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CLONASLEE FLOOD RELIEF SCHEME

Environmental Impact Assessment Report
Chapter 13: Climate

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13.1 Introduction

This chapter of the EIAR identifies, describes, and presents an assessment of the eventual significant effects of the Proposed Scheme on climate. The assessment examines the potential impacts during the construction and operation phases of the Proposed Scheme. This chapter should be read in conjunction with the following chapters, which present related impacts arising from the Proposed Scheme:

- Chapter 5: Project Description;
- Chapter 6: Traffic and Transportation;
- Chapter 10: Land, Soils and Hydrology;
- Chapter 11: Water (Including Hydrology and Flood Risk); and
- Chapter 12: Air Quality.

13.2 Methodology

The climate assessment comprises two main elements, these include:

- A greenhouse gas (GHG) assessment which assesses the impact of the Proposed Scheme on climate; and
- A climate change risk assessment (CCRA) which assesses the vulnerability of the Proposed Scheme to future climate change.

The following sections first detail the relevant guidelines, policy and legislation which drive the need for the climate assessment as well as outlining the relevant criteria for assessing impacts to climate. Secondly, the significance criteria for the GHG assessment and climate change vulnerability assessment are set out. Lastly the methodology used to conduct the construction and operational phase assessments is detailed.

13.2.1 Legislation, Policy, and Guidance

In relation to climate, the following legislation is relevant for this chapter:

- Climate Action and Low Carbon Development Act 2015 ('the 2015 Act'); and
- Climate Action and Low Carbon Development (Amendment) Act 2021 ('the 2021 Amendment Act').

The **National Policy Position on Climate Action and Low Carbon Development (2014)** recognises the threat of climate change for humanity; anticipates and supports mobilisation of a comprehensive international response to climate change, and global transition to a low-carbon future; recognises the challenges and opportunities of the broad transition agenda for society; and aims, as a fundamental national objective, to achieve transition to a competitive, low-carbon, climate-resilient and environmentally sustainable economy by 2050.

The **Climate Action and Low Carbon Development Act 2015** facilitates the approval of plans for Ireland in relation to climate change to aid the transition to a low carbon, climate resilient and environmentally sustainable economy by the end of 2050. In line with this objective, a national mitigation plan and national adaptation framework were required to be produced by the Minister to the Government for approval. The **Climate Action and Low Carbon Development (Amendment) Act 2021** further strengthens the governance framework on climate action, and through this Act, Ireland has:

- Set economy-wide carbon budgets and sectoral emission ceilings (SECs) for the periods 2021-25 and 2026-30;
- Established pathways to deliver the SECs, incorporating 26 $MtCO_2eq$. in unallocated emissions savings for the second carbon budget period; and
- Defined a delivery approach through specific measures and actions to meet emissions ceilings, which are estimated to require €119bn in capital investment between 2022-2030.

The 2021 Act places the national climate objective of achieving, by no later than 2050, the "transition to a climate resilient, biodiversity-rich, environmentally sustainable, and climate-neutral economy" on a statutory footing. The 2021 Amendment Act also replaced the 2015 Act's requirement for a National Mitigation Plan with a requirement for the preparation of an annual update to the Climate Action Plan and to prepare, not less frequently than once every five years, a national long term climate action strategy.

The first **Climate Action Plan 2019 (CAP19)** was formulated on a non-statutory basis. It set out many measures, key objectives, and targets to address the climate change agenda. There have since been two updates building on the 2019 plan – the first in 2021 (CAP21) which set out a wide range of policies aimed at decarbonisation in relation to the particular sectors of the economy, and the second in 2022 (CAP23). The DECC is required to publish an update to the CAP annually. The **Climate Action Plan 2024 (CAP24)** is the latest update of the CAP, building upon the measures and actions of CAP23. The CAP24 at present outlines the actions required to 2035 and beyond to achieve the ambition of halving Ireland's GHG emissions by the end of the decade and aiming for carbon neutrality by 2050. CAP24 sets out a number of high-impact actions that need to be taken. Covering the following sectors: electricity, industry, enterprise, housing, heating, transport, agriculture, waste, and the public sector.

The 2021 Act also requires local authorities to prepare **Local Authority Climate Action Pans (LA CAPs)** and formal instruction was issued by the Minister of the DECC in February 2023 to all local authorities to prepare their plans, with guidelines prepared to assist Las in their preparation. These plans will help ensure that the national climate objective can be achieved through all levels of the planning hierarchy, from the Climate Action Plan, down through the three Regional Spatial and Economic Strategies (RSESs) and forthcoming **Regional Renewable Electricity Strategies** [yet to be prepared], and through the LA CAPs.

The **Long-term Strategy on Greenhouse Gas Emissions Reductions** was published in July 2023 as part of the actions proposed under CAP23 and as a requirement under the Climate Action and Low Carbon Development (Amendment) Act 2021. This strategy sets out indicative pathways, beyond 2030, towards achieving carbon neutrality for Ireland by 2050. A long-term strategy is also a requirement of the Regulation on the governance of the energy union and climate action (EU) 2018/1999. It covers the following with a perspective of at least 30 years:

- Total greenhouse gas emission reductions and enhancements of removals by sinks;
- Emission reductions and enhancements of removals in individual sectors, including electricity, industry, transport, the heating and cooling and buildings sector (residential and tertiary), agriculture, waste and land use, land-use change and forestry (LULUCF);
- Expected progress on transition to a low greenhouse gas emission economy, including greenhouse gas intensity, CO_2 intensity of gross domestic product, related estimates of long-term investment, and strategies for related research, development and innovation;
- The expected socio-economic effect of the decarbonisation measures, including aspects related to macro-economic and social development, health risks and benefits and environmental protection; and
- Links to other national long-term objectives, planning and other policies and measures, and investment.

First published in 2018, the **National Adaptation Framework** contained Ireland's strategy for the application of climate adaptation measures to reduce the vulnerability of the State to the negative effects of climate change, and to seek opportunities for any positive effects that may occur. This framework is currently being reviewed in line with the requirements of the Climate Action and Low Carbon Development Act 2015-2021 and an update to the NAF has been published for public consultation. Following consultation, the new NAF will be finalised and will replace the 2018 NAF.

Twelve **Sectoral Climate Change Adaptation Plans** were published in June 2020 in line with the National Adaptation Framework and CAP19. These sectoral plans identified the key risks faced across sectors including agriculture, biodiversity, built and archaeological heritage, transport infrastructure, electricity and gas networks, communications, flood risk management, water quality and services infrastructure and health. The plans detail the approach being taken to address these risks and build climate resilience for the future. The plans include actions that:

- Mainstream adaptation into key sectoral plans and policies;
- Identify and understand the key vulnerabilities, risks, and opportunities facing specific sectors, as well as major risks crosscutting different sectors;
- Ensure climate-proofing of strategic emergency planning;

- Identify and collect information on the costs and benefits of adaptation within specific sectors;
- Build capacity within sectors to cope with climate change;
- Identify and address key research gaps within their sectors;
- Improve co-ordination with the local government sector; and
- Develop appropriate monitoring and verification systems within sectors.

In relation to carbon budgets, the 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 three sequential budget periods, as shown in **Table 13-1**. 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 July in 2022 and are shown in **Table 13-2**.

Table 13-1: 5-Year Carbon Budgets 2021-2025, 2026-2030 and 2031-2025 (Department of the Taoiseach, 2022)

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 13-2: Sectoral Emission Ceilings 2030 (Department of the Taoiseach, 2022)

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		
Transport	12	54	37	6	50
Electricity	10	40	20	3	75
Built Environment - Residential	7	29	23	4	40
Built Environment - Commercial	2	7	5	1	45
Agriculture	23	106	96	17.25	25
Land Use, Land-use Change and Forestry (LULUCF)	5	TBC	TBC	TBC	TBC
Industry	7	30	24	4	35
Other (F-gases, waste, petroleum refining)	2	9	8	1	50
Unallocated Savings	-	7	5	-5.25	-
Total	**68**	**TBC**	**TBC**	**-**	**-**
Legally Binding Carbon Budgets and 2030 Emission Reduction Targets	-	295	200	-	51

Laois County Council, as a body established by statute, is a public body and therefore a relevant body under the Act of 2015 and the above duties apply to Laois County Council. The primary obligation under the Acts for Laois County Council is to develop a Climate Action Plan for the county, which was published in 2024.

Under this CAP(2024-2029), it is stipulated that Laois County Council will continue to support the OPW flood protection scheme in Clonaslee, which will make the area more resilient to flooding. The Climate Action Plan also contains the objectives of continuing to implement approved flood protection and drainage measures and implementing the use of a flood and incident recording system. The climate policy base is also assessed for the development of the Proposed Scheme.

13.2.2 Zone of Influence

The Zone of Influence (ZoI) for climate includes the national environment (Ireland), where the receptor is the climate and the global atmosphere. Effects arising from the potential impacts on climate are considered to impact on a national level. National, regional, and local data has been considered where relevant and available. Carbon dioxide (CO_2) emissions have a global climate warming effect. This is regardless of their rate of release, location, or the weather when released into the atmosphere. This is unlike pollutants that affect local air quality where the rate of release, location, and prevailing weather, as well as the amount of pollutant, determines the local concentrations and the impact.

Local ambient concentrations of CO_2 are not relevant and there are no limits or thresholds that can be applied to particular sources of carbon emissions. Any amount of CO_2 released into the atmosphere will contribute to climate warming, the extent of which is determined by the magnitude of the release. Although CO_2 emissions are typically expressed as kilograms or tonnes per year, there is a cumulative effect of these emissions because CO_2 emissions have a warming effect which lasts for 100 years or more.

The Proposed Scheme centres along the Clodiagh River that runs through Clonaslee, County Laois. Clonaslee is located upstream of the confluence where the River Clodiagh and Gorragh River converge. The Proposed Scheme aims to alleviate flooding intensity associated with the Clodiagh River along three sections, including:

- Area 1- Brittas Woods;
- Area 2- Chapel Street; and
- Area 3- Tullamore Road and Integrated Constructed Wetlands (ICW).

The design of each element of the Proposed Scheme were selected to achieve the target Standard of Protection (SoP) for fluvial floods to protect areas from flood risk within the community of Clonaslee. All proposed works are planned for the Clodiagh River with no works considered necessary on the Gorragh River.

13.2.3 Sources of Information to Inform the Assessment

This analysis was undertaken by means of a desktop assessment based on available relevant guidance and information sources and other chapters of this EIAR. The following information sources have been consulted in relation to the assessment:

- Key materials, resources, and cut/fill balance inputs from the description of the Proposed Scheme; see **Chapter 5 – Description of the Proposed Scheme**;
- Traffic data provided by the Transport Team; see also **Chapter 6 – Traffic and Transport**;
- Estimates of likely waste volumes provided by the design team;
- Climate vulnerability and flood risk as identified in **Chapter 11 – Water**;
- Environmental Protection Agency (EPA) Greenhouse Gas Emissions Inventories and Projections;
- Global Facility for Disaster Reduction and Recovery ‘Think Hazard!’ tool (https://thinkhazard.org/en/);
- Met Éireann Major Weather Event Database (https://www.met.ie/climate/major-weather-events); and
- Climate Data Tool from Climate Ireland (https://www.climateireland.ie/#!/tools/climateDataExplorer).

Table 13-3 outlines the existing studies, datasets and information used to inform the assessment on climate that was collected through a detailed desktop review. No site-specific baseline surveys were undertaken as part of the assessment for climate. The baseline data presented in this section is derived from EPA inventories and projections, and Met Éireann monitoring network, and may be taken as representative of the background conditions.

Table 13-3: Summary of Key Desktop Reports

Title	Source	Year
Ireland's Greenhouse Gas Emissions Inventory 1990-2022	EPA	2023
Ireland’s Greenhouse Gas Emissions Projections 2023-2050	EPA	2024
30 Year Averages: Dublin Airport	Met Éireann	2022
Met Éireann Monthly Values for Dublin Airport and Casement	Met Éireann	2024
Climatological Note No. 14: A Summary of Climate Averages for Ireland 1981-2010	Met Éireann	2012
ICCA, Volume 1, Irelands Climate Change Assessment Report	EPA	2024
ICCA, Volume 2, Irelands Climate Change Assessment Report	EPA	2024
ICCA, Volume 3, Irelands Climate Change Assessment Report	EPA	2024

13.2.4 Key Parameters for Assessment

During the construction phase the main source of climate impacts will be as a result of GHG emissions and embodied carbon associated with the proposed construction materials and activities for the Proposed Scheme. 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 embodied carbon of the Proposed Scheme has been quantified as part of the construction phase assessment.

There may be some minor vehicle or plant emissions during the operational phase if maintenance work is required. Additionally, operational wastes from maintenance works will have an embodied carbon content. It is not predicted that maintenance vehicle or plant emissions will have a significant impact on GHG emissions and climate.

The Proposed Scheme will provide protection from flooding once operational which will decrease the vulnerability of the area to climate change related flooding which is beneficial.

13.2.4.1 GHG Assessment: Construction and Maintenance Phase Climate Emissions

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. The impact of the Proposed Scheme on climate is determined in relation to this baseline.

PE-ENV-01104 (TII, 2022a) recommends the calculation of the construction stage embodied carbon using the TII Online Carbon Tool (TII, 2022b). The TII Online Carbon Tool has been commissioned by TII to assess GHG emissions associated with road or rail projects using Ireland-specific emission factors and data but may be applied to any construction project. The Carbon Tool aligns with Section 7 of PAS 2080, which was published by the British Standards Institution (BSI), the Construction Leadership Council and the Green Construction Board in 2016.

The TII Online Carbon Tool uses emission factors from recognised sources including the Civil Engineering Standard Method of Measurement (CESSM) Carbon and Price Book database (CESSM, 2013), UK National Highways Carbon Tool v2.4 and UK Government 2021 Greenhouse Gas Reporting Conversion Factors.

The carbon emissions from materials (including transport) and construction/maintenance plant and operations 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 *tCO_2e* (tonnes of carbon dioxide equivalent).

Information on the material quantities employed and waste products generated were provided by the design team and input into the carbon tool. This information was used to determine an estimate of the GHG emissions associated with the construction phase and the maintenance phase of the Proposed Scheme.

Where detailed information regarding the proposed construction materials or material sources was not available best estimates were used to provide an estimate of the GHG associated with the Proposed Scheme.

13.2.4.2 CCR Assessment: Vulnerability of the Proposed Scheme to Climate Change

The TII guidelines for CCRA outlines an approach for undertaking a risk assessment where there is a potentially significant impact on the Proposed Scheme due to climate change. The risk assessment assesses the sensitivity and exposure of the impact occurring to a receptor, leading to the evaluation of the significance of the impact. This is also considered in **Chapter 19 – Risk of Major Accidents and/or Disasters**.

The assessment methodology is a two-stage process, with the first stage being a climate vulnerability assessment. If the results of this first phase indicate the climate hazard is a vulnerability, then the second stage of the assessment is carried out and referred to as a climate change risk assessment.

The Stage 1 Vulnerability Analysis is a combination of sensitivity analysis and exposure analysis and is undertaken through the following methodology:

- In undertaking the sensitivity analysis, the asset categories and climate hazards to be considered in the climate screening must be identified and the list of asset categories and climate hazards include:
  - Asset categories - Pavements; drainage; structures; utilities; landscaping; signs, light posts, associated auxiliary buildings, and fences; and
  - Climate hazards - Flooding (coastal); flooding (pluvial); flooding (fluvial); extreme heat; extreme cold; wildfire; drought; extreme wind; lightning and hail; fog.
- Determine the sensitivity (low, medium, or high) of each asset category to each of the climate hazards by assigning a sensitivity score of 1 to 3.
- Using the historic climate data, assess the level of exposure for each climate hazard within the Proposed Scheme.
- Take the product of sensitivity and exposure, for each climate hazard and each asset category identified. Any climate hazards with vulnerabilities marked as high have been included in the Stage 2 detailed climate change risk assessment.

The Stage 2 climate change risk assessment is a combination of a likelihood analysis and impact analysis:

- The asset categories considered in the climate screening have formed the key project receptors in this assessment as well as any critical connecting infrastructure and significant parts of the surrounding environment.
- Define the climate baseline (historic extreme climate events) using historic climate conditions and gathering climate change projection data to understand future climate conditions.
- The probability levels of future climate projections are determined for the CCR Assessment using relevant resources such as Climate Ireland (2023).

The climate data gathered is used to identify climate-related risks to the project to generate a comprehensive list of risks based on the climate change hazards that have been deemed relevant to the Proposed Scheme and location.

13.2.5 Assessment Criteria and Significance

13.2.5.1 EU and National Targets and Objective

The **European Green Deal** is the EU's long-term growth strategy which aims to make Europe climate-neutral by 2050 and put renewable energy at the heart of the energy system. As part of the Green Deal, with the **European Climate Law**, the EU has set itself a binding target of achieving climate neutrality by 2050. As an intermediate step towards climate neutrality, the EU has raised its 2030 climate ambition, committing to cutting emissions by at least 55% by 2030. The EU is working on the revision of its climate, energy, and transport-related legislation under the so-called 'Fit for 55 packages' in order to align current laws with the 2030 and 2050 ambitions.

The **Fit for 55 Package** comprises a set of proposals to revise and update EU legislation and includes for new initiatives with the overall aim of ensuring that EU policies are in line with the Council and the European Parliament's climate goals of reducing net GHG emissions by at least 55% by 2030. It includes for an update to the **Emissions Trading Scheme (ETS)** with new provisions such as extension to cover maritime emissions and a revision of rules applying to the aviation sector. The changes to the EU ETS have now been agreed under **Directive 2023/959** (amending Directive 2003/87/EC and Decision (EU) 2015/1814) and were to be implemented in national regulation by December 31, 2023, at the latest.

The Fit for 55 Package also includes for a suite of new rules, revisions and targets across many aspects, including: a social justice fund; a carbon border adjustment mechanism, which targets imports of products in carbon-intensive industries, to operate in parallel with the ETS; new rules to increase the EU-level GHG emissions reduction target for 2030 from 29% to 40%; a binding EU commitment to reduce emissions and increase removals from LULUCF with binding national targets for each Member State; CO_2 emissions standards for vans and cars; reducing methane emissions in the energy sector; a provisional agreement on sustainable aviation fuels (SAFs – advanced biofuels and electrofuels) via the **ReFuel Aviation** proposal; a provisional deal on new rules for decarbonised fuels in shipping via the **FuelEU** maritime initiative; new rules under the **Alternative Fuels Infrastructure Regulation (AFIR)**, which includes for charging stations to be installed every 60 km and hydrogen fuel refuelling stations; revision of the RED **(RED III)**; new rules to accelerate energy efficiency and the energy performance of buildings (new buildings should be zero-emission by 2030 and existing buildings transformed into zero-emission buildings by 2050); a hydrogen and decarbonised gas market package; and a proposal to revise the directive on the taxation of energy products and electricity.

The **REPowerEU Plan** is focused on rapidly reducing the European Union's reliance on Russian fossil fuels by progressing the clean energy transition and fostering increased collaboration throughout and across Member States to create a more resilient European energy system. REPowerEU expands the 'Fit for 55' proposals by setting forward additional actions to save energy by reducing demand and consumption, diversify energy sources and supplies, accelerate fossil fuel substitution, and improve investment frameworks facilitating reforms, faster permitting, and innovation.

The 2020 **EU Effort Sharing Decision (ESD)** target commits Ireland to reducing emissions from those sectors that are not covered by the emissions trading scheme (i.e. agriculture, transport, residential, non-energy intensive industry, commercial services, and waste) to 20% below 2005 levels. The Non-ETS (Emissions Trading System) sector (i.e. road transport, buildings, agriculture, waste and small industry) accounts for approx. 60% of the EU's emissions[1], and 78.5% of total emissions in Ireland.[2] The **Effort Sharing Regulation [ESR] (EU) 2018/842** as amended in March 2023 by **Regulation (EU) 2023/857** enshrines a GHG emissions reduction target for Ireland of -42% by 2030, relative to 2005 levels.

The **Renewable Energy Directive [RED] EU 2018/2001 (recast to 2030, RED II)** entered into force in December 2018 and sets a target of at least 32% for renewable energy, at EU-wide level, by 2030. A further revision, **RED III (Directive (EU) 2023/2413)** (part of the Fit for 55 Package) aims to increase the target for the EU's renewable energy to 42.5% by 2030. This directive sets specific targets for Member States in sectors such as industry (e.g. industry will need to increase the use of renewable energy by 1.6% annually), transport (e.g. targets regarding use of advanced biofuels and renewable fuels on non-biological origin, such as hydrogen), and buildings, heating and cooling (renewable targets will gradually increase with a binding increase annually, with minimum annual averages calculated per Member State). RED III also strengthens the sustainability criteria for the use of biomass for energy, in order to reduce the risk of unsustainable bioenergy production; Member states will need to ensure that the cascading principle is applied. The revised directive also includes for permit procedures for renewable energy to be accelerated in the context of the REPowerEU plan. Member states are required to designate acceleration areas where renewable energy projects will undergo simplified and 'fast-tracked' permit-granting processes.

The **revised Energy Efficiency Directive [EED] (EU) 2023/1791**, a revision to the **amending Energy Efficiency Directive (EU) 2018/2002**, came into force in October 2023. The revised EED raises the ambition of the EU in becoming more energy efficient. This Directive makes it binding for EU nations to collectively reduce their final energy consumption (FEC) by 11.7% by 2030. The Directive puts a strong focus on energy

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[1] Fit for 55: reducing emissions from transport, buildings, agriculture and waste. Available at: https://www.consilium.europa.eu/en/infographics/fit-for-55-effort-sharing-regulation/

[2] SEAI: Share of greenhouse gas emissions in Ireland in 2022. Available at: CO_2 Emissions [Accessed April 2024]

poverty, fully decarbonised district heating and cooling, optimisation of energy savings in the industrial sector and an annual energy savings obligation. Member States have agreed to help achieve this cumulative target by setting indicative national contributions in their updated NECPs using a combination of objective criteria which reflect national circumstances (such as energy intensity, GDP per capita, energy savings potential and earlier efforts made on energy efficiency). On 20 February 2024, the Government of Ireland approved Ireland's indicative national energy efficiency contribution under Article 4 of the EED. Ireland's indicative national energy efficiency contribution is 10.451 Mtoe in Final Energy Consumption (FEC) and 11.294 Mtoe in Primary Energy Consumption (PEC) by 2030, which represents a 12.6% reduction in Ireland's FEC relative to 2022. This reduction in every use is extremely ambitious, particularly in the context of Ireland's fast-growing population, and goes beyond what would be delivered by existing policies.

The **Regulation on the Governance of the Energy Union (EU) 2018/1999** sets out "*the necessary legislative foundation for reliable, inclusive, cost-efficient, transparent and predictable governance of the Energy Union and Climate Action (governance mechanism), which ensures the achievement of the 2030 and long-term objectives and targets of the Energy Union in line with the 2015 Paris Agreement on climate change following the 21st Conference of the Parties to the United Nations Framework Convention on Climate Change, through complementary, coherent and ambitious efforts by the Union and its Member States, while limiting administrative complexity*." Under the 2018 Regulation, to help achieve the EU's 2030 and 2050 targets and track progress, each EU Member State (MS) is required to produce an integrated **National Energy and Climate Plan (NECP)** setting out their national energy and climate targets and policies. The first NECPs were produced (including by Ireland) in 2019. Under Article 14(1) of the Regulation, Member States must submit their final updated NECP to the EC and every 10 years thereafter. In the European Commission's assessment of Ireland's draft updated NECP 2021-2030 (version 1 submitted to the EC in December 2023), the EC states: "*The European Green Deal, the fast-evolving geopolitical context and the energy crisis have led the EU and its Member States to accelerate the energy transition, and to set more ambitious energy and climate objectives, with a strong focus on the diversification of energy supplies. These developments are reflected in the legislative framework adopted under the 'Fit for 55' package and the REPowerEU Plan. Ireland's draft updated national energy and climate plan ('the draft updated NECP' or 'the plan'), submitted on 8 December 2023, partially considers this new geopolitical and legislative framework*."

The European Climate Law, **Regulation (EU) 2021/1119**, amends Regulation (EU) 2018/1999. It sets a binding EU target of a net domestic reduction in GHG emissions by at least 55% (compared with 1990 levels) by 2030 and undertakes to set a climate target for 2040 within 6 months of the first global stocktaking under the Paris Agreement. **Regulation (EU) 2018/842** sets binding annual GHG emissions reductions over the 2021–2030 period for Member States in order to fulfil the EU's target of reducing its GHG emissions by 30% below 2005 levels by 2030 in certain sectors listed in Article 2 of the Regulation and also contributes to achieving the objectives of the Paris Agreement.

The **EU Adaptation Strategy 2021** outlines a long-term vision for the EU to become a climate-resilient society, fully adapted to the unavoidable impacts of climate change by 2050. This strategy aims to reinforce the adaptive capacity of the EU and the world and minimise vulnerability to the impacts of climate change, in line with the Paris Agreement and the European Climate Law. The law recognises adaptation as a key component of the long-term global response to climate change and requires Member States and the Union to enhance their adaptive capacity, strengthen resilience and reduce vulnerability to climate change. It also introduces a requirement for the implementation of national strategies. The three main objectives of this Strategy include improving knowledge and managing uncertainty; supporting policy development at all levels and all relevant policy fields; and speeding up adaptation implementation. The Climate Action and Low Carbon Development Act 2015 provides a legal definition for adaptation as adjustment to any system designed or operated by humans, including an economic, agricultural, or technological system, or any naturally occurring system, including an ecosystem, that is intended to counteract the effects of climate change, prevent or moderate environmental damage resulting from climate change, or confer environmental benefits. In the context of climate change, risks emerge from the interactions between climate change and related hazards (heatwaves, floods, droughts etc.), exposure and vulnerability. Risk is in constant evolution as the frequency and intensity of weather extremes increase and as exposure and vulnerability change. Therefore, adaptation should be seen as iterative risk management process[3], that responds to the dynamics and evolution of risk, where emphasis is placed on ongoing processes of assessment, action, monitoring, evaluation, learning and improvement. Widespread, pervasive impacts to ecosystems, people, settlements,

[3]IPCC (2022). Climate Change 2022: Impacts, Adaptation and Vulnerability https://report.ipcc.ch/ar6/wg2/IPCC_AR6_WGII_FullReport.pdf

and infrastructure have resulted from observed increases in the frequency and intensity of climate and weather extremes, including hot extremes on land and in the ocean, heavy precipitation events, drought, and fire weather. These extremes are occurring simultaneously, causing cascading impacts that are increasingly difficult to manage.

The **Energy Performance of Buildings Directive [EPBD] (2010/31/EU)** aimed to promote the improvement of the energy performance of buildings within the Union, taking into account outdoor climatic and local conditions, as well as indoor climate requirements and cost-effectiveness. The **revised EPBD (2018/844/EU)** requires the Member States to describe their national calculation methodology following the national annexes of the overarching standards and will push the Member States to explain where and why they deviate from these standards. This will lead to an increased recognition and promotion of the set of EPB standards across the Member States and will have a positive impact on the implementation of the Directive.

A key target for Ireland is a 42% reduction in GHG emissions which is required under the Effort Sharing Regulation. Table 13-4 compares Ireland's ESR share with the broader EU-wide GHG emissions reduction targets.

Table 13-4: Key Targets for GHG Emissions Reductions by 2030

By 2030	Previous (pre-Fit for 55 Package)	Current	Relative to
EU economy-wide target	40%	At least 55%	1990
EU ETS contribution	43%	62%	2005
EU ESR contribution	30%	40%	2005
Ireland's legally binding ESR target	***30%***	***42%***	***2005***

13.2.5.2 Assessment Criteria for GHG Assessment

The 2022 TII guidelines state that the climate assessment is not solely based on whether a project emits GHG emissions alone but how it makes a relative contribution towards achieving a science based 1.5°C aligned transition towards net zero (as recommended in the 2022 IEMA guidance). The guidance states that the impact assessment must give regard to two major considerations when assessing the significance of a project GHG emissions including:

- 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 TII criteria for defining magnitude in this chapter for the GHG Assessment are outlined in **Table 13-5.**

The CAP24 target of greatest relevance to the construction and maintenance phases is the commitment to decrease embodied carbon in construction materials produced and used in Ireland by at least 30% by 2030. As such, the impacts of both construction and operation/maintenance phases are compared against the criteria in **Table 13-5.**

Table 13-5: TII Significance Matrix for the GHG Assessment

Effects	Magnitude of Impact	Definition
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 provide 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.

Effects	Magnitude of Impact	Definition
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	**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.

13.2.5.3 Assessment Criteria for CCR Assessment

The CCR Assessment is undertaken in two phases with an initial climate screening phase followed by a more detailed analysis. The detailed analysis is subject to the outcome of the screening phase, which helps ensure that the cost and effort associated with climate proofing is proportional to the benefits. The climate screening is intended to provide an indication of the project's vulnerability to climate change. The screening is broken down into three steps: a sensitivity analysis; an exposure analysis; and when combined make up the vulnerability assessment. To undertake the sensitivity analysis, a score is applied for each asset category (embankments, walls, etc.) against each climate hazard (flooding, extreme temperature, etc.). **Table 13-6** provides the definitions and scoring used when assessing sensitivity.

Table 13-6: Sensitivity Definition and Scoring

Level	Definition	Scoring
High sensitivity	The climate hazard will or is likely to have a major impact on the asset category.	**3**
Medium sensitivity	It is possible or likely the climate hazard will have a moderate impact on the asset category.	**2**
Low sensitivity	It is possible the climate hazard will have a low or negligible impact on the asset category.	**1**

The aim of the exposure analysis is to identify which climate hazards are relevant to the Proposed Scheme location e.g., flooding could represent a significant hazard for a project located next to a river in a floodplain. Therefore, whilst sensitivity analysis focuses on the type of project, exposure focuses on location. The hazards assessed are the same as those used for the sensitivity analysis. To undertake the exposure analysis, an exposure score is applied for each climate hazard at the project location. The allocation of exposure level is informed by the high-level climate data collected. **Table 13-7** shows the exposure definitions and scoring.

Table 13-7: Exposure Definition and Scoring

Level	Definition	Scoring
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.	**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.	**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.	**1**

The vulnerability assessment combines the outcomes of the sensitivity and exposure analysis with the aim to identify the key vulnerabilities and the potentially significant climate hazards associated with the Proposed Scheme. To complete the vulnerability assessment, the product of sensitivity and exposure for each climate hazard and each asset category identified and mapped as per **Table 13-8.**

Table 13-8: Vulnerability Matrix

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

Any high vulnerabilities (score >5) are then subjected to the second stage - a climate risk assessment using a combination of likelihood analysis and impact analysis. The likelihood analysis looks at how likely the identified climate hazards are to occur within a given timescale. **Table 13-9** presents the likelihood analysis key used for this assessment.

Table 13-9: Likelihood Analysis Key

Term	Qualitative	Quantitative
Rare	Highly unlikely to occur	5%
Unlikely	Unlikely to occur	20%
Moderate	As likely to occur as not	50%
Likely	Likely to occur	80%
Almost certain	Very likely to occur	95%

The impact analysis investigates the consequences of the climate hazards and also refers to the severity and magnitude. **Table 13-10** provides guidance to ranking the risk areas and this table was taken from the European Commission (2021) technical guidance on the climate-proofing of infrastructure in the period 2021-2027.

Table 13-10: Consequence Analysis Key

Risk areas	Insignificant	Minor	Moderate	Major	Catastrophic
Asset damage, engineering, operational	Impact can be absorbed through normal activity	Adverse event that can be absorbed by taking business continuity actions	A serious event that requires additional emergency business continuity actions	A critical event that requires extraordinary / emergency business continuity action	Disaster with the potential to lead to shut down or collapse or loss of the asset / network
Health and safety	First aid case	Minor injury, medical treatment	Serious injury or lost work	Major or multiple injuries, permanent injury, or disability	Single or multiple fatalities
Environment	No impact on baseline environment. Localised in the source area. No recovery required	Localised within site boundaries. Recovery measurable within one month of impact	Moderate harm with possible wider effect Recovery in one year	Significant harm with local effect. Recovery longer than one year. Failure to comply with environmental regulations / consent	Significant harm with widespread effect. Recovery longer than one year. Limited prospect of full recovery
Social	No negative social impact	Localised, temporary social impacts	Localised, long-term social impacts	Failure to protect poor or vulnerable groups. National, long- term social impacts	Loss of social license to operate. Community protests

Risk areas	Insignificant	Minor	Moderate	Major	Catastrophic
Financial	x % internal rate of return (IRR) < 2% of turnover	x % IRR 2-10% of turnover	x % IRR 10-25% of turnover	x % IRR 25-50% of turnover	x % IRR > 50% of turnover
Reputational	Localised, temporary impact on public opinion	Localised, short-term impact on public opinion	Local, long-term impact on public opinion with adverse local media coverage	National, short- term impact on public opinion. negative national media coverage	National, long-term impact with potential to affect the stability of the government
Cultural Heritage and cultural premises	Insignificant impact	Short-term impact. Possible recovery or repair	Serious damage with a wider impact to tourism industry	Significant damage with national and international impact	Permanent loss with resulting impact on society

Table 13-11 presents summary outcome of the assessment of likelihood and consequence of each climate hazard in the form of a climate risk matrix.

Table 13-11: Climate Risk Matrix

Likelihood	Magnitude of Consequence: Insignificant	Minor	Moderate	Major	Catastrophic
Rare	Low	Low	Medium	High	Extreme
Unlikely	Low	Medium	Medium	High	Extreme
Moderate	Low	High	High	Extreme	Extreme
Likely	Medium	High	High	Extreme	Extreme
Almost Certain	High	High	Extreme	Extreme	Extreme

13.2.6 Data Limitations

There were no difficulties or limitations encountered when carrying out this assessment.

13.2.7 Consultations

No specific agencies were consulted as part of the development of this chapter of the EIAR.

13.3 Description of the Existing Environment

13.3.1 Baseline Environment

PE-ENV-01104 (TII, 2022a) states 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.

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.

Human activities, particularly through the emissions of greenhouse gases (GHG), have been in large part responsible for global warming, with global surface temperatures reaching 1.1°C above 1850–1900 levels in 2011-2020[4].

Future sea-level rise projections over the coming centuries have large uncertainties, concern relates to retrograde ice sheets where much of the icesheet is grounded below present-day sea level which could reach tipping points where they become liable to collapse. Climate change is a multigenerational issue. Many aspects of the climate system, such as temperature and precipitation, are fast responding components, which will stabilise quickly if emissions are stopped quickly. Other aspects such as sea level rise are irreversible and will take thousands of years to stabilise even after anthropogenic emissions are halted.

To stabilise climate requires carbon dioxide (CO_2) emissions to reach at least approximately net zero and emissions of remaining greenhouse gases to be substantially reduced on a sustained basis. It is still possible to attain the Paris Agreement goal of keeping global temperature increases well below 2°C while striving to limit warming to 1.5°C if global CO_2 emissions are reduced to net zero (or below) by approximately mid-century and emissions of other greenhouse gases are simultaneously substantially reduced.

Human-induced climate change, including more frequent and intense extreme events, has caused widespread adverse impacts and related losses and damages to nature and people, beyond natural climate variability. Some development and adaptation efforts have reduced vulnerability. Across sectors and regions, the most vulnerable people and systems are observed to be disproportionately affected. The rise in weather and climate extremes has led to some irreversible impacts as natural and human systems are pushed beyond their ability to adapt.

Ireland has seen an increase in major weather events over time. Truly extreme heat events that are rare in the present climate are projected to become more common under all scenarios. Changes will be larger for the very infrequent, 1-in-50-year events (based upon present climate) than for 1-in-10-year events. The change would be considerably greater under Late action than in Early action scenarios. Extreme cold events are conversely projected to become rarer, with greater reductions in the occurrence of what today would constitute 1-in-50-year events than in 1-in-10-year events. Extreme precipitation events are projected to become more frequent, with changes in rarer 50-year events being more marked than 10- and 20-year return periods. Under the Late action scenario, the annual maximum daily rainfall that used to occur once every 50 years, on average, will become approximately twice as frequent. The shortening of recurrence 431 times that is projected out to mid-century or so can be stabilised or even reversed under the Early action scenarios by the end of the century[5].

Climate system tipping points represent thresholds beyond which components of the Earth system permanently switch to new states. Tipping points would have considerable impacts, including sea level rise from collapsing ice sheets, dieback of the Amazon rainforest and carbon release from thawing permafrost. Several such tipping points would have implications for Ireland either through further shifting global climate or altering the regional climate in the North Atlantic and north-western Europe. For Ireland, the Atlantic Meridional Overturning Circulation (AMOC) is the most immediately important potential tipping point for the Irish climate, given the importance of the North Atlantic in determining our climate and agricultural productivity. The AMOC will almost certainly weaken over the 21st century, and a full collapse cannot be ruled out. If there were to be a collapse in the AMOC, as has occurred repeatedly in the past during rapid climate transitions of past glacial phases, winters would become considerably colder and summers warmer, and there would likely be an increase in storminess and potential implications for sea levels. These would have very profound implications for the Irish climate and society.

Future global sea level rise projections over the coming centuries have large uncertainties. Particular concern relates to retrograde ice sheets where much of the ice sheet is grounded below present-day sea level, which could reach tipping points whereby they become committed to collapsing over a multi-centennial period. The largest such ice sheet is the West Antarctic Ice Sheet (WAIS), which alone could contribute several metres of sea level rise. Historical global emissions may have already committed it to its long-term

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[4] IPCC (2023). Climate Change 2023 Synthesis Report. Available at: https://www.ipcc.ch/report/ar6/syr/downloads/report/IPCC_AR6_SYR_LongerReport.pdf

[5] Clare Noone, Deirdre McClean, Danielle Gallagher, Jennifer McElwain and Peter Thorne, 2023, IRELAND'S CLIMATE CHANGE ASSESSMENT Summary for Policymakers in Volume 1: Climate Science – Ireland in a Changing World, Environmental Protection Agency, Ireland, 22 pp,

collapse. Both the Greenland and Antarctic ice sheets have been considerably smaller in past warm periods, but proxies cannot determine the pace of past ice sheet collapse. Under Late action scenarios, highly uncertain ice sheet instabilities mean that 2m of sea level rise this century cannot be ruled out.

Figure 13-1 presents a summary of the observed global and regional impacts of climate change on ecosystems and on human systems.

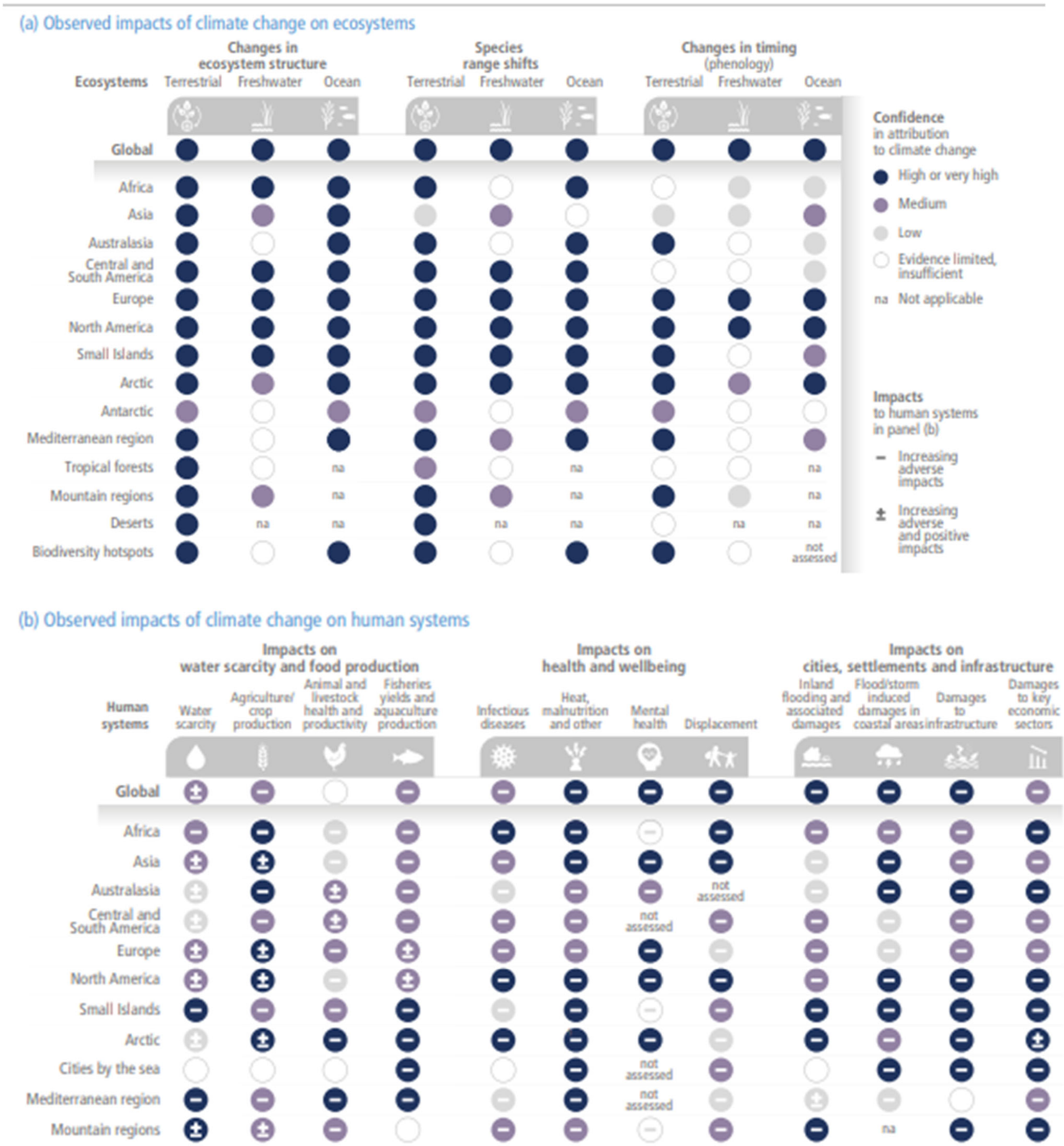

Figure 13-1: Observed global and regional impacts of climate change on ecosystems [Top] and on human systems [Bottom][6]

The World Meteorological Organisation (WMO) published its most recent report on the State of the Global Climate in 2024, updated for COP29.It combines inputs from the National Meteorological and Hydrological Services (including from Ireland's Met Éireann), along with input from regional climate centres, UN partners and climate scientists. The WMO provisional report confirms that 2024 is set to be the warmest year on record, with major impacts felt worldwide. A summary of the key points is provided as follows:

- **Greenhouse Gasses:** Record high concentration levels from the three main greenhouse gases (Carbon Dioxide, Methane and Nitrous Oxide) were recorded in 2023. The rate of increase, for methane in 2023 was the second highest, after 2021, however, the increase rate (of 2.2 ppm) of Carbon Dioxide (CO_2) is lower than the 10-year average.
- **Temperature:** Global mean temperature surpasses the previously warmest years recorded, continuing the trend where the last nine years have been the warmest on record.
- **Ocean Heat Content:** 2023 recorded the highest ocean heat content level in the last 65 years. It's anticipated that the warming will continue and will become irreversible on a centennial to millennial scale. Drivers are expected to be a result in change of anthropogenic climate forcing and natural variability. This increase is skewed geographically where 32% of Global Ocean Heat Content increase are recorded in Southern Ocean, meanwhile the Pacific Ocean accounted for 26% of this global increase.
- **Sea Level:** Sea Levels in 2023 is the highest on record (1993 to present). Rate of increase in the last ten years is double compared to the first recorded period (1993-2002).
- **Marine Heatwaves and Cold Spell:** Marine Heatwaves are occurring more frequently, intensely, and longer while marine cold-spells are being reduced.
- **Sea Ice:** February 2023 recorded the lowest Antarctic sea-ice extent since 1979 and Antarctic ice extent was at a record low from June until early November. The second lowest extent of sea ice was recorded in February 2024. Annual maximum was 1 million km^2 lower than the previous lowest. The 2024 maximum is the second lowest extent in the satellite record.
- **Ice Sheets:** Greenland and Antarctica have recorded a loss of 169 and 92 Gigatonnes per year (Gt·yr-1) respectively, on average. This trend is representative for Greenland ice sheet losses in 2023 but Antarctic recorded an increase in ice sheet in 2023 due to an increase in snowfall.
- **Glaciers:** 2023 recorded the nominally largest loss of ice on record (1950 to 2023). These records are skewed by North America and Europe which experienced extreme melt seasons.
- **Snow Cover:** Seasonal snow cover in the Northern Hemisphere has been experiencing a long-term decline in the late spring and summer. Northern Hemisphere snow cover extent for May was the eighth lowest on record (1967–2023).
- **Precipitation:** Precipitation levels in 2023 were not dispersed evenly where some areas experienced increases while others had average or less rainfall compared to their cumulative precipitation levels.
- **Extreme Weather and Climate Events:** Extreme weather is predicted to remain as a significant impact to socio-economic activities with extreme heat effecting many parts of the world. Extreme weathers included extreme floods, heat, drought, cyclones which cause serious issues to food resources, welfare, and water supplies.
- **Socio Economic Impacts:** Food security, population displacements and impacts on vulnerable populations continue to be of mounting concern in 2023, with weather and climate hazards exacerbating the situation in many parts of the world.

In Ireland, and in line with global patterns, annual average temperatures are now approximately 0.9°C higher than they were in the 1900s. In Ireland the last 30 years show an almost 7% increase in annual precipitation. Global sea level increased by approximately 0.20 m between 1901 and 2018, and recent studies have highlighted greater than expected sea level rise in Cork and Dublin. Climate change under early, middle, and

[6] Source: Figure SPM.2 (a) and (b), IPCC AR6 Climate Change 2023 Synthesis Report. Available at: https://www.ipcc.ch/report/ar6/syr/downloads/report/IPCC_AR6_SYR_LongerReport.pdf

late action climate model scenarios show very different futures for Ireland. All model projections show higher temperatures and an increase in annual precipitation, extreme events will become more common and more extreme.

Figure 13-2 shows the annual minimum and maximum temperate change for Ireland in response to global temperature changes. It is projected that as global temperatures increase as a result of global warming, there will be an increase in average maximum summer temperatures and average minimum winter temperatures. Furthermore, it is projected that there will be a decrease in average summer precipitation and increase in average winter precipitation.

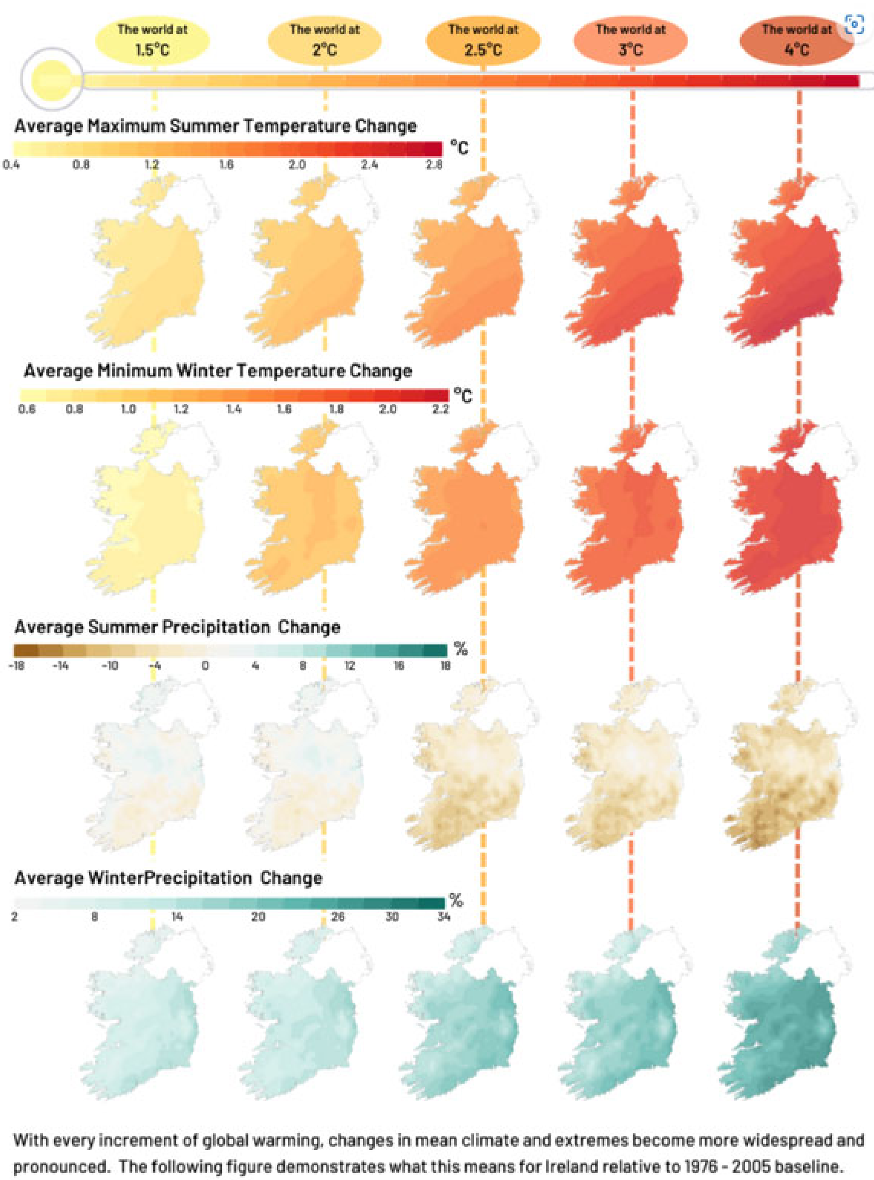

Figure 13-2: Average Projected Temperature and Precipitation Change for Ireland (Met Éireann TRANSLATE)[7]

The Summary for Policymakers (SPM) Volume 1 of Ireland's Climate Change Assessment: Climate Science – Ireland in a Changing World and the synthesis report[8] . The report states the following:

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[7] ***Source:*** *Met Éireann, TRANSLATE: One Climate Resource for Ireland. Available at: https://www.met.ie/science/translate*

[8] Peter Thorne, Jean Boucher, Brian Caulfield, Hannah Daly, Paul Deane, Danielle Gallagher, Liam Heaphy, Deirdre McClean, Shane McDonagh, Jennifer McElwain, Connor McGookin, Abhay Menon, Róisín Moriarty, Conor Murphy, Paul Nolan, Clare Noone, Enda

A. Ireland's climate is changing.

- A.1 There has been a rapid rise in atmospheric greenhouse gas concentrations, measured at numerous sites around the world, including Mace Head, since the Industrial Revolution without precedent in millions of years. Concentrations of methane and nitrous oxide are higher now than in over 800,000 years, and for carbon dioxide, for which longer-term reconstructions are possible, concentrations are higher than for millions of years. The increases in greenhouse gas concentrations since 1850 are due to global human activities, principally through fossil fuel combustion and land use change.
- A.2 Changes in the concentrations of these three major greenhouse gases since 1750 exceed those between successive glacial and interglacial cycles of the past 800,000 years for carbon dioxide and methane. For nitrous oxide the changes in concentration are of comparable magnitude to these successive glacial and interglacial cycles. These past changes in concentrations of all three gases were much slower, occurring over thousands of years.
- A.3 Globally, widespread, and rapid changes in the atmosphere, ocean, land, cryosphere, and biosphere have occurred. The scale of recent changes across the climate system as a whole – and the present state of many aspects of the climate system – are unprecedented over many centuries to many thousands of years.
- A.4 Global surface temperatures have risen by 1.15°C [1.00-1.25°C] between 1850–1900 and the most recent decade, 2013–2022. This most recent decade was likely warmer than any sustained period in at least the past 100,000 years.
- A.5 In Ireland annual average temperatures are now approximately 1.0°C higher than they were in the early 20th century. Sixteen of the top twenty warmest years since 1900 have occurred since 1990, with 2022 being the warmest year to date. Centennial timescale changes in Ireland are broadly consistent with global changes owing to our geographical situation between Europe (which is warming considerably faster than the global mean) and the North Atlantic (which is warming at a slower rate).
- A.6 Globally averaged precipitation over land has likely increased since 1950, with a faster rate of increase since the 1980s. The frequency and intensity of extreme precipitation events has increased almost everywhere, particularly so in already wetter regions in the northern hemisphere, and a greater proportion of total precipitation is falling in extreme precipitation events across most of the globe.
- A.7 Over Ireland median annual precipitation was 7% higher in the period 1991–2020, compared to the 30-year period 1961–1990. Regions where trends in precipitation since 1950 are significant have generally experienced overall annual increases. Analysis of local observations does not reveal evidence of a clear climate change signal in extreme precipitation indices due to natural variability. Overall, when aggregated, there has been an increase in heavy precipitation extremes across a range of indicators.
- A.8 The rate of warming of the global ocean was likely faster in the past century than for any century since the last deglaciation event 11,000 years ago. Global sea level increased by approximately 0.20m between 1901 and 2018, and the rate of global sea level rise is accelerating. Consistent with global open ocean changes, Irish marine waters have experienced long-term acidification due to uptake of anthropogenic atmospheric carbon dioxide.
- A.9 Recent studies have highlighted higher rates of sea level rise since the late 20th century in Cork and Dublin than the global average. Reasons for this are unclear and currently under investigation. There are a range of processes that can lead to local sea level changes diverging to a certain extent from global changes over a broad range of timescales.
- A.10 Globally, over the last century there have been poleward and upslope movements of many terrestrial species in response to climate changes. There have also been changes in the timing of life cycle events, such as birds migrating and plants flowering in all mid-latitude regions. Changes in the marine biosphere are consistent with large-scale warming and changes in ocean geochemistry. The

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O'Brien, Brian Ó Gallachóir, Tadhg O'Mahony, Tim O'Riordan, Tara Quinn, Agnieszka Stefaniec and Diarmuid Torney, 2023, IRELAND'S CLIMATE CHANGE ASSESSMENT: Synthesis Report. Environmental Protection Agency, Ireland, 36 pp.

ranges of many marine organisms are shifting towards the poles and towards greater depths, but a minority of organisms are shifting in the opposite directions.

- A.11 The main impacts of climate change on Irish terrestrial species and habitats observed to date have been changes in species abundance and distribution, lifecycle events, community composition, and habitat structure and ecosystem processes. These changes are in addition to much larger changes arising from other human interventions. In Irish waters, there have been substantial changes in marine ecosystems, including changes in seasonality and abundance of many species, including phytoplankton and zooplankton at the base of the food web. Many of these changes are consistent with a changing climate.
- A.12 Global climate changes have been modified over Ireland by proximity to the North Atlantic and by internal climate system variability, mainly, but not exclusively, related to variations driven by the North Atlantic. Most notably, the Atlantic Multi-decadal Variability explains successive multi-decadal periods when Ireland has warmed or cooled relative to global trends.

C. Future global emissions will determine our future climate.

- C.5 Projections of Irish temperature changes consistently show warming, with the magnitude of this warming increasing with delays in global mitigation action. Under Early action, the temperature increase averaged across the island of Ireland relative to the recent past (1976–2005) would reach 0.91°C [0.44–1.10°C] by mid-century before falling back to 0.80°C [0.34–1.07°C] at the end of the century. Whereas under Late action, by the end of the century it is projected that the temperature increases could be 2.77°C [2.02–3.49°C]. Warming also generally increases with the climate sensitivity of the ESMs used for a given mitigation pathway. Heat extremes will become more frequent and more severe and cold extremes will become less frequent and less severe with further warming.
- C.6 In Ireland, intense precipitation extremes are projected to become more frequent and extreme with further warming in most locations. Projected changes in precipitation accumulations are more uncertain than those for temperature. While winters tend to get wetter and summers tend to get drier, this signal is not consistently found across all global ESMs. There is also substantial sensitivity to the choice of ESM used to drive the national simulations. Changes averaged across the island of Ireland show a slight increase of < 10% in annual mean accumulated precipitation amounts.
- C.8 Global sea level increases will be modified locally around the island of Ireland by ongoing isostatic rebound – the north-east of the island is slowly rising and the south-west slowly sinking (<0.2mm per year in most regions); multi-decadal ocean basin variability (order of several centimetres in a decade); and the relative contributions to sea level change arising from the Greenland and Antarctic Ice Sheets over time. Larger relative contributions from Greenland would result in smaller increases for Ireland and vice versa due to the gravitational effects of the two ice sheets.
- C.9 Storm surges and extreme waves pose an ever-increasing threat to Ireland as sea levels continue to rise, including for many coastal cities such as Cork, Dublin, Galway, and Limerick, and to critical infrastructure. Particularly at risk are soft sediment shorelines. Projections of changes in storminess are highly uncertain and translate into large uncertainties in future frequency and intensity of extreme waves.
- C.10 Compound events are combinations of multiple climate impact drivers that occur at the same time, in the same area or both. The likelihood of both concurrent heatwave and drought conditions and storm surges with heavy precipitation have been observed to increase to date in Europe and are projected to further increase with additional warming.
- C.12 Ireland will continue to experience seasonal to multi-decadal variability arising from natural internal variations in the climate system. These will serve to modulate aspects such as temperature, precipitation, and storminess on seasonal to multi-decadal scales and, in doing so, periodically may reduce or enhance long-term global climate trends arising from human activities.
- C.13 Current atmospheric carbon dioxide levels are higher than at any time since the Middle Miocene (14 to 16 million years ago), according to the latest consensus atmospheric carbon dioxide record from a global consortium of scientists who study past atmospheric composition using proxies. Paleo-temperature estimates for the North Atlantic Ocean off Ireland indicate sea surface temperatures 10 to 13°C warmer than present-day during the Middle Miocene. Early action would

keep global mean surface temperature rise within the bounds of our and our ancestors' (genus Homo dates back 3 million years) past experience.

13.3.1.1 Microclimate

The World Meteorological Organisation (WMO) defines climate as the average weather over an extended period of 30 years. This period is used as it is considered long enough to account for year-to-year variations. Therefore, the existing climate for the environs around Laois is estimated using 30-year (1991-2020) average meteorological data from Met Éireann.

The nearest operational Met Éireann meteorological station to the Proposed Scheme in Clonaslee (following the closure of Birr and Kilkenny in 2007/2008) which records monthly data is the station located in Casement, which lies approximately 75km away from the Proposed Scheme. The 30-year average meteorological data from the station at Casement is presented in **Table 13-12**.

Table 13-12: 30 Year Average Meteorological Data from Casement

Parameter	30-Year Average
Mean Temperature (°C)	9.9
Mean Relative Humidity at 09:00 UTC* (%)	84.2
Mean Daily Sunshine Duration (Hours)	3.8
Mean Monthly Total Rainfall (mm)	783.5
Mean Monthly Wind Speed (knots)	10.1

Source: Met Éireann. Available at: https://www.met.ie/cms/assets/uploads/2023/09/www_met_ie_casement_9120.htm (Accessed March 2024)
* UTC: International abbreviation for 'Coordinated Universal Time', the successor to Greenwich Meantime (GMT).

Note that the data presented in **Table 13-12** is the latest data published by Met Éireann. The EPA has noted a number of observed climate change impacts nationally including the observation that the last five-year and ten-year average temperatures are the warmest on record and 2023 was the warmest year on record.

At Casement Aerodrome, the 30-year record for temperature presented in **Table 13-13** shows that the average daily temperature across a calendar year was 9.9°C with an average maximum of 13.4°C and an average minimum of 6.3°C. Across the calendar year the average number of days with air frost[9] was 34.8.

Table 13-13: 30-Year Average Data for Temperature at Casement (Annual Values from 1991-2020)

Temperature (°C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Mean Daily Max.	8	8.5	10.3	12.4	15.4	18	19.8	19.4	17	13.7	10.3	8.3	**13.4**
Mean Daily Min.	2.4	2.2	3.1	4.5	6.9	9.6	11.6	11.4	9.6	7.2	4.4	2.6	**6.3**
Mean Temperature	5.2	5.3	6.7	8.5	11.2	13.8	15.7	15.4	13.3	10.4	7.4	5.4	**9.9**
Mean No. of Days with Air Frost	6.8	7.1	5	2.9	0.8	0	0	0	0.1	1.1	3.7	7.3	**34.8**

Source: Met Éireann. Available at: https://www.met.ie/cms/assets/uploads/2023/09/www_met_ie_casement_9120.htm (Accessed March 2024)

The prevailing wind direction for the area is between south-west and south-east (4-13%) as presented in the wind-rose for Birr Meteorological Station for 1955-2008 in **Figure 13-3**. North-westerly (4-11%), and north-easterly (5%) winds tend to be less frequent. Wind characteristics are typically moderate with relatively

[9] Defined by the UK Met Office as: 'An air frost is usually defined as the air temperature being below freezing point of water at a height of at least one metre above the ground.' Available at: https://www.metoffice.gov.uk/weather/learn-about/weather/types-of-weather/frost-and-ice/frost

infrequent gales with an average of 12.6 days with gales per annum and an average maximum wind gust of 82 knots during the period as illustrated in **Table 13-14**. The highest mean number of days with gales recorded on average were in the month of January, with 3.3 days of gales recorded. The highest maximum gust was recorded in December, with a maximum wind gust of 82 knots.

Table 13-14: 30-Year Average Data for Wind at Casement (Annual Values from 1991-2020)

Wind	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Mean Monthly Speed (Knots)	12.4	12	11.1	9.5	9	8.4	8.4	8.7	9	10.1	10.9	11.7	**10.1**
Max. Gust (Knots)	80	74	71	59	62	55	45	53	59	64	64	82	**82**
Mean No. of Days with Gales	3.3	2.4	1	0.6	0.3	0.1	0	0	0.2	0.8	1.2	2.6	**12.6**

Source: Met Éireann. Available at:
https://www.met.ie/cms/assets/uploads/2023/09/www_met_ie_casement_9120.htm (Accessed March 2024)

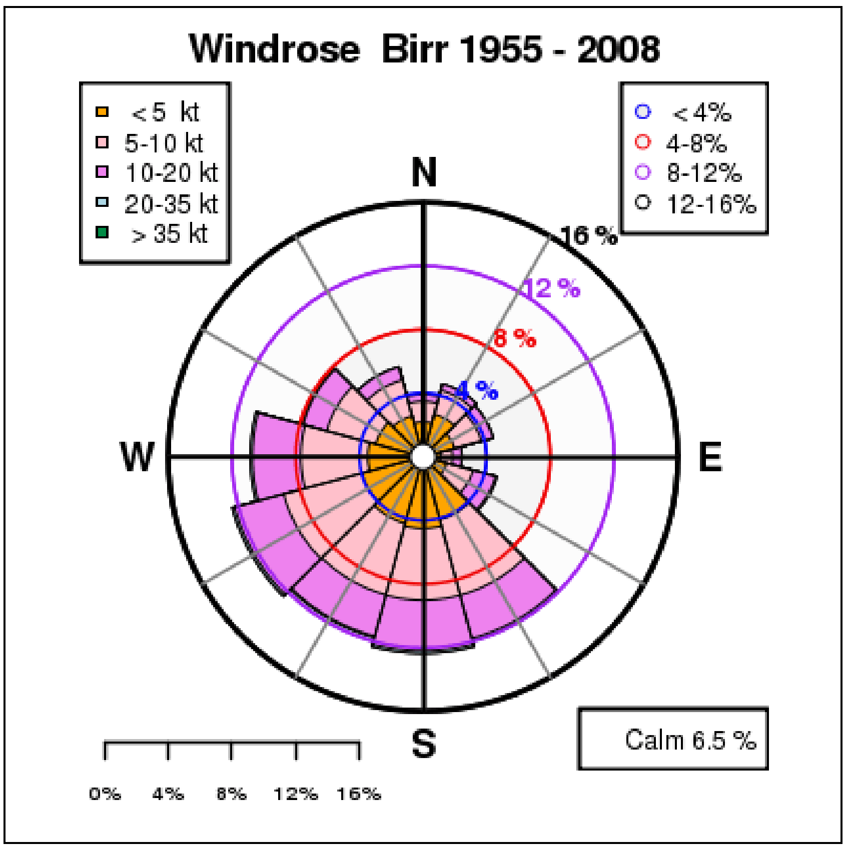

Figure 13-3: Wind-rose for the Birr Meteorological Station (1962-2014) Source: Met Éireann. Available at: https://www.met.ie/climate/what-we-measure/wind

The 30-year average rainfall for Casement is 783.5mm. This is further broken down into monthly averages in **Table 13-15** with the highest monthly total average for the period recorded in November (81.9mm). The greatest daily average total of rain is recorded per year for the period is 98.5mm, with greatest daily average for rainfall generally observed in the month of October (86.1mm) with moderately frequent days with ≥ 5.0 mm rainfall recorded per annum (49.9 days).

Table 13-15: 30-Year Average Data for Rainfall at Casement (Annual Values from 1991-2020)

Rainfall (mm)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Mean Monthly Total	65	55.2	51.8	55.3	59.1	65.7	59.4	71.2	61.6	81.6	81.9	75.7	**783.5**
Greatest Daily Total	30	35.6	34.2	41.5	36	98.5	33.7	36	51.1	86.1	82	46.8	**98.5**
Mean No. Days with ≥ 5.0 mm	4.7	3.4	3.3	3.8	3.6	3.9	3.7	4.5	4.1	4.7	5.1	5.1	**49.9**

Source: Met Éireann. Available at:
https://www.met.ie/cms/assets/uploads/2023/09/www_met_ie_casement_9120.htm (Accessed March 2024)

The scheme must consider weather events relating to extreme temperatures, wind, rain, and events (storms, snow etc.) that may disrupt operations. **Table 13-16** displays the mean number of days per annum on average across the 30-year average a weather event occurs. Snow lying at 09:00 UTC is most infrequent, occurring on average 3.4 days per annum, posing a low risk to operations. Fog is the most frequent weather event, occurring on average 19.8 days per annum. Snow/sleet is the second most frequent weather event observed at the Casement monitoring location during the 30-year average records, occurring on average 11.9 days per annum.

Table 13-16: 30- Year Average Data for Weather Events at Casement (Annual Values from 1991-2020)

Weather (mean No. of days with)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Snow/Sleet	3.2	3.1	2.2	0.7	0.1	0	0	0	0	0	0.6	2	**11.9**
Snow lying at 09:00 UTC	1	0.9	0.6	0	0	0	0	0	0	0	0.1	0.7	**3.4**
Hail	1.1	1.8	2.3	2.7	1.5	0.3	0.2	0	0.1	0.1	0.5	0.7	**11.3**
Thunder	0.1	0.1	0.2	0.6	0.8	0.9	1.2	1.1	0.4	0.4	0.1	0	**6.1**
Fog	1.7	1.4	1.8	1.3	1.1	1.1	0.9	1.4	2.6	2.3	1.8	2.2	**19.8**

Source: Met Éireann. Available at:
https://www.met.ie/cms/assets/uploads/2023/09/www_met_ie_casement_9120.htm (Accessed March 2024)

13.3.1.2 Existing Carbon Sources in the Area (Baseline National Emissions)

The sectoral breakdown of 2023 GHG emissions is shown in **Table 13-17**. The sector with the highest emissions was agriculture followed by transport and energy industries. GHG emission changes 2022 to 2023 are shown in **Table 13-17**.

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 CAP24, 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.

Table 13-17: National and Sectoral GHG Emission Changes 2022 to 2023

Sector	2022	2023	% Change
Agriculture	21.795	20.782	-4.6%
Transport	11.760	11.791	0.3%
Energy Industries	10.003	7.845	-21.6%
Residential	5.753	5.346	-7.1%
Manufacturing Combustion	4.334	4.133	-4.6%
Industrial Processes	2.288	2.155	-5.8%
F-Gases	0.741	0.699	-5.7%
Commercial Services	0.751	0.732	-2.5%
Public Services	0.696	0.677	-2.7%
Waste	0.881	0.846	-4.0%
LULUCF	3.983	5.614	40.9%
Total excluding LULUCF	**59.003**	**55.007**	-6.8%
Total including LULUCF	**62.986**	**60.620**	-3.8%

Note 1: Reproduced from Latest emissions data on the EPA website (EPA, May 2024) [10]

Note 2: 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.

13.3.1.3 Climate Vulnerability

Details of current climate hazards impacting the area have been derived from the Global Facility for Disaster Reduction and Recovery 'Think Hazard!' tool[11] with data specific to County Laois extracted from the tool. This data is supplemented as required with information from the Office of Public Works (OPW) FloodInfo.ie resource. This data is summarised in **Table 13-18** to illustrate the current climate hazard threat to the area of the Proposed Scheme. A more detailed appraisal of flood risk for the Proposed Scheme is presented in **Chapter 11 – Water.**

Table 13-18: Observed Hazard Level in the area of the Proposed Scheme

Hazard Type	Hazard Level
Coastal Flood	No risk of coastal flooding associated with the Proposed Scheme.
Pluvial Flood	Low - there is a chance of more than 1% that potentially damaging and life-threatening river floods occur in the coming 10 years (return period of c. 1 in 1000 years).
Fluvial Flood	High - CFRAM Mapping indicates that there is a high probability of Fluvial flooding.
Extreme Heat	Low - there is between a 5% and 25% chance that at least one period of prolonged exposure to extreme heat, resulting in heat stress, will occur in the next five years.
Wildfire	Medium - there is between a 10% and 50% chance of experiencing weather that could support a hazardous wildfire that may poses some risk of life and property loss in any given year.

In addition to the hazard types listed in **Table 13-18**, this analysis also has due regard for past major weather events which are used to inform future potential hazards and adaption. **Table 13-19** presents a list of historically recorded extreme weather events recorded nationally which have been derived from the Met Éireann Major Weather Events database.

[10] EPA-1990-2022-GHG-Report-Final.pdf

[11] Global Facility for Disaster Reduction and Recovery 'Think Hazard!' tool. Available at: https://thinkhazard.org/en/

Table 13-19:National Major Weather Events

Year	Event	Climate Hazard
2023	Storm Babet	Extreme Flooding
2023	Winter Storms	Strong Wind/Extreme Rainfall
2022	Highest Temperature Recorded in Ireland since 1887 (July 2022)	High Temperature
2022	Storm Eunice	Strong Wind
2021	Storm Barra	Strong Wind
2020	Storm Ellen	Strong Wind
2018	Heatwaves and Drought	High Temperature
2018	Snowstorm Emma & Beast from the East	Snowfall
2018	Storm Doris	Strong Wind
2018	Storm Eleanor	Strong Wind
2017	Storm Dylan	Strong Wind
2017	Storm Ophelia	Strong Wind
2017	Heavy Rain	Extreme Rainfall
2016	Storm Jake	Strong Winds
2015	Storm Frank	Strong Winds
2015	Storm Eva	Strong Winds
2015	Storm Desmond	Flooding
2015	Storm Darwin	High Temperature
2013/14	Winter Storms	Cold snaps
2011	Tropical Storm Katia	Strong winds
2010	Winter Cold Spell	Cold snaps
2009/10	Winter Cold Spell	Cold snaps/ Frost
2009	Severe Flooding	Flooding
2008	Heavy Rain and Flooding	Extreme Rainfall
2006	High Temperature/ Heatwave	High Temperature
2003	Heavy Rainfall/ Cloud Burst	Extreme Rainfall
2002	Severe Flooding in Eastern Areas	Flooding
2002	Coastal flooding along the eastern and southern coasts	Flooding
2000	Severe flooding in east and southern coasts	Flooding
1998	Hurricane-force winds over north and northeast	Strong Wind
1997	Windstorm	Strong Wind
1986	Hurricane Charley	Strong Wind

Source: Met Éireann, Major Weather events. Available at: https://www.met.ie/climate/major-weather-events

13.3.2 Evolution of the Environment in the Absence of the Proposed Scheme

13.3.2.1 Climate Change in County Laois

The TRANSLATE project is a Met Éireann led initiative that focuses on reviewing existing climate models to produce a national set of standardised climate projections. Observed data is based on different Global Warming Levels (GWL). In this analysis, projections were based on a 2˚C GWL.

The results of the data compiled for County Laois are presented in **Table 13-20**. In short, the results predict increasing average temperatures leading to increased frequency of heatwave and reduced frequency of frost and ice. Average precipitation is predicted to decrease but the number of wet and very wet days are projected to increase suggesting more intense rainfall events.

Table 13-20: Predicted Climate Data in the area of the Proposed Scheme

Climate Variable	Observed Climate at Project Location
Average Temperature	Projections indicate an overall increase in average temperature of between 1.2 and 1.6°C for County Laois relative to the 1981-2000 period. The mean annual air temperature in Laois is projected to be 10.47°C in a 2.0°C world.
Average precipitation	The current Mean Monthly Total Rainfall is 783.5 mm in Laois. In a 2.0°C world, average winter and summer precipitation rates are projected to be 3.54 mm/day and 2.21mm/day respectively.
Maximum Temperature	The current mean daily maximum temperature is 13.4°C. In a 2.0° world, the mean summer maximum temperature in Laois is projected to be 1.24°C.
Minimum Temperature	The current mean daily minimum temperature is 6.3°C. In a 2.0° world, the winter minimum temperature in Laois is projected to be 1.22°C.

13.3.2.2 National Predicted Trends in GHG Emissions

Under the Climate Action Plans, Ireland is committed to achieving a net zero carbon energy systems goal for Irish society and in the process, is aiming to create a resilient and sustainable country.

The EPA undertake emissions projections and the latest projections are presented in Ireland's Greenhouse Gas Emissions Projections 2022-2040 in June 2024[12].The EPA report that Ireland is not on track to meet the 51% emissions reduction target (by 2030 compared to 2018) based on these projections which include most 2023 Climate Action Plan measures. Further measures still need to be identified and implemented to achieve this goal. In addition, the following predictions are included in the EPA report:

- The first two carbon budgets (2021-2030), which aim to support achievement of the 51% emissions reduction goal, are projected to be exceeded by a significant margin of between 17% and 27%;
- Sectoral emissions ceilings for 2025 and 2030 are projected to be exceeded in almost all cases, including Agriculture, Electricity, Industry, and Transport; and
- It is projected that Ireland can meet its original EU Effort Sharing Regulation target of a 30% emission reduction by 2030 (compared to 2005) if all measures and flexibilities, including land use change and forestry (LULUCF) flexibility, are used. Reaching the new 42% EU emission reduction target will require full and rapid implementation of Climate Action Plan measures and further measures to be implemented.

13.4 Description of the Likely Significant Effects

13.4.1 Construction Phase

13.4.1.1 GHG Assessment

There is the potential for a number of greenhouse gas emissions to atmosphere during the construction of the scheme. As part of the Proposed Scheme, construction stage embodied GHG emissions have been calculated under the following headings within the TII Carbon Tool where applicable:

- Embodied Carbon of Materials;
- Construction Activities; and
- Construction Waste.

[12] https://www.epa.ie/publications/monitoring--assessment/climate-change/air-emissions/EPA-GHG-Projections-Report-2022-2050-May24--v2.pdf

Transport GHG emissions associated with delivery of materials to site were included in the calculator. In addition, construction worker travel to site was also included within the calculations.

Not all data were available for each category at this stage in the development. Specific material details and sources will not be known until the detailed design stage. However, this assessment has aimed to quantify the embodied carbon associated with the Proposed Scheme as much as possible.

The Proposed Scheme is divided into a number of subsections to represent the works required and different areas of the scheme. The GHG assessment has investigated the individual impact as a result of each subsection of the scheme.

GHG emissions for the construction phase have been estimated using the TII Carbon Tool and using traditional construction materials and traditional construction methods. A summary of the results from the carbon calculation exercise are detailed in **Table 13-21**.

Overall, the results indicate that the primary source of GHG emissions from the construction phase of the Proposed Scheme is from emissions associated with the embodied carbon from the materials used in the construction of the Proposed Scheme. The total estimated carbon generated during the construction phase is **426 tonnes CO_2e**. Embodied carbon in the materials required for construction is the largest component of emissions at circa 87% of the total. Embodied carbon consisted of materials, material transport and maintenance material – this accounts for emissions over the entire design life of the Proposed Scheme, with maintenance works occurring at regular intervals throughout the design lifetime.

Construction activities accounts for circa 12% of the overall emissions, which includes construction worker travel. Similarly, Construction Waste includes construction waste disposal and construction waste transport, and accounts for circa 0.54% of emissions.

Table 13-21: Estimated GHG Emissions associated with the Construction Phase of the Proposed Scheme

Source	Total GHG (tonnes CO_2e)			
	Brittas Wood	Chapel Street	Tullamore Road and ICW	Total
Embodied Carbon	45.17	253.14	73.12	371.43
Construction Activities	28.72	12.43	11.56	52.71
Construction Waste	0.62	0.92	0.78	2.32
Total	74.51	266.49	85.46	**426.46**

The total estimated carbon generated during the construction phase is 426 tonnes CO_2e. Some mitigation is inherent in the design through managing the material balance to reuse topsoil and to try to use suppliers within the region.

13.4.1.2 Climate Change Risk Assessment

Sensitivity Analysis

As per the TII Guidance, a sensitivity analysis was carried out on all construction elements (construction compounds, processing areas, etc.) as well as asset categories including pavements; drainage; structures; utilities; landscaping; signs, light posts, and fences. The sensitivity analysis was used to identify which climate hazards are relevant to the construction phase of the Proposed Scheme. The sensitivity of the Proposed Scheme to the climate hazards is assessed irrespective of the project location. **Table 13-22** presents the sensitivity analysis and the rationale for the sensitivity score for the construction of the project.

Table 13-22: Sensitivity Analysis of Climate Hazards to the Construction of the Proposed Scheme

Climate Hazard	Sensitivity	Sensitivity Score
Flooding (Coastal)	Medium sensitivity to Coastal flooding. Damage caused by flooding tends to last longer than any other weather-related hazard. Construction plant, materials and personnel could be affected by flooding.	2

Climate Hazard	Sensitivity	Sensitivity Score
Flooding (Pluvial)	Medium sensitivity to Pluvial flooding. Damage caused by known flooding events tends to last longer than any other weather-related hazard. Construction plant, materials and personnel could be affected by flooding.	2
Flooding (Fluvial)	Medium sensitivity to Fluvial flooding. Damage caused by known flooding events to last longer than any other weather-related hazard. Construction plant, materials and personnel could be affected by flooding.	2
Extreme heat	Medium sensitivity to extreme heat, as concrete may be sensitive to extreme heat.	2
Extreme cold	Medium sensitivity to extreme cold whereby the asset suffers limited impact, but ice or snow may result in road closures or other economic or social impacts.	2
Wildfire	All assets are considered to have a medium sensitivity to wildfires. Can cause some surface damage to the asset band, may lead to road closures impacting with economic or social impacts.	2
Extreme wind	Extreme wind is not predicted to significantly affect the various elements of the Proposed Scheme due to the nature of the scheme and its design. Construction sites could be affected by extreme winds.	2
Drought	Low sensitivity to drought on all assets.	1
Lightning and hail	Low sensitivity to lightning and hail for all assets. Potential for short term interruptions to works.	1
Fog	Fog is not predicted to significantly affect the various elements of the Proposed Scheme due to the nature of the scheme and its design.	1

Exposure Analysis

An exposure analysis was also carried out on the construction phase of the Proposed Scheme based on the known climate hazards presented in **Section 13.3.1.3.** Given that the construction phase is anticipated to take place within the medium term, the analysis focusses on the current climate hazards but the long-term future climate hazards are also considered as appropriate**. Table 13-23** presents the rationale for the exposure scoring for the construction phase.

Table 13-23: Exposure Analysis based on Past and Predicted Climate Events

Climate Event	Detail	Exposure Score
Flooding (Coastal)	Low exposure according to CFRAM mapping, as the Proposed Scheme is not located on the coast.	1
Flooding (Pluvial)	Pluvial flooding is rated as low exposure. While pluvial flooding has occurred in the area, there is always a potential for impact in Ireland. Flood wall heights have been designed to include for 300 mm ‘freeboard’. This sets the top level of the wall 300 mm above the maximum predicted flood level in the design event. This is to allow for a factor of safety in the design and allow for the wave effect of floodwater. For embankments, an extra 200 mm freeboard is added, to cater for the additional risk of the embankment material settling over time.	1
Flooding (Fluvial)	High exposure, the CFRAM mapping for the area indicates that the Clodiagh river has a high probability of flooding.	3
Extreme heat	Extreme heat hazard in Laois is classified as low based on modelled heat information. There is between a 5% and 25% chance that at least one period of prolonged exposure to extreme heat, resulting in heat stress, will occur in the next five years.	1
Extreme cold	Recent experiences of cold spells and heavy snowfall events, such as Storm Emma in 2018, had a significant impact on County Laois. Projections indicate that as temperatures rise and snowfall decreases in frequency, the risk associated with these events will decrease.	1
Wildfire	Medium exposure to wildfires as per **Table 13-18**. No wildfires have been recorded in the area. The Think Hazard! tool developed by the Global Facility for Disaster Reduction and Recovery (GFDRR) indicates that the wildfire hazard is classified as medium for the Laois area. This means that there is between a 10% to 50% chance of experiencing	2

Climate Event	Detail	Exposure Score
	weather that could support a problematic wildfire in the project area that may some risk of life and property loss in any given year. Area 1 of the proposed scheme is located in a forested area. Future climate modelling indicates that there could be an increase in the weather conditions which are favourable to fire conditions, these include increases in temperature and prolonged dry periods.	
Extreme wind	Extreme wind is rated as high exposure. Between 1991-2020 there were an average of 12.6 days with gales (circa 3.5% of the year).	3
Drought	Drought is rated as medium exposure. Only one recorded drought has been recorded nationally in 2018.	2
Lightning and hail	Lightning and hail are rated as medium exposure. Between 1991-2020 there were 11.3 days of hail, and the mean number of thunder days was 6.1 days equating to circa 5% of the year on average.	2
Fog	Fog is rated as high exposure. Between the years 1991-2020 there were 19.8 days of fog on average per annum equivalent to 5% of the year.	3

Based on the estimated sensitivity and exposure the vulnerability of the construction phase may be assessed and is summarised in **Table 13-24.** The analysis indicates that fluvial flooding and extreme winds represent the highest vulnerability for the construction phase, followed by wildfire, and fog.

Table 13-24: Vulnerability Analysis for the Construction Phase

		Exposure		
		Low	Medium	High
Sensitivity	**Low**		Drought, Lightning/Hail	Fog
	Medium	Coastal Flooding, Pluvial Flooding, Extreme Heat, Extreme Cold	Wildfire	Fluvial Flooding, Extreme Wind
	High			

Climate Risk Assessment

Examples of potential climate impacts are included in Annex D (Climate proofing and environmental impact assessment) of the Technical Guidance on the Climate Proofing of Infrastructure (European Commission, 2021). Potential impacts to the Proposed Scheme as a result of climate change include:

- 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;
- Geotechnical impacts; and
- Major Storm Damage – including wind damage.

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.

In short, the vulnerability of the works to climate change will be suitably mitigated and the potential impact is considered to be **minor adverse** for the short-term construction phase.

13.4.2 Operational Phase

13.4.2.1 GHG Assessment

There will be some GHG emissions during the operation of the Proposed Scheme associated with removal of organic waste vegetation as part of embankment control measures. In addition, there may be some minor wastes associated with ongoing maintenance works, if required. **Table 13-25** outlines the operational phase GHG emissions associated with each subsection of the Proposed Scheme as well as the total for the overall scheme.

Climate modelling predictions indicate that flooding events are likely to increase in future years as a result of increased rainfall and altered weather patterns. The proposed scheme will allow for the elimination of future post-flood recovery works, which will result in a reduction in future GHG emissions, and embodied carbon savings.

As per **Table 13-25**, the total operational phase embodied GHG emissions associated with the Proposed Scheme in a typical year are minor, amounting to 5.8 tonnes CO_2e. In this regard, the impact on climate from maintenance phase emissions is classed as **negligible** which is not significant.

Table 13-25: Estimated Carbon associated with the Operational and Maintenance Phase of the Proposed Scheme

Source	Total GHG (tonnes CO_2e)			
	Brittas Wood	Chapel Street	Tullamore Road and ICW	Total
Operational Use (including operational energy, transport and operational waste disposal)	4.72	1.08	0	5.8

13.4.2.2 Climate Change Risk Assessment

The Proposed Scheme will result in some GHG emissions during construction and more minor GHG emissions during operation – however these GHG emissions must be considered in the context of the overall scheme and the purpose of the scheme. The Proposed Scheme will implement a number of best practice mitigation measures to reduce GHG emissions which will reduce the impact to climate.

The approach to assessing the climate risk associated with the operation phase is analogous to that presented for the construction phase in Section 13.4.1. While the sensitivity of the operation phase has slight variation to the construction phase and is revised in this section, the exposure criteria apply to both phases and the exposure data presented in Table 13-23 is also applied for the operation phase. Table 13-26 presents the sensitivity analysis and the rationale for the sensitivity score for the operation phase of the Proposed Scheme.

Table 13-26: Sensitivity Analysis of Climate Hazards to the Operation of the Proposed Scheme

Climate Hazard	Sensitivity	Sensitivity Score
Flooding (Coastal)	Low sensitivity for damage of infrastructure or assets around the Clodiagh from coastal flooding given the known low risk in the area. The scheme is designed to withstand flood events due to its nature.	1
Flooding (Pluvial)	The purpose of the Proposed Scheme is to provide a resilient flood relief scheme for the area, thereby, reducing the vulnerability of the area to flood impacts. The scheme is designed to withstand flood events due to its nature. Therefore, flooding is not considered a risk to the Proposed Scheme and has been identified as low vulnerability	1
Flooding (Fluvial)	The purpose of the Proposed Scheme is to provide a resilient flood relief scheme for the area, thereby, reducing the vulnerability of the area to flood impacts. With climate change the severity of future flood events could increase. The proposed	1

Climate Hazard	Sensitivity	Sensitivity Score
	flood defences are designed to withstand those higher water levels. The scheme is designed to withstand flood events due to its nature. Therefore, flooding is not considered a risk to the Proposed Scheme and has been identified as low vulnerability	
Extreme heat	At the detailed design stage chosen building materials will be high quality, durable and hard-wearing and chosen to withstand increased variations in temperature in the future as a result of climate change.	1
Extreme cold	At the detailed design stage chosen building materials will be high quality, durable and hard-wearing and chosen to withstand increased variations in temperature in the future as a result of climate change.	1
Wildfire	Due to the project location the risk of wildfire is significantly lessened, and it can be concluded that the Proposed Scheme is of low sensitivity to wildfires	1
Drought	Low sensitivity to drought on all assets with the exceptions of landscaping works which has a high sensitivity to drought.	1
Extreme wind	Low sensitivity to extreme wind on most assets with the exceptions of lighting or signposts which have a moderate sensitivity to extreme winds.	1
Lightning and hail	Low sensitivity to lightning and hail for all assets.	1
Fog	Low sensitivity to fog for all assets.	1

Based on the estimated sensitivity and exposure, the vulnerability of the operational phase is summarised in **Table 13-27**. The analysis indicates that fluvial flooding, extreme wind, and fog represent the highest vulnerabilities for the operation phase.

Table 13-27: Vulnerability Analysis for the Operation Phase

		Exposure		
		Low	**Medium**	**High**
Sensitivity	**Low**	Coastal Flooding, Pluvial Flooding, Extreme Heat, Extreme Cold,	Wildfire, Drought, Lightning/Hail	Fluvial Flooding, Extreme Wind, Fog
	Medium			
	High			

With committed design measures in place, the risk of adverse climate change impact on the Proposed Scheme is low. In short, the vulnerability of the operational phase to climate change has been suitably mitigated and the potential impact is considered to be **beneficial**

in the long-term for the wider area and community.

13.5 Mitigation Measures

13.5.1 Construction Phase

The projected emissions from the construction phase are presented using traditional methods and materials and result in a moderate adverse impact. The need to mitigate these impacts is clearly signalled in national policy such as CAP24 (National KPI for 2030: *Decrease by at least 30% embodied carbon for materials produced and used in Ireland*).

Embodied carbon in the materials employed in the construction phase dominate the impact. As such, to mitigate these impacts the use of the following will be required:

- As a replacement for traditional precast concrete materials made with Portland cement mixes, the Proposed Scheme will use 50% ground granulated blast-furnace slag (GGBS) cement for all structural and non-structural precast structures;

- Similarly, all concrete poured in-situ for the Proposed Scheme will consist of 50% GGBS cement; and
- All reinforcing steel employed on site will be 85% minimum recycled steel; and

The use of these low embodied carbon materials in construction will reduce the construction phase emissions and comply with the requirements of CAP24.

In addition to the above mitigation regarding material choices, there are a series of additional construction mitigation measures that will also be adopted as follows:

- All aggregates shall be secondary aggregates. Virgin aggregates shall only be employed where it is demonstrated that secondary aggregates are unsuitable for structural reasons and/or they are unavailable.
- Wherever available, the contractor shall secure construction materials from local/regional sources or sources within the State to minimise material transport emissions and reduce life cycle carbon emissions associated with the construction materials.
- For electricity generation at the construction compounds, hydrogen generators or electrified plant shall be utilised over traditional diesel generators. This shall also apply to lower powered mobile plant, as appropriate.
- A regular maintenance schedule for all construction plant machinery shall be undertaken to maintain optimum machinery efficiency.
- Sustainable timber post fencing will be specified over steel in boundary treatments where possible.
- Engines will be turned off when machinery is not in use.
- The use of private vehicles by construction staff to access the site will be minimised through the encouragement of use of public transport, encouragement of car sharing, and maximising use of local labour to reduce transport emissions.
- Hydrotreated Vegetable Oil (HVO) is currently being used for plant and equipment on OPW sites and this practise will be implemented at this project site also.

The measures outlined within this chapter will reduce the impact to climate during the construction of the Proposed Scheme.

These measures will be tracked through the development of Project Carbon Management Plan (PCMP) which will be prepared in accordance with PAS 2080 (Carbon Management in Infrastructure). This Plan will be devised by Laois County Council at detailed design stage and then transferred for ownership to the Contractor for construction and handover. The Plan will be used to monitor and report on the above committed carbon management measures and all other measures adopted during the design, procurement, and construction phases.

13.5.2 Operational Phase

The following measures shall be implemented during the operational phase to reduce GHG emissions from ongoing maintenance of the scheme and vegetation removal.

- Prevention of on-site or delivery vehicles from leaving engines idling, even over short periods; and
- Ensure all plant and machinery are well maintained and inspected regularly.

The Project Carbon Management Plan handed over by the Contractor post construction will be maintained through the operation and maintenance phase.

13.6 Residual Impacts

The IEMA guidance (2022) on which the TII guidance (2022a) and associated significance criteria are based on states that '*The significance of a project's emissions should be based on its net impact over its lifetime, which may be positive, negative or negligible*'. Therefore, the impact and significance of the Proposed Scheme has been assessed on this basis.

The projected GHG emissions from the construction phase are presented using traditional methods and materials and result in a moderate adverse impact. The need to mitigate these impacts is clearly signalled in national policy such as CAP24. Embodied carbon in the materials employed in the construction phase dominate the impact. To mitigate these impacts, the design specification will mandate the contractor on the use of low carbon materials. The commitment to reduce embodied emissions on the Proposed Scheme is fully aligned with the targets and trajectory of CAP24. As such, the residual impact on climate of the construction phase emissions, with this mitigation commitment, is classed as **temporary minor adverse** which is not significant.

The climate change risk assessment for the construction phase shows that with the construction controls in place, the risk of adverse climate impact on the Proposed Scheme has been suitably mitigated to reduce the likelihood of such an event having a significant adverse impact. In short, the vulnerability of the works to climate change has been suitably mitigated and the potential impact is considered to be **temporary minor adverse**.

Maintenance and operational emissions equate to circa 6 tonnes CO_2e per annum and the impact on climate of the maintenance phase emissions is classed as **negligible**.

The purpose of the Proposed Scheme is to provide for a resilient flood relief scheme to reduce the vulnerability of the area to future flood events. In this regard, the Proposed Scheme is predicted to have a **long-term beneficial** impact for the area in terms of climate vulnerability.

13.7 Monitoring

No project specific monitoring is proposed for climate during the construction or operational phases of the Proposed Scheme.

13.8 Interactions and Cumulative Effects

13.8.1 Interactions

Environmental factors which interact with Climate include Air Quality, Hydrology Material Assets, including Utilities, Waste Management, Traffic and Transport, Population, Human Health and Biodiversity. None of these have been assessed as having significant effects on Climate or vice versa for the construction or operational/maintenance phases. Refer to **Chapter 18 Interactions and Cumulative Effects** for details.

13.8.2 Cumulative Effects

With respect to the requirement for a cumulative assessment PE-ENV-01104 (TII, 2022a) 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*.'

13.9 Conclusion

Table 13-28 collates all the mitigation and monitoring commitments recommended in this chapter.

Table 13-28: Summary of Likely Significant Effects and Environmental Commitments

Description of Impact	Magnitude of Impact	Importance of Receptor	Significance of Effect	Controls and Mitigation Measures	Residual Effect
Construction GHG Emissions	Moderate adverse	Medium	Temporary, adverse, and moderate.	Implement mitigation measures as outlined in **Section 13.5**	Not significant
Construction Adaptation Risk	Minor adverse	Medium	Temporary, adverse and minor.	None	Not significant
Operation GHG Emissions	Negligible	Medium	Long-term, neutral.	None	Not significant
Operation Adaptation Risk	Beneficial	Medium	Long-term, beneficial.	None	Not significant

13.10 Chapter References

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