

NR 20 40 National Roads 2040

Strategic Flood Risk Assessment of National Roads 2040 Strategy

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Tionscaldal Éireann
Project Ireland
2040



National Roads 2040

Strategic Flood Risk Assessment

TABLE OF CONTENTS

1. INTRODUCTION	1
1.1 SFRA Methodology	1
1.2 SFRA Integration with NR2040	2
2. DESCRIPTION OF NR2040	1
2.1 Overview	1
2.2 Policy Context	1
2.2.1 National Planning Framework	1
2.2.2 National Development Plan 2021-2030	2
2.2.3 National Investment Framework for Transport (NIFTI)	2
2.2.4 National Sustainable Mobility Policy	4
2.2.5 Climate Action Plan	5
2.3 NR2040 Long-term Strategic Issues	5
2.4 NR2040 Vision and Key Objectives	6
2.5 NR2040 Investment Priorities and Portfolios	7
2.6 Implementation	7
2.7 Commitments	8
3. THE PLANNING SYSTEM AND FLOOD RISK ASSESSMENT GUIDELINES	9
3.1 Introduction	9
3.2 The Assessment of Flood Risk	9
3.3 Sequential Approach & Justification Test	9
3.4 Flood Risk Assessment Hierarchy	10
3.5 Climate Change	11
4. IDENTIFICATION OF FLOOD RISK	13
4.1 Assessing Key Flood Risk Issues	13
5. ASSESSMENT OF NR2040 STRATEGY	15
6. MITIGATION MEASURES	28
7. FLOOD RISK ASSESSMENT CONCLUSIONS	29

APPENDIX A Glossary of Terms

1. INTRODUCTION

This report has been prepared independently by Roughan & O'Donovan as sub-consultant to AECOM on behalf of Transport Infrastructure Ireland (TII). The purpose of this report is to assess flood risk in accordance with “The Planning System and Flood Risk Management Guidelines for Planning Authorities”¹, herein referred to as “The FRM Guidelines”, and ‘Technical Appendices’², issued under the Planning and Development Act 2000 (as amended) published by the Office of Public Works (OPW) and Department of Environment, Heritage and Local Government (DEHLG) in 2009. The overall aim of this report is to undertake a Strategic Flood Risk Assessment (SFRA) of National Roads 2040 (NR2040) Strategy, hereafter referred to as “NR2040” or the “Strategy”. NR2040 is TII’s long-term strategy for the maintenance, development, and management of Ireland’s National Roads.

This report is structured as follows:

- Section 1 of this SFRA gives an overview of the SFRA methodology and its integration with NR2040;
- Section 2 provides an overview of NR2040;
- Section 3 provides a background to flood risk, including an overview of the staged approach to the assessment of flood risk, the likelihood of flooding and flood zones; a summary of the Sequential Approach and Justification Test for Plan Making; and an outline of the flood risk assessment hierarchy;
- Section 4 gives an overview of the sources of flood risk information and assesses the potential flood risk impact on, and effects from NR2040 in terms of a source-pathway-receptor model;
- Section 5 examines NR2040’s vision, key objectives and commitments, and assesses the likelihood of them having a significant adverse effect on flood risks;
- Section 6 provides a summary of the mitigation measures, and;
- Section 7 provides the flood risk assessment conclusions.

An SFRA on the draft Strategy was published for public consultation, along with the draft Strategy, in August 2022. This SFRA presents the assessment of the updated Strategy text assessing the amendments made on foot of public consultation feedback. Minor corrections to text and grammar are not considered as part of the SFRA assessment as these are not material changes.

1.1 SFRA Methodology

In Ireland, Flood Risk Assessments (FRAs) are carried out in accordance with The FRM Guidelines and Technical Appendices. The FRM Guidelines outline how flood risk management must be integrated at all stages of the planning process.

This SFRA has been carried out alongside the preparation of NR2040 and the SEA process. It seeks to identify potential beneficial and adverse outcomes as a result of the Strategy. Where adverse outcomes are identified, avoidance and mitigation strategies will be put in place to address them.

¹ DEHLG & OPW (2009) The Planning System and Flood Risk Management - Guidelines for Planning Authorities. Available: <https://www.gov.ie/en/publication/7db50-the-planning-system-and-flood-risk-management-guidelines-for-planning-authorities-nov-09/>

² DEHLG & OPW (2009) The Planning System and Flood Risk Management Guidelines for Planning Authorities – Technical Appendices. Available: <https://www.gov.ie/en/publication/97b61-the-planning-system-and-flood-risk-management-guidelines-for-planning-authorities-technical-appendices-nov-09/>

The SFRA will determine the requirement for any Site-Specific Flood Risk Assessment (SSFRA). This assessment will:

- Review the potential effects of NR2040 in the context of flood risk;
- Identify flood risk issues and challenges associated with the implementation of NR2040;
- Set out mitigation strategies to ensure that any adverse outcomes are addressed, so that this process is embedded in the decision-making approach for investments in road infrastructure, and;
- Outline further recommendations, where appropriate, to contribute towards the successful implementation of NR2040.

1.2 SFRA Integration with NR2040

Historic failures to adequately assess flood risk at a strategic level has resulted in unsustainable land use practices and associated negative societal, economic and environmental outcomes. Section 3.3 of NR2040 (Climate Adaptation and Resilience) and the 'Transport Climate Change Sectoral Adaptation Plan' for Transport³, identify flooding as a key threat to the national road network resulting in reduced performance and increased risk to the user. Climate change will likely exacerbate flood risk with impacts to weather severity and sea level. Climate change adaptation and mitigation has become an essential aspect of asset management and planning for the national road network.

NR2040 provides a framework where any future plan/project will be, where necessary, subject to a (S)FRA promoting sustainable strategic and development level decision making within regard to the national road network.

³ Department of Transport, Tourism & Sport (2019) Transport Climate Change Adaption Plan. Available: <https://www.gov.ie/en/publication/a2444e-sectoral-adaptation-plan-for-transport-infrastructure/>

2. DESCRIPTION OF NR2040

2.1 Overview

NR2040 has been developed by TII to support the delivery of Project Ireland 2040 and to align with the Department of Transport's (DoT) 'National Investment Framework for Transport in Ireland' (NIFTI).⁴ It also aligns with commitments in wider policy including the Climate Action Plan and the DoT's 'National Sustainable Mobility Policy'.

NR2040 is structured as follows:

- Chapter 1 Introduction – introduces TII's long-term strategy for planning, operating, and maintaining the National Roads network;
- Chapter 2 Policy Context – reviews the key government policies and plans that influence NR2040;
- Chapter 3 Long Term Strategic Issues for National Roads – presents key strategic issues facing the National Roads network;
- Chapter 4 NR2040 Vision and Key Objectives – is a statement of TII's goals in the development of this strategy, considering national policy context and strategic issues;
- Chapter 5 National Roads Investment Priorities and Portfolios – presents TII's priority investment themes;
- Chapter 6 Implementation – summarises the guidance to sponsoring agencies in developing projects/ interventions that align with NR2040;
- Chapter 7 Monitoring Framework, and;
- Appendices.

2.2 Policy Context

NR2040 is TII's response for National Roads to recently published Government policies, plans and planning/investment frameworks:

- Project Ireland 2040 – National Planning Framework and National Development Plan 2021-2030;
- National Investment Framework for Transport in Ireland;
- National Sustainable Mobility Policy, and;
- Climate Action Plan.

2.2.1 National Planning Framework

'Project Ireland 2040: National Planning Framework' (NPF) is the government's long-term spatial strategy for accommodating population growth, as well as responding to the need to rapidly decarbonise. The NPF's vision is encapsulated with the National Strategic Outcomes (NSOs), representing a shared set of goals which include compact growth, enhanced regional accessibility, access to services and opportunities, strong rural communities, sustainable mobility, and the transition to a low carbon and climate resilient society, among others. Within the NPF, there are various actions directly related to National Roads set out under several of the NSOs.

⁴ DoT (2021) National Investment Framework for Transport in Ireland. Available: <https://www.gov.ie/en/publication/cfae6-national-investment-framework-for-transport-in-ireland-nifti/>



Figure 2-1 NPF National Strategic Outcomes

2.2.2 National Development Plan 2021-2030

In October 2021, Government launched the revised 'National Development Plan' (NDP) 2021-2030. The NDP identified several National Roads schemes "currently under construction" and several to "start construction" in the near future; it also includes 31 National Roads schemes that are "subject to further approvals." The NDP gives an overview of transport strategy and subsequent strategic investment priorities across each of the ten NSOs.

A mid-term review of NDP (2021-2030) will be undertaken in 2025, to allow Government to take stock of progress in terms of delivery of the planned projects and programmes, and to review and reaffirm the investment priorities of Government.

2.2.3 National Investment Framework for Transport (NIFTI)

NIFTI is DoT's framework for prioritising future investment in the land transport network to support the delivery of the NSOs, as presented in Figure 2-2.

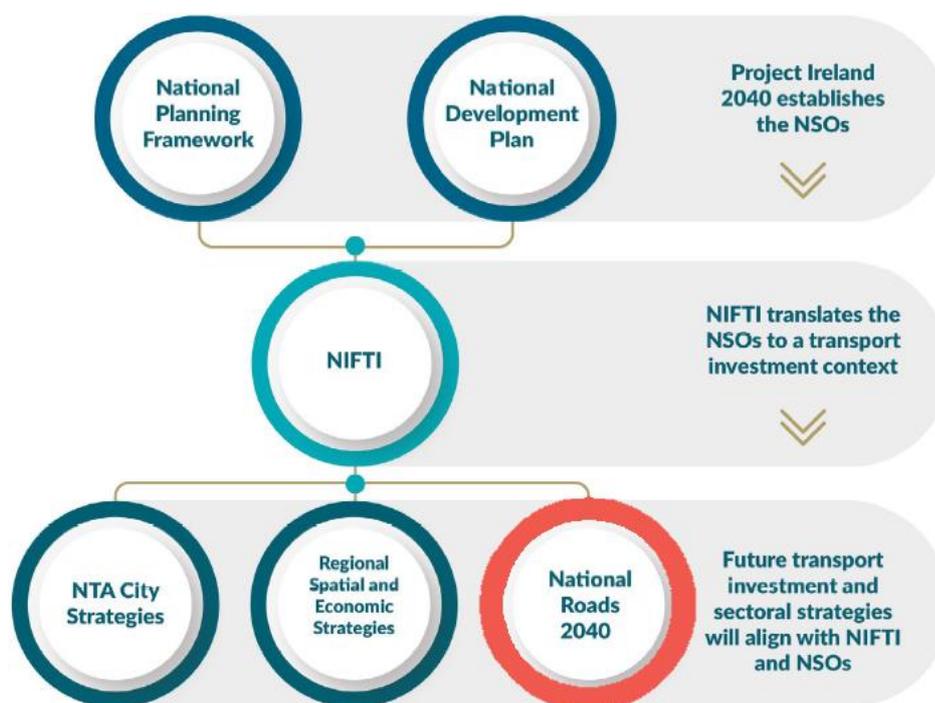


Figure 2-2 Overview of NR2040 Existing Policy Context (Source: NIFTI, 2021)

2.2.3.1 NIFTI Investment Priorities

NIFTI translates the ten NPF NSOs to a land transport specific context, developing four Investment Priorities that will ensure that the transport sector plays its part in delivering the NPF. NIFTI also considers and incorporates the requirements of the ‘Climate Action Plan’ (CAP) with respect to transport.

Future transport projects must align with one or more of NIFTI’s four Investment Priorities: Decarbonisation, Protection and Renewal, Mobility of People and Goods in Urban Areas, and Enhanced Regional and Rural Connectivity, and set out how potential negative impacts against them will be mitigated, to be considered for funding.

As the NSOs are embedded in NIFTI, future National Roads investment that is in accordance with these priorities will support the delivery of the NPF over the coming decades to 2040.

2.2.3.2 NIFTI Modal and Intervention Hierarchies

Well-managed National Roads (now and into the future) will support the achievement of various Project Ireland 2040 NSOs, for instance: by enhancing regional accessibility by reducing congestion on the National Roads, and by allowing people and goods to move freely between the five cities and five regional centres in Ireland (as defined in the NPF). NIFTI also establishes Modal and Intervention Hierarchies to further guide transport investment, and to ensure appropriate transport solutions are developed, as presented in Table 2.1 below.

Table 2.1 NIFTI Model Hierarchy and Intervention Hierarchy

NIFTI Modal Hierarchy:	NIFTI Intervention Hierarchy:
1) Active Travel	1) Maintain
2) Public Transport	2) Optimise
3) Private Vehicles	3) Improve

NIFTI Modal Hierarchy:	NIFTI Intervention Hierarchy:
	4) New

These Modal and Intervention Hierarchies are also incorporated within NR2040, and any future investment on National Roads will have to be developed in accordance with them. NR2040 mentions that this process is consistent with existing TII ‘Project Appraisal Guidelines’ (PAG), DoT’s ‘Common Appraisal Framework (CAF) for Transport Projects and Programmes’, and NIFTI Investment Priorities and hierarchies. It also aligns with the Department of Public Expenditure and Reform’s ‘Public Spending Code’ (PSC) requirements to demonstrate the strategic rationale for significant, publicly funded investments. Table 2.2 presents the intervention types and examples.

Table 2.2 Intervention types and examples

Intervention	Description	Example
Priority of public transport, walking, cycling and goods	Enable a sustainable transport system through coordination with partner organisations. Reduce the reliance on private vehicles by coordinating access and priority on National Roads for public transport, goods vehicles, walking and cycling.	<ul style="list-style-type: none"> National Cycling Network active mode collaboration and interchange Building pedestrian and cycle bridges to reduce severance
New transport and road technologies	Integrate new road technologies and provide for vehicle innovation. Incentivise and promote quicker, easier and lower-carbon travel alternatives to fossil-fuelled vehicles.	<ul style="list-style-type: none"> Smart motorways C-ITS Modern asset management systems
Demand management	Prioritise and incentivise use of the network. Restrict use of the network by time, location, trip purpose, vehicle type or other criteria necessary to balance the needs of the community, environment and economy.	<ul style="list-style-type: none"> HOV, bus and cycle lanes Ramp metering Tolling
Resilience and capacity via local reconstruction	Improve resilience or capacity through localised reconstruction, notably on National Secondary Roads	<ul style="list-style-type: none"> Junction improvements Short road segment improvements
Road construction	Where no reasonable alternative exists to serve the required function, deliver new road corridors with sustainable construction practices.	<ul style="list-style-type: none"> Town bypasses Build new to reduce net carbon Build better (new multi-modal links)

2.2.4 National Sustainable Mobility Policy

The ‘National Sustainable Mobility Policy’, published in April 2022, sets out a strategic framework to 2030 for active travel and public transport, to support Ireland’s overall requirement to achieve a 51% reduction in carbon emissions by the end of this decade. The policy targets the delivery of at least 500,000 additional daily active travel and public transport journeys, and a 10% reduction in kilometres driven by fossil fuelled cars by 2030, in line with targets for transport set out in the CAP. Actions for TII relating to National Roads focus on improving road safety and provision of infrastructure to support sustainable mobility.

2.2.5 Climate Action Plan

The CAP 2023 is the second annual update to Ireland's CAP 2019. It sets out a roadmap of actions in various sectors, including transport, such as to reduce greenhouse gas emissions by 51% by 2030 (relative to 2018 levels) and reach net zero emissions no later than 2050. The accompanying Annex of Actions will be published later in 2023. The 2023 plan is the first to be prepared under the Climate Action and Low Carbon Development (Amendment) Act 2021, following the introduction of economy-wide carbon budgets and sectoral emissions ceilings approved by Government in 2022.

Government recognises that there is transformational and unprecedented systems and behavioural change required to deliver transport sector emissions reductions. Transport is identified in the CAP as a sector required to reduce emissions by 50% by 2030. The CAP supports policies to transform how society travel and reduce transport emissions by adopting the Avoid-Shift-Improve approach i.e., reducing or avoiding the need to travel, shifting to sustainable modes of travel and improving the energy efficiency of vehicles.

The transport sector has been the fastest growing source of greenhouse gas (GHG) emissions, and is the source of 15.7% emissions in Ireland in 2021.⁵ There are a number of actions identified across the transport sector. The transport emissions reductions pathway is focused on the electrification of road transport, the use of biofuels, and a modal shift from private car use to public transport and active travel modes. These actions range from updating standards, support for active travel projects, greenways, and working collaboratively with other stakeholders to influence positive climate action.

The CAP recognises that the transport networks are becoming increasingly exposed to the effects of climate change where flooding, high temperatures and increased storms, in particular, are posing challenges for the operation and resilience of roads. In line with the 'Transport Climate Change Sectoral Adaptation Plan', the CAP identifies transport adaptation actions that will be progress in accelerating the transition to a low carbon climate resilient society.

2.3 NR2040 Long-term Strategic Issues

NR2040 presents the key strategic issues facing the National Roads network, which are identified as follows:

- **Future Demographic Growth Trends** - demographic growth poses a challenge to maintaining and improving levels of service in road transport;
- **Road Transport Decarbonisation** - adherence to Ireland's decarbonisation goals poses a significant challenge for the road transport sector, including the National Roads network;
- **Climate Adaptation and Resilience** - the road network, and the people who rely on it, are vulnerable to a range of possible climate change effects;
- **Sustainability** - striking the appropriate balance between investment in transport and sustainability impacts requires a continued effort;
- **Road Safety** - Road Safety is at the heart of every aspect of management of the National Roads network, on the way towards achieving Vision Zero;

⁵ Government of Ireland (2023) Climate Action Plan 2023. Available: <https://www.gov.ie/en/publication/7bd8c-climate-action-plan-2023/>

- **Movement of People** - the operation, maintenance, renewal, and development of National Roads must focus on the movement of people, rather than vehicles;
- **Movement of Goods and Services** - on National Roads, a balance must be found between the movement of people and the movement of goods;
- **Urban Congestion** - we cannot build our way out of urban congestion challenges - the management of National Roads must balance increasing mobility demands and finite road space;
- **Technological Change** - the management and operation of National Roads must evolve to support and manage the uptake in developing technologies to the benefit of customers;
- **Asset Management and Operations** - the National Roads network is a valued state asset that requires extensive investment for ongoing management and operations;
- **Integrated Mobility** - is key to an inclusive, well connected and sustainable transport system, and must be facilitated through the National Roads network, and;
- **Customer Experience** - TII recognises the need for a customer-centric approach when planning for the National Roads network/

2.4 NR2040 Vision and Key Objectives

NR2040 sets out TII's long-term strategy for the maintenance, development, and management of Ireland's National Roads network. It is fully aligned with NIFTI and Project Ireland 2040 and focused on strategic issues for national roads identified by TII.

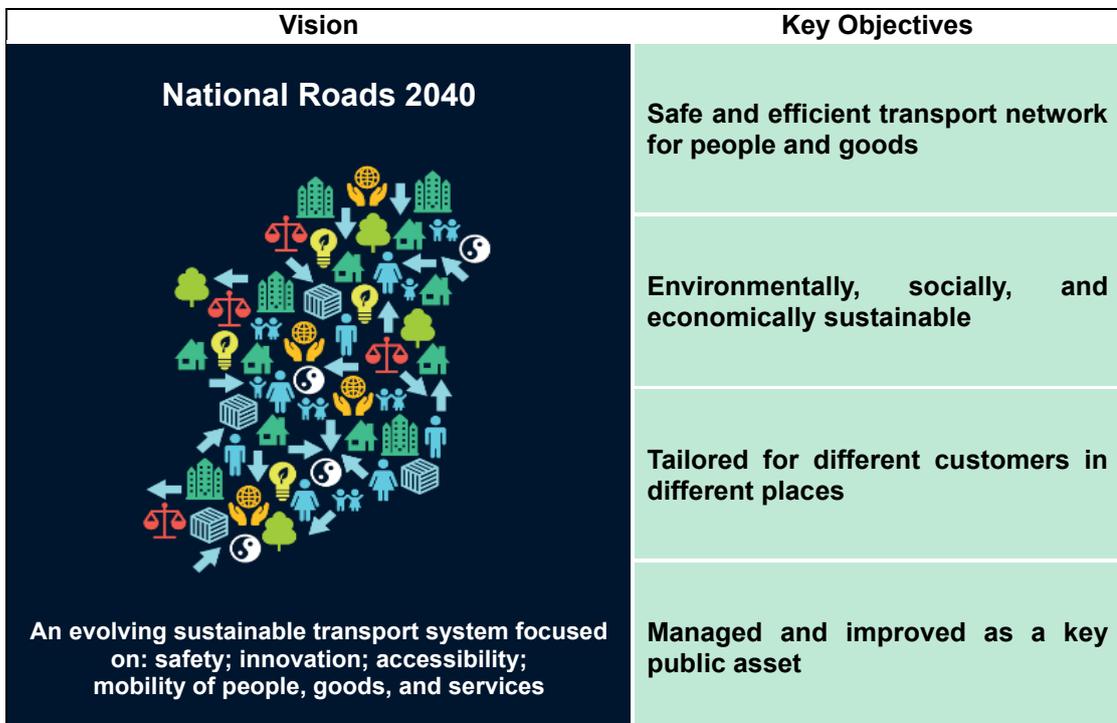


Figure 2-3 NR2040 Vision and Key Objectives (Source: NR2040)

2.5 NR2040 Investment Priorities and Portfolios

NR2040's four Investment Priorities are consistent with the four NIFTI Investment Priorities and aligned with the NPF:

- Decarbonisation;
- Protection and renewal;
- Mobility of people and goods in urban areas, and;
- Enhanced regional and rural connectivity.

The measures under each investment priority and portfolios are described and assessed in further detail in Section 5 of this SFRA.

2.6 Implementation

NR2040 is TII's strategy for the National Roads network, identifying the function and investment priorities for different parts of the National Roads network and providing for TII's aspiration to:

- Enable Project Ireland 2040 (NPF and NDPs);
- Support the realisation of several NSOs, and;
- Align with NIFTI and other Government policy.

The implementation chapter provides NR2040's summary guidance to Sponsoring Agencies. It outlines:

- TII commitments to addressing strategic issues;
- Provides a means of filtering future interventions;
- Defines TII investment portfolios, and;
- TII's emphasis on collaboration, recognised throughout the strategy as a necessary means for the successful implementation of identified interventions and achievement of national targets.

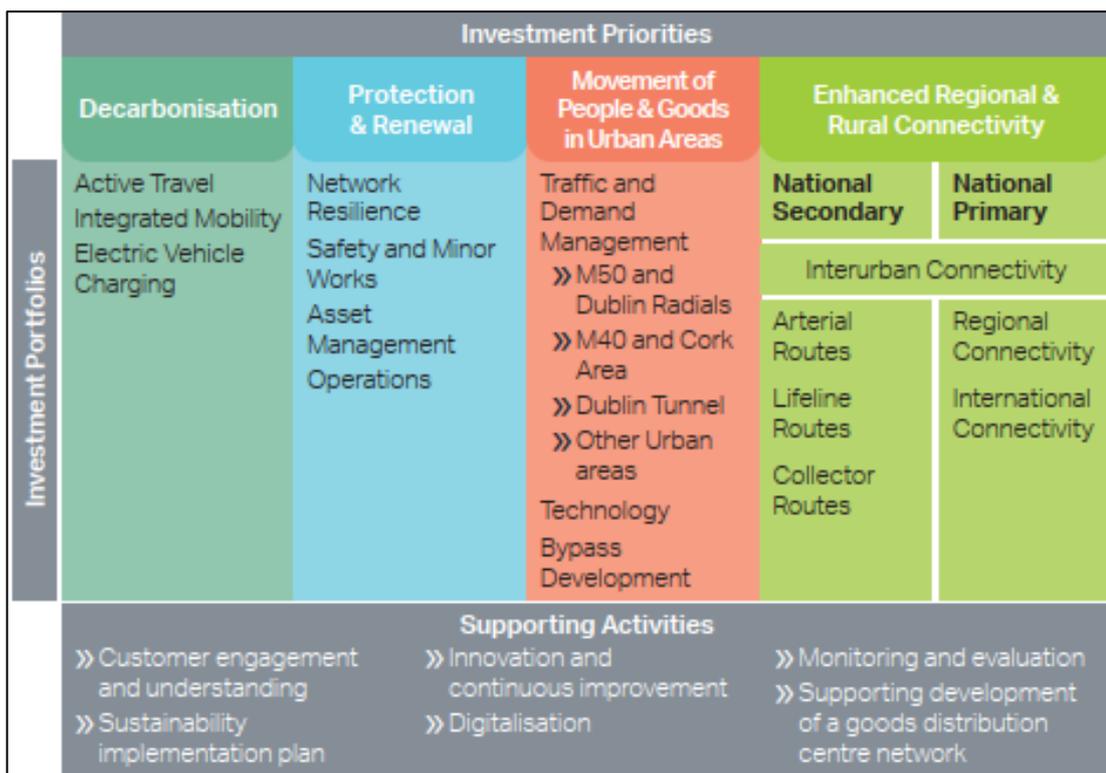


Figure 2-4 NR2040 Implementation Structure (Source: NR2040)

2.7 Commitments

The NR2040 investment priorities are reinforced by a series of TII commitments, further addressing the strategic issues facing the National Roads network in the coming years. Policy obligations, including NPF / NIFTI / the ‘Road Safety Strategy’, and internal TII analysis and plans, inform these commitments. These commitments can also be used to influence the scope of projects on National Roads developed by local authorities or other agencies.

The commitments are detailed in Section 6.1 in the Strategy and are replicated and assessed in Section 5 of this SFRA.

3. THE PLANNING SYSTEM AND FLOOD RISK ASSESSMENT GUIDELINES

3.1 Introduction

The FRM Guidelines introduced comprehensive mechanisms for the incorporation of identification, assessment and management of flood risk into the planning process. Implementation of the FRM Guidelines is achieved through actions at the national, regional, local authority and site-specific levels. This report has been prepared in accordance with FRM Guidelines to assess the likely flood risk effect of the NR2040 Strategy.

3.2 The Assessment of Flood Risk

Flood risk is a combination of the likelihood of a flood event occurring and the potential consequences arising from that flood event, and is then normally expressed in terms of the following relationship:

Flood risk = Likelihood of flooding x Consequences of flooding.

To fully assess flood risk, an understanding of where the water comes from (i.e., the source), how and where it flows (i.e., the pathways), and the people and assets affected by it (i.e., the receptors) is required. Figure 3.1 below shows a source-pathway-receptor model reproduced from the FRM Guidelines.

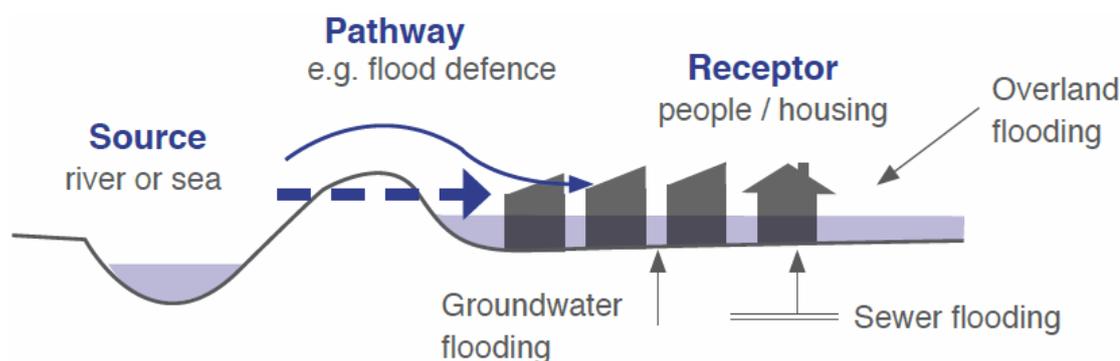


Figure 3.1 Sources, Pathways and Receptors of Flooding (Source: OPW & DEHLG, 2009)

The principal sources of flooding, generally, are rainfall or higher than normal sea levels. The principal pathways are rivers, drains, sewers, overland flow, and river and coastal floodplains. The receptors can include people, their properties and the environment. All three elements, as well as the vulnerability and exposure of receptors, must be examined to determine the potential consequences.

3.3 Sequential Approach & Justification Test

The FRM Guidelines outline the Sequential Approach that is to be applied to all levels of the planning process. This approach should also be used in the design and layout of a development, and the broad philosophy is shown in Figure 3.2 below. In general, development in areas with a high risk of flooding should be avoided as per the sequential approach. However, this is not always possible as many town and city centres are within flood zones and are targeted for development.

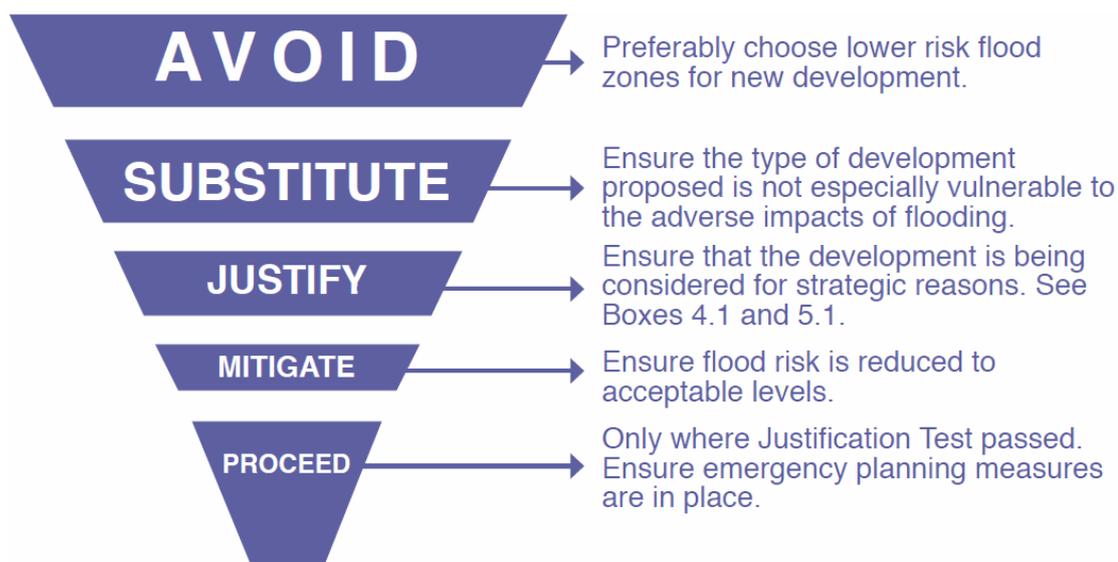


Figure 3.2 Sequential Approach (Source: The Planning System and Flood Risk Management)

The Justification Test in Table 3.1 has been designed to rigorously assess the appropriateness, or otherwise, of developments that are being considered in areas of moderate or high flood risk. The test comprises the following two processes.

- The first is the Plan-making Justification Test and is used at the plan preparation and adoption stage where it is intended to zone or otherwise designate land which is at moderate or high risk of flooding.
- The second is the Development Management Justification Test and is used at the planning application stage where it is intended to develop land at moderate or high risk of flooding, for uses or development vulnerable to flooding that would generally be inappropriate for that land.

Table 3.1 Matrix of Vulnerability Versus Flood Zone to Illustrate Appropriate Development that is Required to Meet the Justification Test (Source: FRM Guidelines Man)

	Flood Zone A	Flood Zone B	Flood Zone C
Highly vulnerable development (including essential infrastructure)	Justification Test	Justification Test	Appropriate
Less vulnerable development	Justification Test	Appropriate	Appropriate
Water-compatible development	Appropriate	Appropriate	Appropriate

3.4 Flood Risk Assessment Hierarchy

Within the hierarchy of Regional, Strategic and Site-Specific Flood Risk Assessments, a tiered approach ensures that the level of information is appropriate to the scale and nature of the flood risk issues, and the location and type of development proposed, avoiding expensive flood modelling and the development of mitigation measures where it is not necessary.

The stages and scales of FRA comprise the following.

- SFRA – an assessment of all types of flood risk informing land use planning decisions. This will enable the Planning Authority to allocate appropriate sites for development, whilst identifying opportunities for reducing flood risk. This SFRA will revisit and develop the flood risk identification undertaken in the Regional Flood Risk Assessment (RFRA) and give consideration to a range of potential sources of flooding. An initial FRA, based on the identification of Flood Zones, will also be carried out for those areas which will be zoned for development. Where the initial FRA highlights the potential for a significant level of flood risk, or there is conflict with the proposed vulnerability of development, then a detailed Stage 3 FRA will be required to ensure zoning objectives are compatible with flood risk at the site and, more importantly, that mitigation measures which reduce flood risk to the site and neighbouring lands can be implemented. The SFRA will highlight the scale of assessment required within a SSFRA.
- SSFRA – to consider all types of flood risk associated with the site or project, and to propose appropriate site management and mitigation measures to reduce flood risk to and from the site to an acceptable level. An assessment of all sources of flood risk is required on every site. It should consider residual risks, such as surcharging of the stormwater system, culvert blockage or defence overtopping, and access/evacuation plans that are likely to form important elements of the assessment. There may also be a requirement for a detailed channel and site survey, and hydraulic modelling.

3.5 Climate Change

Climate change adaption and resilience will most likely become the fundamental consideration for strategic planning in the coming decades. Climate change, as a result of human activities, is occurring and is going to continue for centuries to come. The likely results of climate change in Ireland include:

- Sea levels rising;
- Increase in the duration of summer with more frequent droughts;
- More intense storms and rainfall events;
- Increased likelihood and magnitude of river and coastal flooding;
- Adverse impacts on water quality, and;
- Changes in distribution of plant and animal species.

Nonetheless, when properly managed, the potential challenge may provide the catalyst for an integrated approach to environmental stewardship that archives long-term sustainability goals at diverse scales, ranging from local community investiture, to satisfying our international obligations. With the knowledge of what we, as a society, may face in the future, land use planning policies can be developed which are mindful of current management practices. As such, an appraisal of the potential impacts of climate change must be carried out as part of the SFRA with regard to the OPW climate change parameters stated in the 'Flood Risk Management Climate Change Sectoral Adaptation Plan'.⁶ OPW climate change allowances are stated in Table 3.2.

⁶ OPW (2019) Flood Risk Management Climate Change Sectoral Adaption Plan. Available: <https://www.gov.ie/en/publication/97984b-climate-change-and-sectoral-adaptation-plan/#sectoral-adaptation-plan>

Table 3.2 Allowances in Flood Parameters for Mid-Range and High-End Future Scenarios

Parameter	MRFS	HEFS
Extreme Rainfall Depths	+ 20%	+ 30%
Peak Flood Flows	+ 20%	+ 30%
Mean Sea Level Rise	+ 500 mm	+ 1000 mm
Land Movement	- 0.5 mm / year ¹	- 0.5 mm / year ¹
Urbanisation	<i>No General Allowance – Review on Case-by-Case Basis</i>	<i>No General Allowance – Review on Case-by-Case Basis</i>
Forestation	- 1/6 Tp ²	- 1/3 Tp ² + 10% SPR ³

Note 1: Applicable to the southern part of the country only (Dublin – Galway and south of this)

Note 2: Reduction in the time to peak (Tp) to allow for potential accelerated runoff that may arise as a result of drainage of afforested land

Note 3: Add 10% to the Standard Percentage Runoff (SPR) rate: This allows for temporary increased runoff rates that may arise following felling of forestry.

4. IDENTIFICATION OF FLOOD RISK

Key flood risk issues applicable to and arising from NR2040 at a national scale have been identified and are discussed below.

4.1 Assessing Key Flood Risk Issues

The proposed investment in National Road infrastructure is likely to give rise to infrastructure improvements facilitating travel between settlements across Ireland. In terms of flood risk, such infrastructure has the potential to result in works including, but not limited to:

- New or modified watercourse crossings, comprising bridges and culverts;
- Modifications to watercourses and their natural floodplains;
- New infrastructure development resulting in extensive areas of hardstanding and reduced permeability; and;
- New drainage networks or increased reliance on existing drainage networks to facilitate the construction of infrastructure.

The following source-pathway-receptor model, in Table 4.1, has been developed to categorise the sources of flooding that could potentially affect National Road infrastructure, where it flows to (pathway), and the people and infrastructure affected by it (receptors), and their potential flood risk impacts on, and effects from NR2040. The potential flood risk impacts to and arising from NR2040 will be a key consideration of future national roads schemes.

Table 4.1 Source-Pathway-Receptor Model

Source – Pathway - Receptor	Effects
<p>Source: Fluvial flooding</p> <p>Pathway: Overbank flow from rivers</p> <p>Receptor: Road infrastructure</p>	<p>Potential Flood Risk Impact on NR2040</p> <ul style="list-style-type: none"> • Inundation of road infrastructure adjacent to watercourses, leading to hazardous conditions for users and temporary closure. • Inundation of road infrastructure at watercourse crossings with insufficient capacity. • Flooding and erosion resulting in physical damage to road infrastructure. • Deposition of sediment and debris on National Roads post flood event. <p>Potential Flood Risk Effects from NR2040</p> <ul style="list-style-type: none"> • Increased flood risk to other vulnerable receptors within the vicinity of road development, e.g., road embankments effecting flow paths through the floodplain or displacing flood volumes. • Increased flood risk to other vulnerable receptors due to the provision watercourse crossings with insufficient capacity as part of road infrastructure projects. • Adverse impact on existing flood risk management infrastructure, leading to failure and flooding (e.g., flood defence walls, bunds and tie-in points with watercourse crossings). • Potential to prejudice the implementation of future flood risk management infrastructure.

Source – Pathway - Receptor	Effects
<p>Source: Pluvial flooding</p> <p>Pathway: Extreme rainfall events and inadequate surface water drainage</p> <p>Receptor: Road infrastructure</p>	<p>Potential Flood Risk Impact on NR2040</p> <ul style="list-style-type: none"> • Inundation of road infrastructure from overland runoff during extreme rainfall (e.g., hill runoff), leading to hazardous conditions for users and temporary closure. • Inundation of road infrastructure due to failure or capacity exceedance of its drainage infrastructure in extreme rainfall events. <p>Potential Flood Risk Effects from NR2040</p> <ul style="list-style-type: none"> • Increased flood risk to other vulnerable receptors within the vicinity of road developments due to increased hardstanding and associated runoff generation.
<p>Source: Coastal flooding</p> <p>Pathway: Extreme tides, storm surges or wave overtopping</p> <p>Receptor: Road infrastructure</p>	<p>Potential Flood Risk Impact on NR2040</p> <ul style="list-style-type: none"> • Inundation of road infrastructure in the coastal floodplain, leading to hazardous conditions for users and temporary closure. • Physical damage to road infrastructure from coastal flooding and erosion. • Deposition of sediment and debris on National Roads post flood event. <p>Potential Flood Risk Effects from NR2040</p> <ul style="list-style-type: none"> • Increased flood risk to other vulnerable receptors within the vicinity of road development, e.g., road embankments effecting flow paths through the floodplain. • Adverse impact on existing flood risk management infrastructure leading to failure and flooding. • Potential to prejudice the implementation of future flood risk management infrastructure.
<p>Source: Groundwater flooding</p> <p>Pathway: Rising groundwater levels</p> <p>Receptor: Road infrastructure</p>	<p>Potential Flood Risk Impact on NR2040</p> <ul style="list-style-type: none"> • Inundation of road infrastructure in areas prone to groundwater flooding (e.g. turloughs). <p>Potential Flood Risk Effects from NR2040</p> <ul style="list-style-type: none"> • Adverse impact on groundwater / surface water flow regime, leading to flood defence failure and flooding. • The effects of potential increases in groundwater levels are significant for road drainage and pavement foundations.
<p>Source: Artificial drainage</p> <p>Pathway: Overflow from drainage</p> <p>Receptor: Road infrastructure</p>	<p>Potential Flood Risk Impact on NR2040</p> <ul style="list-style-type: none"> • Inundation of road infrastructure from existing drainage networks that do not meet modern design standards or have been poorly maintained. <p>Potential Flood Risk Effects from NR2040</p> <ul style="list-style-type: none"> • Increased risk of flooding from additional runoff discharging to existing drainage networks which do not have spare capacity.

5. ASSESSMENT OF NR2040 STRATEGY

This section of the SFRA assesses the measures of the Strategy, including the vision, key objectives, commitments and implementation structure of NR2040 Strategy, and examines how its implementation will potentially have an effect on flood risk.

The NR2040 vision, key objectives and Investment Priorities, are assessed in Table 5.1. Table 5.2 assesses NR2040 commitments developed to address the strategic issues identified facing the National Roads network. Table 5.3 assesses the Implementation Programme: Supporting Activities and their potential to affect flood risk. Table 5.4 assesses intervention types and examples. Each component is assessed in terms of the likelihood of adversely affecting flood risk:

- Low - A change which is unlikely to adversely affect flood risk;
- Moderate - A change which is likely to adversely affect flood risk;
- High – A change which is highly likely to adversely affect flood risk;

NR2040 sits within the overall hierarchy of policy documents, and any future plans or projects influencing policy or requiring planning consent arising from NR2040 are subject to the relevant plan/project level environmental assessment requirements, including Strategic Environmental Assessment (SEA), Environmental Impact Assessment (EIA), Appropriate Assessment (AA) and (S)FRA as appropriate. This assessment has considered that any project, plan or strategy arising out of NR2040 will be required to comply with all relevant legislation and statutory guidance.

Table 5.1 Assessment of NR2040 Vision, Objectives, Investment Priorities and Flood Risk

Investment Priorities (Source of Effects)	Description	Does NR2040 have the potential to adversely affect flood risk?
	<p>TII's vision is for the National Roads network to be “an evolving sustainable transport system focused on safety, innovation, accessibility and mobility of people, goods, and services.”</p>	<p>This is a high-level statement which sets out TII's vision for the National Roads network. Given the nature of the vision any subsequent plans/projects arising out of NR2040 will be required to comply with all relevant legislation including environmental assessments, i.e. SEA,EIA(S)FRA, as appropriate.</p>
Key Objectives:		
1) Safe and efficient transport network for people and goods		<p>These are high-level objectives and any subsequent plans/projects arising out of NR2040 will be required to comply with all relevant legislation including environmental assessments, i.e. SEA,EIA(S)FRA, as appropriate.</p>
2) Environmentally, socially, and economically sustainable		
3) Tailored for different customers in different places		
4) Managed and improved as a key public asset		
NR2040 Investment Priorities:		
<p>Decarbonisation</p>	<p>Decarbonisation encompasses three investment portfolio themes:</p> <ul style="list-style-type: none"> • Integrated Mobility TII will contribute to integrated mobility by investing in measures such as Park and Ride, Park and Share and bus prioritisation, where appropriate along National Roads. Improving connections to major public transport hubs, e.g., active travel infrastructure within the commuting locus of rail stations, could also form part of this portfolio of investment. TII will ensure that the potential for induced travel demand will be estimated for all major projects such that the need for any future investments in the road network will align with decarbonisation objectives. • Electric Vehicle Charging TII will work with the Department of Transport's Zero Emissions Vehicles office to support the delivery of the national EV charging infrastructure in line with its 'EV Charging Infrastructure strategy', currently under development. • Active Travel 	<p>Decarbonisation is a high-level investment priority, and this is in line with Climate Action and Low Carbon Development Act 2015 (as amended).</p> <p>The works required as part of plans/projects which will be developed to provide for integrated mobility, electric vehicle charging, and active travel have the potential to increase/cause flood risk. This is a high level investment priority and any subsequent plans/projects arising out of NR2040 will be required to comply with all relevant legislation including environmental assessments, i.e. SEA, EIA, (S)FRA, as appropriate. Thus, ensuring that potential adverse effects at project level are mitigated as appropriate.</p> <p>The effect of the implementation of this priority investment is expected to be beneficial in terms of</p>

Investment Priorities (Source of Effects)	Description	Does NR2040 have the potential to adversely affect flood risk?
	<p>TII is committed to delivering more for active travel modes in all its projects, such as improving the safety of National Roads for active travel users and reducing the severance caused by some National Roads in urban areas. TII will collaborate with other stakeholders to implement the National Cycle Network plan to cater for more active trips and expand the Greenway network nationwide, on behalf of the Department of Transport.</p>	<p>reducing the adverse impact of climate change and flood risk in the long run. As such, the likelihood of adversely affecting flood risk is low.</p>
<p>Protection and Renewal</p>	<p>Protection and Renewal encompasses three investment portfolio themes:</p> <ul style="list-style-type: none"> • Road Safety TII will deliver on its actions in the Road Safety Strategy (2021-2030) and collaborate with partners to deliver on supporting actions. In line with the European Union Road Infrastructure Safety Management (RISM) directive, TII will target investment on sections of National Roads with the highest risk of fatal or serious injury. In line with NIFTI, TII will meet asset protection and renewal requirements to help to ensure the safety of the network. TII's road safety programme will focus on achieving safe roadsides and a safe environment for vulnerable road users, in line with the safe systems approach. • Asset Management & Network Operations A key priority for TII is to maintain the existing National Roads network to a robust and safe standard. TII will use asset management principles to manage National Roads assets safely, sustainably, efficiently and effectively over their useful life. • Resilience & Climate Adaptation TII is updating its 'Strategy for Adapting to Climate Change on Ireland's Light Rail and National Road Network'. 	<p>Protection and Renewal is a high-level investment priority. Plans/projects which will be developed to provide for National Road safety, asset management & network operations, and resilience & climate adaption have the potential to adversely affect surface water and groundwater bodies. For example, the development of National Road schemes for the improvement of safety along the National Roads network could result in adverse effects to hydromorphology, increased erosion and surface runoff, generation of suspended solids, etc.</p> <p>This is a high level investment priority and any subsequent plans/projects arising out of NR2040 will be required to comply with all relevant legislation including environmental assessments, i.e. SEA, EIA, (S)FRA, as appropriate. Thus, ensuring that potential adverse effects at project level are mitigated as appropriate.</p> <p>The long-term focus on sustainability and climate adaptation/resilience is likely to have a positive effect on flood risk. As such, the likelihood of adversely affecting flood risk is low.</p>
<p>Mobility of People and Goods in Urban Areas</p>	<p>Mobility of People and Goods in Urban Areas encompasses three investment portfolios:</p> <ul style="list-style-type: none"> • Movement of People 	<p>Mobility of People and Goods in Urban Areas is a high-level investment priority.</p> <p>Plans/projects which will be developed to provide for movement of people and goods, as well as traffic management. As NR2040's key strategy is to avoid</p>

Investment Priorities (Source of Effects)	Description	Does NR2040 have the potential to adversely affect flood risk?
	<p>Where National Roads present a hostile or dangerous environment for cyclists and pedestrians, TII will work to provide segregated facilities adjacent to National Roads. TII will identify and address severance associated with busy urban National Roads through provision of safe crossing infrastructure for cyclists and pedestrians.</p> <ul style="list-style-type: none"> • Movement of Goods The Department of Transport is currently developing its Ten-Year Strategy for the Haulage Sector; TII will implement actions arising for National Roads. TII will work with the Department of Transport and partner agencies to explore traffic and demand management measures to improve the journey time reliability required for the efficient movement of imports and exports. TII will support the development of rail freight and multi-modal distribution centres on or near National Roads. • Demand and Traffic Management TII will support travel demand management measures for National Roads in the five cities (Dublin, Cork, Galway, Limerick, and Waterford) and implement other government policy on demand management on National Roads. It will explore the potential of demand management measures, including road-user charging. TII will expand traffic management measures in congested sections of National Roads to ensure optimal vehicle flow to minimise carbon emissions, particularly from freight. 	<p>extensive new road building, but rather, use the existing capacity to focus on transporting more people, in line with NIFTI Modal and Intervention Hierarchies, therefore, there will be reduced creation of hardstanding surfaces related to new road building. The likelihood of adversely affecting flood risk is low.</p> <p>The development of segregated bus priority route in place of private vehicle capacity, to accommodate the movement of people, is not likely to result in the increase of surface water and groundwater flood risk. As the mobility of people and goods in urban areas comprises reallocation of existing road spaces and minimal new construction of hardstanding surfaces. The likelihood of adversely affecting flood risk is low.</p> <p>This is a high level investment priority and any subsequent plans/projects arising out of NR2040 will be required to comply with all relevant legislation including environmental assessments, i.e. SEA, EIA, (S)FRA, as appropriate. Thus, ensuring that potential adverse effects at project level are mitigated as appropriate.</p>
<p>Enhanced Regional and Rural Connectivity</p>	<p>Enhanced regional and rural connectivity encompasses:</p> <ul style="list-style-type: none"> • National Primary Network The National Primary Network relates to Interurban connectivity, Regional connectivity and International connectivity. <i>Inter-urban connectivity</i> TII analysis, using its National Transport Model, has identified National Roads corridors where this target is not currently achieved and where additional interventions would support the achievement of an average inter-urban speed of approximately 90 kph, between the five cities and five centres of scale. 	<p>Enhanced Regional and Rural Connectivity is a high-level investment priority.</p> <p>Plans/projects which will be developed to provide for the enhancement of regional and rural connectivity, have the potential to adversely affect flood risk derived from surface water and groundwater.</p> <p>This is a high level investment priority and any subsequent plans/projects arising out of NR2040 will be required to comply with all relevant legislation including environmental assessments,</p>

Investment Priorities (Source of Effects)	Description	Does NR2040 have the potential to adversely affect flood risk?
	<p>Targeted interventions along sections of these corridors may include road upgrades, enhancements and/or town bypasses. Any interventions proposed must be developed in accordance with NIFTI's Investment Priorities and its Modal and Intervention Hierarchies.</p> <p>Any interventions brought forward will be developed in accordance with the NIFTI Investment Priorities and the Modal and Intervention Hierarchies. For example, provision of town bypasses on corridors shown in Figure 5.2 of the NR2040 strategy, may remove traffic from towns and thus, support the Government's 'Town Centre First' policy.</p> <p><i>Regional Connectivity</i></p> <p>Both the NPF and NIFTI indicate the importance of maintaining and improving accessibility to and between the more peripheral areas of the state, for instance, the South and Northwest. The provision of a safe, efficient and reliable network under this classification is a priority; ensuring that the South, Northwest and Northeast regions, as defined by the NPF, have a high degree of accessibility to Dublin and other urban centres.</p> <p>Any interventions brought forward will be developed in accordance with the NIFTI Investment Priorities and the Modal and Intervention Hierarchies. For example, provision of town bypasses may remove traffic from towns and thus, support the Government's 'Town Centre First' policy.</p> <p><i>International Connectivity</i></p> <p>National Roads are an important element in ensuring High Quality International Connectivity to ports and airports. Two National Roads schemes are in planning to Tier 1 ports; apart from these schemes, it will be a priority to maintain route quality, efficient operation and to manage congestion in the vicinity of Tier 1 and Tier 2 ports and airports, including the Dublin tunnel.</p> <ul style="list-style-type: none"> • National Secondary Network <p>The National Secondary Road Network identifies the function of the different parts of the Road Network. No specific interventions are proposed. Any interventions will be decided in line with NIFTI and the required project specific environmental assessments.</p>	<p>i.e. SEA, EIA, (S)FRA, as appropriate. Thus, ensuring that potential adverse effects at project level are mitigated as appropriate.</p> <p>This investment priority is not likely to have significant effects with regard to flood risk and the likelihood of adversely affecting flood risk is low.</p>

Table 5.2 Assessment of NR2040 commitments addressing identified long-term Strategic Issues for NR2040

Strategic Issues	NR2040 Commitments	Does NR2040 have the potential to adversely affect flood risk?
<p>Future Demographic Growth Trends</p>	<ul style="list-style-type: none"> TII will continue to analyse possible growth in travel demand, reflecting Project Ireland 2040 population targets. TII will continue to develop and plan for multiple future demand scenarios that factor in possible behavioural and technological change. TII will ensure that the potential for induced travel demand will be estimated for all major projects. TII will implement government policy on demand management. NIFTI sets out the importance of the provision of alternative transport options, such as cycle infrastructure and public transport services before demand-side measures are implemented. TII will ensure that any future implementation of demand management proposals on the National Roads network aligns with the National Sustainability Mobility Policy as well as NIFTI Modal and Intervention Hierarchies. TII will explore the potential of road-user charging measures through the Better Road User Charging Evaluation (BRUCE) study. 	<p>Future Demographic Growth is a strategic issue facing the National Roads network. This commitment sets out to develop and plan for multiple future demand scenarios in consideration of future demographics and growth trends. Since it is the TII's responsibility to implement government policy on demand management, it will ensure that it aligns with NIFTI's objective to provide alternative transport options, such as cycle infrastructure and public transport services before demand-side measures are implemented. The commitments relating to future demographic growth and associated travel demand have the potential to bring additional persons into flood risk areas.</p> <p>This is a high level strategic issue and any subsequent plans/projects arising out of NR2040 will be required to comply with all relevant legislation including environmental assessments, i.e. SEA, EIA,(S)FRA, as appropriate. Thus, ensuring that potential adverse effects at project level are mitigated as appropriate. This strategic issue is not likely to have significant effects with regard to flood risk and the likelihood of adversely affecting flood risk is low.</p>
<p>Decarbonisation</p>	<ul style="list-style-type: none"> To reduce emissions, TII will prioritise traffic management investment in freight corridors and where congestion results in high levels of GHG emissions. National Road projects will be appraised in the context of compliance with Ireland's climate change targets, in line with the Governments Climate Action Plan, NIFTI and in accordance with the Department of Transport's Common Appraisal Framework. Predicted changes and/or targets associated with the levels of usage of each mode (e.g., bicycle, car, public transport, truck, van) will inform this. TII will continue to develop and enhance its Road Emissions Model to explore the emissions impact of changes in transport demand, supply of transport networks/services and changes in vehicle fleet technology. 	<p>With the NR2040's commitment for road transport decarbonisation (i.e., reduction in carbon emissions, sustainable energy consumption, sustainable transport, use of promoting low carbon options), it is expected that there will be reduction in air pollution from transport, leading to an improved environment in terms of air interaction with the water environment. Changes in climatic events may potentially impact the National Roads network, however, there is no direct likelihood of this commitment addressing this strategic issue to increased flood risk.</p> <p>Decarbonisation is a strategic issue facing the National Roads network, as well as a high-level commitment. The effect of the implementation of TII's commitment is expected to be positive in the long run in terms of climate adaptation and the likelihood of adversely affecting flood risk is low.</p>

Strategic Issues	NR2040 Commitments	Does NR2040 have the potential to adversely affect flood risk?
	<ul style="list-style-type: none"> TII will reduce its emissions and environmental impacts from maintenance and operations of existing National Road infrastructure. TII will reduce carbon emissions associated with the development, construction, and operation of new infrastructure. TII will support Department of Transport to increase the provision of electric vehicle charging infrastructure nationwide. TII will continue to participate in wider efforts to decarbonise road transport through the provision of appropriate infrastructure and technology, and support of policy instruments and behaviour change measures. 	
<p>Climate Adaption & Resilience</p>	<ul style="list-style-type: none"> TII will enhance the resilience of National Roads, in particular sections of the rural National Secondary road network, that provide lifeline links to individuals and communities. TII will implement its Climate Change Adaptation Strategy (2022). 	<p>The commitment to enhance National Roads includes considering climatic factors, such as increases in rainfall, being factored into the design of attenuation systems for the future. Since plans/projects will account for climate change, it is unlikely that there will be increased frequent flooding or potential storm damage to infrastructure. With the implementation of the right strategy for climate adaption, plan/projects should not be adversely effected by climate change in the long-term.</p> <p>Climate Adaption and Resilience is a long-term strategic issue facing the National Roads network, as well as a high-level investment priority. The effect of the implementation of TII's commitments is expected to be positive in the long run-in terms of climate adaptation and the likelihood of adversely affecting flood risk is low.</p>
<p>Sustainability</p>	<ul style="list-style-type: none"> TII will work with government agencies and stakeholders to support the Climate Action Plan and government's national climate objective to "<i>transition to a climate resilient, biodiversity rich, environmentally sustainable and climate neutral economy by 2050.</i>" TII will incorporate economic, social and environmental sustainability objectives and goals in all decisions, policies, projects and processes. 	<p>Sustainability is a strategic issue facing the National Roads network and a key component in TII's vision for the National Roads network. TII is thus, committed to support the transition to a climate resilient, biodiversity rich, environmentally sustainable and climate neutral economy. This will be done by ensuring that plans/projects are climate resilient as they will need to function in a climate altered environment, and also minimise the impact of the road infrastructure on the environment. This means that the roads will be able to</p>

Strategic Issues	NR2040 Commitments	Does NR2040 have the potential to adversely affect flood risk?
	<ul style="list-style-type: none"> • TII will promote inter-modal solutions that maximise overall transport efficiency in terms of infrastructure and resource use. For example, facilitating safe active travel along National Road corridors that connect with rail and bus stations. • In line with its legislative remit, TII will minimise the impact of road infrastructure on the environment and support the development and maintenance of ecological corridors along National Roads. • In line with NIFTI, TII will prioritise online improvements and avoid delivering high levels of excess capacity. • In line with its legislative remit, TII will work with relevant bodies to support measures to reduce air quality and noise impacts from road transport. • Continue to support TII's Sustainability Implementation Plan (and subsequent revisions) to integrate all aspects of sustainability in to TII's core activities. 	<p>withstand increased intensity of storm events and rainfall and, through adequate design, location, and drainage elements, would not contribute to problems elsewhere, such as increased runoff. In terms of flood risk, drainage standards will be modified to allow for the construction of more sustainable solutions to road runoff, such as use of constructed wetlands, grassed channels and maintenance of ecological corridors. These standards have also been modified to account for increased rainfall and environmental objectives of the receiving environment, specifically surface and groundwaters, hence, this will be positive and the likelihood of adversely affecting flood risk is low.</p>
<p>Road Safety</p>	<ul style="list-style-type: none"> • TII will deliver on its actions in the Government's Road Safety Strategy 2021-2030 'Our Journey towards Vision Zero' and collaborate with partners to deliver on supporting actions. • TII will prioritise delivery of high quality, suitable infrastructure to create forgiving roadsides, self-explaining roads and a safe environment for vulnerable road users. • In line with NIFTI, TII will meet asset protection and renewal requirements to help to ensure the safety of the network. • In line with the European Union's Road Infrastructure Safety Management (RISM) Directive, TII will target investment on sections of National Roads with the highest risk of fatal or serious injury. 	<p>As part of the commitment for improved road safety, forgiving roadsides will be created to ensure safety. This commitment is not likely to have significant effects with regard to flood risk and the likelihood of adversely affecting flood risk is low.</p>
<p>Movement of People</p>	<ul style="list-style-type: none"> • TII will support Connecting Ireland and prioritisation measures such as dedicated bus lanes where such prioritisation results in greater transport efficiency. • TII will consider the needs of all road users for all projects. On urban dual carriageways and motorways approaching cities, 	<p>The movement of people is a strategic issue facing the National Roads network, as well as a high-level investment priority. The effect of the implementation of TII's commitments in this instance is expected to be positive in terms of climate adaptation and the likelihood of adversely affecting flood risk is low.</p>

Strategic Issues	NR2040 Commitments	Does NR2040 have the potential to adversely affect flood risk?
	<p>TII will work with partner agencies to enable public transport and safe active travel alternatives for car users.</p> <ul style="list-style-type: none"> TII will continue to support reductions in car dependency and levels of car usage nationally while recognising the important role that private mobility plays for many transport system users. TII recognises that busy urban motorways, ring roads and town bypasses can be hostile environments for pedestrians and cyclists wishing to cross. TII will identify and remedy severance impacts from National Roads. 	
<p>Movement of Goods & Services</p>	<ul style="list-style-type: none"> In line with the NPF and NIFTI, TII will work to achieve average inter-urban speeds of 90km/h on National Road corridors between Ireland's five cities (Dublin, Cork, Galway, Limerick, and Waterford) and five regional centres (Letterkenny, Drogheda, Dundalk, Sligo and Athlone). In some instances, this will mean the development of new infrastructure or upgrading of existing infrastructure to deliver on this NPF and NIFTI inter-urban accessibility objective. TII will work towards improving regional and rural accessibility in line with the NPF and NIFTI objectives. In partnership with other agencies, TII will protect access to ports and airports and improve access where required. TII will provide/ consider prioritisation measures such as dedicated freight lanes where such prioritisation results in greater transport efficiency. TII supports the development of rail freight and multi-modal freight distribution centres on or near National Roads. TII recognises the issue of safe and secure parking areas for HGV drivers and is currently undertaking a review of the Service Area Policy, published in 2014, to improve service areas on motorway and dual carriageway sections of the NRN as well as providing safe stop and rest areas. 	<p>The movement of goods is a strategic issue facing the National Roads network, as well as high-level investment priority. The key aspects of this priority investment are the development of new infrastructure and/or upgrading the existing infrastructure to deliver on interurban accessibility objective.</p> <p>This is a high level strategic issue and any subsequent plans/projects arising out of NR2040 will be required to comply with all relevant legislation including environmental assessments, i.e. SEA, EIA, (S)FRA, as appropriate. Thus, ensuring that potential adverse effects at project level are mitigated as appropriate. This strategic issue is not likely to have significant effects with regard to flood risk and the likelihood of adversely affecting flood risk is low.</p>

Strategic Issues	NR2040 Commitments	Does NR2040 have the potential to adversely affect flood risk?
<p>Urban Congestion</p>	<ul style="list-style-type: none"> • TII will promote traffic management interventions that help optimise traffic movement on urban National Roads. • TII will support the use of public transport on or adjacent to urban National Roads. • TII will support the provision of segregated or offline active travel infrastructure adjacent to National Roads. 	<p>Urban congestion is a strategic issue facing the National Roads network. Part of the strategy to promote traffic management is to ensure that measures are implemented to support the provision of segregated or offline active travel infrastructure.</p> <p>This is a high level strategic issue and any subsequent plans/projects arising out of NR2040 will be required to comply with all relevant legislation including environmental assessments, i.e. SEA, EIA, (S)FRA, as appropriate. Thus, ensuring that potential adverse effects at project level are mitigated as appropriate. This strategic issue is not likely to have significant effects with regard to flood risk and the likelihood of adversely affecting flood risk is low.</p>

Table 5.3 NR2040 Implementation Programme: Supporting Activities

Implementation	Description	Does NR2040 have the potential to adversely affect flood risk?
Customer engagement and understanding-	developing and delivering practices and processes to improve TII's engagement with, and understanding of, all road customers.	Engagement and understanding of user experience is likely to identify issues relating to flood risk where they occur, leading to the reduction of associated risk overall. There are likely no adverse impacts to flood risk from customer engagement and understanding activities. The likelihood of adversely affecting flood risk is low .
Sustainability implementation plan-	Integrating sustainable practices and processes into every aspect of National Roads development and management, and ensuring sustainability is the bedrock of all decision-making, as articulated in TII's <i>Sustainability Implementation Plan</i> . It requires new ways of thinking; reviewing all corporate policies, standards and specifications; engaging with the wider supply chain and construction industry; and extensive collaboration.	Activities associated with promoting sustainability are unlikely to affect flood risk in the short-term, and likely to reduce flood risk in the long-term. The likelihood of adversely affecting flood risk is low .
Innovation and continuous improvement-	TII's track record is one of continuous improvement, for example effective implementation of the motorways programme and innovation; early adopters of free flow tolling – M50 and interoperable tolling. This tradition must be maintained in the new policy context of decarbonisation, multi-modality and technological change.	Activities associated with innovation and continuous improvement are unlikely to affect flood risk in the short-term, and likely to reduce flood risk in the long-term. The likelihood of adversely affecting flood risk is low .
Digitalisation-	including embedding a 'digital-by-design' philosophy; continued development and maintenance of a digital twin of the National Roads network; C-ITS integration; and delivery of digital platforms.	Digitalisation and associated productivity benefits are unlikely to have adverse effects on flood risk. The likelihood of adversely affecting flood risk is low .
Monitoring and evaluation-	of investment programmes and projects is a key requirement of the Public Spending Code for capital and operating expenditure. NR2040 and its supporting environmental assessments provides the framework for monitoring and evaluation activity	Monitoring and evaluation are key to the successful management of flood risk. Monitoring and evaluation activities are unlikely to adversely affect flood risk. The likelihood of adversely affecting flood risk is low .
Supporting development of a goods distribution centre network-	on or near National Roads (developed by third parties) to play a significant part in the creation of a more efficient, lower emission, haulage industry.	Supporting development of a goods distribution centre network is unlikely to affect flood risk in the short-term, and may reduce flood risk in the long-term. The likelihood of adversely affecting flood risk is low .

Table 5.4 Assessment of intervention types and examples

Intervention	Description	Does NR2040 have the potential to adversely affect flood risk?
<p>Priority of public transport, walking, cycling and goods Example National Cycling Network active mode collaboration and interchange Building pedestrian and cycle bridges to reduce severance</p>	<p>Enable a sustainable transport system through coordination with partner organisations. Reduce the reliance on private vehicles by coordinating access and priority on National Roads for public transport, goods vehicles, walking and cycling.</p>	<p>This will promote sustainability by reducing reliance on private use of vehicles by building pedestrian and cycle bridges. There is limited potential for significant adverse effect on flood risk as the increase in impermeable surface relating to these infrastructure will be minimal and not result in significant surface water runoff volumes. The likelihood of adversely affecting flood risk is low.</p>
<p>New transport and road technologies Example Smart motorways C-ITS Modern asset management systems</p>	<p>Integrate new road technologies and provide for vehicle innovation. Incentivise and promote quicker, easier and lower-carbon travel alternatives to fossil-fuelled vehicles.</p>	<p>New transport and road technologies will promote alternatives to internal combustion engine vehicles and favour lower carbon travel alternatives. This will likely result in decarbonation, induce carbon offset and reduce the impact of climate change. The likelihood of adversely affecting flood risk is low.</p>
<p>Demand management Example HOV, bus and cycle lanes Ramp metering Tolling</p>	<p>Prioritise and incentivise use of the network. Restrict use of the network by time, location, trip purpose, vehicle type or other criteria necessary to balance the needs of the community, environment and economy.</p>	<p>Demand management may promote decarbonisation and thus, induce carbon offset and reduce the impact of climate change. The likelihood of adversely affecting flood risk is low.</p>
<p>Resilience and capacity via local reconstruction Example Junction improvements Short road segment improvements</p>	<p>Improve resilience or capacity through localised reconstruction, notably on National Secondary Roads.</p>	<p>Localised reconstructions of short segments of roads and junction improvements have limited potential for adverse effect on flood risk as the increase in impermeable surface relating to this infrastructure will be minimal and not result in significant runoff and increased flood risks. The likelihood of adversely affecting flood risk is low.</p>

Intervention	Description	Does NR2040 have the potential to adversely affect flood risk?
<p>Road construction</p> <p>Example</p> <p>Town bypasses</p> <p>Build new to reduce net carbon</p> <p>Build better (new multi-modal links)</p>	<p>Where no feasible alternative exists to serve the required function, deliver new road infrastructure with green procurement and circular economy practices.</p>	<p>The construction of roads serving as town bypasses will reduce net carbon which is beneficial in terms of climate change adaptation. However, the new multi-modal links have a potential for minor increase in flood risk as a result of increase in impermeable surfaces relating to this infrastructure. There is limited potential for significant adverse effect on flood risk as the increase in impermeable surface relating to this infrastructure will be minimal and not result in significant surface water runoff volumes. The likelihood of adversely affecting flood risk is low.</p>

6. MITIGATION MEASURES

The following provides an overview of the mitigation measures for incorporation within the NR2040.

Compliance with Flood Risk Management Guidance

As the primary tool in ensuring sustainable flood risk management, compliance with 'The Planning System and Flood Risk Management Guidelines for Planning Authorities' and 'Technical Appendices' published in 2009 is required. This will ensure that the sequential approach is appropriately applied as part of any future plans and projects stemming from NR2040, and any necessary mitigation will be devised on a case by case basis at the relevant plan or project level.

Nature Based Solutions (NbS)

Definition: Nature-based solutions are actions to protect, conserve, restore, sustainably use and manage natural or modified terrestrial, freshwater, coastal and marine ecosystems which address social, economic and environmental challenges effectively and adaptively, while simultaneously providing human well-being, ecosystem services, resilience and biodiversity benefits. (United Nations Environment Assembly of the UN Environment Programme, Resolution, 02 March 2022).

NbS is key consideration in addressing environmental effects including flood risk. The inclusion of NbS for future developments (and retrofit) should be considered when progressing investment priorities. NbS includes SuDS, to reduce flood risk and alleviate pressure on existing surface water drainage systems.

Further information can be found:

- 'Nature-based Solutions to the Management of Rainwater and Surface Water Runoff in Urban Areas Water Sensitive Urban Design Best Practice Interim Guidance Document'.⁷

⁷ Government of Ireland (2021) Nature-based Solutions to the Management of Rainwater and Surface Water Runoff in Urban Areas Water Sensitive Urban Design Best Practice Interim Guidance Document Available: <https://assets.gov.ie/219872/409cd225-5afc-44b8-a7b1-bb595632a904.pdf>

7. FLOOD RISK ASSESSMENT CONCLUSIONS

This report has documented the strategic flood risk assessment on NR2040, TII's long-term strategy for the maintenance, development, and management of Ireland's National Roads. The vision, key objectives, investment priorities and intervention hierarchies of the NR2040 strategy were examined to highlight the implementation component that has a potential to increase flood risk.

This report has described the methodology for assessing flood risk. The key implementation measures of NR2040 have been assessed to identify any aspects that have the potential for effecting flood risk. The assessment showed that the investment priorities, commitments, implementation programme: supporting activities and interventions have a low likelihood of adversely affecting flood risk. Any infrastructure developments stemming from NR2040 interventions may potentially lead to increased flood risk in the absence of appropriate flood risk assessment and management measures, which will also be required to take account of climate change effects. Project level interventions that may increase flood risk include new road development; park and ride/share; multi-modal distribution centres; greenways, etc.; and modification of bridges, crossings, culverts, drainage, ground raising and drainage works to accommodate these works.

This examination of NR2040 for the development and management of Ireland's National Road network has shown that overall, there is a low likelihood of adversely affecting flood risk. NR2040 is a high-level strategic document and does not specify any plans or projects in specific locations. In conclusion, any subsequent plan/projects stemming from the implementation of NR2040 will be required to comply with the mitigation included in this SFRA, and all relevant legislation and statutory guidance at the appropriate plan/project level, including any environmental assessments such as flood risk assessment.

APPENDIX A

GLOSSARY OF TERMS

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Catchment: The area that is drained by a river or artificial drainage system.

Catchment Flood Risk Assessment and Management Studies (CFRAMS): A catchment-based study involving an assessment of the risk of flooding in a catchment and the development of a strategy for managing that risk in order to reduce adverse effects on people, property and the environment. CFRAMS precede the preparation of Flood Risk Management Plans (see entry for FRMP).

Climate change: Long-term variations in global temperature and weather patterns, which occur both naturally and as a result of human activity, primarily through greenhouse gas emissions.

Core of an urban settlement: The core area of a city, town or village which acts as a centre for a broad range of employment, retail, community, residential and transport functions.

Detailed flood risk assessment: A methodology to assess flood risk issues in sufficient detail and to provide a quantitative appraisal of flood hazard and potential risk to an existing or proposed development, of its potential impact on flood elsewhere and of the effectiveness of any proposed measures.

Estuarial (or tidal) flooding: Flooding from an estuary, where water level may be influenced by both river flows and tidal conditions, with the latter usually being dominant.

Flooding (or inundation): Flooding is the overflowing of water onto land that is normally dry. It may be caused by overtopping or breach of banks or defences, inadequate or slow drainage of rainfall, underlying groundwater levels or blocked drains and sewers. It presents a risk only when people, human assets and ecosystems are present in the areas that flood.

Flood Relief Schemes (FRS): A scheme designed to reduce the risk of flooding at a specific location.

Flood Defence: A man-made structure (e.g. embankment, bund, sluice gate, reservoir or barrier) designed to prevent flooding of areas adjacent to the defence.

Flood Risk Assessment (FRA): FRA can be undertaken at any scale from the national down to the individual site and comprises 3 stages: Flood risk identification, initial flood risk assessment and detailed flood risk assessment.

Flood Risk Identification: A desk-based study to identify whether there may be any flooding or surface water management issues related to a plan area or proposed development site that may warrant further investigation.

Flood Hazard: The features of flooding which have harmful impacts on people, property or the environment (such as the depth of water, speed of flow, rate of onset, duration, water quality, etc.).

Floodplain: A flood plain is any low-lying area of land next to a river or stream, which is susceptible to partial or complete inundation by water during a flood event.

Flood Risk: An expression of the combination of the flood probability, or likelihood and the magnitude of the potential consequences of the flood event.

Flood Storage: The temporary storage of excess run-off, or river flow in ponds, basins, reservoirs or on the flood plain.

Flood Zones: A geographic area for which the probability of flooding from rivers, estuaries or the sea is within a particular range.

Fluvial flooding: Flooding from a river or other watercourse.

Groundwater flooding: Flooding caused by groundwater escaping from the ground when the water table rises to or above ground level.

Initial flood risk assessment: A qualitative or semi-quantitative study to confirm sources of flooding that may affect a plan area or proposed development site, to appraise the adequacy of existing information, to provide a qualitative appraisal of the risk of flooding to development, including the scope of possible mitigation measures, and the potential impact of development on flooding elsewhere, and to determine the need for further detailed assessment.

Freeboard: Factor of safety applied for water surfaces. Defines the distance between normal water level and the top of a structure, such as a dam, that impounds or restrains water.

Justification Test: An assessment of whether a development proposal within an area at risk of flooding meets specific criteria for proper planning and sustainable development and demonstrates that it will not be subject to unacceptable risk nor increase flood risk elsewhere. The justification test should be applied only where development is within flood risk areas that would be defined as inappropriate under the screening test of the sequential risk-based approach adopted by this guidance.

Likelihood (probability) of flooding: A general concept relating to the chance of an event occurring. Likelihood is generally expressed as a probability or a frequency of a flood of a given magnitude or severity occurring or being exceeded in any given year. It is based on the average frequency estimated, measured or extrapolated from records over a large number of years and is usually expressed as the chance of a particular flood level being exceeded in any one year. For example, a 1-in-100 or 1% flood is that which would, on average, be expected to occur once in 100 years, though it could happen at any time.

Ordnance Datum (or OD) Malin: is a vertical datum used by an ordnance survey as the basis for deriving altitudes on maps. A spot height may be expressed as AOD for "above ordnance datum". Usually mean sea level (MSL) is used for the datum. In the Republic of Ireland, OD for the Ordnance Survey of Ireland is Malin Ordnance Datum: the MSL at Portmoor Pier, Malin Head, County Donegal, between 1960 and 1969. Prior to 1970, Poolbeg Ordnance Datum was used: the low water of spring tide at Poolbeg lighthouse, Dublin, on 8 April 1837. Poolbeg OD was about 2.7 metres lower than Malin OD.

Management Train/Treatment Train: the sequence of drainage components that collect, convey, store and treat runoff as it drains through the site.

Mitigation: The term is used to describe an action that helps to lessen the impacts of a process or development on the receiving environment. It is used most often in association with measures that would seek to reduce negative impacts of a process or development.

Pathways: These provide the connection between a particular source (e.g. high river or tide level) and the receptor that may be harmed (e.g. property). In flood risk management, pathways are often 'blocked' by barriers, such as flood defence structures, or otherwise modified to reduce the incidence of flooding.

Pluvial flooding: Usually associated with convective summer thunderstorms or high intensity rainfall cells within longer duration events, pluvial flooding is a result of rainfall-generated overland flows which arise before run-off enters any watercourse or sewer. The intensity of rainfall can be such that the run-off totally overwhelms surface water and underground drainage systems.

Regional Planning Guidelines (RPG): These provide the regional context and priorities for applying national planning strategy to each NUTS III region and encourage greater co-ordination of planning policies at the city/county level. RPGs are an important part of the flood policy hierarchy as they can assist in co-ordinating flood risk management policies at the regional level.

Resilience: Sometimes known as “wet-proofing”, resilience relates to how a building is constructed in such a way that, although flood water may enter the building, its impact is minimised, structural integrity is maintained, and repair, drying and cleaning and subsequent reoccupation are facilitated.

Receptors: Things that may be harmed by flooding (e.g., people, houses, buildings or the environment).

Residual risk: The risk which remains after all risk avoidance, substitution and mitigation measures have been implemented, on the basis that such measures can only reduce risk, not eliminate it.

Sequential Approach: The sequential approach is a risk-based method to guide development away from areas that have been identified through a flood risk assessment as being at risk from flooding. Sequential approaches are already established and working effectively in the plan-making and development management processes.

Sustainable Drainage System (SuDS): Drainage systems that are considered to be environmentally beneficial, causing minimal or no long-term detrimental impact.

Site-specific Flood Risk Assessment: An examination of the risks from all sources of flooding of the risks to and potentially arising from development on a specific site, including an examination of the effectiveness and impacts of any control or mitigation measures to be incorporated in that development.

Source: Refers to a source of hazard (e.g. the sea, heavy rainfall).

Strategic Flood Risk Assessment: The assessment of flood risk on a wide geographical area against which to assess development proposed in an area (Region, County, Town).

Vulnerability: The resilience of a particular group of people or types of property or habitats, ecosystems or species to flood risk, and their ability to respond to a hazardous condition and the damage or degree of impact they are likely to suffer in the event of a flood. For example, elderly people may be more likely to suffer injury, and be less able to evacuate, in the event of a rapid flood than younger people.

Source: *The definitions above are sourced from the DEHLG Guidelines for Planning Authorities on ‘The Planning System and Flood Risk Management, 2009’ and Ciria 753 ‘the SuDS Manual’*

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