Limerick WWTP Upgrade and Regional Bioresource Centre

EIAR Chapter 9 - Climate

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Formerly JB Barry Partners who became part of Egis in 2023

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GLOSSARY AND DEFINED TERMS

Acronym	Description
AD	Anaerobic Digestion
AGS	Aerobic Granular Sludge
BC	Bioresource Centre
BSI	British Standards Institute
CAP	Climate Action Plan
CCRA	Climate Change Risk Assessment
CHP	Combined Heat and Power
EC	European Commission
ECMRWF	European Centre for Medium-Range Weather Forecasts
EIAR	Environmental Impact Assessment Report
EPA	Environmental Protection Agency
EU	European Union
EU ETS	European Union Emissions Trading System
GHG	Greenhouse Gas
GHGA	Greenhouse Gas Assessment
HGV	Heavy Goods Vehicle
IPCC	Intergovernmental Panel on Climate Change
ISEP	Institute of Sustainability and Environmental Professionals
ISO	International Organisation Standard
LULUCF	Land Use, Land-use Change and Forestry
NAF	National Adaptation Framework
NCCRA	National Climate Change Risk Assessment
NDC	Nationally Determined Contributions
RBC	Regional Bioresource Centre
RCP	Representative Concentration Pathways
SuDS	Sustainable Urban Drainage Systems
THP	Thermal Hydrolysis Process
TII	Transport Infrastructure Ireland
UNFCCC	United Nations Framework Convention on Climate Change
WFD	Water Framework Directive
WWTP	Wastewater Treatment Plant
WQWSI SAP	Water Quality and Water Services Infrastructure Sectoral Adaptation Plan

9 CLIMATE

9.1 Introduction

9.1.1 Purpose of this Report

This chapter assesses the likely climate impacts and the impact of climate change risks on the proposed development located in Co. Limerick. A full description of the development is available in Chapter 3 (The Proposed Development).

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.
- Climate Change Risk Assessment (CCRA) – Identifies the impact of a changing climate on a project and receiving environment. The assessment considers a projects vulnerability to climate change and identifies adaptation measures to increase project resilience.

9.1.2 Outline Project Description

The Proposed Development will cater for future population growth and industrial development in the area, in line with population projections for Limerick as set out in the National Planning Framework (NPF) Implementation Roadmap and the Southern Region Regional Economic Spatial Strategy (RSES). It will provide 20% Headroom allowance, in line with Uisce Éireann guidelines for large urban settlements. It will also ensure the WWTP continues to comply with requirements of the EPA Wastewater Discharge License (WWDL), Urban Wastewater Treatment Regulations (UWWTR) and other relevant Uisce Éireann Guidelines.

The initial upgrade works will cater for the +10-year growth projections, increasing to 285,000 PE including a future industrial committed load of 27,500 PE. There will be provision made in the civil infrastructural development of the plant (tank sizing and pipework) for the +25-year growth projections of 325,000 PE. However, a planning review will be required before any uplift above 285,000 PE can be instated.

9.2 Methodology

9.2.1 Relevant Legislation, Policy and Guidelines

In common with all environmental legislation, in Ireland climate legislation is driven primarily by international agreements or European Directives that are then transcribed into domestic law by the Government of Ireland. This is then interpreted through European and domestic policy instruments that clarify aspects, objectives, targets and requirements described in the legislation.

9.2.1.1 Guidance

The principal guidance and best practice documents used to inform the assessment of potential impacts on climate are summarised below. In addition to specific climate guidance documents, the following EIA guidelines were considered and consulted in the preparation of this chapter:

- Guidelines on the Information to be Contained in Environmental Impact Assessment Reports (hereafter referred to as the Environmental Protection Agency (EPA) Guidelines) (EPA, 2022); and
- Environmental Impact Assessment of Projects – Guidance on the Preparation of the Environmental Impact Assessment Report (European Commission, 2017).

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:

- Environmental Protection Agency (2024) National Climate Change Risk Assessment. Technical Guidance for Sectoral assessment;
- Transport Infrastructure Ireland (TII) PE-ENV-01104: Climate Guidance for National Roads, Light Rail and Rural Cycleways (Offline & Greenways) – Overarching Technical Document (TII, 2022a);
- Transport Infrastructure Ireland (TII) GE-ENV-01106: TII Carbon Assessment Tool for Road and Light Rail Projects and User Guidance Document (TII, 2025);
- Intergovernmental Panel on Climate Change (IPCC) (2023) 6th Synthesis report;
- International Organization for Standardization (ISO) (2021) ISO 14091:2021. Adaptation to climate change-Guidelines on vulnerability, impacts and risk assessment;
- Institute of Sustainability & Environmental Professionals (ISEP) (formerly known as IEMA) Environmental Impact Assessment Guide to: Assessing GHG Emissions and Evaluating their Significance (hereafter referred to as the ISEP GHG guidance) (ISEP, 2022);
- ISEP Environmental Impact Assessment Guide to: Climate Change Resilience and Adaptation (hereafter referred to as the ISEP Climate Change guidance) (ISEP, 2020a);
- ISEP GHG Management Hierarchy (hereafter referred to as the ISEP GHG Management Hierarchy) (ISEP, 2020b);
- ISEP Principles Series: Climate Change Mitigation & EIA (ISEP, 2010);
- Publicly Available Specification (PAS) 2080:2016 on Carbon Management in Infrastructure (BSI, 2016); and
- Technical Guidance on the Climate Proofing of Infrastructure in the Period 2021-2027 (European Commission, 2021a).

9.2.1.2 Legislation

The **United Nations Paris Agreement** (United Nations, 2015) treaty binds signatory nations to a commitment to hold global average temperature increase well below 2°C above pre-industrial levels with efforts to limit the increase to 1.5°C below pre-industrial levels. Signatories commit to Nationally Determined Contributions (NDCS) which are self- defined climate pledges made by countries in response to climate change, which also includes the direction of finance. Adaptation to the adverse impacts of climate change and lowering greenhouse gas emissions should be undertaken in an equitable manner so as not to disadvantage populations on lower incomes or those most at risk from climate change.

Regulation (EU) 2021/1119 of the European Parliament and of the Council of 30 June 2021 establishing the framework for achieving climate neutrality and amending Regulations (EC) No 401/2009 and (EU) 2018/1999 (European Parliament and Council, 2021) follows from the Paris Agreement and writes into EU law the goal set out in the European Green Deal for Europe's economy and society to become climate-neutral by 2050. The law also sets the intermediate target of reducing net greenhouse gas (GHG) emissions by at least 55% by 2030, compared to 1990 levels. These targets are also applied to member states.

Directive 2014/52/EU of the European Parliament and of the Council of 16 April 2014 amending Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment (European Parliament and Council, 2014) acknowledges that climate change will play a crucial role in the sustainable development of society. Directive 2014/52/EU requires assessment of the impact of specific types of new development on the climate. There is a requirement for the quantification of greenhouse gases from a development, and an assessment of the risk posed to specific types of new development by the adverse effects of climate change.

The **Climate Action and Low Carbon Development Act 2015** (Government of Ireland, 2015) enables Ireland '*to pursue, and achieve, the transition to a low carbon, climate resilient and environmentally sustainable economy by the end of the year 2050*'. This is referred to in the 2015 Act (as amended) as the '*national transition objective*'. The 2015 Act (as amended) made provision for a national mitigation plan, and a national adaptation framework. In addition, the 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.

Section 15 of the 2015 Act, sets out the duties imposed by certain bodies, including local authorities and An Coimisiún Pleanála. This section was amended by the 2021 Act and states:

"(1) A relevant body shall, in so far as practicable, perform its functions in a manner consistent with—

(a) the most recent approved climate action plan,

(b) the most recent approved national long term climate action strategy,

(c) the most recent approved national adaptation framework and approved sectoral adaptation plans,

(d) the furtherance of the national climate objective, and

(e) the objective of mitigating greenhouse gas emissions and adapting to the effects of climate change in the State.".

The **Climate Action and Low Carbon Development (Amendment) Act 2021** (Government of Ireland, 2021) provides the framework for Ireland to achieve a climate resilient and climate neutral economy by the end of the year 2050. The Act allows for the setting of carbon budgets and sectoral emissions ceilings to apply to sectors of the economy whilst promoting climate justice and just transition to the climate resilient and climate neutral economy. Carbon budgets are determined based on the requirements for reductions in GHG described in *EU Regulation 2018/842* and *EU Regulation 2018/842*. The Climate Action and Low Carbon Development (Amendment) Act 2021 should be read together with the Climate Action and Low Carbon Development Act 2015, and together are referred to in this report as the "Climate Act".

The **EU Industrial Emissions Directive** (Directive 2010/75/EU, as amended by Directive (EU) 2024/1785) aims to control the environmental impact of industrial installations, reduce harmful emissions to human health and the environment, while supporting the transition of EU industry towards resource efficiency, decarbonisation and circularity.

The directive establishes an integrated framework for the permitting and operation of industrial installations. Under this framework, operators must apply best available techniques (BAT), ensure effective prevention and reduction of emissions to air, water and land, prevent the generation of waste, use energy and resources efficiently, and ensure a high level of protection of the environment as a whole.

9.2.1.3 Policy

The **European Green Deal** published by the European Commission in December 2019, provides an action plan which aims for the EU to achieve climate neutrality by 2050. The EU Green Deal highlights a reduction in emissions of 55% in comparison to 1990 levels by 2030 and 90% by 2040. The deal outlines plans for a just and fair transition to a climate neutral society though funding and social investment, carbon pricing, the Emissions Trading Scheme, green industry, the circular economy and stakeholder engagement in the processes at every level.

The Energy Efficiency Directive (2023) forms part of the European Green Deal aimed at improving energy efficiency across all sectors of society. The recast 2023 EED strengthens previous measures and sets targets for improving energy efficiency across the EU. Through promoting the more efficient use of energy, it supports the transition to a climate neutral Europe, reduces carbon emissions and lowers energy bills for citizens and businesses.

Methane is the second biggest contributor to climate change after carbon dioxide (EU Commission (2020). **The EU Methane Strategy** therefore sets out measures to accurately measure, report and reduce methane from agriculture, waste and energy production. Mitigation measures include: providing targeted support to accelerate the development of the market for biogas from sustainable sources and conducting a review of the Landfill Directive, Urban Waste Water Treatment Directive and Sewage Sludge Directive.

Ireland's **National Biomethane Strategy** (Government of Ireland, 2024) is Ireland's first major policy statement on biomethane and is an important milestone in the development of an indigenous sector. The Strategy sets out twenty-five actions to be delivered in the coming years to enable the development of the sector and to achieve the government's target of 5.7 TWh of indigenously produced biomethane by 2030. The publication of this Strategy was coupled with the launch of grant aid towards development of the sector which is expected to drive expansion of the anaerobic digestion sector towards achieving the 2030 target.

Biomethane that satisfies the Renewable Energy Directive's life cycle sustainability criteria can be classified as "a zero-carbon rated fuel". Biomethane can therefore directly contribute to meeting Ireland's decarbonisation targets.

Currently under consultation for the next revision, the **National Wastewater Sludge Management Plan** (Uisce Eireann, 2016) aims to ensure sludge is treated, transported, stored and reused/ disposed of safely and sustainably, protecting public health and the environment. The plan aims to support a circular economy which is standardised nationwide and is in compliance with EU regulations.

The **2021 EU Strategy on Adaptation to Climate Change** (European Commission, 2021a) sets out the pathway to prepare for the unavoidable impacts of climate change. The aim is that "by 2050, when we aim to have reached climate neutrality, we will have reinforced adaptive capacity and minimised vulnerability to climate impacts…"

The latest iteration of the Government of Ireland's ***Climate Action Plan*** (CAP25) (Government of Ireland, 2025a) was published in 2025 updating many of the suggested measures and actions required to achieve carbon budgets and sectoral emissions ceilings from CAP24, (Government of Ireland, 2024a). Both CAP24 and CAP25 should be read together. The plans taken together provide the roadmap for halving Ireland's emissions by 2030 and achieving carbon neutrality by 2050. CAP25 details the 5-year carbon budget periods, shown in Table 9-1 and the Sectoral Emissions Ceilings, shown in Table 9-2, as required by the Climate Act.

TABLE 9-1 5-YEAR CARBON BUDGETS 2021 TO 2035

BUDGET PERIOD	CARBON BUDGET	REDUCTION REQUIRED
2021-2025	295 Mt CO_2e	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 9-2 SECTORAL EMISSIONS CEILINGS 2030 (GOVERNMENT OF IRELAND, 2025)

SECTOR	BASELINE ($MTCO_2e$)	CARBON BUDGETS ($MTCO_2e$)		2030 EMISSIONS ($MTCO_2e$)	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
Industry	7	30	24	4	35
Agriculture	23	106	96	17.25	25
Other (F-gases, waste, petroleum refining)	2	9	8	1	50

SECTOR	BASELINE ($MTCO_2e$)	CARBON BUDGETS ($MTCO_2e$)		2030 EMISSIONS ($MTCO_2e$)	INDICATIVE EMISSIONS % REDUCTION IN FINAL YEAR OF 2025 – 2030 PERIOD (COMPARED TO 2018)
	2018	2021-2025	2026-2030		
Land Use, Land-use Change and Forestry (LULUCF)	5	Reflecting the continued volatility for LULUCF baseline emissions to 2030 and beyond, a new approach aligned with the EU LULUCF Regulation has been adopted.			
Total	68				
Unallocated Savings	-	-	26	-5.25	-
Legally Binding Carbon Budgets and 2030 Emission Reduction Targets	**-**	**295**	**200**		**51**

The **Long-Term Strategy on Greenhouse Gas Emissions Reductions** (Government of Ireland, 2023) provides the indicative pathways beyond 2030 on how Ireland will transition towards carbon neutrality by 2050. The strategy is intended to bridge the gap between the short-term objectives of the Climate Action Plans and the longer-term objectives of EU Climate Law and Ireland's National Climate Objective.

The **National Planning Framework (First Revision)** (Government of Ireland, 2025b) specifies policies relevant for the Proposed Development:

- National Policy Objective 1: Ensure that all plans, projects and activities requiring consent arising from the National Planning Framework are subject to the relevant environmental assessment requirements including SEA, EIA, SFRA and AA as appropriate.
- National Policy Objective 66: The planning system will be responsive to our national environmental challenges and ensure that development occurs within environmental limits, having regard to the medium and longer-term requirements of all relevant environmental and climate legislation and the sustainable management of our natural capital.
- National Policy Objective 77: Enhance water quality and resource management by: Ensuring that River Basin Management Plan objectives are fully considered throughout the physical planning process. Integrating sustainable water management solutions, such as Sustainable Urban Drainage (SUDS), non-porous surfacing and green roofs, and nature-based solutions, to create safe places.

9.2.1.4 Climate Change Vulnerability policy

The Second National Adaptation Framework (NAF) (Government of Ireland, 2024c), published in June 2024 under the Climate Action and Low Carbon Development Act 2015, outlines a comprehensive, whole-of-government and whole-of-society approach to climate adaptation. Its core objective is to enhance Ireland's resilience to a wide range of climate risks, including extreme weather events, flooding, drought, biodiversity loss, sea level rise, and rising temperatures.

Building on the principles of a "Just Transition", the NAF introduces the concept of "Just Resilience'', envisioning a climate-resilient Ireland that ensures fairness, equity, and inclusivity in adaptation planning and implementation. It promotes reduced reliance on fossil fuels, the expansion of electrified and accessible public transport, and the integration of sustainability and climate resilience across all sectors. These include energy, water, wastewater, agriculture, transport, health, built environment, and biodiversity, with a strong emphasis on mainstreaming adaptation practices into policy, planning, and operations.

With respect to the wastewater sector, the 2nd NAF highlights several potential climate impacts and risks and adaptation measures:

- **Increased frequency and intensity of rainfall** events may overwhelm combined sewer systems, leading to overflows and pollution incidents. This necessitates the upgrading of sewer infrastructure, separation of stormwater and wastewater systems, and enhanced real-time monitoring and control systems.
- **Flooding and sea level rise** pose risks to low-lying wastewater treatment plants and pumping stations, requiring flood defences, elevation of critical infrastructure, and relocation strategies for highly vulnerable assets.
- **Extended drought** periods can reduce dilution capacity in receiving waters, impacting effluent discharge standards and ecological health. Adaptive responses include improved water reuse systems, advanced treatment technologies, and dynamic discharge permitting.
- **Temperature increases** may affect biological treatment processes, altering microbial activity and reducing treatment efficiency. This calls for process optimization, temperature-resilient technologies, and contingency planning for operational adjustments.
- **Storm surges and coastal erosion** threaten coastal wastewater infrastructure, prompting the need for reinforced structural designs, strategic retreat planning, and integration of nature-based solutions such as constructed wetlands for resilience.
- **Power outages during extreme weather events** can disrupt wastewater operations, highlighting the importance of backup power systems, decentralised treatment options, and emergency response protocols.

The Water Quality and Water Services Infrastructure Sectoral Adaptation Plan (WQWSI SAP) (Government of Ireland, 2025a) outlines how Ireland intends to implement the measures set out in the NAF through 59 actions which were assessed to determine their long-term consequences, to avoid maladaptation. The 'live' document will be regularly updated to account for changing science and socio-economic conditions. The WQWSI SAP will be used by policy makers, implementing organisations and stakeholders within the water sector to further inform detailed adaptation planning.

The National Climate Change Risk Assessment Main Report (NCCRA) was published in June 2025 (EPA, 2025d). The NCCRA was required to be developed under Action 457 from the 2021 CAP (Government of Ireland, 2021). Action 457 seeks to "Further develop Ireland's national climate change risk assessment capacity to identify the priority physical risks of climate change to Ireland'. The NCCRA uses definitions of the risk determinants from the Intergovernmental Panel on Climate Change (IPCC) Risk Framework (IPCC, 2023):

- **Hazard** - the potential occurrence of a natural or human-induced physical event or trend or physical impact that may cause loss of life, injury, or other health impacts, as well as damage and loss to property, infrastructure, livelihoods, service provision, ecosystems, and environmental resources
- **Exposure** - the presence of people, livelihoods, species or ecosystems, environmental functions, services, and resources, infrastructure, or economic, social, or cultural assets in places and settings that could be adversely affected
- **Sensitivity** - refers to the degree to which a system or asset is affected by climate hazards. It reflects how vulnerable something is to changes such as temperature extremes, flooding, or drought, based on its physical, functional, or ecological characteristics.
- **Vulnerability** - the propensity or predisposition to be adversely affected. Vulnerability encompasses a variety of concepts including sensitivity
- **Risk** - the potential for adverse consequences for human or ecological systems.

When considering risk, the NCCRA assess exposure and vulnerability for two future climate change scenarios or Representative Concentration Pathways (RCPs):

- **RCP4.5** was selected as it represents a scenario aligned with the global temperature trajectory
- **RCP8.5** was selected as it represents a high-emissions scenario and achieves the highest level of modelled temperature increases by the end of the century. Consequently, this scenario will result in the highest level of physical risk for Ireland, and therefore the greatest requirement for adaptation.

These scenarios align with a conservative approach to assess risks to Ireland and assumes global emission reduction targets are not met. This aligns with the principle of precaution as stated in the NAF (Government of

Ireland, 2024b). In addition to the future climate scenarios, the NCCRA assesses the risk from the future climate during the following timeframes:

- Present (~2030)
- Medium term (2040-2070) (~ 2050)
- Long term (2070-2100) (~2100)

9.2.1.5 Local Policy

Local Authority GHG policy

The Limerick City and County Council Climate Action Plan 2024–2029 (LCCC, 2024) outlines the council's strategic approach to climate mitigation and adaptation, aiming to reduce greenhouse gas (GHG) emissions by 51% by 2030 (from a 2018 baseline) and to achieve climate neutrality by 2050. The plan is structured around a place-based approach, aligning with national and EU climate objectives, and is designed to support a just transition for communities across Limerick.

The plan is built on five key thematic areas:

- Buildings and Energy;
- Transport;
- Environment and Nature-Based Solutions;
- Flood Resilience; and
- Circular Economy and Resource Management

Strategic vison of LCC– "*A Green City Region on the Waterfront By 2030, Limerick will become a green City region on the Shannon Estuary connected through people and places. This will be achieved through engagement, innovation, resilient urban development and self-sustaining rural communities*".

Local Climate Change Vulnerability Policy

The LCC Climate Action Plan 2024 - 2029 highlights the risks that climate change poses, with risks mainly associated with extreme weather events. The future risks of climate change hazards as identified and reproduced from the LCC Climate Action Plan 2024 - 2029 are shown in Figure 9-1.

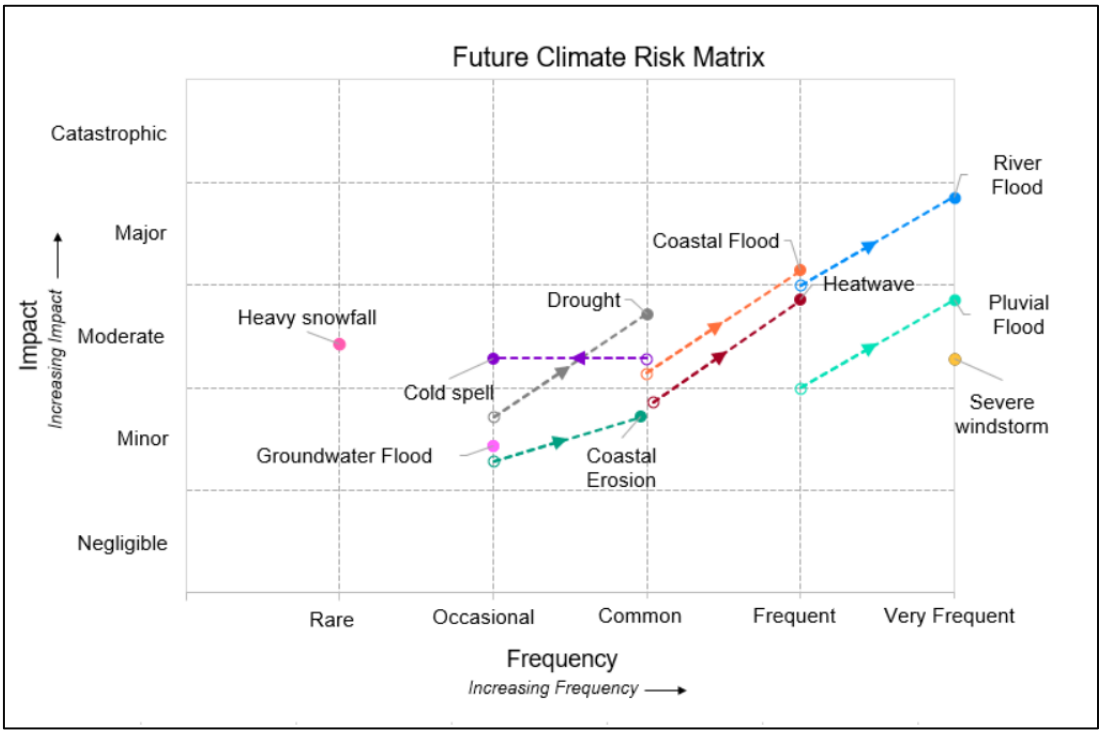

FIGURE 9-1 ASSESSMENT OF FUTURE CLIMATE HAZARDS IN LIMERICK CITY AND COUNTY (LCCC,2024)

The risk matrix on the right shows the future change in risk with the hollow marker showing the current risk and the solid marker the future risk. The dotted line shows the change between the current and future risk. The risk of existing hazards such as river, pluvial, and coastal flooding and coastal erosion is projected to increase in the future because of projected increases in the frequency of heavy precipitation events, rising sea levels and associated increases in inundation extent and depth. Heatwaves and droughts, although already experienced in Limerick City and County, are expected to occur more frequently due to climate change and with a greater impact on Limerick City and County in the future. These hazards can therefore be considered as resulting in emerging risks for the region. Although the frequency and impact of severe windstorms is thought to be unchanged in the future, these events will remain a risk for Limerick City and County. The level of impact associated with cold spells for Limerick City and County remains constant, however, due to the potential decrease in hazard frequency, the overall risk of these hazards is likely to reduce in the future, resulting in a lesser risk.

9.2.2 Appraisal Method for the Assessment of Impacts

9.2.2.1 Greenhouse Gas Assessment Methodology

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 9.3.3).

Construction Phase

The GHG assessment has been conducted following the TII PE-ENV-01104 guidance (TII, 2022a). PE-ENV-01104 (TII, 2022a) recommends the calculation of the construction stage GHG emissions, including embodied carbon, using the TII Online Carbon Tool (TII, 2025). 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, 2025) has been commissioned by TII to assess GHG emissions associated with road or rail projects using Ireland-specific emission factors and data. However, the tool can be used to estimate the GHG emissions from other development types such as the proposed project as a number of the material types and activities are somewhat similar. The tool 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 tool aligns with PAS 2080.

The purpose of the embodied carbon assessment is to engage the design team in the consideration of embodied carbon at an early stage in the development and mitigate embodied carbon. This engagement aims to ensure carbon savings are made and to assist in aligning the project to Ireland's CAP goal of Net Carbon Zero by 2050.

The TII Carbon Tool has been used to assess the GHG emissions associated with excavation works, construction materials, material transport, energy usage during construction and construction worker travel. Reasonable conservative estimates have been used in this assessment where necessary to provide an estimate of the GHG emissions associated with the proposed development.

Operational Phase

Operational phase emissions are linked with the ongoing energy, transport and waste requirements of the site. For the proposed development GHG emissions associated with future energy demand has been calculated. Avoided carbon associated with the use of biogas produced on site and used to generate heat and power has also been considered. A qualitative assessment of operational waste and transport has been undertaken as part of the GHG Assessment as due to the nature of the proposed development, volumes are negligible.

9.2.2.2 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,

2022a) 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, 2022a) is based on ISEP GHG Guidance (ISEP, 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 ISEP GHG Guidance (ISEP, 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 TII 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 ISEP GHG Guidance (ISEP, 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 9-3 (derived from Table 6.7 of PE-ENV-01104 (TII 2022a)) and EPA (2022) guidance 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.

TABLE 9-3 SIGNIFICANCE CRITERIA FOR GHGA

Effects	Significance Level	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.

Effects	Significance Level	Description
		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	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.

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 (Government of Ireland, 2025a). With the publication of the Climate Action Act in 2021 and CAP25, sectoral carbon budgets have been published for comparison with the net GHG emissions from the proposed development over its lifespan.

9.2.2.3 Climate Change Risk Assessment Methodology

As per the TII PE-ENV-01104 guidance (2022), an initial screening of risk during the operational phase is conducted. 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 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.

First an initial screening of physical hazards is carried out based on the proposed site location. This is a qualitative screening which intends to only proceed with relevant hazards (e.g., sea level rise is not an applicable hazard to inland areas or wildfire is not considered a hazard in an urban location). Following this all-relevant hazards are assessed on their exposure under future climate change.

The sensitivity is based on a High, Medium or Low rating with a score of 1 to 3 assigned as per the criteria below.

- **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 project location irrespective of the project type. For example, flooding could be a risk if the project location is next to a river in a floodplain. 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.

For this project, future climate risk has been assessed using the 2050s timeframe.

9.2.2.4 Significance Criteria for CCRA

The CCRA involves an initial screening assessment to determine the vulnerability of the proposed development to various climate hazards. The vulnerability is determined by combining the sensitivity and the exposure of the proposed development to various climate hazards.

Vulnerability = Sensitivity x Exposure

The vulnerability assessment takes any proposed mitigation into account. Table 9-4 details the vulnerability matrix; vulnerabilities are scored on a high, medium and low scale.

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

However, 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.

TABLE 9-4 VULNERABILITY MATRIX

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

The screening CCRA, detailed in Section **Error! Reference source not found.**, 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 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 9.5.

9.3 Baseline Environment

PE-ENV-01104 (TII, 2022) and the EIA Directive (2014) state that a baseline climate scenario should identify,

consistent with the study area for the project, GHG emissions without the project for both the current and future baseline.

9.3.1 Current GHG Baseline

9.3.1.1 National GHG baseline

Data published in July 2025 (EPA, 2025a), indicates that Ireland exceeded, without the use of flexibilities, its 2024 annual limit set under EU's Effort Sharing Decision (ESD) (406/2009/EC) by 1.03 Mt CO_2e. However, the 2024 emissions represent the second consecutive year in which Ireland's emission were below (-4.2%) 1990 levels. ETS (Emissions Trading Scheme) emissions decreased (-1.1%) and ESR (Effort Sharing Regulation) emissions decreased (-2.2%). Ireland's target is an emission reduction of 626 kt of CO_2e by 2030 on an average baseline of 2016 to 2018.

The EPA estimate that 2024 total national GHG emissions, excluding LULUCF, have decreased by 2.0% on 2023 levels to 53.82 Mt CO_2e, with a 0.7 Mt CO_2e (-8.9%) reduction in electricity industries alone. This was driven by a 39.7% share of energy from renewables in 2024 and the complete phase-out of peat for electricity generation. Manufacturing combustion and industrial processes decreased by 4.6% to 6.0 Mt CO_2e in 2024 due to declines in fossil fuel usage. The sector with the highest emissions in 2024 was agriculture at 37.9% of the total, followed by transport at 20.8%. For 2024, total national emissions (including LULUCF) were 57.64 Mt CO_2e (EPA, 2025a) Table 9-5.

The current estimates of national greenhouse gas emissions (including LULUCF) in 2024 are 12.0% below 2018, well off the national climate ambition of a 51% reduction by 2030. The data indicate that from 2021- 2024 Ireland has used 82.8% (243.3 Mt CO_2e) of the 295 Mt CO_2e carbon budget for the five-year period 2021-2025. This leaves 17.5% of the budget available for 2025, requiring a substantial 10.3% annual emissions reduction for 2025 to stay within budget.

TABLE 9-5 TRENDS IN TOTAL NATIONAL GHG EMISSIONS 2021 – 2024

Sector *Note 1*	2021	2022	2023	2024	Total Budget (Mt CO_2e) (2021-2025)	% Budget 2021-2025 Used	Annual Change 2023 to 2024
Electricity	9.89	9.69	7.57	6.95	40	85.25%	-8.19%
Transport	11.09	11.76	11.8	11.65	54	85.74%	-1.27%
Buildings (Residential)	6.87	5.75	5.35	5.61	29	81.31%	4.86%
Buildings (Commercial and Public)	1.44	1.45	1.39	1.49	7	82.43%	7.19%
Industry	7.09	6.62	6.31	6.01	30	86.77%	-4.75%
Agriculture	21.94	21.78	20.72	20.41	106	80.05%	-1.50%
Other *Note 2*	1.86	1.93	1.81	1.63	9	80.33%	-9.94%
LULUCF	4.63	3.98	3.89	3.89	–	–	0
Total including LULUCF	**64.82**	**62.99**	**58.83**	**57.64**	**295**	**82.81%**	**-2.04%**

Note 1 Reproduced from latest emissions data from the EPA (EPA, 2025a).

Note 2 Other includes Petroleum refining, F-Gases and Waste (emissions from solid waste disposal on land, solid waste treatment (composting and anaerobic digestion), wastewater treatment, waste incineration and open burning of waste).

9.3.1.2 Proposed Development GHG Baseline

Based on information provided in the Energy and Climate Statement (Appendix 9.1, Volume 4 of this EIAR), operational energy demand at the Proposed Development is 8,606,246 kWh/yr, equivalent to 2,215 tCO2e. GHG emissions from traffic and transport have been scoped out of this assessment as the transport consultant has confirmed in Chapter 6 (Traffic and Transportation) that operational phase traffic will not exceed any of the TII criteria for a detailed assessment.

9.3.2 Future GHG 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 ISEP GHG guidance (ISEP, 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 CAP25, and future CAPs, alongside binding 2030 and net zero by 2050 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.

In May 2025, the EPA released the report *Ireland's Greenhouse Gas Emissions Projections 2024-2055* (EPA, 2025c), which includes total projected emissions and a breakdown of projected emissions per sector under the 'With Existing Measures' and 'With Additional Measures' scenarios. The EPA projections indicate that currently implemented measures (With Existing Measures) will achieve a reduction of 10% on 2005 levels by 2030, significantly short of the 42% reduction target. If measures in the higher ambition (With Additional Measures) scenario are implemented, EPA projections show that Ireland can achieve a reduction of 22% by 2030, still short of the 42% reduction target.

9.3.3 Current CCRA Baseline

The region of the proposed development has a temperate, oceanic climate, resulting in mild winters and relatively cooler summers when compared with continental Europe. This baseline data is derived from the European Centre for Medium-Range Weather Forecasts (ECMWF) ERA5 data reanalysis (ECMWF, 2023) which includes observed data from individual meteorological weather stations across Ireland from 1950-2023. This data is reanalysed to model a complete picture of Ireland's historical climate. This method has been chosen to ensure data can be analysed at the daily level and harmoniously compared with future scenarios as historical data from weather stations around Ireland and Limerick have gaps in records and variables. The baseline time-period referred to in this assessment was from 1991-2020 and is specific to county Limerick.

Figure 9-2 below shows the climatology for the 30-year period from 1991 to 2020 indicating the wettest months are from October through to January, with December (102mm) being the wettest. August is also notably wet (92mm) on average. The driest month on average was September (79mm), with February through to July also experiencing lower than average rainfall. Precipitation in Ireland is largely aligned to its oceanic climate, and it is no surprise that the wettest months align to the periods where low pressure Atlantic storms are most frequent.

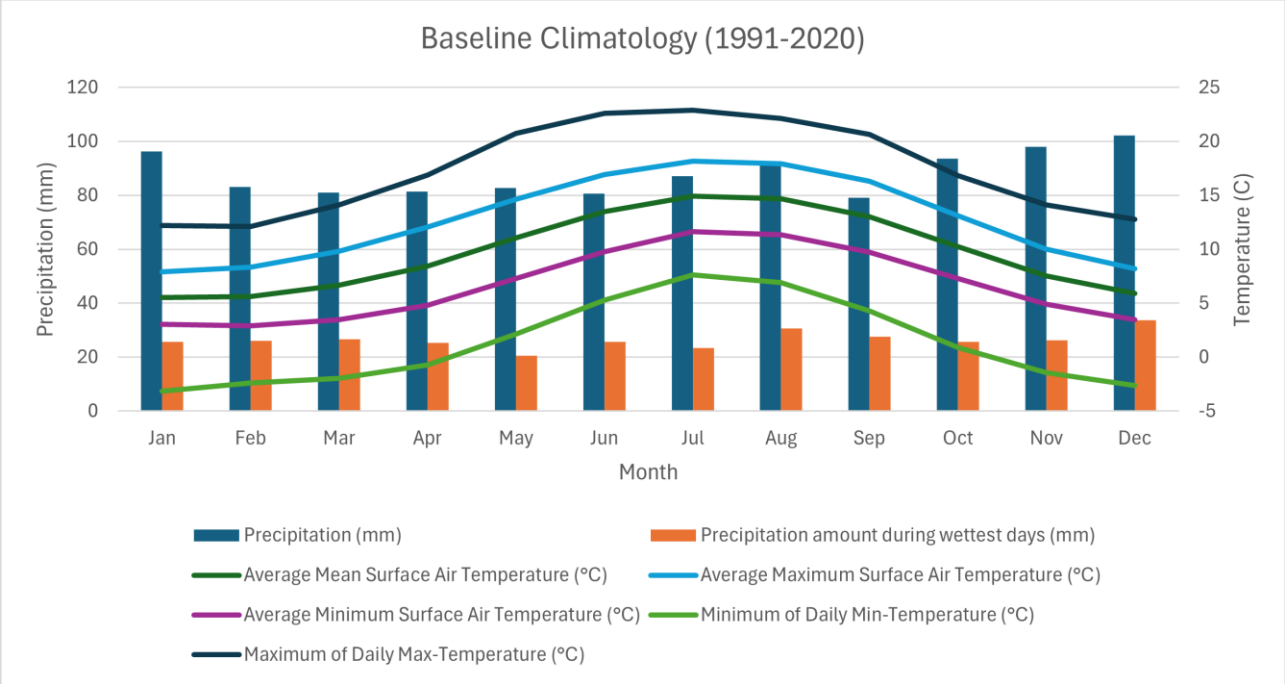

FIGURE 9-2 BASELINE CLIMATOLOGY FOR LIMERICK (1991-2020)

July was the warmest month with a mean temperature of 14.9°C with average mean surface temperatures across the summer months (July – August) >14°C. July is also the warmest month for maximum daily temperatures which showcases the higher value ranges recorded during a particular month. Across the summer months daily maximums >20°C with 23°C on average for July.

January is the coldest month with average mean surface air temperatures of 5.5°C. For daily minimum temperatures which references the lowest range values (10th percentile range). January remains the coldest at -3°C and several other winter and early spring months (November - March) also experiencing minimums of below 0°C

Historical records show Ireland has experienced several severe storms in the last decade, including a national record for wind speed during Storm Éowyn in January 2025. Storm activity is concentrated in winter (December–February), with an average of eight named storms annually (Met Éireann, 2025).

Historical data was taken from Shannon Airport Weather Station from 1990-2020 approximately 25km from the proposed development site and indicates a mean monthly wind speed of 9.1 knots (17 km/hr) and mean maximum gusts ≥44 knots (81 km/h) (Met Éireann, 2026).

Overall, the baseline climatology for the project site and region shows evidence of a high frequency of precipitation across the year with instances of very wet days (≥30mm) occurring across August and December. Winters are mild, with average minimums 3°C, and summers are relatively mild, with average maximums of +17°C but no significant risk of extreme heat or prolonged drought.

9.3.4 Future CCRA Baseline

Climate Change Impacts and Projections for Ireland

Ireland is already experiencing increased annual rainfall in the north and west, with more variable patterns in the south and east (EPA, 2021b). Key risks identified by the EPA relevant to the proposed project include:

- Increased likelihood of more frequent and intense North Atlantic low-pressure systems bringing high rainfall and storms.
- Greater risk of river flooding.
- Impact to water quality.

Climate Modelling and Planning

International best practice and national policy such as the NCCRA (2024) and PE-ENV-01104 (TII, 2022) recommends using two emission scenarios to project future climate change. This includes a moderate and high emission scenarios (RCP4.5 and RCP8.5) for future planning. These Representative Concentration Pathways (RCPs) reflect varying levels of global climate mitigation explained below.

- RCP 4.5 (a 'moderate' scenario) represents an approximate 2.4°C increase in global average temperatures (1.7-3.2°C). It assumes moderate mitigation efforts leading to stabilisation of emissions by mid-century and is generally aligned with current policies for emission reduction.
- RCP 8.5 (a 'worst case' / high emissions scenario) represents an approximate 4.3°C increase in global average temperatures (3.2-5.4°C) and assumes continued high emissions with minimal mitigation. This high-end scenario is useful for understanding potential impacts of current emission trends continue. Consequently, this scenario will result in the highest level of physical risk for Ireland, and therefore the greatest requirement for adaptation.

This climate change assessment uses the latest climate change projections, standardised and bias corrected, for Ireland available through the EPA and the TRANSLATE project (Met Éireann, 2023b).

9.3.4.1 Key Findings from Climate Projections

Table 9-6 presents the key findings from the analysis of future climate projections under two scenarios: a medium-emissions pathway (RCP4.5) and a high-emissions 'worst-case' pathway (RCP8.5). Both scenarios are compared against the site-specific baseline (1976–2005) derived from the Ireland TRANSLATE projections (EPA, 2025b) dataset and historical data taken from Shannon Airport (Met Eireann, 2023 & 2025). The table details the principal climate hazards and their projected changes under each scenario.

Projected changes include:

- Summer temperatures rising by over 1.5°C and overall mean temperatures increasing >1°C by mid-century under RCP8.5.
- Annual rainfall increasing by 25mm and 45mm under RCP4.5 and RCP8.5 respectively.
- Fewer frost days and cold winter nights and more frequent short heatwaves (≥5 days >25°C).
- Increased likelihood of more storms which may increase the risk of flooding due to deluge of rainfall which may be a factor in increased Max 1-day projections (+5mm).

TABLE 9-6 FUTURE CLIMATE CHANGE SUMMARY OF PROJECTIONS UNDER BOTH RCP SCENARIOS FOR 2050 PERIOD (2040-2070) TAKEN FROM THE EPA CLIMATE IRELAND TRANSLATE PROJECTIONS.

Climate Hazard	Indicator	Baseline	RCP4.5 (2040-2070)	RCP8.5 (2040-2070)
Temperature	*Mean temp (°C)*	10.4	11.4 (+1°C)	11.8(+1.4°C)
	Mean Max temp (°C)	14	15.1 (+1.1°C)	15.5(+1.5°C)
	Mean Min temp (°C)	6.7	7.8 (+1.1°C)	8.3 (+1.6°C)
Frost, Snowfall and Ice	*Frost Days Annually (no. days)*	27	15.5	12
Precipitation and Flooding	*Annual precipitation (mm)*	947	972 (+25)	992 (+45)
	Max 1-day (mm)	27	32 (+5)	33 (+6)
	No. Wet Days annually (>1mm)	178	173	173

Climate Hazard	Indicator	Baseline	RCP4.5 (2040-2070)	RCP8.5 (2040-2070)
Storms and high winds	*Number of Storms Qualitative (Description)*	On Average 8 named storms annually with speeds exceeding 100km/hr *(Note 1)*	Winter storm frequency is projected to increase, with a possible extension of the storm season. While the intensity of individual storms cannot be accurately projected, wind speeds are likely to remain above 100 km/hr.	
	Max Gust Speed (90th percentile) (knots) *Note 2*	61		
Drought	*Absolute Drought (≥ 15 days with less than 1mm)*	Rare	Marginal increase	Increased Likelihood
Lightning	*Qualitative (Descriptive)*	Occurring during summer periods	This hazard may modestly increase in the future due to more favourable conditions, such as rising temperatures and extended warm periods beyond the traditional summer season	
Note 1 Data from combined Met Éireann, UK Met Office and Dutch Meteorological services *Note 2 Data from Shannon Airport between 1976 - 2005*				

Recent weather patterns and records of extreme weather events recorded by Met Éireann have been reviewed. Considering the 2025 data, Met Éireann states that the latest Irish climate change projections indicate further warming in the future, including warmer winters and reduction in cold spells and subzero temperatures. This will result in longer dry periods and heavy rainfall events. 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.

Impacts resulting from climate change hazards will evolve and have the potential to include increases in global temperatures and increases in the intensity and frequency of rainfall days per year combined with increases in the intensity and frequency of low-pressure systems in the north Atlantic during the winter storm period. Therefore, it is expected that the climate over the proposed site in Limerick will evolve over time and consideration is needed with respect to this within the design of the proposed development.

9.3.5 Evolution of the Environment in the Absence of the Proposed development

In the Do-Nothing scenario, the site will remain as per the baseline and will change in accordance with trends within the wider area. The Do-Nothing scenario is considered neutral in terms of the climate assessment.

9.4 Potential Impacts

9.4.1 Greenhouse Gas Assessment

9.4.1.1 Construction Phase

The most significant proportion of GHG emissions tend to occur during the construction phase as a result of embodied carbon in construction materials and GHG emissions from construction activities including transport of materials (see Table 9-7 for details).

The construction phase of the Proposed Development is predicted to result in 14,304 tCO_2e (238 tCO_2e annualised). Of this, construction materials (concrete, steel and aggregates) make up 37%. A further 39% of GHG emissions are a result of construction transport including material deliveries to site. Fuel usage by construction plant contribute 15% and construction worker travel to site makes up 9% of construction emissions.

TABLE 9-7 CONSTRUCTION PHASE GHG ASSESSMENT RESULTS

GHG Assessment Category	Predicted GHG Emissions (tCO_2e)	Relevant Sector for Carbon Budget Comparison
Materials	5,289	Industry
Material Transport	5,532	Transport
Excavation	71	Industry
Construction energy use	2,085	Electricity
Construction Worker Travel	1,328	Transport
Total Construction Phase Emissions	**14,304 (3,576 annualised)**	**tCO_2e**

The GHG emissions from the construction phase as a total cannot be compared against one specific sector 2030 carbon budget. The emissions are broken down into different assessment categories and these must be compared separately to the relevant sectoral emissions budget. The predicted GHG emissions (as shown in Table 9-7) have been averaged over the construction period (4 years) to give the predicted annual emissions to allow for direct comparison with national annual emissions and targets.

In Table 9-8, GHG emissions have been compared against the carbon budget for the industry, transport and energy sectors in 2030 (Government of Ireland, 2025), against Ireland's total GHG emissions in 2024, against Ireland's EU 2030 target of a 42% reduction in non-ETS sector emissions based on 2005 levels (27.7 Mt CO_2e) (set out in Regulation EU 2018/842 of the European Parliament and of the Council).

The estimated total GHG emissions, when annualised over the 4-year proposed construction period, are equivalent to 0.01% of Ireland's total GHG emissions in 2024 and 0.01% of Ireland's non-ETS 2030 emissions target. Total annualised industry-related emissions are 0.03% of the 2030 Industry budget and the total annualised energy use emissions are 0.02% of the Energy Industries budget. The estimated annualised GHG emissions associated with transport-related activities are 0.03% of the 2030 Transport budget.

TABLE 9-8 ESTIMATED GHG EMISSIONS RELATIVE TO SECTORAL BUDGETS AND GHG BASELINE

Target/Sectoral Budget	(tCO_2e)	Annualised Development GHG Emissions (tCO_2e)		% of Relevant Target/ Budget
Ireland's 2024 Total GHG Emissions (existing baseline)	57,640,000	Total GHG Emissions	3,576	0.01%
Non ETS 2030 Target (42% of 2005 ETS Level)	27,722,000			0.01%
2030 Sectoral Budget (Industry Sector)	4,000,000	Total Industry Emissions	1,340	0.03%
2030 Sectoral Budget (Transport Sector)	6,000,000	Total Transport Emissions	1,715	0.03%
2030 Sectoral Budget (Energy Industries (including electricity generation)	3,000,000	Total Energy Emissions	521	0.02%

9.4.1.2 Operational Phase

The Energy and Climate Statement, prepared by Egis (Appendix 9.1, Volume 4 of this EIAR) sets out the benefits of the proposed development on operational GHG emissions. The WWTP emits direct GHG emissions from sludge treatment and biological wastewater and indirect GHG emissions from the electricity and heat demand required to operate processes.

However, the proposed development will minimise operational emissions through 'a combination of energy-efficient process selection, advanced monitoring and control systems, and maximised on-site renewable energy recovery'. A full description can be found in the Energy and Climate Statement, in summary:

- Aeration energy demand (electricity) reduced by installation of new plant;
- Thermal Hydrolysis Process (THP) enhances biogas generation during anaerobic digestion which will be utilised through Combined Heat and Power to offset electrical and thermal demands;
- THP also reduces biosolids production. Due to the increased treatment capacity of the Proposed Development, GHG emissions associated with transportation of sludge offsite would significantly increase if the THP process was not incorporated into the design. The biosolids that are produced will be reused as fertiliser further reducing downstream emissions associated with the production of synthetic fertilisers;
- Increased biogas storage capacity will increase the efficiency of renewable energy generation and reduce need for flaring.

Operational energy demand at the proposed development is 8,606,246 kWh/yr, equivalent to 2,215 tCO_2e. The upgraded biogas production facility from the Regional Bioresource Centre has the potential to generate 8,768,000 kWh/yr. The upgraded plant therefore has the potential to be self-sufficient and carbon neutral in its main operations.

9.4.1.3 GHGA Significance of Effects

TII reference the ISEP guidance (2022) which states 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".

The proposed project will result in GHG emissions during the construction and operational phases; however the proposed project will minimise its impacts through design and management measures (see Section 9.5). The Energy and Climate Statement (Appendix 9.1, Volume 4 of this EIAR) clearly sets out how the proposed development will mitigate against climate impacts throughout the construction period as described in Section 9.5. During the operational phase, the upgrades associated with the proposed development will significantly reduce the carbon intensity of direct and indirect GHG emissions compared to the existing facility. The proposed development will be largely self-sufficient in terms of energy demand.

The level of mitigation described in Section 9.5 has therefore been taken into account when determining the significance of the proposed project's GHG emissions.

According to the TII significance criteria described in Section 9.2.2.2 and Table 9-3, the significance of the GHG emissions during the construction and operational phase is **minor adverse**. The proposed development aligns with the following GHG significance criteria as per Table 9-3:

- 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.

The ISEP GHG guidance (ISEP, 2022) (which has been embraced by the updated TII Guidance (TII, 2022) in Section 6.7.2) states as follows:

"A minor adverse not significant impact is described with: A project that is compatible with the budgeted, science based 1.5°C trajectory (in terms of rate of emissions reduction) and which complies with up-to-date policy and 'good practice' reduction measures to achieve that has a minor adverse effect that is not significant. The project

may have residual impacts but is doing enough to align with and contribute to the relevant transition scenario. A 'minor adverse' or 'negligible' non-significant effect conclusion does not necessarily refer to the magnitude of GHG emissions being carbon neutral (i.e. zero on balance) but refers to the likelihood of avoiding severe climate change and achieving net zero by 2050. A 'minor adverse' effect or better is a high bar and indicates exemplary performance where a project meets or exceeds measures to achieve net zero earlier than 2050."

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, negative** and **not significant.**

9.4.2 Climate Change Risk Assessment

9.4.2.1 Construction Phase

A detailed CCRA of the construction phase has been scoped out, as discussed in Section 9.2.2.4. 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 9.5.

- Flood Risk due to increased precipitation, and intense periods of rainfall. This includes fluvial and pluvial flooding.
- Increased temperatures potentially causing water scarcity and prolonged periods of hot weather.
- Reduced temperatures resulting in ice or snow and possible hazard to working conditions.
- Major Storm Damage, including wind damage.

9.4.2.2 Operational Phase

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. Table 9-9 presents the initial qualitative climate hazards screening, based on the location of the proposed development.

TABLE 9-9 CLIMATE HAZARD SCREENING

Climate-related Hazard	Hazard Screening Rationale	Screening
Extreme Heat temperatures	High temperatures are a key consideration for both construction and long-term operation of the proposed project. Historical data shows rising temperatures in Ireland. Heat and thermal expansion can damage buildings, materials, and road surfaces, and affect the lifecycle of assets.	Screen in
Extreme Cold Temperature	Snow and ice events pose significant risks to health, safety, and site operations. Road access may be disrupted, and low temperatures can affect assets such as fuel tankers, workers, and infrastructure. Freeze-thaw cycles may cause cracking in concrete and road surfaces, requiring snow clearance and ice management.	Screen in
High precipitation and pluvial flooding	Surface water remains a key vulnerability for any proposed development during both construction and operational phases due to the sensitivity of construction materials and site assets to water exposure.	Screen in
Fluvial flooding	The project site is approximately 200m from the River Shannon which is relatively large water course. However, according to the Flood Risk Assessment by Barry & Partners the site lies in Flood Zone C 'low risk'.	Screen out
Coastal flooding	According to the Flood Risk Assessment, the proposed development lies within coastal Flood Zone C (Bunlicky) & Flood Zone B (Corcanree).	Screen in
Drought	Droughts have occurred across Ireland, previously impacting water supply. Future reductions in availability could directly affect the proposed project's operations and resilience.	Screen in

Climate-related Hazard	Hazard Screening Rationale	Screening
Wildfire	The area surrounding the site is largely industrial and urban. The proposed site is located at a reasonable distance from areas susceptible to wildfire (e.g. forests) for this assessment to not view wildfire as a risk for the proposed project or design.	Screen out
High winds and storms	While the site itself isn't significantly elevated, existing and proposed assets and design components may be exposed to high winds. Historically, Ireland has experienced several notable storm events including Storm Éowyn and Storm Darragh (2024), which caused widespread damage across Ireland. These storms often bring heavy rainfall and flood warnings, increasing overall risk.	Screen in
Fog	Fog is not considered a significant hazard for this development, as it does not involve transport, aviation, or activities requiring high visibility.	Screen out
Lightning & Hail	The proposed design is not considered at significant risk from electrical storms or severe hail. Severe hail events are rare in Ireland and are not regarded as a major hazard.	Screen out
Landslides and Subsidence	The Geological Society of Ireland (GSI) landslide susceptibility mapping database (GSI, 2025) was reviewed to determine the risk from landslides at the proposed development. Consideration has been given to fluvial erosion however, adequate protective measures are in place to mitigate risks of erosion and landslip from the river.	Screen out

9.4.3 Climate Vulnerability Assessment

The sensitivity and exposure of the development to the screened in climate hazards must first be established, to then determine the vulnerability of the proposed development to climate change. Flooding (pluvial, coastal), extreme heat, extreme cold, drought, and extreme wind, have been considered as climate hazards in the context of the proposed development.

The sensitivity of the proposed development to the climate hazards is assessed irrespective of the project location. Table 9-10 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 reflects on the possible likelihood of the climate hazard occurring at the project 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 9-10.

TABLE 9-10 CLIMATE CHANGE VULNERABILITY ASSESSMENT

Climate Hazard	Sensitivity	Exposure	Vulnerability
Flooding (Fluvial)	1 (Low)	1 (Low)	1 (Low)
Flooding (Coastal)	1 (Low)	2 (Medium)	1 (Low)
Extreme Heat	1 (Low)	2 (Medium)	2 (Low)
Extreme Cold	1 (Low)	1 (Low)	1 (Low)
Drought	2 (Medium)	1 (Low)	1 (Low)
Extreme Wind	1 (Low)	2 (Medium)	2 (Low)

The sensitivity and exposure of the area was determined with reference to a number of online tools and with input from the various discipline specialists on the project team. It was concluded that the proposed

development does not have any significant vulnerabilities to the identified climate hazards as described in the below sections. All vulnerabilities are classified as low.

Flooding

Future increases in rainfall due to climate change may elevate the risk of flooding. In accordance with the FRA, the Corcanree Pumping Station is located within Flood Zone B however a stormwater tank is due to be installed as part of the construction works making the risk low. The Energy and Climate Statement (Appendix 9.1, Volume 4 of this EIAR) explains: 'The provision of significant additional stormwater storage at Corcanree Pumping Station will reduce the frequency and duration of untreated storm discharges during extreme rainfall events. By moderating peak inflows to the WWTP, this infrastructure will reduce the risk of hydraulic overloading, limit uncontrolled bypasses, and improve overall system stability during adverse weather conditions, thereby reducing the likelihood of operational disruption and energy-intensive recovery following storm events.'

The FRA notes: "The national flooding website www.floodmaps.ie uncovered 1 No. record of historic flooding at the site (>20 years ago). The root cause of this flooding has since been rectified.

There will be no increase in surface runoff arising from the proposed development. It is proposed to implement SuDS measures in order to limit the discharge from the site. The implementation of these SuDS measures will not increase the risk of flooding elsewhere."

As part of the site's flood risk management strategy stormwater drainage design will adhere to all relevant drainage standards. Therefore, it can be concluded the vulnerability of the proposed development to flooding is low.

Extreme Wind

In relation to extreme winds, the proposed development shall be designed to the appropriate standards to account for the relevant wind loadings events for RCP4.5 and RCP8.5. If required as part of the design, lightning protection shall be provided but this assessment concludes that lightning is not considered a risk to the site.

Extreme Temperatures (Heat & Cold)

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, materials will be selected which meet the relevant design standards and which account for extreme temperatures. The likelihood of extreme cold events in the future is projected to decrease reducing their overall exposure and risk. Prolonged dangerous heat levels (+30°C) are equally unlikely (see Table 9-6. Therefore, both extreme temperatures (cold and heat) are not considered a significant risk given the mitigation integrated across the design.

Drought

This development requires water for its operation. Future projections do show an increased likelihood of water scarcity however, when matched with increases in rainfall throughout the year the overall impact of water scarcity events is considered low.

The Water Modelling Report by Royal Haskoning DHV states that "overall, it can be concluded that the Bunlicky WWTP upgrade results in an increase in concentrations of all analysed water quality parameters, with a higher increase observed directly near the WWTP outfall. However, the impact of this upgrade on the general water quality in the study area is relatively limited as it only leads to small changes in the Environmental Quality Standards status compared to the baseline situation".

Summary

Overall, the Proposed Development has at most low vulnerabilities to the identified climate hazards. Therefore, no detailed risk assessment is required.

9.4.3.1 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,*** and ***negative*** which is overall ***not significant*** in EIA terms.

9.5 Mitigation Measures

9.5.1 Embedded design mitigation

The Proposed Development is designed with energy efficiency, reduction in carbon intensity and climate adaptation in mind, as set out in the Energy and Climate Statement (Appendix 9.1, Volume 4 of this EIAR):

- Stormwater tank installation to reduce the frequency and duration of untreated storm discharges during extreme rainfall events;
- Installation of an Aerobic Granular Sludge (AGS) process system will reduce energy demand from the existing AGS process;
- Development of Regional Bioresource Centre with Thermal Hydrolysis Process which reduces energy demand required for sludge treatment and reduces biosolids volume whilst increasing biogas production. Biogas can then be used on the site as fuel for the CHP to generate heat and power;
- Increased biogas storage capacity to reduce the need for gas flaring;
- Incorporation of THP reduces biosolids production and therefore transportation of sludge offsite, relative to the increased capacity of the sites processes.
- The biosolids that are produced are Class A and can therefore be reused as fertiliser. This supports a circular economy and lowers demand for the production of synthetic fertilisers.

9.5.2 Construction Phase

As set out in the Energy and Climate Statement (Appendix 9.1, Volume 4 of this EIAR) by Egis, for the Proposed Development: the appointed contractor will be required to minimise construction-related CO_2 emissions through best-practice construction management. Measures will include efficient programming of works, consolidation of deliveries associated with tank construction, optimisation of haul routes, and the use of modern, fuel-efficient plant compliant with current emissions standards. Where practicable, electrically powered or hybrid equipment will be used in preference to diesel-powered plant, and temporary site power will be sourced from the electricity grid rather than diesel generators, consistent with national objectives to reduce fossil fuel consumption and emissions intensity.

Given that the two tanks (AGS tanks and stormwater storage tank) represent the most material-intensive elements of the scheme, embodied carbon will be reduced where practicable through the specification of optimised concrete mixes, responsible sourcing of steel, and the reuse of excavated materials on site in accordance with the Site Waste Management Plan. These measures align with circular economy principles and will reduce both material-related and transport-related CO_2 emissions, consistent with the objectives of the Waste Action Plan for a Circular Economy.

Construction energy use and fuel consumption will be monitored and recorded through the Construction Environmental Management Plan (CEMP), enabling identification of inefficiencies and implementation of corrective actions. With these measures in place, construction-stage climate impacts will be reduced as far as reasonably practicable and are not considered significant in the context of the overall project lifecycle.

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 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.

9.5.3 Operational Phase

As set out in the Energy and Climate Statement (Appendix 9.1, Volume 4 of this EIAR) by Egis, for the proposed development: During operation, the upgraded Limerick (Bunlicky) WWTP will achieve a substantial reduction in carbon intensity compared with the existing facility through energy-efficient process selection and the recovery and utilisation of renewable energy on site. The integration of advanced anaerobic digestion with Thermal Hydrolysis, increased biogas storage, and expanded combined heat and power generation will reduce reliance on imported grid electricity and fossil fuels, supporting progress towards operational energy self-sufficiency.

This approach aligns with Uisce Éireann's National Wastewater Sludge Management Plan (NWSMP) and national policy commitments on greenhouse gas reduction, renewable energy, and the transition to a low-carbon, climate-resilient wastewater treatment sector.

9.6 Residual Effects

The impact to climate as a result of the Proposed Development must be assessed as a whole for all phases. The proposed development will result in some impacts to climate through the release of GHGs. TII reference the ISEP GHG Guidance which states 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*". The proposed development has proposed some best practice mitigation measures and is committing to reducing climate impacts where feasible. The upgrades to the proposed development will reduce operational GHG emissions compared to the existing infrastructure. As per the assessment criteria in Table 9-3 the residual effect of the proposed development in relation to GHG emissions is considered ***direct, long-term, negative*** and ***slight***, which is overall ***not significant*** in EIA terms.

In relation to climate change vulnerability, it has been assessed that there are no significant residual risks to the proposed development as a result of climate change. The residual effect of climate change on the proposed development is considered ***direct, long-term, negative*** and ***not significant***.

9.7 Cumulative Effects

With respect to the requirement for a cumulative assessment the ISEP (ISEP, 2022) and TII (TII, 2022) guidance on which the assessment is based states that:

"*the identified receptor for the 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. By presenting the GHG impact of a project 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 project to affect Ireland's ability to meet its national carbon reduction target. This assessment approach is considered to be inherently cumulative*".

Although GHG emissions are associated with the construction phase of the Proposed Development, the upgrades associated with the proposed development will significantly reduce the carbon intensity of direct and indirect GHG emissions during the operational phase, compared to the existing facility, thereby contributing to Irelands ability to meet its national carbon reduction target. The cumulative effect of the Proposed Development in relation to GHG emissions is therefore considered ***direct, long-term, negative*** and ***slight***, which is overall ***not significant*** in EIA terms.

9.8 Difficulties encountered in Compiling Information

The proposed development is still in the design stage and therefore materials used, construction and operational activities are subject to change. Despite these uncertainties, there is sufficient information for this Chapter to provide an accurate assessment. Any deviation from the assumptions set out below, will not result

in a significant change to the assessment set out in this chapter. Data assumptions for the GHG assessment are set out in the table below:

TABLE 9-11 GHG ASSESSMENT ASSUMPTIONS

Phase	GHG Assessment Category	Data inclusions and assumption
Construction	**Materials**	Steel, concrete, aggregate, asphalt.
	Material transport	50 arrivals & departures of HGV concrete loads for Limerick and Corcanree Pump Station (12 months (314 days)). 4 arrivals & departures of HGV for materials and diesel for Limerick and Corcanree Pump Station (18 months (471 days)). (EIAR Chapter 6 Traffic and Transport).
	Clearance and demolition	Not required as site already exists as urban fabric.
	Land use change and vegetation loss	No land use change required, the proposed development will be an upgrade of an existing site.
	Excavation	Excavation of soil and stones (48,970 m3). All excavated material removed off site. (EIAR Chapter 17 Resource and Waste Management).
	Construction energy	Gas oil/ diesel for plant use.
	Construction worker travel to site	80 arrivals of staff (40 to each site- Limerick and Corcanree Pump Station), assumed 30km distance travelled and 1248 days total construction period. (EIAR Chapter 6 Traffic and Transport).
	Construction waste disposal	With the proposed on-site and off-site waste management measures, the change in regional landfill or incineration capacity without energy recovery is predicted to be less than 1%, rendering the magnitude of the impact negligible. (EIAR Chapter 17 Resource and Waste Management).
	Construction waste transport	Included within material transport values.
	Construction water	Scoped out in line with ISEP guidance- associated GHG emissions are predicted to be a small proportion of total emissions.
Operation	**Operational energy**	Semi-quantitative assessment carried out on GHG emissions from site energy demand. See Section 9.4.1.2.
	Operational transport	Compared with the operation of existing Limerick WWTP and Corcanree Pump Station, there will be no additional / insignificant change of trips generation during the operation of the project as a result of the proposed development. (EIAR Chapter 6 Traffic and Transport).
	Operational waste disposal	Main waste streams: biosolids- to be used on agricultural land and managed as a resource not a waste stream. Biogas- to be used on site to generate heat and power in the CHP.

Phase	GHG Assessment Category	Data inclusions and assumption
	Operational waste transport	Reduced biosolids produced as explained in Section 9.4.1.2, associated transport will not be in addition to existing transport.
	Maintenance	Scoped out in line with ISEP guidance- associated GHG emissions are predicted to be a small proportion of total emissions.
	Landscaping and vegetation	Scoped out in line with ISEP guidance- associated GHG emissions are predicted to be a small proportion of total emissions.
	Operational water	Scoped out in line with ISEP guidance- associated GHG emissions are predicted to be a small proportion of total emissions.
Avoided emissions	**Renewable energy**	Biogas used to generate heat and power for proposed development.

9.9 Monitoring

Monitoring and reporting of the embodied carbon in the construction phase will be conducted. The aim of monitoring will be to seek further ways to minimise climate impacts. Monitoring will include contractual obligations, in line with the most recent Climate Action Plan and sectoral targets, for the successful tenderer to ensure that the proposed development stays in line with updated aims. Commitments to monitor GHG emissions during the construction phase will also be secured through the final Construction Environmental Management Plan (CEMP). Monitoring will include embodied carbon of construction materials, water usage, power and fuel usage, and waste generation (including reuse and recycling rates). Where monitoring shows that the proposed development is not meeting its targets, further mitigation will be put in place.

Monitoring should also include reviewing potential for extreme weather events which may cause damage during construction. Contractors' Environmental Management System (EMS) will include measures to address risks during such events i.e. flooding.

9.10 Section 15 Compliance

Section 15 of the 2015 Act, sets out the duties imposed by certain bodies, including local authorities and An Coimisiún Pleanála. This section was amended by the 2021 Act and states:

"(1) A relevant body shall, in so far as practicable, perform its functions in a manner consistent with—

(a) the most recent approved climate action plan,

(b) the most recent approved national long term climate action strategy,

(c) the most recent approved national adaptation framework and approved sectoral adaptation plans,

(d) the furtherance of the national climate objective, and

(e) the objective of mitigating greenhouse gas emissions and adapting to the effects of climate change in the State.".

This chapter demonstrates how the Proposed Development is consistent with the objectives of Section 15 of the 2015 Act (as amended). The EIAR has carried out a greenhouse gas emissions assessment and assessed the Proposed Development's resilience/adaptation to climate change.

- Greenhouse Gas Emissions Assessment – This assessment considers the Proposed Development's GHG emissions over its lifetime. The assessment analyses these emissions in the context of the relevant carbon budgets, targets and policies to ensure consistency with the most recent approved climate action plan and the most recent approved national long term climate action strategy, and with measures in furtherance of the national climate objective. This complies with subsections 15 (1) (a), (b), and (d) of the Act.
- Climate Change Vulnerability Assessment – This assessment identifies the impact of a changing climate on the Proposed Development and receiving environment in the context of the most recent approved national adaptation framework and approved sectoral adaptation plans. The assessment considers the Proposed Development's vulnerability and adaption to climate change and identifies adaptation measures to increase resilience, as discussed in Section 9.4.3.1. This covers sections 15(1)(c) and (e) of the Act.

The above measures pursue the furtherance of the national climate objective and the objective of mitigating greenhouse gas emissions and adapting to the effects of climate change in the State as far as practicable as required by section 15(1)(d) and(e) of the Acts.

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