National Investment Framework for Transport in Ireland

Strategic Flood Risk Assessment Report

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<td>P01</td>
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</tr>
</tbody>
</table>
# Contents

Strategic Flood Risk Assessment Report

Executive Summary .................................................................................................................................................. 3
List of Abbreviations .......................................................................................................................................... 4
Glossary .................................................................................................................................................................. v

1. Introduction .......................................................................................................................................................... 1
   1.1 Background to NIFTI ....................................................................................................................................... 1
   1.2 SFRA Integration with NIFTI ...................................................................................................................... 1
   1.3 Purpose and Structure of the Report ............................................................................................................ 2

2. The Planning System and Flood Risk Assessment Guidelines ................................................................................. 3
   2.1 Purpose of the Guidelines ............................................................................................................................ 3
   2.2 Guideline Objectives ....................................................................................................................................... 3
   2.3 Types of Flooding .......................................................................................................................................... 3
   2.4 Sequential Approach ...................................................................................................................................... 4
   2.5 Justification Test ............................................................................................................................................ 4
   2.6 Climate Change .............................................................................................................................................. 5
   2.7 SFRA Methodology ....................................................................................................................................... 6

3. Flood Risk Appraisal of Available Datasets ....................................................................................................... 7
   3.1 Sources of Flood Risk Information ............................................................................................................... 7

4. Identification of Flood Risk ................................................................................................................................ 11
   4.1 Investing in Transport ................................................................................................................................... 11
   4.2 Key Issues related to Flood Risk .................................................................................................................. 11

5. Flood Risk Assessment of NIFTI potential Outcomes and Investment Priorities ..................................................... 14
   5.1 Implementation of Sequential Approach .................................................................................................... 14

6. Conclusion ............................................................................................................................................................ 18
Executive Summary

Following publication of the draft National Planning Framework: Project Ireland 2040 (NPF) in October 2017, the Department of Transport initiated a programme to update the existing transport investment framework. The new strategy titled: 'National Investment Framework for Transport in Ireland' sets out DoT strategy for the development and management of Ireland’s land transport network over the next two decades. The NPF and its projections around population and settlement patterns are central to the development of NIFTI.

Investments in transport networks and services and, therefore, the policies that drive these investments, can impact on the water environment. The EU Directive on the assessment and management of flood risk (2007/60/EC), which is more commonly known as the ‘Floods Directive’, recognises the importance of land use management and spatial planning in flood risk management, and brings a requirement to consider flood risk management in the implementation of NIFTI.

Failure to fully consider flood risk in previous land use strategies has caused economic, social and environmental issues due to land in unsuitable locations being developed without appropriate consideration to flood risk and flood risk mitigation. Furthermore, the Sectoral Adaptation Plan for Transport (which sits under the 2019 Climate Action Plan), identifies the increase in extreme precipitation levels and sea level rise and associated increase in flooding as a high priority risk to the transport sector and its future resilience.

This Strategic Flood Risk Assessment (SFRA) has been produced in accordance with the Planning System and Flood Risk Assessment Guidelines (2009) to appraise the suitability of available data for the assessment of flood risk, identify issues related to flood risk arising from NIFTI, and set out guidance to ensure these issues can be addressed and mitigated in an appropriate manner.

This SFRA has identified that NIFTI, and infrastructure projects that sit beneath it, have the potential to result in significant adverse impacts on flood risk without appropriately considered development and mitigation. These issues relate primarily to infrastructure creep in flood zones, increased surface water runoff, and an increase in the vulnerability of the transport network.

NIFTI acknowledges this challenge and the potential Outcomes of NIFTI and sets out a number of Investment Priorities and a clear ambition to direct future investments along a more sustainable path. This includes the desire to protect and renew existing transport networks to increase resilience, adapt to climate change, and establish a reliable and environmentally sustainable network.

This SFRA sets out a list of criteria against which future investments under NIFTI will be assessed. It is designed to complement the existing Guidelines and not replace them. These criteria are aligned to the sequential approach and will ensure that the potential for significant adverse impacts on flood risk are avoided. Furthermore, aligned to NIFTI’s potential Outcomes and Investment Priorities, this approach embeds opportunities to reduce and manage flood risk into the decision-making criteria, to ensure sustainable development and increased transport resilience is achieved.

It should be noted that this SFRA must be revisited intermittently during the implementation period of NIFTI to ensure it remains current and considers future changes to policy and legislation.
**List of Abbreviations**

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
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</thead>
<tbody>
<tr>
<td>CFRAM</td>
<td>Catchment Flood Risk Assessment and Management</td>
</tr>
<tr>
<td>DoT</td>
<td>Department of Transport</td>
</tr>
<tr>
<td>DTTAS</td>
<td>Department of Transport, Tourism and Sport (now Department of Transport)</td>
</tr>
<tr>
<td>EU</td>
<td>European Union</td>
</tr>
<tr>
<td>FRMP</td>
<td>Flood Risk Management Plans</td>
</tr>
<tr>
<td>NDP</td>
<td>National Development Plan</td>
</tr>
<tr>
<td>NIFTI</td>
<td>National Investment Framework for Transport in Ireland</td>
</tr>
<tr>
<td>NPF</td>
<td>National Planning Framework</td>
</tr>
<tr>
<td>NSS</td>
<td>National Spatial Strategy</td>
</tr>
<tr>
<td>OPW</td>
<td>Office of Public Works</td>
</tr>
<tr>
<td>PFRA</td>
<td>Preliminary Flood Risk Assessment</td>
</tr>
<tr>
<td>NIFTI</td>
<td>National Investment Framework for Transport in Ireland</td>
</tr>
<tr>
<td>SIFLT</td>
<td>Strategic Investment Framework for Land Transport</td>
</tr>
<tr>
<td>SFRA</td>
<td>Strategic Flood Risk Assessment</td>
</tr>
</tbody>
</table>
## Glossary

<table>
<thead>
<tr>
<th>Glossary Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Catchment Flood Risk Assessment and Management (CFRAM)</td>
<td>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).</td>
</tr>
<tr>
<td>Coastal Flooding</td>
<td>Flooding from the sea which is caused by higher than normal sea levels and/or high waves resulting in the sea overflowing onto the land.</td>
</tr>
<tr>
<td>Flood Risk Management</td>
<td>Flood Risk Management combines the function of mitigating and monitoring flood risks and may include pre-flood, flood event or post-flood activities.</td>
</tr>
<tr>
<td>Flood Risk Management Plan</td>
<td>Plans which are developed in accordance with national flood policy and the EU Floods Directive and which provide the strategic direction for flood risk management decisions in a catchment. These will describe a range of traditional river or coastal defences to non-structural responses such as flood warning and resilience measures at property level.</td>
</tr>
<tr>
<td>Fluvial Flooding</td>
<td>River flooding which occurs when excessive rainfall over an extended period of time causes a river to exceed its capacity.</td>
</tr>
<tr>
<td>Mitigation</td>
<td>The implementation of measures designed to reduce the predicted effects of a plan or project on the environment.</td>
</tr>
<tr>
<td>Pluvial Flooding</td>
<td>Surface water flooding which occurs when an extremely heavy downpour of rain saturates drainage systems and the excess water cannot be absorbed.</td>
</tr>
<tr>
<td>Strategic Flood Risk Assessment (SFRA) Screening Report</td>
<td>The document that considers the requirement for and methodology for undertaking a Strategic Flood Risk Assessment for NIFTI in accordance with the Strategic Environmental Assessment Regulations.</td>
</tr>
</tbody>
</table>
1. Introduction

1.1 Background to NIFTI

To prepare for future growth in population and employment; an overall increase in travel; and the changing demographic structure of Ireland, the Irish Government has developed the National Planning Framework: Project Ireland 2040 (NPF). The NPF was published in February 2018 and provides the over-arching strategic policy framework for Ireland's social and economic development. The NPF establishes a macro spatial growth approach to promote balanced regional development, achieved through coordinated spatial planning, the sustainable use of resources, protection of the environment and the Natura 2000 network of European conservation sites. The NPF coordinates regional and national investment strategies with respect to housing, water services, communications, energy, health, education and transport infrastructure. The NPF replaced the National Spatial Strategy for Ireland 2002-2020 (NSS).

The Department of Transport (DoT) is the Government Department responsible for the development of safe and sustainable transport, tourism, and sport to support economic growth and social progress in Ireland. DoT has oversight of the decision-making framework specific to transport investment and published the Strategic Framework for Investment in Land Transport (SFILT) in 2015. This framework set out the priorities for Ireland's land transport (referring to roads, public transport, and walking and cycling) investment.

In October 2017, after the draft NPF was published for consultation, DoT initiated a programme to update the existing transport investment framework. The new strategy titled: ‘National Investment Framework for Transport in Ireland (NIFTI)’ will set out DoT’s strategy for the development and management of Ireland's land transport network over the next two decades. The NPF and its projections around population and settlement patterns are central to the development of NIFTI.

Investment in transport networks and services and the policies that drive it, can impact on the water environment. The EU Directive on the assessment and management of flood risk (2007/60/EC), which is more commonly known as the 'Floods Directive' was transposed into Irish law by the European Communities Assessment and Management of Flood Risk Regulations, 2010 (SI 122/2010). The EU Directive recognises the importance of land use management and spatial planning in flood risk management and brings a requirement to consider flood risk management in the implementation of NIFTI.

1.2 SFRA Integration with NIFTI

Failure to properly assess flood risk in previous land use strategies has caused economic, social and environmental issues due to land in unsuitable locations being developed, without appropriate consideration to flood risk and flood risk mitigation.

Section 3.3 of NIFTI, and the Sectoral Adaptation Plan for Transport, identify the increased risk of flooding due to extreme precipitation levels and sea level rise as a high priority risk to the transport sector. It is acknowledged within NIFTI that rural areas are particularly vulnerable, and costs associated with protection and renewal of the existing network face upward pressure in the coming years to minimise the impact this risk has on disruption.

In a planning and land use management context, a framework established in NIFTI and any schemes informed by it will be, where necessary, subject to a flood risk assessment as part of a future planning application to ensure they are consistent with the appropriate FRMPs. In Ireland, flood risk assessments are carried out in accordance with 'The Planning System and Flood Risk Management – Guidelines for Planning Authorities' (the FRM Guidelines), (OPW 2009). The FRM Guidelines were developed to integrate flood risk assessment and management into spatial planning development decisions and therefore are applicable to strategic objectives identified for NIFTI.
1.3 Purpose and Structure of the Report

The objective of this report is to carry out a Strategic Flood Risk Assessment (SFRA) of the Investment Priorities of NIFTI. At this point in time, it is not possible to definitively list all of Ireland’s transport needs over the next two decades, nor is it the purpose of NIFTI to identify specific transport interventions.

To ensure NIFTI is aligned with the 10 National Strategic Outcomes set out in the Project Ireland 2040 vision, 4 potential Outcomes that are aligned with the NSOs have been set out within NIFTI:

- **Outcome 1:** Delivering clean, low-carbon and environmentally sustainable mobility.
- **Outcome 2:** Supporting successful places and vibrant communities.
- **Outcome 3:** Facilitating safe, accessible, reliable and efficient travel on the network.
- **Outcome 4:** Promoting a strong and balanced economy.

Additionally, 4 key Investment Priorities, which are informed by the ten National Strategic Objectives (NSO) have been identified to ensure that the transport sector plays its part in delivering Project Ireland 2040. These are:

- **Investment Priority 1:** Decarbonisation.
- **Investment Priority 2:** Protection and Renewal.
- **Investment Priority 3:** Mobility of People and Goods in Urban Areas.
- **Investment Priority 4:** Enhancing Rural and Regional Connectivity.

This SFRA has been carried out alongside NIFTI and seeks to identify potential negative environmental outcomes of the framework. Where such outcomes are identified, avoidance and mitigation strategies will be put in place to address them. The assessment will ensure that flood risk is a key consideration in planning and delivering NIFTI.

The report is structured as follows:

**Section 2** contains a summary of the existing Planning System and Flood Risk management guidelines and how these are applied to the NIFTI Strategic Flood Risk Assessment.

**Section 3** provides a high-level flood risk appraisal of available datasets for use in NIFTI.

**Section 4** covers the identification of flood risk issues associated with NIFTI.

**Section 5** sets out proposed criteria to govern the decision-making process for all works delivered under NIFTI in the context of flood risk management.

**Section 6** concludes the Strategic Flood Risk Assessment.
2. The Planning System and Flood Risk Assessment Guidelines

2.1 Purpose of the Guidelines

The Planning System and Flood Risk Assessment Guidelines were published in 2009 by the Office of Public Works in conjunction with the Department of Housing, Planning and Local Government. The Guidelines are to be used by all levels of government when preparing development plans, from national strategies to individual planning applications.

2.2 Guideline Objectives

The core objectives of The Guidelines are to:

- Avoid inappropriate development in areas at risk of flooding;
- Avoid new developments increasing flood risk elsewhere, including that which may arise from surface water run-off;
- Ensure effective management of residual risks for development permitted in floodplains;
- Avoid unnecessary restriction of national, regional or local economic and social growth;
- Improve the understanding of flood risk among relevant stakeholders and;
- Ensure that the requirements of EU and national law in relation to the natural environment and nature conservation are complied with at all stages of flood risk management.

2.3 Types of Flooding

Flooding can occur from a range of sources and is usually caused by a combination of events. Typical flood sources are described below.

2.3.1 Fluvial (River) Flooding

Fluvial flooding occurs when rivers and streams break their banks and water flows out onto the adjacent low-lying areas (the natural floodplains). This can arise where the runoff from heavy rain exceeds the natural capacity of the river channel and can be exacerbated where a channel is blocked or constrained or, in estuarine areas, where high tide levels impede the flow of the river out into the sea.

2.3.2 Pluvial (Rainfall) Flooding

Pluvial flooding occurs when the amount of rainfall exceeds the capacity of urban storm water drainage systems or the ground to absorb it. This excess water flows overland, ponding in natural or man-made hollows and low-lying areas or behind obstructions. This occurs as a rapid response to intense rainfall before the flood waters enter a piped or natural drainage system. This type of flooding is driven particularly by short, intense, rain storms.

2.3.3 Coastal Flooding

Coastal flooding occurs when: sea levels along the coast or in estuaries exceed neighbouring land levels, or overcome coastal defences where these exist, or when waves overtop the coast. Wind speed and direction and low-pressure systems can force water into estuaries and harbours, cause surge effects, and create extreme wave conditions.
2.3.4 Groundwater Flooding

Groundwater flooding occurs when the level of water stored in the ground rises as a result of prolonged rainfall, to meet the ground surface and flows out over it, i.e. when the capacity of this underground reservoir is exceeded. Groundwater flooding tends to be very local and results from the interaction of site-specific factors such as local geology and tidal variations. While water level may rise slowly, groundwater flooding can last for extended periods of time.

2.3.5 Other Sources of Flooding

The above causes of flooding are all natural; caused by either extreme sea levels or heavy or intense rainfall. Floods can also be caused by the failure or exceedance of capacity of built or man-made infrastructure, such as bridge collapses, from blocked or under-sized drainage systems or other piped networks, or the failure or overtopping of reservoirs or other water-retaining embankments (such as raised canals).

2.4 Sequential Approach

The sequential approach is a tool used in the planning process to ensure developments are directed towards land at low risk of flooding. Figure 2-1 below shows the sequence of stages required when deciding if a development should be permitted in a particular location.

NIFTI will be required to demonstrate adherence to the sequential approach through the selection of investment opportunities and routes which are sympathetic to existing flood risk.

Figure 2-1 Sequential Approach principles in flood risk management (extract of Figure 3-1 from the Planning System and Flood Risk Assessment Guidelines, 2009)

2.5 Justification Test

The Sequential Approach introduces the Justification Test, used to assess the appropriateness or otherwise of particular developments that are being considered in areas of moderate or high flood risk. The Guidelines acknowledge that the existing urban structure of the country contains many urban centres and infrastructure located in areas which means they will continue to be at risk of flooding. To enable compact, economic and
sustainable urban development, spatial plans may identify land for development that is within a higher flood risk zone than desirable.

There are two levels of Justification Test:

- **Plan Making Justification Test**, used at the plan preparation and adoption stage
- **Development Management Justification Test**, used at the planning application stage for a particular project

Any land transport investments proposed under NIFTI will be required to comply with the Justification Test to demonstrate the requirement for the proposed works and associated mitigation.

Each land use and type of development is categorised by a Vulnerability Class, and development will be subject to a Justification Test depending on the Vulnerability Class and the level of flood risk it is subject to.

NIFTI will involve the implementation of schemes which sit under the “Essential infrastructure” category, classed as **Highly Vulnerable**. As such, a Justification test will be required if any proposals which sit under NIFTI are put forward within Flood Zone A or B.

### 2.6 Climate Change

Climate change is expected to lead to a long-term effect on weather patterns leading to higher sea levels, wetter winters and more intense rainfall. Due to expected change in weather patterns, climate change could potentially have a significant effect on long term flood risk causing an increase in both the frequency and intensity of flooding.

Due to the uncertainty of the potential impacts of climate change The Planning System and Flood Risk Management Guidelines recommend a conservative approach.

#### 2.6.1 Flood Risk Management Sectoral Adaptation Plan

The Flood Risk Management Sectoral Adaptation Plan was developed by the Office of Public Works as part of the 2019 Climate Action Plan. The purpose of the Plan is to:

- Outline the potential impacts of climate change on flooding and flood risk management in Ireland;
- Identify the objectives for an effective and sustainable approach to adaptation as part of flood risk management for the future;
- Promote a coordinated approach to adaptation
- Recommend any further actions required to meet objectives for adaptation.

Schemes developed under NIFTI will need to consider, at the earliest stage, the impact of climate change on flood risk and any necessary measures to mitigate or adapt to that risk.

#### 2.6.2 Transport Sectoral Adaptation Plan

The Transport Sectoral Adaptation Plan was developed by the Department of Transport as part of the 2019 Climate Action Plan.

This set out the key sectoral risks and priorities, whilst also recommending 21 adaptation actions. These aim to increase knowledge and understanding of the likely impacts of climate change on the sector, support stakeholders in identifying and prioritising risks, and assist in the implementation of adaptation measures to improve resilience across the sector.
Many adaptation measures include considerable engineering and construction undertakings that amend or alter transport infrastructure and the surrounding environment.

2.7 SFRA Methodology

The Planning System and Flood Risk Assessment Guidelines outline how flood risk management must be integrated at all stages of the planning process.

This SFRA has been carried out alongside NIFTI, in accordance with the Guidelines, and seeks to identify potential negative outcomes of the framework. Where such outcomes are identified, mitigation strategies will be put in place to address them.

The SFRA will determine the requirement for any site-specific flood risk assessment. This assessment will:

- Review the potential Outcomes and Investment Priorities of NIFTI in the context of flood risk.
- Identify flood risk issues and challenges associated with the implementation of NIFTI.
- Set out mitigation strategies to ensure any issues are addressed and this process is embedded in the decision-making approach for investments in land transport infrastructure.
- Outline further recommendations, where appropriate, to contribute towards the successful implementation of the NIFTI potential Outcomes and Investment Priorities.
3. **Flood Risk Appraisal of Available Datasets**

3.1 **Sources of Flood Risk Information**

A high-level appraisal of key available datasets has been undertaken to identify the coverage, suitability and accuracy of information that can be used under NIFTI. The datasets reviewed are set out below together with commentary on the appropriateness of their future use. Additional, scheme specific data may be available beyond those assessed below and this should be reviewed as part of the data collection stage on a case by case basis. It is also noted that many of these datasets will be reviewed and refined in the years ahead, with the potential to increase the appropriateness over time.

All investments which sit under NIFTI will be required to assess flood risk and, in doing so, only adopt appropriate use of the datasets outlined in this section.

3.1.1 **Local Authority Development Plans**

Local Authority Development Plans set out policy and objectives to guide where and how development will take place. In the context of flood risk, these will be informed by a Strategic Flood Risk Assessment and appropriate application of the Sequential Approach and Justification Test.

The Development Plans identify proposed land zoning and usage with consideration for flood risk alongside other drivers for sustainable growth.

**Table 3-1 Appraisal of Local Authority Development Plan flood risk data**

<table>
<thead>
<tr>
<th>Dataset</th>
<th>Description</th>
<th>Appropriateness</th>
<th>Commentary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Development Plans</td>
<td>Outlines where and how development is proposed for the respective area.</td>
<td>High</td>
<td>Compatibility with the applicable Development Plan(s) is critical in the identification of land transport infrastructure.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Strategic decision-making will have made use of much of the available datasets set out in this section.</td>
</tr>
</tbody>
</table>

3.1.2 **The National Preliminary Flood Risk Assessment (PFRA), 2012**

The Preliminary Flood Risk Assessment was produced as a requirement of the EU ‘Floods Directive (2007) and identified, on a national scale, the flood risk from fluvial, coastal, groundwater, and pluvial sources.

Flood extent maps were produced as part of a national screening exercise and indicate the areas at potential risk. The study did not produce flood level information. An appraisal of the appropriateness of this dataset is detailed in Table 3-2.
Table 3-2 Appraisal of National PFRA flood risk data

<table>
<thead>
<tr>
<th>Dataset</th>
<th>Description</th>
<th>Appropriateness</th>
<th>Commentary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fluvial PFRA Maps</td>
<td>Hydrological analysis utilising OPW FSU approach, coarse modelling using DTM data</td>
<td>Moderate</td>
<td>Majority of data superseded by CFRAM study (3.1.3). Appropriate for use for non-CFRAM rivers but requires validation.</td>
</tr>
<tr>
<td>Coastal PFRA Maps</td>
<td>Tidal data from the Irish Coastal Protection Strategy Study (2011) and inundation determined using linear projection.</td>
<td>Low</td>
<td>Superseded by more recent data (3.1.2).</td>
</tr>
<tr>
<td>Pluvial PFRA Maps</td>
<td>Coarse modelling using DTM data, no local drainage structures.</td>
<td>Low</td>
<td>Appropriate as part of a Stage 1 assessment but cannot be used to screen out risk without further validation.</td>
</tr>
<tr>
<td>Groundwater PFRA Maps</td>
<td>No modelling. Assessment based on historic flooding and known groundwater features.</td>
<td>Low</td>
<td>Appropriate as part of flood risk identification but cannot be used to screen out risk without further validation.</td>
</tr>
</tbody>
</table>

3.1.3 Irish Coastal Protection Strategy Study (ICPSS), 2018

The ICPSS is a national study to provide information to support the management of coastal flood risk. The assessment provides coastal flood hazard maps for current and future scenarios and includes flood level data.

The updated analysis supersedes the Irish Coastal Protection Strategy Study (2011) dataset.

Table 3-3 Appraisal of ICPSS flood risk data

<table>
<thead>
<tr>
<th>Dataset</th>
<th>Description</th>
<th>Appropriateness</th>
<th>Commentary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coastal ICPSS 2018 Maps</td>
<td>Tidal data from the Irish Coastal Protection Strategy Study (2018) and inundation determined using linear projection.</td>
<td>High</td>
<td>Robust dataset which is appropriate for use in flood risk assessment. Depending on the initial flood risk assessment, further analysis to consider wave overtopping and site-specific inundation may be required.</td>
</tr>
</tbody>
</table>
3.1.4 **National Catchment Flood Risk Assessment and Management (CFRAM) Programme**

The National CFRAM Programme assigned 6 CFRAM study areas covering 29 river basins to investigate flood risk in Areas for Further Assessment identified by the PFRA (see 3.1.1). Each CFRAM study area produced flood risk maps based on detailed hydraulic modelling.

Detailed hydrological analysis was undertaken including calibration against historic flood events where data was available. This was a comprehensive study which covered 80% of properties in Ireland, however watercourses with smaller catchments were excluded.

This dataset also includes a comprehensive option assessment exercise which has identified the viability of numerous flood relief schemes across Ireland. Many of these have subsequently been approved for implementation and are at various stages of project progression.

The dataset was also used to derive a Flood Risk Management Plan for each of the 29 river basins. These contain proposed interventions to reduce or manage flood risk within the catchment.

The analysis and maps produced within the CFRAM study supersede the mapping for the same watercourses in the PFRA.

### Table 3-4 Appraisal of National CFRAM Programme flood risk data

<table>
<thead>
<tr>
<th>Dataset</th>
<th>Description</th>
<th>Appropriateness</th>
<th>Commentary</th>
</tr>
</thead>
<tbody>
<tr>
<td>CFRAM Maps</td>
<td>Detailed fluvial and coastal modelling of areas at risk of flooding across Ireland (as derived from initial PFRA screening.)</td>
<td>High</td>
<td>Robust dataset which is appropriate for use in flood risk assessment. Depending on the initial flood risk assessment, further analysis to consider site-specific inundation may be required.</td>
</tr>
<tr>
<td>Flood Risk Management Plans</td>
<td>Sets out planned measures to reduce flood risk and update them on a six-yearly cycle.</td>
<td>High</td>
<td>Must be reviewed to ensure any planned infrastructure is compatible with planned interventions to manage flood risk. These will also assist in the identification of areas which may benefit from flood defences in the future. Preliminary Option Reports provide further detail of planned measures.</td>
</tr>
<tr>
<td>Preliminary Option Reports</td>
<td>Optioneering of viable measures to reduce flood risk where appropriate and viable.</td>
<td>High</td>
<td>Must be reviewed to ensure any planned infrastructure is compatible with planned interventions to manage flood risk. These will also assist in the identification of areas which may benefit from flood defences in the future.</td>
</tr>
</tbody>
</table>

3.1.5 **Historical flood records**

Detailed information related to historical flood events across Ireland is available online at [www.floodinfo.ie](http://www.floodinfo.ie). The information available for each flood event varies but often includes data on the date, magnitude, extent, source and impact (together with minutes, levels, and photographs). The availability of information varies for each record, but the accuracy of the information is relatively robust.
Other sources of historic flood information including newspaper reports, public bodies, residents, social media and anecdotal evidence should also be used with appropriate caution.

Table 3-5 Appraisal of Historical flood records data

<table>
<thead>
<tr>
<th>Dataset</th>
<th>Description</th>
<th>Appropriateness</th>
<th>Commentary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Historical flood</td>
<td>Detailed historical records available on <a href="http://www.floodinfo.ie">www.floodinfo.ie</a> and other</td>
<td>Moderate</td>
<td>Robustness of the information varies on a case by case basis, but critical part of the flood risk assessment, particularly where site-specific assessment is required.</td>
</tr>
<tr>
<td>records</td>
<td>sources.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3.1.6 Geological Survey Ireland (GSI)

The GSI provide data and maps on sub-surface features for Ireland including groundwater data. Groundwater data available includes groundwater wells and springs, Karst data including turlough locations, and aquifers.

Table 3-6 Appraisal of GIS flood risk data

<table>
<thead>
<tr>
<th>Dataset</th>
<th>Description</th>
<th>Appropriateness</th>
<th>Commentary</th>
</tr>
</thead>
<tbody>
<tr>
<td>GSI spatial mapping</td>
<td>Online mapping identifying groundwater features (turloughs, springs, etc) and other layers available on <a href="http://www.gsi.ie">www.gsi.ie</a>.</td>
<td>Moderate</td>
<td>Appropriate as part of flood risk identification but cannot be used to screen out risk without further validation.</td>
</tr>
</tbody>
</table>

3.1.7 Environmental Protection Agency (EPA)

The EPA provides maps showing the locations of surface water features, groundwater features, and mapping of the river networks in Ireland.

Table 3-7 Appraisal of EPA flood risk data

<table>
<thead>
<tr>
<th>Dataset</th>
<th>Description</th>
<th>Appropriateness</th>
<th>Commentary</th>
</tr>
</thead>
<tbody>
<tr>
<td>EPA spatial mapping</td>
<td>Online mapping identifying surface water and groundwater features, as well as mapping of the river network and other layers available on <a href="http://www.gsi.ie">www.gsi.ie</a>.</td>
<td>Low</td>
<td>Appropriate as part of flood risk identification, particularly in relation to the presence / absence of smaller watercourses not covered by the CFRAM study (3.1.3).</td>
</tr>
</tbody>
</table>
4. Identification of Flood Risk

4.1 Investing in Transport

As stated in Section 1.3, the objective of this report is to carry out a Strategic Flood Risk Assessment (SFRA) of the potential Outcomes and Investment Priorities of NIFTI. At this point in time, it is not possible to definitively list all of Ireland’s transport needs over the next two decades, nor is it the purpose of NIFTI to identify specific transport interventions.

This SFRA has been carried out alongside NIFTI and seeks to identify potential negative environmental outcomes of the framework.

NIFTI has been developed to guide the future investment in land transport networks, which are fundamental for economic development. Transport supports liveable communities and connects families and friends. Investing in transport allows people to travel around the island, accessing amenities, employment and key public services such as healthcare and education.

The population of Ireland is projected to grow by 1 million people between 2018 and 2040. Most of this growth is expected to occur in Dublin and the wider Eastern and Midland region.

The NPF targets half of the growth in population between now and 2040 to take place in the Eastern and Midland region, with 25% within Dublin and its suburbs. The remaining half is to be shared between the Northern and Western, and Southern Regions. Half of population growth is targeted to take place in the five cities—Dublin, Cork, Limerick, Galway and Waterford—and half in towns, villages and rural areas.

With this target in mind, investment in transport can be expected to materialise in the form of significant new and improved highway and rail infrastructure.

4.2 Key Issues related to Flood Risk

The proposed investment in transport is likely to give rise to new and improved infrastructure links between urban cities, towns, and villages across Ireland in order to meet the potential Outcomes of NIFTI.

Such infrastructure has the potential to result in works including, but not limited to:

- New or modified river crossings including bridges and culverts;
- Ground raising or re-profiling near to watercourses and their natural floodplains;
- New infrastructure development resulting in extensive areas of reduced permeability;
- New or modified drainage networks to facilitate the construction of infrastructure;
- Increased reliance on existing drainage networks with limited capacity and future resilience.

Works of this nature have the potential to have an adverse impact on both flood risk and the natural environment. A national scale assessment of all sources of flood risk is set out below in Table 4-1.

Given this evaluation of flood risk, it is recommended that all schemes that sit under NIFTI are subject to a Flood Risk Assessment in line with the Planning System and Flood Risk management Guidelines for Planning Authorities. The initial assessment must be undertaken at the site / route selection stage of the relevant scheme and consider all sources of flood risk.
### Table 4-1 National scale assessment of sources of flood risk in relation to NIFTI

<table>
<thead>
<tr>
<th>Flooding Source</th>
<th>Potential Flood Risk Impact on NIFTI</th>
<th>Potential Flood Risk Effects from NIFTI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fluvial (Rivers)</td>
<td>• Inundation of transport infrastructure from construction of works in the floodplain leading to hazardous conditions for users and temporary closure&lt;br&gt;• Inundation of transport infrastructure from under sizing of bridge or culverted watercourse crossings&lt;br&gt;• Physical damage to transport infrastructure from flooding&lt;br&gt;• Physical damage to transport infrastructure from erosion e.g. scour at bridge crossings</td>
<td>• Increased flood risk to other receptors e.g. residential properties due to transport infrastructure intercepting and diverting floodwaters elsewhere&lt;br&gt;• Increased flood risk to other receptors due to under sizing of bridge or culverted watercourse crossings as part of transport infrastructure projects&lt;br&gt;• Adverse impact on existing flood risk management infrastructure leading to failure and flooding</td>
</tr>
<tr>
<td>Coastal (Sea)</td>
<td>• Inundation of transport infrastructure from construction of works in areas prone to coastal flooding leading to hazardous conditions for users and temporary closure&lt;br&gt;• Physical damage to transport infrastructure from flooding&lt;br&gt;• Physical damage to transport infrastructure from coastal erosion</td>
<td>• Increased flood risk to other receptors e.g. residential properties due to transport infrastructure intercepting and diverting floodwaters elsewhere&lt;br&gt;• Adverse impact on existing flood risk management infrastructure leading to failure and flooding</td>
</tr>
<tr>
<td>Pluvial (Rainfall)</td>
<td>• Inundation of transport infrastructure from overland runoff during extreme rainfall&lt;br&gt;• Inundation of transport infrastructure due to failure of its drainage infrastructure due to extreme rainfall</td>
<td>• Increased risk of flooding to other receptors from additional runoff generated from paved areas constructed on greenfield sites&lt;br&gt;• Increased risk of flooding to other receptors from ponding of surface water runoff by new transport infrastructure</td>
</tr>
<tr>
<td>Groundwater</td>
<td>• Inundation of transport infrastructure from construction of works in areas prone to groundwater flooding</td>
<td>• No significant impacts</td>
</tr>
<tr>
<td>Artificial Drainage</td>
<td>• Inundation of transport infrastructure from existing drainage networks that do not meet modern design standards or have been poorly maintained</td>
<td>• Increased risk of flooding from additional runoff discharging to existing drainage networks which do not have spare capacity</td>
</tr>
</tbody>
</table>

Specific risks to be considered at this stage include, but are not limited to, those outlined in Section 4.2.1 to 4.2.3.

#### 4.2.1 Infrastructure Creep in Flood Risk Zones

Expansion of existing infrastructure or the creation of new infrastructure could put pressure on flood risk zones. This may include encroachment onto the natural floodplain and associated loss of flood storage, alteration to flooding mechanisms and flow routes, and / or reduced conveyance of watercourses due to channel alterations or new / modified in-channel structures.
The Planning System and Flood Risk management Guidelines for Planning Authorities must be applied to ensure infrastructure development seeks to avoid areas of high or moderate flood risk (Flood Zone A or B) including consideration of climate change.

In exceptional circumstances, where this cannot be avoided, the development must be fully justified including determination of why alternative routes or sites that avoid these areas are not possible. In these circumstances, adequate mitigation measures, including compensatory flood storage, will be incorporated at the earliest stage and embedded into the design.

### 4.2.2 Increase in Surface Water Run-off

The expansion of transport infrastructure has the potential to increase surface water run-off rates due to the introduction of new impermeable areas. This run-off may increase flood risk locally or at a wider scale due to increased flows in receiving watercourses or storage areas.

New transport infrastructure should be implemented following the Flood Risk Management Guidelines and, where possible, permeable or semi-permeable areas adopted to avoid an increase in flood risk. Where this cannot be avoided, mitigation measures should incorporate best practice, including SuDS, to reduce flood risk and alleviate pressure on existing surface water drainage systems.

### 4.2.3 Increase in the vulnerability of infrastructure

The expansion of transport infrastructure has the potential to increase traffic flows and / or volumes on existing or upgraded infrastructure, and as such, increase the reliance on this infrastructure.

Whilst the Guidelines acknowledge that the existing urban structure of the country contains many urban centres and infrastructure located in areas that are already at risk of flooding, an increased reliance on such infrastructure increases the risk due to the additional impact associated with a flood event.

To ensure sustainable growth, in line with NPF, any schemes that sit under NIFTI will be required to incorporate works to increase resilience to flooding where existing infrastructure at risk is identified for use. Such works will be proportionate to the level of investment on the associated site or route.
5. **Flood Risk Assessment of NIFTI potential Outcomes and Investment Priorities**

The purpose of NIFTI is to ensure transport investment is aligned with the 10 National Strategic Outcomes set out in the Project Ireland 2040 vision. NIFTI has identified 4 potential Outcomes that are aligned with the NSOs, and so support the delivery of Project Ireland 2040. The NIFTI potential Outcomes are:

- **Outcome 1.** Delivering clean, low-carbon and environmentally sustainable mobility.
- **Outcome 2.** Supporting successful places and vibrant communities.
- **Outcome 3.** Facilitating safe, accessible, reliable and efficient travel on the network.
- **Outcome 4.** Promoting a strong and balanced economy.

In addition, four key investment priorities that have been identified to ensure that the transport sector plays its part in delivering Project Ireland 2040. These are:

- **Investment Priority 1.** Decarbonisation.
- **Investment Priority 2.** Protection and Renewal.
- **Investment Priority 3.** Mobility of People and Goods in Urban Areas.
- **Investment Priority 4.** Enhanced Rural and Regional Connectivity.

5.1 **Implementation of Sequential Approach**

The Planning System and Flood Risk Management Guidelines identifies the Sequential Approach when planning projects. The sequential approach should be applied at the earliest stages to all projects undertaken under the NIFTI framework.

This section sets out guidance in the application of the sequential approach to future investments under NIFTI to ensure that the potential for significant adverse impacts on flood risk are avoided, and opportunities to create betterment are identified and embedded at the earliest opportunity.

Guidance on decision making criteria under each step of the sequential approach is set out below. It is designed to complement the existing Guidelines and not replace them. All schemes will be required to demonstrate the requirement of the proposed investment and option selection in accordance with criterion in Step 1: Avoid prior to progress through Step 2 to 5.
### Table 5-1 Decision-making criteria under the Sequential Approach for schemes under NIFTI

<table>
<thead>
<tr>
<th>Step</th>
<th>Criterion</th>
<th>Description</th>
<th>Applicable Potential Outcome</th>
<th>Applicable Investment Priority</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1: Avoid</strong></td>
<td>1.1</td>
<td>Opportunities to avoid areas of flood risk (either in full or in part), including those vulnerable to climate change, have been identified and ruled in or out as necessary during the shortlist of options / routes.</td>
<td>1, 3</td>
<td>2, 4</td>
</tr>
<tr>
<td></td>
<td>1.2</td>
<td>An initial assessment of the impact of the development on flood risk elsewhere has been undertaken and appropriately considered in the selection of the preferred option / route.</td>
<td>1, 4</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>1.3</td>
<td>Existing and future flood resilience has been assessed and factored into the business case and selection of the preferred option / route.</td>
<td>3</td>
<td>1, 2, 4</td>
</tr>
<tr>
<td></td>
<td>1.4</td>
<td>The scheme demonstrates compatibility with the Climate Action Plan, with particular reference to the Transport and Flood Risk Management Sectoral Adaptation policies, is set out to ensure sustainable growth.</td>
<td>1, 3</td>
<td>1, 2, 4</td>
</tr>
<tr>
<td></td>
<td>1.5</td>
<td>The scheme demonstrates compatibility with existing and planned flood relief schemes and other measures as set out in the respective Flood Risk Management Plans and, where possible, should help facilitate their implementation.</td>
<td>2, 3</td>
<td>2, 4</td>
</tr>
<tr>
<td><strong>Step 2: Substitute</strong></td>
<td>2.1</td>
<td>The design of the scheme demonstrates appropriate zoning to minimise the susceptibility of Highly Vulnerable infrastructure.</td>
<td>2, 3</td>
<td>2, 3</td>
</tr>
<tr>
<td></td>
<td>2.2</td>
<td>The type, elevation and alignment of infrastructure has been designed to increase flood resilience where possible to reduce impacts.</td>
<td>1, 3</td>
<td>2, 4</td>
</tr>
<tr>
<td></td>
<td>2.3</td>
<td>Where existing transport infrastructure is being used, protected, and / or renewed, measures to improve resilience and reduce existing flood risk have been considered.</td>
<td>1, 2, 3, 4</td>
<td>1, 2, 3, 4</td>
</tr>
</tbody>
</table>
### Step 3: Justify

| 3.1 | The scheme land has been zoned or otherwise designated, demonstrating compatibility with the National Spatial Strategy, regional planning guidelines, and statutory plans including relevant Local Authority Development Plans. | 2, 3 | 2, 3 |
| 3.2 | The need for the scheme, including mode of transport, is demonstrated and justified by a robust business case and meets the wider potential outcomes and investment priorities of NIFTI. | 1, 2, 3, 4 | 1, 2, 3, 4 |
| 3.3 | The initial Flood Risk Assessment carried out demonstrates that flood risk can be managed with or without mitigation measures and will not cause unacceptable adverse impacts elsewhere. | 3, 4 | 1 |

### Step 4: Mitigate

| 4.1 | Measures to not only mitigate but also further reduce existing and future flood risk have been incorporated where appropriate and economically viable (hereafter considered within “mitigation measures”). | 1, 2, 3, 4 | 1, 2, 3, 4 |
| 4.2 | Mitigation measures have been designed and embedded into the scheme design to ensure adverse impacts associated with all sources of flood risk have been addressed. | 3 | 1 |
| 4.3 | Mitigation measures proposed demonstrate consideration of sustainable development over the entire design life, particularly in relation to performance, carbon, operation / maintenance, and protection of the wider natural environment. | 1, 4 | 1, 2, 4 |
| 4.4 | A comprehensive flood risk assessment has proven that all reasonable steps have been taken to ensure no adverse impact, regardless of acceptability. | 3, 4 | 1 |
| 4.5 | The performance of mitigation measures in the design flood event, and in an exceedance event, have been reviewed to minimise the duration and extent of disruption to the transport network. | 3, 4 | 2, 3, 4 |

### Step 5: Progress

| 5.1 | Adherence to these criteria has been reviewed and approved by an authorised person within the client organisation. | 1, 2, 3, 4 | 1, 2, 3, 4 |
| 5.2 | A robust and comprehensive flood risk assessment, in line with appropriate guidance and legislation, is produced demonstrating the above criteria have been successfully met. | 1, 2, 3, 4 | 1, 2, 3, 4 |
| 5.3 | All required mitigation measures are dealt with in the pre-application stage and form an integral part of the development proposal and planning application. | 1, 2, 3, 4 | 1, 2, 3, 4 |
| 5.4 | All necessary consents have been applied for and secured including, but not limited to Section 9 (Modification or Relocation of Watercourse, Embankment or Other Works) and Section 50 (Construction or Alteration of Bridges and Culverts) application under the Arterial Drainage Act 1945 and Arterial Drainage Amendment Act 1995 respectively. | 1, 2, 3, 4 | 1, 2, 3, 4 |
6. Conclusion

NIFTI will set out DoT’s strategy for the development and management of Ireland’s land transport network over the next two decades. Investments in transport networks and services and therefore, the policies that drive these investments, can impact on the water environment. Failure to properly assess flood risk in previous land use strategies has caused economic, social and environmental issues due to land in unsuitable locations being developed without appropriate consideration to flood risk and flood risk mitigation.

Furthermore, the Sectoral Adaptation Plan for Transport (which sits under the 2019 Climate Action Plan), identifies the increase in extreme precipitation levels and sea level rise and associated increase in flooding as a high priority risk to the transport sector and the future resilience.

This SFRA has identified that NIFTI, and infrastructure projects that sit beneath it, have the potential to result in significant adverse impacts on flood risk without appropriately considered development and mitigation. These issues relate primarily to infrastructure creep in flood zones, increased surface water runoff, and an increase in the vulnerability of the transport network.

NIFTI acknowledges this challenge and the potential Outcomes and Investment Priorities of NIFTI set out a clear ambition to direct future investments down a more sustainable path. This includes the desire to protect and renew existing transport networks to increase resilience, adapt to climate change, and establish a reliable and environmentally sustainable network.

The Planning System and Flood Risk Assessment Guidelines (2009) published by the Office of Public Works in conjunction with the Department of Housing, Planning and Local Government moves towards managing the appropriateness of developments in the context of flood risk management. However, these are not explicit to the transport industry, nor do they place particular onus on the developer to increase resilience of existing infrastructure where new development in itself does not give rise to an increased risk.

This SFRA sets out a list of criteria against which future investments under NIFTI will be assessed. It is designed to complement the existing Guidelines and not replace them. These criteria are aligned to the sequential approach and will ensure that the potential for significant adverse impacts on flood risk are avoided. The purpose of this is to ensure a robust and comprehensive assessment of flood risk is undertaken and is at the forefront of future decision-making to facilitate sustainable development.

It should be noted that this SFRA must be revisited intermittently during the implementation period of NIFTI to ensure it remains up to date and considers future changes to policy and legislation.