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Climate Guidance for National Roads, Light Rail, and Rural Cycleways (Offline & Greenways) - Overarching Technical Document

PE-ENV-01104
December 2022

PE Planning & Evaluation

Technical

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TII Publications

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Contents

Contents Table

Glossary of Terms

Key Term	Definition
Active Travel Infrastructure	All types of pedestrian and cycle facilities which improve conditions for people walking, wheeling, and cycling.
Baseline scenario	The current state of environmental characteristics – including any evident trends in its status (EPA, 2022).
Carbon dioxide equivalent (CO_{2e})	The unit for comparing the radiative forcing of a greenhouse gas to carbon dioxide
Construction Environmental Management Plan (CEMP)	A working document that describes how a construction project will be managed and carried out to minimise impacts on the environment. The CEMP addresses all relevant environmental aspects of the management of the construction works and sets out the mitigation and monitoring requirements to be implemented.
Climate	The prevailing weather conditions of a region, as temperature, air pressure, humidity, precipitation, sunshine, cloudiness, and winds, throughout the year, averaged over a series of years.
Climate assessment	For the purpose of this Overarching Technical Document (OTD), climate assessment is a catch all term for the assessments required for planning and evaluation – which incorporates the greenhouse gas assessment as well as climate change risk assessment.
Climate change adaptation	The process that a receptor or project has to go through to ensure it maintains its resilience to climate change. In the case of a development project, adaptation can be embedded in the design to account for future climate conditions, or the project can introduce measures to ensure it retains it resilience (i.e. the project adapts) to future climate conditions. Environmental receptors will adapt to climate change in varying degrees depending on how vulnerable they are to climate.
Climate change	The United Nations Framework on Climate Change (UNFCCC, 1992) defines climate change as a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods.
Climate change mitigation	The Intergovernmental Panel on Climate Change (IPCC, 2018) defines mitigation of climate change as: *'a human intervention to reduce emissions or enhance the sinks of greenhouse gases. Note that this encompasses carbon dioxide removal (CDR) options.'* Mitigation measures include technologies, processes or practices that contribute to mitigation.
Climate Change Risk (CCR) Assessment	For the purpose of this OTD, the CCR identifies the impact of a changing climate on a project. The assessment considers a project's vulnerability to climate change and identifies adaptation measures to accommodate climate change impacts.
Climate Practitioner	The climate expert undertaking the climate assessment meeting the qualification and competency defined in Section 1.3.
Competent Authority	The term 'competent authority' means the Minister or public authority to which an EIAR is required to be submitted, i.e., the authority charged with examining an EIAR with a view to issuing a consent to develop or operate (EPA, 2022).
Cumulative impacts	Cumulative Impact Assessment falls into two strands, the first being to ensure that the effects of the project are considered cumulatively alongside those of other proposed projects in geographic proximity to the project, and then secondly, to ensure that cumulative effects are considered for a single receptor (i.e. people, wildlife or the physical environment) where multiple impacts (i.e. noise, air quality, traffic and visual impacts) are predicted to arise from the project.
Cycleway	An offline public road reserved for the exclusive use of people cycling or people walking, wheeling, and cycling (see also definitions of 'Greenway').

Key Term	Definition
	All mechanically propelled vehicles, other than mechanically propelled wheelchairs and electric bikes, are prohibited from entering except for the purpose of maintenance and access.
Cycleway	An offline public road reserved for the exclusive use of people cycling or people walking, wheeling, and cycling (see also definitions of 'Greenway' and 'Shared Use Active Travel Facility'). All mechanically propelled vehicles, other than mechanically propelled wheelchairs and electric bikes, are prohibited from entering except for the purpose of maintenance and access.
Cycle Track	A part of the road carriageway, including adjacent to a footway, which is reserved for the use of cycles and from which all mechanically propelled vehicles, other than mechanically propelled wheelchairs and electric bikes, are prohibited from entering except for the purpose of maintenance and access. A cycle track can be off-road, on-road (see definition of 'Cycle Lane') or shared (see definition of 'Shared Use Active Travel Facility').
Designer/Design Team	The group of experts, including internal (e.g. NRO/PO) designers and/or external engineering, environmental, valuation and legal advisors, who are responsible for all aspects of the project design, up to and including the award of the Main Construction Contract (and for employer design projects for Project design after the awarding of construction contract).
Do Minimum Scenario	The scenario that represents the situation that would occur without the proposed project in operation.
Do Something Scenario	The scenario that represents the situation that would occur with the proposed project in operation.
Effect/Impact	A change resulting from the implementation of a project (EPA, 2022).
Environmental Impact Assessment (EIA)	The process of examining the anticipated environmental effects of a proposed project – from consideration of environmental aspects at design stage, through consultation and preparation of an EIAR, evaluation of the EIAR by a competent authority, and the subsequent decision as to whether the project should be permitted to proceed, encompassing public response to that decision (EPA, 2022).
Environmental Impact Assessment Report (EIAR)	A report or statement of the effects, if any, that the proposed project, if carried out, would have on the environment (EPA, 2022)
Embodied carbon	GHG emissions emitted in producing materials, includes emissions caused by extraction, manufacture/processing, transportation and assembly of materials and products.
Emissions	Emissions in the context of this OTD, refer to the release of greenhouse gases and/or their precursors into the atmosphere over a specified area and period of time (EPA, 1992).
Exposure Analysis	In the context of a climate change risk assessment, the aim of an exposure analysis is to identify which climate hazards are relevant to the planned project location, irrespective of the project type.
Greenhouse gases	Gaseous constituents of the atmosphere, both natural and anthropogenic, that absorb and emit radiation at specific wavelengths within the spectrum of infrared radiation emitted by the Earth's surface, the atmosphere, and clouds (BSI, 2016).
Greenhouse Gas (GHG) Assessment	For the purpose of this OTD, the greenhouse gas assessment identifies the greenhouse gas impact of a project on the climate over the life of a project.
Greenway	A cycleway that caters for people walking, wheeling, and cycling in a mainly recreational environment.
Mitigation Measures	Measures designed during the planning and evaluation process to avoid, prevent, or reduce impacts. These measures can mitigate impacts:

Key Term	Definition
	• By avoidance - When no impact is caused (often through consideration of alternatives). • By prevention - When a potential impact is prevented by a measure to avoid the possibility of the impact occurring. • By reduction - When an impact is lessened (EPA, 2022).
Monitoring	The observation, measurement and evaluation of environmental data to follow changes over a period of time, to assess the efficiency of control measures and to record any unforeseen effects in order to be able to undertake appropriate remedial action. This is typically a repetitive and continued process carried out during construction, operation or decommissioning of a project.
Operational Environmental Management Plan (OEMP)	A working document that describes how a project will be managed and implemented, to minimise environmental impacts during the operational phase of the project.
Overarching Technical Document (OTD)	The purpose of TII's OTDs are to provide consistent theory and methodology (with the accompanying theory) of a subject matter e.g. climate change, to enable the assessment of National Roads and related infrastructure.
Project Manager	The role and responsibility of the Project Manager in this OTD is to ensure that a project is delivered on time, to budget and to the required standards and specifications, for more detail on duties please refer to PE-PMG-02041.
Representative Concentration Pathways (RCPs)	To model and predict future climate it is necessary to make assumptions about the economic, social and physical changes to our environment that will influence climate change. Representative Concentration Pathways (RCPs) are a method for capturing those assumptions within a set of scenarios. The conditions of each scenario are used in the process of modelling possible future climate evolution. RCPs specify concentrations of greenhouse gases that will result in total radiative forcing, increasing by a target amount by 2100, relative to pre-industrial levels. Total radiative forcing is the difference between the incoming and outgoing radiation at the top of the atmosphere. Radiative forcing targets for 2100 have been set at 2.6, 4.5, 6.0 and 8.5 watts per square metre (W m-2) to span a wide range of plausible future emissions scenarios and these targets are incorporated into the names of the RCPs; RCP2.6, RCP4.5, RCP6.0 and RCP8.5. Each pathway results in a different range of global mean temperature increases over the 21st century.
Scope and Boundary	The scope is the identification of which receptors/effectors (e.g. climate, GHG emissions, environment, project element) should and should not be included within an assessment. The boundary is the remit of where (spatial) and when (temporal) the receptors/effectors should be looked at.
Sensitivity Analysis	Sensitivity analysis is a method for testing uncertainty in different outcomes of a situation based on different scenarios and/or variables.
Significance	Details evidence of practice, associated with assessing and reporting on the extent of impact associated with the climate related assessments undertaken as part of the preparation of planning deliverables.
Standards Document (SD)	TII's SD provides the standard approach to the analysis and production of assessments and outputs/documents being prepared for use in National Roads and related infrastructure.
Thresholds	Thresholds, which may relate to the characteristics and location of a project or to the type and characteristic of the potential impact, are often laid down in relevant legislation. Where a project meets or exceeds these thresholds, EIA is mandatorily or automatically required. The thresholds in respect of roads are set down in Section 50(1)(a) of the Roads Act 1993, as amended, and Article 8 of the Roads Regulations 1994.

Key Term	Definition
	In respect of light rail, regard should be had to the requirements of the Transport (Railway Infrastructure) Act 2001, as amended. See Section 2.5 for more information.
Vulnerability Assessment	The vulnerability assessment combines the outcomes of the analysis of sensitivity and exposure and aims to identify potential significant climate hazards to the project.

Abbreviations and Acronyms

Acronym	Name
BaU	Business as Usual
BSI	British Standards Institution
CAP	Climate Action Plan
CBA	Cost Benefit Analysis
CO_2e	Carbon dioxide equivalent
CCR	Climate Change Risk
CDR	Carbon Dioxide Removal
CEMP	Construction Environmental Management Plan
DoT	Department of Transport
DM	Do Minimum
DS	Do Something
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
EPA	Environmental Protection Agency
EPD	Environmental Product Declarations
ES	Environmental Statement
ESR	Effort Sharing Regulation
EU	European Union
EV	Electric Vehicle
GHG	Greenhouse Gas
IEMA	The Institute of Environmental Management and Assessment
IPCC	Intergovernmental Panel on Climate Change
kWh	Kilowatt hour
LCA	Life Cycle Assessment
MCA	Multi-Criteria Analysis
NAF	National Adaptation Framework
NDP	National Development Plan
NIFTI	National Investment Framework for Transport in Ireland
NRN	National Road Network
NRO/PO	National Road Office/Project Office
NTA	National Transport Authority
OEMP	Operational Environmental Management Plan
OTD	Overarching Technical Document

Acronym	Name
PABS	Project Appraisal Balance Sheet
PAG	Project Appraisal Guidelines
PAS	Publicly Available Specification
PB	Project Brief
PMG	Project Management Guidelines
RCMs	Regional Climate Models
RCPs	Representative Concentration Pathways
SD	Standards Document
SLR	Sea Level Rise
TII	Transport Infrastructure Ireland
UKCP	United Kingdom Climate Projections
UNFCCC	United Nations Framework Convention on Climate Change
WBCSD	World Business Council for Sustainable Development
WRI	World Resources Institute

1. Introduction

This Overarching Technical Document (OTD) **PE-ENV-01104**, provides guidance on the methodology, scope and processes underlying climate assessment (CA) for National Roads, Light Rail, and Rural Cycleways (Offline & Greenways) projects.

The climate assessment process outlined in this document builds on existing best practice guidance for the transportation sector. The climate assessment describes the minimum requirement to establish a comprehensive and consistent description and understanding of the climate factors relevant to National Roads, Light Rail, and Rural Cycleways (Offline & Greenways). The CA process does not replace the requirement for, or supersede, any national, regional, county, or local-level climate assessments.

This Overarching Technical Document **PE-ENV-01104** sets out the approach for CA to all TII projects, whilst the Standards Document **PE-ENV-01105** sets out the required standards for proposed National Roads. They are applicable to Projects which are funded through TII and/or where TII is the Approving Authority.

The NTA is the Approving Authority for Public Transport Projects, in such cases the Project Approval Guidelines for Projects Funded by the NTA shall apply. Where TII is the Sponsoring Agency, then agreement shall be reached at Project outset with the relevant Approving Authority as to the applicability of these guidelines.

1.1 Background

Climate change poses significant challenges to Ireland. Ireland has already experienced an unprecedented level of damage to infrastructure and disruption to services caused by multiple extreme weather events such as the floods of winter 2015/16, and storms Ophelia and Emma in 2017 and 2018 respectively. Recent climatic observations show that Ireland’s climate is changing in terms of Sea Level Rise (SLR), increases in average temperature, changes in precipitation patterns and weather extremes (Department of the Environment, Climate and Communications, 2018). Risk assessment analysis recognises that the highest climate risk for the transport sector comes from the projected increase in precipitation extremes, flooding, high winds, increased storm intensity and projected rises in sea level (Department of Transport, Tourism and Sport, 2019).

The Irish Government has committed to reducing greenhouse gas (GHG) emissions in Ireland to net-zero by 2050 to safeguard the future of the next generation (Government of Ireland, 2021). All sectors across the economy have an important role to play in achieving these commitments, including the transportation sector which accounts for Ireland’s second largest source of GHG emissions.

The transportation decarbonisation targets in Ireland’s Climate Action Plan (Department of Transport, Tourism and Sport, 2019) will be aided in delivery through the National Investment Framework for Transport in Ireland (NIFTI) (Department of Transport, 2021) which prioritises investment in decarbonisation though the application of its modal and intervention investment hierarchies.

Transport Infrastructure Ireland’s (TII’s) vision as part of its Sustainability Implementation Plan (TII, 2021) is to lead in the delivery and operation of sustainable transport. The Plan promotes six key Sustainability Principles developed to reflect TII’s organisational ambition, including:

- Provide effective, efficient, and equitable mobility.
- Enable safe and resilient networks and services.
- Collaborate for a holistic approach.

- Deliver end-to-end improvements.
- Transition to net zero; and
- Create total value for society.

This OTD has been developed to ensure that climate change is comprehensively evaluated from project inception. Addressing and mitigating against the GHG impacts of a project as early as possible in the planning stage will support TII's 'Transition to net zero' principle.

Designing projects so that they are resilient to a changing climate will help deliver safe and resilient networks and services. As Figure 1.1 shows, carbon mitigation, and climate adaptation of Ireland's infrastructure projects will enable the development of a net zero resilient future that is aligned with Ireland's national ambitions. The transition to a net zero resilient infrastructure system may also bring with it wider benefits through possible health, environmental and quality of life benefits such as improved air quality and increased levels of physical activity.

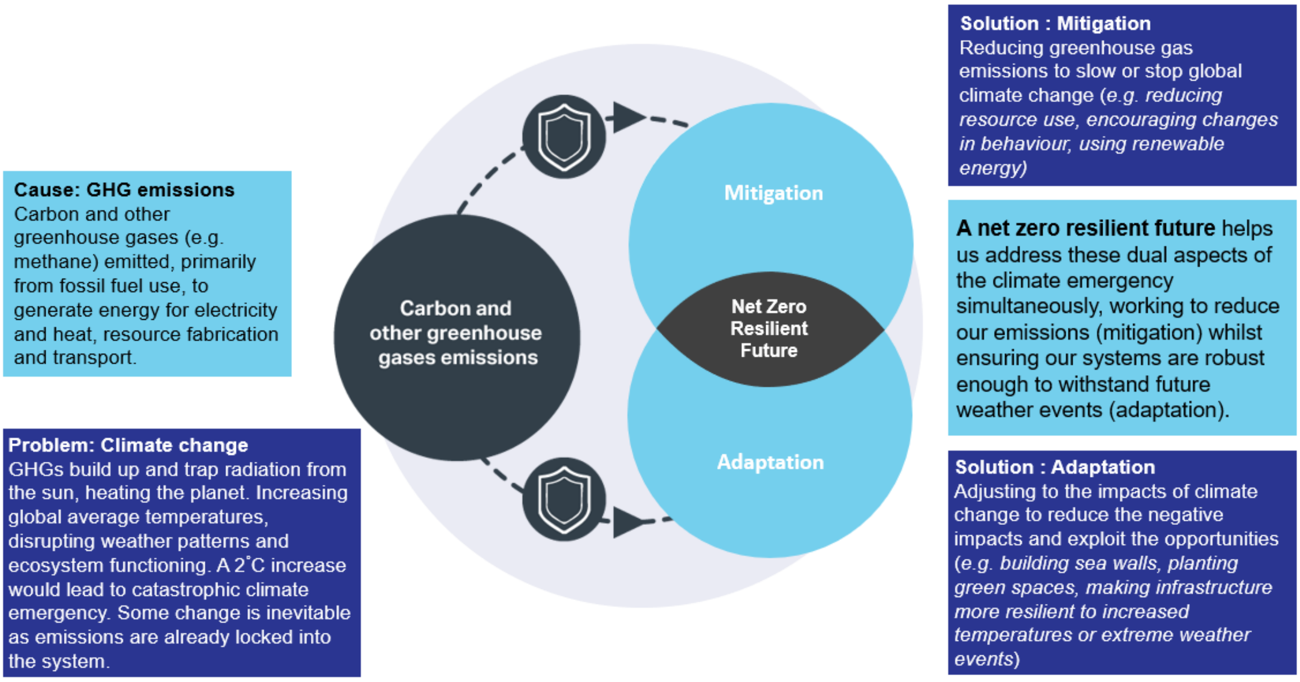


Figure 1.1 Transition to a net zero resilient future

1.2 Purpose of the Overarching Technical Document

The primary purpose of this OTD is to provide a consistent theory and methodology on the assessment of climate change for National Roads, Light Rail, and Rural Cycleways (Offline & Greenways) going through the statutory planning process (including EIA), in accordance with Ireland's policy requirements and best practice.

A secondary purpose of this OTD is to provide a consistent theory and methodology which can be more widely applied to National Roads, Light Rail, and Rural Cycleways (Offline & Greenways) outside of the statutory planning process.

The Standards Document (SD) PE-ENV-01105 provides the standard approach to the analysis and production of the climate assessment and outputs/documents being prepared for use in National Roads and related infrastructure.

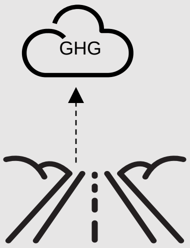
Together, the OTD and SD documents explain TII's approach to the assessment of climate change impacts including the identification of appropriate mitigation and any likely significant effects. This OTD should be used by Climate Practitioners in the preparation of a climate assessment for National Roads, Light Rail, and Rural Cycleways (Offline & Greenways) projects.

This OTD should also be used as a reference for those with a direct involvement in the planning, design and evaluation of National Roads, Light Rail and Rural Cycleways (Offline & Greenways) projects. This may include the Project Manager, local authorities and other authorities, planners, infrastructure engineers, and sustainability professionals.

1.2.1 Climate Assessment Definitions and Descriptions

To align with the requirements of the Environmental Impact Assessment (EIA) Directive 2014/52/EU (The European Parliament and the Council of the European Union, 2014 amending Directive 2011/92/EU) the climate assessment should consider the following assessments shown in Figure 1.2.

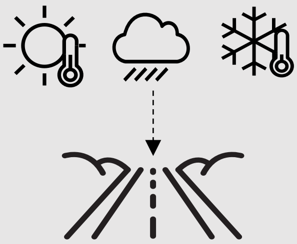
1. Greenhouse Gas Emissions (GHG) Assessment



Impact of the project on the climate

Quantifies GHG emissions from a project during its lifetime and contextualises the magnitude of the impact of these emissions against relevant carbon budgets, targets and policy.

2. Climate Change Risk (CCR) Assessment



Impact of a changing climate on the project

Identifies the impact of a changing climate on a project and receiving environment. The assessment considers a project's vulnerability to climate change and identifies adaptation measures to accommodate climate change impacts.

Figure 1.2 Assessments required for climate assessment and their Definitions

1.3 Requirements of the Climate Assessment Practitioner

Undertaking a climate assessment as part of the preparation of the planning process deliverables requires expertise, independence, and objectivity.

Directive 2011/92/EU, as amended by Directive 2014/52/EU, stipulates that the EIAR and assessments must be carried out by competent practitioners. Where required for National Roads, Light Rail, and Rural Cycleways (Offline & Greenways), the climate assessment will be carried out by a suitably qualified and competent Climate Practitioner who has previous experience in this field.

The Climate Assessment Practitioner undertaking the climate assessment is referred to as the 'Climate Practitioner' in this document. It is recommended that the Climate Practitioner(s) involved in the preparation of the EIAR and/or carrying out of the climate assessment in respect of TII projects have the following qualifications, as a minimum:

- An honours degree in environmental science, climate change (or equivalent discipline); and/or a master's degree in environmental science, climate change (or equivalent discipline).

It is also recommended that:

- The Climate Practitioner undertaking the GHG Assessment will be experienced in GHG management, including GHG Assessment aligned with PAS 2080 Carbon Management in Infrastructure (BSI, 2016). The Climate Practitioner should also have experience utilising the TII Carbon Assessment Tool.
- The Climate Practitioner undertaking the CCR Assessment should be experienced in conducting CCR Assessments including the interpretation and application of climate change data (historic and projections) and have experience managing climate change impacts on transport projects.
- The Climate Practitioner should hold membership of a relevant/appropriate professional body.

In general, it is recommended that the Climate Practitioners have five years' relevant post-graduate experience in GHG management and climate change. The minimum number of years' relevant post-graduate experience may change (upwards or downwards) depending on the size, nature or complexity, of the project in question. In addition, it is essential to carefully lay down further criteria defining what post-graduate experience is considered relevant in the context of the project at hand.

The Climate Practitioner should have experience with the EIA process (or other planning processes as applicable) and requirements, and therefore be capable of characterising the existing environment and assessing how the proposed project will impact upon it. The Climate Practitioner should also have technical knowledge of, and be up to date with:

- The relevant legislation, policy and standards that apply.
- The relevant EIA, planning and climate change guidance.
- The criteria for evaluation and classification of the significance of impacts.

The person(s) responsible for the submission of the climate assessment must document compliance with the criteria above to ensure that its Climate Practitioners, who carry out climate assessments on TII projects (which require EIA), are qualified, competent, and expert.

1.4 Related Documents and Tools

The following documents and tools are of relevance to Climate Practitioners undertaking a climate assessment (Table 1.1).

The Air Quality OTD and SD are relevant as the outputs of these documents (e.g. road user emissions) will be used to inform the GHG Assessment. The TII Carbon Assessment Tool (Appendix B) and the TII Road Emissions Model (REM) (Appendix C) are for use in the assessment of air quality and climate effects for Specified Infrastructure Projects.

Table 1.1 Relevant Documents and Tools

Document/Tool	Reference	Description
Climate SD	**PE-ENV-01105**	**Provides a methodology for a climate assessment of National Road projects, including motorway service areas and toll schemes**
Air Quality OTD	**PE-ENV-01106**	**Provides guidance on the methodology, scope and processes underlying Air Quality Assessment (AQA) for Specified Infrastructure Projects**
Air Quality SD	**PE-ENV-01107**	**Sets out the methodology for AQA for developments on National Roads, including motorway service areas and toll schemes**
TII Road Emission Model (REM)*	**N/A**	**The TII REM tool calculates greenhouse and non-greenhouse gas emissions from road transport integrating traffic volumes and speeds for light and heavy vehicles on the Irish national road network with Irish fleet composition information.**
TII Road Emissions Model (REM): Model Development Report	**GE-ENV-1107**	**A step-by-step document that shows how to use the TII REM Tool.**
TII Carbon Assessment Tool*	**N/A**	**The TII Carbon Assessment Tool uses a series of calculations, emission factors and assumptions to calculate a carbon footprint for proposed road and light rail projects.**
TII Carbon Assessment Tool User Guide	**GE-ENV-1106**	**A step-by-step document that shows how to use the TII Carbon Assessment Tool.**

** Please note that in order to get access to the REM and Carbon Tools, prospective users should email climatetools@tii.ie to be set up as an authorised user on the TII Web Application Portal*

1.5 Organisation of the Overarching Technical Document

This document is organised as shown in Figure 1.3.

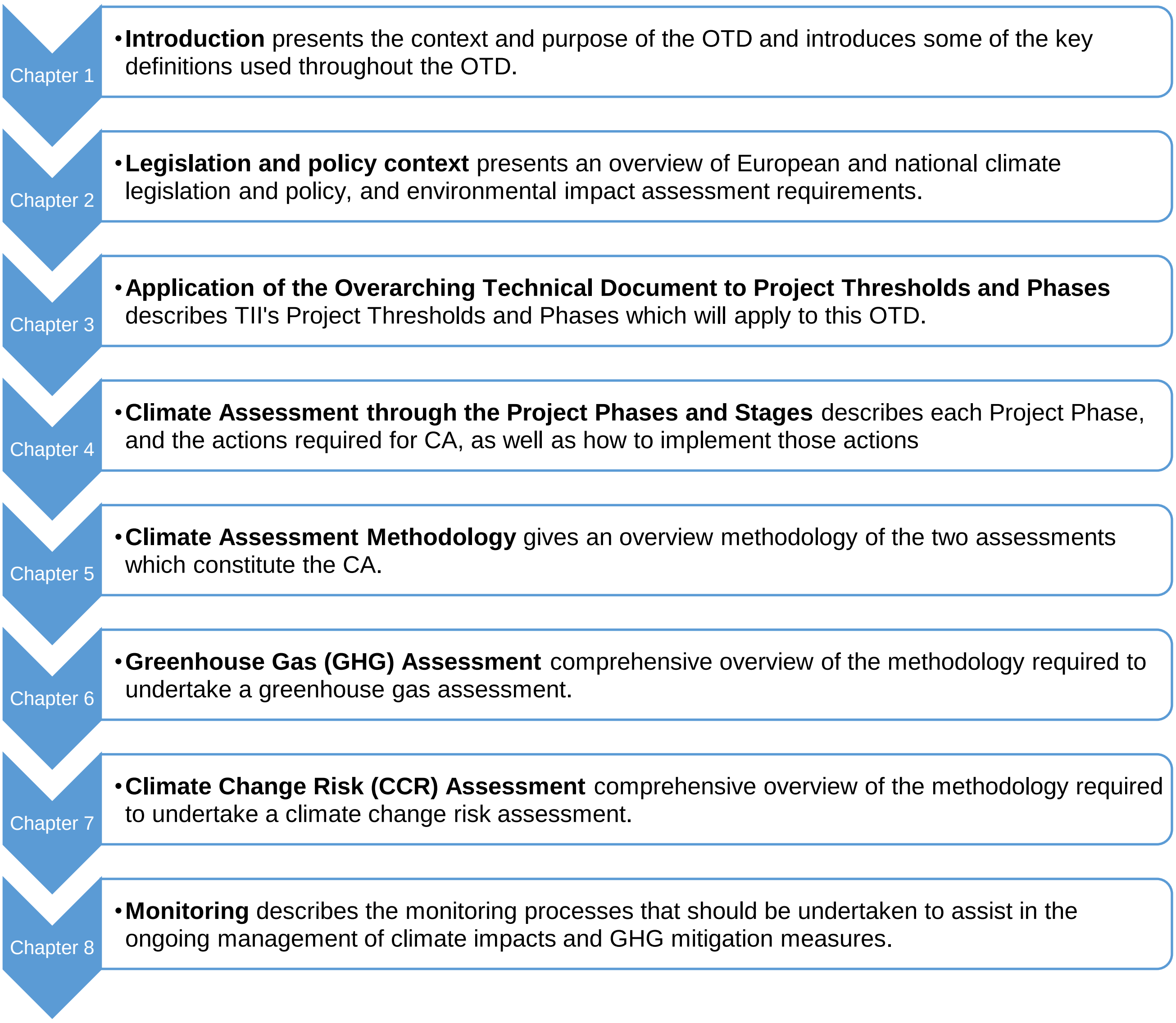


Figure 1.3 Organisation of OTD

2. Climate Change Regulatory and Policy Framework

An overview of the regulatory and policy framework on climate is provided in Figure 2.1. This is followed by a summary of key climate legislation and policy, driving the requirement for action to reduce GHG emissions and mitigate the impacts of climate change. Further details on climate legislation and policy is provided in Appendix A.

Planning and climate change policy is an evolving area and Climate Practitioners must be cognisant of the relevant legislation within the EU, national and local policy landscape, including the Climate Action Regional Offices.

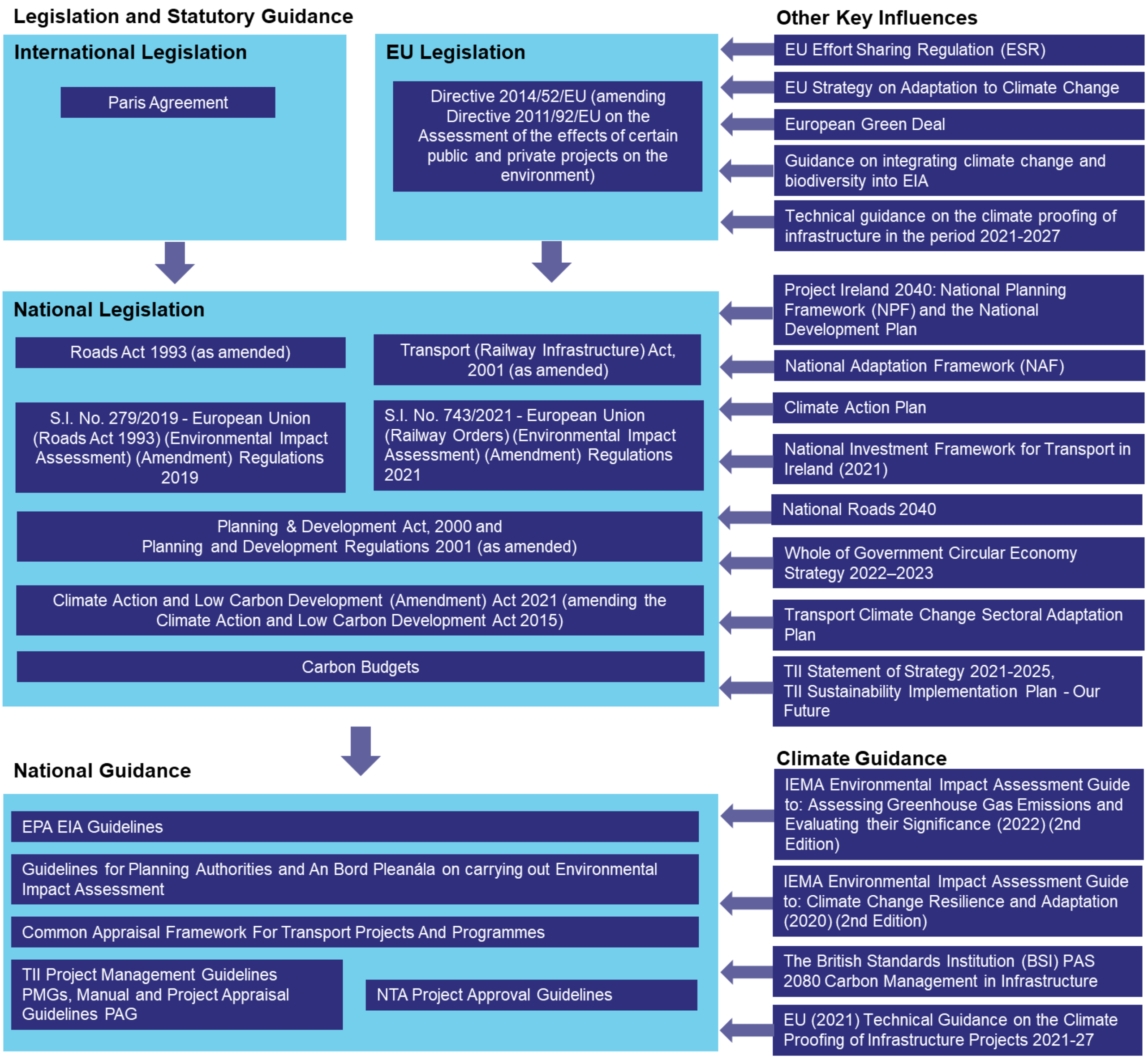


Figure 2.1 Legislation, Statutory Guidance and other Key Influences on Climate Change and GHG for National Roads, Light Rail and Rural Cycleways (Offline & Greenways) projects

2.2 United Nations Paris Agreement

Ireland is a party to the United Nations Framework Convention on Climate Change (UNFCCC), and the Paris Agreement signed in 2015, which together provides the international legal framework for addressing climate change (UNFCCC, 2015). It requires all signatories to strengthen their climate change mitigation efforts to keep global warming to well below 2°C this century and to pursue efforts to limit global warming to 1.5°C.

2.3 EU Effort Sharing Regulation (ESR) (European Commission, 2021)

The ESR Regulation (European Commission, 2021) sets out binding annual GHG emission targets for Member States for the period 2021–2030 inclusive. Under the ESR, targets for Member States are based on GDP per capita and the cost-effectiveness of domestic emissions reductions within individual Member States. The final agreement sets a target of 30% reduction in GHG emissions (compared to 2005 levels) by 2030 for Ireland. This will be Ireland’s contribution to the EU objective to reduce EU emissions by 40% by 2030 compared to 1990 levels (Department of the Environment, Climate and Communications, 2021).

2.4 Climate Action and Low Carbon Development (Amendment) Act 2021 (amending the Climate Action and Low Carbon Development Act 2015) (Government of Ireland, 2021)

Climate Action and Low Carbon Development Act 2015 (Government of Ireland, 2021) is Ireland's first framework piece of climate change legislation. It provided the ground for transition towards a low carbon economy, to be achieved through a combination of the following: a national greenhouse gas mitigation plan, a national adaptation framework, and specific sectoral adaptation plans.

The Act also includes the establishment of an independent Climate Change Advisory Council on climate change to conduct an annual review of the progress made in achieving planned GHG emissions reductions, and furthering transition to a "low carbon, climate resilient and environmentally sustainable economy".

In July 2021, the Climate Action and Low Carbon Development (Amendment) Act of 2021 amended the original 2015 Act and was signed into law (Government of Ireland, 2021). It supports Ireland’s transition to net zero and to achieve a climate neutral economy by no later than 2050. It requires the government to adopt into law a series of economy-wide five-year carbon budgets, including sectoral targets, on a rolling 15-year basis, starting in 2021.

2.4.1 Carbon Budgets

Carbon budgets for Ireland took effect on the 6 April 2022 (Department of the Environment, 2022). The budgets set maximum GHG emissions thresholds or caps permitted for Ireland during a five-year budget period. The emissions caps are measured in tonnes of carbon dioxide equivalent (tCO_2e) as reported by the EPA under the UNFCCC on the basis of Global Warming Potential values[1]. The first carbon budget programme comprises carbon budgets for the periods: 2021-2025; 2026-2030 and 2031-2035 (Climate Change Advisory Council, (2021)).

[1] *There are seven main GHGs that contribute to climate change, as covered by the Kyoto Protocol: carbon dioxide (CO_2), methane (CH4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulphur hexafluoride (SF6) and nitrogen trifluoride (NF3).*

A National Long-Term Climate Action Strategy will be prepared every five years and actions for each sector will be detailed in the Climate Action Plan which will be updated annually.

2.5 Environmental Impact Assessment (EIA)

Requirements for the assessment of climate impacts as part of the EIA process derive from Amended Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment ('EIA Directive').

As of May 2017, EIA Directive requires an EIA (where relevant) to include assessment of the impact of a proposed development on climate change, for example the impact (magnitude) of GHG emissions from a project and the impact of climate change on a project.

Recital (13) states: *"Climate change will continue to cause damage to the environment and compromise economic development. In this regard, it is appropriate to assess the impact of projects on climate (for example greenhouse gas emissions) and their vulnerability to climate change."* The EIA Directive requires that the climate assessment provides:

- A description of the impact of a proposed project on climate change (for example GHG emissions, impacts relevant to adaptation); and
- A description of the likely significant effects of the proposed project on the environment resulting from the impact of the project on climate (for example the nature and magnitude of greenhouse gas emissions) and the vulnerability of the project to climate change.

Directive 2014/52/EU was transposed into the Irish law through the following Irish planning legislation:

- Amendment to the Roads Act 1993: S.I. No. 279/2019 - European Union (Roads Act 1993) (Environmental Impact Assessment) (Amendment) Regulations 2019 in relation to the proposed road developments (Minister for Transport, Tourism and Sport, 2019), and
- Amendment to the Transport (Railway Infrastructure) Act 2001 and Planning and Development (Strategic Infrastructure) Act 2006: S.I. No. 743/2021 - European Union (Railway Orders) (Environmental Impact Assessment) (Amendment) Regulations 2021 in relation to the proposed railway developments (Minister for Transport, 2021).

The EIA processes that are carried out and the associated requirements for projects are shown in Table 2.1. How a climate assessment is documented is demonstrated in Table 2.2.

Table 2.1 EIA Processes and their Requirements

EIA processes	Requirement
Mandatory EIA	EIA is a mandatory requirement in respect of certain projects e.g. a new motorway, a new light rail, service area, and any prescribed type of proposed road development consisting of the construction of a proposed public road or the improvement of an existing public road. Prescribed types include the construction a new road of four or more lanes, or the realignment or widening of an existing road so as to provide four or more lanes, where such new, realigned or widened road would be eight kilometres or more in length in a rural area, or 500 metres or more in length in an urban area, as well as the construction a new bridge or tunnel which would be 100 metres or more in length.

EIA processes	Requirement
Screening to determine if an EIA is required	Where EIA is not a mandatory requirement, specified linear infrastructure projects i.e. National Roads, and Rural Cycleways (Offline & Greenways), are subject to sub-threshold 'Screening for the requirement for EIA' to determine if the project is, or is not likely to have significant effects on the environment. Where likely significant effects are identified the project is subject to a 'Sub-threshold Development EIA'.
Scoping	Where EIA is a mandatory requirement, or is 'screened in for EIA', EIA 'scoping' is required: a process of determining the content and extent of the matters which should be covered in the environmental information to be submitted in an EIA Report. The scoping opinion may be requested from the planning authority or An Bord Pleanála, as appropriate.

Table 2.2 Projects type and how a climate assessment is documented

Project type	How climate is Documented
Projects requiring EIA	Formally, as part of the preparation of an EIAR for projects above a certain threshold, or sub-threshold project, where the Competent Authority considers that a development would be likely to have significant effects on the environment.
Projects not requiring EIA	Some projects may not require EIA. Where EIA is not required, individual standalone assessments may still be required to address particular environmental aspects. This may include GHG emissions and climate change risk. Where climate assessment is required, it should continue to follow the broad approach and structure outlined in this OTD.

3. Application of the Overarching Technical Document to Project Thresholds and Phases

This Chapter gives an overview of TII and the NTA's Project Thresholds and Project Phases and describes how they will apply to this OTD. Detail on where and how the climate assessment process is applied to TII's Project Phases is provided in Chapter 4.

TII's Project Management Guidelines (PMG) provide a framework for a phased approach to the management of the development and delivery of National Road and Public Transport Capital Projects.

This OTD PE-ENV-01104 sets out the approach to climate assessment for National Roads, Light Rail and Rural Cycleways (Offline & Greenways), whilst SD PE-ENV-01105 sets out the required standards for proposed National Roads, motorway service areas, and toll schemes. They are applicable to projects which are funded through TII and/or TII is the Approving Authority, unless otherwise instructed by TII. The Technical and Standards Documents shall be used by Project Managers and those responsible for the delivery of such projects.

The National Transport Authority (NTA) is generally the Approving Authority for Public Transport Projects, in such cases the Project Approval Guidelines for projects funded by the NTA (NTA, 2020) shall apply. The NTA is the Approving Authority for Public Transport Projects, in such cases the Project Approval Guidelines for Projects Funded by the NTA shall apply. Where TII is the Sponsoring Agency, then agreement shall be reached at Project outset with the relevant Approving Authority as to the applicability of these guidelines.

TII and the NTA classify projects into different cost value thresholds as well as identify different phases within the delivery of projects. The different TII project thresholds are outlined in this Chapter along with the climate assessment outputs required for TII projects. The different TII and NTA project phases are outlined in Table 3.2.

3.1 Project Thresholds

TII classifies projects into different value thresholds in Project Appraisal Guidelines as either minor or major projects (refer to Table 3.1).

In general, the full extent of this OTD does not apply to TII projects of less than €5 million, unless an EIA is required. TII may decide to apply certain Sections of the OTD to a specific project below these thresholds.

The complexity of projects between €5 and €20 million can vary considerably. In practice, upgrading a section of National Road may not require the same level of assessment as a new bypass for a town. Therefore, the level of assessment should be proportionate to the nature and scale of the project. How this is carried out should be recorded in TII's Project Execution Plan (PEP) for that particular project. The OTD will generally apply in full to TII major projects.

Table 3.1 TII Project Threshold

Project Threshold	TII Project Classification
Up to €0.5 million	Generally not applicable, unless otherwise instructed by TII
€0.5 to €5 million	

Project Threshold	**TII Project Classification**
€5 to €20 million	Minor Projects[2]
Greater than €20 million	Major Projects

3.2 Project Phases

This OTD applies to Project Phases 0 to 4 of the TII Project Management Guidelines (PMG) PE-PMG-02041 (TII) which address scope, option selection, design and environmental evaluation, and statutory processes.

However, this document does not apply to TII Project Phases 5 to 7, which relate to procurement, construction and implementation, and closeout and review.

While each use slightly different terminology, TII and the NTA both have a multi-phase sequential approach to the delivery of projects (refer to Table 3.2 below for reference). Some of these phases may be amalgamated for lower threshold projects.

Table 3.2 TII and NTA Project Phases

<table>
<tr><th colspan="3">TII PMG Project Phases</th><th colspan="3">NTA Project Phases</th></tr>
<tr><td rowspan="5">Planning and Design</td><td>Phase 0</td><td>Scope and Pre-Appraisal</td><td rowspan="6">Planning and Design</td><td rowspan="2">Phase 1</td><td rowspan="2">Scope and Purpose</td></tr>
<tr><td>Phase 1</td><td>Concept & Feasibility</td></tr>
<tr><td>Phase 2</td><td>Option Selection</td><td>Phase 2</td><td>Concept Development and Option Selection</td></tr>
<tr><td>Phase 3</td><td>Design and Environmental Evaluation</td><td>Phase 3</td><td>Preliminary Design</td></tr>
<tr><td>Phase 4</td><td>Statutory Processes</td><td>Phase 4</td><td>Statutory Processes</td></tr>
<tr><td rowspan="3">Construction / Implementation</td><td>Phase 5</td><td>Enabling and Procurement</td><td rowspan="3">Construction / Implementation</td><td>Phase 5</td><td>Detailed Design and Procurement</td></tr>
<tr><td>Phase 6</td><td>Construction and Implementation</td><td>Phase 6</td><td>Construction and Implementation</td></tr>
<tr><td>Phase 7</td><td>Closeout and Review</td><td>Phase 7</td><td>Closeout and Review</td></tr>
</table>

[2] *It should be noted that projects between 0.5 to 5 million will generally follow the Design Phase Procedure for Road Safety Improvement Schemes, Urban Renewal Schemes and Local Improvement Schemes DN-GEO-03030*

4. Climate Assessment through the Project Phases

4.1 Introduction

Chapter 3 outlines the different Project Phases of TII Specified Infrastructure Projects. In this Chapter details are given on where and how the climate assessment process is applied to the Project Phases. Table 4.1 provides an overview of the actions required for climate assessment at each Phase, and how it should be implemented. Further details on how to implement a climate assessment at each Project Phase is explained in Sections 4.3 - 4.9.

At the early Project Phases (e.g. Phase 0 and 1), a Climate Practitioner may not yet be appointed on the project. Where this is the case, it is the expectation that the Project Manager will be responsible for the climate assessment actions covered at these Phases. Otherwise, it is the responsibility of the Climate Practitioner.

Table 4.1 Summary of climate assessment actions required at each Phase, and How to Implement

Climate Assessment Actions Required	How to Implement
Phase 0 – Scope and Pre-Appraisal (TII)	
• Align with local and national climate policy. • Apply NIFTI investment hierarchies. • Input findings into relevant documents including: Strategic Assessment Report, Project information Summary Notices, and Phase 0 Gate Review Statement.[3]	• Examine local and national policy in relation to climate change and identify whether the project scope is in keeping with policy, in relation to GHG emissions and climate risk. • Critically assess the need for infrastructure. A prioritisation of sustainable modes of travel should take place; explore the rationale behind the project and whether opportunities for sustainable modes of travel e.g. Rural Cycleways (Offline & Greenways) and cycle paths can be accommodated via pragmatic application of the NIFTI intervention and modal hierarchies.
Phase 1 – Concept & Feasibility (TII)	
• Describe the greenhouse gas and climate impacts of the project. • Describe mitigation and adaptation principles and opportunities. • Input into relevant documents including: Project Execution Plan, Phase 1 Gate Review Statement, Feasibility/Constraints Report, etc.	• Define the purpose and scope of the assessment. • Identify the existing local conditions for reasonable alternatives and any difference between them that may impact GHG and/or climate risk. **GHG Assessment** • Describe the potential GHG impacts of the project on the climate, with any differences in the long list of options identified. Differences in options which have a significant bearing on the carbon emissions impact should therefore be deduced. These include land use types traversed, type(s) of infrastructure, length of infrastructure. • Discuss mitigation principles and opportunities with the Design Team. • CCR Assessment Describe historic climate events for the project location.

[3] If a project is of significant size (e.g. > €20m), then some traffic modelling may have been undertaken at Phase 0 allowing for the quantification of road user emissions from the Air Quality Practitioner.

Climate Assessment Actions Required	How to Implement
Phase 2 – Stage 1 Preliminary Options Assessment (TII)	
• Determine the existing local conditions. • Identify the design features and route length for each option. • Undertake a climate screening. • Discuss any opportunities for mitigation. • The results of the qualitative statement will be used to inform the comparative ranking (Multi-Criteria Assessment (MCA)) and PAG and PMG deliverables at Stage 3, with consideration given to possible mitigations. • From Phase 2 onwards, the climate assessment outputs must be acknowledged by the Project Manager and receipt of this recorded by the Climate Practitioner.	• Define the study area and zone of influence for the assessment. • Identify/update the existing local conditions for each option and any differences between them that may impact GHG and/or climate risk. **GHG Assessment** • Describe the potential GHG impacts of the project on the climate, with any differences in the options identified. At Phase 2, Stage 1 route specific carbon data will not be available. • In order to determine the key differences in carbon emissions, the variables in Table 4.2 should be assessed qualitatively for each route option. • Discuss mitigation measures based on available data. **CCR Assessment** • Using the historic data gathered under Phase 1 and the methodology described in Section 4.3.1 to undertake the climate screening of options to provide an assessment on vulnerability.
Phase 2 – Stage 2 Project Appraisal Matrix	
• Where available obtain GHG emissions data for refined options selection. • Update the climate screening. • Update opportunities for mitigation. • The results of the assessment will be used to inform the comparative ranking (MCA) and PAG and PMG deliverables at Stage 3, with consideration given to possible mitigations.	• Where more information on the existing conditions becomes available update the assessments e.g. with the narrowing of route options, more detail may become available on the location such as the land use type traversed or the climate receptors in the areas. **GHG Assessment** • Quantify carbon sources, available quantitative variables (as identified in Table 4.2) should be inputted into the TII Carbon Assessment Tool. • Where data is not available, a qualitative assessment should be provided. • Evaluate the GHG emissions for each option and rank options from lowest to highest carbon impact in terms of tCO_2e and split via lifecycle stage as demonstrated in Table 6.2. • Any GHG emissions unable to be quantified, should be qualitatively ranked via Red Amber Green (RAG) rating. • To enable alignment with Ireland's net zero trajectory, discuss/update mitigation measures based on available data. Mitigation measures should follow the mitigation hierarchy (Figure 6.3) with reduction impacts quantified where possible. **CCR Assessment:** • Update the climate screening using the methodology in Chapter 7 based on any additional data available.
Phase 2 – Stage 3 Selection of Preferred Option	
• Assist in the preparation of the climate change section of the Project Appraisal Balance Sheet (PABS).	• Review the Stage 2 Report and update where necessary the GHG Assessment calculations and CCR Assessment data based on updated design information.

Climate Assessment Actions Required	How to Implement
• Input into the PAG and PMG deliverables for the preferred option. Project Appraisal Balance Sheet (PABS)*	
Phase 2 Deliverables	
Input into relevant phase 2 documents including: • Options Appraisal Report (OAR), • Phase 2 Gate Review Statement • Options Selection Report	
Phase 3 – Design and Environmental Evaluation (TII)	
• Participate in the EIA screening process. • Complete Climate section of EIAR or project specific environmental report /standalone climate assessment report (including both GHG Assessment and CCR Assessment). • The EIA Chapter/project specific environmental report/standalone report should be used to inform the PAG and PMG deliverables for Phase 3. • The Project Manager should be consulted with, and the reported outputs shared with them so that the necessary mitigation and adaptation measures are taken forward in Phases 5-7.	• Obtain all project quantitative data for preferred option as per Table 4.2 and Table 4.3. • For EIA projects follow the methodology in Chapter 5 to produce a Climate Chapter for GHGs and climate change risk. • Where EIA is not required produce a project specific environmental report or standalone report which follows the methodology outlined in Chapter 5.
Phase 4 – Statutory Processes (TII)	
• Review and draft responses, where warranted, to climate assessment issues raised in submissions to the consenting process. • Review and draft responses, to any climate assessment requests for further information issued by the consenting authority. • Review and update, if necessary, any aspect of the climate assessment and document same. • Draft a Climate Assessment Statement of Evidence, where a oral hearing is to be held, in relation to climate assessment aspects, including the assessment and responses to submissions. • Taking part in oral hearing preparation meetings. • Finalise the Statement of Evidence. • Present the Statement of Evidence at the oral hearing and respond to any questions on climate assessment aspects from the public, other bodies or the Inspector for the consenting authority. Review and report on any climate aspects addressed in the decision of the consenting authority (and the planning Inspector's report).	

4.2 Data Availability

When undertaking a GHG Assessment less data is likely to be available at earlier stages i.e. Project Phases 0-2. Emissions will therefore, more than likely need to be based on assumptions, using publicly available data. Each project phase and the likely data availability at each phase is shown in Table 4.2 for GHG Assessment and Table 4.3 for CCR Assessment.

Table 4.2 TII Project Phases and data availability for GHG Assessment

Data type	Project Phases						
	Phase 0	Phase 1	Phase 2			Phase 3	Phase 4
			Stage 1	Stage 2	Stage 3		
Project location							
Infrastructure type(s)							
Infrastructure length							
Land use type(s) traversed							
Current road user emissions							
Design features							
Before use - Embodied carbon							
Before use - Transport							
Before use – Construction processes							
Use – material use							
Use - maintenance							
Use - operation							
Use – user emissions							
End of life – Deconstruction							
End of life – Transport							
End of life – Recovery and disposal							
	Qualitative assessment				**Quantitative assessment**		
	Partial dataset available						
	Complete dataset available						

Table 4.3 TII Project Phases and data availability for CCR Assessment

Data type	Project Phases						
	Phase 0	Phase 1	Phase 2			Phase 3	Phase 4
			Stage 1	Stage 2	Stage 3		
Project location							
Land use type(s) traversed							
Key design features							
Design details e.g. to inform planned controls (refer to Chapter 7)							
Historical climate data							
Climate change projection data							
	Qualitative assessment			**Quantitative assessment**			
	Partial dataset available						
	Complete dataset available						

4.3 Phase 0: Scope and Pre-Appraisal

The aim of Phase 0 is to establish investment rationale and ensure that the project aligns with current TII strategic programmes and plans.

4.3.1 Phase 0 Climate-Specific Objectives

To allow for GHG emissions and climate risk to be considered from project inception, so that the project scope and its objectives are aligned with local and national climate policy and the overarching goal of decarbonising the transport sector.

4.3.2 Phase 0 Climate Assessment Approach and Process

1. At the scope and pre-appraisal phase there is no project-specific data available to perform a quantitative climate assessment. The Project Manager should examine local and national policy in relation to climate change and identify whether the project scope is in keeping with policy.
2. The project's rationale must align with NIFTI's investment priority of decarbonisation[4]. As part of the climate assessment, a critical assessment of the need for infrastructure and a prioritisation of sustainable modes of travel should take place, via pragmatic application of the NIFTI intervention and modal hierarchies (Figure 4.1).

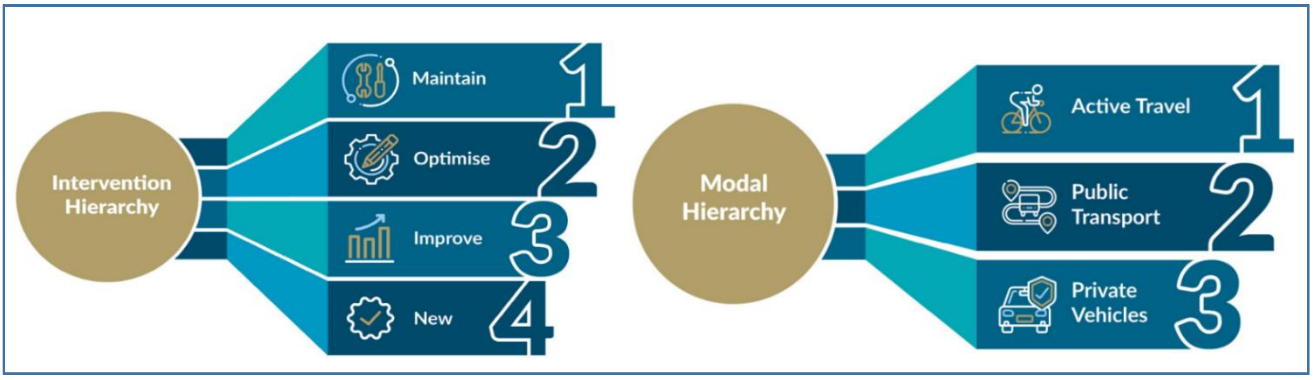


Figure 4.1 NIFTI's Intervention and Modal Hierarchies (source NIFTI)

4.3.3 Phase 0 Climate Assessment Outputs

Steps 1-3 of the Phase 0 climate assessment approach and process should be documented and captured within the Strategic Assessment Report and Phase 0 Gate review Statement.

4.4 Phase 1: Concept and Feasibility

At Phase 1 the aim is to develop and investigate in further detail the feasibility of the project and Project Management structure. Phase 1 will establish whether a sufficient case exists for considering the proposal in more detail and will also consider a range of modes/options proposed to solve the identified problem.

4.4.1 Phase 1 Climate-specific Objectives:

To allow for concept and feasibility evaluation to include GHG and climate risk impact.

4.4.2 Phase 1 Climate Assessment Approach and Process:

1. Define the purpose and scope of the assessment.
2. Identify the existing local conditions for each option and any difference between them that may impact GHG and/or climate risk.

GHG Assessment:

1. Describe the potential GHG impacts of the project on the climate, with any differences identified.

[4] *NIFTI has given priority to a number of investment areas to enable future transport investment to help deliver the needs of the National Planning Framework. It's investment priorities include mobility of people and goods in urban areas, protection and renewal, enhanced regional and rural connectivity, and decarbonisation.*

At Phase 1, route specific carbon data for options will not be available. Differences in routes which have a significant bearing on the carbon emissions impact should therefore be deduced. These would include:

a) Land use types traversed.

b) Type(s) of infrastructure.

c) Length of infrastructure.

2. Discuss mitigation principles and opportunities with the Design Team.

CCR Assessment:

1. Describe historic climate events for the project location in order to identify possible climate vulnerabilities that may impact the project. Refer to the Climate SD for detailed instructions on how to gather and describe historic climate events.
2. Document all steps within a climate assessment statement.

4.4.3 Phase 1 Climate Assessment Outputs

The climate assessment statement should be used to inform the Project Brief (PB), Cost Benefit Analysis (CBA), Project Execution Plan, and Phase 1 Gate Review Statement.

4.5 Phase 2, Stage 1: Preliminary Options Assessment

The Stage 1 Preliminary Options Assessment in the Option Selection process is to identify the nature and extent of significant constraints within a defined study area (which should be representative feasible options and their respective zones of influence). These constraints should be documented and mapped so that feasible options can be designed to avoid such constraints, where possible. The first part of this data collection should be based on desk-based research studies.

Phase 2, Stage 1 Climate-specific Objectives:

To ensure that climatic and GHG impacts of each option are assessed as part of the MCA.

4.5.1 Phase 2, Stage 1 Climate Assessment Approach and Process:

1. Define the purpose and scope of the assessment.
2. Identify the existing local conditions for each option and any differences between them.

GHG Assessment:

1. Define the study area and zone of influence – this is Ireland's Climate budget.
2. Describe the potential GHG impacts of the project on the climate, with any differences in the options identified. At Phase 2, Stage 1 route specific carbon data will not be available.
3. In order to determine the key differences in carbon emissions, project Distinguishable design attributes that will have a bearing on GHG emissions should be assessed qualitatively for each route option.

Describe applicable mitigation measures. **CCR Assessment:**

It anticipated that route options are unlikely to differ significantly in terms of location, and so a proportionate approach should be taken to identify options where there are key differences in climatic conditions and receptors.

1. Define the study area and zone of influence – the climate impacts on the proposed projects and in-combination impacts as defined by other environmental disciplines.
2. Using the historic data gathered under Phase 1 and the methodology described in Section 7.1 undertake the climate screening taking into account the sensitivity and exposure of the project to climate to provide an assessment on vulnerability.
3. Document all steps within a Stage 1 report.

4.5.2 Phase 2, Stage 1 Climate Assessment Outputs:

- The results of the qualitative statement will be used to inform the comparative ranking (Multi-Criteria Assessment (MCA)) and PAG and PMG deliverables at Stage 3, with consideration given to possible mitigations.
- Record that receipt of the outputs has been acknowledged by the Project Manager.

4.6 Phase 2, Stage 2: Project Appraisal Matrix

Following an examination of the Stage 1 Preliminary Options Assessment of the Option Selection process, option selection continues. The design team develops feasible options in accordance with the Project Appraisal Matrix.

Phase 2, Stage 2 is a more detailed or refined options selection based on a narrowing or reduction of selected options. This will likely include some of the options from Stage 1 but may also include amendments (to improve performance) or indeed new options Highlighted during the Stage 2 process.

The climate input for the feasible route options should consider the relative impacts of each of the route options on GHG emissions and Climate Risk.

4.6.1 Phase 2, Stage 2 Climate Assessment Approach and Process:

GHG Assessment:

Quantify available GHG data. There is likely to be limited quantitative data for each of the route options at Phase 2, Stage 2. Where possible, available quantitative variables (as identified in Table 6.2) should be inputted into the TII Carbon Assessment Tool. Major sources of GHG emissions (in addition to those identified in earlier phases) that should be included at this phase for each route include:

a) Cut and fill balance.
b) Main materials for construction.
c) Road user emissions.
d) Traction energy demand.

Where data is not available, a qualitative assessment should be provided, with key sources of emissions described, with reference to where the key sources of emissions appear on similar schemes.

1. Evaluate the GHG emissions for each option

   Using the calculation methodology outlined in Chapter 6, the options should be ranked in, from lowest to highest carbon impact in terms of tCO_2e and split via lifecycle stage as demonstrated in Table 6.2, with any GHG emissions unable to be quantified, ranked via Red Amber Green (RAG) rating.

2. <u>Discuss/update mitigation measures based on available data</u>

   To enable alignment with Ireland's net zero trajectory, mitigation measures should follow the mitigation hierarchy (Figure 6.3) with reduction impacts quantified where possible.

CCR Assessment:

1. Update the climate screening using the methodology in Chapter 7 based on any additional data available.
2. Document all steps within a Stage 2 Report.

4.6.2 Phase 2, Stage 2 Climate Assessment Outputs:

- The results of the assessment will be used to inform the comparative ranking (MCA) and PAG and PMG deliverables at Stage 3, with consideration given to possible mitigations
- Record that receipt of the outputs has been acknowledged by the Project Manager.

4.7 Phase 2, Stage 3: Selection of Preferred Option

The purpose of Stage 3 is to select the preferred option and to outline the likely environmental effects, including climate effects. Further project detail may or may not be available for the preferred option. Where available any additional detail should be reflected in the Stage 3 report.

4.7.1 Phase 2, Stage 3 Climate Assessment Approach and Process:

1. Review of the Stage 2 report.
2. Review and update where necessary the GHG and CCR calculations based on updated design information.
3. Assist where necessary the Design team in preparing the climate section of the PABS.

4.7.2 Phase 2, Stage 3 Climate Assessment Outputs:

- Input into the Stage 3 report to inform the PAG and PMG deliverables for the preferred option
- Record that receipt of the outputs has been acknowledged by the Project Manager.

4.8 Phase 3 – Design and Environmental Evaluation

This phase of project delivery allows for the iterative design and environmental assessment, where required, of the project. The environmental assessment will include climate assessment as part of the EIA Report. Otherwise, a climate assessment may be undertaken in its own right as part of the statutory planning process, if required. In the latter scenario the climate assessment will either form a standalone report or be compiled within a project specific environmental report.

Significant detail will emerge through this iterative design and assessment phase of the project. This detail will address construction and operation stages as well as the detailed design of all aspects of the project. Phasing of construction may also be a relevant consideration.

As the design and assessments progress, the detail of proposed mitigation measures for all environmental factors assessed, will also evolve.

All of this detail must be reflected and assessed in the climate assessment where it is relevant to the determination of likely significant effects. The process for identifying, assessing, and mitigating significant climate effects is set out in detail in Chapter 5 of this OTD. However, some further aspects of the process and outputs for this phase are outlined in the following.

4.8.1 Phase 3, Climate Assessment Approach and Process:

1. For projects with an EIAR follow the methodology described in Chapter 5 to produce a Climate Chapter which includes both GHG Assessment and CCR Assessment.
2. Where an EIAR is not required produce a project specific environmental report or standalone report which follows the methodology described in Chapter 5.

4.8.2 Phase 3, Climate Assessment Outputs:

- EIAR Chapter or Project specific environmental report /standalone climate assessment report
- The EIAR Chapter/project specific environmental report/standalone report should be used to inform the PAG and PMG deliverables for Phase 3.
- The output report should be acknowledged by the Project Manager so that they are taken forward in Phases 5-7.
- Record that receipt of the outputs has been acknowledged by the Project Manager.

4.9 Phase 4 – Statutory Processes

This phase is focused on securing approval for the project from the consenting authority e.g. the Local Authority or An Bord Pleanála. Climate related inputs in Phase 4 are likely to include:

- Compile documentation and participation in oral hearing(s) as required by the statutory processes to ensure that the proposed project is developed in accordance with planning and environmental legislation.
- Participation in oral hearing preparation meetings. Draft a Statement of Evidence where a public oral hearing is to be held and prepare responses to submissions.
- Present the Statement of Evidence at the public oral hearing and respond to questions direct from the public, other bodies, or the Inspector for the consenting authority.
- Review, draft and respond where warranted to issues raised in submissions to the consenting process, and in requests for further information from the consenting authority.
- Reviewing and updating, if necessary, any aspect of the assessments.
- Finalising the Statement of Evidence.
- Review and report on any aspects addressed in the decision of the consenting authority (and planning inspector's report).

5. Climate Assessment Methodology

5.1 Introduction

This Chapter presents the methodology to undertake a climate assessment. In line with the principles of EIA, the methodology allows Climate Practitioners to undertake a proportionate level of assessment based on the size, type and potential impact of project. The climate assessment is split into two assessments: Greenhouse Gas Assessment (Chapter 6) and Climate Change Risk Assessment (Chapter 7). An overview of the step-by-step methodology for each is shown in Table 5.1 and Table 5.2 respectively.

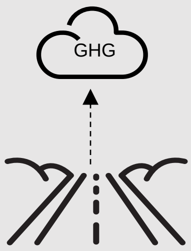
Table 5.1 GHG Assessment Step by Step Methodology

GHG Assessment step by step process	
1.	**Evaluate Early Opportunities to Reduce GHG Emissions**
1.1	Work with the Project Manager and design team to discuss and apply the mitigation hierarchy to the project.
2.	**Establish the Scope and Boundaries**
2.1	Define the temporal and spatial boundaries of the assessment.
2.2	Provide justification for any stages and/or GHG emissions sources that are scoped out of the assessment.
3.	**Collect the Data**
3.1	Work with the Project Manager to obtain the data required.
3.2	Review the data quality.
3.3	Discuss any data gaps or limitations with the Project Manager and relevant discipline/team.
3.4	Describe any assumptions, uncertainties, and limitations of the data in the assessment.
4.	**Establish the Baseline and 'Do-Minimum Scenario'**
4.1	Establish the baseline and 'Do-Minimum scenario (s)'.
4.2	Factor in policy changes into the 'Do-Minimum Scenario (s)'.
4.3	Where it is not reasonably possible to calculate emissions from an existing site then a zero emissions baseline shall be assumed as a worst case for construction emissions.
5.	**Calculate the GHG emissions from the Proposed Project**
5.1	Establish the 'Do-Something scenario(s)' – the emissions produced over the proposed project's lifespan.
6.	**Identify Mitigation Measures**
6.1	Work with the design team to reinterrogate the mitigation hierarchy.
6.2	Include mitigation measures in the designs and the plans for the project's construction and operation.
6.3	Describe how the proposed mitigation measures align with the mitigation hierarchy.
6.4	Quantify the mitigation impact.
6.5	Where data is not available, provide a qualitative description of the potential impact of mitigation measures.
6.6	Reference the agreed mitigation measures and any associated securing mechanisms within the EIAR.
7.	**Assess the Significance**
7.1	Assess the project's GHG trajectory against Ireland's net zero trajectory, and the level of mitigation taking place to evaluate the level of significance.
8.	**Assess the Cumulative Impact**
8.1	Demonstrate cumulative impacts via the project's alignment to Ireland's 2050 net zero target.

Table 5.2 CCR Assessment Step by Step Methodology

Climate change risk assessment step by step process	
Climate screening	
1.	**Sensitivity analysis**
1.1	Identify asset categories and climate variables to be considered in the sensitivity analysis.
1.2	Assess sensitivity of each asset category to each of the climate variables.
2.	**Exposure analysis**
2.1	Identify which climate hazards are relevant to the planned project location.
2.2	Assess the project's level of exposure for each climate variable for the current and future climate.
3.	**Vulnerability assessment**
3.1	Combine the sensitivity and exposure levels to identify potential significant climate hazards to the project i.e. the project's key vulnerabilities.
Detailed climate change risk assessment	
4.	**Establish scope and boundaries**
4.1	Define the temporal and spatial boundaries of the assessment.
4.2	Identify the climate hazards and project receptors to be considered in the assessment.
5.	**Gather climate data**
5.1	Gather historical climate data including information on past extreme climate events.
5.2	Gather climate change projection data.
6.	**Identify climate change risks**
6.1	Identify climate-related risks to the project noting the associated climate variable, the project receptors and existing/planned controls for each risk.
6.2	Generate a risk register to document the risk assessment process.
7.	**Assess climate change risks**
7.1	Define risk framework including likelihood and consequence descriptors
7.2	Assess initial risk and initial significance of climate risks.
7.3	Ensure continual communication and consultation throughout the risk assessment process.
8.	**Identify adaptation measures**
8.1	Identify the adaptation measures required including the timing and responsible party.
9.	**Assess residual risk and significance**
9.1	Assess the residual risk rating and significance of each risk taking into consideration the identified adaptation measures.

6. Greenhouse Gas Assessment



Impact of the project on the climate

Quantifies GHG emissions from a project during its lifetime and contextualises the magnitude of the impact of these emissions against relevant carbon budgets, targets and policy.

This chapter discusses the methodology for conducting a GHG Assessment. The key steps are outlined in Figure 6.1.

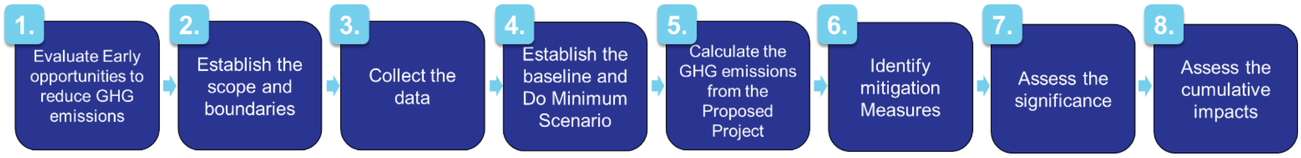
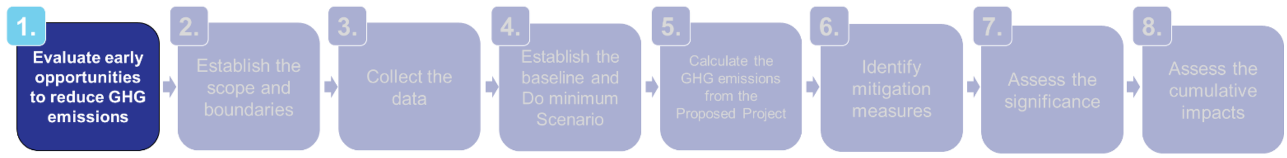


Figure 6.1 Key steps for a GHGA

The assessment process is guided by the following documents:

- Publicly Available Specification (PAS) 2080:2016 on Carbon Management in Infrastructure (BSI, 2016): this provides a framework that allows all parties involved in the development of an infrastructure project to work together to quantify the project's overall carbon impact.
- The Institute of Environmental Management and Assessment Assessing Greenhouse Gas Emissions and Evaluating their significance (2nd Edition) (IEMA, 2022): lays out the process of assessing GHG emissions to understand their significance in the context of an EIA.



6.1 Evaluate Early Opportunities to Reduce GHG Emissions

As demonstrated in Figure 6.2, the ability to achieve GHG emissions reductions for a project reduces as you move through the project lifecycle, this is because key decisions made at a project's concept, optioneering and design phases will inform the amount of GHGs emitted once a project is operational. For example, the decision to maintain/upgrade a road over building a new one, will have a significantly lower carbon impact due to the comparably fewer materials required. Similarly, the decision to build a multi-modal linear infrastructure project over a singular transport mode, and the materials selected at design stage, will impact the embodied carbon within a project.

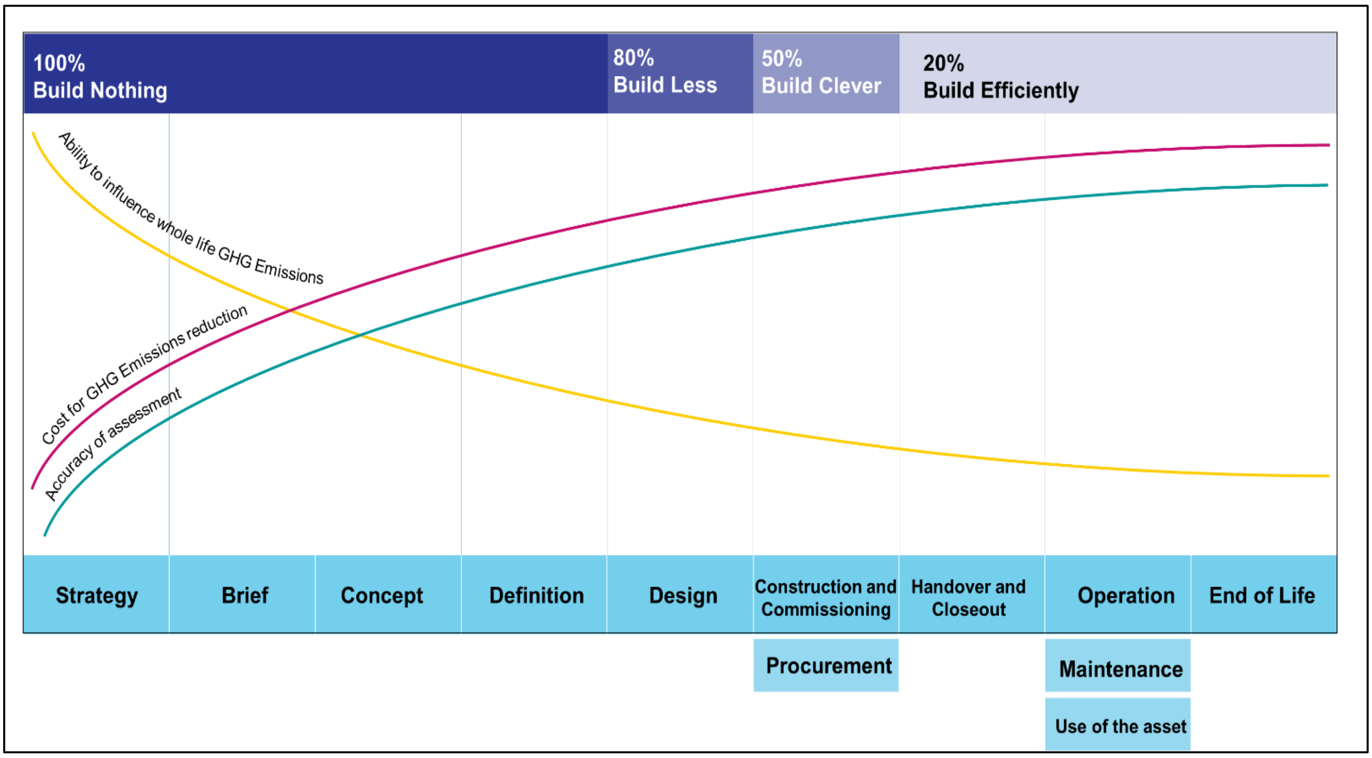


Figure 6.2 Ability to influence GHG emissions throughout the Project Lifecycle

Graphic adapted from PAS2080 Carbon Management in Infrastructure (2016)

6.1.2 Applying the Mitigation Hierarchy

Once the project rationale, transport mode(s), and preferred route have been determined over Phases 0 to 2, the principles of the mitigation hierarchy (Figure 6.3) should be reviewed as part of the climate assessment process.

From the point the Climate Practitioner is brought onto the project (ideally Phase 1 onwards), there must be early engagement between the Project Manager and the design team to identify potential options to avoid and reduce climate impacts of the proposed project, reducing the need for additional or subsequent design and mitigation measures.

As part of this, the mitigation hierarchy should be used as part of the decision-making process in Figure 6.3. The mitigation hierarchy must be followed in order of preference - with emissions avoidance being most favoured and offsetting as a last resort, examples of this are also provided in Figure 6.3.

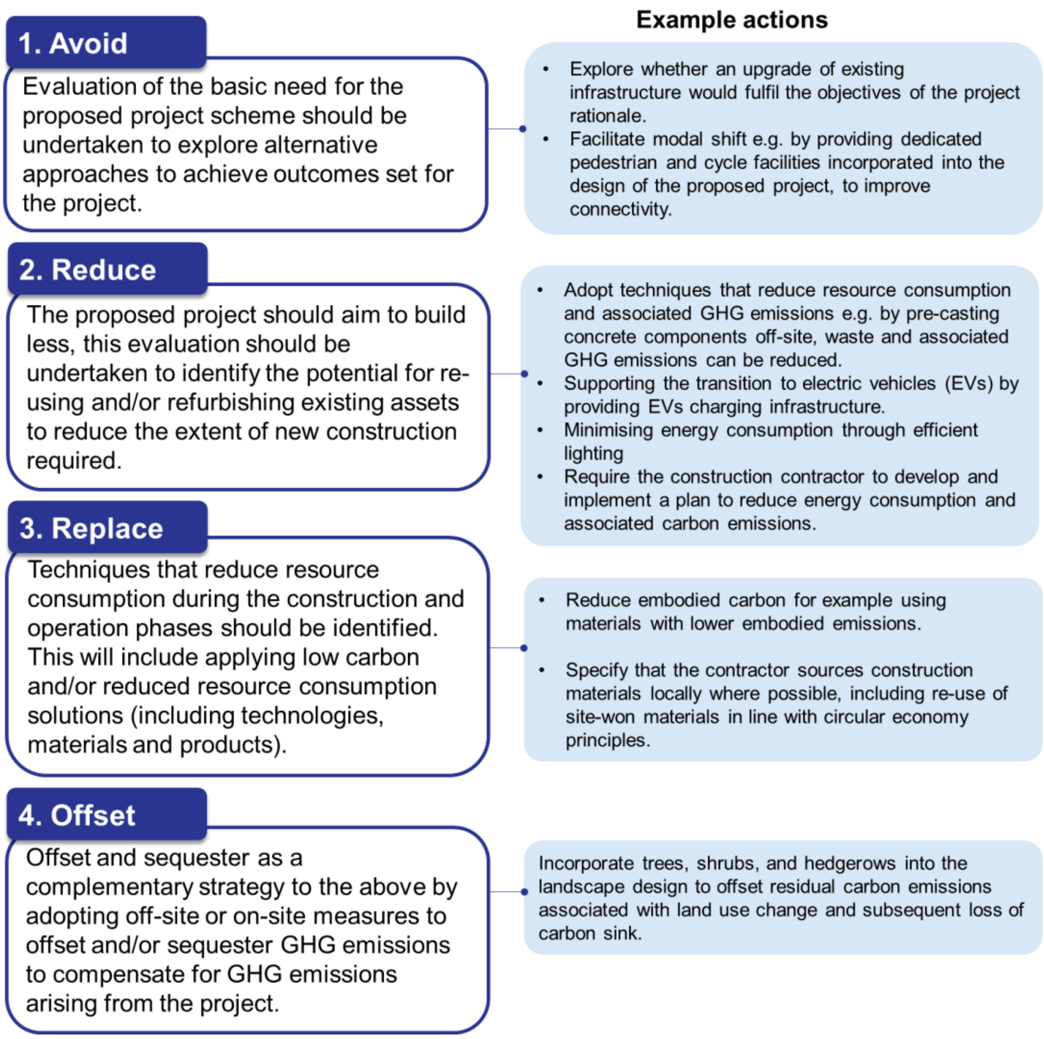
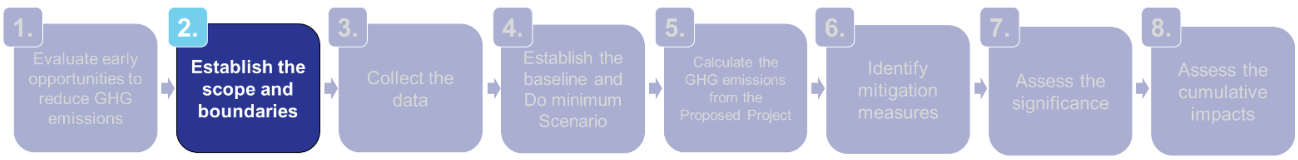


Figure 6.3 GHG Emissions Mitigation Hierarchy

Evaluate Early Opportunities to Reduce GHG Emissions Checklist

☑ Work with the Project Manager and design team to discuss and apply the mitigation hierarchy to the project.



6.2 Establish the Scope and Boundaries

6.2.1 Scope of the Assessment

The next step of the process is to define the scope of the GHG Assessment. When defining the scope of an assessment the Climate Practitioner should consider the purpose of the assessment and the physical assets to be included as part of the assessment process.

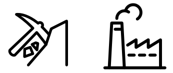
6.2.2 Boundary of the Assessment

To define the boundary of the assessment consideration should be given to the system boundary and to the temporal boundary, as shown in Table 6.1.

Table 6.1 Boundary Type and Description

Boundary Type	Description
System boundary	The system boundary should include the emission sources of the project and the lifecycle stage in which they arise. For EIA purposes it is good practice to consider the full lifecycle of a project. In some cases, it is acceptable to scope out the end-of-life impacts of a project because most road, light rail and Greenway projects will be in place well beyond the design life of the project. Table 6 provides a simplified framework for each lifecycle stage based on the modular approach from PAS 2080. This can be used to assist with defining boundaries and emission sources as well as gathering and reporting of information required for the assessment.
Temporal boundary	The temporal boundary is the time period which the assessment covers. It is based on the anticipated construction period and operational design life of the project being assessed. The temporal boundary should be appropriate to the type of infrastructure being developed and agreed between the Climate Practitioner and Design Team. As an example, a road scheme typically has a 60-year design life. The temporal boundary should be reported and a justification for its duration provided within the assessment.

Table 6.2 Lifecycle Stages and Emission Sources

Lifecyle stage	Reporting Category	Description	Primary emissions sources
Before use	Embodied carbon 	Raw material extraction, transportation (within the supply chain up to the point of final factory gate) and manufacturing of products required for the proposed project	Embodied carbon (GHG emissions) within the construction materials.
	Transport 	Transportation of products/materials and construction equipment from point of production/storage to construction site	Fuel consumed for material and plant transportation to construction site.
		Transport to works site	Fuel consumed for worker commuting to and from the construction site.
	Construction processes 	Temporary works, ground works, and landscaping	Clearance / demolition activities (including the area of land to be cleared, vegetation/sequestration loss and water use). All advanced works for example archaeological works, fencing etc., should be included. All ground works including earthworks material, laying and compaction etc.
		Excavation	GHG emissions from the excavation of material.
		On site energy use	Grid electricity to power auxiliary facilities. Fuel consumed by construction vehicles and plant.
		On site water use	GHG emissions from the provision of water and treatment of wastewater.
		Waste production, transportation, and waste management	GHG emissions from the treatment of waste.
	Material use 	Carbon emitted or sequestered directly from the fabric of products and materials once they have been installed as part of infrastructure and it is in normal use	GHG emissions savings arising from planting of different vegetation types and/or rehabilitation activities e.g. peat restoration. For maturing vegetation such as trees, sequestration should be accounted for as the vegetation matures (e.g., <30 years) and once matured (e.g., >30 years).

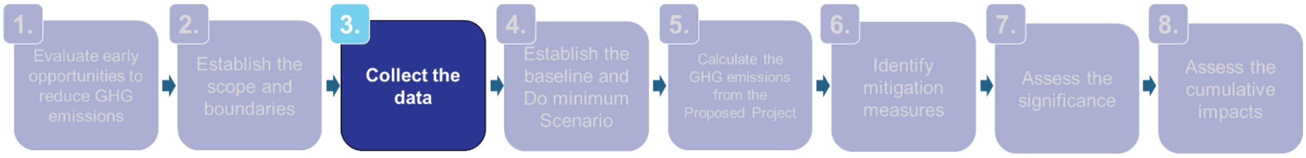
Lifecyle stage	Reporting Category	Description	Primary emissions sources
Use	Maintenance	Maintenance and repair activities	GHG emissions from energy and fuel use, maintenance vehicles, provision of water and treatment of wastewater during maintenance. Embodied emissions associated with maintenance and repair e.g. rail/steel replacement and resurfacing materials.
Use	Operation	Operational energy (B6) Operational water (B7) Other operational processes (B8)	GHG emissions resulting from the consumption of energy and fuel use for infrastructure operation e.g. lighting, signage, Luas Stops. GHG emissions resulting from the consumption of water. Other could include GHG emissions as a result of management of operational waste.
	User emissions	User's utilisation of infrastructure	Light Rail energy use. Tailpipe emissions from vehicle journeys.
End of Life	Deconstruction	Onsite activities involved in deconstructing, dismantling, and demolishing the infrastructure	GHG emissions from vehicles and fuel use for generators on site.
	Transport (C2)	Transport to and from disposal	GHG emissions from the fuel consumed for worker(s) commuting to and from the site.
	Waste processing for recovery and disposal (C4)	Reuse, recycling, and recovery of materials Disposal of materials	Activities associated with treatment and processing for recovery, reuse and recycling of waste materials arising from infrastructure. GHG emissions resulting from final disposal of demolition materials.
Supplementary information beyond the infrastructure lifecycle	Lifecycle benefits and loads beyond the system boundary	GHG emissions potential of reuse and recycling Benefits and loads of additional infrastructure functions	Offsetting carbon emissions of a scheme through credible offsite renewable, planting, rehabilitation, and regenerative schemes.

Activities that account for less than 5% of the total energy usage and/or 5% of the mass balance can be excluded from the assessment scope. e.g., if electricity for operating signage is less than 5% of total electricity used of the project infrastructure, it can be excluded from the assessment scope.

Activities that are scoped in the assessment must be described and/or any stages scoped out of the assessment must be accompanied with written justification.

Scope and Boundary Checklist

☑ Define the system boundary i.e. the lifecycle stages and emissions sources to be included.
☑ Define the temporal boundary to the assessment, based on the project lifespan.
☑ Provide justification for any stages and/or GHG emissions sources that are scoped out of the assessment.



6.3 Collect the Data

To calculate GHG emissions the Climate Practitioner should collect project specific data from reliable and auditable sources, representative of the identified scope and boundary for the assessment.

The Climate Practitioner should liaise with the Project Manager to identify other disciplines and teams working on the project to obtain the data required e.g., design team, environmental assessment disciplines, transport modelling team, contractor if involved at the project stage. Table 6.3 presents input data that should be collected and used for calculating GHG emissions at project Phase 3.

Table 6.3 Data Sources for Assessment of GHG Emissions

Lifecycle Stage	Type of data
Before Use	Information that defines and describes the size, magnitude, and physical nature of the proposed project. Project value for construction phase.
	Land use change – size of the area, existing and future type / material.
	The quantity and specifications of construction materials.
	Construction works techniques/technologies, volume of fuel/ electricity consumed during advanced works and construction.
Before Use and Use	Transportation distances and modes for construction workers and construction materials. Number of construction workers,
	Waste generation during construction and operation- quantity of waste and disposal method, distance to the waste facility.
	Energy and water demand during construction and operation.
Use	Transport information e.g. traffic modelling.
	Air Quality data: road user emissions.

Once project data has been collected, the impact on future GHG emissions from government policy should also be taken into account by the respective Practitioner shown and collated by the Climate Practitioner. For example:

- A possible increase in number of journeys by bike or/and public transport combined with a reduction in car travel should be considered by the Transport Practitioner, when looking at vehicle fleet make-up to incorporate a modal shift in favour of active travel and public transport as appropriate.
- Possible changes to the road vehicle fleet in terms of the efficiency of vehicles, and the shift to an increasing number of EVs should be considered by the Air Quality Practitioner through the REM tool which includes detailed fleet predictions for age, fuel technology, engine size and weight based on available national forecasts.
- The grid is forecast to reduce its carbon intensity in the future, meaning that the GHG emissions from electricity use will reduce per kilowatt hour (kWh), the Climate Practitioner should use national forecasts for grid decarbonisation as available.

6.3.1 Data Quality

The Climate Practitioner should define and apply data requirements in terms of the criteria shown in Figure 6.4.

Graphic adapted from PAS2080 Carbon Management in Infrastructure

Figure 6.4 Data Requirements Criteria

When there are data gaps or insufficient data, the Climate Practitioner must:

- Discuss the limitations of the collected data with the Project Manager and relevant discipline to agree appropriate assumptions or approximations.
- Describe any assumptions, uncertainties, and limitations around the quality of data within the assessment.

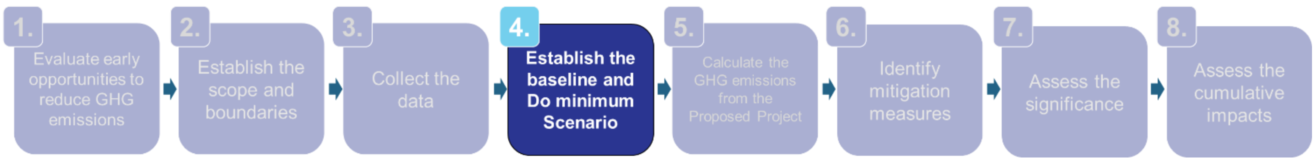
Collect the Data Checklist

☑ Work with the Project Manager to identify other disciplines and teams working on the project to obtain the data required.

☑ Review the data quality.

☑ Discuss any data gaps or limitations with the Project Manager and relevant discipline/team, with any data assumptions agreed between all parties.

☑ Describe any assumptions, uncertainties, and limitations of the data in the assessment.



6.4 Establish the Baseline and 'Do Minimum' Scenario

6.4.1 Baseline and 'Do Minimum' Scenario

The baseline is an assessment of current GHG emissions without the proposed project in place. Future GHG emissions without the proposed project in place are known as the 'Do Minimum' (DM) Scenario, as defined in Table 6.4.

Combined, the Baseline and DM scenario are a reference point against which the impact of a proposed project can be compared.

Table 6.4 Emissions Required to Establish the Baseline and DM Scenario

Emissions	Description
Current (Baseline)	Represents the existing GHG emissions from within the boundary of the proposed study area, this may include calculating emissions from existing structures (e.g., energy consumption from a building which is scheduled for refurbishment, demolition or replacement) and existing infrastructure (e.g., current operational and use emissions of the affected Road/Light Rail network being assessed).
Future (DM)	Is developed using the current baseline and projections of the future situation without the proposed project. The future baseline should reflect changes as a result of other factors and projects in proximity to the project area e.g., increased efficiency in vehicles, grid decarbonisation due to the increase in energy generated from renewable source.

Where it is not reasonably possible to calculate emissions from an existing site then a zero emissions baseline should be assumed as a worst case. As the GHG impact of a project is the variation between the existing baseline and the DM Scenario and the proposed project, by taking this approach the impact of emissions from the project reported in the EIA will be presented as higher than in reality. Table 6.5 presents the approach to calculate the Baseline and DM scenario.

Table 6.5 How to calculate the baseline and DM scenario

Emissions	Lifecycle Stage	Road	Light Rail	Greenway
Current (baseline)	Construction	DM scenario assumes no construction is taking place.		
	Use - Maintenance	Use the TII Carbon Assessment Tool (Appendix B) to calculate of emissions arising from the existing maintenance operations.		Assume no maintenance in place.
	Use - Operation	Use the TII Carbon Assessment Tool to calculate the emissions arising from existing infrastructure operation e.g., grid electricity for lighting, signs, ticket machines, and buildings.		Assume no energy use.
	Use – User Transport	Obtain user transport emissions from Air Quality Practitioner. Air Quality Practitioner should use the TII REM tool (Appendix C), to calculate GHG emissions from existing road / transport network based on current Transport model and fleet mix.	Use the TII Carbon Assessment Tool to calculate TII Passenger transportation emissions (grid electricity).	If 'In-use' emissions scoped in - obtain user transport emissions from Air Quality Practitioner.

Emissions	Lifecycle Stage	Road	Light Rail	Greenway
			Obtain user transport emissions from Air Quality Practitioner. Air Quality Practitioner should use the TII REM tool, to calculate GHG emissions from existing road / transport network based on current Transport model and fleet mix.	Air Quality Practitioner should use the TII REM tool, to calculate GHG emissions from existing road / transport network based on current Transport model and fleet mix.
Future (Do-minimum)	Use – Maintenance	Use the TII Carbon Assessment Tool to calculate emissions arising from future maintenance.		
	Use – Operation	Use the TII Carbon Assessment Tool to calculate emissions arising from future infrastructure operation e.g., grid electricity for lighting, signs, ticket machines, and buildings.		
	Use – User transport Impact of future changes in vehicle fleet mix and GHG emissions should be considered	Obtain user transport emissions data from an Air Quality Practitioner to show future user emissions during operation without the project in place.	Use the TII Carbon Assessment Tool to calculate Passenger transportation emissions (grid electricity). Obtain user transport emissions data from Air Quality Practitioner to show the future user emissions during operation without the project in place.[5]	If in-use emissions scoped in; obtain user transport emissions without the greenway project from the Air Quality Practitioner to estimate baseline GHG emissions.

As a minimum, the following DM vs 'Do Something' (see section 6.5) scenarios should be presented for road user carbon:

- Year of opening – the year which the project opens.
- Design year – 15 years after opening; and
- 2050 Horizon.

The year of opening, design year and 2050 Horizon year provides a range of assessments years with different vehicle fleets to enable practitioners to consider how road user emissions may change over time with a scheme. The 2050 Horizon year will also provide road user carbon emissions which align with the 2050 year where net zero is anticipated to be achieved in Ireland with CAP policy measures.

[5] *To understand the impact of modal shift as a result of the Light Rail project, future traffic data on no. of journeys made by different modes of transport without the Light Rail project in place should be provided from the Transport Planning Practitioner and used by the Air Quality Practitioner via the TII REM tool to inform the future user emissions during operation without the project in place.*

The last function of the three assessment years is to provide a series of points which can be interpolated between providing road user emissions over a 60-year operational period. No further changes in emissions assumed for years beyond 2050.

Establishing the Baseline and DM Scenario Checklist:

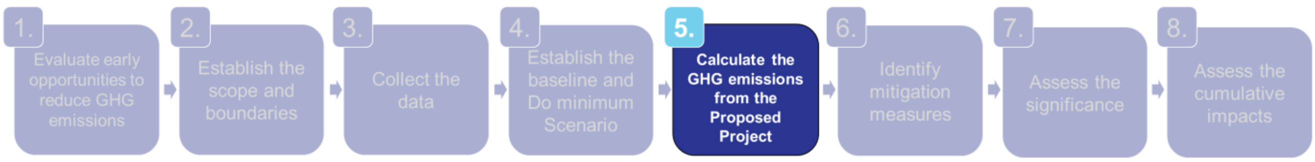
☑ Establish the baseline:

- The current baseline – existing GHG emissions from within the study area.

☑ Establish the DM Scenario: – estimated future emissions within the study area without the proposed project in place.

☑ Where data is available, the future baseline should reflect changes as a result of other factors and projects in proximity to the project area e.g. grid decarbonisation.

☑ Where it is not reasonably possible to calculate emissions from an existing site, a zero emissions baseline should be assumed as a worst case.



6.5 Calculate the GHG Emissions for the Proposed Project

The Do Minimum scenario will be used in the assessment to compare the GHG emissions against the proposed project, which is referred to as the 'Do-Something' (DS) scenario. The DS scenario is used to calculate GHG emissions during the project lifespan and their impact.

There might be one or multiple DS scenarios, this will depend on the project phase at which the assessment is undertaken, for example during the option selection phase each design option will form separate DS scenario. Table 6.6 describes approach to calculating emissions for DS scenario.

Table 6.6 How to calculate the Proposed Project ('Do Something') Scenario

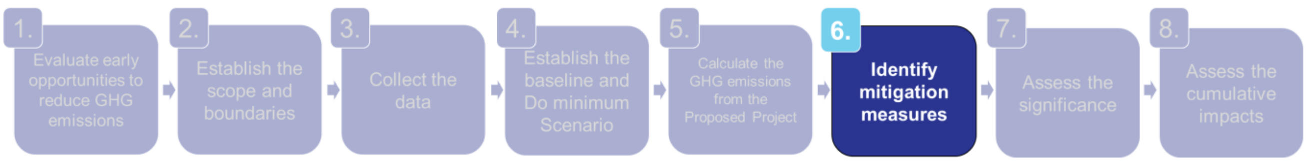
Lifecycle Stage	Road	Light Rail	Greenway
Construction	Use the TII Carbon Assessment Tool to calculate emissions arising from construction.		
Use - Maintenance	Use the TII Carbon Assessment Tool to calculate emissions arising from maintenance.		
Use - Operation Impact of national grid decarbonisation	Use the TII Carbon Assessment Tool to calculate emissions arising from the operation of the road e.g. grid electricity for lighting and signs.	Use the Carbon Assessment Tool to calculate emissions arising from the operation of the Light Rail project e.g. lighting for signs, and lighting. Obtain energy data (lighting and signalling) from the design team.	Use the TII Carbon Assessment Tool to calculate emissions arising from operation of the greenway project e.g. lighting.

Lifecycle Stage	Road	Light Rail	Greenway
Use – User Transport Impact of future changes in vehicle fleet mix, modal shift and GHG emissions	Obtain user transport emissions data from an Air Quality Practitioner (who will use the REM tool) to show future user emissions during operation with the project in place.	Use the TII Carbon Assessment Tool to calculate passenger transportation emissions (grid electricity).	If traffic change is below traffic threshold – In use stage emissions scoped. If traffic change above traffic threshold, traffic data with the greenway project in place should be obtained from an Air Quality Practitioner to estimate change in GHG emissions.
		Calculating the impact of modal shift Use a three-step process to calculate modal shift: 1. Obtain future traffic data on no. of journeys made by different modes of transport with the Light Rail project in place from the Transport Planning Practitioner. 2. Air Quality Practitioner to calculate the change in road user emissions on a local or strategic level using traffic data using available NTA tools as appropriate. 3. Capture net difference in emissions displacement as part of operational footprint emissions for the project.	

When considering the DS scenario for road projects, the Climate Practitioner should be aware of the assumptions used in TII's REM tool with regard to future emissions. Such assumptions will relate to the uptake of Electric Vehicles assumed within the modelled data and should be clearly stated within the proposed project's documentation.

Calculate the GHG emissions for the Proposed Project Checklist

☑ Establish the current baseline – the Do-Something scenario – the emissions produced over the proposed project's lifespan.



6.6 Identify Mitigation Measures

Through collaboration with the Project Manager, design team and environmental disciplines, an iterative approach to the identification and development of mitigation measures should be evidenced by the Climate Practitioner at each Project Phase.

Following the calculation of GHG emissions, the mitigation hierarchy presented in Figure 6.3 should be reinterrogated to identify and agree further mitigation measures across the project lifecycle. The Climate Practitioner should describe how proposed mitigation measures fit into the mitigation hierarchy. Examples of possible mitigation options are shown in Figure 6.4.

6.6.1 Quantification of Mitigation Impact

Agreed mitigation measures should be included within the GHG Assessment and impacts quantified where possible. The Climate Practitioner undertaking the assessment should:

- Revise calculations to establish a new DS scenario with embedded mitigation measures.
- Where data is not available, provide a qualitative description of the potential impact of mitigation measures in order to calculate emissions savings.

Agreed mitigation measures and the processes for securing them should be referenced within the GHG Assessment. Mitigation to be implemented during construction and operation should be captured in a Construction Environmental Management Plan (CEMP) or Operational Environmental Management Plan (OEMP), respectively, acknowledging that further refinement and implementation of these measures is likely to occur in Phase 5 (Enabling and Procurement) and onwards of the project.

Identify Mitigation Measures Checklist

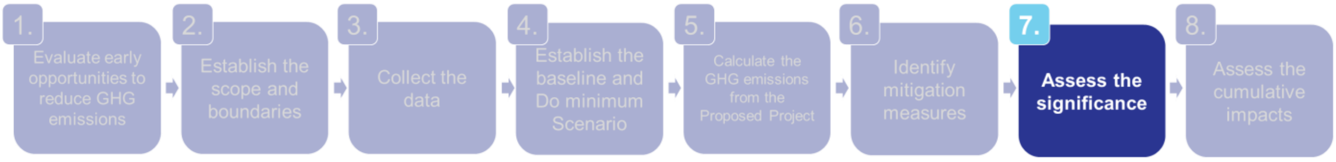
☑ Work with the design team, project manager, and environmental disciplines to reinterrogate the mitigation hierarchy from Step 1 and include mitigation measures in the designs and plans for the project’s construction and operation.

☑ Describe how the proposed mitigation measures align with the mitigation hierarchy.

☑ Quantify the mitigation impact – revise project data and calculations to establish an updated Do Something scenario with embedded mitigation measures.

☑ Where data is not available, provide a qualitative description of the potential impact of mitigation measures in order to calculate emissions savings.

☑ Reference the agreed mitigation measures and any associated securing mechanisms within the EIAR.



6.7 Assess the Significance

The evaluation of significance in terms of GHG emissions for effects during the construction and operational phases should be undertaken.

Determining the significance of GHG effects is based on IEMA guidance (IEMA, 2022) and ensures consistency with the terminology contained within Figure 3.4 of the EPA's (2022) 'Guidelines on the information to be contained in Environmental Impact Assessment Reports'.

As per IEMA guidance (2022), "*any GHG emissions or reductions from a project might be considered to be significant*" (IEMA, 2022).

6.7.1 Project's GHG Emissions against the Net Zero Trajectory

The Climate Practitioner should use their professional judgement to determine how best to contextualise and assess the significance of a project's GHG impact. The 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 (IEMA, 2022). In the climate assessment, the Climate Practitioner must give regard to two major considerations when assessing the significance of a project's GHG emissions:

- Alignment to Ireland's trajectory towards net zero by 2050; and
- Mitigation of GHG emissions.

The crux of assessing significance is *"not whether a project emits GHG emissions, nor even the magnitude of GHG emissions alone, but whether it contributes to reducing GHG emissions relative to a comparable baseline consistent with a trajectory towards net zero by 2050"* (IEMA, 2022).The Climate Practitioner must assess:

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

6.7.2 Significance Criteria

Based on the above two considerations and in line with IEMA criteria, the Climate Practitioner should use the matrix shown in Table 6.7 to assess the significance of GHG emissions arising as a result of the project.

Table 6.7 Significance Matrix

Effects	Significance level	Description
Significant adverse	Major adverse	• The project's GHG impacts are not mitigated. • The project has not complied with do-minimum standards set through regulation, nor 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.
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.

Effects	Significance level	Description
	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.

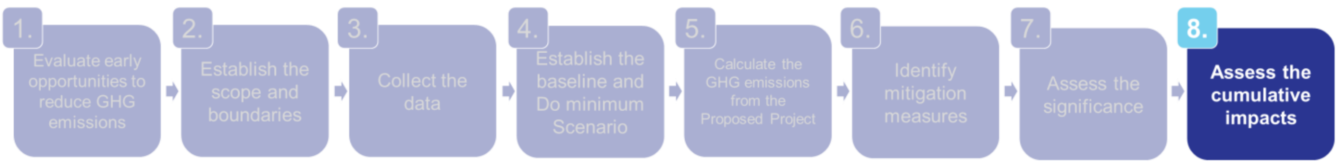
6.7.3 Contextualising the Emissions

The Climate Practitioner should use sectoral, local, or national carbon budgets, as available and appropriate, to contextualise a project's GHG impact. Ireland's national and (once published) sectoral carbon budgets[6] should be used to contextualise the magnitude of GHG emissions from a project, in order to demonstrate the level of impact of additional GHG emissions on Ireland's ability to meet its reduction targets.

When using Ireland's carbon budget, it should be noted that these budgets are based on the emissions directly produced in Ireland. It does not include emissions produced outside of Ireland but arising as a result of activities undertaken within Ireland. An example of this might be for construction materials where emissions associated with the initial excavation and processing of the raw materials occurs outside of Ireland. However, particularly at the early stages of a project, the origin of materials may not be known. In this instance it should be assumed the emissions arising from materials assessed may all potentially contribute to Ireland's carbon budget. This represents a worst case, which should be reflected within the limitations of the assessment.

Assess the Significance Checklist

- ☑ Assess the trajectory of the GHG emissions across the lifespan of the project.
- ☑ Assess the level of mitigation taking place.
- ☑ Evaluate the level of significance.
- ☑ Contextualise the Emissions against the appropriate carbon budget.



[6] *Ireland's latest national carbon budgets are available via the Department of the Environment, Climate and Communications website, although not published yet, a sectoral budget for the transport sector is anticipated.*

6.8 Assess the Cumulative Impacts

Cumulative impact assessment in EIAR requires that the impact from a project is assessed cumulatively with other projects being brought forward in a defined geographical and temporal boundary.

However, as the identified receptor 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.

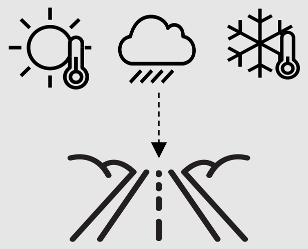
By presenting the GHG impact of a project in the context of its alignment to Ireland's trajectory of net zero and any sectoral carbon budgets, this assessment will demonstrate the potential for the project to affect Ireland's ability to meet its national carbon reduction target. This assessment approach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

For road projects, transport modelling used as the basis for calculating road user emissions, will also have accounted for the cumulative impacts of other locally committed projects.

Assess the Cumulative Impact

☑ As GHG emissions are inherently cumulative, the cumulative impact for this assessment must be demonstrated via the project's alignment to any sectoral carbon budgets and Ireland's 2050 net zero target

7. Climate Change Risk Assessment



Impact of a changing climate on the project

Identifies the impact of a changing climate on a project and receiving environment. The assessment considers a project's vulnerability to climate change and identifies adaptation measures to accommodate climate change impacts.

This chapter describes the methodology that Climate Practitioners should use when carrying out a CCR assessment as part of a planning deliverables. Figure 7.1 illustrates the key stages in a best practice approach for undertaking a CCR Assessment

The CCR Assessment is guided by the principles set out in the overarching best practice guidance documents which include:

- EU (2021) Technical guidance on the climate proofing of Infrastructure in the Period 2021-2027 (European Commission, 2021).
- The Institute of Environmental Management and Assessment, Environmental Impact Assessment Guide to: Climate Change Resilience and Adaptation (2nd Edition) (IEMA, 2020).

The EU Technical Guidance divides the process of climate proofing into two phases, **climate screening** and **detailed analysis** (as per Figure 7.1**)**. 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.

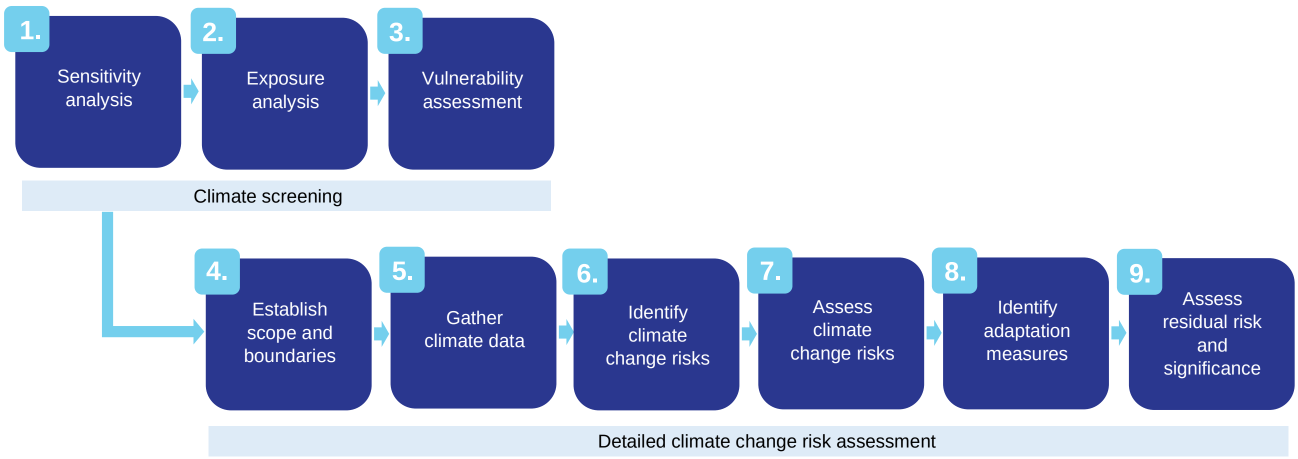
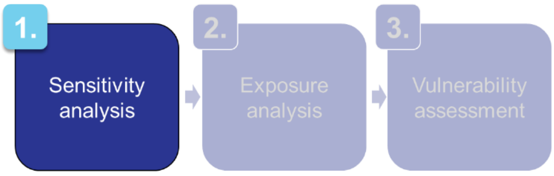


Figure 7.1 Climate Change Risk Assessment Methodology Flow Diagram

Chapter 4 on 'Climate Assessment through the Project Phases and Stages' provides guidance on when the Climate Practitioner should carry out each of these phases whilst Sections 7.1 and 7.2 provide the steps involved with the screening and detailed assessment, respectively.

7.1 Climate Screening

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.



7.1.1 Sensitivity Analysis

The aim of the sensitivity analysis is to identify which climate hazards are relevant to the specific type of project, irrespective of its location (European Commission, 2021). The analysis should consider the project in a comprehensive manner looking at the individual components making up the asset. For TII projects, the following asset categories should be considered:

- **Pavements** – e.g. road pavement, shoulders, and footpaths
- **Drainage** –e.g. culverts, drains, pipes.
- **Structures** – e.g. bridges, retaining walls, crash barriers.
- **Earthworks, geotechnical assets** – e.g. foundations, pavement subgrades, embankments.
- **Utilities** – e.g. substations, and cabling.
- **Landscaping** – e.g. vegetated median strips or embankments.
- **Signs, light posts and fences** – e. g street lighting, road signs, gantries, boundary fences.
- **Buildings** – e.g. motorway service areas, road and light rail depots

With regards to climate hazards, at this stage of the project (refer to Chapter 4 for timing), the analysis should consider:

- **Flooding (coastal)** – including sea level rise and storm surge.
- **Flooding (pluvial)**
- **Flooding (fluvial)**
- **Extreme heat** – including extreme heat events and increasing temperatures overtime.
- **Extreme cold** – including frost and snow.
- **Wildfire**
- **Drought**
- **Extreme wind**
- **Lightning and hail**
- **Landslides**
- **Fog**

Discretion should be left to the Climate Practitioner as to if any additional climate hazards are to be considered.

To undertake the sensitivity analysis, a sensitivity score should be given for each asset category against each climate hazard. The following definitions and scoring should be used when assessing sensitivity:

Table 7.1 Sensitivity definition and scoring

Sensitivity 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 output of the sensitivity analysis can be summarised in a table as demonstrated in Table 7.2.

Table 7.2 Example Sensitivity Analysis

Example Climate Hazard	Flooding (coastal)	Flooding (pluvial)	Flooding (fluvial)	Extreme heat	Extreme cold	Wildfire	Drought	Extreme wind	Lightning & hail	Landslides	Fog
Pavements	2	2	2	2	2	2	1	1	1	1	1
Utilities	3	3	3	3	2	3	1	2	2	1	1

Sensitivity Analysis Checklist

- ☑ Confirm asset categories and climate hazards to be considered in the sensitivity analysis.
- ☑ Assess sensitivity of each asset category to each of the climate hazards.

7.1.2 Exposure Analysis

Different geographical locations are exposed to different climate hazards. The aim of the exposure analysis is to identify which climate hazards are relevant to the planned project 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.

At this stage of the project (refer to Chapter 4 for timing), this analysis should focus on current climate, and use high level qualitative climate data to inform the analysis, e.g., desktop-based research on historical climate events at the project location.

The hazards assessed should be the same as those used for the sensitivity analysis e.g. flooding (coastal, pluvial and fluvial), extreme heat, extreme cold, wildfire, drought, extreme wind, lightning and hail, landslides and fog. As with the sensitivity analysis discretion should be left to the Climate Practitioner as to if any additional climate hazards are to be considered.

To undertake the exposure analysis, an exposure score should be given for each climate hazard at the project location. The allocation of exposure level should be informed by the high-level climate data collected. The following definitions and scoring should be used when assessing exposure:

Table 7.3 Exposure definition and scoring

Sensitivity 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 output of the exposure analysis can be summarised in a table as demonstrated in Table 7.4 below.

Table 7.4 Example Exposure Analysis

Climate Hazard	Flooding (coastal)	Flooding (pluvial)	Flooding (fluvial)	Extreme heat	Extreme cold	Wildfire	Drought	Extreme wind	Lightning & hail	Landslides	Fog
Exposure at project location	3	3	2	2	2	2	1	2	2	1	2

Exposure Analysis Checklist

- ☑ Collect high level qualitative climate data at project location.
- ☑ Assess the level of exposure for each climate hazard at the project location.

7.1.3 Vulnerability Assessment

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 project. It is intended to form the basis of the detailed climate change risk assessment in that it reveals the most relevant hazards to the project; these can be considered the vulnerabilities ranked as 'A' and possibly 'medium' (to be decided by the Climate Practitioner depending on the outcomes of the assessment).

As illustrated below, vulnerability is simply the product of sensitivity and exposure. To complete the vulnerability assessment, the Practitioner should take the product of sensitivity and exposure for each climate hazard and each asset category identified. Table 7.5 provides an example vulnerability matrix whilst Table 7.6 provides an example vulnerability assessment using the example sensitivity and exposure analyses in Table 7.1 and Table 7.2 above.

$$\boldsymbol{Vulnerability} = \boldsymbol{Sensitivity} \times \boldsymbol{Exposure}$$

Table 7.5 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

Vulnerability key

(green)	Low
(amber)	Medium
(red)	High

With regards to the next stage of the climate assessment, the EU Technical Guidance (2021) notes that if all vulnerabilities are ranked as low in a justified manner, no detailed climate risk assessment may be needed. However, in most cases it is advised to undertake a detailed climate change risk assessment to identify the level of adaption required. Therefore, the outcomes of the vulnerability assessment will primarily influence the climate hazards prioritised in Phase 2 of the climate proofing process. For example, as per the vulnerability assessment in Table 7.8 below, flooding, extreme temperatures and wildfire would be prioritised in relation to pavement related risks, whilst flooding, extreme temperatures, wildfire, extreme wind, lightning and hail would be prioritised for utility related risks.

Table 7.6 Example Vulnerability Analysis

Climate Hazard	**Flooding (coastal)**		**Flooding (pluvial)**		**Flooding (fluvial)**		**Extreme heat**		**Extreme cold**		**Wildfire**		**Drought**		**Extreme wind**		**Lightning & hail**		**Landslides**		**Fog**	
	Sensitivity	**Exposure**	**Sensitivity**	**Exposure**	**Sensitivity**	**Exposure**	**Sensitivity**	**Exposure**	**Sensitivity**	**Exposure**	**Sensitivity**	**Exposure**	**Sensitivity**	**Exposure**	**Sensitivity**	**Exposure**	**Sensitivity**	**Exposure**	**Sensitivity**	**Exposure**	**Sensitivity**	**Exposure**
Pavements	2	3	2	3	2	2	2	2	2	2	2	2	1	1	1	2	1	2	1	1	1	2
Vulnerability	6		6		4		4		4		4		1		2		2		1		2	
Utilities	3	3	3	3	3	2	3	2	2	2	3	2	1	1	2	2	2	2	1	1	1	2

Climate Hazard	**Flooding (coastal)**		**Flooding (pluvial)**		**Flooding (fluvial)**		**Extreme heat**		**Extreme cold**		**Wildfire**		**Drought**		**Extreme wind**		**Lightning & hail**		**Landslides**		**Fog**	
	Sensitivity	**Exposure**	**Sensitivity**	**Exposure**	**Sensitivity**	**Exposure**	**Sensitivity**	**Exposure**	**Sensitivity**	**Exposure**	**Sensitivity**	**Exposure**	**Sensitivity**	**Exposure**	**Sensitivity**	**Exposure**	**Sensitivity**	**Exposure**	**Sensitivity**	**Exposure**	**Sensitivity**	**Exposure**
Vulnerability	9		9		6		6		4		6		1		4		4		1		2	
Asset category																						
Vulnerability																						

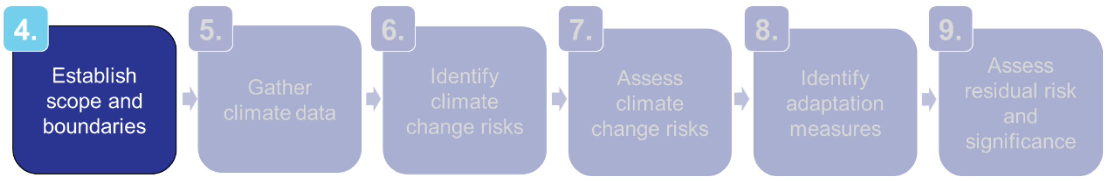
Vulnerability Assessment Checklist

☑ Combine the sensitivity and exposure levels to identify potential significant climate hazards to the project i.e. the project's key vulnerabilities.

7.2 Detailed Climate Risk Assessment

The detailed climate risk assessment provides a structured method of analysing climate hazards and their impacts to provide information on decision making (European Commission, 2021). The aim is to quantify the significance of the risks to the project in the current and future climate conditions. The process works by assessing likelihoods and consequences of the impacts or risks associated with the hazards identified in the vulnerability assessment (or climate screening) and assessing the significance of the risk to the project. This process also enables the identification, appraisal, selection and implementation of adaptation measures, which aim to improve the resilience of the project to climate change.

In comparison to the vulnerability assessment, the risk assessment more readily facilitates the identification of longer cause-effect chains linking climate hazards to project performance and therefore may identify issues that are not picked up by the vulnerability assessment. As detailed below, it is best practice that the risk assessment be performed in consultation with relevant stakeholders including TII, the design team and environmental specialists.



7.2.1 Establish the Scope and Boundary

The first step of a CCR Assessment is to define the scope and boundary of the assessment. In the context of the assessment, this involves defining the spatial and temporal boundaries along with the relevant climate hazards or variables to be considered in the risk assessment.

This also includes defining the elements of a proposed project that may be vulnerable to climate change such as the individual asset components comprising the project and where relevant, connected infrastructure. These elements are known as receptors.

The scope and boundary of the assessment should be clearly established and communicated in the project documentation. Table 7.7 provides detail on the scope and boundary considerations relevant to a climate risk assessment.

Table 7.7 Scope and Boundary Considerations

Scope and boundary aspects	Informed by:
Spatial boundary	The project boundary and aligned to the GHG Assessment
Temporal boundary	The project lifespan and design life of asset components. In the context of TII projects, the temporal lifespan of a project is considered to be 60 years. Both the construction and operation phases of the project should be considered in the assessment.
Climate hazards	The outcomes of the climate screening i.e. vulnerability assessment (refer below for more information.
Project receptors	The asset categories considered in the climate screening shall form the key project receptors in this assessment as well as any critical connecting infrastructure and significant parts of the surrounding environment e.g. water bodies that should be considered as a part of the indirect, cumulative and in-combination impact assessment.

Whilst the climate variables considered in the assessment should be informed by the climate screening, Table 7.8 provides a long list of potential variables to be included in the assessment.

Table 7.8 Potential climate variables to be considered in the assessment

Climate theme	Potential climate parameters
Temperature	Mean annual maximum daily temperature (°C) Mean annual minimum daily temperature (°C) Mean summer maximum daily temperature (°C) Mean winter minimum daily temp (°C) Average temperature during the warmest month (°C) Average temperature during the coolest month (°C) Days per annum under 0 (°C) (days) Heatwaves (no.)
Rainfall	Mean annual rainfall levels (mm) Mean summer rainfall (mm) Mean winter rainfall (mm) Wettest month on average & mean rainfall during month (mm) Driest month on average & mean rainfall during month (mm) Wet days (>20 mm) (no.) Very wet days (>30mm) (no.) Summer dry days (5 consecutive days where daily rain <1 mm) Highest daily rainfall (mm) for baseline period

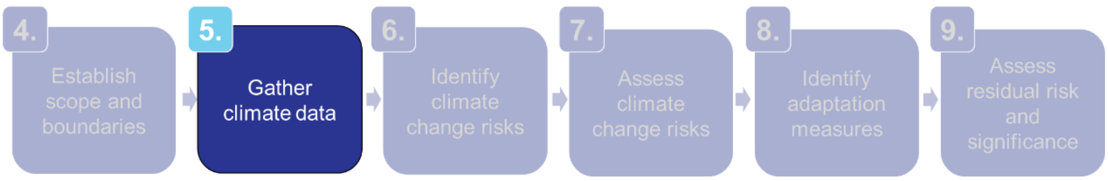
Climate theme	Potential climate parameters
Other	Mean wind speed (knot) Highest gust (knot) Snowfall Storms (frequency and severity) Lightning Sea level rise (m) Potential Evapotranspiration (mm)

Where there is uncertainty regarding the impact of climate on a receptor, the Climate Practitioner should apply a precautionary approach, so that risks can be scoped out as the project progresses and as more information is available. In practice this would result in scoping in all those aspects where the Climate Practitioner is uncertain of the impact. If there are no significant effects found, this should be stated.

Establishing the Scope and Boundary Checklist

By this stage, the Climate Practitioner should have defined the scope and boundary of the assessment, including:

- ☑ The temporal boundary of the assessment based on the project lifespan
- ☑ The spatial boundary of the assessment, based upon site locations and operational impact
- ☑ The climate hazards to be considered based on the outcomes of vulnerability assessment
- ☑ The project receptors to be considered in the assessment.



7.2.2 Gather Climate Data

Having defined the scope and boundary of the assessment, the next step is to gather the climate data. This includes defining the climate baseline based on historic climate conditions and gathering climate change projection data to understand future climate conditions.

Define Climate Baseline

It is important to understand the historic climate conditions experienced at the project location as this provides an indication of existing exposure to climate hazards. The climate baseline is based on historic climate data collected for a selection of climate variables across a specified time period. It is best practice for this period to encompass the baseline period upon which the selected climate change projections are based.

To establish an accurate and consistent baseline, the Climate Practitioner should:

1. Collect historical climate data from Met Éireann for the chosen baseline period (Met Éireann, Historical Data, n.d). In most cases, the climate change projections available for Ireland will be from Climate Ireland's database, which use 1981 to 2000 as their baseline period. Data should be collected from the closest weather station with the largest availability of data. It is acknowledged that for some locations data is unavailable; in such cases, any proxy data used should be identified and justified.

2. Identify historic extreme climate events that have occurred at or nearby the project location to provide insight on past vulnerability.

   This is important, as it is not uncommon to describe the existing baseline using historical climatic trends which may not properly account for extreme events. Examples of such events include cold snaps, storms, drought, wildfires and floods.

   Useful sources in the identification of past extreme events include Office of Public Works – Flood Maps (Office of Public Works, n.d)[7], Met Éireann website – Major Weather Events (Met Éireann, n.d.) and reports from Local Authorities.

Gather Climate Change Projection Data

To identify and manage risks to projects, it is necessary to understand how climate is projected to change in the future. This is achieved through the consideration of climate change projections, which are simulations of the Earth's climate in future decades based on assumed 'scenarios' for the concentrations of GHGs and other atmospheric constituents. The following steps in Table 7.9 should be followed when selecting climate change projections.

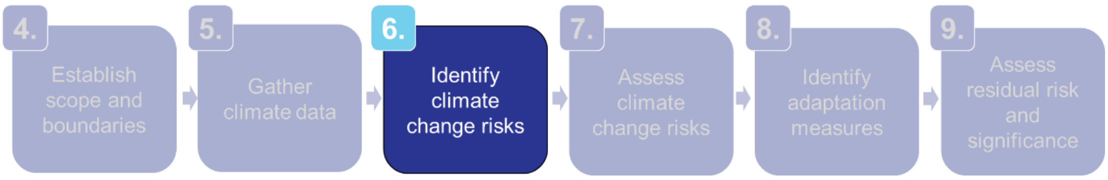
Table 7.9 Steps to Select Climate Change Projections

1. Define the GHG Scenario
Given the inherent uncertainty surrounding climate change projections, it is recommended that a moderate and high emissions scenario are adopted. This provides decision-makers with a more holistic understanding of the range of potential climate futures possible, which is essential when understanding risk and developing appropriate adaptation measures. Climate Ireland provides data for Representative Concentration Pathways (RCP) scenarios 4.5 (moderate) and 8.5 (high), which are appropriate to adopt for this assessment.[8]
2. Define the Time frame
It is preferable to consider several time frames to inform the change in risk over time. For longer lived infrastructure projects, a range of time slices should be considered to reflect the varying design life of individual asset components e.g. utilities typically have a short life span of 10-15 years whilst bridges have a lifecycle of up to 120 years. Currently, Climate Ireland's data explorer tool only provides one time period of 2041 – 2060, however, if in the future more data is available, multiple time frames should be selected.
3. Selection of Climate data
The climate change data should be current, authoritative, and credible to enable a robust and accurate estimation of risk. As climate change projections are updated when new climate change information becomes available, the data sources should be reviewed on a regular basis to ensure the most up-to-date sources are used. The data used and the justification for determining its relevance should be noted in the assessment. An example of a credible data source in Ireland is Climate Ireland (Climate Ireland, 2022) which provides readily available climate change projections for a wide range of climate variables across multiple GHG emission scenarios.[9]
4. Scenario Probability
The probability levels of climate projections should also be determined for the CCR Assessment. Where available, the 50% probability scenario should be presented alongside the 10th and 90th percentiles to demonstrate the range in projections.

[7] The Office of Public Works' national flood information portal provides access to historical and projected maps of flood extents and plans for Ireland. This map and plan viewer website is an important resource, to support planning, emergency response planning, and to empower people and communities to respond to flood risk
[8] Representative Concentration Pathways (RCPs) describe different 21st century pathways of GHG emissions depending on the level of climate mitigation action undertaken. Refer glossary for more detail.
[9] Climate Practitioners should be aware of the Met Éireann research project 'TRANSLATE', which is aimed at standardising national climate projections for Ireland and is due to finish in early 2023.

Gathering Climate Data Checklist
At this stage, the Climate Practitioner should have defined the climate baseline and gathered the climate change projection data to be used for this assessment. This includes:

- ☑ Historical climate data on the climate variables selected for the assessment and information on past extreme climate events.
- ☑ Climate change projection data on the climate variables selected for the assessment



7.2.3 Identify the Climate Change Risks

In this step, the climate data gathered should be used to identify climate-related risks to the project. The aim of this step is to generate a comprehensive list of risks based on the climate change hazards that have been deemed relevant to the project type and location.

Risks should be associated with a specified climate variable and the project receptors for each risk should be noted. Risk statements should link a climate-related cause to a project-related effect. For each risk, existing or planned controls should be noted. In this instance, existing or planned controls represent business-as-usual measures that are typically included in the design and operation of a TII project that work to mitigate the climate risk.

At this stage of the assessment, it is best practice to generate a risk register to document the risk assessment process. Table 7.10 provides an example risk register to document the outcomes of the risk identification process. Appendix E provides a more complete risk register template that can be used for the detailed climate change risk assessment.

Table 7.10 Example risk register

Risk ID	Climate variable	Risk statement	Project receptors	Existing/ planned controls
1	Extreme rainfall	Extreme rainfall results in overflow of drainage system causing flooding of road.	Drainage system, pavements.	Drainage infrastructure designed to account for 1% AEP flood event.
2	Extreme heat	Extreme heat affects pavement durability, causing cracking or damage resulting in reduced reliability and design life.	Pavements	Pavement design inherently allows for extreme temperatures.

Appendix F provides further examples of climate-related risks as well as questions that the Climate Practitioner can ask themselves to aid in the identification of risks. The examples are not exhaustive and when ascertaining climate change hazards and impacts, Climate Practitioners should identify climate change hazards based on the project's context. It is important that the outputs of this stage are validated by subject matter experts e.g. members of the design team to ensure that the risks are realistic to the project. More detail is provided below on consultation throughout the risk assessment process.

Indirect Risks, In-Combination and Cumulative Impacts

In addition to direct physical risks to the infrastructure asset, consideration should also be given to indirect, in-combination and additive risks. For example, flooding of connected transport routes can impact the operation of the asset in question, in that it can cause increased travel time and inconveniences for road users.

Conversely, Climate Practitioners could consider the impact on the surrounding transportation network if a proposed project is impacted by a climate change hazard so as to disrupt its use.

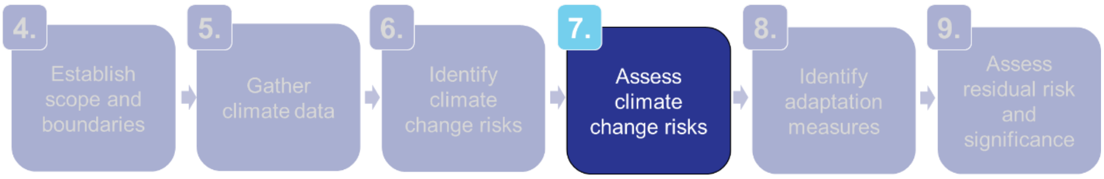
For example, what would be the impact on the surrounding transport network if a proposed project is disrupted by severe flooding. As part of this Climate Practitioners could provide commentary on the potential capacity of the existing transport network.

The cumulative or in-combination impacts of climate change and the project on environmental receptors should also be considered in the risk assessment process. For example, does climate change exacerbate the noise impacts of the road scheme as extreme heat days force occupants of nearby households to open their windows. It is critical these risks are identified and assessed through consultation with other, relevant environmental specialists.

Identifying Climate Change Risks Checklist

☑ Identified climate-related risks to the project noting the associated climate variable, the project receptors and existing/planned controls for each risk. Ensure consideration is given to indirect, cascading and cumulative risks.

☑ Generated a risk register to document the risk assessment process.



7.2.4 Assess the Climate Change Risks

For each climate change risk identified, a risk assessment should be undertaken. This involves an assessment of likelihood and consequence, which results in a risk rating and an evaluation of significance. The assessment of risk should be performed for each of the climate change scenarios selected, for example for the moderate and extreme GHG scenarios for the chosen time frames. This is because the likelihood and consequence are expected to change as global warming and climate change unfolds.

The risk assessment process should include an **initial** and **residual** risk rating. The initial risk rating takes into consideration the existing or planned controls, whilst the residual risk rating takes into consideration the proposed adaptation measures (refer to Appendix F for more on adaptation measures). The former gives the Climate Practitioner and any other users of the climate change risk assessment an understanding of current risk profile and directs decision making on adaptation measures. The latter provides a residual level of risk if the proposed measures are implemented.

Risk Framework

In order to undertake the assessment, the Climate Practitioner must adopt an appropriate risk framework. The risk framework suggested in this guidance is taken from the EU Technical Guidance (2021). The likelihood and consequence descriptors and the risk matrix associated with this risk framework are provided in Appendix D.

An alternative risk framework can be adopted for the assessment if the Climate Practitioner deems appropriate. For example, a project specific risk framework may have been established to ensure consistency in the assessment and discussion on project risks, which the Climate Practitioner may deem relevant for the assessment of climate risk.

Likelihood

The selection of likelihood is one metric to be determined in an assessment of risk. Likelihood refers to how likely the identified climate hazards are to occur within a given timescale e.g. the lifetime of the project.

It should be determined for each of the climate change scenarios considered and should take into account the climate data gathered earlier in the risk assessment process. The likelihood associated with the initial risk rating should take into account the existing or planned controls, whilst the likelihood associated with the residual risk rating should also take into consideration the adaptation measures identified.

Appendix D provides the likelihood descriptors associated with the risk framework from the EU Technical Guidance (2021). To help in the determination of likelihood this framework provides both qualitative and quantitative criteria for each likelihood category.

Consequence

The selection of consequence is another metric to be determined in the assessment of risk. Consequence refers to the severity or magnitude of the impact associated with the climate risk, should it eventuate. As with likelihood, it should be determined for each of the climate change scenarios considered for both the initial and residual risk rating. The consequence associated with the initial risk rating should take into account the existing or planned controls, whilst the consequence associated with the residual risk rating should also take into consideration the adaptation measures identified.

The Climate Practitioner should consider multiple categories of consequence including (but not limited to):

- Asset damage / engineering / operational
- Safety and health
- Environmental
- Social
- Financial
- Reputation
- Cultural heritage

The analysis should reflect the geographical extent of the effect, the number of receptors affected (e.g., scale), the complexity of the effect, the degree of harm to those affected and the duration, frequency, and reversibility of effect Appendix D provides the consequence descriptors associated with the risk framework from the EU Technical Guidance (2021).

Initial Risk Assessment

Using a combination of the selected likelihood and consequence levels, the initial risk rating should be determined for each climate change risk, taking into consideration the existing or planned controls. A risk matrix such as that shown in Table 7.11 , should be used to determine the appropriate risk rating. Detailed explanations should be provided to substantiate the assessment conclusions, with each risk categorisation defendable and justifiable.

For example, it may be that a catastrophic event, even if it is rare or unlikely, still represents an extreme risk to the project as the consequences are so severe, EU Technical Guidance (2021).

Table 7.11 Risk Matrix as per the EU Technical Guidance (2021).

Likelihood	Magnitude of consequence				
	Insignificant	**Minor**	**Moderate**	**Major**	**Catastrophic**
Rare	Low	Low	Medium	High	Extreme
Unlikely	Low	Low	Medium	High	Extreme
Moderate	Low	Medium	High	Extreme	Extreme
Likely	Medium	High	High	Extreme	Extreme
Almost certain	High	High	Extreme	Extreme	Extreme

Assessing Initial Significance

Following the assessment of the initial risk rating, is an assessment of which risks are of significance to the project.

This process is a simple binary assessment that indicates if the risk is 'Significant' or 'Not Significant', the allocation of which determines the priority given to that risk in the next step of the assessment.

The risk framework and the risk ratings allocated can be used to determine significance. It is recommended that risk rating levels e.g., 'Low', 'Medium', 'High', 'Extreme' are denoted as either 'Significant' or 'Not Significant', and that each risk is allocated a significance rating depending on its highest initial risk rating.

In the example provided in Table 7.12, 'Low' and 'Medium' have been defined as 'Not Significant' whilst, 'High' and 'Extreme' have been defined as 'Significant'. The criteria on significance should be decided in consultation with TII as this could vary between projects and will depend on the risk framework adopted for the assessment.

All risks defined as 'Significant' should be given priority in the next phase of the assessment i.e. the identification of adaptation measures. The intention is to increase the resilience of the asset and reduce the number of risks classified as 'Significant'.

Table 7.12 Assessing Significant using the Risk Matrix

Likelihood	Magnitude of consequence				
	Insignificant	**Minor**	**Moderate**	**Major**	**Catastrophic**
Rare	Not significant	Not significant	Not significant	Significant	Significant
Unlikely	Not significant	Not significant	Not significant	Significant	Significant
Moderate	Not significant	Not significant	Significant	Significant	Significant
Likely	Not significant	Significant	Significant	Significant	Significant
Almost certain	Significant	Significant	Significant	Significant	Significant

Legend	Low	Medium	High	Extreme

Communication and Consultation

Communication and consultation are key elements of a climate change risk assessment due to the uncertainty and complexity surrounding the process.

The Climate Practitioner should engage with TII and other relevant stakeholders including members of the design team and other disciplines involved in the EIA process to determine the consequence, likelihood and significance of each risk identified.

Often the Climate Practitioner's role is to facilitate the climate change risk assessment process, with the technical know-how of how likely or severe a risk is, based on the expertise of a design lead or specialist.

Ongoing communication and consultation also helps to ensure that those accountable for implementing the risk management process understand the decisions made with regards to adaptation and have an opportunity to contribute to the decision-making process. It is important that consultation is undertaken in a way that those engaged with understand the context in which their responses are being applied.

A recommended approach for effective consultation is the facilitation of a **risk assessment workshop** which brings in the relevant internal and external stakeholders to validate the risks identified and assist in the assessment of likelihood, consequence and significance as well as in the identification of adaptation measures.

Assessing Climate Change Risks Checklist

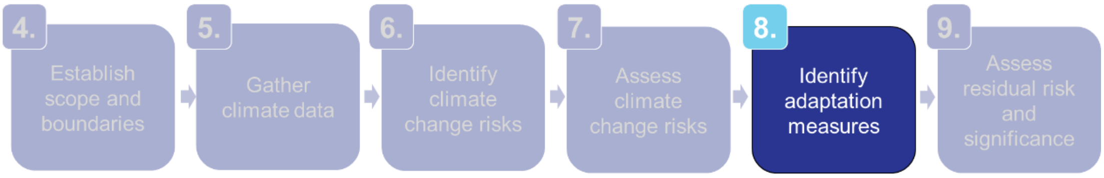
At this stage in the assessment the Climate Practitioner should have completed the following:

☑ Decided on the risk framework to be adopted for the assessment.

☑ Determined the initial likelihood, consequence and risk rating for each risk identified for each climate scenario considered.

☑ Assess the number of 'Significant' climate risks facing the project (prior to the implementation of adaptation measures).

☑ Conducted effective consultation throughout the risk assessment process for example via a risk assessment workshop.



7.2.5 Identify Adaptation Measures

If the risk assessment concludes that there are significant climate risks to the project, these must be managed and reduced to an acceptable level through the identification and implementation of adaptation measures. Adaptation measures are actions that can be implemented to improve resilience to climate change. The preferred measures should be integrated into the project design and/or its construction or operation to improve climate resilience.

In line with Ireland's National Adaptation Framework (Department of the Environment, Climate and Communications, 2018), and the terminology used in both the Local Authority Strategies and the Sectoral Plans, adaptation actions should be described as either Grey, Green or Soft.

- **Grey Actions** involve technical or engineering oriented responses to climate impacts, for example the consideration of climate change projections in the design of drainage structures.
- **Green Actions** seek to use nature-based solutions to enhance the resilience of human and natural systems, for example the addition of green spaces to linear infrastructure projects to counteract urban heat island effect, or the use of drought and heat tolerant species in landscaping.

- **Soft Actions** involve the alterations in behaviour, regulation, or systems of management such as increased monitoring of climate change impacts during operation, or the consideration of climate risk in asset management plans. They are generally relatively flexible and inexpensive to implement.

In each case, early and regular communication and consultation (as detailed above) is the most effective way of eliminating and reducing climate change impacts on the project, thereby reducing the need for additional and costly measures late in design or during operation. Appendix F provides an example of adaptation measures linked to example risks.

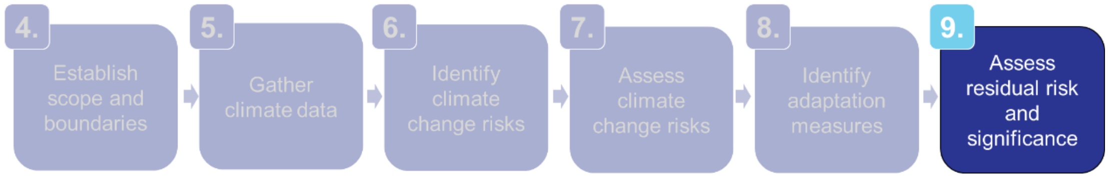
Timing and Responsibility of Adaptation

For each adaptation measure identified, an implementation timeframe and responsible party should be allocated. This will provide direction during later stages of the project and ensure accountability. To ensure measures are carried forward into subsequent project phases, adaptation measures should be included in the appropriate project documentation e.g., in design reports or from Phase 5 onwards in CEMPs and OEMPs.

Identifying Adaptation Measures Checklist

At this stage in the assessment the Climate Practitioner should have completed the following:

☑ Identified the adaptation measures required including the timing and responsible party.



7.2.6 Assess Residual Risk and Significance

Using the adaptation measures identified an assessment of residual risk should be undertaken for each risk using the same risk framework as for the initial risk rating. This assessment is conducted assuming the adaptation measures identified have been implemented (whether they are design, construction or operation related) and accordingly will often result in a lower risk rating. The residual risk assessment should be undertaken in consultation with TII and other relevant stakeholders with the appropriate specialists confirming how and if the adaptation measures change the likelihood and consequence of an identified risk.

It can be helpful to provide a summary table comparing the initial and residual risk profiles to understand how the climate change risk assessment process and the implementation of adaptation measures has increased the resilience of the asset. An example of this is provided in Table 7.13 below. Alternatively, this could be graphically represented.

Table 7.13 Risk profile comparison

Risk rating	Number of risks	
	Initial risk rating RCP8.5	Residual risk rating RCP8.5
Low	*no. of low risks*	*no. of low risks*
Medium	*no. of medium risks*	*no. of medium risks*
High	*no. of high risks*	*no. of high risks*
Extreme	*no. of extreme risks*	*no. of extreme risks*

Assessing Residual Significance

The final step in the climate change risk assessment process is to reassess the number of significant risks following the implementation of adaptation measures.

The same criteria should be used as when assessing initial significance with the intention that the number of ‘Significant’ risks would have reduced due to the increased resilience of the asset. Any risks that remain ‘Significant’ should be prioritised in the monitoring and update of the climate change risk assessment throughout subsequent project phases (refer to Chapter 4).

Assessing Residual Risk and Significance Checklist
At this final stage of the assessment the Climate Practitioner should have completed the following:
☑ Assessed the residual risk rating and significance of each risk taking into consideration the identified adaptation measures.

8. Monitoring

Monitoring should be undertaken to assist with the ongoing management of adaptation and mitigation actions identified through the climate assessment process in order to measure their effectiveness. This should include monitoring of all measures specified in the project documentation. As the planning enforcement authority, TII is responsible for ensuring that road authorities comply with conditions (including those related to monitoring) associated with national road projects (Government of Ireland, 2019), and the Minister for Transport has an equivalent role in respect of light rail. To encourage the implementation of both the GHG and CCR monitoring requirements throughout the lifecycle of the asset, these should be embedded in the appropriate management plans, which should include the monitoring of contractors and operators to ensure measures are implemented properly.

8.1.1 Monitoring – GHGA

To assist with the ongoing management of GHG emissions, the GHGA should be monitored and if necessary, updated at various stages throughout the lifecycle of the asset. These stages are detailed in Figure 8.1.

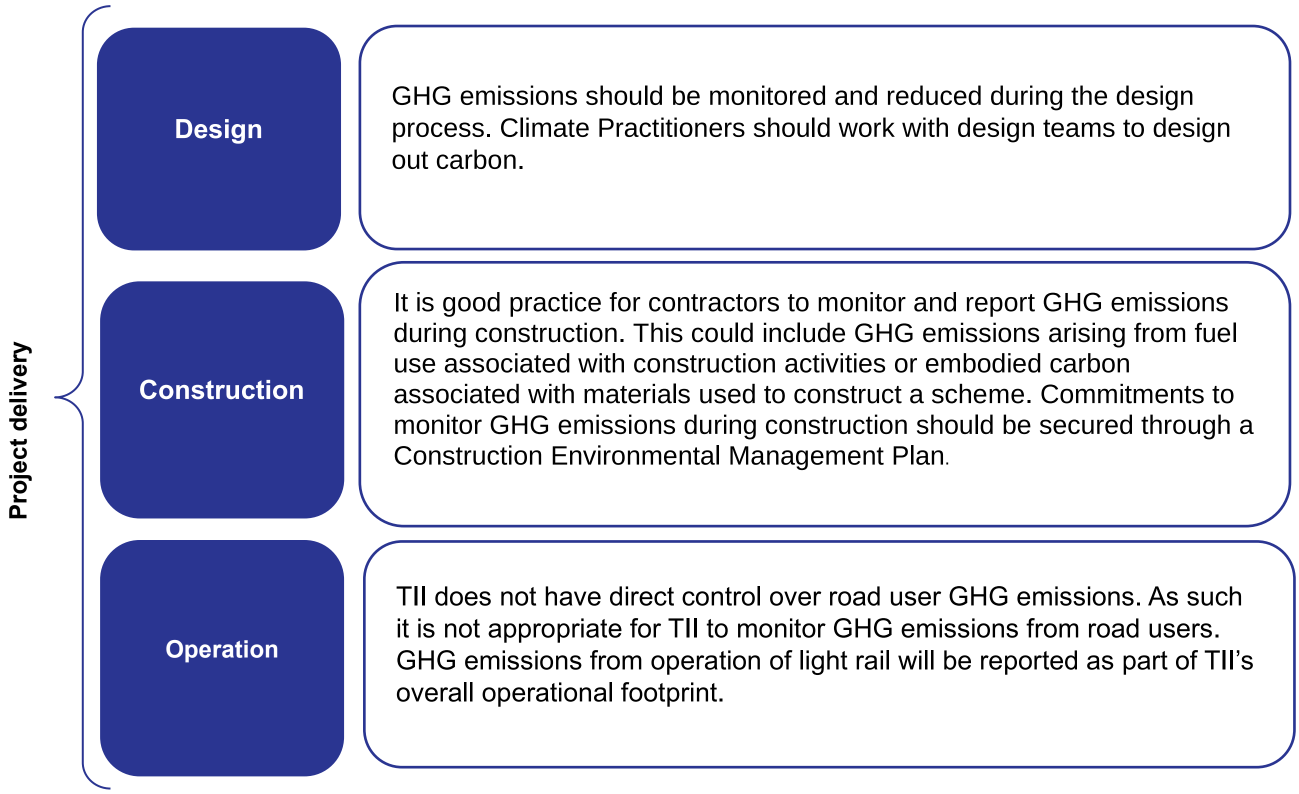


Figure 8.1 Monitoring Plan for GHGA

8.1.2 Monitoring – CCR Assessment

To assist with the ongoing resilience of the project to climate change and the currency of the risk assessment itself, the CCR Assessment should be monitored and if necessary, updated at various stages throughout the lifecycle of the asset i.e., at specific frequencies or in response to certain events. These stages are detailed in Figure 8.2.

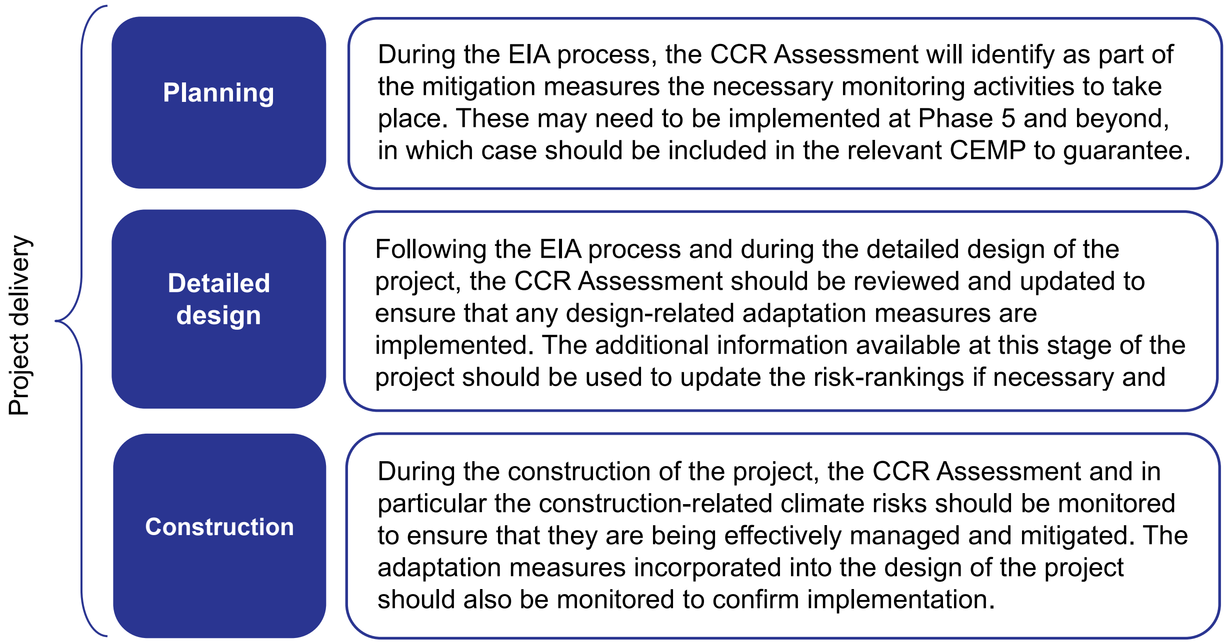


Figure 8.2 Monitoring Plan for CCR Assessment

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9.1 Additional Reading

An evidence base review of existing literature relating to climate change assessments was undertaken to inform this OTD. Where identified, this OTD incorporates current best practice from the evidence review and builds on it in a manner that reflects the national context. Key literature referenced includes:

- Guidance on integrating climate change and biodiversity into EIA (European Commission, 2013);
- Technical guidance on the climate proofing of infrastructure in the period 2021-2027 (European Commission, 2021);
- PAS 2080:2016 Carbon Management in Infrastructure (BSI, 2016);

- Environmental Impact Assessment Guide to: Climate Change Resilience and Adaptation (IEMA, 2020);
- Assessing Greenhouse Gas Emissions and Evaluating their significance 2nd Addition IEMA (2022)
- ISO 14044:2006 Environmental management — Life cycle assessment (International Organization for Standardization, 2021); and
- Greenhouse Gas Protocol guidelines (World Business Council for Sustainable Development (WBCSD)/ World Resources Institute (WRI), 2015).

Appendix A:

Policy Context

This appendix provides a summary of existing European and Irish policy. The policy relevant to climate assessment is an evolving area, therefore Climate Practitioners undertaking the climate assessment must be cognizant of the relevant up-to-date policy and should not be limited to the policy outlined below.

A1.1 EU Climate Policy

European Green Deal (2019)

European Green Deal (launched in December 2019) is a package of proposals adopted to make the EU's climate, energy, land use, transport and taxation policies fit for reducing net greenhouse gas emissions by at least 55% by 2030, compared to 1990 levels (European Commission, 2021). Proposals combine the application of emissions trading to new sectors and a tightening of the existing EU Emissions Trading System; increased use of renewable energy; greater energy efficiency; a faster roll-out of low emission transport modes and the infrastructure and fuels to support them; an alignment of taxation policies with the European Green Deal objectives; measures to prevent carbon leakage; and tools to preserve and grow our natural carbon sinks.

EU Adaptation Strategy on Climate Change (2021)

The strategy sets out how the European Union can adapt to the unavoidable impacts of climate change and become climate resilient by 2050 (European Commission, 2021). The Strategy has threee objectives: i) smarter adaptation, ii) systemic adaptation and iii) faster adaptation t. It proposes actions to improve knowledge on adaptation and gather more and better data on climate-related risks and losses. It focuses on developing and rolling out adaptation solutions to help reduce climate-related risk, increase climate protection, and safeguard the availability of fresh water. It sets out the priorities for the Commissions to develop further and implement of adaptation strategies and plans at all levels of governance.

Technical Guidance on the Climate Proofing of Infrastructure in the period 2021-2027 (2021)

The guidance is consistent with the Paris Agreement and European Union climate objectives (European Commission, 2021). It provides technical guidance on climate proofing, a process that integrates climate change mitigation and adaptation measures into the development of infrastructure projects. It includes an updated carbon footprint methodology and an assessment of the shadow cost of carbon. It integrates climate proofing with project cycle management, environmental impact assessments (EIA), and strategic environmental assessment (SEA) processes, and it includes recommendations to support national climate-proofing processes in Member States. It has been used in the development of this TII Climate Guidance.

A1.2 Irish Policy

Planning Policy

EPA EIAR Guidelines (2022)

The Irish Environmental Protection Agency (EPA) provides guidelines on how the EIA Directive should be addressed, to consider climate assessment for all EIA Reports submitted to the EPA or other consent authorities on or after 16 May 2017. Further detail is provided within the Guidelines on the Information to be Contained in Environmental Impact Assessment Reports (EPA, 2022).

Project Ireland 2040 National Planning Framework (NPF) (2018) and the National Development Plan (NDP) (2018; revised [2021-2030])

Project Ireland 2040 is the overarching national policy initiative which sets out, through the National Planning Framework (NPF) (Government of Ireland, 2018) and the National Development Plan (NDP) (Government of Ireland, 2018), the Government's long-term strategic vision towards the development of an environmentally sustainable transport system in Ireland.

NPF with the NDP sets the context for each of Ireland's three regional assemblies to develop their Regional Spatial and Economic Strategies.

NPF is a high-level framework supported by a series of National Policy Objectives (14) and National Strategic Outcomes which promote coordinated spatial planning, sustainable use of resources and protection of the environment. Several National Policy Objectives identified in the NPF directly call for the mainstreaming of climate change adaptation measures into the spatial planning and infrastructure development process.

Under the NPF, the Government will support:

- integrating climate considerations into statutory plans and guidelines;
- more energy efficient development;
- the roll-out of renewables and protection and enhancement of carbon pools such as forests, peatlands and permanent grasslands;
- the development of sustainable supply chains in the bio economy;
- grey and green adaptation.

NDP provides enabling investment to implement the strategy set in the National Planning Framework, it sets out the significant level of investment, almost €116 billion. NDP sets out 10 Strategic Outcomes, of which Outcome 8 applies to climate change: 'Transition to a Low-Carbon and Climate-Resilient Society'. It sets a number of actions in energy efficiency, renewable energy, transport, commercial & private sector investments, agriculture and flood defences, to deliver transition by 2050 to a competitive, low-carbon, climate-resilient and environmentally sustainable economy. Specific measures include: Climate Action Fund Cycling and Walking Network for metropolitan areas of Ireland's cities, and expanded Rural Cycleways (Offline & Greenways), comprehensive integrated public transport network for Ireland's cities and flood risk management.

Climate Policy

National Adaptation Framework (NAF): Planning for a Climate Resilient Ireland (2018)

Prepared under the Climate Action and Low Carbon Development Act 2015, NAF was launched in January 2018 (Department of the Environment, Climate and Communications, 2018). It presents progress to date in Ireland in planning for climate change and developing climate resilience. It sets out the national strategy to reduce the vulnerability of the country to the negative effects of climate change and to avail of positive impacts. It provides an overview of some potential costs of climate change and outlines a whole of government and society approach to climate adaptation in Ireland.

Climate Action Plan 2021

The Plan sets a roadmap for Ireland for taking decisive action to halve GHG emissions in Ireland by 2030 and reach net zero no later than 2050 (Department of the Environment, Climate and Communications , 2021). The Plan will be updated annually to align with the legally binding economy-wide carbon budgets and sectoral ceilings.

Once the programme of carbon budgets has been legally adopted, future Climate Action Plans must be consistent with their achievement, and provide a roadmap of actions, including sectoral actions, that are needed to ensure such compliance.

Transport currently accounts for approximately 18% of Ireland's greenhouse gas (GHG) emissions. To put Ireland on a pathway to achieve net zero emissions by 2050, the Climate Action Plan 2021 sets an emission reduction target for the transport sector of 7 million tonnes of CO_2, approximately 51% over the period 2021 to 2030. To achieve this target the Plan sets out a range of measures to reduce emissions in the transport sector, these are:

- 500,000 extra walking, cycling and public transport journeys per day by 2030,
- increasing the proportion of kilometres driven by passenger electric cars to between 40 and 45% by 2030, in addition to a reduction of 10% in kilometres driven by the remaining internal combustion engine cars,
- all replacements for bus and commuter rail vehicles and carriages to be low or zero carbon by 2030,
- increased rollout of rural public transport through Connecting Ireland.

The proposed pathway in transport is focused on accelerating the electrification of road transport, the use of biofuels, and a modal shift to transport modes with lower energy consumption (e.g. public and active transport). Transport electricity demand is forecast to grow approx. 23% per annum as a result of fast uptake of EV charging.

Transport Policy

Strategy for the Future Development of National and Regional Greenways (2018)

The purpose of the Strategy is to assist in the strategic development of nationally and regionally significant Greenways (Department of Tourism, Transport and Sport, 2018). It aims to ensure that Greenways are developed in appropriate locations and to an appropriate standard in order to deliver a quality experience for all Greenway users. It set out the target to increase the number and geographical spread of Greenways of scale and quality around the country over the next 10 years and a consequent significant increase in the number of people using Greenways as a visitor experience and as a recreational amenity.

Transport Climate Change Sectoral Adaptation Plan (2019)

The transport sectoral plan was published in 2019 under the NAF (Department of Transport, 2019). The plan superseded the adaptation plan 'Developing Resilience to Climate Change in the Irish Transport sector' published in 2017.

The plan sets out the policy on adaptation strategies for transport, to build adaptive capacity within the sector's administrative structures and assist organisations to better understand the implications of climate change on transport infrastructure and services. The plan identifies vulnerabilities at a national level across the transport system and provides climate impact screening for the transport sector followed by priority impact assessment. The Plan outlines an adaptation action plan which includes three implementation objectives:

- Improve understanding of the impacts of climate change on transport infrastructure, including cross-sectoral cascading impacts, and close knowledge gaps.
- Assist transport stakeholders in identifying and prioritising climate risks to existing and planned infrastructural assets and enabling them to implement adaptation measures; and

- Ensure that resilience to weather extremes and longer-term adaptation needs are considered in investment programmes for planned future transport infrastructure.

TII Statement of Strategy 2021-2025 (2020)

The strategy was published in 2020 and is framed in a context of climate change, political change, and a global pandemic (TII, 2020). It sets out the following objectives in relation to climate:

- Introduce measures to support the reduction of carbon and other emissions in our operations.
- Deliver infrastructure that supports low-carbon transport systems and emission reductions.
- Plan and design major transport projects to encourage active travel and public transport.
- Promote further use of low-carbon products in our construction projects.
- Deliver infrastructure that supports low-carbon transport systems and emission reductions.

Sustainability Implementation Plan - Our Future (2021)

TII's vision as part of the TII Sustainability Implementation Plan is to lead in the delivery and operation of sustainable transport (TII, 2021). Six key sustainability principles have been developed to reflect TII's organisational ambition. 'Transition to net zero' principles, focus on reduction of the carbon impact of construction, operation and use of the transport network through responsible use of resources, reuse and repurposing, as well as driving the net-zero transition and enabling customers to make more sustainable choices.

'Enable safe and resilient networks and services' principles focuses on the provision of transport networks, services, systems and assets that are resilient to future change, including changes in climate.

National Investment Framework for Transport in Ireland (2021)

The NIFTI was prepared and published in 2021 by the Department for Transport as a high-level strategic framework to support the consideration and prioritisation of future investment in land transport (Department of Transport, 2021). It is aligned with the National Planning Framework and supports the delivery of the National Strategic Outcomes. The NIFTI was informed by extensive research and analysis including environmental assessments and public consultation. To address the transport specific challenges identified, NIFTI established four Investment Priorities: Decarbonisation, Protection and Renewal, Mobility of People and Goods in Urban Areas, and Enhanced Regional and Rural Connectivity.

The Decarbonisation priority specifically acknowledges the large and urgent role the transport sector must play in meeting Ireland's climate change targets. It therefore supports and prioritises sustainable mobility where feasible including active and public transport and aims to extend the reach of sustainable mobility in rural areas.

National Roads 2040 (2022)

NR2040 National Roads 2040 is TII's long-term strategy for planning, operating, and maintaining the National Roads network ((TII, 2022). It has been developed to support the delivery of Project Ireland 2040 objectives and to align with the Department of Transport's (DoT) National Investment Framework for Transport in Ireland (NIFTI, December 2021) and with commitments in wider policy including the Climate Action Plan and the DoT's National Sustainable Mobility policy.

Waste Policy

Waste Action Plan for a Circular Economy (2020)

The plan was published in 2020 and provides direction to waste planning and management in Ireland over the coming years (Department of the Environment, Climate and Communications, 2020). It sets out a range of aims and targets for Ireland, which includes increased regulation and measures across various waste areas e.g. Circular Economy, Construction and Demolition, Green Public Procurement and Waste Enforcement.

Whole of Government Circular Economy Strategy 2022 – 2023 'Living more, Using Less' (2021)

Published in 2021, it is Ireland's first national circular economy strategy (Department of the Environment, Climate and Communications, 2021). It aims to support a 51% reduction target in overall greenhouse gas emissions by 2030 and to get on a path to reach net-zero emissions by no later than 2050. The strategy sets out a vision for Ireland's transition to circularity; explaining the concept of the circular economy, describing what initiatives are already happening, what opportunities are available and how the Government will drive the changes required. It sets our actions for inclusion in sectoral circular economy roadmaps including construction and transport sectors.

Appendix B:

Carbon Assessment Tool

The Climate Practitioner should use the TII Carbon Assessment Tool for the calculation of emissions arising from the construction (e.g., embodied carbon in construction materials, energy, and fuel use) and maintenance emissions. The tool uses a series of calculations, emission factors and assumptions to calculate a carbon footprint for proposed National Roads, Light Rail, and Rural Cycleways (Offline & Greenways) projects. The carbon footprint calculation is designed to align with TII's project phases as well as (PAS) 2080 (BSI, 2016). The tool includes an emission factors library, using factors developed by relevant industry bodies including:

- Institution of Civil Engineers (2013), CESMM4 Carbon & Price Book 2013.
- Sustainable Energy Authority of Ireland (2017), Conversion Factors.
- European Commission (2010) Guidelines for the calculation of land carbon stocks.
- Environment Agency, Carbon Calculator for Construction Activities (Version 3.6).
- UK Government (2021), Greenhouse Gas Reporting Conversion Factors.

The tool includes functionality to enable the assessment of both National Road and Light Rail projects and allows for different levels of assessment to be carried out and is, aligned with the project phases for TII National Road and Light Rail projects. It is also designed so that new emerging carbon emission factors data (from Environmental Product Declarations (EPDs).) can be added to the tool. The Climate Practitioner should use the latest country-specific emissions factors or EPDs and identify the most appropriate emissions factors source in the absence of Ireland-specific data.

The outputs from the tool allow Climate Practitioners to compare and evaluate the lifecycle carbon impacts of multiple design options for any given National Road or Light Rail project.

Environmental Product Declarations (EPDs) provide a standardised way of providing data about the environmental impacts of a product throughout the product life cycle. EPDs provide material-specific data including carbon emissions factors that can be used for calculating GHG emissions. Irish Green Building Council (IGBC) has developed the EPD Ireland programme which enables Irish producers of construction products to create Ireland-specific EPDs or their products using Product Category Rules. Where available produce specific EPD data should be considered for use in the Carbon

Appendix C:

TII Road Emissions Model

Data from the TII REM tool should be obtained from an Air Quality Practitioner to inform user emissions for National Roads and Light Rail during operation.

The TII REM tool should be used by an Air Quality Practitioner to estimate user emissions during the operation of the proposed project. These tools have been specifically designed to calculate emissions from National Road and Light Rail projects in Ireland.

The TII REM tool is a scalable and user-editable emissions calculation tool. It enables differentiation of discrete geospatial areas, road types, and vehicle classifications, to match the resolution of the traffic model. The tool focuses on road emissions and, in particular, the National Road Network (NRN) and identifies NRN route sections with the highest emissions that could be focused on to manage emissions. It also considers how emissions may change over time on the NRN due to anticipated traffic growth and national policies and provide analysis how interventions on the NRN (e.g. speed limit changes) will affect emissions. The tool uses a link-by-link based emission calculation approach and detailed fleet predictions for age, fuel technology, engine size and weight, it also enables the user to gain additional insights to inform on possible interventions for different scenarios. The carbon emissions data calculated from the TII REM tool are output using common nomenclature (i.e. tCO_2e), and so ensures compatibility with associated industry tools. Importantly, data from the TII REM tool can be inputted into the TII Carbon Assessment Tool.

Appendix D:

Example Risk Framework

As detailed in Chapter 7 a risk framework with which to assess climate risks must be selected in consultation with TII. The risk framework provided as an example in this guidance is based on the framework detailed in the EU Technical Guidance on climate proofing (2021). The risk matrix, likelihood analysis and consequence analysis are provided in Table D.1, Table D.2 and Table D.3, respectively.

Table D.1 Impact Criteria to establish Significance

Likelihood	Magnitude of consequence				
	Insignificant	**Minor**	**Moderate**	**Major**	**Catastrophic**
Rare	Low	Low	Medium	High	Extreme
Unlikely	Low	Low	Medium	High	Extreme
Moderate	Low	Medium	High	Extreme	Extreme
Likely	Medium	High	High	Extreme	Extreme
Almost certain	High	High	Extreme	Extreme	Extreme

Table D.2 Assessment of Likelihood

Likelihood 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%

Table D.3 Assessment of Consequence

Risk areas	Magnitude of consequence				
	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.	Localised within site boundaries.	Moderate harm with possible wider effect Recovery in one year	Significant harm with local effect Recovery longer than one year.	Significant harm with widespread effect.

Risk areas	Magnitude of consequence				
	Insignificant	**Minor**	**Moderate**	**Major**	**Catastrophic**
	No recovery required	Recovery measurable within one month of impact		Failure to comply with environmental regulations / consent	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[91]. National, long-term social impacts	Loss of social licence to operate. Community protests
Financial	x % 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 wider impact to tourism industry	Significant damage with national and international impact	Permanent loss with resulting impact on society

Appendix E:

Example Climate Change Risk Register

Risk Identification					Risk Assessment							Adaptation Measures								Significance
Risk ID	**Climate variable**	**Risk statement**	**Project receptors**	**Impact type**	**Planned controls**	**Initial risk rating**						**Adaptation Measures**	**Timing & Responsibility**	**Residual Risk Rating**						**Significance**
						RCP4.5 (2041-2060)			**RCP8.5 (2041-2060)**					**RCP4.5 (2041-2060)**			**RCP8.5 (2041-2060)**			
						Likelihood	**Consequence**	**Risk rating**	**Likelihood**	**Consequence**	**Risk rating**			**Likelihood**	**Consequence**	**Risk rating**	**Likelihood**	**Consequence**	**Risk rating**	
1	*e.g. Extreme rainfall*	*Description of impact associated with climate variable.*	*Asset components impacted e.g. pavements, drainage, landscaping, utilities, etc.*	*Nature of the impact, often associated with consequence category e.g. asset damage, safety and health, environmental, social, financial etc*	*Description of controls planned within the current design or business-as-usual operational measures that mitigate the identified risk*	*e.g. Rare*	*e.g. Moderate*	*e.g. Medium*	*e.g. Unlikely*	*e.g. Moderate*	*e.g. Medium*	*Additional measures to be implemented during design, construction or operation with the intention of addressing and mitigating the identified risk.*	*Timing and responsible party for the implementation of adaptation measures e.g. Construction, Constructor*	*e.g. Rare*	*e.g. Minor*	*e.g. Low*	*e.g. Unlikely*	*e.g. Minor*	*e.g. Low*	*e.g. Not significant*
2																				
3																				
4																				
5																				
6																				
7																				

Appendix F:

Climate Change Risk and
Adaptation Examples

Example Climate Change Hazards and Potential Associated Impacts

Climate change hazard	Key questions to consider	Example risk statements	Example adaptation measures
Construction			
Extreme weather events (e.g. storms)	Can construction works continue during extreme weather conditions.	Extreme weather event results in an inaccessible construction site or health and safety risk to workers, causing restricted working hours and a delay in operations.	Contractors' Environmental Management System (EMS) should consider all measures deemed necessary to manage extreme weather events and should as a minimum cover training of personnel and prevention and monitoring arrangements. Construction method statements should also consider extreme weather events where risks have been identified. Emergency preparedness and contingency procedures in place for an extreme weather event on the construction site or within the supply chain.
	Can storms have an impact on the construction's stability.	Extreme weather events cause damage to construction materials, plant, and equipment.	
Extreme temperatures	Can the materials used during construction withstand higher temperatures (or will they experience material fatigue or surface degradation).	Extreme heat impacts concrete curing process resulting in damaged infrastructure components and rework.	Contractor to schedule concrete curing to avoid peak temperatures.
	Are the construction activities likely to generate dust which could be exacerbated in hot and dry conditions.	Warm and dry conditions exacerbate dust generation and dispersion, health risks to construction workers.	Contractor to consider increased dust suppression measures in hot and dry conditions. Contractor to have health and safety plan in place that takes into consideration dust-related air quality concerns.
Extreme rainfall	Will the construction activities and workers be at risk because the site is located in a flood zone.	Extreme rainfall event results in flooding onsite causing soil erosion during early works or damage to partially constructed infrastructure, resulting in programme delays and/or increased costs.	Use short to medium range weather forecasting to inform short to medium term programme management, environmental control, and impact adaptation measures. Contractor to register with the flood warning service in areas of flood risk.
Operation			
Extreme weather events (e.g. storms)	Can ice affect the functioning/operation of the proposed project.	Cold weather conditions result in ice or 'black ice' on road surface presenting safety hazard for road users including car accidents which could result in injury or fatality.	Road signage to include ice warnings. Consider inclusion of variable message signs or variable speed limit signs to provide up-to-date messaging on weather warnings and to decrease speed limit in dangerous conditions.
	Is the proposed project's connectivity to energy and ICT networks ensured during extreme weather events such as storms.	Extreme weather event such as a storm results in loss of power to infrastructure including street lighting and traffic lights resulting in reduced functionality of infrastructure and causing potential safety hazard.	Consider including redundancy in design in the event of loss of power to the asset.
Extreme rainfall	Is the site located in a flood zone.	Infrastructure drainage system is unable to cope with extreme rainfall event leading to flooding of road surface which has implications on road safety and the operation of the asset.	Drainage design to consider flood alleviation measures to improve the resilience of the project to potential flooding events. For example, Sustainable Drainage Systems (SuDs) to be implemented where appropriate and runoff to be conveyed via filter drains and attenuation ponds.
Extreme wind	Will the proposed project be at risk because of storms and strong winds.	Strong wind gusts result in damage from wind borne debris including fallen trees on carriageway presenting safety hazard to road users.	Design to include minimum clearing distance between road edge and landscaping to ensure fallen trees do not impact road users. Establish maintenance and inspection program for landscaping.
Extreme heat	Are extreme heat conditions expected in the project location.	Extreme heat affects pavement/material durability, causing cracking and damage, resulting in reduced reliability and design life.	Consider designing for expected temperature extremes under future climate change scenarios e.g., consider using modified binders in surfacing to reduce susceptibility of asphalt to deformation. Implement regular maintenance regime to detect deterioration and damage.
Wildfire	Is the proposed project located in an area vulnerable to wildfires.	Wildfire reaches infrastructure site causing road closures and presenting safety hazard to road users.	Standard operating procedures to be developed for use in the event of necessary road closure and/ or traffic diversion.
Sea level rise / storm surge	Is the proposed project located in an area that may be affected by rising sea levels and/or storm surge.	Sea level rise or storm surge event results in flooding of roadway, which has implications on road safety and the operation of the asset.	Drainage design to account for expected sea level rise over the lifetime of the asset and increased severity of storm surge event. Design to incorporate flood alleviation measures.

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