has been prepared by Stantec. In accordance with Regulation 18(5) of the Town and Country Planning (Environmental Impact Assessment) Regulations 2017, as amended, a statement outlining the relevant expertise and qualifications of competent experts appointed to prepare this ES is provided in **Appendix 1.6**.

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Part 1: GHG Emissions Assessment

15.2 Policy, Legislation, Guidance and Standards

National Policy and Legislation

15.2.1 The following legislation and policy has informed the assessment of effects within this section. Further details are provided in **Appendix 15.1**.

- The Paris Agreement, 2015
- Climate Change Act (CCA) 2008, as amended
- Carbon Budget Orders 2009, 2011, 2016 and 2021
- Town and County Planning (Environmental Impact Assessment) Regulations 2017
- National Planning Policy Framework (NPPF) 2021
- Planning Practice Guidance (PPG) 2019
- The Road to Zero 2018
- The Ten Point Plan for an Industrial Revolution, 2020
- Transport Decarbonisation Plan, 2021

Guidance

15.2.2 Several standards and guidance documents have been used to inform the GHG emissions assessment methodology and potential mitigation measures. Full details of how the following documents have been considered in the GHG emissions assessment is provided in **Appendix 15.1**:

- Environmental Impact Assessment (EIA) Guidance on assessing greenhouse gas emission and significance (IEMA, 2017).
- Publicly Available Standard (PAS) 2080:2016 Carbon management in Infrastructure (British Standards Institute (BSI), 2016).
- World Business Council for Sustainable Development (WBCSD) and World Resources Institute (WRI) Greenhouse Gas Protocol guidance (WBCSD and WRI, 2004).

Local Policy

Climate Emergency

15.2.3 In 2020, SDC released a Climate Emergency Strategy and Action Plan which sets out six areas of focus and a series of actions to reduce/address the climate and ecological crisis. The six areas are travel, waste, energy & buildings, business & economy, food & agriculture and nature. The Action Plan sets out several actions which seek to reduce GHG emissions, including improving public transport infrastructure, delivering carbon neutral housing, and promoting climate change awareness.

15.2.4 In addition, the five Somerset local authorities have jointly developed Somerset's Climate Emergency Strategy (SCES) (Climate Resilient Somerset, 2020). The aim of the strategy is to reduce carbon emissions in the county and make Somerset a county resilient to the

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inevitable effects of Climate Change. The strategy includes the goal of making Somerset carbon neutral by 2030. Gravity is referenced several times in the SCES and is identified as one of the key developments in Somerset that will play an important role in delivering the clean growth agenda.

Sedgemoor Local Plan 2011-2032

15.2.5 A summary of the relevant planning policy within the Sedgemoor Local Plan 2011-2032 is provided below:

- Policy S4 Sustainable Development Principles requires development proposals to contribute to "*Mitigating the causes of climate change and adapting to those impacts that are unavoidable*".
- Policy S5 Mitigating the Causes and Adapting to the Effects of Climate Change: "*Development should seek to reduce greenhouse gas emissions and contribute to mitigating the causes of climate change. Proposals for zero carbon development will be strongly supported. Development should contribute to all of the relevant following objectives:*
  - *Minimising of natural resources by the use of sustainably sourced materials;*
  - *Reuse and recycling of materials where appropriate;*
  - *Minimising of greenhouse gas emissions;*
  - *Incorporating energy efficiency;*
  - *Reducing waste;*
  - *Encouraging modes of transport other than the car; and*
  - *Utilising renewable and low carbon energy (including decentralised energy) where appropriate, taking into account the need to safeguard amenity, the natural, built and historic environment, and landscape.*"
- Policy D24 Pollution Impacts of Development requires planning applications to be supported by assessments relating to carbon emissions.

Puriton Energy Park Supplementary Planning Document (SPD) 2012

15.2.6 The Puriton Energy Park SPD, adopted March 2012, sets out how the allocation for an Energy Park on the site of the former Royal Ordnance Factory should be developed. The SPD identifies relevant policies for the Energy Park, including those regarding climate change and low carbon energy generation.

15.2.7 The SPD sets out the major power generation likely to be used on site, including combined cycle gas turbine or combined heat and power plant and energy recovery processes, and potential secondary power generation including microgeneration such as biomass, small scale wind turbines or photovoltaic (PV) cells, and notes that any proposed manufacturing uses should involve clean process that relate or complement the renewable and low carbon generation and green technologies on site.

15.2.8 It also provides key considerations for landscape, including use of additional trees to provide summer shade and carbon capture benefits.

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Bridgwater Vision 2015

15.2.9 The Bridgwater Vision, updated and published in December 2015, provides a framework for the planned growth of Bridgwater and states within the Vision that "*In 2060 Bridgwater will be an energy conscious town known for its ambitious approach to sustainability and low carbon living*."

15.2.10 The document includes a section on sustainability which highlights the key environmental consideration of efficient resource use: "*including minimal waste* generation *during construction and in use using WRAP protocols, zero to landfill policies, anaerobic digestion facilities and CHP incineration*."

15.2.11 The document also states that "*new development within the area will need to reflect* the *area's highly visible position along the M5 corridor through high profile, contemporary and highly sustainable (zero carbon) buildings*."

15.2.12 The long term vision for the locality also identified the former Royal Ordnance Factory site, now known as Gravity, as a transformational opportunity to restructure the local economy and more towards a higher value model. This informed the Sedgemoor Core Strategy and site allocation for redevelopment and regeneration, and this informed the designation of the enterprise zone to attract international investment, and the current local plan.

15.2.13 Guidance for new developments is available and includes specific approaches to deal with the headline issues which are; increased risk of high temperatures in summer, flooding in winter, extreme weather events, subsidence due to ground conditions variability and general baseline warming which affects design benchmarking.

15.2.14 This is Gravity Ltd, has considered the policy context locally and nationally, and in response have developed the Clean and Inclusive Growth Strategy to shape and guide the re-imagination of the Site. This is driven by a review of the UN Sustainable Goals and the Governments Grand Challenge of Clean Growth. Gravity, is proposing a focus on large scale advanced manufacturing to secure international investment, create high value jobs, and deliver this in ways that are designed to reduce GHG emissions. This is moving away from previous energy solutions on site to the import of renewable energy via the grid, and working to secure manufacturers that can play an active strategic role in helping the UK economy shift into a lower carbon model, for example, through the manufacturing of electric vehicles, to accelerate progress towards a net zero carbon economy.

15.3 Consultation

15.3.1 The EIA Scoping Report (**Appendix 5.2**) identified the proposed scope and approach of the GHG emissions assessment. SDC provided its EIA Scoping Opinion for Gravity September 2021 (**Appendix 5.3**). SDC's comments regarding GHG emissions are set out in **Table 15.1** below. SDC's comments regarding climate resilience and adaptation are set out in **Section 15.13**.

15.3.2 Further consultation was undertaken with SDC via email correspondence.

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SDC Scoping Comments	Response
The Council agrees that Climate Change should be scoped into the ES. Overall, the scope and methodology set out is considered reasonable and fits in with IEMA guidance, as well as SDC's recently published Climate Emergency Strategy and Action Plan. Given the UK has legally binding GHG emission reduction targets we would recommend the scope explicitly includes reference to how the EIA will give due consideration to how the project will contribute to the achievement of these targets.	The UK's legally binding targets are set out in **Table 15.5**. A series of mitigation measures have been embedded within the design which will help to reduce the GHG emissions associated with the Proposed Development, set out in **Section 15.6**. Additional mitigation measures to be considered as the design progresses and occupiers come forward is set out in **Section 15.8**.
We note that in relation to GHG emissions it is proposed to take into account sources from both construction and operational stages. A review of the potential GHG emission sources during construction and operation should ensure we are able to understand expected emissions from the site, which will help with our pledge to work towards carbon neutrality by 2030 in the district. We look forward to reviewing the details as part of the Environmental Statement.	A review of potential GHG emission sources during construction and operation is set out in Section 15.7. As noted above, measures to reduce these emissions are set out in Sections 15.6 and 15.8.
A qualitative assessment is proposed in the technical note, justified on the basis of this methodology being acceptable where mitigation has been agreed early on in the design phase. The technical note refers to embedding several mitigation measures to reduce GHG emissions, referring to a Clean and Inclusive Growth Strategy and creation of a low carbon campus. In our Climate Emergency Action Plan and Local Plan, we have included a focus on clean growth, which the technical note has captured with the mention of providing low and zero carbon energy infrastructure, creating green-collar jobs and transitioning to net zero transport; therefore supporting low carbon economic growth overall. It is important that these factors are followed through in order to keep the emissions in the operation stage to a minimum. We would therefore agree that the qualitative assessment proposed is appropriate and proportionate, provided the details of the mitigation measures referred to can be secured with the necessary certainty as part of the Local Development Order. Mitigation measures should therefore be set out in detail as part of the Environmental Statement and other relevant LDO material.	The Gravity Clean and Inclusive Growth Strategy is underpinned by a review of the UN Sustainable Development Goals, to identify those which are particularly relevant to this site. This review resulted in themes and suggested implementation priorities which has informed the development process which has led to the LDO. The approach to the mobilisation of the smart campus is to connect to national scale energy through the National Grid, providing renewable energy on site. This is a shift away from the energy generation on site previously considered and factored into the ES. Whilst those former energy uses were 'safeguarded' and subject to separate applications, Gravity are proposing to move into different energy solutions to actively reduce GHG emissions and this is a significant benefit. Attracting the right occupier with shared ambitions is key to delivering the outcomes sought. Therefore, the whole proposition at Gravity, including the LDO which is a marketing tool to attract international investment and create green collar jobs. The transport strategy approach has been co funded and shared with SDC at an early stage in December 2020. This seeks to focus on transport decarbonisation and smart mobility, with rail restoration to provide both passenger and freight services as part of the overall proposal. It is therefore essential that the whole approach is considered from concept to energy provision, to

	transport solutions, to understand the smart campus vision and ambition and how it translates into delivery on the ground. Low and zero carbon energy infrastructure, creating green-collar jobs and transitioning to net zero transport; therefore supporting low carbon economic growth overall.
In our experience of projects of this scale emissions during the construction phase are likely to be high. It is therefore essential that Gravity operates at a low/zero carbon capacity in order to minimise its impact on the environment. In recognising the inevitable carbon emissions in the construction stage of development, this is only valuable if efforts are made to offset those emissions, for example by planting trees in the local area; and to reduce those emissions, for example by using low carbon building materials, recruiting a local workforce to minimise travel to the site etc.	Construction effects are long term but temporary. Gravity will be working with occupiers to shape design and construction processes to minimise emissions and would expect the details submitted through the compliance processes to confirm methodology. The workforce strategy is driven by the Skills Charter to optimise the use of local labour and the Business Charter seeks to utilise local business where possible. A bespoke transport strategy geared around transport decarbonisation with rail restoration and bespoke public transport services aligned to shift patterns will be central to achieving planning outcomes to minimise emissions.

Table 15.1 SDC Scoping Opinion and Response

15.3.3 Somerset County Council (SCC) also provided a response to the Scoping Opinion as follows:

"As you will be aware, SCC, along with the other District Councils in Somerset all passed resolutions declaring a climate change emergency. Working jointly together, all of the Somerset Councils produced the Somerset Climate Emergency Strategy (SCES) document, published in 2020. This sets out Somerset's aspiration to be carbon neutral by 2030 and to build our resilience for and adapting to the impacts of a changing climate. 3 Clear goals are set out in this document:

- *To decarbonise local authorities, wider public sector and reduce our carbon footprint;*
- *To work towards making Somerset carbon neutral by 2030; and*
- *Making Somerset prepared for and resilient to the impacts of climate change.*

The Gravity scheme is referenced several times in the SCES as being a great example of how a new development needs to be delivered and constructed in order to reach our climate change goals. The clean growth agenda lies at the heart of the SCES. The Gravity project is identified as one of the key development projects that will play an important role in delivering the clean growth agenda. In particular, delivering low carbon growth, climate resilient industries, and providing a range of high value jobs that will help Somerset reach its net zero future.

A number of different sectors that will have major impacts on our ambition to become carbon neutral are outlined in the SCES. These include amongst others, Energy, Transport, Local Economy and water resources. Whilst it is acknowledged that the Scoping report is not a planning application, hence many specific details will only emerge with any subsequent planning application(s), it is noted that the key objectives and goals of the SCES align with details outlined in the Gravity Scoping Opinion. Various key Strategies referred to in the Scoping Report that will underpin the Gravity development include a Clean and Inclusive Growth Strategy, an Energy Strategy, Water Strategy and a Travel Plan. These will help deliver an integrated live, work, and play living environment which will respond positively to the challenge of clean growth and transport decarbonisation.

SCC welcome the key principles to address climate change that have been outlined in the Scoping Report, in particular reducing need to travel, providing quality pedestrian and cycle links, good public transport and rail connectivity. The Energy Strategy looks to increase low carbon power generation, energy storage and management on site. The construction of the various new buildings on site will be subject to a Sustainable Procurement Plan in order to reduce waste generation and to maximise energy efficient buildings.

From a climate change perspective, SCC are keen to ensure that the Gravity project delivers the goals of the SCES. SCC welcomes the clear ambition of the Gravity project to deliver clean growth and would welcome the opportunity to be consulted on any subsequent development proposals."

15.4 Methodology

Study Area

15.4.1 The GHG emissions assessment study area includes the Site and extends to include activities that occur beyond the Site boundary, such as the generation of electricity off site. As GHG impacts are global and cumulative with all other sources of emissions, no specific geographical study area is defined for the identified GHG emission sources that are set out in **Table 15.2**.

Baseline Data Collection

15.4.2 A high-level review of existing land use and associated activities on Site has been undertaken to identify the baseline GHG emissions. This includes a review of Chapter 11 Air Quality and the supporting appendices, along with the UK Carbon Budgets and UK local authority GHG inventory data (DBEIS, 2020).

15.4.3 A review has also been undertaken of relevant reports that will be submitted with the LDO including the Energy Strategy and Waste Strategy. The Clean and Inclusive Growth Strategy, available on the Gravity website, has also been reviewed. Where information from reporting outside the ES has been considered, all relevant information to inform the assessment of likely significant effects on the environment has been summarised within this Chapter.

15.4.4 The 2032 Baseline takes into consideration the carbon budgets for this time period, which the UK Government is legally bound to achieve, and anticipated policy changes such as revisions to Approved Document Part L of the Building Regulations. In addition, the 2032 Baseline considers several technological advances which are extremely likely to come forward, including the progressive decarbonisation of the National Grid, and increased uptake of Electric Vehicles. However, it is acknowledged under Limitations below that it is not possible to anticipate all technological advances which may come forward and result in changes to GHG emissions.

Sensitive Receptors

15.4.5 GHG emissions have a global effect rather than directly affecting specific local receptors to which levels of sensitivity can be assigned. The global climate has therefore been treated as a single receptor. Given the global scale and severe consequences of climate change and limited recoverability, the receptor sensitivity is considered to be high.

Assessment Methodology

15.4.6 There is no nationally adopted method for assessing climate change within EIA and therefore the assessment approach draws upon IEMA guidance (IEMA, 2017). It identifies that all GHG emissions will contribute to climate change and thus might be considered

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significant, this is set out further in paragraphs 15.4.14-15.4.20. It therefore suggests the impact of a development on climate should be based on its potential to emit GHGs.

15.4.7 The GHG emissions assessment will be based on the broad parameters of the Proposed Development, as the design will be progressed subsequently.

15.4.8 IEMA guidance emphasises the need for proportionality in the context of national, sector and local GHG emissions. The guidance recognises that qualitative assessments are acceptable, particularly where mitigation measures are agreed early on in the design stage and is agreed during the EIA scoping stage with stakeholders. Taking a qualitative approach has been agreed with SDC as appropriate and proportionate for the Proposed Development at scoping. The Proposed Development has embedded several measures to reduce GHG emissions associated with the design and construction, outlined in Section 15.6 below. In addition, there is anticipated to be limited emissions on Site once the Proposed Development is operational.

15.4.9 The GHG Protocol (WBCSD and WRI, 2019) categorises direct and indirect emissions into three broad scopes:

- *Scope* 1: all direct GHG emissions;
- Scope 2: indirect GHG emissions from the generation of purchased electricity, heat, or steam; and
- Scope 3: other indirect emissions, such as the extraction and production of purchased materials and fuels, electricity-related activities not covered in Scope 2, outsourced activities, waste disposal, etc.

15.4.10 The scope of the GHG Emissions assessment is set out in **Table 15.2** below.

Stage of Development	GHG Protocol	Activity Assessed
Demolition/ Construction	Scope 1	Enabling activities, land clearance and construction processes such as emissions resulting from the combustion of fuels for vehicles, plants or equipment used for construction of the Proposed Development and emissions released by soil movement
	Scope 2	Emissions associated with electricity needed for plant and welfare facilities.
Operation	Scope 1	Emissions associated with transport.
	Scope 2	Emissions associated with purchased electricity from the National Grid and distribution network during operation of the Proposed Development, for example emissions associated with the Energy Strategy.

Table 15.2 GHG Emissions Sources and Qualitative Scope

15.4.11 During operation of the Proposed Development, it is anticipated that all power will be supplied from the National Grid and/or through the Distribution Network Operator (DNO). It is unlikely there would be direct Scope 1 emissions associated with energy generation in the Proposed Development, as the Energy Strategy does not identify burning gas as a primary energy generation technology at this stage (Stantec, 2021).

15.4.12 Indirect Scope 3 emissions are emitted from activities which are predominantly outside of Gravity's control, for example, waste disposal and emissions related to the supply chain of

construction materials. It is therefore difficult to assess these accurately and meaningfully at the early stage of a project and it is not considered appropriate or proportionate in the context of the Proposed Development and the EIA Regulations.

15.4.13 IEMA guidance recognises that the assessment of GHGs should be proportionate in the context of EIA. Therefore Scope 3 emissions have been scoped out of further assessment as it is not considered proportionate to the Proposed Development within the context of the EIA. Embedded and further mitigation that reduces GHGs, including indirect Scope 3 emissions, associated with the Proposed Development are considered within the assessment.

Determining Significance

15.4.14 There is an absence of significance criteria or defined threshold for determining the significance of effects resulting from GHG emissions in EIA. Significance of effect is therefore determined using professional judgement, and consideration of the following elements:

- Appraisal of the Proposed Development's emissions in the context of national, regional and local emissions.
- *IEMA* EIA Guide to Assessing Greenhouse Gas Emissions and Evaluating their Significance (IEMA, 2017).
- How the Proposed Development has embedded design features to reduce GHG emissions and identified opportunities for further mitigation in the Proposed Development's design and delivery.

15.4.15 IEMA guidance identifies three underlying principles to inform the assessment of significance and conclude that:

- *"all projects create GHG emissions that contribute to climate change;*
- *climate change has the potential to lead to significant environmental effects;*
- *there is a GHG emission budget that defines a level of dangerous climate change whereby any GHG emission within that budget can be considered as significant."*

15.4.16 Therefore, in the absence of any significance criteria or a defined threshold, IEMA recommends that all GHG emissions should be considered as significant, and that the EIA should ensure the project addresses their occurrence through mitigation.

15.4.17 IEMA guidance goes on to say that a projects carbon contribution should be contextualised against sectoral, local or national carbon budgets as this will provide a sense of scale. The methodology applied to this assessment uses a 'magnitude of impact' that takes into consideration the impact of GHG emissions generated by the Proposed Development on national, regional and local GHG emissions targets, outlined in **Table 15.3**. The level of effect will be based on the considerations identified above and the matrix in **Table 15.4** below.

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Magnitude	Measure of Impact
Large	A large impact considered to be of national scale.
Moderate	A moderate impact considered to be of regional scale.
Small	A small impact considered to be of local scale.
Negligible	An impact considered to be beneath level of perception.

Table 15.3 Magnitude of Impacts

15.4.19 GHG emissions have a global effect rather than directly affecting specific local receptors to which levels of sensitivity can be assigned. The global climate has therefore been treated as a single receptor. Given the global scale and severe consequences of climate change and limited recoverability, the receptor sensitivity is considered to be high.

Magnitude	Receptor Sensitivity
	High
Large	Major to Substantial
Moderate	Moderate to Major
Small	Minor to Moderate
Negligible	Negligible to Minor

Table 15.4 Significance of Effects Matrix

15.4.20 In accordance with IEMA guidance, which states all GHG emissions might be considered significant due to the global severity of climate change, all effects stated in **Table 15.4** above are considered to be **Significant**.

15.4.21 The assessment takes account of embedded and further mitigation. Any effect that has no mitigation is considered to have a national scale effect, and therefore large magnitude of impact, as unmitigated GHGs have the potential to impact national carbon budgets. Effects that have been mitigated but are still expected to emit GHGs, are considered to have a regional or local scale effect depending on the activity being assessed as the emitted GHGs have the potential to impact local or regional baseline emissions and carbon targets. In line with IEMA guidance, all effects are considered significant but will be of national, regional or local significance.

Limitations

15.4.22 Given the nature of the LDO, the assessment has been based on high level information. This has been taken into consideration through the use of a qualitative approach to assessing the GHGs of the Proposed Development.

15.4.23 The trajectory of GHG emissions into the future is dependent on influences outside of the Applicant's control, for example Government policy and global technology and economic shifts, which are difficult to predict. The UK carbon budgets are legally binding, and the Government have an array of policies and levers to be deployed if the carbon budgets are not likely to be met.

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15.5 Baseline Conditions

Current State of the Environment

National and Regional Emissions

15.5.1 This section establishes the existing GHG emissions at a national and regional level. GHG emissions do not have a local receptor as, once they are emitted, they are not limited to geographic boundaries.

15.5.2 **Table 15.5** sets out the UK carbon budgets from 2008 until 2017.

UK Budget	Carbon budget level (million tonnes carbon dioxide equivalents - MtCO2e)	Reduction below 1990 levels	UK Emissions
1st carbon budget (2008 to 2012)	3,018 MtCO2e	25%	2,982 $MtCO_2e$
2nd carbon budget (2013 to 2017)	2,782 MtCO2e	31%	2,398 MtCO2e

Table 15.5 2008-2017 UK Carbon Budget

15.5.3 From a national perspective, in 2019, UK total GHG emissions were estimated to be 454.8 million tonnes carbon dioxide equivalents (MtCO2e), a decrease of 2.9% compared to 2018 (DBEIS, 2021). National GHG emissions in 2019 have decreased by 43.8% since 1990 (DBEIS, 2020).

15.5.4 The Department for Business, Energy & Industrial Services (DBEIS, 2020) sets out the CO_2 emissions estimates from a number of sources for 2005-2018, and is the most up to date available figures for the UK, Somerset and Sedgemoor. The CO_2 estimates for 2018 is presented in **Table 15.6** below.

	Industry and Commercial ($ktCO_2$)	Domestic ($ktCO_2$)	Transport ($ktCO_2$)	Land Use, Land Use Change and Forestry ($ktCO_2$)	Total ($ktCO_2$)
UK	133,293.3	96,429.8	126,801.1	-11,699.9	344,824.3
Somerset	962.3	785.1	1,505.5	15.8	3,268.7
Sedgemoor	220.0	165.1	450.9	29.4	865.4

Table 15.6 National, Somerset and Sedgemoor CO_2 estimates for 2018

15.5.5 Sedgemoor accounts for approximately 26% of the total CO_2 emissions in Somerset, and 0.25% of the total UK emissions.

Local Emissions

15.5.6 The Site comprises 263 ha of open flat land. There are currently limited GHG emissions from the Site. Scattered trees and shrubs across the Site, as well as those clustered in the

northwest corner, along the railway line, and along the southern boundary, may provide a limited amount of carbon sequestration on site.

2032 Baseline

National and Regional Emissions

15.5.7 The Climate Change Act 2008, as amended, requires the government to set five-yearly carbon budgets, after taking advice from the Committee on Climate Change (CCC). The budgets are fixed in advance and set five-year caps on the total GHG emissions allowed to ensure the UK meets its emissions reductions commitments.

15.5.8 The carbon budgets enable net increases in emissions to be managed within the carbon budgets by balancing with performance in other sectors. Governments can use an array of policies and levers to achieve the net reductions necessary to meet the carbon budgets whilst taking an economy-wide and national approach to securing overall emissions reductions whilst facilitating other objectives including economic growth, energy security and levelling up.

15.5.9 The carbon budget for England for the period 2023-2026 is set to reduce GHG emissions by an average of 51% lower than the 1990 baseline emissions, as set out in **Table 15.7** below. The 6th carbon budget, for the period 2033-37, was accepted by the Government in April 2021 and adopted into law in July 2021. It is the first budget to consider the UK's net zero target by 2050 with a trajectory that is consistent with the Paris Agreement.

UK Budget	Carbon budget level (million tonnes carbon dioxide equivalents - MtCO2e)	Reduction below 1990 levels
3rd carbon budget (2018 to 2022)	2,544 $MtCO_2e$	37% by 2020
4th carbon budget (2023 to 2027)	1,950 $MtCO_2e$	51% by 2025
5th carbon budget (2028-2032)	1,725 $MtCO_2e$	57% by 2030
6th carbon budget (2033-2037)	965 $MtCO_2e$	78% by 2035

Table 15.7 2018-2037 UK Carbon Budget Targets

Local Emissions

15.5.10 As set out in **Chapter 5**, the 2032 baseline comprises the consented Huntspill Energy Park (HEP) (excluding safeguarded land for energy generation), local approved developments and the Hinkley C overhead lines. The HEP planning consent allowed for up to 32,150 sqm of B1a, b or c buildings, up to 43,600 sqm of B2 buildings and up to 99,462 sqm of B8 buildings. Due to the outline nature of the LDO, the exact use of these buildings was not defined. However, due to the scale and use class, if implemented the HEP would generate GHG emissions.

15.5.11 It is assumed that the buildings of HEP will need to comply with the 2013 Building Regulations at the Reserved Matters stage. An uplift to the energy efficiency requirements of buildings set by the Building Regulations Part L (conservation of fuel and power) is expected later this year and due to be adopted in 2022. The proposed update would include an uplift

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to the energy efficiency standards and requirements, 'tightening' the current building standards. It aims to reduce the energy demand of buildings through higher standards of building fabric and insulation. This would reduce the GHG emissions associated with heating and cooling of buildings.

15.5.12 Sources of GHG emissions would include emissions associated with transport. By 2032, it is anticipated that emissions from the transport sector will have declined, (DBEIS, 2020). In 2018, 97% of final energy consumption in transport was from fossil fuels, however by 2035 this is projected to fall to 93% due to the update of EVs and increased use of biofuels.

15.5.13 In 2018, the UK Government launched the Road to Zero strategy, which sets out its ambition to reduce emissions from vehicles on UK roads and promote the uptake of zero emissions vehicles (DfT, 2018). Proposed support mechanisms to facilitate this transition include increasing the supply and sustainability of low carbon fuels in the UK through a legally-binding 15-year strategy, offering grants for plug-in vehicles and introduce a voluntary industry-supported commitment to reduce Heavy Goods Vehicles GHG emissions by 15% by 2025, from 2015 levels.

15.5.14 In March 2020, the Electric Vehicles and Infrastructure paper was published, which outlined how the infrastructure for EVs have been planned for and what incentives are available to encourage growth. In November 2020, the UK Government announced that the sale of new petrol and diesel cars will be stopped in the UK by 2030 (DfT, 2020). The two phased processed will see the phase out date for the sale of new petrol and diesel cars and vans be brought forward to 2030, and all new cars and vans to be fully zero emissions at the tailpipe from 2035. This target is also supported by DfT's Transport Decarbonisation Plan (July 2021),as set out in **Appendix 15.1**. Significant investment has been allocated to support the greater uptake of zero emission vehicles, including £1.8 billion to build more chargepoints, as well as £582 million in grants.

15.5.15 The Proposed Development would also generate emissions associated with purchased electricity from the National Grid during operation of the development, for example for lighting. The National Grid is currently decarbonising, which is anticipated to continue over the next decade. This is an outcome of the continued uptake of renewable energies and the decline of coal-fired power stations across the UK. The increasing share of low carbon, renewable energy sources with a corresponding decrease in the use of fossil fuels, is termed "decarbonisation". This change is significant as it encourages the use of grid-supplied electricity systems, such as air source heat pumps, over gas-fired plant. Furthermore, technologies generating on-site electricity (such as gas-engine combined heat and power (CHP)) will not achieve the carbon savings they have to date (because they are offsetting less 'carbon' as the grid decarbonises). Therefore, the emissions per unit of electricity generated (grams of carbon dioxide per kilowatt hour) is reducing. The Governments policy paper 'Transitioning to a net zero energy system: smart systems and flexibility plan' (July 2021), see **Appendix 15.1**, further supports the decarbonisation of energy across the UK. As a result, GHG emissions within HEP from elements dependant on grid energy, including EV charging, will reduce.

15.5.16 Under the 2017 Planning Consent there is a series of proposed habitat retention, losses, creation and enhancement to habitats within the Site, which is anticipated to be managed through habitat management strategies. The discrete blocks of plantation woodland present throughout the Site is considered to be retained as part of the 2032 Baseline, which will continue to mature and sequester carbon. Amendments to the landscaping plan relating to the 2017 Planning Consent including new areas of woodland will not be in a mature condition as part of the 2032 Baseline. Outside of the woodland, orchard and hedgerow treelines, there are relatively few mature trees within the Site. New tree planting is proposed together with a tree nursery so that there is a pipeline of specimens to plant and renew the tree population on Site and support tree planting off the main Site including on the Gravity Link Road. The Gravity tree nursery can be used to accelerate tree planting across a wider area.

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15.6 Embedded Mitigation

Construction

15.6.1 During construction, a Framework Demolition and Construction Environmental Management Plan (FDCEMP) will be prepared prior to the commencement of construction works at the Site. The FDCEMP will include mitigation measures covering transport, materials, waste and air quality during construction. Measures that will reduce GHG emissions during construction include, for example, no unnecessary idling of engines, maintenance of plant equipment to check they are operating optimally and efficient use of materials to reduce waste. The FDCEMP is secured through the Compliance Form.

15.6.2 Additionally, a Site Waste Management Plan (SWMP) will be implemented to manage waste during construction. The SWMP aims to ensure that the waste produced during the construction phase and other phases of the Proposed Development are dealt with in accordance with the duty of care provisions in the Environmental Protection Act (1990). The adoption of the principles of the waste management hierarchy will be implemented throughout. This will help to reduce GHG emissions associated with waste management. The SWMP is secured through the Compliance Form.

Operation

Transport

15.6.3 As outlined in Chapter 9 Transport and Access, the general approach to access and movement through the Proposed Development focuses on the following themes:

- Reducing the need to travel;
- Reducing travel distances;
- Improving access and choice for pedestrian movement;
- Improving access and choice for cycle movement;
- Introducing new and innovative micromobility measures;
- Improving local bus / public transport connectivity.

15.6.4 A Framework Travel Plan (**Appendix 9.2**) has been prepared which sets out modal share targets, measures to encourage travel by sustainable modes of transport, and a robust monitoring and review programme.

Energy

15.6.5 The Design Guide sets out the ambitions to deliver a smart campus that supports clean and inclusive growth sectors and identifies a clear need to provide this with consideration of climate change. This is supported by an Energy Strategy (Stantec, 2021) which sets out key targets for delivering clean energy. As stated in the Energy Strategy, the residential dwellings on Site will have 100% electric-led heating and hot water. As described in **Section 15.5.13** above, as the National Grid continues to decarbonise, the grams of carbon per kilowatt hour for electricity will decrease, and therefore associated carbon emissions with grid electricity will continue to reduce over time.

15.6.6 Gravity will adopt the nationally and locally recognised energy hierarchy of reducing energy demand in the first instance, using energy efficiently and, only then, providing renewable and low carbon energy generation technologies where it is appropriate to do so. The Energy Strategy sets out a series of design principles to reduce energy demand, such as orienting

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buildings where possible to take advantage of south-facing aspects for winter passive solar gains, as well as 'passive' and 'active' building design principles to reduce energy demand of buildings.

Retention and Creation of Habitats, Green Infrastructure and Open Space

15.6.7 The Strategic Landscape parameter plan outlines the proposals for the incorporation of green infrastructure and natural open space, retention of existing meadow grasslands and proposed new woodland planting. The Strategic Landscape Parameter Plan shows a green, landscaped edge in the south east corner of the Site, in the south west corner of the Site and on the Western boundary of the site. Additionally, a landscaped green edge will be provided along Woolavington road and an east-west landscape corridor south of the HEP which will incorporate street trees and rhynes. Additional landscape works are proposed in the North east of the site.

15.6.8 The incorporation of green infrastructure and natural open space will provide evaporative cooling at night and help to reduce the heat island effect. The permeability of green spaces throughout the Proposed Development will help to facilitate air movement, enhance natural ventilation and will help provide shading and local cooling of the microclimate. This will assist in passively reducing the energy demands, and therefore the GHG emissions, of the Proposed Development.

15.7 Assessment of Likely Effects

Construction

Scope 1

15.7.1 The main sources of direct GHG emissions during construction relate to the combustion of fossil fuels during the transportation of building materials and waste by Heavy Goods Vehicles (HGV) to and from the Site, as well as powering construction plant engines and equipment. The implementation of the FDCEMP will help to manage and reduce GHG emissions associated with construction vehicles, plant and equipment. The direct GHG emissions from construction activities is considered to have a regional scale of impact given the size of the site and the carbon intensive nature of construction without intervention and based on current emission standards. This is Moderate Adverse impact at a regional level and therefore is of **Moderate Significance** without the implementation of further mitigation.

15.7.2 The enabling activities and land clearance activities required for the construction of the Proposed Development will result in direct GHG emissions released from movement and disturbance of soil on Site. However, as the majority of the Site has been remediated under the 2017 Planning Consent, it is considered that the existing ground conditions are already well disturbed, and this is likely to affect only the greenfield elements of the Site (approximately 11 ha). This will result in a local scale and Small Adverse impact and therefore is of **Minor Significance**.

Scope 2

15.7.3 The temporary construction office, welfare facilities, temporary residential accommodation for construction workers and temporary lighting on the Site will require electricity purchased from the National Grid. This will result in indirect GHG emissions generated from the burning of fossil fuels to deliver electricity to the National Grid. Construction for Gravity is anticipated to come forward as the National Grid continues to decarbonise. Additionally, the implementation of a FDCEMP will help to manage and control the use of electricity on Site. The indirect GHG emissions from construction activities is considered to have a regional scale and Moderate Adverse impact and therefore is of **Moderate Significance** without the implementation of further mitigation.

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Operation

Scope 1

15.7.4 The Proposed Development will generate an increase in traffic volumes through the Site and along the local transport network thereby generating GHG emissions from burning fossil fuels through road transport. Traffic associated with the residential land uses will generate a limited number of HGVs, however there may be a higher number of HGV movements associated with the commercial and energy distribution land uses. **Section 9.7** of the Transport Chapter outlines the anticipated changes to traffic flows as a result of Gravity against the 2032 Baseline. No road link shows an increase of traffic movements above 13%. It is noted that some links are anticipated to experience reduced traffic movements, however this may be as a result of redistribution across the road network rather than a reduction of trips. The direct emissions from operational transport are anticipated to have a regional scale and Moderate Adverse impact and therefore is of **Moderate Significance** without the implementation of further mitigation.

15.7.5 The woodland areas on the Site currently act as land carbon sinks which naturally sequesters and stores carbon. The Strategic Landscape parameter plan shows indicative areas of structural and woodland planting. It is typical for planting to take approximately 15 years to mature and, once established, these new woodland areas will also sequester and store carbon. Therefore, the direct GHG emissions from land use change is a Small Beneficial impact at a local level and therefore of **Minor Beneficial Significance**.

Scope 2

15.7.6 GHG emissions will be produced as electricity from the National Grid is purchased for electric heating, powering appliances and maintaining lighting on the proposed road network. However, as noted above, the amount of GHG's anticipated to be released as a result of generating electricity for the National Grid is anticipated to decrease over the next 10 years as a direct result of the rapid decarbonisation. The decarbonisation of the Grid will reduce the amount of GHGs emitted by the operational energy uses of the Site over time, however until the National Grid is net zero, the indirect emissions from purchased electricity within the Proposed Development is considered to have a regional scale and Moderate Adverse impact and therefore is of **Moderate Significance** without the implementation of further mitigation.

15.8 Further Mitigation

15.8.1 The below further mitigation alongside the embedded mitigation outlined above **section 15.6**, is in line with local policy, including Policy S5 of SDCs Local Plan which requires new development to contribute to the following objectives:

- Minimising of natural resources by the use of sustainably sourced materials: **Paragraph 15.8.3**;
- Reuse and recycling of materials where appropriate: **Paragraph 15.6.2**;
- Minimising of greenhouse gas emissions: all mitigation referenced in **sections 15.6** and **15.8**;
- Incorporating energy efficiency: **Paragraph 15.8.4**;
- Reducing waste **Paragraph 15.6.2**;
- Encouraging modes of transport other than the car: **Paragraphs 15.6.3** and **15.8.8**; and

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- Utilising renewable and low carbon energy (including decentralised energy) where appropriate, taking into account the need to safeguard amenity, the natural, built and historic environment, and landscape: **Paragraphs 15.8.7, 15.6.6-7** and **15.8.10**.

Construction

15.8.2 Construction Traffic Management Plans (CTMP) will be prepared for the construction phase, which will set out the routing plans for working and deliveries, scheduling and timing of deliveries, and logistics plans. This will help to improve the efficiencies of vehicle movements during operation and in turn, reduce GHG emissions associated with construction traffic. The Framework Demolition and Construction Environmental Management Plan (FDCEMP) identifies mitigation measures that limit potential impacts from construction traffic. This will also consider vehicle type, fuel and emissions and include the opportunity for trials and test beds to explore new methodologies and practice. CTMPs (within the FDCEMP) are secured through the Compliance Form.

15.8.3 The LDO will require occupiers to develop their own Environmental and Social Governance (ESG) policies and prepare an annual ESG report on progress. This is secured through the Compliance Form (and is an obligation within the S106). This will include measures on sustainable procurement. and the responsible sourcing of materials. Utilising recycled materials, where possible, is the most sustainable approach, with the consideration of using materials that go through less energy-intensive processes and that can be sourced locally. There are a number of UK organisations promoting the review and reduction of embodied carbon and supply chain emissions associated with construction as part of their sustainability initiatives. These include WRAP, the UK Green Building Council and the Green Construction Board. The Site Waste Management Plan, (**Appendix 3.3**) includes measures on material procurement and the use of material suppliers with environmental standards where possible. These measures will help to reduce embodied carbon.

Operation

Energy Efficiency

15.8.4 The energy efficiency requirements of the Building Regulations are set out in Part L of Schedule 1, as well as in a number of specific building regulations. Approved Documents L1A and L2A set out the requirements for conservation of fuel and power in dwellings and non-domestic buildings, respectively.

15.8.5 An update to Approved Document Part L1A is planned to be released in 2021, which is expected to have significant implications for energy strategies for new developments. The proposed update would include an uplift to the energy efficiency standards and requirements, 'tightening' the current building standards. It aims to reduce the energy demand of buildings through higher standards of building fabric and insulation. This would reduce the GHG emissions associated with heating and cooling of buildings.

15.8.6 As outlined in the Energy Strategy (Stantec, 2021), a Future Homes Standard will be coming forward and introduced by 2025. As a result of the uplifts in energy efficiency standards, it is anticipated that homes at the Proposed Development will built out to a high level of energy efficiency, thereby reducing the GHG emitted associated with heating and cooling of buildings.

Renewable Technologies

15.8.7 The Energy Strategy (Stantec, 2021) for the Proposed Development has identified a number of opportunities for incorporating renewable and low carbon energy generation technologies. The most suitable technologies are anticipated to be photovoltaic solar panels (PV), battery storage, heat recovery technology, solar water heating systems (or solar thermal) and heat

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pumps. These technologies would reduce the GHG emissions associated with energy use during the operation of the Proposed Development.

15.8.8 It is noted that EON has signed a 50-year agreement with This is Gravity ltd. to provide renewable and low carbon energy solutions for the Site. This is Gravity ltd. is also seeking agreement with National Grid to secure renewable energy through the grid system using Purchase Power Agreements (PPAs) and Renewable Energy Guarantees Origin (REGOs). This agreement will be completed once occupiers for the Site are confirmed.

Transport

15.8.9 Opportunities will be sought to integrate EV charging across the Site, as well a Car Club to reduce the need to own a car. These measures will help to reduce GHG emissions resulting from transport.

15.8.10 Whilst it is not mitigation, as noted in the 2032 Baseline section, emissions from transport are predicted to decline in the coming decades. The uptake of EVs and hydrogen is anticipated to increase in line with Government policies, as petrol and diesel car sales will be banned by 2030. It is projected that the proportion of milage driven by EVs for example is anticipated to almost double from 7.5% in 2030 to 14.1% in 2035 (add ref). An increase in EV uptake will result in a reduction in transport emissions associated with the Proposed Development in the long term, as vehicles will be powered by lower (or zero) emitting electricity sources.

Landscape and Ecology

15.8.11 As outlined in **Chapter 12 Biodiversity**, an Ecological Mitigation and Enhancement Strategy (EMES), which is secured within the Compliance Form, will be prepared for the Site that secured by way of the design code and mitigation checklist. This report will include consideration of the maintenance / management measures associated with onsite ecological networks and features that are to be retained, enhanced and created within the Proposed Development. This will help to ensure maturation of existing retained and proposed woodland planting which will continue to sequester carbon on site.

Future Occupation of the Site

15.8.12 The Proposed Development is framed to attract large scale advanced manufacturing facilities to the UK to accelerate progress towards achieving a net zero carbon economy, hosting new business to support transport decarbonisation and the shift to electrification. Supporting green industries could result in wider carbon reductions beyond the Site GHG emissions.

15.9 Residual Effects

Construction

15.9.1 The assessment identified a moderate adverse significant resulting from Scope 1 GHG emissions from the combustion of fossil fuels on Site during construction activities. It is anticipated that, with the implementation of the further mitigation which includes ESG policies on, for example, sustainable procurement and the use of renewable energy in construction as identified in **Section 15.8**, this will be reduced to a **Minor Adverse Significant** effect on the local context of emissions, in keeping with IEMA guidance.

15.9.2 Minor adverse effects from Scope 1 GHG emissions from land clearance and enabling activities were identified. There are no further mitigation measures identified and therefore the effect remains **Minor Adverse Significant** effect on the local context of emissions, in keeping with IEMA guidance.

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15.9.3 Moderate adverse effects from Scope 2 use of electricity from the National Grid were also identified in the assessment. Through the use of electric and hydrogen led construction techniques adopting decarbonised grid electricity and local renewable generation, the context of the emissions would reduce to local and therefore **Minor Adverse Significant** effect on the local context of emissions, in keeping with IEMA guidance.

15.9.4 The Proposed Development considers several mitigation measures to reduce these emissions through responsible and sustainable construction practices. Embedded and further mitigation for the Proposed Development is in line with local policy requirements and it is therefore considered that, while residual effects remain, the Proposed Development addresses GHG emissions during construction.

Operation

15.9.5 The assessment identified a moderate adverse effect resulting from Scope 1 GHG emissions during the operation stage as a result of transport emissions. It is anticipated that, with the implementation of the further mitigation on electric and hydrogen movement, identified in **Section 15.8**, this will be reduced to a local impact therefore consider a **Minor Adverse Significant** effect on the local context of emissions, in keeping with IMEA guidance.

15.9.6 A Minor Beneficial effect has been identified in relation to carbon sequestration from the proposed planting within the Site. While further mitigation will help to see the longer term success of the planting, the effect is considered to remain as **Minor Beneficial** and **Significant** on a local scale.

15.9.7 Moderate adverse effects were also identified from Scope 2 use of electricity from the National Grid. With the incorporation of energy efficiency measures, electric heating led energy use and renewable energy provision, this will reduce to a **Minor Adverse Significant** effect on the local context of emissions, in keeping with IEMA guidance.

15.9.8 With the national decarbonisation of the grid and the potential for agreement of securing REGOs or directly connected renewable energy with smart grid infrastructure with future occupiers of the Site, there is the potential for this effect to become Negligible and Not Significant.

15.9.9 Several mitigation measures are embedded into the design of the Proposed Development and further mitigation has also been identified to be secured through the design guide and mitigation checklist. It is also acknowledged that the Proposed Development is an enabler of low carbon industries which could result in wider carbon reductions beyond the Site GHG emissions. The mitigation for the Proposed Development is in line with local policy and it is therefore considered that the Proposed Development addresses GHG emissions during the operation stage.

15.9.10 GHG emissions are also expected to reduce over time due to several Government policies and strategies, including the national decarbonisation of the Grid, the transition to greener industrial uses and the increased use of EVs over petrol or diesel vehicles. In the context of Government policy, it is considered that GHGs resulting from the Proposed Development will be **Not Significant** on a national scale.

15.10 Monitoring

15.10.1 GHG emissions during construction and operation are considered to be significant on a local scale. Construction activities, including transport, energy consumption and plant emissions will be monitored and managed through the FDCEMP. It is not considered proportionate to monitor the operational GHG emissions of the Proposed Development given that there are several sources of emissions, many of which that are out of the control of the Applicant as the occupiers are not yet known.

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15.10.2 However, the travel patterns of future occupiers of the Proposed Development will be monitored through travel surveys, as identified in the Framework Travel . Energy use will be regulated as each plot comes forward in more detail, detailing how the energy commitments have been met through the design for each Phase, and development control will certify the Proposed Development to be delivered in accordance with the regulatory requirements. Monitoring of the existing retained and proposed planting will be undertaken as part of the EMES.

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Part 2: Climate Change Risk Assessment

15.11 Introduction

15.11.1 This section presents the assessment of likely significant effects of climate change upon the Proposed Development. Assessing climate change resilience and adaptation aims to determine the vulnerability of key environmental receptors to climate change, the likely significant effects climate change would have on these receptors and outline the mitigation measures that the Proposed Development takes to adapt to the projected climate change effects. The Climate Change Risk Assessment (CCRA) is presented in **Table 15.11**.

15.12 Policy, Legislation, Guidance and Standards

National Policy and Legislation

15.12.1 The following legislation has informed the assessment of effects within this section. Further details are provided in **Appendix 15.1**

- Town and County Planning (Environmental Impact Assessment) Regulations 2017 (as amended)
- National Planning Policy Framework (NPPF) 2021
- Planning Practice Guidance (PPG) 2019

Local Policy

15.12.2 In 2020, SDC released a Climate Emergency Strategy and Action Plan, which sets out six areas of focus and a series of actions to reduce address the climate and ecological crisis. The six areas are travel, waste, energy & buildings, business & economy, food & agriculture and nature. The Action Plan sets out key climate resilience measures within Sedgemoor, including preparing for extreme weather events, and increasing tree cover within the district.

15.12.3 A summary of the relevant planning policy within the Sedgemoor Local Plan 2011-2032 is provided below:

- Policy S4 Sustainable Development Principles requires development proposals to contribute to "*Mitigating the causes of climate change and adapting to those impacts that are unavoidable*", and "*Providing a wider choice of housing to meet the needs of local people with improved house type designs that respond to climate change and population change*";
- Policy S5 Mitigating the Causes and Adapting to the Effects of Climate Change requires development to adapt to the effects of climate change by:
  - "*Minimising and where possible reducing the risk of flooding, including avoiding inappropriate development in flood risk areas. Where development is necessary ensuring development is safe over its lifetime without increasing flood risk elsewhere and ensuring appropriate management of land within areas vulnerable to flooding;*
  - *Maximising resilience to climate change through design, layout and construction;*
  - *Providing additional measures through natural shade and cooling in the built environment and the provision of networks of green infrastructure and tree planting to compensate for CO2 emissions;*

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- *Ensuring that the ability of landscapes, habitats and species to adapt to the adverse effects of climate change is not affected with compensatory habitats provided;*
- *Water efficiency and other measures to improve drought-resilience, maintain water flows and quality, including the use of sustainable drainage systems;*
- *Protecting soils to ensure they are resilient to the effects of climate change;*
- *Providing increased opportunities to walk or cycle;*
- *Supporting opportunities for local food production and farming*."

- Policy D2 Promoting High Quality and Inclusive Design requires development to demonstrate "*High quality sustainable and inclusive design that responds positively to and reflects the particular local characteristics of the site and the identity of the surrounding area as well as taking into account climate change*" and "*That consideration has been given through the design process to climate change mitigation and adaptation, including good design of layout, aspect, massing and use of materials in order to reduce energy consumption and thereby minimise contributions to climate change*".

Puriton Energy Park Supplementary Planning Document (SPD) 2012

15.12.4 The Puriton Energy Park SPD, adopted March 2012, sets out how the allocation for an Energy Park on the site of the former Royal Ordnance Factory should be developed. The SPD identifies relevant policies for the Energy Park, including those regarding climate change, and highlights the need to consider climate change within a range of topics including green infrastructure provision, flood risk, and community, recreation and leisure facilities.

Bridgwater Vision 2015

15.12.5 The Bridgwater Vision, updated and published in December 2015, provides a framework for the planned growth of Bridgwater and states within one of the 15 primary objectives for Bridgwater is "*To create an urban design framework using creative development concepts that are innovative in their response to climate change, sustainable development, retail, residential and commercial opportunities*."

15.12.6 The document referencing the National Guidance on Adaptation to Climate Change and the headline issues for climate change include "*increased risk of high temperatures in summer, flooding in winter, extreme weather events, subsidence due to ground conditions variability and general* baseline *warming which affects design benchmarking*".

15.12.7 The document notes that "*Further integration of energy generation, green infrastructure, air quality improvements, sustainable transport and flood prevention measures into growth and development will ensure that Bridgwater is resilient and able to adapt to climate and economic change*." A key priority for the area going forward is the need for "*resilience planning and infrastructure to protect the district from the effects of climate change*".

Guidance

15.12.8 Several standards and guidance documents have been used to inform this chapter. Full details of how the following documents have been considered in climate change resilience and adaptation is provided in **Appendix 15.1**:

- EIA Guidance on Climate Change Resilience & Adaptation (IEMA, 2020)
- UKCP18 Guidance: How to use the UKCP18 Land Projections (Met Office, 2018)

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- UK Climate Change Risk Assessment 2021 (CCC, 2021);
- The National Adaptation Programme (Defra, 2018).

15.13 Consultation

15.13.1 SDC provided its EIA Scoping Opinion for Gravity in September 2021, and stated that:

"*In relation to climate adaptation and resilience we support the use of latest UKCP18 projections and note the conservative use of the high emission RCP8.5 scenario (i.e. business as usual) when assessing the vulnerability and resilience of the proposed development. In line with IEMA guidance it should be considered whether any further sensitivity testing is appropriate taking into account the vulnerability of receptors. If following an assessment of susceptibility/vulnerability of receptors further sensitivity testing is not considered appropriate, we would recommend this is explained/justified as part of the Environmental Statement. In relation to receptors to assess we would agree with the technical note that these can be grouped into three broad categories – Building and Infrastructure, Human health / future users, and environmental receptors (e.g. habitats, species, landscaping and planting)*."

15.13.2 In response to the above, defining receptor sensitivity has been undertaken and is described in **Table 15.8** below.

15.14 Methodology

Study Area

15.14.1 The CCRA uses the UK Climate Change Projections 2018 (UKCP18) provided by the UK Met Office (Met Office, N.Da) for the 25 km grid cell within which the Site is located (SP 337500, 137500), although the area of influence for potential climate vulnerability impacts is expected to be limited to the Site and the immediate area around this.

Baseline Data Collection

15.14.2 The following data sources were reviewed to establish the baseline conditions:

- Met Office historic climate data – to identify the historic trends of relevant climatic factors for the geographic area of the Scheme.
- UKCP18 – to identify the climate projections for the geographic area, including the 2032 baseline, and appropriate temporal scope of the Proposed Development.

15.14.3 In addition, a review was undertaken of the following chapters within this ES, which directly feed into the CCRA:

- Chapter 8: Health, Wellbeing and Social Impacts
- Chapter 9: Transport and Access
- Chapter 12: Biodiversity
- Chapter 13: Water Environment
- Chapter 14: Landscape and Visual

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UKCP18

15.14.4 The UK Climate Projections (UKCP18) produced by the UK Met Office (Met Office, 2018) is the main source of information for the 2032 Baseline and future baseline. UKCP18 uses observations of weather and climate combined with climate models to create a range of climate projections for different emissions scenarios. UKCP18 builds upon previous projections to provide information on how the climate of the UK may change over the rest of this century, describing how climatic conditions, long term seasonal averages and extreme weather conditions may change over future decades. The baseline data is complemented a literature review of relevant publications for variables for which UKCP18 does not provide information (for example, wind direction).

15.14.5 UKCP18 uses Representative Concentration Pathways (RCPs) to develop projections and consider factors such as economic activity, population growth and land use change, which will result in a different range of global mean temperature increases until 2099. RCP8.5 is the most conservative, highest-impact scenario. The scenario reflects an average increase in global mean surface temperature compared to the pre-industrial period of 4.3˚C by 2081-2099. IEMA guidance (2020) generally recommends that the high emission scenario, RCP8.5, is used for climate change risk assessments. As set out in the Climate Change Act (2008), the UK Government has committed to reaching net zero emissions by 2050, with legally binding carbon budgets.

15.14.6 This is also considered the most appropriate scenario for assessing the impact of climate change on the Proposed Development based on policy and legislation for the UK to achieve net zero carbon by 2050, which is in line with limiting global temperature increases to 1.5˚C, and professional judgement.

15.14.7 IEMA guidance recommends that the climatic baseline should consider extremes in short-term weather events, such as heatwaves; long-term climatic variability, such as seasonal changes in precipitation; and average climate norms, such as ambient temperature.

15.14.8 A review of the following data from this projection has been undertaken:

- Average Summer Precipitation (% change);
- Average Winter Precipitation (% change);
- Average Annual Precipitation (% change);
- Maximum Average Summer Temperature;
- Minimum Average Winter Temperature; and
- Annual Mean Temperature.

15.14.9 The projections (**Appendix 15.2** and **15.3**) show the potential change in temperature or precipitation above or below the observed temperature/precipitation for 1981-2000.

15.14.10 The CCRA considers the assessment year (2032) as well as 25-year intervals up to 2099, as this is the last date available in the UKCP18 data.

Assessment Methodology

15.14.11 In accordance with IEMA guidance, the vulnerability and resilience of the Proposed Development to climate change has been identified by undertaking a risk assessment that includes:

- "*Identifying potential climate change risks to a scheme or project;*

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- *Assessing these risks (potentially prioritising to identify the most severe); and*
- *Formulating mitigation actions to reduce the impact of the identified risks*." (IEMA, 2020)

15.14.12 The risk assessment considers the likelihood of a hazard occurring that could result in an impact on sensitive receptors. In addition, the magnitude of effects on the Proposed Development will depend on the severity of the consequence of the impact, and the vulnerability of the receptor itself. The definitions of these terms can therefore be summarised as follows (IEMA 2020):

- **Hazard** is an effect of climate change which has the potential to cause an impact on sensitive receptors associated with the Proposed Development;
- **Magnitude** is the likelihood of impact occurring and the consequence of the impact of a hazard; and
- **Vulnerability** is the degree to which receptors are susceptible to adverse impacts and is influenced by sensitivity, adaptive capacity, and exposure to climate hazards.

Identification of Receptors

15.14.13 Receptors that may be affected by climate change have been identified with consideration of both extreme weather events and gradual climatic changes in the study area for the Proposed Development. In accordance with IEMA guidance, the sensitivity of receptors to climate change effects during operation is described in **Table 15.7**. In ascribing the sensitivity of receptors in relation to potential climate change effects, the susceptibility of the receptor (e.g. ability to be affected by a change) and the vulnerability of the receptor (e.g. potential exposure to a change) must be taken into account. These are defined in IEMA (2020) guidance as follows:

"*The susceptibility of the receptor can be determined using the following scale:*

- *High susceptibility = receptor has no ability to withstand/not be substantially altered by the projected changes to the existing/prevailing climatic factors (e.g. lose much of its original function and form).*
- *Moderate susceptibility = receptor has some limited ability to withstand/not be altered by the projected changes to the existing/prevailing climatic conditions (e.g. retain elements of its original function and form).*
- *Low susceptibility = receptor has the ability to withstand/not be altered much by the projected changes to the existing/prevailing climatic factors (e.g. retain much of its original function and form).*

The vulnerability of a receptor can be defined using the following scale:

- *High vulnerability = receptor is directly dependent on existing/prevailing climatic factors and reliant on these specific existing climate conditions continuing in future (e.g. river flows and groundwater level) or only able to tolerate a very limited variation in climate conditions.*
- *Moderate vulnerability = receptor is dependent on some climatic factors but able to tolerate a range of conditions (e.g. a species which has a wide geographic range across the entire UK but is not found in southern Spain).*

Low vulnerability = climatic factors have little influence on the receptors."

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Receptor	Sensitivity	Reasoning
Future users of the site (residents, employees, students)	Moderate to High	Some future users of the Site will be more susceptible to climate change than others, depending on a range of factors such as age (children, young people and the elderly) and existing poor health.
Infrastructure including buildings and roads	Moderate	Infrastructure across the Proposed Development ranges in value. Critical infrastructure, such as energy and water pipes/cables are considered to be of moderate susceptibility given that it can tolerate some changes in climate but is critical for the operation of the Proposed Development.
Ecology, Landscaping and Planting	Moderate	The habitats that have been identified onsite are representative of typical lowland landscapes including woodlands, hedgerows, grasslands and elements of wetland (see **Chapter 12** for details) are not considered to be of high vulnerability to the broad effects of climate change such as changes in average temperatures or changes to the hydrology, however some habitat such as reed beds, rhynes and wet grasslands may be more sensitive to changes in summer rainfall and droughts. The compliment of protected / notable species recorded within the Site are not considered to be significantly sensitive to the effects of climate change in terms of their current distribution or climactic tolerances, and the majority of species recorded are widespread regionally, nationally or internationally (e.g. northern and central Europe).

Table 15.8 Receptor Sensitivity

15.14.14 During the construction phase, it is anticipated that the risk of climate hazards (e.g. heatwaves or periods of heavy precipitation) may increase, however it is expected that these will be managed through standard construction and health and safety practices, such as securing material/equipment and not undertaking works during periods of extreme rainfall. Therefore, the vulnerability of the Proposed Development to climate change during construction has been scoped out of the assessment for the ES.

Assessment of Significance

15.14.15 There is an absence of significance criteria for determining the significance of effects resulting from climate change. IEMA guidance states that receptor vulnerability and uncertainties must be considered. Significance has therefore been determined by IEMA guidance and professional judgement.

Limitations

15.14.16 Scientific evidence shows that our climate is changing. However, there are significant uncertainties in the magnitude, frequency and spatial occurrence within the climate projections utilised in this assessment. The projections are dependent on future global GHG emissions and, while several different scenarios are provided, it cannot be reliably predicted which (if any) emission scenario will occur over the next 80 years (Fung et al., 2018).

15.14.17 Additionally, projections after the 2040s increasingly diverge between scenarios and provide greater confidence for long-term climate averages than extreme events. For example, there is greater confidence around changes in temperature than there is in relation to wind. Levels of confidence and certainty are considered when assessing the likelihood and consequence of climate hazards.

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15.15 Baseline Conditions

Current State of the Environment

UK Observations

15.15.1 Observed climate changes over the UK include:

The most recent decade (2009-2018) has been on average 0.3 °C warmer than the 1981-2010 average and 0.9 °C warmer than 1961-1990. All of the top ten warmest years have occurred since 2002 (Lowe *et al*., 2019);

- In the past few decades there has been an increase in annual average rainfall over the UK. However, natural variations are also seen in the longer observational record (Lowe *et al*., 2019);
- The period since 2000 accounts for two-thirds of hot-day records, and close to half of wet-day records, in monthly, seasonal, and annual observations since 1910 (Kendon, 2014);
- The frequency of severe autumn and winter wind storms increased between 1950 and 2003 (Alexander et al., 2005), although storminess in recent decades is not unusual in the context of longer European records dating back to the early 20th century (Metulla et al., 2008); and
- Widespread and substantial snow events have occurred in 2018, 2013, 2010 and 2009, but their number and severity have generally declined since the 1960s (Met Office, N.Db).

Regional Observations

15.15.2 Historic climate averages during the period 1981-2010 for the closest climate station to the site (Cannington), obtained from the Met Office website (Met office, N.Dc), indicates the following:

- Average annual maximum temperature was 14.7°C;
- Warmest month on average was July (mean maximum temperatures of 21.6°C);
- Coldest month on average was January (mean minimum temperature of 8.5°C);
- Average total annual rainfall was 755 mm;
- Wettest month on average was October (average monthly rainfall of 83.9 mm); and
- Driest month on average was April (average monthly rainfall of 51.1 mm).

15.15.3 Chapter 13 Water Environment sets out the existing conditions with regards to flood risk. The majority of the Site is designated as Flood Zone 3, although it should be noted that this is identified as tidal and not fluvial, and does not take into account of any existing defences which the Site is indicated to benefit from, and it is considered that the Site is not known to have flooded since its development as a ROF. Areas of Flood Zone 2 are indicated towards the southern part of the Site, also indicated to be tidally rather than fluvial influenced. Further south and at higher elevation, the remaining land within the Site is indicated to lie within Flood Zone 1. This is defined as land having a less than 1 in 1,000 annual probability of tidal flooding. The Study Area is predominantly within an area at very low risk of surface water flooding. Groundwater and reservoir flooding are not considered to be significant source of flood risk.

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2032 Baseline

15.15.4 Table 15.9 below provides a summary of the projected climatic changes for the Site for 2032, with data from 2021 provided for context. This is based on the UK Climate Projections 2018 (UKCP18) produced by the UK Met Office (Met Office, 2018).

Date	Mean air temperature anomaly* at 1.5 m (Â°C)	Annual Precipitation rate anomaly (%)	Maximum Summer air temperature anomaly at 1.5 m (Â°C)	Average Summer Precipitation rate anomaly (%)	Minimum Winter air temperature anomaly at 1.5 m (Â°C)	Average Winter Precipitation rate anomaly (%)
2021	0.73	-1.09	1.04	-13.91	0.66	10.91
2032	1.05	-3.54	1.82	-20.47	1.06	7.18

*Anomaly refers to the change compared to the baseline. The projections are not absolute values.

Table 15.9 50th Percentile Climate Projections in 2021 for context, and 2032 for 25 km grid square 337500, 137500 using baseline 1981-2000 scenario RCP8.5

15.15.5 The projections show that the Site is likely to experience an increase in annual average temperature and a decrease in annual rainfall. By 2032, the Site is expected to experience warmer, drier summers and milder, wetter winters.

15.15.6 As outlined in Chapter 13 Water Environment, it is anticipated that, as flood risk is predominantly tidally influenced, the likely impact sea level rise will have on the Site for the 2032 baseline scenario is estimated to be minimal. As the 2017 Planning Consent required implementation of a Surface Water Management Strategy to serve the development and manage rainfall on site, it is assumed that surface water flood risk on site for the 2032 baseline scenario will be very low. Risk from groundwater and reservoir flooding also remains unchanged from the current state of the environment.

15.15.7 In addition, under the 2017 Planning Consent there is a series of proposed habitat retention, losses, creation and enhancement to habitats within the Site, which is anticipated to be managed through habitat management strategies.

Future Baseline

15.15.8 This section presents the future climate simulations extracted from UKCP18 up to 2099. Figures 15.2.1 – 15.2.6 in Appendix 15.2 show the grid square projections for average summer, winter and annual precipitation, maximum average summer temperature, minimum average winter temperature and annual mean temperature. A summary of the projections is provided below. This is supported by data extracted from the probabilistic projections which is presented in Appendix 15.3, a summary of which is provided in Table 15.10 below.

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Date	Climate Variable at 50th Percentile					
	Mean air temperature anomaly at 1.5 m (Â°C)	Annual Precipitation rate anomaly (%)	Maximum Summer air temperature anomaly at 1.5 m (Â°C)	Average Summer Precipitation rate anomaly (%)	Minimum Winter air temperature anomaly at 1.5 m (Â°C)	Average Winter Precipitation rate anomaly (%)
2040	1.2700	1.2525	1.7205	-19.4792	1.2990	8.5645
2050	1.7252	0.8204	2.7148	-25.1392	1.6075	8.5184
2075	3.0804	1.9082	4.9348	-35.0712	2.7810	22.6013
2099	4.9084	-5.5775	7.9854	-48.6258	4.1581	23.3458

Table 15.10 50th Percentile Climate Projections at 25 km grid square 337500, 137500 using baseline 1981-2000 scenario RCP 8.5

15.15.9 The projections show an almost continuous increase in annual average temperature over the next 80 years (**Figure 15.1** in **Appendix 15.2)**. Annual precipitation is shown to vary year on year, with some years being dryer or wetter than previous years (**Figure 15.2** in **Appendix 15.2)**.

15.15.10 The projections suggest that summers will become warmer and drier, with an expected increase in maximum summer temperatures and overall decline in summer precipitation (**Figures 15.3 and 15.4** in **Appendix 15.2)**. Natural variations may mean that some cooler and/or wet summers will occur.

15.15.11 Winters may become milder and wetter, with an overall increase in both minimum winter temperature and winter precipitation. Natural variations may mean that some cold and/or dry winters may still occur (**Figure 15.5 and 15.6** in **Appendix 15.2)**.

15.15.12 In the UK, the heaviest snowfalls tend to occur when the air temperature is between zero and 2°C (Met Office, N.Dd). There is less certainty in the magnitude of change to snow occurrence and amount, although climate models do show a downward trend in both falling and lying snow over time.

Extreme Weather Events

15.15.13 UKCP18 projections indicates an almost continuous increase in annual average temperature over the next 80 years. Annual precipitation is shown to vary year on year, with some years being drier or wetter than previous years.

Heatwaves

15.15.14 A heatwave is an extended period of hot weather relative to the expected conditions of the area at that time of year, which may be accompanied by high humidity. For the UK, the Met Office defines a heatwave as "*when a location records a period of at least three consecutive days with daily maximum temperatures meeting or exceeding the heatwave temperature threshold*" (Met Office, N.De). The threshold varies by county and have been calculated using the 1981-2010 climatology of daily maximum temperature at the mid-point of the meteorological summer (15 July), which for the Site is 21.6°C. As outlined in **Table 15.10** above, temperatures are projected to increase by 4.9°C by 2099, which will exceed the threshold for this region.

15.15.15 Research has found that the likelihood of heatwave events in the UK is about 10 times higher due to climate change (Vautard R. *et al*., 2019). As discussed above, the maximum

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summer air temperature and annual average air temperature is expected to increase over the next 80 years, which could result in more intense and more frequent heatwaves.

Extreme Cold Snaps

15.15.16 It is projected that winters may become increasingly milder, with minimum temperatures set to rise to over 4°C by 2099. Natural variations may mean that some cold and/or dry winters may still occur.

Heavier Rainfall

15.15.17 Heavy rainfall that may lead to flooding is hard to predict in the long term. A study has shown that an extended period of extreme winter rainfall in the UK is now about seven times more likely due to human-induced climate change (Christidis and Stott, 2015), although the largest changes in heavy rainfall since 1961 have occurred in Scotland and northern England.

15.15.18 The climate projections for the Site show there will be an increase in average winter precipitation (**Figure 15.6** in **Appendix 15.2**). There is also a pattern of larger increases in winter precipitation over southern and central England toward 2099.

15.15.19 While projections indicate a trend that summers will become dryer toward the end of the century, there is also evidence that summer rainfall events may become more intense when they do occur.

Low Rainfall and Drought

15.15.20 Droughts are natural events which occur when a period of low rainfall creates a shortage of water. The UKCP18 projections show a trend toward drier summers on average, although the uncertainties of these are wide ranging. Research on the influence of climate change on drought in the UK is limited and given the several different factors that influence droughts (meteorological, hydrological, and societal), it is challenging to identify whether drought events will become more common and prolonged in the future.

High Winds

15.15.21 On average throughout the year, near-surface wind speeds are projected to decrease. However, during the winter season, where more significant impacts of winds are experienced (Met Office, 2019), near-surface winds speeds are projected to rise towards the second half of the 21st Century.

15.15.22 However, these projections are modest compared to natural variability from month to month and season to season. Projections of future wind and storm occurrence and intensity are uncertain and confidence in projections is low. Research has shown that there are no compelling trends in maximum gust speeds over the last four decades (Kendon *et al*., 2019) and therefore there is no evidence that link climate change and storms.

Summary of Projected Climatic Changes

15.15.23 In summary, it is anticipated that the Proposed Development will experience the following climatic changes:

- An increase in average annual temperature
- An increase in maximum temperature, particularly in the summer
- More extreme rainfall events
- An increase in winter rainfall

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- A reduction in summer rainfall

15.16 Embedded Mitigation

15.16.1 The Proposed Development has been designed to incorporate mitigation and adaptation measures to address climate change. This section provides a summary of these measures below, many of which have been addressed in full in other discipline chapters within this ES:

- **Flood risk**: In accordance with the NPPF, all flood vulnerable development will be located outside of the modelled flood extents. This is effective inherent mitigation against tidal flooding. A surface water management strategy has been prepared, which has been designed to manage runoff up to the 1 in 100 year storm event, plus a 40% increase in peak rainfall intensity to account for the likely effects of climate change.

- **Retention and Creation of Habitats, Green Infrastructure and Open Space**: the incorporation of green infrastructure and natural open space, provision of soft landscaping across the Site, as shown on the Strategic Landscape Parameter Plan (**Appendix 3.1**), will provide floral diversity within the Site, helping to provide climate resilience. The Design Guide sets out principles for the planting strategy, including using a selection of native species of local provenance. Where practicable, the selection of native plant and tree species will include species that are deemed suitable for future climate conditions, including tolerance to higher temperatures, drought resilience and species that require less irrigation.

15.17 Assessment of Likely Effects

15.17.1 The projected climatic changes outlined in **Section 15.15** above may have a direct impact on the Proposed Development or result in secondary impacts which may impact the performance or integrity of the Proposed Development i.e. a 'climate hazard'. A summary of the potential climate hazards as a result of the projected climatic changes is provided below, with more detail provided in **Table 15.11**. As a result of the projected climatic changes, there is an increased risk of:

- Long term changes to climate norms;
- Heatwaves;
- Low rainfall and drought; and
- Increased risk of flooding as a result of more extreme rainfall events, and increased rainfall during winter.

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Receptor	Receptor Sensitivity	Climate Hazard	Potential Impact (with Embedded Mitigation)	Significance
Future users of the Site	Moderate to High	Long term changes to climate norms	Increased temperatures and drier summers may affect human behaviour with, for example, an increase in outdoor activity. The Proposed Development includes a network of open spaces, including footpaths, recreational cycle routes and areas for informal recreation. However, as noted in **Chapter 8 Health, Wellbeing and Social** extreme conditions will have the greatest adverse impacts on health. The design of the Proposed Development and open spaces considered creating shade and allowing throughflow of air to allow for cooling and reduce risk of overheating. The warmer winters and reduced risk of cold snaps may have potentially positive outcomes for those with circulatory and respiratory impacts.	Minor
		Heatwaves	As noted in **Chapter 8**, extreme conditions have adverse impacts on human health, with most vulnerable to heatwaves likely to be those with circulatory and respiratory conditions. Embedded mitigation in the design of the Proposed Development, for example the provision of open space will help to provide evaporative cooling at night. This will help to reduce the risk of building overheating and maintain thermal comfort during periods of extreme heat.	Minor
		Low rainfall and drought	Periods of low rainfall and drought have the potential to adversely affect public water supply. Water companies have a statutory duty to maintain a secure water supply during a drought and to produce Water Resources Management Plans (WRMP), which consider climate change and drought.	Negligible
		Heavy rainfall and flooding	Flooding has the potential to isolate future users of the Site, disrupt service provision, damage homes and increase risk to human health, in particular mental health. **Chapter 13 Water Environment** assesses the likely significant effects of flood risk and states that there will be a Negligible effect with the implementation of the Surface Water Management Strategy and ongoing maintenance and management.	Negligible
Infrastructure, including buildings and roads	Moderate	Long term changes to climate norms	Infrastructure may require more maintenance and repair as changes to climatic norms may cause increased stress on, for example, below ground cables and pipes. This will be managed as each plot comes forward in more detail, where risk assessments will be undertaken to manage risks from future climate change in accordance with nationally accepted standards and guidance	Negligible
		Heatwaves	Extremes in temperatures have the potential to damage infrastructure, for example causing tarmac to soften, melt and be more susceptible to damage. As a result, additional maintenance and emergency repairs may be required. This will be managed as each plot comes forward in more detail, where risk assessments will be undertaken to manage risks from future climate change in accordance with nationally accepted standards and guidance.	Negligible

		Low rainfall and drought	Reduction in rainfall could cause soil moisture deficits, which may affect soil stability. This may increase risk of damage to infrastructure. This will be managed as each plot comes forward in more detail, where risk assessments will be undertaken to manage risks from future climate change in accordance with nationally accepted standards and guidance.	Negligible
		Heavy rainfall and flooding	Increased precipitation during the winter and more intense rainfall events are likely to increase flood risk and surface water run-off. This could prevent the use of and/or damage infrastructure and also adversely affect water quality. **Chapter 13** assesses the likely significant effects of flood risk and states that there will be a Negligible effect with the implementation of the Surface Water Management Strategy.	Negligible
Ecology, landscaping and planting	Moderate	Long term changes to climate norms	As noted in **Table 15.8** above, the semi-habitats identified onsite are not considered to be of high vulnerability to the broad effects of climate change such as changes in average temperatures or changes to the hydrology. Climate change is understood to be having an effect on the migration patterns of some bird species, with 'short stopping' a recognised effect, whereby birds stop short of completing historical migrations because suitable foraging resources remain available closer to their breeding grounds. Those bird species recorded are generally limited to common and / or widespread species which in this geographical location are unlikely to be significantly affected. Specific species recorded onsite considered of relatively greater sensitivity are associated with wetter habitats such as Marsh Harrier *Circus aeruginosus*, Cetti's Warbler *Cettia cetti* and Reed Warbler *Acrocephalus scirpaceus*, but as described in **Table 15.8** these habitats are considered to have existing resilience to such effects. For other species groups recorded at the Site such as bats, reptiles and amphibians most species recorded are widespread across the UK or are regionally common. Such species that rely on hibernation are reducing their period of hibernation due to warmer winters that also effects their ability to enter into hibernation states resulting in reduced body condition and survival rates. However, the effects of climate change may allow for the northward expansion of such species range, including Horseshoe bats Rhinolophus sp. that have strongholds within the south of England and Wales, although this will depend on their ability to move between fragmented habitats. Existing pressures such as habitat loss and land use (e.g. intensive agriculture) are more important limiting factors as well as their reliance on specific hibernation features. Again, whilst some specific species may be more sensitive to the effects of climate change than others, it is considered that the overall species assemblage would not be significantly affected.	Minor
		Heatwaves	Increased frequency of extreme weather events such as heatwaves could change the type and structure of vegetation. The selection of native plant and tree species will include species that are deemed suitable for future climate conditions, including being tolerant to higher temperatures.	Minor
		Low rainfall and drought	In respect of the wetland features, it should be noted that the Site is located within the Somerset Levels and Moors landscape that has a heavily modified network of waterways	Minor

			that facilitates the regulation of water levels and quality, thereby an existing regime is in place, providing resilience to such effects. The planting strategy includes the consideration of species that are drought resistant and need less irrigation, which will increase resilience and reduce pressure on water supply during a drought.	
		Heavy rainfall and flooding	In consideration of the Proposed Development in relation to ecology and climate change, as noted above the sensitivity is focussed upon wetter habitats which would be expected to experience more periodic drought or flooding. However, as noted above, the wider landscape forms part of a heavily modified network of waterways that allows for the regulation of water and given that a surface water management plan is to be developed for the Site, this will add further resilience to the system. In addition, given the wide range of ecological mitigation to be provided as part of the Proposed Development, including the implementation of appropriate habitat creation, and betterment through targeted management, it is considered that further resilience to the effects of climate change will be provided in ecological terms. Flooding has the potential to damage planting and habitats on Site. The Surface Water Management Strategy has been designed to mimic as closely as practical the hydrology of the undeveloped catchment, therefore, as stated in **Chapter 13** effects are expected to be Negligible.	Negligible

Table 15.11 Climate Change Risk Assessment

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15.18 Further Mitigation

- As each plot comes forward in more detail, measures to reduce water demand and increase water efficiency in line with Building Regulations Part G will be considered to further increase resilience to droughts. This will in turn, also provide GHG emission savings. These measures may include measures such as:
  - Dual flush toilets - to reduce water consumption
  - Leak detection systems
  - Flow control devices - to reduce the flow rate of kitchen sink and bathroom basin taps
  - Installing pulsed water meters with pulsed output and fitting sub-meters – to reduce the energy demands associated with water heating
  - Using water-efficient appliances (e.g. those with an 'A' or 'B' rating as defined by the European Water Label).
- As outlined in **Chapter 12 Biodiversity**, an Ecological Mitigation and Enhancement Strategy (EMES) will be prepared for the Site to be secured by way of planning condition. This report will include consideration of the maintenance / management measures associated with onsite ecological networks and features that are to be retained, enhanced and created within the Proposed Development. This would increase the long-term resilience of habitats and species within the Site and managing areas that may be affected by droughts.

15.19 Residual Effects

15.19.1 The minor adverse effect on human health as a result of the increased likelihood and frequency of heatwaves has been mitigated as far as possible with embedded mitigation. Mitigating these effects further is reliant on aspects outside the scope of the Proposed Development, such as increasing the resilience of health services and availability of emergency services. Therefore, these effects remain as minor adverse, which is considered to be Not Significant.

15.19.2 Potential minor adverse effects to ecology, landscaping and planting resulting from droughts and storms would be managed through the implementation of the EMES. The likely effect is therefore considered to be negligible and Not Significant.

15.20 Monitoring

15.20.1 No significant effects have been identified in relation to climate vulnerability and resilience, therefore no monitoring is proposed. However, monitoring of the existing retained and proposed planting will be undertaken as part of the EMES.

15.21 Summary

15.21.1 This Chapter has assessed the likely significant effects of the Proposed Development on climate change, and the likely significant effects of climate change on the Proposed Development, with due regard to IEMA guidance.

GHG Emissions Assessment

15.21.2 The GHG emissions assessment provided a qualitative description of the anticipated GHG emissions arising during the construction and operational phases of the Proposed

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Development. During construction, Significant local effects were identified in relation to combustion of fossil fuels during construction activities (Minor Adverse), land clearance and enabling works (Minor adverse), and consumption of electricity for office / welfare facilities and lighting (Minor Adverse). During the operational phase, Significant effects were identified in relation to transport emissions of the Proposed Development (Minor Adverse), carbon sequestration (Minor Beneficial) and electricity purchased from the national grid (Moderate Adverse).

15.21.3 Embedded mitigation measures to reduce GHG emissions associated with the Proposed Development includes the implementation of a FDCEMP, sustainable transport proposals and an extensive green infrastructure network. Further mitigation measures to reduce GHG emissions include energy efficiency design principles, consideration of low and/or zero carbon technology and EV charging infrastructure which are secured within the Design Guide. It is also acknowledged that the Proposed Development is an enabler of low carbon industries which could result in wider carbon reductions beyond the Site GHG emissions.

15.21.4 All effects identified in the GHG emissions assessment are considered Significant on a local scale however the Proposed Development addresses these emissions with mitigation in line with local policy. In the context of Government policies and national strategies that will leads to national GHG reductions, it is considered that GHGs resulting from the Proposed Development will be Not Significant on a national scale.

Climate Change Risk Assessment

15.21.5 UKCP18 climate projections were used to establish evolving baseline climate conditions up to 2099. It is expected that the Proposed Development may experience warmer, drier summers and milder, wetter winters, along with an increase in frequency and intensity of extreme weather events such as droughts or heatwaves. This has the potential to adversely affect receptors within the Proposed Development, including future users of the Site, buildings and infrastructure, and ecology.

15.21.6 The climate resilience assessment identified key environmental receptors to climate change and determined their sensitivity to the projected climate change impacts. During the operational phase, infrastructure such as buildings and roads, and ecology, landscaping and planting were determined to be moderately vulnerable, and future users of the site including residents, employees and students, were determined to be moderately to highly vulnerable to climate change. The effects of climate change on the Proposed Development are determined to be Not Significant (Minor-Negligible).

15.21.7 Embedded mitigation to address climate change includes the development of a surface water management strategy to address flood risk, and the retention and creation of habitats, green infrastructure and open space. Further mitigation includes the implementation of a FDCEMP, an EMES, and consideration of water efficiency measures.

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