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Climate

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12.0 Climate

12.1 Introduction

This chapter assesses the potential climate impact of the proposed development of an anaerobic digestion facility to produce renewable biomethane and bio-based fertilizer at the former Lisheen Mine Site, Killoran, Moyne, Thurles, Co. Tipperary. The assessment of impacts has been undertaken in the context of current relevant standards and guidance, and identifies any requirements or possibilities for mitigation. A full description of the development can be found in **Chapter 6 Description of Proposed Development**.

Mitigation measures are included, where relevant, to ensure the proposed development is constructed in an environmentally sustainable manner in order to ensure minimal impact on the receiving environment.

In relation to climate, impacts will occur during both the construction and operational phases of the development.

During the construction phase engine emissions from site vehicles and machinery have the potential to impact climate through the release of carbon dioxide [CO_2] and to a lesser extent, other greenhouse gases [GHGs]. Embodied carbon of materials used in the construction of the development along with site activities will impact climate. Impacts to climate are assessed against Ireland's obligations under the EU 2030 GHG targets and sectoral emissions ceilings.

During the operational phase vehicle emissions from traffic changes associated with the proposed development have the potential to release CO_2 and other GHGs which will impact climate. In addition, the vulnerability of the proposed development in relation to future climate change must be considered during the operational phase.

The climate assessment is divided into two distinct sections – a greenhouse gas assessment (GHGA) and a climate change risk assessment (CCRA):

- Greenhouse Gas Emissions Assessment [GHGA] – Quantifies the GHG emissions from a project over its lifetime. The assessment compares these emissions to relevant carbon budgets, targets and policy to contextualise magnitude; and
- Climate Change Risk Assessment [CCRA] – Identifies the impact of a changing climate on a project and receiving environment. The assessment considers a project's vulnerability to climate change and identifies adaptation measures to increase project resilience.

This chapter was also prepared by Dr. Jovanna Arndt, a Senior Environmental Consultant in the Air Quality & Climate section of AWN Consulting. She holds a BSc. in Environmental Science and a Ph.D. in Atmospheric Chemistry from University College Cork. She is an Associate Member of both the Institute of Air Quality Management and the Institute of Environmental Sciences. She has been specialising in the area of air quality and climate over 7 years and has prepared air quality and climate assessments for inclusion within EIARs for residential developments such as Twenties Lane (Planning Application Ref: 22713), Cherrywood T13 (Planning Application Ref: DZ23A/0028), Corballis Donabate LRD (Planning Application Ref: LRD0017/S3), commercial and industrial developments by Dublin Airport Authority, Zoetis, Ipsen, Merck Millipore, Greener Ideas Limited and Abbvie, as well as renewable energy developments such as Codling Wind Park and the Cúil Na Móna Anaerobic Digestion Facility. She also specialises in assessing air quality impacts using air dispersion modelling of transportation schemes such as BusConnects Dublin, major Highways England Road schemes and major rail infrastructure in the form of High Speed 2 (HS2 in the UK). She has prepared air dispersion modelling assessments of emissions from data centres, energy centres and the chemical industry as part of Environmental Protection Agency [EPA] Industrial Emissions Licences for Microsoft, Greener Ideas Limited, Merck Millipore, Lilly Limerick, Chemifloc, Takeda, Kingspan and Kilshane Energy. She has also provided Air Quality Action Plan [AQAP] and Air Quality Management Area [AQMA] support to several UK councils and assessed the air quality impacts of potential Clean Air Zones in the UK.

12.2 Legislation, Policy and Guidance

The assessment of potential impacts on climate has been prepared taking the relevant legislation, policy and guidance described in the following sections into consideration.

12.2.1 Legislation

In 2015, the Climate Action and Low Carbon Development Act 2015 (No. 46 of 2015) (Government of Ireland, 2015) was enacted (the 2015 Climate Act). The purpose of the Act was to enable Ireland “to pursue, and achieve, the transition to a low carbon, climate resilient and environmentally sustainable economy by the end of the year 2050” (3.(1) of No. 46 of 2015). This is referred to in the 2015 Climate Act as the “National Transition Objective”. The 2015 Climate Act made provision for a national low carbon transition and mitigation plan (now known as a Climate Action Plan), and a national adaptation framework. In addition, the 2015 Climate Act provided for the establishment of the Climate Change Advisory Council with the function to advise and make recommendations on the preparation of the national mitigation and adaptation plans and compliance with existing climate obligations.

The first Climate Action Plan (CAP) was published by the Irish Government in June 2019 (Government of Ireland, 2019). The Climate Action Plan 2019 (CAP19) outlined the current status across key sectors including Electricity, Transport, Built Environment, Industry and Agriculture and outlined the various broadscale measures required for each sector to achieve ambitious decarbonisation targets. The 2019 CAP also detailed the required governance arrangements for implementation including carbon-proofing of policies, establishment of carbon budgets, a strengthened Climate Change Advisory Council and greater accountability to the Oireachtas. The current Climate Action Plan is CAP24, published in December 2022 (DECC, 2023a).

Following on from Ireland declaring a climate and biodiversity emergency in May 2019, and the European Parliament approving a resolution declaring a climate and environment emergency in Europe in November 2019, the Government published the Climate Action and Low Carbon Development (Amendment) Act 2021 (hereafter referred to as the 2021 Climate Act) in March 2021 (Government of Ireland, 2021). The Climate Act was signed into

Law on the 23rd of July 2021, giving statutory effect to the core objectives stated within the first Climate Action Plan.

The purpose of the 2021 Climate Act (Government of Ireland, 2021) is to provide for the approval of plans "*for the purpose of pursuing the transition to a climate resilient, biodiversity rich and climate neutral economy by no later than the end of the year 2050*". The 2021 Climate Act will also "*provide for carbon budgets and a decarbonisation target range for certain sectors of the economy*". The 2021 Climate Act defines the carbon budget as "*the total amount of greenhouse gas emissions that are permitted during the budget period*".

In relation to carbon budgets, the 2021 Climate Action and Low Carbon Development (Amendment) Act states "*A carbon budget, consistent with furthering the achievement of the national climate objective, shall be proposed by the Climate Change Advisory Council, finalised by the Minister and approved by the Government for the period of 5 years commencing on the 1 January 2021 and ending on 31 December 2025 and for each subsequent period of 5 years (in this Act referred to as a 'budget period')*". The carbon budget is to be produced for 3 sequential budget periods, as shown in **Table 12.1**. The carbon budget can be revised where new obligations are imposed under the law of the European Union or international agreements or where there are significant developments in scientific knowledge in relation to climate change.

In relation to the sectoral emissions ceiling, the Minister for the Environment, Climate and Communications (the Minister for the Environment) shall prepare and submit to government the maximum amount of GHG emissions that are permitted in different sectors of the economy during a budget period and different ceilings may apply to different sectors. The sectorial emission ceilings for 2030 were published in the Climate Action Plan 2024 [CAP24] (DECC, 2023a) and are shown in **Table 12.2**.

Budget Period	Carbon Budget	Reduction Required
2021-2025	295 Mt CO_2e [Note 1]	Reduction in emissions of 4.8% per annum for the first budget period.
2026-2030	200 Mt CO_2e	Reduction in emissions of 8.3% per annum for the second budget period.
2031-2035	151 Mt CO_2e	Reduction in emissions of 3.5% per annum for the third provisional budget.

Table 12.1: 5-Year Carbon Budgets 2021-2025, 2026-2030 and 2031-2025. (Source: DECC, 2023a) .

[Note 1] Million tonnes of carbon dioxide equivalent [Mt CO_2e].

Sector	Baseline (Mt CO_2e)	Carbon Budgets (Mt CO_2e)		2030 Emissions (Mt CO_2e)	Indicative Emissions % Reduction in Final Year of 2025- 2030 Period (Compared to 2018)
	2018	2021-2025	2026-2030		
Electricity	10	40	20	3	75
Transport	12	54	37	6	50
Built Environment - Residential	7	29	23	4	40
Built Environment - Commercial	2	7	5	1	45

Sector	Baseline (Mt CO_2e)	Carbon Budgets (Mt CO_2e)		2030 Emissions (Mt CO_2e)	Indicative Emissions % Reduction in Final Year of 2025- 2030 Period (Compared to 2018)
	2018	2021-2025	2026-2030		
Industry	7	30	24	4	35
Agriculture	23	106	96	17.25	25
Other (F-gases, waste, petroleum refining)	2	9	8	1	50
Land Use, Land-use Change and Forestry (LULUCF)	5	Reflecting the continued volatility for LULUCF baseline emissions to 2030 and beyond, CAP24 puts in place ambitious activity targets for the sector reflecting an EU-type approach.			
Total	68				
Unallocated Savings	-	-	26	-5.25	-
Legally Binding Carbon Budgets and 2030 Emission Reduction Targets	-	295	200	-	51

Table 12.2: Sectoral Emission Ceilings 2030. (Source: DECC, 2023a).

12.2.2 Policy

In December 2023, CAP24 was published (DECC, 2023a). This CAP builds on the progress of CAP23, which first published carbon budgets and sectoral emissions ceilings, and it aims to implement the required changes to achieve a 51% reduction in carbon emissions by 2030 and 2050 net zero goal. The CAP has six vital high impact sectors where the biggest savings can be made: renewable energy, energy efficiency of buildings, transport, sustainable farming, sustainable business and change of land-use. CAP24 states that the decarbonisation of Ireland's manufacturing industry is key for Ireland's economy and future competitiveness. There is a target to reduce the embodied carbon in construction materials by 10% for materials produced and used in Ireland by 2025 and by at least 30% for materials produced and used in Ireland by 2030. CAP24 states that these reductions can be brought about by product substitution for construction materials and reduction of clinker content in cement. Cement and other high embodied carbon construction elements can be reduced by the adoption of the methods set out in the Construction Industry Federation 2021 report Modern Methods of Construction. In order to ensure economic growth can continue alongside a reduction in emissions, the IDA Ireland will also seek to attract businesses to invest in decarbonisation technologies.

In April 2023 the Government published its *Long-Term Strategy on Greenhouse Gas Emissions Reductions* (DECC, 2023b). This strategy provides a long-term plan on how Ireland will transition towards net carbon zero by 2050, achieving the interim targets set out in the Climate Action Plan.

The Tipperary County Council Climate Action Plan 2024 - 2029 (Tipperary County Council 2024) sets out 100 Council climate actions including the Council's commitment to achieving its own emissions reductions (51%) and energy efficiency (50%) targets. Climate actions are grouped under five key themes:

- Governance and Leadership,
- Built Environment and Transport,
- Natural Environment and Green Infrastructure,
- Communities: Resilience and Just Transition and Sustainability and
- Resource Management

The Tipperary County Council (TCC) *Local Authority Climate Action Plan (LACAP) 2024-2029* (TCC, 2024) outlines TCC's goals to mitigate GHG emissions and plans to prepare for and adapt to climate change.

In relation to GHG emissions relevant to the Proposed Development, Action No. 51 of Strategic Goal No. 4 of the LACAP states that TCC will:

> *"Advocate for both proactive national planning policy and fit for purpose national grid infrastructure in Tipperary that will support the transition to renewable energy and to ensure that local authority planning policy is aligned with national policy change and updates as they relate to national and regional renewable energy/electricity targets, guidance and support schemes."*

Action No. 52 of Strategic Goal No. 4 states that TCC will also:

> *"Dedicate and train a team of cross-sectoral personnel to support planning assessment of large-scale renewable energy projects/bio-energy projects and new and emerging technologies."*

Action No. 55 of Strategic Goal No. 4 directly relates to the Proposed Development:

> *"Prepare a Master Plan for the National Bioeconomy Campus located at Lisheen, Co. Tipperary in line with the objective of the County Development Plan 2022 – 2028 (and as reviewed)."*

The TCC LACAP highlights the risks that climate change poses, with risks mainly associated with extreme weather events. The TCC LACAP notes that based on the climate hazard baseline, severe windstorm and extreme precipitation events have impacted upon Tipperary County most frequently over the last 30 years. Pluvial flooding, above average surface temperatures, above average precipitation, river flooding, heatwaves and drought were common occurrences. Cold spells, heavy snowfall and an increase in Relative Sea Level have also impacted Tipperary County, but less frequently.

The risk of existing hazards such as severe windstorm and extreme precipitation events is projected to increase in the future to very frequent due to a projected increases in the frequency of very wet days (>30mm of precipitation), though due to a limited number of studies the projections for severe windstorms should be considered with caution. Pluvial flooding, above average surface temperatures, above average precipitation, river flooding, heatwaves and drought are all predicted to increase from a common occurrence to frequent.

In terms of asset damage from climate change hazards, TCC's LACAP identifies that densification of urban area has the potential to result in an increase in the number of exposed assets and populations to river and pluvial flooding. The LACAP also notes that *"future developments will be required to utilise sustainable urban drainage systems to control the release of water runoff in a managed way"* to manage above average and extreme precipitation events. In relation to above average surface temperatures and heatwaves, the LACAP states that new building regulations, design and material will be required for use in new developments to manage the increase in these hazards. **Figure 12.1** (from Appendix F of TCC's *Tier 1 Climate Change Risk Assessment*, which accompanies the LACAP) gives full details of the asset damage due to increases in future climate change hazard frequency.

Assessment of Future Climate Impacts - Asset Damage

Hazard No.	Hazard Type	Current Asset Damage	Projected Change	Rationale
1	River flood	Major	Major	Densification of urban areas to deliver compact growth will potentially increase the amount of properties at risk of flooding. However, the Tipperary CDP outlines an objective to ensure vulnerable developments are directed away from areas at risk of flooding. Works will also be continued with OPW to develop flood relief schemes and maintain existing defences. There is a likely increase in river flows across most of the country leading to an increase in severity of flooding (Climate Ireland).
2	Pluvial flood	Moderate	Moderate	Similarly to river flooding, densification of urban areas will potentially increase the amount of properties at risk. Adaptation and spatial planning goals include the conversion of land at risk of flooding to less vulnerable uses e.g. parks, gardens and open spaces for natural habitats (Tipperary CDP). Works will also be continued with OPW to develop flood relief schemes and maintain existing defences. When compared with an annual average rainfall of 1186mm for the period 1961-1990, the thirty year period 1990-2019 shows a 70mm or almost 7% increase in rainfall (Status of Ireland's Climate, EPA).
3	Above average precipitation	Moderate	Moderate	Future developments will be required to utilise sustainable urban drainage systems to control the release of water runoff in a managed way (Tipperary CDP). The last decade from 2006 - 2015 has been the wettest period in the period 1711- 2016 and there is evidence of an increasing trend in winter rainfall and a decreasing trend in summer rainfall (Status of Ireland's Climate, EPA). This implies there is an increase in severity in winter periods but a reduction in summer periods.
4	Extreme precipitation	Moderate	Moderate	Future developments will be required to utilise sustainable urban drainage systems to control the release of water runoff in a managed way (Tipperary CDP). When compared with an annual average rainfall of 1186mm for the period 1961-1990, the thirty year period 1990-2019 shows a 70mm or almost 7% increase in rainfall (Status of Ireland's Climate, EPA).
5	Severe windstorm	Minor	Moderate	Current predictions indicate an increase in the intensity of windstorms (Climate Ireland), increasing the impacts involved.
6	Increase in Relative Sea Level	Negligible	Negligible	Satellite observations indicate that sea levels around Ireland have increased by approximately 2-3 mm per year since the 1990s (The Status of Ireland's Climate, EPA). However, this will unlikely increase the impact.
7	Heatwave	Minor	Minor	Average surface air temperatures are expected to increase across all seasons which will likely increase the intensity of heatwaves (Climate Ireland). New building regulations and materials will be required for use in new developments to accommodate this, but there will also be an increase in the impact of heatwaves due to more compacted urban areas (Tipperary CDP).
8	Drought	Minor	Moderate	Average surface temperature are expected in increase, as well as a decrease in the levels of summer rainfall (Status of Ireland's Climate, EPA), leading to an increase in the impact of droughts.
9	Above average surface temperature	Negligible	Negligible	Average surface air temperatures across all seasons are expected to increase (Climate Ireland). New building design and materials will be introduced to accommodate hotter summers without compromising resilience to other climate changes, but densification of urban areas will potentially increase the solar radiation of urban areas (Tipperary CDP).
10	Cold spell	Minor	Minor	No changes in the assets affected. There has been a decrease in the number of frost days (temperatures below 0°C) and a shortening of the frost season duration, with projections to be in line with current trends (Climate Ireland). However, the impact remains as a minor impact.
11	Heavy snowfall	Minor	Minor	No changes in the assets affected. Snowfall is projected to decrease substantially by the middle of the century (Nolan and Flanagan), but impacts will remain the same.

Figure 12.1: Assessment of Future Climate Hazards and in Tipperary County. (Source: TCC, 2023)

12.2.3 Guidance

The principal guidance and best practice documents used to inform the assessment of potential impacts on climate are summarised below. The assessment has made reference to national guidelines where available, in addition to international standards and guidelines relating to the assessment of climate impacts. These are summarised below:

- *Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment* (Department of Housing, Planning & Local Government, 2018);
- *Guidelines on the Information to be Contained in Environmental Impact Assessment Reports* (EPA, 2022);
- *Environmental Impact Assessment of Projects: Guidance on the preparation of the Environmental Impact Assessment Report* (European Commission, 2017);
- *GE-GEN-01101: Guide to the Implementation of Sustainability for Transport Infrastructure Ireland Projects* (Transport Infrastructure Ireland [TII], 2023);
- *PE-ENV-01104: Climate Guidance for National Roads, Light Rail and Rural Cycleways (Offline & Greenways) – Overarching Technical Document* (TII, 2022);
- *GE-ENV-01106: TII Carbon Assessment Tool for Road and Light Rail Projects and User Guidance Document* (TII, 2024);
- *Guidance on Integrating Climate Change and Biodiversity into Environmental Impact Assessment* (European Commission, 2013);
- *2030 Climate and Energy Policy Framework* (European Commission, 2014);
- *Technical Guidance on the Climate Proofing of Infrastructure in the Period 2021-2027 (European Commission*, 2021a).
- *2030 EU Climate Target Plan* (European Commission, 2021b);
- *Climate Action and Low Carbon Development (Amendment) Act 2021* (the 2021 Climate Act) (No. 32 of 2021) (Government of Ireland, 2021).
- *Climate Action Plan 2024* (DECC, 2023a);
- *Environmental Impact Assessment Guide to: Climate Change Resilience and Adaptation* (hereafter referred to as the IEMA 2020 EIA Guide) (*Significance* (Institute of Environmental Management & Assessment [IEMA], 2020a);
- *GHG Management Hierarchy* (hereafter referred to as the IEMA 2020 GHG Management Hierarchy) (IEMA, 2020b);
- *Assessing Greenhouse Gas Emissions and Evaluating their Significance* (IEMA, 2022); and
- *Environmental Impact Assessment Guide to: Assessing GHG Emissions and Evaluating their Significance* (hereafter referred to as the IEMA GHG Guidance) (IEMA, 2022).

12.3 Methodology

12.3.1 Greenhouse Gas Assessment

As per the EU guidance document *Guidance on Integrating Climate Change and Biodiversity into Environmental Impact Assessment* (European Commission, 2013) the climate baseline is first established with reference to EPA data on annual GHG emissions (see **Section 12.4.1**).

The GHG assessment accounts for various components relating to the project during different life stages to determine the total impact of the development on climate. The reference study period (i.e. the assumed building life expectancy) for the purposes of the assessment is 35 years. Embodied carbon emissions are attributed to four main categories, taken from BS EN 15978. The categories are:

- **Product Stages (category A1 to A3)**: The carbon emissions generated at this stage arise from extracting the raw materials from the ground, their transport to a point of manufacture and then the primary energy used (and the associated carbon impacts that arise) from transforming the raw materials into construction products. These stages have been included within the scope of this assessment;
- **Construction (category A4 to A5)**: These carbon impacts arise from transporting the construction products to site, and their subsequent processing and assembly into the building. This has been included within the scope of the assessment. Information for these stages was incorporated into the TII tool;
- **Use Stage (category B1 to B7)**: This covers a wide range of sources from the GHG emissions associated with the operation of the building (B1), maintenance (B2), repair (B3), refurbishment (B4) and replacement (B5) of materials, and operational energy use (B6) and water use (B7). Categories B1-B5 are not included in the assessment scope of this study, as these are highly variable and dependent on individual users of the buildings during operation. Operational energy use and water use throughout the lifetime of the development (category B6 – B7) has been included within this assessment. Stages B6 and B7 include also provision and transport of all materials, products, as well as energy and water provisions, waste processing up to the end-of-waste state or disposal of final residues during this part of the use stage; and
- **End of Life Stages (category C1 to C4)**: The eventual deconstruction and disposal of the existing building at the end of its life takes account of the on-site activities of the demolition contractors. No ‘credit’ is taken for any future carbon benefit associated with the reuse or recycling of a material into new products. This stage as not included within the scope of this study due to the variability and uncertainty in deconstruction methods which may be in place at the end of the development's lifespan.

12.3.1.2 Construction Phase

PE-ENV-01104 (TII, 2022) recommends the calculation of the construction stage embodied carbon using the TII Online Carbon Tool (TII, 2022b). Embodied carbon refers to the sum of the carbon needed to produce a good or service. It incorporates the energy needed in the mining or processing of raw materials, the manufacturing of products and the delivery of these products to site.

The TII Online Carbon Tool (TII, 2024) has been commissioned by TII to assess GHG emissions associated with road or rail projects in Ireland. The TII Carbon Tool (TII, 2024) uses emission factors from recognised sources including the Civil Engineering Standard Method of Measurement (CESSM) Carbon and Price Book database (CESSM, 2013), which can be applied to a variety of developments, not just road or rail. The use of the TII carbon tool is considered appropriate as the material types and construction activities employed by the proposed development are accounted for in the tool. The carbon emissions are calculated by multiplying the emission factor by the quantity of the material that will be used over the entire construction / maintenance phase. The outputs are expressed in terms of tonnes of CO_2e (tCO_2e).

Reasonable conservative estimates have been used in this assessment where necessary to provide an estimate of the GHGs associated with the proposed development.

Information on the site clearance activities, land clearance and land use change, excavations, fuel usage during construction, waste quantities and construction traffic (material, staff and waste transport) were provided by the design team for input into the TII carbon tool and are also discussed in **Chapter 14 - Traffic and Transportation** and **Chapter 15 – Material Assets: Waste**. This information was used to determine an estimate of the GHG emissions associated with the development.

12.3.1.2 Operational Phase

The GHG emissions associated with the construction and operation of the development will be offset by the production of the biogas. Approximately 98,000 tonnes of feedstock annually (the majority of which is waste material such as dairy sludge and manure) will be used to generate approx. 9,8000,000 m^3 of biomethane per year, 92% will be exported and the balance will be used for self-consumption to run the on-site 2 MWe CHP. It is assumed that the on-site CHP will provide approximately 20% of the site's annual power demand with the balance coming from the grid which is fed locally from a 160 MW wind farm. Heat demand on-site is satisfied by a combination of process heat recovery, on-site CHP and a 500 kW biomass boiler.

The quantification of the GHG emissions associated with this biogas production was carried out using Internation Sustainability and Carbon Certification (ISCC) methodology in ISCC EU 205 Greenhouse Gas Emissions (ISCC, 2023). Under the EU Renewable Energy Directive (RED II) (2018/2001), mandatory GHG emissions quantification and GHG reduction targets are required for biofuels. ISCC is one of the leading certification systems for the EU renewable energy market, issuing sustainability certificates for biofuels under its ISCC EU program, recognised by the European Commission to demonstrate compliance with the sustainability criteria for biofuels set out in RED II (ISCC, 2024). Certification from ISCC will be sought for the biogas produced by the proposed development.

The ISCC methodology provides carbon intensity factors for by-products (10 grams of CO_2 equivalent per megajoule of energy produced (gCO_2e/Mj)), crops (30 gCO_2e/Mj), solid manure (-105 gCO_2e/Mj) and liquid manure

(-100 gCO_2e/Mj), which were applied to the energy production capacity of the annual feedstock quantities. These carbon intensity factors take the production of the crop feedstock into account, as well as the methane emissions usually released by manure as a waste produced and now avoided by using it as a feedstock. Application of these factors results in an annual tCO_2e value associated with the total biogas production by the proposed development. This value is then compared to the annual tCO_2e value of the same volume of biogas if this were instead comprised of fossil methane, utilising a carbon intensity factor of 94 gCO_2e/Mj (ISCC, 2023). The difference between the two is the amount of CO_2e that can be avoided by the proposed development's biogas production i.e. GHG emissions offset. The ISCC methodology calculations were carried out and provided by the design team.

Emissions from road traffic associated with the proposed development have the potential to emit CO_2 which will impact climate. Information on the operational traffic were provided by the design team for input into the TII carbon tool and are also discussed in **Chapter 14 - Traffic and Transportation**.

12.3.1.3 Significance Criteria for GHGA

The Transport Infrastructure Ireland (TII) guidance document entitled *PE-ENV-01104 Climate Guidance for National Roads, Light Rail and Rural Cycleways (Offline & Greenways) – Overarching Technical Document* (TII, 2022) outlines a recommended approach for determining the significance of both the construction and operational phases of a development.

The significance of GHG effects set out in PE-ENV-01104 (TII, 2022) is based on IEMA guidance (IEMA, 2022) which is consistent with the terminology contained within Figure 3.4 of the EPA's (2022) *Guidelines on the information to be Contained in Environmental Impact Assessment Reports*.

The 2022 IEMA Guidance (IEMA, 2022) sets out the following principles for significance:

- When evaluating significance, all new GHG emissions contribute to a negative environmental impact; however, some projects will replace existing development or baseline activity that has a higher GHG profile. The significance of a project's emissions should, therefore, be based on its net impact over its lifetime, which may be positive, negative or negligible;
- Where GHG emissions cannot be avoided, the goal of the EIA process should be to reduce the project's residual emissions at all stages; and
- Where GHG emissions remain significant, but cannot be further reduced, approaches to compensate the project's remaining emissions should be considered.

The criteria for determining the significance of effects are a two-stage process that involves defining the magnitude of the impacts and the sensitivity of the receptors (i.e. Ireland's National GHG targets). In relation to climate, there is no project specific assessment criteria, but the project will be assessed against the recommended IEMA significance determination. This takes account of any embedded or committed mitigation measures that form part of the design which should be considered.

TII (TII, 2022) states that professional judgement must be taken into account when contextualising and assessing the significance of a project's GHG impact. In line with IEMA Guidance (IEMA, 2022), TII state that the crux of assessing significance is:

> "*not whether a project emits GHG emissions, nor even the magnitude of GHG emissions alone, but whether it contributes to reducing GHG emissions relative to a comparable baseline consistent with a trajectory towards net zero by 2050*".

Significance is determined using the criteria outlined in **Table 12.3** (derived from Table 6.7 of PE-ENV-01104 (TII, 2022)) along with consideration of the following two factors:

- The extent to which the trajectory of GHG emissions from the project aligns with Ireland's GHG trajectory to net zero by 2050; and
- The level of mitigation taking place.

The significance of the effect of GHG emissions on climate is assessed for the total GHG emissions across all project stages.

Effects	Significance Level Description	Description
Significant Adverse	Major Adverse	The project's GHG impacts are not mitigated. The project has not complied with do-minimum standards set through regulation, nor provided reductions required by local or national policies; and No meaningful absolute contribution to Ireland's trajectory towards net zero.
	Moderate Adverse	The project's GHG impacts are partially mitigated. The project has partially complied with do-minimum standards set through regulation, and have not fully complied with local or national policies; and Falls short of full contribution to Ireland's trajectory towards net zero.
Not Significant	Minor Adverse	The project's GHG impacts are mitigated through 'good practice' measures. The project has complied with existing and emerging policy requirements; and Fully in line to achieve Ireland's trajectory towards net zero.
	Negligible	The project's GHG impacts are mitigated beyond design standards. The project has gone well beyond existing and emerging policy requirements; and Well 'ahead of the curve' for Ireland's trajectory towards net zero.
	Beneficial	The project's net GHG impacts are below zero and it causes a reduction in atmosphere GHG concentration. The project has gone well beyond existing and emerging policy requirements; and Well 'ahead of the curve' for Ireland's trajectory towards net zero, provides a positive climate impact.

Table 12.3: Greenhouse Gas Assessment (GHGA) Significance Criteria. (Source: TII, 2022).

Ireland's carbon budgets can also be used to contextualise the magnitude of GHG emissions from the proposed development (TII, 2022). The approach is based on comparing the net proposed development GHG emissions to the relevant carbon budgets (DECC, 2023a). With the publication of the Climate Action Act in 2021 and the Climate Action Plan 2024, sectoral carbon budgets have been published for comparison with the net GHG emissions from the proposed development over its lifespan. The relevant sector budgets are for Transport and Industry. The Transport sector emitted approximately 12 $MtCO_2e$ in 2018 and has a ceiling of 6 Mt CO_2e in 2030 which is a 50% reduction over this period. The Industry sector emitted approximately 7 $MtCO_2e$ in 2018 and has a ceiling of 4 Mt CO_2e in 2030 which is a 35% reduction over this period (see **Table 12.1**).

12.3.2 Climate Change Risk Assessment

The assessment involves an analysis of the sensitivity and exposure of the proposed development to climate hazards which together provide a measure of vulnerability of the proposed development to hazards as a results of climate change. PE-ENV-01104 (TII, 2022) states that the CCRA is guided by the principles set out in the overarching best practice guidance documents:

- EU (2021) *Technical Guidance on the Climate Proofing of Infrastructure in the Period 2021-2027* (European Commission, 2021); and
- Assessment *Environmental Impact Assessment Guide to: Climate Change Resilience and Adaptation* (2nd Edition) (IEMA, 2020a).

The baseline environment information provided in **Section 12.4.2**, future climate change modelling and input from other experts working on the proposed development (i.e. hydrologists) should be used in order to assess the likelihood of a climate risk.

First an initial screening CCRA based on the operational phase is carried out, according to the TII guidance PE-ENV-01104 (TII, 2022). This is carried out by determining the sensitivity of proposed development assets (i.e. receptors) and their exposure to climate change hazards.

The proposed development asset categories must be assigned a level of sensitivity to climate hazards. PE-ENV-01104 (TII, 2022) provides the below list of asset categories and climate hazards to be considered. The asset categories will vary for development type and need to be determined on a development by development basis.

- **Asset Categories:** Pavements; drainage; structures; utilities; landscaping; signs, light posts, buildings, and fences.
- **Climate Hazards:** Flooding (coastal, pluvial, fluvial); extreme heat; extreme cold; wildfire; drought; extreme wind; lightning and hail; landslides; fog.

The asset sensitivity is based on a High, Medium or Low rating with a score of 1 to 3 assigned as per the criteria below. Asset sensitivity takes into account design mitigation measures.

- **High Sensitivity:** The climate hazard will or is likely to have a major impact on the asset category. This is a sensitivity score of 3.
- **Medium Sensitivity:** It is possible or likely the climate hazard will have a moderate impact on the asset category. This is a sensitivity score of 2.
- **Low Sensitivity:** It is possible the climate hazard will have a low or negligible impact on the asset category. This is a sensitivity score of 1.

Once the sensitivities have been identified the exposure analysis is undertaken. The exposure analysis involves determining the level of exposure of each climate hazard at the proposed development location. Exposure is assigned a level of High, Medium or Low as per the below criteria.

- **High Exposure:** It is almost certain or likely this climate hazard will occur at the project location i.e., might arise once to several times per year. This is an exposure score of 3.
- **Medium Exposure:** It is possible this climate hazard will occur at the project location i.e., might arise a number of times in a decade. This is an exposure score of 2.
- **Low Exposure:** It is unlikely or rare this climate hazard will occur at the project location i.e., might arise a number of times in a generation or in a lifetime. This is an exposure score of 1.

Once the sensitivity and exposure are categorised, a vulnerability analysis is conducted by multiplying the sensitivity and exposure to calculate the vulnerability, as shown in **Table 12.4**.

12.3.2.1 Significance Criteria for CCRA

The assessment of vulnerability to climate change combines the outcomes of the sensitivity and exposure analysis with the aim of identifying the key vulnerabilities and potentially significant climate hazards which could impact the proposed development. The vulnerability assessment takes any proposed mitigation into account.

Vulnerability = Sensitivity x Exposure

Table 12.4 details the vulnerability matrix; vulnerabilities are scored on a high, medium and low scale. A risk that is low or medium is classed as non-significant, while a high or extreme risk is classed as a significant risk.

TII guidance (TII, 2022) and the EU technical guidance (European Commission, 2021) note that if all vulnerabilities are ranked as low in a justified manner, no detailed climate risk assessment may be needed. The impact from climate change on the proposed development can, therefore, considered to be not significant. The impact from climate change on the proposed development can therefore considered to be not significant.

Where residual medium or high vulnerabilities exist the assessment may need to be progressed to a detailed climate change risk assessment and further mitigation implemented to reduce risks. An assessment of construction phase CCRA impacts is only required according to the TII guidance (TII, 2022) if a detailed CCRA is required.

Sensitivity	Exposure		
	High (3)	Medium (2)	Low (1)
High (3)	9 – High	6 – High	3 – Medium
Medium (2)	6 – High	4 – Medium	2 – Low
Low (1)	3 – Medium	2 – Low	1 – Low

Table 12.4: Climate Change Risk Assessment - Vulnerability Matrix.

The screening CCRA, discussed in **Section 12.5.3.1**, did not identify any residual medium or high risks to the proposed development as a result of climate change. Therefore a detailed CCRA for the construction and operational phase were scoped out.

While a CCRA for the construction phase was not required, best practice mitigation against climate hazards is still recommended in **Section 12.6.1**.

12.4 Receiving Environment

PE-ENV-01104 (TII, 2022) states that a baseline climate scenario should identify, consistent with the study area for the proposed development, GHG emissions without the proposed development for both the current and future baseline.

Ireland declared a climate and biodiversity emergency in May 2019 and in November 2019 there was European Parliament approval of a resolution declaring a climate and environment emergency in Europe. This, in addition to Ireland's current failure to meet its EU binding targets under Regulation 2018/842 (European Union, 2018) results in changes in GHG emissions either beneficial or adverse being of more significance than previously considered prior to these declarations.

12.4.1 Current GHGA Baseline

Data published in July 2024 (EPA, 2024) indicates that Ireland exceeded (without the use of flexibilities) its 2023 annual limit set under EU's Effort Sharing Decision (ESD) (EU 2018/842) by 2.27 Mt CO_2e. However, the 2023 emissions were the first time that Irelands emission were below (-1.2%) 1990 levels. ETS emissions decreased (-17.0%) and ESR emissions decreased (-3.4%). Ireland's target is an emission reduction of 0.626 Mt CO_2e by 2030 on an average baseline of 2016 to 2018 (Regulation (EU) 2023/839). ETS emissions in this report refers to CO_2 emissions from stationary installations and from domestic aviation. It does not include emissions from intra-EU aviation as those are not considered part of Ireland's total reportable greenhouse gas emissions.

The sectoral breakdown of 2023 GHG emissions is shown in **Table 12.5**. The sector with the highest emissions in 2023 was agriculture at 34.3% of the total, followed by transport at 19.5%. For 2023 total national emissions (including LULUCF) were estimated to be 60.62 Mt CO_2e as shown in **Table 12.5** (EPA, 2024). The provisional 2023 figures indicate that Ireland has used 63.9% of the 295 Mt CO_2e Carbon Budget for the five-year period 2021-2025.

The EPA estimate that 2023 total national greenhouse gas emissions (excluding LULUCF) have decreased by 3.8% on 2022 levels to 60.62 Mt CO_2e, with a 2.1 Mt CO_2e (-22%) reduction in electricity industries alone. This was driven by a 40.7% share of energy from renewables in 2023 and increasing our imported electricity.

Sector	2022 Emissions (Mt CO_2e)	2023 Emissions (Mt CO_2e)	% Total 2023 (including LULUCF)	% Change from 2022 to 2023	Total Budget (Mt CO_2e) (2021-2025)
Electricity	9.694	7.558	12.5%	-22.0%	40
Transport	11.76	11.791	19.5%	0.3%	54
Buildings (Residential)	5.753	5.346	8.8%	-7.1%	29
Buildings (Commercial and Public)	1.447	1.409	2.3%	-2.6%	7
Industry	6.622	6.288	10.4%	-5.0%	30
Agriculture	21.795	20.782	34.3%	-4.6%	106
Other [Note 1]	1.931	1.832	3.0%	-5.1%	9
LULUCF	3.983	5.614	9.3%	40.9%	-
Total including LULUCF	**62.99**	**60.62**		**-3.8%**	**295**

Table 12.5: Total National GHG Emissions in 2023. (Source: EPA, 2024).

[Note 1] Waste includes emissions from solid waste disposal on land, solid waste treatment (composting and anaerobic digestion), wastewater treatment, waste incineration and open burning of waste.

12.4.2 Future GHGA Baseline

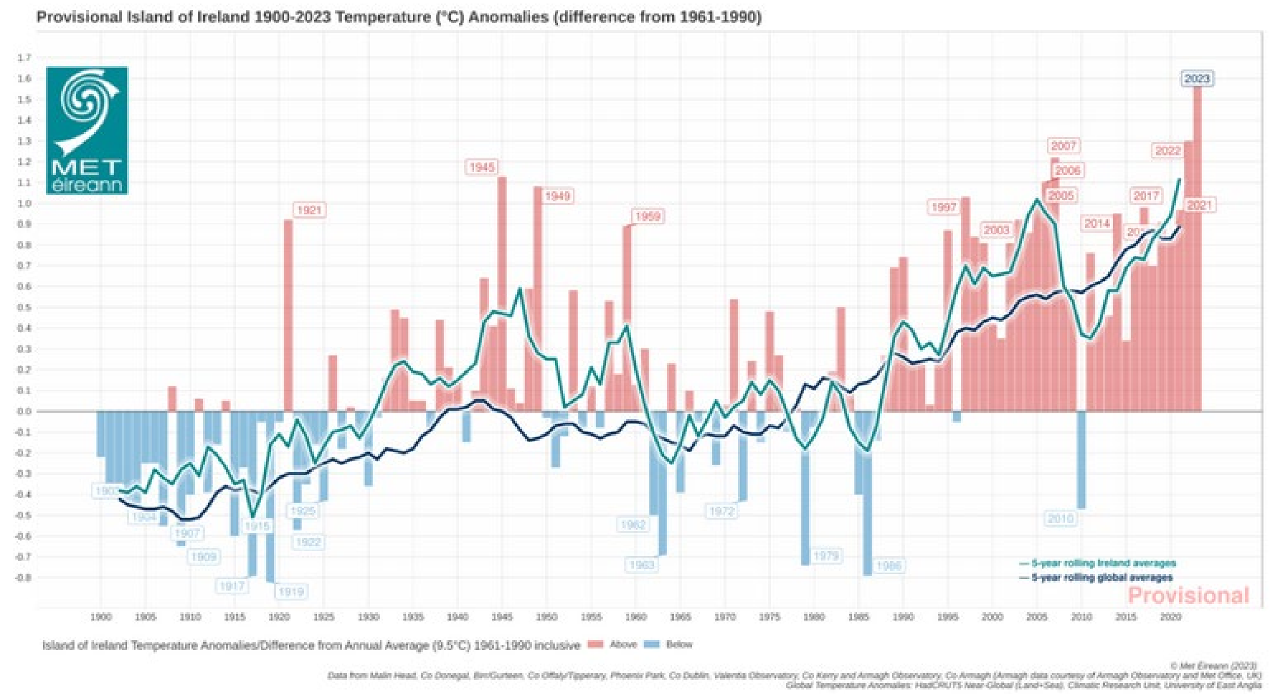
The future baseline with respect to the GHGA can be considered in relation to the future climate targets which the assessment results will be compared against. In line with TII (TII, 2022) and IEMA Guidance (IEMA, 2022) the future baseline is a trajectory towards net zero by 2050, *"whether it [the project] contributes to reducing GHG emissions relative to a comparable baseline consistent with a trajectory towards net zero by 2050"*.

The future baseline will be determined by Ireland meeting its targets set out in the CAP23, and future CAPs, alongside binding 2030 EU targets. In order to meet the commitments under the Paris Agreement, the European Union (EU) enacted *Regulation (EU) 2018/842 on binding annual GHG emission reductions by Member States from 2021 to 2030 contributing to climate action to meet commitments under the Paris Agreement and amending Regulation (EU) No. 525/2013* (hereafter referred to as the Regulation) (European Union, 2018). The Regulation aims to deliver, collectively by the EU in the most cost-effective manner possible, reductions in GHG emissions from the Emission Trading Scheme (ETS) and non-ETS sectors amounting to 43% and 30%, respectively, by 2030 compared to 2005. The Regulation was amended in April 2023 and Ireland must now limit its greenhouse gas emissions by at least 42% by 2030. The ETS is an EU-wide scheme which regulates the GHG emissions of larger industrial emitters Including electricity generation, cement manufacturing and heavy industry. The non-ETS sector includes all domestic GHG emitters which do not fall under the ETS scheme and thus includes GHG emissions from transport, residential and commercial buildings and agriculture.

12.4.3 Current CCRA Baseline

The region of the proposed development has a temperate, oceanic climate, resulting in mild winters and cool summers. The Met Éireann weather station at Shannon Airport is the nearest weather and climate monitoring station to the proposed development with meteorological data recorded for the 30-year period from 1991 to 2020. The historical regional weather data for Shannon Airport meteorological station is representative of the current climate in the region of the proposed development. The data for the 30-year period from 1991 to 2020 (Met Éireann, 2023a) indicates that the wettest months at Shannon Airport Station were November- January, and the driest month on average was April. July was the warmest month with a mean temperature of 19.5 Celsius. January was the coldest month with a mean temperature of 8.9 Celsius.

Met Éireann's 2023 Climate Statement (Met Éireann, 2024) states 2023's average shaded air temperature in Ireland is provisionally 11.20 °C, which is 1.65°C above the 1961-1990 long-term average. Previous to this 2022 was the warmest year on record, however 2023 was 0.38 °C warmer (see **Figure 12.2**).



Island of Ireland annual average temperature anomalies (1961-1990 Long-Term Average) 1900 to 2023: 2023 average shaded air temperature in Ireland is provisionally 11.20°C which is 1.65°C above the 1961-1990 LTA

Figure 12.2: 1900-2023 Temperature (°C) Temperature Anomalies (differences from 1961-1990). (Source: Met Eireann, 2024)

2023 also had above average rainfall, the warmest June on record and the wettest March and July on record. Record high sea surface temperatures (SST) were recorded since April 2023 which included a severe marine heatwave to the west of Ireland during the June 2023. This marine heatwave contributed to the record rainfall in July.

Recent weather patterns and records of extreme weather events recorded by Met Éireann have been reviewed. Considering the extraordinary 2023 data, Met Éireann states that the latest Irish climate change projections indicate further warming in the future, including warmer winters. The record temperatures means the likelihood of extreme weather events occurring has increased. This will result in longer dry periods and heavy rainfall events. Storm surges and coastal flooding due to sea level rise. Compound events, where coastal surges and extreme rainfall events occur simultaneously will also increase. Met Éireann has high confidence in maximum rainfall rates increasing but not in how the frequency or intensity of storms will change with climate change.

12.4.4 Future CCRA Baseline

Impacts as a result of climate change will evolve with a changing future baseline, changes have the potential to include increases in global temperatures and increases in the number of rainfall days per year. Therefore, it is expected that the baseline climate will evolve over time and consideration is needed with respect to this within the design of the proposed development.

Ireland has seen increases in the annual rainfall in the north and west of the country, with small increases or decreases in the south and east including in the region where the proposed development will be located (EPA, 2021b). The EPA also note the following may occur as a result of climate change (EPA, 2021a):

- More intense storms and rainfall events;
- Increased likelihood and magnitude of river and coastal flooding;
- Adverse impacts on water quality; and
- Changes in distribution of plant and animal species.

The EPA's *State of the Irish Environment Report (Chapter 2: Climate Change)* (EPA, 2020b) notes that projections show that full implementation of additional policies and measures, outlined in the 2019 Climate Action Plan, will result in a reduction in Ireland's total GHG emissions by up to 25% by 2030 compared with 2020 levels. Climate change is not only a future issue in Ireland, as a warming of approximately 0.8°C since 1900 has already occurred. The EPA state that it is critically important for the public sector to show leadership and decarbonise all public transport across bus and rail networks to the lowest carbon alternatives. The report (EPA, 2020b) underlines that the next decade needs to be one of major developments and advances in relation to Ireland's response to climate change in order to achieve these targets. Ireland must accelerate the rate at which it implements GHG emission reductions. The report states that mid-century mean annual temperatures in Ireland are projected to increase by between 1.0°C and 1.6°C (subject to the emissions trajectory). In addition, heat events are expected to increase by mid-century (EPA, 2020b). While individual storms are predicted to have more severe winds, the average wind speed has the potential to decrease (EPA, 2020b).

TII's Guidance document PE-ENV-01104 (TII, 2022) states that for future climate change a moderate to high Representative Concentration Pathways (RCP) should be adopted. RCP4.5 is considered moderate while RCP8.5 is considered high. Representative Concentration Pathways (RCPs) describe different 21st century pathways of GHG emissions depending on the level of climate mitigation action undertaken.

Future climate predictions undertaken by the EPA have been published in *Research 339: High-resolution Climate Projections for Ireland – A Multi-model Ensemble Approach* (EPA, 2020a). The future climate was simulated under both Representative Concentration Pathway 4.5 (RCP4.5) (medium-low) and RCP8.5 (high) scenarios. This study indicates that by the middle of this century (2041–2060), mid-century mean annual temperatures are projected to increase by 1 to 1.2°C and 1.3 to 1.6°C for the RCP4.5 and RCP8.5 scenarios, respectively, with the largest increases in the east. Warming will be enhanced at the extremes (i.e. hot days and cold nights), with summer daytime and winter night-time temperatures projected to increase by 1 to 2.4°C. There is a projected substantial decrease of approximately 50%, for the number of frost and ice days. Summer heatwave events are expected to occur more frequently, with the largest increases in the south. In addition, precipitation is expected to become more variable, with substantial projected increases in the occurrence of both dry periods and heavy precipitation events. Climate change also has the potential to impact future energy supply which will rely on renewables such as wind and hydroelectric power. More frequent storms have the potential to damage the communication networks requiring additional investment to create resilience within the network.

The EPA's *Critical Infrastructure Vulnerability to Climate Change* report (EPA, 2021b) assesses the future performance of Irelands critical infrastructure when climate is considered. With respect to road infrastructure, fluvial flooding and coastal inundation/coastal flooding are considered the key climate change risks with snowstorm and landslides being medium risks. Extreme winds and heatwaves/droughts are considered low risk to road infrastructure. One of the key outputs of the research was a framework that will provide quantitative risk-based decision support for climate change impacts and climate change adaptation analysis for infrastructure.

National Framework for Climate Services (NFCS) was founded in June 2022 to streamline the provision of climate services in Ireland and will be led by Met Éireann. The aim of the NFCS is to enable the co-production, delivery and use of accurate, actionable and accessible climate information and tools to support climate resilience planning and decision making. In addition to the NFCS, further work has been ongoing into climate projects in Ireland through research under the TRANSLATE project. TRANSLATE (Met Éireann, 2023b) has been led by climate researchers from University of Galway – Irish Centre for High End Computing (ICHEC), and University College Cork – SFI Research Centre for Energy, Climate and Marine (MaREI), supported by Met Éireann climatologists. TRANSLATE's outputs are produced using a selection of internationally reviewed and accepted models from both CORDEX and CMIP5. Representative Concentration Pathways (RCPs) provide a broad range of possible futures based on assumptions of human activity. The modelled scenarios include for "least" (RCP2.6), "more" (RCP4.5) or "most" (RCP8.5) climate change, see **Figure 12.3**.

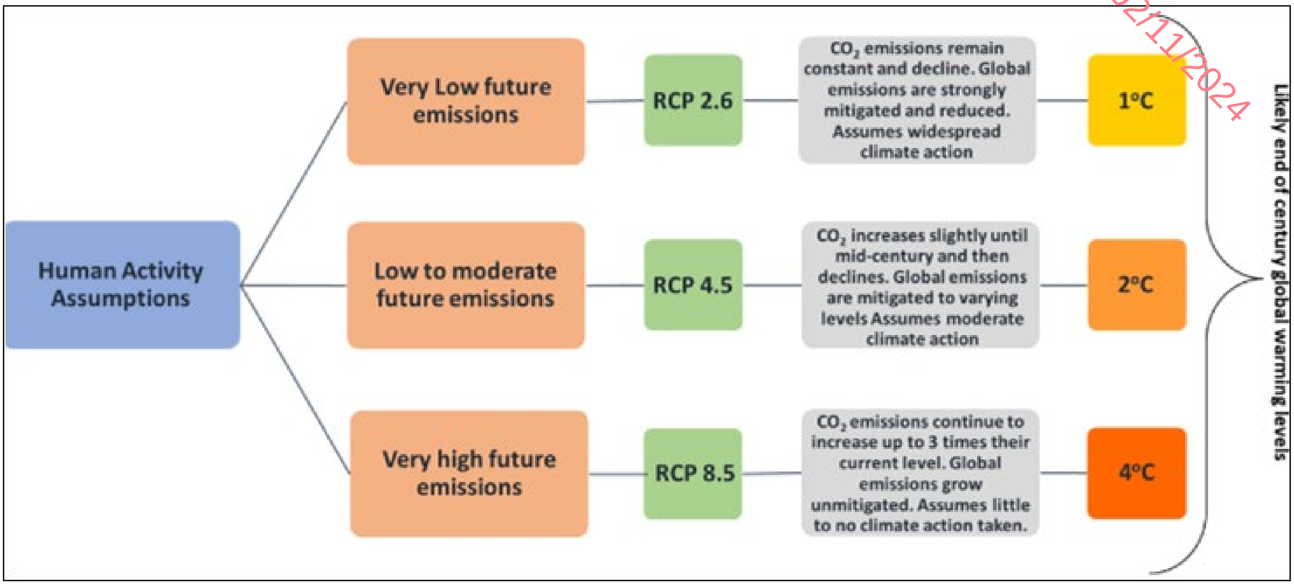


Figure 12.3: TRANSLATE Project Story Map - Representative Concentration Pathways Associated Emission Levels (Met Éireann, 2023b)

TRANSLATE (Met Éireann, 2023b) provides the first standardised and bias-corrected national climate projections for Ireland to aid climate risk decision making across multiple sectors (for example, transport, energy, water), by providing information on how Ireland's climate could change as global temperatures increase to 1.5˚C, 2˚C, 2.5˚C, 3˚C or 4˚C (see **Figure 12.4**). Projections broadly agree with previous projections for Ireland. Ireland's climate is dominated by the Atlantic Meridional Overturning Circulation (AMOC), a large system of ocean currents – including the Gulf Stream – characterised by a northward flow of warm water and a southward flow of cold water. Due to the AMOC, Ireland does not suffer from the extremes of temperature experienced by other countries at a similar latitude. Recent studies have projected that the AMOC could decline by 30 – 40 % by 2100, resulting in cooler North Atlantic Sea surface temperatures (SST)s (Met Éireann, 2023b). Met Éireann projects that Ireland will nevertheless continue to warm, although the AMOC cooling influence may lead to reduced warming compared with continental Europe. AMOC weakening is also expected to lead to additional sea level rise around Ireland. With climate change Ireland's temperature and rainfall will undergo more and more significant changes e.g. on average summer temperature could increase by more than 2°C, summer rainfall could decrease by 9% while winter rainfall could increase by 24%. Future projects also include a 10-fold increase in the frequency of summer nights (values > 15°C) by the end of the century, a decrease in the frequency of cold winter nights and an increase in the number of heatwaves. A heatwave in Ireland is defined as a period of 5 consecutive days where the daily maximum temperature is greater than 25°C.

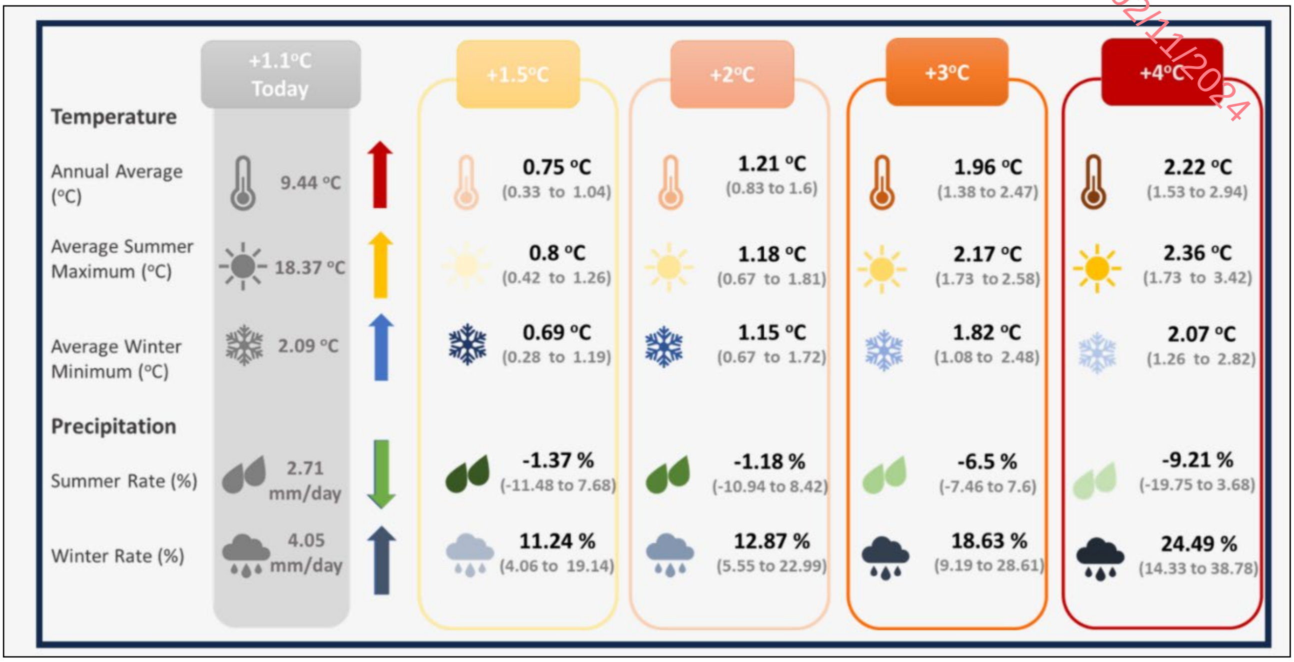


Figure 12.4: TRANSLATE Project Story Map - Change of Climate Variables for Ireland for Different Global Warming Thresholds (Met Éireann, 2023b)

12.5 Potential Impacts

12.5.1 Do Nothing

Under the Do Nothing Scenario the proposed development will not be constructed, no construction works associated with the proposed development will take place and the potential impacts of GHG emissions will not occur. The operational GHG emissions or offsets associated with the proposed development will also not occur. However, as the site is zoned for development, in the absence of the proposed development it is likely that a development of a similar nature would be constructed in the future in line with national policy and the development plan objectives. The construction and operational phase GHG emissions outlined in this assessment may occur in the future even in the absence of the proposed development, however GHG offsets may not occur unless another development is permitted which results in these.

12.5.2 Greenhouse Gas Assessment

There is the potential for greenhouse gas emissions to atmosphere during the construction and operational phases of the proposed development. As per the TII guidance (2022), the significance of the effect of GHG emissions on climate is assessed for the total GHG emissions across all proposed development stages (**Section 12.3.1.3**).

12.5.2.1 Construction Phase

Embodied carbon is carbon dioxide emitted during the manufacture, transport and construction of building materials, together with site activities. The most significant proportion of carbon emissions tend to occur during the construction phase because of embodied carbon in construction materials and emissions from construction activities. Therefore, the assessment has included the construction phase embodied carbon for the purposes of the EIAR. The assessment is broken down into the following stages as per **Section 12.3.1.2**:

- Product stage (A1 – A3);
- Transportation to site (A4); and
- Site operations (construction activities) (A5).

The construction phase GHG emissions comprise stages A1 – A5 and include the construction materials, the transport of the materials to site and the construction activities or site operations.

The GHG assessment has highlighted the areas where the highest GHG emissions occur, specifically as a result of building materials. Construction materials make up the majority of GHG emissions for the proposed development, at approx. 47% of the total construction phase GHG emissions, and 1.2% of the total GHG emissions over the assumed 35 year lifespan of the proposed development (shown in **Figure 12.5** and **Table 12.6**). The construction phase emissions are discussed further in the context of total proposed development GHG emissions and the relevant sectoral emissions in **Section 12.5.2.3**.

12.5.2.2 Operational Phase

The operation phase assessment is broken down into the following stages as per **Section 12.3.1.2**:

- Use Stage (operational energy use and transport) (category B1 to B7).

The operational phase GHG emissions comprise stages B6 – B7 and include the operational energy use and transport of bio-based fertilizer to the feedstock (crop) suppliers.

The GHG assessment has highlighted the areas where the highest GHG emissions occur, specifically as a result of operational energy use. Energy use makes up the majority of GHG emissions for the proposed development, at 85% of the total operational phase GHG emissions, and 83% of the total GHG emissions over the assumed 35 year lifespan of the proposed development (shown in **Figure 12.5** and **Table 12.6**). The operational phase emissions are discussed further in the context of total proposed development GHG emissions and the relevant sectoral emissions in **Section 12.5.2.3**.

12.5.2.3 Total GHG Emissions Over Construction and Operational Phases

Figure 12.5 shows the GHG for the proposed development over the assumed 35 year lifespan per life-cycle stage, with the output from the TII Carbon Tool assessment included. Construction materials result in 1.2% of the total GHG emissions, while operational energy usage results in 83% of the total GHG emissions.

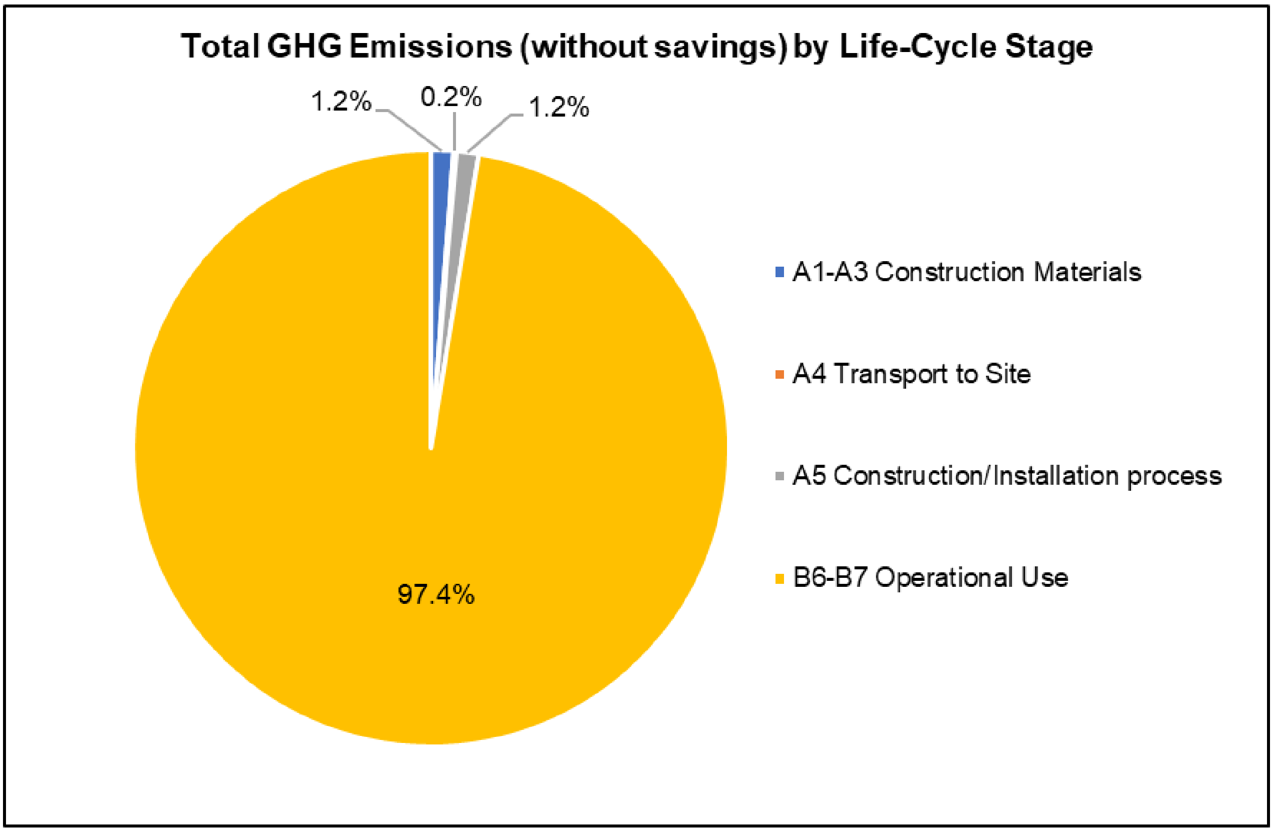


Figure 12.5: Total GHG Emissions (without savings) by Life-Cycle Stage

Stage	GHG Assessment Category	Elements Considered	Predicted GHG Emissions (tCO_2e)	% of Total GHG Emissions	Relevant Sector for Carbon Budget Comparison	Annualised GHG Emissions as % of Relevant Carbon Budget
A1-A3	Materials	Aggregates and other fill material, plastic pipework and cabling, concrete, road pavement materials (e.g. asphalt), steel, geotextiles, timber	1,677	1.2%	Industry	0.001%
A4	Material Transport	HGV and LGV trips	231	0.2%	Transport	0.0001%
A5	Clearance and demolition	Site preparation and clearance	2.4	0.002%	Industry	0.000002%
A5	Excavation	Rock, topsoil and other excavation	38	0.03%	Industry	0.00003%
A5	Construction Water Use	Water used during construction	778	0.5%	Industry	0.001%
A5	Plant Use	Fuel usage by plant operation (diesel generators)	397	0.3%	Electricity	0.0004%
A5	Construction Worker Travel to Site	Car trips	143	0.1%	Transport	0.0001%
A5	Construction Waste Disposal	Mixed construction and demolition waste	286	0.2%	Waste	0.001%
A5	Construction Waste Transport	Transport of waste offsite. Waste will be taken from the site by HGV. Conservatively estimated that destination waste management facility will be 50 km from the site (100 km to and from the site).	17	0.01%	Transport	0.00001%
B6-B7	Operational Energy	Electricity demand by site during operational phase lifetime	114,894	83%	Electricity	0.1%

Stage	GHG Assessment Category	Elements Considered	Predicted GHG Emissions (tCO_2e)	% of Total GHG Emissions	Relevant Sector for Carbon Budget Comparison	Annualised GHG Emissions as % of Relevant Carbon Budget
B6-B7	Operational Transport	HGV trips, assuming 50 km travel distance per trip.	20,579	15%	Transport	0.01%
B6-B7	Operational Biogas Production GHG Offset	GHG emissions offset - methane emissions avoidance from feedstock and displacement of fossil methane as combustion fuel	-1,580,108	-	Electricity	-1.5%
Total Over Lifetime		**Construction plus operational emissions**	**139,045 tCO_2e**			
Total Over Lifetime (including GHG offset)		**Includes GHG emissions avoided by using feedstock to produce biogas and displacement of fossil methane by biogas**	**-1,441,063 tCO_2e (-41,173 tCO_2e per year)**			

Table 12.6: Greenhouse Gas Assessment for Proposed Development Lifetime.

The predicted GHG emissions (as shown in **Table 12.6**) can be averaged over the full construction phase and the lifespan of the proposed development to give the predicted annual emissions to allow for direct comparison with national annual emissions and targets.

In **Table 12.7**, GHG emissions have been compared against the carbon budget for the electricity, transport, industry and waste sectors in 2030 (DECC, 2023a), against Ireland's total GHG emissions in 2023 and against Ireland's EU 2030 target of a 30% reduction in non-ETS sector emissions based on 2005 levels (33 Mt CO_2e) (set out in Regulation EU 2018/842 of the European Parliament and of the Council).

The proposed development is estimated to result in total GHG emissions of 139,045 tCO_2e over the 35 year lifetime of the development, or 3,973 tonnes CO_2e when annualised over the development lifetime. This is equivalent to an annualised total of 0.01% of Ireland's total 2023 GHG emissions and 0.01% of Ireland's non-ETS 2030 target.

When the GHG emissions offset (from using feedstock to produce biogas, thereby avoiding methane emissions, and displacement of fossil methane by biogas, thereby avoiding use of a more carbon intensive fuel) are taken into account, the proposed development is estimated to result in total GHG emissions offset of -1,441,063 tCO_2e

(-1.4 Mt CO_2e) over the 35 year lifetime of the development, or -41,173 tonnes CO_2e when annualised over the development lifetime. This is equivalent to an annualised total of -0.1% of Ireland's total 2023 GHG emissions and -0.1% of Ireland's non-ETS 2030 target i.e. the offset represents a reduction of GHG emissions by these percentages.

The total lifetime energy emissions offset is -41,852 tonnes CO_2e, which equates to a reduction relative to the 2030 Electricity sector budget of approximately 1.4%, when annualised over the lifespan of the project (35 years).

The total annualised industry emissions are 71 tonnes CO_2e, which equates to approximately 0.002% of the 2030 Industry sector budget.

The total annualised waste emissions are 8 tonnes CO_2e, which equates to approximately 0.001% of the 2030 Waste sector budget.

The total annualised transport emissions are 599 tonnes CO_2e, which equates to approximately 0.01% of the 2030 Transport sector budget.

Target/Sectoral Budget	(tCO_2e)	Annualised (35 year lifespan) Proposed Development GHG Emissions (including offset) (tCO_2e)		% of Relevant Target/Budget
Ireland's 2023 Total GHG Emissions (existing baseline)	60,620,000	Total GHG Emissions	-41,173	-0.1%
Non-ETS 2030 Target	33,000,000			-0.1%
2030 Sectoral Budget (Industry Sector)	4,000,000	Total Industry Emissions	71	0.002%
2030 Sectoral Budget (Transport Sector)	6,000,000	Total Transport Emissions	599	0.01%
2030 Sectoral Budget (Electricity Sector)	3,000,000	Total Energy Usage Emissions	-41,852	-1.4%
2030 Sectoral Budget (Waste Sector)	1,000,000	Total Waste Emissions	8	0.001%

Table 12.7: Estimated GHG emissions relative to sectoral budgets and GHG baseline.

12.5.2.4 GHGA Significance of Effects

The TII guidance states that the following two factors should be considered when determining significance:

- The extent to which the trajectory of GHG emissions from the project aligns with Ireland's GHG trajectory to net zero by 2050; and
- The level of mitigation taking place.

The proposed development will result in GHG emissions offsets through using feedstock to produce biogas, thereby avoiding methane emissions, and displacement of fossil methane by biogas, thereby avoiding use of a more carbon intensive fuel. This is a positive impact on Ireland's greenhouse gas emissions, in line with CAP24 and Ireland's GHG net zero by 2050 trajectory.

The level of mitigation described in **Section 12.6** has been taken into account when determining the significance of the proposed development's GHG emissions. According to the TII significance criteria described in **Section 12.3.1.3** and **Table 12.3**, the significance of the GHG emissions during the construction and operational phase is ***beneficial.***

In accordance with the EPA guidelines (EPA, 2022), the above significance equates to a significance of effect of GHG emissions during the construction and operational phase which is ***direct, long-term, positive*** and ***slight***, which is overall not significant in EIA terms.

12.5.3 Climate Change Risk Assessment

12.5.3.1 Construction Phase

A detailed CCRA of the construction phase has been scoped out, as discussed in **Section 12.3.2.1**. However, consideration has been given to the proposed development's vulnerability to the following climate change hazards with best practice mitigation measures proposed in **Section 12.6**:

- Flood Risk due to increased precipitation, and intense periods of rainfall. This includes fluvial and pluvial flooding;
- Increased temperatures potentially causing drought, wildfires and prolonged periods of hot weather;
- Reduced temperatures resulting in ice or snow; and
- Major Storm Damage – including wind damage.

12.5.3.2 Operational Phase

In order to determine the vulnerability of the proposed development to climate change the sensitivity and exposure of the development to various climate hazards must first be determined. The following climate hazards have been considered in the context of the proposed development: flooding (coastal, pluvial, fluvial); extreme heat; extreme cold; wildfire; drought; extreme wind; lightning, hail, landslides and fog. Wildfire and landslides were not considered relevant to the proposed development due to the proposed development location and have been screened out of the assessment.

The sensitivity of the proposed development to the above climate hazards is assessed irrespective of the proposed development location. Table 8.6 details the sensitivity of the proposed development on a scale of high (3), medium (2) and low (1). Once the sensitivity has been established the exposure of the proposed development to each of the climate hazards is determined, this is the likelihood of the climate hazard occurring at the proposed development location and is also scored on a scale of high (3), medium (2) and low (1). The product of the sensitivity and exposure is then used to determine the overall vulnerability of the proposed development to each of the climate hazards. The results of the vulnerability assessment are detailed in **Table 12.8**.

Climate Hazard	Sensitivity	Exposure	Vulnerability
Flooding (Coastal, Pluvial, Fluvial)	1 (Low)	2 (Medium)	2 (Low)
Extreme Heat	1 (Low)	2 (Medium)	2 (Low)
Extreme Cold	1 (Low)	2 (Medium)	2 (Low)
Drought	1 (Low)	2 (Medium)	2 (Low)
Extreme Wind	1 (Low)	2 (Medium)	2 (Low)
Lightning & Hail	1 (Low)	1 (Low)	1 (Low)
Fog	1 (Low)	1 (Low)	1 (Low)

Table 12.8: Climate Change Vulnerability Assessment.

The proposed development has a worst-case low vulnerability to the identified climate hazards. The Site-Specific Flood Risk Assessment (SFRA) completed by Donnachadh O'Brien & Associates Consulting Engineers indicates that the areas of the site where the proposed works will be undertaken are contained within Flood Zone C and are not at risk of flooding from ais contained within a Flood Zone C and therefore is not at risk of flooding from a 0.1% Annual Exceedance Probability AEP (1 in 1000 year flood) or less flood event.

The proposed dedicated surface water drainage networks for the new development have been designed and adequately sized in accordance with best practice SuDS to accommodate flows in peak rainfall events. The drainage system has been designed for the 30 and 100-year high-intensity short-duration storm events plus 30% Climate Change in line with the 'precautionary approach' principle adopted in the Flood Risk management.

The groundwater flooding vulnerability, when the groundwater table may be high, is considered as moderate. Building Finished Floor Levels (FFLs) have been set above the internal road/yard levels to ensure that any seepage of groundwater onto the development does not flood into the building. In the event of groundwater flooding on site, this water can escape from the site via the overland flood routing. The attenuation tank will be open and provide a drainage path for the groundwater in the event that it rises above ground level.

In relation to extreme temperatures, both extreme heat and extreme cold, these have the potential to impact the building materials and some related infrastructure. However, the building materials selected at the detailed design stage will be of high quality and durability. Therefore, extreme temperatures are not considered a significant risk.

There is no additional vulnerability with respect to all climate hazards when design mitigation has been put in place in order to alleviate this known vulnerability to future climate change risk.

12.5.3.3 CCRA Significance of Effects

With design mitigation in place, there are no significant risks to the proposed development as a result of climate change. In accordance with the EPA Guidelines (EPA, 2022), the significance of effect of the impacts to the proposed development as a result of climate change are ***direct, long-term, negative*** and ***imperceptible***.

12.6 Mitigation Measures

12.6.1 Construction Phase

Embodied carbon of materials and construction activities will be the primary source of climate impacts during the construction phase. Best practice measures to reduce the embodied carbon of the construction works include:

- Appointing a suitably competent contractor who will undertake waste audits detailing resource recovery best practice and identify materials can be reused/recycled;
- Materials will be reused on site where possible;
- Prevention of on-site or delivery vehicles from leaving engines idling, even over short periods;
- Ensure all plant and machinery are well maintained and inspected regularly;
- Minimising waste of materials due to poor timing or over ordering on site will aid to minimise the embodied carbon footprint of the site; and
- Sourcing materials locally where possible to reduce transport related CO_2 emissions.

Specific measures are proposed to reduce GHG emissions during the construction phase:

- A total of approx. 27,000 m^3 of excavated material generated during the construction phase will be reused on site. This material re-use represents an avoidance of GHG emissions of 172 tCO_2e (if avoidance of recycling disposal is assumed), and has been accounted for in the total GHG emissions discussed in Section 16.3.1.1; and
- Lower carbon structural concrete composed of at least 25% ground granulated blast-furnace slag (GGBS), instead of a standard concrete mix, will be utilised in concrete based structures. This represents GHG savings of approximately 0.6 tCO2e (assuming a C32/40 mix).

In terms of impact on the proposed development due to climate change, during construction the Contractor will be required to mitigate against the effects of extreme rainfall/flooding through site risk assessments and method statements. The Contractor will also be required to mitigate against the effects of extreme wind/storms, temperature extremes through site risk assessments and method statements. All materials used during construction will be accompanied by certified datasheets which will set out the limiting operating temperatures. Temperatures can affect the performance of some materials, and this will require consideration during construction. During construction, the Contractor will be required to mitigate against the effects of fog, lighting and hail through site risk assessments and method statements.

12.6.2 Operational Phase

The proposed development by design will reduce GHG emissions during the operational phase as follows:

- An estimated 3,253,600 tonnes of bio-based fertiliser will be produced over the lifetime of the proposed development and distributed back to the feedstock (crop) suppliers, completing the proposed development's circular economy process. This bio-based fertiliser is the remaining by-product from the anaerobic digestion process and in this state is a product instead of a waste. This avoidance of a waste stream represents a total emissions offset of approx. 1,883,700 tCO_2e (1.9 Mt tCO_2e) over the lifetime of the proposed development (if avoidance of landfill disposal of organic waste is assumed); and
- The same truck which delivers the feedstock will also collect a load of bio-based fertiliser, reducing the number of truck movements. This efficiency results in an emission offset of approx. 20,580 tCO_2e.

Some measures have been incorporated into the of the development to mitigate the impacts of future climate change. For example, adequate attenuation and drainage have been incorporated to avoid potential flooding impacts due to increased rainfall events in future years. These measures have been considered when assessing the vulnerability of the proposed development to climate change (see **Section 12.6**).

12.7 Residual Impacts

The proposed development will result in GHG emissions offsets through using feedstock to produce biogas, thereby avoiding methane emissions, and displacement of fossil methane by biogas, thereby avoiding use of a more carbon intensive fuel. This is a positive impact on Ireland's greenhouse gas emissions, in line with CAP24 and Ireland's GHG net zero by 2050 trajectory. TII state that the crux of assessing significance is "*not whether a project emits GHG emissions, nor even the magnitude of GHG emissions alone, but whether it contributes to reducing GHG emissions relative to a comparable baseline consistent with a trajectory towards net zero by 2050*". As per the assessment criteria in **Table 12.3** the effect of GHG emissions during the construction and operational phase which is ***direct, long-term, positive*** and ***slight,*** which is overall ***not significant***.

In relation to climate change vulnerability, it has been assessed that the effect on the proposed development as a result of climate change is ***direct, long-term, negative*** and ***imperceptible***.

12.8 Indirect and/or Secondary Impacts

The significance of effect of the impacts assessed has been described in terms of direct or indirect effects in Sections **12.5** and **12.7**. All impacts assessed will have direct effects, and there are no other residual indirect and/or secondary effects as a result of the proposed development.

12.9 Monitoring Requirements

There is no proposed monitoring during the construction phase or during the operational phase.

12.10 Interactions

Climate has the potential to interact with a number of other environmental attributes.

12.10.1 Hydrology and Hydrogeology

The impact of flood risk has been assessed and the surface water drainage network will be designed to cater for increased rainfall in future years as a result of climate change. The effect of the interactions between climate and land, soils and ground water (Chapter 10 – Hydrology and Hydrogeology) are direct, short-term, negative and imperceptible during the construction phase and direct, long-term, negative and imperceptible during the operational phase, which is overall not significant in EIA terms.

12.10.2 Air Quality

Air quality (Chapter 11 – Air Quality (including Odour)) and climate have interactions due to the emissions from the burning of fossil fuels during the construction and operational phases generating both air quality and climate impacts. Air quality modelling outputs are utilised within the climate chapter. There is no impact on climate due to air quality; however, the sources of impacts on air quality and climate are strongly linked.

12.10.3 Traffic and Transportation

During the construction and operational phase, there is the potential for interactions between climate and traffic (for more information see Chapter 14 - Traffic and Transportation). Vehicles accessing the site will result in emissions of CO2, a greenhouse gas. The effects of the proposed development on air quality are assessed by reviewing the change in annual average daily traffic on roads close to the site. In this assessment, the effects of the interactions between traffic and climate are considered to be direct, short-term, negative and not significant during the construction phase and direct, long-term, negative and not significant during the operational phase, which is overall not significant in EIA terms.

12.10.4 Waste

Waste (Chapter 15 – Material Assets – Waste) management measures will be put in place to minimise the amount of waste entering landfill, which has higher associated embodied carbon emissions than other waste management such as recycling. The effect of the interactions between waste and climate are considered to be direct, short-term, negative and not significant during the construction phase and direct, long-term, negative and not significant during the operational phase, which is overall not significant in EIA terms.

12.11 Cumulative Impacts

With respect to the requirement for a cumulative assessment PE-ENV-01104 (TII, 2022) states that "*for GHG Assessment is the global climate and impacts on the receptor from a project are not geographically constrained, the normal approach for cumulative assessment in EIA is not considered applicable.*"

However, by presenting the GHG impact of a proposed development in the context of its alignment to Ireland's trajectory of net zero and any sectoral carbon budgets, this assessment will demonstrate the potential for the proposed development to affect Ireland's ability to meet its national carbon reduction target. Therefore, the assessment approach is considered to be inherently cumulative.

12.12 Difficulties Encountered

There were no difficulties encountered in compiling this assessment.

12.13 References

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- Transport Infrastructure Ireland (TII) (2022) PE-ENV-01104: Climate Guidance for National Roads, Light Rail and Rural Cycleways (Offline & Greenways) – Overarching Technical Document
- Transport Infrastructure Ireland (TII) (2024) GE-ENV-01106: TII Carbon Assessment Tool for Road and Light Rail Projects and User Guidance Document