South Industrial Zone

Environmental Statement
July 2020

Volume 2

Chapter K - Climate Change

Contents

K1.0 Introduction 1

About the Author 1

K2.0 Policy Context 2

K3.0 Assessment Methodology & Significance Criteria 5

Assessment Methodology 5

Significance Criteria 10

Consultation 10

Assumptions and Limitations 10

K4.0 Baseline Conditions 13

Existing Conditions 13

Future Baseline 13

K5.0 Potential Effects 14

Embedded Mitigation 14

During Construction 14

During Operation 15

K6.0 Mitigation and Monitoring 17

During Construction 17

During Operation 18

K7.0 Residual Effects 20

During Construction 20

During Operation 20

K8.0 Summary & Conclusions 21

K9.0 Abbreviations & Definitions 22

K10.0 References 23

K1.0 Introduction

K1.1 This Chapter of the Environmental Statement ('ES') has been prepared by Arup on behalf of the applicant, South Tees Development Corporation ('STDC'). It assesses the proposed development described in Chapter B and it considers the effects of the proposed development on the climate, with regard to atmospheric greenhouse gas (GHG) concentrations, by assessing the magnitude of GHG emissions arising from the proposed development.

K1.2 The baseline situation is considered before the likely environmental effects of the proposed development are identified, both during the construction and operational phases of the proposed development. Mitigation measures to reduce any negative environmental effects are identified as appropriate, before the residual environmental effects are assessed.

K1.3 This Chapter is supported by the following technical appendices: -

1 Appendix K1: Meeting notes from consultation

2 Appendix K2: Assessment data and detailed assumptions

About the Author

K1.4 The author is a Climate Change Consultant at Arup. He has two years of experience in environmental consultancy, with experience in GHG assessments across a range of infrastructure projects. These include national scale rail and aviation projects under the Development Consent Order (DCO) regulations [Ref 1], and neighbourhood scale energy and carbon assessments. The author holds an MSci (Hons) Geography obtained from Durham University.

K1.5 This assessment has been reviewed by a Senior Climate Change Consultant at Arup. He is a Chartered Engineer and technical expert in the quantification, assessment and management of GHG emissions in projects with over fourteen years' experience. Since changes to the 2017 Environmental Impact Assessment (EIA) Regulations (as amended) [Ref 2] he has led on the inclusion of GHG assessments in several rail, aviation, and highway infrastructure projects as well as developing area-based Climate Change GHG assessments at city scale.

K1.6 This assessment has been approved by an Associate at Arup who has over 20 years of experience in environmental assessment and is a Chartered Environmentalist (CEnv).

K2.0 Policy Context

K2.1 The following legislation, regulations and policies have been consulted to inform the assessment of the proposed development with relation to climate change impacts and during the design development.

The Town and Country Planning (Environmental Impact Assessment) Regulations 2017 (EIA Regulations)

K2.2 At the European level, the EIA Directive 2011/92/EU [Ref 3] places a requirement upon projects which have the potential for significant effects on the surrounding environment and communities to make a formal assessment of these effects. The amended Directive 2014/52/EU [Ref 3], identifies the important role that the Environmental Impact Assessment ('EIA') process can play in assessing climate change impacts. It states that EIAs shall identify, describe and assess the direct and indirect significant effects of climate change relevant to the project. The regulations implementing this directive were transposed into UK legislation in May 2017. The 2017 EIA Regulations (as amended), under Part 1 Regulation 5(2)(c) state that EIAs shall identify, describe and assess the direct and indirect significant effects of climate change relevant to the project.

The Climate Change Act 2008 and the Climate Change Act 2008 (2050 Target Amendment) Order 2019

K2.3 The Climate Change Act 2008 [Ref 4] committed the UK to its first statutory carbon reduction target, to reduce carbon emissions by at least 80% from 1990 levels by 2050. In June 2019, the legislated target was amended to net zero emissions by 2050, following advice from the Committee on Climate Change [Ref 5]. The Climate Change Act requires that that five-yearly carbon budgets are set and not exceeded to ensure that progress is made towards the long-term target. The first three carbon budgets were set in 2009, with the fourth and fifth following in 2011 and 2016 respectively [Ref 6]. The sixth carbon budget will be produced in September 2020 and will mark the first carbon budget produced under the new net zero legislation.

Construction Industry Strategy (2013)

K2.4 The Government's Construction Industry Strategy [Ref 7] presents the UK's low carbon construction aspirations. It includes the aspiration to decrease construction GHG emissions by 50% by 2025 based on 1990 levels, as reported in the Green Construction Board's Low Carbon Route map for the Built Environment [Ref 8].

Clean Growth Strategy (2017)

K2.5 The Clean Growth Strategy [Ref 9] further details how the UK will move to a low carbon economy through:

i Encouraging green finance;

ii Improving business and industry efficiency;

iii Improving the energy efficiency of houses;

iv Supporting the shift to low carbon transport;

v Moving to low carbon power sources; and

vi Resource efficiency.

The National Planning Policy Framework (NPPF)

K2.6 The National Planning Policy Framework ('NPPF') [Ref 10], first published in March 2012 and later revised in 2018 and again in 2019, strongly encourages renewable and low carbon decentralised energy supply systems as well as minimisation of energy consumption. The NPPF does this by focusing on three pillars of sustainability: economic, social and environmental. A low carbon economy sits within environmental sustainability, under which the requirement is *"to contribute to protecting and enhancing our natural, built and historic environment; including making effective use of land, helping to improve biodiversity, using natural resources prudently, minimising waste and pollution, and mitigating and adapting to climate change, including moving to a low carbon economy"* (NPPF, 2019 paragraph 8 c).

K2.7 In addition, Chapter 14 includes the objective of supporting the transition to a low carbon future in a changing climate, taking full account of flood risk and coastal change. This includes, at paragraph 149, *"to shape places in ways that contribute to radical reductions in greenhouse gas emissions, minimise vulnerability and improve resilience; encourage the reuse of existing resources, including the conversion of existing buildings; and support renewable and low carbon energy and associated infrastructure".*

The Tees Valley Climate Change Strategy (2010)

K2.8 The Tees Valley Climate Change partnership was established in 2005. All local authorities in the region have signed up to the Covenant of Mayors with a commitment to improve energy efficiency and promote low-carbon business and economic development. The partnership has set out a Tees Valley Statement of Ambition [Ref 11] to drive the transition to a high value low carbon economy. Within the Statement of Ambition, the North and South Tees Industrial Framework outlines the actions required to deliver a low carbon economy in the Tees Valley. These include:

i Decarbonising industry;

ii Low carbon energy using biomass, waste and industrial by-products;

iii Resource recovery that recovers value from 'waste' resources;

iv Biofuels and biotechnology to produce low carbon fuels and feedstock for the chemicals sector; and

v Advanced engineering and manufacturing.

Redcar and Cleveland Local Plan (2018)

K2.9 Redcar and Cleveland recognise the potential to support the Government's objectives on climate change through the positioning of Tees Valley as a centre for green technology and renewable energy [Ref 12].

K2.10 Policy SD 6 encourages the incorporation of low carbon energy initiatives into developments, particularly as part of major schemes. The policy states that the Council will *"actively support community-led renewable energy schemes which are led by, or meet the needs of, local communities. Development of district heating schemes will also be supported."*

K2.11 Policy LS 4 states that the Council will *"encourage clean and more efficient industry in the South Tees area to help reduce carbon dioxide emissions and risk of environmental pollution; support the development Carbon Capture and Storage to de-carbonise the local economy"* and *"promote the reduction of transport's emissions of carbon dioxide and other greenhouse gases, with the desired outcome of tackling climate change".*

Emerging strategies

K2.12 Redcar and Cleveland Borough Council (RCBC) declared a climate emergency in 2019 and have committed to the Borough of Redcar and Cleveland becoming carbon neutral by 2030, taking into account both production and consumption emissions.

K2.13 RCBC are in the process of developing an Environment Strategy which will reflect this commitment, as well as wider environmental priorities for the Borough.

K3.0 Assessment Methodology & Significance Criteria

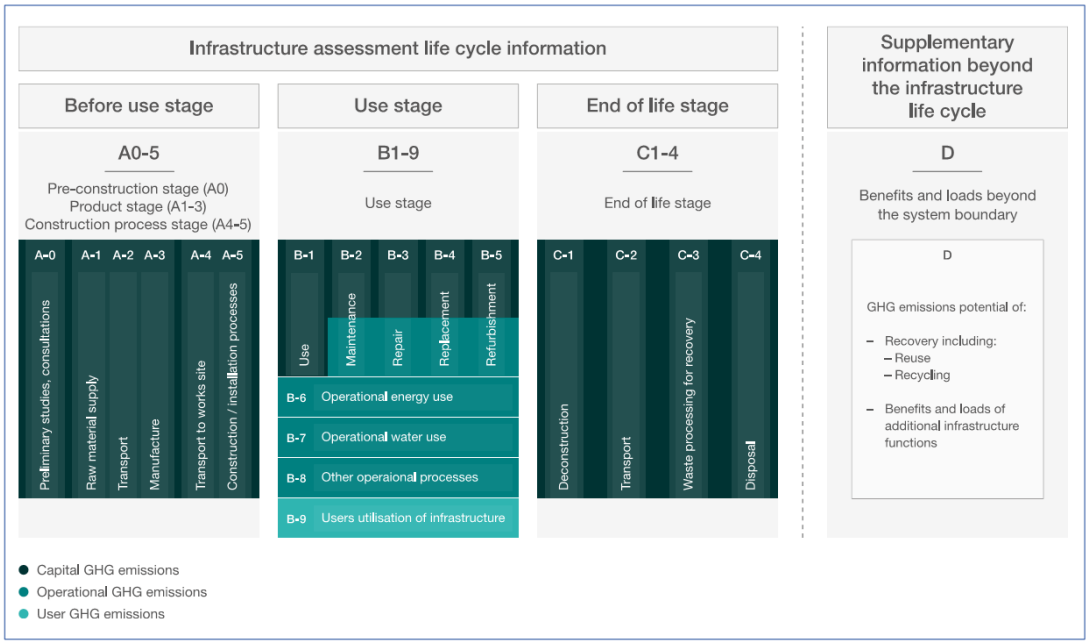
Assessment Methodology

Scope of assessment

K3.1 The approach for the assessment is based on the current best practice principles for GHG assessments of projects outlined in the Royal Institute of Chartered Surveyors (RICS) guidelines [Ref 13] on carbon assessment in the built environment.

K3.2 The scope for the carbon accounting process is defined according the lifecycle of the project in the built environment. The lifecycle approach is adopted in order to capture both direct and indirect GHG emissions arising as a result of the development. The lifecycle stages for a typical project are shown in Figure K.1.

Figure K.1 Lifecycle stages for whole life GHG assessment (PAS 2080) [14]



K3.3 The GHG emissions assessment is carried out across the following project scope and lifecycle phases:

a **Product stage (A1-3):** Emissions associated with this phase are predominantly associated with the extraction and supply of raw materials, transport to any manufacturing plant/location, and the manufacturing process.

b **Construction stage (A4-5):** Emissions calculated for this phase are primarily concerned with the transportation of materials, plant and people to and from the construction site, the energy consumed through plant use, and the impacts associated with any waste generated through the construction process, including waste treatment and disposal.

c **Use stage (B):** Use stage emissions refer to the operation of the built asset and the maintenance, repair and replacement of assets over its life cycle.

d **End of life stage (C):** Emissions associated with this phase relate to the decommissioning, disassembly and demolition of the built asset, as well as the transport, processing and disposal of materials at the end of their life.

K3.4 The spatial and temporal scope of emissions sources included in the GHG assessment is summarised in table K3.1. The baseline assessment considers the site area that will undergo a change in land use type as a result of the proposed development.

Table K3.1 Study area spatial and temporal scope

Emissions source	Spatial scope	Temporal scope
Stage A – Construction		
Buildings	Buildings within red line boundary of site	The principal temporal scope of the assessment encompasses the production of buildings materials, and the construction of the proposed development. The construction process will occur in two phases: Phase 1 will commence in early 2021 and last for 18 months. This phase will focus on site preparation and infrastructure works. The next phase (referred to as phase 2) will commence in 2023 be phased over a 5 to 8-year period. This phase will focus on building construction.
Outdoor space	Outdoor space within red line boundary of site	
Transport	Transport of construction workforce and materials to site from home or the location of manufacture	
Construction process	The use of plant equipment during the construction phase and the removal and disposal of waste material from the site	
Stage B – Operation		
Buildings	Regulated energy from buildings within red line boundary of site	Defined design life of 50 years for the proposed development.
Transport	Emissions from traffic arising from operation of the proposed development	
Stage C – End of life		
The proposed development life is 50 years. Full deconstruction/demolition of the proposed development has not been assessed as the assessment focusses on specific years rather than whole life carbon.		

Assessment methodology

K3.5 The methodology focusses on assessing the impact of the proposed development on GHG emissions by quantifying the net GHG emissions arising from each lifecycle stage.

K3.6 As this is an outline planning application, the end users of the development site are not yet known. To provide a preliminary estimate of GHG emissions, a number of assumptions have been made in order to assess a reasonable worst-case scenario. The assumptions are detailed in the section below (paragraphs K3.9 to K3.13).

K3.7 The information to inform this GHG assessment has come from a combination of project specific information available at the current design stage alongside publicly available industry benchmarks that can be used to provide a preliminary estimate of embodied carbon emissions

and operational energy use. The quantification of GHG emissions presented in the potential effects section represent a before mitigation scenario.

K3.8 The GHG emissions for the proposed development have been calculated by converting 'activity' data into GHG emissions through the application of widely used and referenced emissions conversion factors.

K3.9 The main emissions factors used in the assessment are from the following sources:

a Greenhouse gas reporting: conversion factors 2019, published by the UK Department for Environment Food & Rural Affairs (DEFRA) and Department of Business, Energy and Industrial Strategy (BEIS) [Ref 15].

b Inventory of Carbon & Energy (ICE) database 2019 published by the University of Bath Sustainable Energy Research Team [Ref 16].

c Green Book supplementary guidance: valuation of energy use and greenhouse gas emissions for appraisal 2012, published by BEIS [Ref 17].

K3.10 Future national and local carbon targets, for the period between 2020 and 2050, are not yet known. The eventual emissions from the proposed development will be affected by the wider response across the UK to meeting the 2050 Net Zero target. Linked to this is uncertainty in the future carbon intensity of energy generation and emissions from transport, and these are increasingly unclear in the longer term towards 2050. In broad terms the national grid carbon intensity has been rapidly reducing in recent years, and wider policy will continue to encourage this decarbonisation in the period to 2050. Similarly, national policy is likely to significantly reduce the carbon intensity of freight and passenger transport in the next thirty years.

K3.11 Due to these uncertainties the GHG assessment does not attempt to fully estimate emissions over the whole life 60-year period. The assessment, instead, considers key years in the project programme, and assesses emissions for:

1 2021 – Annual construction emissions for construction phase 1;

2 2023 – Annual construction emissions for construction phase 2;

3 2028 – first year of full site occupancy and operation.

K3.12 The main reference periods for assessing emissions are in line with the UK Carbon budgets, that cover periods from 2018-22 (Third carbon budget), and 2023-27 (Fourth carbon budget). As Construction Phases 1 and 2 fall within different carbon budget periods these are compared against the relevant carbon budget.

K3.13 Table K3.2 summarises the assessment methodology for estimating emissions sources included in this GHG assessment.

Table K3.2: Methodology for estimating emissions sources included in the GHG emissions assessment

Emissions source	Summary of assessment methodology	Data sources
Product stage (A1-3)		
Buildings	Embodied emissions resulting from building materials have been calculated based on total floor area estimates for each building type and by applying benchmarks for typical buildings of each type. Total floor areas by building type are taken from the Project Description.	Chapter B (Project Description) RICS (2014) Methodology to calculate embodied carbon [Ref 18]

Emissions source	Summary of assessment methodology	Data sources
Outdoor space	Material quantities have been calculated based on total floor areas for two principal use types; concrete hardstanding and tarmac road surface. Typical depth specifications for each use type have been used to calculated volumes for each principal material. The assessment does not attempt to capture all materials used in the construction of outdoor space but focusses on those of high quantity or high carbon intensity. The principal materials considered are concrete, asphalt and aggregate. The material quantities have then been converted to embodied GHG emissions using carbon conversion factors from the ICE database.	Chapter B (Project Description) Typical material specifications based on professional experience from similar projects. ICE database
Construction stage (A4-5)		
Buildings	Emissions associated with the transport of material to site and the construction assembly process have been estimated based on a typical scaling ratio between product stage and construction stage emissions for building projects.	London Energy Transformation Initiative Embodied Carbon Primer [Ref 19]
Outdoor space	Emissions associated with transportation of materials from the manufacturer to site have been calculated by converting material volumes to material mass using typical densities for each material. Emissions have been calculated using the following formula: *transport distance x material mass x carbon conversion factor (average laden heavy goods vehicle (HGV))* Emissions associated with the construction assembly process have been estimated based a typical ratio between product stage and construction stage emissions.	ICE database BEIS (2019) Conversion Factors
Logistics	Emissions associated with the transport of construction workers have been calculated based on the maximum number of full-time construction workers undertaking two-way commuting trips every day throughout both construction phases. Total kilometres travelled have been calculated by estimating the number of trips between site and surrounding destinations based on the Tees Valley Travel to Work Survey. Total kilometres were allocated to different transport modes based on 2011 UK census Journey to Work mode splits for the South Tees area (Census zone E02002517). Carbon emissions have been calculated using BEIS 2019 carbon conversion factors for each transport mode.	Construction methodology (Chapter B: Project Description) and employment calculations (Chapter I: Socio-economic) 2011 travel to work pattern data – Tees Valley [Ref 20] Method of Travel to Work data, ONS, 2011 National Census data [Ref 21] BEIS 2019 Conversion Factors
Waste material	The preliminary assessment of quantities of materials generated through excavation indicates that the site will be balanced in terms of cut and fill, and it is assumed there is no disposal of excavation material offsite.	Chapter B (Project Description)

Emissions source	Summary of assessment methodology	Data sources
	It is known that there are some demolition activities being carried out on site that will result in offsite waste management. However, there is insufficient information at this stage to quantify this impact. Once further information is available, and an appropriate waste management strategy is developed, the GHG emissions should be quantified and the impact on the overall conclusions of the assessment should be reassessed.	
Operational stage (B)		
Buildings – operation	Annual regulated energy consumption for buildings have been calculated based on published industry standard data for energy benchmarks, based on the estimated floor area for each building type. Annual regulated energy consumption has been split into electrical energy and fossil thermal energy. Energy consumption has been converted to GHG emissions using BEIS conversion factors based on grid electricity and gas. Projected changes to the emissions intensity of the electricity grid have been incorporated.	CIBSE TM46: 2008 – Energy Benchmarks [Ref 22] Green Book supplementary guidance: valuation of energy use and greenhouse gas emissions for appraisals
Transport emissions	Emissions associated with operational vehicular journeys inside the Redcar and Cleveland boundary have been calculated based on projected daily trips derived from the Trip Rate Information Computer System (TRICS) database, in accordance with Chapter C (Transport). This includes employee and visitor travel, HGV and light goods vehicle (LGV) movements. Annual trip generation has been calculated by multiplying daily trips by the number of working days in a year. Journeys have been apportioned between surrounding destinations and total kilometres travelled within the Redcar and Cleveland boundary have been estimated. Total kilometres for employee trips have been apportioned between transport modes according to 2011 UK census Journey to Work data. Carbon emissions were calculated using BEIS 2019 carbon conversion factors for each transport mode.	2011 travel to work pattern data – Tees Valley Method of Travel to Work data, ONS, 2011 National Census data BEIS 2019 Conversion Factors
Material replacement	Typically, an assessment of replacement emissions for key materials would be included in a whole life carbon assessment. However, as emissions are only being considered for specific years, an assessment of material replacement emissions has not been carried out.	
End of life stage (C)		
Buildings	There is no expectation on when new buildings will reach end of life, but this is not anticipated to be within 60 years of construction. End of life emissions have not been considered within the assessment.	N/A

Significance Criteria

K3.1 The Institute of Environmental Management and Assessment ('IEMA') guide to Assessing greenhouse gas (GHG) emissions and evaluating their significance [Ref 23] states the over-arching principle:

"The GHG emissions from all projects will contribute to climate change; the largest inter-related cumulative environmental effects…as such any GHG emissions or reductions from a project might be considered to be significant…"

K3.2 Further the guidance notes that: "*…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"*

K3.3 On this basis the emissions of GHG arising from the project are considered significant.

K3.4 However, the IEMA guide also states that *"under the principal that all GHG emissions might be considered significant…it is down to the practitioner's professional judgment on how best to contextualise a project's GHG impact."*

K3.5 To provide context for the consideration of GHG emissions, emissions associated with the construction of the proposed development have been compared with the national carbon budgets to determine whether they are likely to impinge on the overarching ability of the UK Government to meet its statutory commitments.

K3.6 To provide additional context for the annual operational emissions associated with the proposed development, the assessment compares emissions identifiable within the spatial extent of RCBC against the Council's existing GHG baseline [Ref 24].

Consultation

K3.7 Liaison with the wider client and assessment teams has taken place in order to identify data sources to inform the assessment, agree and align assumptions for the proposed development, and highlight identified impacts of the project.

K3.8 Consultation was conducted with Rebecca Wren, Planning Strategy Manager at RCBC. It was confirmed that there are no additional policy or guidance documents in addition to those set out in the Policy Context section above. The meeting notes can be found in Appendix K1.

Assumptions and Limitations

K3.9 The assessment of the proposed development has been undertaken on the basis of the information available at the time of writing. As this is in outline planning application, limited information is currently available regarding materials, design, assembly, earthworks, and use of components, therefore industry benchmark figures and assumptions have been used to develop the GHG emissions assessment.

K3.10 The assessment is based on the assumptions and limitations outlined in Table K3.3.

Table K3.3: Assumptions within the GHG assessment

Emissions source	Assumptions and limitations
Product stage (A1-3)	
Buildings floor schedule	The gross floor areas for buildings of each use type were estimated based on the data and assumptions detailed in Appendix K2. The gross floor areas for each building use type were estimated as follows: Office units – 83,608 m^2 Single storey warehouse units – 188,118 m^2 Two storey industrial units – 376,236 m^2
Buildings - materials	No information is available regarding the quantity and volume of materials used for construction of buildings. High level industry benchmarks have therefore been used to provide an estimate of product stage embodied carbon emissions (see Appendix K2).
Outdoor space - materials	No information is available on the use of outdoor space. Based on the data and assumptions detailed in Appendix K2, the surface areas for each surface type have been estimated: Concrete hardstanding – 1,189,764 m^2 Tarmac road – 132,196 m^2 From this, material quantities for concrete, asphalt and aggregate have been estimated (see Appendix K2 for more details): Concrete – 773,347 m^3 Asphalt – 39,659 m^3 Aggregate – 396,588 m^3 The site is expected to be cut and fill neutral, but a worst case (highest emissions) assumption has been made that all aggregate materials will be imported from virgin sources (rather than recycled sources).
Construction stage (A4-5)	
Construction phases	Construction Phase 1 will occur in an 18-month period between 2021 and 2023. To generate a worst-case annual emissions scenario, it has been assumed that the next construction phase will occur over a 5-year period from 2023 to 2027. In reality, this is expected to take longer (up to 8 years)
Material transport - buildings	Emissions associated with the transport of buildings materials have been calculated based on a typical benchmark of 6.25% of embodied material emissions.
Material transport – outdoor space	A transport distance of 50km is has been used for all materials, based on RICS guidance. It is assumed that HGVs will be used to transport all materials to site.
Worker transport	As a worst-case scenario, it has been assumed that 420 construction staff will commute to site every day during both phases of the construction period. The number of kilometres travelled has been estimated based on likely origins and destinations taken from the Tees Valley Travel to Work Survey data. See Appendix K2. Transport modes have been estimated using 2011 UK census Journey to Work data for the South Tees area (Census zone E02002517). See Appendix K2. Emissions related to car transport and car passenger transport have been calculated based on the assumption of single car occupancy. This is likely to be a conservative estimate.

Emissions source	Assumptions and limitations
Construction Plant	Emissions associated with construction plant use have been calculated based on a typical benchmark of 6.25% of embodied material emissions for each construction phase.
Waste materials	It has been assumed that the site will achieve a balanced cut/fill and no excavation waste will be removed from site. Estimates of demolition materials are not known at this time and have been excluded from the GHG assessment. Once demolition quantities and waste management strategy are known, this should be reassessed.
Operational stage (B)	
Operational energy use	Operation energy estimates have not yet been developed for the site. Benchmark data has been used to estimate energy consumption based on floor area by building type. The benchmarks used are detailed in Appendix K2. The benchmarks used are based on data collected from energy use in older buildings. Part L of the Building Regulations [25] requires new buildings to comply with a minimum energy efficiency standard. In reality, energy demand is expected to be lower. The assessment accounts for regulated[1] energy use only. No process energy has been considered due to uncertainty around the end use of the site. A worst-case assumption for continued gas use during operation has been made. In practice, it is expected that an alternative energy strategy will be developed for the site in the longer term. Assumptions regarding the decarbonisation of the UK electricity grid have been made. These are detailed in Appendix K2.
Operational transport	The number of daily operational vehicle movements when the site is fully operational has been taken from Chapter C (Transport). Total kilometres travelled within the Redcar and Cleveland council area have been calculated based on likely transport routes as detailed in Appendix K2. Transport modes have been estimated using 2011 UK census Journey to Work data for the South Tees area (Census zone E02002517). See Appendix K2. Assumptions have been made regarding the split of diesel, petrol and hybrid/electric vehicles for car transport. The split assumed for the 2028 assessment year is detailed in Appendix K2. Assumptions regarding efficiency improvements for each transport mode have been made based on a linear reduction to zero carbon by 2060. In practice, this affect may take place more rapidly. The carbon factors used for each transport mode in the 2028 assessment year are outlined in Appendix K2.

K3.11 No allowance has been made for emissions associated with the repair, replacement and maintenance of infrastructure.

K3.12 Due to the uncertainty in the end use of the proposed development, this assessment does not consider embedded mitigation.

[1] 'Regulated' energy is building energy consumption resulting from the specification of controlled, fixed building services and fittings, including space heating and cooling, hot water, ventilation, fans, pumps and lighting.

K4.0 Baseline Conditions

Existing Conditions

K4.1 There are currently no operational activities within the site. There are no known sources of GHG emissions within the site at present and therefore baseline emissions are assumed to be zero.

K4.2 The UK national carbon budgets can provide useful context for assessing the significance of the GHG emissions associated with the product and construction stages of the proposed development. The figures below summarise key GHG emission baseline numbers for the UK:

- UK 3rd carbon budget (2018-2022): 2,544 $MtCO_2e$
- UK 4th carbon budget (2023-2027): 1,950 $MtCO_2e$

K4.3 The historic emissions for RCBC [Ref 24] can be used to contextualise the predicted operational emissions from the proposed development. It should be noted that these emissions only represent CO_2 emissions, not wider CO_2e (which accounts for the small contribution from other non-CO_2 GHGs), although these represent the majority of CO_2e emissions for the relevant geography and provide useful context for the assessment. These are summarised in Table K4.1.1.

Table K4.1: GHG Baseline for Redcar and Cleveland local authority area

Emissions sector	**2017 GHG emissions ($ktCO_2$)**
Industrial and commercial	1,619.5
Domestic	205
Transport	200.3
Grand total (including LULUCF Net)	**2,018.5**

Future Baseline

K4.4 The future baseline for the site, in the absence of the proposed development, is assumed to be zero as no other construction/operational changes are proposed for the site.

K4.5 No allowance in the future baseline has been made for other developments in the local area, and any associated changes in their usage resulting from the presence or absence of the proposed development.

K5.0 Potential Effects

Embedded Mitigation

K5.1 Due to the current flexibility of end use of the proposed development this assessment does not consider embedded mitigation that relate to climate change and greenhouse gases.

K5.2 Many of the design decisions that provide an efficient development process will as a by-product provide a reduction in carbon emissions. These include efficient use of space, recycling and reuse of materials, and minimised transportation. These have not been identified at this stage, but the range of opportunities is set out in the mitigation section. As the detailed scheme design progresses these will be taken into account and, where relevant and possible, can be embedded into the scheme. If necessary, climate change can be considered at the reserved matters stage of the planning process.

During Construction

K5.3 The construction process contributes to GHG emissions through the extraction, production and delivery of materials and onsite energy consumption.

K5.4 Table K5.1 presents the annual emissions associated with each of the two construction phases.

Table K5.1: Construction GHG emissions

Construction Phase	Emissions source	Total GHG emissions (tCO_2e)	Annual average GHG emissions (tCO_2e)
Phase 1 (2021-2023): Site preparation and outdoor infrastructure (assumed 18-month construction period)	Construction materials	188,301	125,534
	Material transport	14,773	9,849
	Construction plant usage	11,769	7,846
	Construction worker transport	1,653	1,102
	Total	**216,497**	**144,331**
Phase 2 (2023-2027): Building infrastructure (assumed 5-year construction period)	Building construction materials	359,514	71,903
	Material transport	22,470	4,494
	Construction plant usage	22,470	4,494
	Construction worker transport	5,510	1,102
	Total	**409,965**	**81,993**

K5.5 The majority of emissions (those for materials and a large proportion of material transport and construction worker transport) will be emitted outside the boundary of the Redcar and Cleveland Local Authority.

K5.6 The annual construction emissions for phase 1 of the construction period are 144,331 tCO_2e and for phase 2 of the construction period are 81,993 tCO_2e. The majority of the emissions (approximately 87%) in both construction phases arise from the extraction and manufacturing of the principal construction materials which will take place across a wide spatial area. The working assumption is that these are fully generated within the UK, although some significant material elements (e.g. steel used in buildings) may be sourced from outside the UK at some point in their production lifecycle.

K5.7 At a national scale the most relevant benchmarks for assessing significance are the UK carbon budgets [6]. The assessment is compared to these benchmarks in Table K5.2.

Table K5.2: Emissions arising from construction of the Project

UK Carbon budget period	UK carbon budget	Annual average carbon budget	Peak annual construction emissions from proposed development	Proportion of national carbon benchmarks
3rd carbon budget (2018 to 2022)	2,544 $MtCO_2e$	509 $MtCO_2e$	0.144 $MtCO_2e$	0.028 %
4th carbon budget (2023 to 2027)	1,950 $MtCO_2e$	390 $MtCO_2e$	0.082 $MtCO_2e$	0.021 %

K5.8 It should be noted that the UK carbon budgets have not been updated following the change in the UK Climate Change Act from an 80% reduction by 2050, to a 100% reduction by 2050 [4]. In practice the annual levels at which the UK can emit GHGs between now and 2050 will be reduced from those in the current budgets. However, given the very small contribution of the proposed development to national carbon budgets, it is not expected to compromise the ability of the UK to meet its national targets.

During Operation

K5.9 During the operational phase of the proposed development, use-related emissions will contribute significantly to whole life emissions of the project and typically represent the largest component of project emissions when considered in aggregate over the whole lifetime period.

K5.10 Key impact areas include provision of heating, cooling and electrical energy in buildings included within the proposed development, the transportation of employees and visitors to and from the proposed development, the movement of HGVs and LGVs, and the periodic replacement of materials.

K5.11 It should be noted that, depending on the use of the site, energy consumed through the operation of specialist industrial plant equipment and operational vehicles, along with unregulated energy consumption in buildings could significantly increase the operational emissions estimates presented in this assessment. However, as future uses of the site are not known, these have not been estimated. Once further information is available on the end use energy demand for the proposed development, and an appropriate energy strategy has been developed, the GHG emissions should be quantified and the impact on the overall conclusions of the assessment should be reassessed.

K5.12 Table K5.3 presents the GHG emissions arising within the boundary of Redcar and Cleveland for each of the assessment periods.

Table K5.3: Emissions arising from operation of the Project

Emissions source	First year of full operation – 2028 (tCO_2e)
Building energy use	23,231
Transport emissions within RCBC	10,563
Total operational emissions	**33,793**

K5.13 First occupation for the proposed development will start in 2023, but full operation will not occur until 2028. Operational emissions within Redcar and Cleveland for the first full year of operation are estimated at 33,793 tCO_2e. 69% of these arise from the energy required to operate the buildings on site, and 31% arise from operational transport emissions, including employee commuting. The emissions arising from the site in 2028 is likely to represent a worst-case scenario given that both energy supply to buildings and transport are expected to decarbonise towards net zero carbon in 2050.

K5.14 The forecast emissions can be contextualised by comparing against the most recent local authority area emissions for Redcar and Cleveland from 2017 [24]. Table K5.4 shows this comparison.

Table K5.4: Comparison of 2028 operational emissions against Redcar and Cleveland 2017 baseline emissions

Emissions sector	2017 GHG emissions ($ktCO_2$)	First full operational year emissions ($ktCO_2e$)	Proportion of RCBC annual emissions
Industrial and commercial	1,619.5	23.2	1.4%
Transport	200.3	10.6	5.3%
Full Local Authority emissions	**2,018.5**	**33.8**	**1.7%**

K5.15 This indicates that the proposed development, in operation, contributes approximately 1.7% of the annual emissions from Redcar and Cleveland as a whole. This is not a negligible contribution but must be considered in the context of the overall scale of the proposed development and the assumptions made which represent a worst-case scenario. It also represents a worst-case assumption in terms of regulated energy use, assuming full use of grid electricity and natural gas, and no onsite renewable energy use.

K5.16 It is noticeable that part of the emissions, relating to transport, represent a relatively large proportion of local authority transport emissions. Again, the assessment is based on a worst case set of assumptions for transport that includes a large proportion of car usage for commuting to work, and a large number of operational vehicles in use. The assessment does not include for the wide range of measures proposed under the emerging wider South Tees Regeneration Masterplan Transport Strategy, which are expected to reduce vehicle movements significantly, and lead to increased use of lower carbon transport measures.

K5.17 Once the intended operational use of the site is confirmed, it is expected that a detailed energy strategy will be developed that will utilise low and zero carbon energy supply options, and a travel plan will be established to encourage transport modal shift away from predominantly private car use. On this basis it is considered unlikely that the proposed development will compromise national or local GHG commitments.

K6.0 Mitigation and Monitoring

During Construction

K6.1 At this stage in the project, full construction design and logistics are yet to be confirmed. However, a range of construction and procurement strategies can be investigated to provide mitigation measures to reduce the GHG emissions associated with the proposed development, across the full life cycle. Table K6.1 summarises possible mitigation measures for each of the product and construction lifecycle stages outlined in PAS 2080 [14] (shown in Figure K1).

Table K6.1: Mitigation opportunities by life cycle - Construction

Lifecycle stage	Possible mitigation measures	Implementation and monitoring
Product stage	Further design iteration to reduce the absolute quantities of construction materials through efficient design and use materials with a lower carbon intensity where possible. Specification to reduce the embodied carbon of building materials and components e.g. through cement replacement and preferences for readily available products with higher recycled content. Maximised use of offsite construction for efficiency of material use and reduced construction waste. Challenges during procurement to encourage supply chains to provide products and materials with high recycled content. Application of circular economy principals to maximise the quantity of recycled and reused materials.	Opportunities to be identified as proposed development proposals for the site continue to be developed, and to be implemented through the application of wider sustainability principles to the proposed development.
Construction – transport to site	Preference for materials and components that are locally sourced to minimise transportation distances. Use of lower emissions vehicles for transporting materials to site where possible. Construction vehicle management plan to minimise the number of journeys required.	As for Product stage. Material transportation emissions could be managed through use of a Construction Environmental management Plan (CEMP).
Construction – installation process	Offsite construction/manufacturing for energy efficient assembly and minimising site installation processes.	Opportunities to be identified as proposed development proposals for the site continue to be developed, and to be implemented through the application of wider

Lifecycle stage	Possible mitigation measures	Implementation and monitoring
	Use of electrical plant over fossil fuelled construction plant.	sustainability principles to the proposed development. Installation process emissions could be managed through use of a Construction Environmental management Plan (CEMP).

During Operation

K6.2 The impacts arising from the operational stage of the proposed development are greater than those for construction, although there is uncertainty in the operational use and the energy supply strategy for the site.

K6.3 Key contributions are likely to change in the future as the UK progresses towards its 2050 national carbon target of net zero. Possible mitigation measures against each relevant operational lifecycle stage (as per PAS 2080 [14], presented in Figure K1) are set out in Table K6.2.

Table K6.2: Mitigation opportunities by life cycle- Operation

Stage	Possible mitigation measures	Implementation and monitoring
Use stage (Maintenance, Repair and Refurbishment)	Reduced future maintenance due to design decisions being informed by early service life planning. Consideration of the degradation impact on construction materials arising from present and future climate. Maintenance planning which optimises the replacement cycles of key materials, minimising inadvertent early replacement.	Detailed design of buildings and facilities should adopt whole life assessments for the main building materials and systems to understand full impacts and replacement cycles. Maintenance plans should be informed by a Life Cycle Costing exercise.
In-Use (Operational energy use)	Implementation of an energy strategy that includes the installation of low and zero carbon technologies to provide lower carbon energy to the proposed development. Construction of energy efficient buildings to minimise energy demand. Ongoing engagement with the energy supply company to promote future transitions to low and zero carbon heat/power sources. Encouraging procurement of energy efficient equipment within the proposed development. Development of a comprehensive suite of transport measures to reduce reliance on cars by staff, and	Operational energy management strategy for the proposed development should be developed. Development of sustainable procurement guide for energy consuming equipment to minimise unregulated energy. Promotion of alternative transport measures during operational stage to reduce reliance on car, and to promote low carbon transport options.

Stage	Possible mitigation measures	Implementation and monitoring
	to encourage active and low carbon transport choices.	

K6.4 The final energy supply strategy for the proposed development will be developed as the project proceeds and more certainty is provided over the intended use of the site. Where relevant, further information can be submitted at the reserved matters stage of the development. This will need to be cognisant of both national legislations to achieve net zero carbon emissions by 2050, and Redcar and Cleveland's Climate Emergency commitment to achieve net zero carbon emissions by 2030. It is therefore expected to reduce the projected carbon emissions associated with the operation of the site.

K6.5 Mitigation of emissions from user and staff travel will be developed in full as part of a Full Travel Plan to be prepared once planning permission has been granted. The Travel Plan will provide further details of targeted mode share, supplemented with a travel survey and monitoring regime.

K7.0 Residual Effects

During Construction

K7.1 The construction stage measures have the potential to reduce carbon emissions from the proposed development through detailed design stage. However, the nature of the proposed development requires significant volumes of building materials, and associated construction related emissions.

K7.2 Given the nature and scale of the proposed development it is expected that there will be substantial residual construction-related emissions, even after mitigation.

K7.3 However, it is not considered that these emissions will compromise the ability of the UK to meet its carbon targets (including carbon budgets) nor are these expected to contribute significantly to the overall GHG emissions from Redcar and Cleveland.

During Operation

K7.4 The energy strategy for the site has yet to be developed but will be important for minimising the overall carbon emissions associated with the operation of the proposed development. Given Redcar and Cleveland's commitment to achieve net zero carbon emissions, including both production and consumption, this is expected to maximise the use of low and zero carbon technologies.

K7.5 Similarly, there will be transport emissions associated with worker and visitor commuting, and HGV and LGV movements associated with site use. Until such time as the UK can completely decarbonise transport then it is inevitable that there will be residual GHG emissions arising from staff travelling to/from the proposed development.

K7.6 Opportunities to further mitigate operational emissions – through travel planning and through energy system design and operation – will be identified through subsequent design stages.

K7.7 It is not considered that emissions during operation will compromise the ability of the UK or Redcar and Cleveland to meet respective carbon targets.

K8.0 Summary & Conclusions

K8.1 While all GHG emissions from a project in construction and operation can be considered significant, the scale of emissions arising from the proposed development is not considered to be so great as to prevent the UK achieving its national carbon targets and budgets.

K8.2 In addition, the scale of operational emissions is not considered so great as to materially affect the overall GHG emissions within Redcar and Cleveland.

K9.0 Abbreviations & Definitions

1	BEIS UK	Government Department of Business, Energy and Industrial Strategy
2	BREEAM	Building Research Establishment Environmental Assessment Method
3	CEnv	Chartered Environmentalist
4	CO2	Carbon dioxide
5	CO2e	Carbon dioxide equivalent (where other GHGs have been converted into an equivalent mass of CO2)
6	DCO	Development Consent Order
7	DEFRA	Department for Environment Food and Rural Affairs
8	EIA	Environmental Impact Assessment
9	ES	Environmental Statement
10	GHG	Greenhouses gases as defined by the Kyoto Protocol (1997)
11	HGV	Heavy goods vehicle
12	ICE	Inventory and Carbon and Energy
13	IEMA	Institution of Environmental Managers and Assessors
14	ktCO2e	Kilotonnes of carbon dioxide equivalent
15	LGV	Light goods vehicle
16	LULUCF	Land use, land use change and forestry
17	MtCO2e	Megatonnes of carbon dioxide equivalent
18	NPPF	National Planning Policy Framework
19	RCBC	Redcar and Cleveland Borough Council
20	RCBC	Redcar and Cleveland Borough Council
21	RICS	Royal Institute of Chartered Surveyors
22	STDC	South Tees Development Corporation
23	tCO2e	Tonnes of carbon dioxide equivalent

K10.0 References

1 Planning Act (2008)

2 Town and Country Planning (Environmental Impact Assessment) Regulations 2017 (as amended in the Town and Country Planning and Infrastructure Planning (Environmental Impact Assessment) (Amendment) Regulations 2018)

3 DIRECTIVE 2011/92/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 13 December 2011 on the assessment of the effects of certain public and private projects on the environment (amended 2014)

4 Climate Change Act (2008), c.27 (as amended)

5 Committee on Climate Change (CCC) (2019) Net Zero – the UK's contribution to stopping global warming.

6 Committee on Climate Change (2018) Carbon budgets.

7 Department for Innovation, Business and Skills (2013) Construction 2025: Strategy

8 Green Construction Board (2012) Low Carbon Routemap for the Built Environment

9 Department for Business, Energy and Industrial Strategy (2017) The Clean Growth Strategy

10 Ministry of Housing, Communities and Local Government (2019) National Planning Policy Framework

11 Tees Valley Climate Change Partnership (2010) Tees Valley Climate Change Strategy

12 Redcar and Cleveland Borough Council (2018) Local Plan

13 RICS (2017) Whole life carbon assessment for the built environment

14 British Standards Institute (BSI) (2017) Carbon Management in Infrastructure, PAS 2080.

15 Department for Business, Energy & Industrial Strategy (2018) BEIS GHG conversion factors.

16 Circular Ecology Ltd. (2019) Embodied energy and carbon – The ICE database version 3.

17 Department for Business, Energy and Industrial Strategy (2019) Green Book supplementary guidance: valuation of energy use and greenhouse gas emissions for appraisals

18 RICS (2014) Methodology to calculate embodied carbon of materials

19 London Energy Transformation Initiative (2020) Embodied Carbon Primer

20 Tees Valley Combined Authority (2011) Census 2011 Travel to Work Patterns

21 Office for National Statistics (2011) Census 2011 Method of Travel to Work

22 Chartered Institute of Building Services Engineers (CIBSE) (2008) TM46 Energy Benchmarks

23 Institute of Environmental Management and Assessment (2017) The Environmental Impact Assessment Guide to: Assessing Greenhouse Gas Emissions and Evaluating their Significance.

24 Department for Business, Energy and Industrial Strategy (2019) Emissions of carbon dioxide for Local Authority areas

25 The Building Regulations (2010)