Pell Frischmann

A1237 York Outer Ring Road Dualling - A19 to Little Hopgrove

Environmental Statement: Volume I Chapter 12 - Climate: Greenhouse Gas Assessment

August 2022

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Acronyms

Abbreviation	Definition
AADT	Annual Average Daily Traffic
CEMP	Construction Environmental Management Plan
CYC	City of York Council
DEFRA	Department for Environment, Food and Rural Affairs
DMRB	Design Manual for Roads and Bridges
DM	Do Minimum (scenario where the Proposed Scheme is not implemented)
DS	Do Something (scenario where the Proposed Scheme is implemented)
EA	Environment Agency
EC	European Commission
EFT	Emissions Factors Toolkit (DEFRA)
EIA	Environmental Impact Assessment
EPA	Environmental Protection Act
EPR	Environmental Permitting Regulations
EQS	Environmental Quality Standards
ES	Environmental Statement
EU	European Union
FRA	Flood Risk Assessment
GHG	Greenhouse gas
HGV	Heavy Goods Vehicle
IEMA	Institute of Environmental Management and Assessment
IPPC	Intergovernmental Panel on Climate Change
MAGIC	Multi-Agency Geographic Information for the Countryside
MMP	Material Management Plan
NH	National Highways
NPPF	National Planning Policy Framework
OS	Ordnance Survey
REAC	Register of Environmental Actions and Commitments
SWMP	Site Waste Management Plan

12 Climate: Greenhouse Gas Assessment

12.1 Introduction

12.1.1 This chapter reports the outcome of the assessment of likely significant effects on the climate from greenhouse gas emissions associated with the construction and operation of the Proposed Scheme. Climate Vulnerability of the Proposed Scheme to climate change is assessed in Chapter 13 (Climate Vulnerability).

12.1.2 The Proposed Scheme has the potential to affect the earth's climate by increasing the emission of greenhouse gases (GHG) into the atmosphere, during construction and throughout its operational life.

12.1.3 The assessment approach adopted focuses on capturing the principal contribution of the Proposed Scheme effects on climate, quantifying the magnitude of GHG emissions and assessing the significance of these in comparison with a baseline scenario where the Proposed Scheme is not implemented. The assessment methodology is presented in Section 12.5 and follows the latest IEMA guidance[i].

12.1.4 Section 12.10 determines that the magnitude of GHG emissions arising from construction of the Proposed Scheme is negligible in comparison with the UK Carbon Budget. However, in line with IEMA guidance, it is recognised that without mitigation measures in place, effects may be considered significant, and as such, additional mitigation is required to ensure that those effects are rendered 'insignificant'.

12.1.5 The operation of the Proposed Scheme will lead to a decrease of GHG emissions in comparison with the Do Minimum scenario (existing A1237 without the Proposed Scheme implemented), which has a beneficial effect on climate, albeit of a negligible magnitude (refer to Section 12.11).

12.1.6 This chapter is intended to be read as part of the wider ES, with particular reference to Chapter 2 (The Proposed Scheme) and the Appendix 13.1: Climate Baseline, presented in ES Volume III.

Competent Expert

12.1.7 This chapter has been prepared by Susana Camarao, a Principal Environmental Consultant, who is a Chartered Environmentalist (CEnv) and full Member of the Institution of Environmental Management and Assessment (MIEMA), with 10 years of experience in environmental impact assessment and sustainability consultancy, including carrying out detailed carbon footprint calculations and climate change assessments for infrastructure projects.

12.2 Legislative Framework, Policy and Guidance

Legislative Framework

12.2.1 The applicable legislative framework is summarised within Table 12.1. This table presents a summary of the requirements of the legislation and demonstrates how the chapter complies with these requirements.

Table 12.1: Compliance with Legislative Framework

Summary of requirements	Chapter / Assessment Compliance
Town & Country (Environmental Impact Assessment) Regulations 2017 [ii]	
N.4 Regulations require: "A description of the factors specified in regulation 4(2) likely to be significantly affected by the development: (…) climate (for example greenhouse gas emissions, impacts relevant to adaptation) …"	A description of climate (baseline) is presented in Section 13.6 of Chapter 13 (Climate Vulnerability) and complemented by the Climate Baseline Appendix 13.1 (ES Volume III). Baseline conditions in relation to GHG emissions are presented in Section 12.6 of this chapter. A description of likely climate change impacts upon the Proposed Scheme is presented in Chapter 13 (Climate Vulnerability). As such, this chapter provides evidence of compliance of this ES with EIA Regulations.
N.5 of Regulations require: "A description of the likely significant effects of the development on the environment resulting from, inter alia: (…) the impact of the project on climate (for example the nature and magnitude of greenhouse gas emissions) and the vulnerability of the project to climate change"	A description and assessment of likely significant effects of the project on climate during the construction phase is presented in Section 12.10. The likely significant effects of the project on climate during the operation of the Proposed Scheme is reported in Section 12.11. As such, this chapter provides evidence of compliance of this ES with EIA Regulations.
Climate Change Act 2008, as amended [iii]	
The Climate Change Act (2008) and amendments sets the framework for the UK to achieve its long-term goals of reducing Greenhouse Gas (GHG) by 34% (from the 1990 baseline) by 2020 and by 100% by 2050, whilst also ensuring that steps are taken towards adapting to the impact of climate change. The Climate Change Act has introduced a system of carbon budgeting which constrains the total amount of carbon emissions in a given time period (refer to Table 12.2). The Climate Change Act also sets out a procedure for assessing the risks of the impact of climate change for the UK and a requirement on the Government to develop an adaptation programme policy.	The assessment presented in this chapter has tested magnitude of the Proposed Scheme GHG emissions against UK Carbon Budgets. Refer to Section 12.10 and Section 12.11 for further details.
Carbon Budget Order 2021 [iv]	
The Carbon Budget Order 2021 was made on 23 June 2021 to act as a stepping-stone towards the net zero target in 2050. The Carbon Budget Order 2021 requires a reduction of greenhouse gas emissions by 78% by 2035 compared to 1990 levels. This means that by 2035 the UK will be more than three-quarters of the way to the 2050 net zero target. Included within this greenhouse gas emissions target is the UK's share of international aviation and shipping emissions. These emissions have previously been excluded from carbon budgets and greenhouse gas emissions targets.	The assessment presented in this chapter has tested the magnitude of the Proposed Scheme GHG emissions against UK Carbon Budgets. Refer to Section 12.10 and Section 12.11 for further details.

Table 12.2: UK Carbon Budgets[v]

Budgetary period	Carbon budget (t CO_2e)
3rd Carbon Budget: 2018–2022 [1]	2,544,000,000
4th Carbon Budget: 2023–2027 [2]	1,950,000,000
5th Carbon Budget: 2028–2032 [3]	1,725,000,000
6th Carbon Budget: 2033–2037 [4]	965,000,000

Source: [1] The Carbon Budgets Order 2009; [2] The Carbon Budget Order 2011; [3] The Carbon Budget Order 2016; [4] The Carbon Budget Order 2021.

Policy

12.2.2 This Chapter has been prepared in accordance with the National Planning Policy Framework, 2021 and Government's National Planning Practice Guidance, 2019.

12.2.3 Planning policies relevant to this Chapter are summarised within Table 12.3. This table presents (i) a summary of the policy requirements and (ii) demonstrates how the chapter complies with these requirements.

Table 12.3: Compliance with Planning Policy

Policy Name	Summary of requirements	Chapter / Assessment Compliance
National Planning Policy Framework (NPPF) 2021[vi]		
Section 2: Achieving sustainable development	The NPPF develops a planning system that contributes to the achievement of sustainable development, setting objectives that include mitigating and adapting to climate change, supporting the moving to a low carbon economy.	The design of the Proposed Scheme is in accordance with the objectives of the policy set out in the NPPF. The Proposed Scheme has been designed with the aim of avoiding significant effects and identifying appropriate mitigation and adaptation measures to reduce potentially significant impacts where they are anticipated to arise. (Refer to Section 12.9 of this chapter)
Section 9: Promoting Sustainable Transport	This section of the NPPF encourages the pursuit of "…opportunities to promote walking, cycling and public transport…and offer a choice of genuine transportation modes". Moreover, , the environmental impacts of traffic and transport infrastructure can be identified, assessed and taken into account; including appropriate opportunities for avoiding and mitigating any adverse effects, and for net environmental gains.	The design of the Proposed Scheme is in accordance with the objectives of the policy set out in the NPPF. The design for the Proposed Scheme includes new cycleways that increase opportunities for sustainable transportation modes (refer to Section 12.9 of this chapter). The environmental impacts of traffic and transport infrastructure have been identified within the ES and specifically in this chapter in relation to GHG emissions. The development of the Proposed Scheme has considered potential impacts, incorporating measures to avoid and mitigate adverse effects of the Proposed Scheme (refer to mitigation in Section 12.9).
Section 14: Meeting the challenge of climate change, flooding and coastal change	In this section, the NPPF notes the planning system should support the transition to a low carbon future in a changing climate, taking full account of flood risk and coastal change. New development should be planned in ways that: "a) avoid increased vulnerability to the range of impacts arising from climate change. When new development is brought forward in areas which are vulnerable, care should be taken to ensure that risks can be managed through suitable adaptation measures, including through the planning of green infrastructure; and b) can help to reduce greenhouse gas emissions, such as through its location, orientation and design".	A Flood Risk Assessment (FRA) has been completed for the Proposed Scheme which reviews areas at highest risk of flooding, as well as climate change considerations. Mitigation to reduce risk of flooding is provided within the FRA report. Impacts are also considered for the operational phase. Further details can be found in Chapter 11 (Road Drainage and Water Environment) and the FRA report.
City of York Local Plan Publication Draft, February 2018 – Regulation 19 Consultation[vii]		

Policy Name	Summary of requirements	Chapter / Assessment Compliance
Policy GI1: Green Infrastructure	"York's landscapes, geodiversity, biodiversity and natural environment will be conserved and enhanced recognising the multifunctional role of green infrastructure in supporting healthy communities, cultural value, a buoyant economy and aiding resilience to climate change."	The design of the Proposed Scheme is in accordance with the objectives set out in this policy. The Proposed Scheme design has aimed to incorporate enhancement opportunities for biodiversity and landscape, that will provide resilience to climate change (refer to Section 12.9 of this chapter)
Policy CC1: Renewable and Low Carbon Energy Generation and Storage	In line with this policy, new buildings must achieve a reasonable reduction in carbon emissions of at least 28% unless it can be demonstrated that this is not viable. This should be achieved through the provision of renewable and low carbon technologies in the locality of the development or through energy efficiency measures.	This policy has been reviewed, however as the Proposed Scheme will not involve new buildings this policy does not apply to this assessment.
Policy CC2: Sustainable Design and Construction of New Development	This policy establishes that development proposals will be required to demonstrate energy and carbon dioxide savings in accordance with the energy hierarchy and water efficiency. Development proposals will be expected to consider good practice adaptation principles for climate resilience in their design, construction, and operation. All new residential and non-residential developments will be required to submit an energy statement which demonstrates how these requirements will be met. This should include a sustainability checklist, which shows how principles for sustainable design, construction and operation will be achieved.	In line with this policy, the design of the Proposed Scheme has considered sustainable design principles, such as waste prevention and material resource efficiency, application of the PAS 2080 carbon reduction hierarchy, incorporation of Sustainable Drainage Systems (SuDS) and a high-quality landscape scheme, which includes native planting for provision of landscape and habitat restoration and the achievement of at least 10% of Biodiversity Net Gain. This has been demonstrated in Chapter 2 (The Proposed Scheme) and in this chapter.
Policy ENV4: Flood Risk	This policy covers flood risk requirements for new developments including the overall aim of new development not being subjected to unacceptable flood risk and that it should be designed and constructed to mitigate against current and future flooding events. It states that 'a site-specific flood risk assessment that takes account of future climate change must be carried out for all planning applications of 1 hectare or greater in Flood Zone 1 and for all applications in Flood Zones 2, 3a, 3a (i) and 3b'.	The design of the Proposed Scheme considers flood risk, including mitigation. The associated site-specific FRA also covers flood risk and the proposed highway drainage scenario in more detail. Further details can be found in Chapter 11 (Road Drainage and Water Environment) and the FRA.
Policy ENV5: Sustainable Drainage	This policy provides sustainable drainage requirements for both brownfield and greenfield land. Any design should also ensure that storm water resulting from a 1 in 100 year event plus the recommended additional flows from the latest climate change advice, to account for climate change and surcharging the drainage system, can be stored on the site without risk to people or property and without overflowing into a watercourse or adjacent areas.	The drainage design for the Proposed Scheme complies with this policy. In addition, requirements from EA were also followed in the drainage design. Further details can be found in Chapter 2 (The Proposed Scheme), Chapter 11 (Road Drainage and Water Environment) and the FRA.
Earswick Neighbourhood Plan[viii] (adopted 2019)		
ENP3 – Flood Risk and Climate Change	This policy states that development proposals in high flood risk areas should be avoided, wherever possible. Developers are also encouraged to mitigate against the impact of climate change on flood risk.	The design of the Proposed Scheme considers flood risk, including mitigation. The associated site-specific FRA also covers flood risk and the proposed highway drainage scenario in more detail. Further details can be found in Chapter 11 (Road Drainage and Water Environment) and the FRA. Assessment of vulnerably of the Proposed Scheme to climate change is presented in Chapter 13 (Climate Vulnerability).

Policy Name	Summary of requirements	Chapter / Assessment Compliance
Huntington Parish Neighbourhood Plan 2017 – 2032/33 (adopted 2021)[ix]		
N/A	The Parish Neighbourhood Plan Submission Draft does not address specific requirements related to climate change.	N/A

12.2.4 CYC declared a Climate Emergency in March 2019 and have since set an ambition for York to be a Net-Zero Carbon city by 2030. A report went to Council Executive in August 2019[1] to update on activities already underway. Since then, significant progress has been made to support carbon reduction, including the work on the Climate Change Strategy, which is to be published in 2022[2]. The Council has several activities already underway, for example, investing in a council housing energy retrofit programme, planting 210,000 trees at the new York Community Woodland, significant investment in improvements to cycling and walking infrastructure including the Scarborough Bridge cycle route, a programme to promote active travel, delivering high-speed electric vehicle charging hyper-hubs, eScooter trial and recycled road surfaces trial [3].

Standards and Guidance

12.2.5 The following standard and guidance documents have been used to inform the methodology for this assessment:

- IEMA Guide: Assessing Greenhouse Gas Emissions and Evaluating their Significance (2022) (2nd edition)**Error! Bookmark not defined.** ;
- DMRB LA 114: Climate[x];
- PAS 2080:2016 Carbon management in infrastructure[xi]; and
- RICS (2017) Whole Life Carbon Assessment for the built environment (1st edition)[xii].

12.3 Consultation

12.3.1 A request for a Scoping Opinion was submitted to the City of York Council which included the proposed methodology and scope of the GHG Assessment presented in this Chapter. The Scoping Opinion (Appendix 5.2 (ES Volume III)) raised no objections to the proposed assessment methodology. No other consultations were required for this assessment.

12.4 Scope of Assessment

Scoping Opinion Requirements

12.4.1 The scope of effects of the Proposed Scheme on climate (GHG Assessment) was set within the Scoping Report, presented in Appendix 5.1 (ES Volume III) of this ES and subsequently the Scoping Opinion issued by the City of York Council on 8 January 2021 (document reference 20/01659/EIASP), presented in Appendix 5.2 (ES Volume III).

12.4.2 The Memorandum of the City of York mentioned receptors in relation to climate change that were identified within the Scoping Report. Nevertheless, no further requirements in relation to the scope of assessment of the GHG emissions were requested within the Scoping Opinion nor in the responses from the other organisations consulted.

[1] Responding to The Council's Climate Change Motion (August 2019)
[2] York Climate Strategy Update
[3] https://www.york.gov.uk/climate-change-2/carbon-reduction

Assessment Scope

12.4.3 Table 12.4 outlines the potential GHG emissions sources scoped into the assessment, which takes into consideration the life cycle stages as advised in DMRB LA 114: Climate. A modular approach to life cycle stages, as detailed in PAS 2080:2016, are also presented in this table.

Table 12.4: Sources of GHG emission scoped into the assessment.
(Adapted from Table 3.11.1 published in DMRB LA 114)

Project Life Cycle Stage	Sub-stage of life cycle	Potential sources of GHG emissions (not exhaustive)	Examples of activity data
Construction Stage	Product stage (A1-A3); including raw material supply, transport and manufacture.	Embodied GHG emissions associated with the required raw materials.	Materials quantities.
	Transport to/from works site and construction (A4).	The transportation of materials to the Proposed Scheme site, e.g. by HGV.	Assumed distances of materials from suppliers to site.
	Construction process stage; including installation processes and waste generation (A5).	Activities for organisations conducting construction work.	Fuel/ electricity consumption. Construction activity type/duration. Area of land use change.
	Land use change (A5).	GHG emissions mobilised from vegetation or soil loss during construction.	Type and area of land subject to change in usage.
Operation ('use-stage')	Land use change (B1).	Ongoing land use GHG emissions/ sequestration each year.	Type and area of land subject to change in usage. Net change in vegetation.
	Use of the infrastructure by the end-user (road user) (B9).	Vehicles using highways infrastructure.	Traffic count/ speed by vehicle type for highway links.
Opportunities for reduction	GHG emissions potential for recovery including reuse and recycling and the potential benefits of additional functions associated with the study system.	Avoided GHG emissions through substitution of virgin raw materials with those from recovered sources.	Waste and arisings material quantities and recycling/reuse fate.

Elements Scoped Out of the Assessment

12.4.4 In accordance with the findings of the Scoping Report and the requirements of the Scoping Opinion, the elements presented in Table 12.5 have been scoped out because it is considered unlikely that these elements will give rise to significant effects as a result of the Proposed Scheme..

Table 12.5: Elements Scoped out of the EIA

Element Scoped Out	Justification
Forestry receptors	It was agreed that impacts in relation to forestry should be scoped out of the GHG assessment as no forestry receptors will be affected by the Proposed Scheme.
Operation and maintenance activities	It was agreed that impacts from the operation and maintenance of the Proposed Scheme could be scoped out of the GHG assessment as roadside technology would be minimal, with GHG emission impacts considered to be negligible. It is noted that the lighting used is expected to be efficient LED units providing some reduction in emissions compared to the baseline.
Impacts from replacement and refurbishment during operation	It was agreed that impacts associated with repair, replacement and refurbishment activities during operation could be scoped out of the GHG assessment on the basis that these are likely to be small-scale replacement of components and occasional resurfacing and therefore significant effects are unlikely to occur.
Decommissioning (End of Life Stage)	The end-of-life stage has been scoped out as the expected timescales for decommissioning are so far into the future that there is insufficient certainty about the likelihood, type or scale of emissions from this activity. Moreover, this is not considered necessary to understand the likely significant effects of the Proposed Scheme taking account of available information.

Extent of the Study Area

12.4.5 The study area of GHG emissions arising from the construction of the Proposed Scheme is not limited to the geographic extent of the scheme itself, as many emissions will result from upstream and off-site activities such as materials production.

12.4.6 In line with the DMRB, for construction and operational maintenance, the study area comprises GHG emissions associated with project construction related activities which is defined by the Application Site boundary (drawing reference: 104739-PEF-GEN-ZZ-DG-CH-01015) and the associated transport of materials, which can be extended to several miles from the Proposed Scheme depending on source location of material (see Limitations and Assumptions for these distances).

12.4.7 For operational road user GHG emissions, the study area is consistent with the affected road network defined in the project's traffic model (refer to Chapter 17 (Traffic and Transport)).

12.5 Assessment Methodology

Method of Baseline Collection

Desk Study

12.5.1 The baseline data collected and presented in this chapter were sourced through desktop research.

12.5.2 Data used to calculate construction GHG emissions was collected directly from the design team (further details in 'Limitations and Assumptions' below) and in accordance with Proposed Scheme description presented in Chapter 2 (The Proposed Scheme) of this ES and information in Table 12.4.

Site Visits and Surveys

12.5.3 For the purpose of determining the effects of the Proposed Scheme on climate GHG, no site visits or surveys were required.

Impact Assessment Methodology

12.5.4 The assessment of the effects of the Proposed Scheme on climate was undertaken in line with guidance within DMRB LA 114: Climate.

12.5.5 The assessment approach adopted focusses on capturing the principal contribution of the Proposed Scheme effect on climate, considering the likely magnitude of its GHG emissions (or avoided GHG emissions) and comparison of these to the baseline scenario (the Do Minimum (DM) scenario).,, GHG emissions were quantified throughout the lifecycle of the Proposed Scheme (in the Do Something (DS) scenario') including:

- Construction phase GHG emissions, including embodied GHG emissions associated with materials, transportation of materials to site and waste arisings from the Proposed Scheme, and the construction process.
- Operation GHG emissions (or avoided GHG emissions), for example from end-user vehicles and repair.

12.5.6 This approach is also in line with PAS 2080:2016: Carbon management in infrastructure and IEMA EIA Guide to Assessing GHG and Evaluating their Significance **Error! Bookmark not defined.**.

12.5.7 Further details about GHG emissions scoped into the assessment are presented in Table 12.4.

12.5.8 For the construction phase, it was assumed this will start in 2023 and finish in 2025, as set in the construction programme presented in Chapter 2 (The Proposed Scheme) of the ES.

12.5.9 For the operational phase, the assessment considered the following scenarios and related years of assessment:

- Do Minimum scenario (i.e. without the Proposed Scheme) for 2025 and 2040; and
- Do Something scenario (i.e. with the Proposed Scheme) for 2025 and 2040.

Quantifying construction GHG emissions

12.5.10 For the construction phase of the Proposed Scheme, calculations have been undertaken by using the latest version of National Highways (NH) Carbon Tool (V2.4)[xiii], which is an industry recognised carbon calculation tool that quantifies carbon emissions for operational, construction and maintenance activities (throughout a project lifestyle) from highways schemes. The NH Carbon Tool is spreadsheet-based, and provides space to input material and non-material construction information under the following categories:

- Bulk materials;
- Earthworks;
- Fencing, barriers and road restraint systems;
- Drainage;
- Road pavements;
- Street furniture;
- Civil structures and retaining walls;
- Fuel, electricity and water use;
- Business and employee transport; and
- Waste.

12.5.11 The Carbon Tool uses a range of pre-programmed materials data (e.g. concrete, steel) and carbon factors to calculate an itemised and overall emissions total.

12.5.12 The design data required to input into the Carbon Tool was obtained from the design team. Waste types and quantities are consistent with those reported in Chapter 15 (Materials and Waste) of this ES.

12.5.13 At this stage, the fuel, electricity and water used in site offices, plant and equipment, are not known. As such, assumptions applying professional judgement based on similar road schemes have been made when completing calculations in NH Carbon Tool.

12.5.14 Further detail of data sources, collection methodology, assumptions and calculation input data are described in the sub-section Limitations and Assumptions below.

Quantifying operational GHG emissions

12.5.15 Operational GHG emissions are calculated considering road user carbon emissions that have been modelled using the Emissions Factors Toolkit (EFT) v11.0 published by the Department for Environment, Food and Rural Affairs (Defra) in 2021. The EFT makes assumptions about the makeup of future fleets based on DfT projections. This allows for predicted uptake of electric and hybrid vehicles as well as conventional vehicles (petrol and diesel).

12.5.16 Emissions have been calculated for the DM scenario (i.e. the Proposed Scheme is not implemented) and the DS scenario (i.e. the Proposed Scheme is implemented), for the opening year of the Proposed Scheme (2025) and the design year (2040).

12.5.17 As referred to in Section 12.4, operation and maintenance activities, and refurbishment were scoped out of this assessment.

Quantifying GHG emissions and removals of land use

12.5.18 GHG emissions and removals due to land use change have been estimated by identifying the relevant habitat type and using the different sources of methods of calculation. Chosen source methods are presented in the table below (Table 12.6) which also presents the confidence of their result.

Table 12.6: Source of method of calculation for GHG emissions and removals in relation to type of habitat

Habitat	Source	Confidence
Hedgerows	Natural England (2021) Carbon storage and sequestration by habitat: a review of the evidence (second edition)[xiv]	Low
Trees in isolation	Forest Research (2021) Selecting urban trees for ecosystem service provision[xv]	Medium/ High
Woodland/ group of trees	Woodland Carbon Code (2021)[xvi]	Medium/ High

Significance Criteria

12.5.19 IEMA guidance (2022) builds upon the previously established IEMA (2010) principles that GHG emissions produced by all projects will have a negative environmental impact, to acknowledge projects that actively replace baseline activity or existing development to reduce GHG emissions (section 6.1 IEMA guidance 2022). From this, IEMA (2022) states that significance of a project's emissions can either be positive, negative or negligible, when reference is applied to a project's impact over its lifetime.

12.5.20 In addition, the updated IEMA guidance (2022) states that in order to determine the significance of effects, judgement should be based on a project's whole life GHG emissions, and how these align with the UK's net zero compatible trajectory.

12.5.21 Based on above, Section VI of IEMA guidance (2022) contains a key difference from previous 2017 guidance, as it introduces five distinct levels of significance that are determined with reference to the following:

- **Major Adverse**: a project that follows 'business-as-usual' or 'do minimum' approaches or fails to mitigate GHG impacts or provide further reductions as required, will not meaningfully contribute to the UK's net zero trajectory or accepted aligned practice or area-based transition targets, so therefore can be assessed as having a major adverse effect that is **significant**.
- **Moderate Adverse:** a project that only partially mitigates GHG impacts and partially meets the applicable existing and emerging policy requirements, and does not fully contribute to decarbonisation in line with local and national policy goals for projects of this type, is assessed as having a **moderate adverse** effect that is **significant**;
- **Minor Adverse:** a project compatible with the budgeted, science-based 1.5°C trajectory (rate of emissions reduction) and complying with current policy and 'good practice' reduction measures to achieve that, has a minor adverse effect that is **not significant**. Residual emissions may still be produced, but efforts are made to align with and contribute towards the relevant transition scenario;
- **Negligible:** a project that achieves emissions mitigation that goes substantially beyond the reduction trajectory, or substantially beyond existing and emerging policy in line with that trajectory, and has minimal residual emissions, is assessed as having a **negligible** effect that is not significant; and
- **Beneficial**: a project that avoids or removes GHG emissions from the atmosphere, whether directly or indirectly, compared to the without project baseline, is assessed as having a beneficial effect that is **significant.** Only projects that are active in the reversal (not just the reduction) of the risk of severe climate change, can be judged as having a beneficial effect.

12.5.22 Major or moderate adverse effects and beneficial effects are considered to be significant, whilst minor adverse and negligible effects are not considered to be significant.

12.5.23 Where the production of GHG emissions is unavoidable, the objective of the EIA process should be to reduce the residual emissions produced by the project at all stages. Additionally, compensation approaches

should be considered where GHG emissions are unable to be reduced further and subsequently remain significant.

12.5.24 As mentioned above, the context of a project's GHG emissions determines whether it supports or undermines a trajectory towards net zero. As stated by IEMA, it is down to the practitioner's professional judgement to best contextualise a project's GHG impact. In this case, the magnitude of GHG emissions to be generated by the Proposed Scheme have been compared with the UK carbon budgets and in relation to their regional context (where relevant).

Limitations and Assumptions

12.5.25 The assessment has been based on data obtained and collected directly from the design team and is up to date at the time of writing. Where assumptions have been made, they have been selected to present the worst-case scenario for that particular item/factor.

12.5.26 Data collection of construction materials to input into the NH Carbon Tool has been provided by the design team and is based on the current design of the Proposed Scheme which is still under development. Type and quantities of material and waste are therefore indicative at this stage and will be refined as the design progresses. Where the design is not finalised, assumptions were made by engineering specialists based on professional judgement.

12.5.27 As a contractor has not yet been appointed, information regarding the sources of materials is not currently available. The engineering team undertook a review of potential sources of materials, and it was assumed that most of materials, including concrete, will be sourced locally, i.e. within 50km, transported to the site by Heavy Goods Vehicle (HGV). This would minimise transport emissions and would reduce transportation cost. For steel, a distance to the site of 300km was assumed. These transport distances are aligned with assumptions from RICS guidance 2017.

12.5.28 As the Principal Contractor will be appointed at a later date, information regarding use of fuel, energy and water in site offices, plant and construction vehicles is not known at this stage. As such, assumptions applying professional judgement based on other road schemes of similar nature and size have been made when completing the NH Carbon Tool.

12.5.29 The assessment of road end-user emissions applies modelled traffic data, which includes assumptions and limitations (for example, assumptions about fleet characteristics). Validation has been undertaken of the traffic model. Calculations use traffic data from the Proposed Scheme-specific traffic model and consider the road network included in the traffic model. Traffic data used in GHG emissions modelling for assessment of this chapter has considered future developments which are designated in the Local Plan and which are expected to be in place in future years (refer to Chapter 17 (Traffic and Transport) for further details).

12.5.30 Emissions of road end-users were calculated using DEFRA's 2021 EFT V11.0. This tool incorporates vehicle exhaust emission factors and fleet compositions and CO_2 emissions have been factored to take account of improved engine efficiency in future years in line with DfT predictions. For years 2031-2050, this tool version includes basic fleet composition data provided by DfT/HE for England (non-London) only. It also calculates non-exhaust CO2e emissions for electric vehicles. This function provides the CO2 equivalent emissions from charging of electric vehicles as a factor of the distance travelled.

12.6 Baseline Conditions

12.6.1 Baseline conditions have been established considering background emissions from all sources, i.e. all UK emissions, at all scales.

12.6.2 GHG emissions occur constantly and widely as a result of human and natural activity including energy consumption (fuel, power), industrial processes and land use change – both in the area of the Proposed Scheme but also more widely.

12.6.3 Table 12.7 shows GHG Emissions in National, Regional and Local context for the latest year for which such data is available (2019).

Table 12.7: GHG Emissions in National, Regional and Local context (2019)

Source: Department for Business, Energy and Industrial Strategy (2021) UK local authority and regional carbon dioxide emissions national statistics: 2005-2019[xvii]

Source	York	Yorkshire and the Humber	England
Industry Electricity	17.2	1,355.5	10,988.3
Industry Gas	33.1	2,060.7	10,648.5
Industry 'Other Fuels'	19.8	1,308.3	12,591.0
Large Industrial Installations	0.1	6,887.5	20,221.6
Agriculture	6.3	375.0	3,736.3
Industry Total	**76.5**	**11,987.0**	**58,185.8**
Commercial Total (electricity, gas, 'other fuels')	**104.5**	**2,481.6**	**26,523.2**
Public Sector Total (electricity, gas, 'other fuels')	**41.3**	**1,094.8**	**10,271.0**
Domestic Electricity	63.5	1,696.5	18,450.9
Domestic Gas	208.5	5,707.9	52,760.8
Domestic 'Other Fuels'	12.2	719.3	6,415.9
Domestic Total	**284.1**	**8,123.7**	**77,627.5**
Road Transport (A roads)	165.8	3,523.1	40,273.5
Road Transport (Motorways)	0.0	3,268.7	24,380.5
Road Transport (Minor roads)	132.6	4,092.4	35,888.4
Diesel Railways	7.1	180.7	1,505.6
Transport Other	4.3	154.9	2,139.0
Transport Total	**309.8**	**11,219.7**	**104,187.0**
LULUCF Net Emissions	**-8.6**	**30.8**	**-704.8**
Grand Total	**807.6**	**34,937.7**	**276,089.6**
Population ('000s, mid-year estimate)	210.6	5,503.0	56,287.0
Per Capita Emissions (t)	3.8	6.3	4.9
Area (km^2)	272.0	15,560.5	132,929.1
Emissions per km^2 (kt)	3.0	2.2	2.1

12.6.4 The UK has in place carbon budgets for five-year periods from 2023 to 2037. Both the construction and Opening Year of the Proposed Scheme fall within the fourth budget period (2023 - 2027). The carbon budget for the 2023-2027 budgetary period is 1,950 $MtCO_2e$, and the budget for 2033-2037 is 965 $MtCO_2e$. Budgets are not set beyond 2037 (sixth carbon budget) but, as described earlier in this Chapter, there is a legal requirement for the UK to reduce net emissions by at least 100% by 2050.

12.7 Future Baseline

12.7.1 The future baseline scenario has been set assuming the Proposed Scheme is not constructed, i.e. the DM scenario. However, emissions arising from operation and maintenance of the existing A1237 from end-users (i.e. traffic emissions) will be still occurring. This scenario also assumes the traffic modelling with Local Plan development expected to be in place in future years (refer to Chapter 17 (Traffic and Transport)).

12.7.2 The operation and maintenance of the existing A1237 asset will require a small number or volume of specialist components (for example signage) as well as some bulk material (bitumen, concrete, gravel) for minor maintenance and refurbishment works and repairs of the highway and ancillary infrastructure. This use of materials in the baseline scenario would have embodied emissions associated with them. However, due to the small quantities of materials required, emissions are considered to be negligible and, as such, have been excluded from further assessment.

12.7.3 In terms of end-user emissions from road traffic, the existing A1237 route experiences significant congestion, with more GHG emissions than if the traffic is flowing freely. The short distance between the existing roundabout junctions and configuration of those junctions results in queues which can block adjacent junctions, causing significant additional delay to radial routes. In order to avoid this congestion, many drivers choose to divert through the city centre and outlying villages, adding to the already considerable congestion throughout the historic city centre. This situation is expected to worsen in the coming years with the emergence of new developments projected along and in close proximity to the existing A1237.

12.7.4 Predicted total road end-users GHG emissions occurring for the Opening Year (2025) and the Future Year (2040), in the DM scenario (i.e. assuming the Proposed Scheme is not constructed), is presented in Table 12.8.

Table 12.8: Proposed Scheme Do Minimum GHG emissions (Baseline Scenario).

Life cycle module	2025 Emissions (tCO2e)	2040 Emissions (tCO2e)
Operation – Road End User Emissions	273,169	202,198

12.8 Sensitive Receptors

12.8.1 The local, regional, national and global climate is considered the sensitive receptor of the Proposed Scheme GHG emissions.

12.9 Establishing the Scenario for Assessment

Construction Phase

12.9.1 Chapter 2 (The Proposed Scheme) provides a full description of the proposed construction activities. With respect to the assessment of effects of the Proposed Scheme (GHG Emissions) on climate, key features include:

- The associated construction compounds;
- The carriageway widening, including the five associated junction improvements;
- The new combined pedestrian and cycleway;
- Structures:
  - The existing and new River Foss Bridge;
  - The new railway bridge over the York - Scarborough railway line;
  - The new combined pedestrian and cycleway which will run along the A1237;
  - The new underpass at Clifton Moor Roundabout;
  - The four underpasses at the Haxby Road Junction (two to be upgraded and extended and two new);
  - The new underpass at the Strensall Road Junction;
- Proposed drainage and attenuation;
- Proposed landscape planting; and
- Ancillary equipment, including signage, signals, and street furniture.

Embedded Mitigation

12.9.2 Chapter 2 (The Proposed Scheme) provides details of environmental mitigation measures that have been incorporated within the development proposals in order to avoid, reduce or compensate for potential adverse effects during the construction phase. The assessment has considered the Proposed Scheme with the embedded mitigation in place.

12.9.3 Emissions have been mitigated through the design development of the Proposed Scheme by applying PAS 2080:2016[xi] carbon emissions reduction hierarchy:

- 'Build Nothing' (evaluating the need for an asset or works);
- 'Build Less' (maximising potential for re-using and / or refurbishing);
- 'Build Clever' (e.g. using of low carbon materials and efficient technologies); and
- 'Build Efficiently' (e.g. using techniques that reduce resource consumption).

12.9.4 The IEMA GHG hierarchy[xviii] provides a similar structure set out as eliminate, reduce, substitute and compensate.

12.9.5 These reduction principles will be applied in all design stages (current and subsequent), as follows:

- Existing structures, such as culverts and bridges (existing River Foss Bridge and existing railway overbridge), drainage, and others as detailed in Chapter 2 (The Proposed Scheme), will be retained, where possible;
- The construction method for the River Foss bridge, new railway bridge and underpasses will comprise prefabricated elements (precast concrete beams, and precast piles) which would reduce waste production on site; and
- Use of precast elements such as concrete beams, culverts and manholes/ chambers, where practicable, that would avoid construction on site and therefore, reduce waste production on site.
- Design has taken particular care in incorporating material resource efficiency and waste minimisation best practice into design, in particular improving the cut and fill balance (as detailed in Chapter 15 (Materials and Waste) of this ES);

- Materials resource efficiency will be carried out in accordance with the mitigation measures outlined Chapter 15 (Materials and Waste). In addition, consideration will be given to alternative low carbon materials e.g. recycled aggregates, cement substitution, low carbon concrete etc.;
- Re-use of site arisings (earthworks, road planings, concrete (through crushing and use on haul roads)) and vegetation (through mulching and use as temporary footways) as outlined in Chapter 15 (Materials and Waste);
- Construction plant emissions will be minimised by designing for efficient construction processes as part of design development; and
- Trees and hedgerows will be retained, as far as possible, in order to protect biodiversity and retain natural carbon sinks. Additionally, new planting areas included as part of the landscape design will be included to achieve biodiversity net gain and to offset some of the carbon emissions associated with land use change and subsequent loss of carbon sink (further details about the landscape design in Chapter 10 (Landscape and Visual)).

Operational Phase

12.9.6 Chapter 2 (The Proposed Scheme) provides a full description of the proposed operational activities. With respect to the assessment of effects of the Proposed Scheme (GHG Emissions) on climate, key features include:

- The lighting of the Proposed Scheme;
- The traffic signage and safety equipment that require energy for operation; and
- In addition to the above features of the Proposed Scheme, the road end users will be the main source of GHG emissions during the operational phase.

Embedded Mitigation

12.9.7 Chapter 19 (Environmental Management) provides details of environmental mitigation measures that have been incorporated within the development proposals in order to avoid, reduce or compensate for potential adverse effects during the operational phase. The assessment has considered the Proposed Scheme with the following embedded mitigation in place:

- The Proposed Scheme and new configuration of roundabouts junctions – which results in improvement of traffic flow reducing congestion and related GHG emissions;
- Additional pedestrian and cycleways – that create safe and attractive routes, encouraging active and sustainable travel; and
- Use of low energy lighting (efficient LED units) and traffic management systems, specification of controls that minimise on-time, and use of low carbon energy sources, where practicable.

12.10 Construction Phase: Significant Effects, Mitigation and Residual Effects

Construction Effects of the Proposed Scheme on Climate (GHG Emissions)

12.10.1 The construction stage of the Proposed Scheme would have an overall adverse effect on climate, as it would give rise to GHG emissions. These emissions would arise at various project lifecycle stages as detailed in Table 12.4.

12.10.2 The impacts of GHGs relating to their contribution to global warming and climate change are global and cumulative in nature, with every tonne of GHG contributing to climate change impacts upon natural and human systems.

Impact Assessment

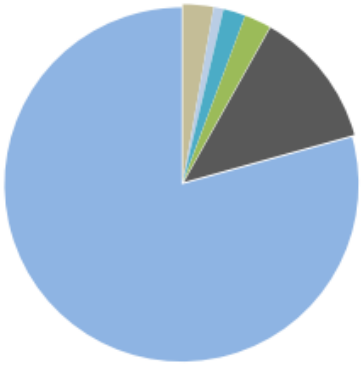
12.10.3 During construction, the main source of emissions is anticipated to be the embedded carbon in construction materials including those associated with the dualling of the A1237, the upgrade of the five roundabout junctions (i.e. asphalt and aggregate); new pedestrian and cycleway; and the new structures such

as the new bridge over the River Foss, new bridge over the Scarborough Railway Line and the extended or renewed subways and culverts (i.e. structural and reinforced steel and concrete). Another important source of GHG emissions during construction is the transport of materials to/from site and the use of construction plant (i.e. use of electricity, diesel and water). There is also a temporary loss of carbon stocks due to vegetation removal (land use change).

12.10.4 Construction phase GHG emissions obtained from the NH Carbon Tool are presented in Figure 12.1. The figure is a direct output from the tool and shows a breakdown of the GHG emissions arising from the use of materials (supply and manufacturing), energy use (including electricity, diesel and water), waste generation and disposal and transportation of materials to and from site. The figure also shows 'carbon hotspots' of materials, as the main source of emissions.

Materials

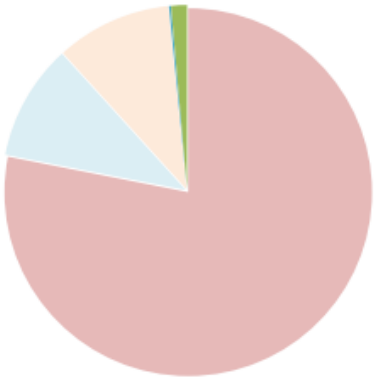
The table and pie chart displayed below show the total CO_2e emissions associated with materials purchased for the contract.



Category	CO_2e Emissions
Fencing / RRS / barriers	1,066.313
Drainage	344.424
Earthworks	0.000
Pavements	768.059
Street furniture	931.204
Civil Structures	4,819.277
Bulk Materials	30,378.624
Total	**38,307.900**

Materials, Transport, Energy and Waste Emissions

This table and pie chart show the total CO_2e emissions associated with materials compared to materials transport, energy use, business and employee transport and waste



Category	CO_2e Emissions
Materials Total	38,307.900
Materials Transport	4,997.897
Energy Use	4,984.020
Business and Employee transport	89.170
Waste	682.586
Total	**49,061.572**

Figure 12.1: Total and breakdown of Construction phase GHG Emissions (tonnes CO_2e) taken from NH Carbon Tool.

12.10.5 As shown in Figure 12.1, GHG emissions from construction of the Proposed Scheme is approximately 49,061 tCO_2e, as estimated using the NH Carbon Tool. The majority of these emissions are associated with materials (product stage 'cradle to gate') with 78.1% of emissions. Materials transport and energy use from plant and construction vehicles (diesel, electricity, and water consumption) are the next largest sources of GHG emissions, both being responsible for 10.2 % of emissions. Waste generation is responsible for 1.4% of emissions.

12.10.6 Regarding emissions from materials' consumption, the majority relate to the bulk materials (79.3%), comprising asphalt, aggregate and ready-mixed concrete. Another significant contribution relates to structures (12.6%), which includes the two new bridges. Fencing and barriers are responsible for 2.8% of emissions; street furniture 2.4%; pavements 2.0% (for materials not included in bulk materials) and drainage only for 0.9%.

12.10.7 In addition, , it has been estimated that GHG emissions related to vegetation removal (land use change) are 2,511 tCO_2e. This source is not accounted for by the NH Carbon Tool.

12.10.8 Hence, in total, the GHG emissions from the construction of the Proposed Scheme are estimated to be 51,573 tCO_2e.

Assessment of Effect Significance

12.10.9 As set out in the assessment methodology (Section 12.5), the assessment of effects and their significance on climate due to GHG emissions arising from construction of the Proposed Scheme has been undertaken considering the comparison of the Proposed Scheme emissions against UK Carbon Budgets (details in Table 12.2) and project alignment with trajectory towards net zero by 2050.

12.10.10 Construction of the Proposed Scheme is a short-term activity expected from 2023 to 2025. Emissions from construction therefore fall within the fourth carbon budget (2023-2027). Table 12.9 presents the net GHG emissions associated with the construction phase of the Proposed Scheme and comparison to the relevant carbon budget.

Table 12.9: Proposed Scheme GHG emissions from construction phase against relevant carbon budgets.

Life cycle module	Estimated total carbon over carbon budget (tCO2e) (DS)	Net GHG emissions over relevant carbon budgets (tCO2e) (DS - DM)	4th Carbon Budget (2023–2027) (tCO2e)	Net Scheme GHG emissions proportion of the Carbon Budget (%)
Construction	51,573	+51,573	1,950,000,000	0.0026%

12.10.11 Table 12.9 shows that the construction of the Proposed Scheme will contribute a total of 51,573tCO_2e to the UK's fourth carbon budget (2023 – 2027). This represents only 0.0026% of the budget and therefore, within the national context is considered to have negligible magnitude.

12.10.12 Table 12.10 below summarises the construction phase GHG Emissions assessment of effect significance on climate considering embedded mitigation in place.

Table 12.10: Construction Phase Proposed Scheme GHG Emissions Assessment of Effect Significance

Criteria	Assessment
Receptor: Global climate	
Receptor Sensitivity	Very high.
Impact Magnitude	The GHG emissions arising from the construction of the Proposed Scheme could have an adverse impact on global climate. For national contextual purposes and as detailed above, the magnitude of change in GHG emissions is considered to be negligible when comparing with UK Carbon Budget in related budgeting period.
Effect Significance	There is likely to be a direct permanent, medium to long-term adverse effect due to GHG emissions arising from the construction of the Proposed Scheme in line with IEMA guidance. Even with the "good practice" design standards as embedded mitigation described in Section 19.2 of Chapter 19 (Environmental Management), it is recognised that without additional mitigation measures in place, effects may be considered significant. Further mitigation should be progressed during the construction phase to ensure that effects of project's GHG emissions are reduced to a minor adverse effect. Without this additional mitigation and in line with criteria set in section 12.5 of this chapter, it can be considered that Proposed Scheme only partially mitigates GHG emissions and therefore, it may have a moderate adverse effect that is **'significant'**.

12.10.13 Following IEMA EIA Guidance, all GHG emissions from all projects will contribute to climate change and will have an interrelated cumulative environmental effect on climate. From the assessment presented in Table 12.10 the adverse effect on climate due to the construction of the Proposed Scheme may be considered '**significant**' and additional mitigation measures should be put in place to reduce that effect.

Additional Mitigation Requirements

12.10.14 Mitigation measures to reduce effects on climate form an inherent part of the project's design. Therefore, the design that will be progressed after the submission of this ES should develop in accordance with principles and measures outlined in Section 12.9, Construction Phase Embedded Mitigation. These measures have been incorporated in the Outline CEMP and Register of Environmental Actions and Commitments (REAC), presented in Appendix 19.1 and Appendix 19.2 (ES Volume III). The Outline CEMP should be developed by the Principal Contractor into a detailed CEMP to be secured by planning condition in accordance with standard practice.

12.10.15 Additional mitigation should be also implemented within construction practices because GHG emissions are considered to have a significant adverse effect on climate, as discussed above. This includes the following measures, which are also within the Outline CEMP and REAC to be developed in more detail and implemented by the Principal Contractor:

- A Site Waste Management Plan (SWMP) and Materials Management Plan (MMP) will be developed by the Principal Contractor (as outlined in Chapter 15 (Materials and Waste) of this ES) to ensure waste minimisation and re-use of materials on site;
- Transportation of materials and waste would be minimised through local sourcing of material and use of local waste facilities, where possible. Procurement measures will be specified to source locally materials in the first instance and then consider longer distances (regional or nationally) depending on the availability of construction materials;
- The Principal Contractor will select and engage with material suppliers taking into consideration their policies and commitments to reduction of GHG emissions; and
- The Principal Contractor should develop a Carbon Management Plan prior to construction. This should be set in accordance with PAS 2080 principles and should also include a plan to reduce energy consumption and associated carbon emissions, which may include consideration of renewable and / or low or zero carbon energy sources, where practicable. The management plan should include some form of monitoring requirements to ensure that is being adhered to and to promote carbon reductions as far as possible.

Residual effects and monitoring

12.10.16 The likely residual effects following the implementation of additional mitigation have been assessed and the findings are presented in Table 12.11.

12.10.17 Although there may still be residual GHG emissions from the construction of the Proposed Scheme, with the implementation of embedded and additional mitigation it is recognised that efforts are made to align with and contribute towards the relevant transition scenario, keeping the UK on track towards net zero by 2050, and as such the Proposed Scheme is considered to have a minor adverse effect, which is not significant.

Table 12.11: Construction Phase GHG Emissions Assessment of Residual Effects

Criteria	Assessment
Receptor: Global climate	
Receptor Sensitivity	Very high.
Impact Magnitude	The GHG emissions arising from the construction of the Proposed Scheme could have an adverse impact. The magnitude of change in GHG emissions is considered to be negligible when comparing with UK Carbon Budgets.
Effect Significance	There is likely to be a direct permanent, medium to long-term minor adverse effect on global climate, which likely to be **'not significant'** with the implementation of additional (and embedded) mitigation measures.

Monitoring Requirements

12.10.18 During the construction phase, the Principal Contractor should collect data relative to use of materials, fuel/electricity consumption, and waste arising from the construction, which would enable the calculation and

monitoring of GHG emissions from construction activities (refer to Chapter 19 (Environmental Management) and the Outline CEMP presented in Appendix 19.1 (ES Volume III)). This can be registered and calculated using an appropriate carbon tool. The actual GHG emissions (output data) can then be compared to the GHG emissions estimates at the ES stage (i.e. this chapter). It is suggested that data collected, and related GHG emissions should be reported by the Principal Contractor to the Applicant on a regular basis, the timing of this to be agreed. The register of carbon emissions should be identified in the Carbon Management Plan.

12.11 Operational Phase: Significant Effects, Mitigation and Residual Effects

Operational phase Effects of the Proposed Scheme on Climate (GHG Emissions or Removals)

12.11.1 The operational stage of the Proposed Scheme would give rise to emissions from road end users and operational energy use (for example streetlights). The operation of the Proposed Scheme would cause emissions from road end users, resulting in an adverse effect on climate.

Impact Assessment

12.11.2 During operation, the main source of GHG emissions with potential effects on climate would be from end-users or road users (traffic emissions).

12.11.3 The operational GHG emissions for the 2025 (Opening Year of the Proposed Scheme) and 2040 (future modelled year) in DM and DS scenarios are compared below in Table 12.12.

12.11.4 In addition, results from Table 12.12 can give a net average per year of GHG emissions for operation of the Proposed Scheme.

Table 12.12: GHG Emissions due to Road User Carbon in a DM and DS scenario.

Life cycle module	Emissions (tCO_2e)						
	2025 DM	2025 DS	Change (Net Emissions)	2040 DM	2040 DS	Change (Net Emissions)	Net Average Year (DS-DM)
Operation – Road End User Emissions	273,169	273,022	-147	202,198	201,262	-935	-541

12.11.5 In both the Opening Year (2025) and Future Year (2040), the Proposed Scheme will lead to a decrease in operational GHG emissions of 147 tCO_2e and 935 tCO_2e respectively. This is due to the improvement of traffic flows with the Proposed Scheme in place, especially in road links into the City of York.

12.11.6 The magnitude of this change (i.e. with the Proposed Scheme implemented) is considered to be minor; however, all reduction of GHG emissions in terms of global impacts on climate and achievement of the UK Net Zero Target is considered to be very important.

12.11.7 It is also noted that in 2020 the UK Government realised the Ten Point Plan for a Green Industrial Revolution[xix] confirming that the UK will end the sale of new petrol and diesel cars and vans by 2030, and the sale of hybrid cars and vans by 2035 and as such, the extent of the uptake of electric vehicles could be higher than projections in the modelling scenarios of future road traffic emissions as a result of updated policies and improved vehicle technology arising. Therefore, the estimation of road user GHG emissions in the Future Year (2040) in a DM and DS Scenario could be lower than the results presented in Table 12.12.

12.11.8 Table 12.13 shows the net GHG sequestration in 30 years on, when the new planting and especially trees/woodland is considered to be established and sufficiently mature. The table shows a comparison with a DM scenario that corresponds to the baseline.

Table 12.13: Net GHG Sequestration once Proposed Scheme Landscape is established.

Life cycle module	Sequestration (tCO_2e)		
	DM scenario (baseline)	DS scenario (30 years on)	Net Carbon Sequestration after 30 years
Land Use	2,608	3,403	795

12.11.9 It is noted that there is net benefit of carbon sequestration with the Proposed Scheme, that can offset the vegetation loss due to the construction of the Proposed Scheme. However, this result should be viewed with caution as the success of establishment of new planting depends on several factors, including its resilience to climate change (refer to Chapter 13 (Climate Vulnerability), ES Volume I).

Assessment of Effect Significance

12.11.10 As set out in the assessment methodology (Section 12.5), the assessment of effects and their significance on climate due to GHG emissions arising from operation of the Proposed Scheme has been undertaken considering the comparison of the Proposed Scheme emissions against the UK Carbon Budget (Table 12.2); and the magnitude of change in comparison between the DM scenario and DS scenario (discussed above).

12.11.11 Table 12.14 presents the net GHG emissions associated with the operational phase of the Proposed Scheme and comparison to the relevant carbon budgets.

Table 12.14: Proposed Scheme GHG emissions from operational phase against relevant carbon budgets.

Life cycle module	Estimated total carbon over carbon budget (tCO_2e) (DS)	Net GHG emissions over relevant carbon budgets (tCO2e) (DS - DM)	Relevant Carbon Budget	Net Scheme GHG emissions proportion of the Carbon Budget (%)
Operation Road User 2025-2027	747,306	-1,230	1,950,000,000	-0.0001
Operation Road User 2028-2032	1,185,710	-2,707	1,725,000,000	-0.0002
Operation Road User 2033-2037	1,006,311	-4,677	965,000,000	-0.0005

12.11.12 Table 12.14 shows that the first three years of operation of the Proposed Scheme (opening year in 2025) will contribute approximately 747,306tCO2e, which represents a reduction of -1,230tCO2e when compared to the baseline and DM scenarios, i.e. the A1237 remains without the proposed improvements. This reduction represents a negative 0.0001% of the Fourth Carbon Budget (2025-2027). In the following budgeting period, the reduction will be 0.0002% of the Fifth UK Carbon Budget (2028-2032) and for the Sixth Carbon Budget period (2033-2037) the reduction of emissions with the Proposed Scheme is estimated to represent 0.0005% of the carbon budget. Beyond 2037, no carbon budgets have been set yet, and therefore it does not cover the future year of assessment, which is 2040. However, it is expected that emissions contributions of the Proposed Scheme in that time will follow the same trend of previous periods, having a negligible material impact on the carbon budgets.

12.11.13 Whilst there is a minor net benefit due to carbon sequestration of Proposed Scheme landscape, this has not been included in Table 12.14 because it is considered that carbon sequestration will be only claimable after the period of the sixth carbon budget (2033-2037), when the new planting is established (30 years on - 2045).

12.11.14 Table 12.15 summarises the operational phase GHG Emissions assessment of effect significance on climate.

Table 12.15: Proposed Scheme Operational Phase GHG Emissions Assessment of Effect Significance

Criteria	Assessment
Receptor: Global climate	
Receptor Sensitivity	Very High.
Impact Magnitude	The GHG emissions arising from road end users will be reduced in a DS scenario when comparing with the DM scenario (without the Proposed Scheme implemented). In addition, the Proposed Scheme landscape will also contribute to sequestrate a portion of GHG after new vegetation is established (30 years on). Overall, the magnitude of reduction of GHG emissions due to the Proposed Scheme is considered to be negligible when compared with UK carbon budgets, but there is a net benefit in the local context.
Effect Significance	There is likely to be a direct permanent, medium to long-term beneficial effect due to reduction of GHG emissions from road end users, which in line with IEMA guidance should be considered **'significant'** because the Proposed Scheme will avoid GHG emissions to the atmosphere when comparing to a DM scenario (without the Proposed Scheme).

12.11.15 In summary, there is a **beneficial effect** from the operational phase of the Proposed Scheme in supporting UK government targets for Net Zero emissions by 2050 and its contribution to tackle climate change that is '**significant**'.

Additional Mitigation Requirements

12.11.16 No additional mitigation measures have been put forward for the operational stage of the Proposed Scheme. The mitigation measures described in Section 12.9 are sufficient in reducing potential GHG emissions as far as reasonably possible.

Residual effects and monitoring

12.11.17 No residual effects from the operation phase of the Proposed Scheme are expected over the effects reported above.

Monitoring Requirements

12.11.18 There are no monitoring requirements related to GHG emissions for the operation phase of the Proposed Scheme.

12.12 Summary of Findings

12.12.1 The following table (Table 12.16) provides a summary of the findings of the assessment.

Table 12.16: Summary of Effects Table

Key to table: + / - = Beneficial or Adverse P / T = Permanent or Temporary, D / I = Direct or Indirect, ST / MT / LT = Short Term, Medium Term or Long Term, N/A = Not Applicable

Description of Effects	Receptor	Significance and Nature of Effects Prior to Mitigation	Summary of Additional Mitigation	Significance and Nature of Residual Effects
Construction Phase				
Proposed Scheme construction GHG emissions that can impact on global climate	Global climate	- / P/ D/ MT, LT Moderate adverse, Significant	Design that will be progressed after the submission of this ES to be develop in accordance with principles and measures outlined in Section 12.9, Construction Phase Embedded Mitigation. Additionally, following measures should be part of the CEMP and to be developed in more detail and implemented by the Principal Contractor: ➢ A SWMP and MMP to be produced prior construction; ➢ Transportation of materials and waste would be minimised through local sourcing of material and use of local waste facilities, where possible; ➢ The Principal Contractor will select and engage with material suppliers taking into consideration their policies and commitments to reduction of GHG emissions; ➢ The Principal Contractor should develop a Carbon Management Plan prior to construction.	- / P/ D/MT, LT Minor adverse, Not Significant
Operation Effects				
Proposed Scheme Road Users GHG emissions that can have an adverse effect on global climate	Global climate	Beneficial, Significant + / P / D / MT, LT	N/A	Beneficial, Significant + / P / D / MT, LT
Decommissioning Effects – Not applicable				

12.13 References

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[ix] Huntington Parish Council Neighbourhood Plan 2017 – 2032/33 (adopted in 2021). Available on https://www.york.gov.uk/downloads/file/6504/huntington-neighbourhood-plan-adopted-version.pdf

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