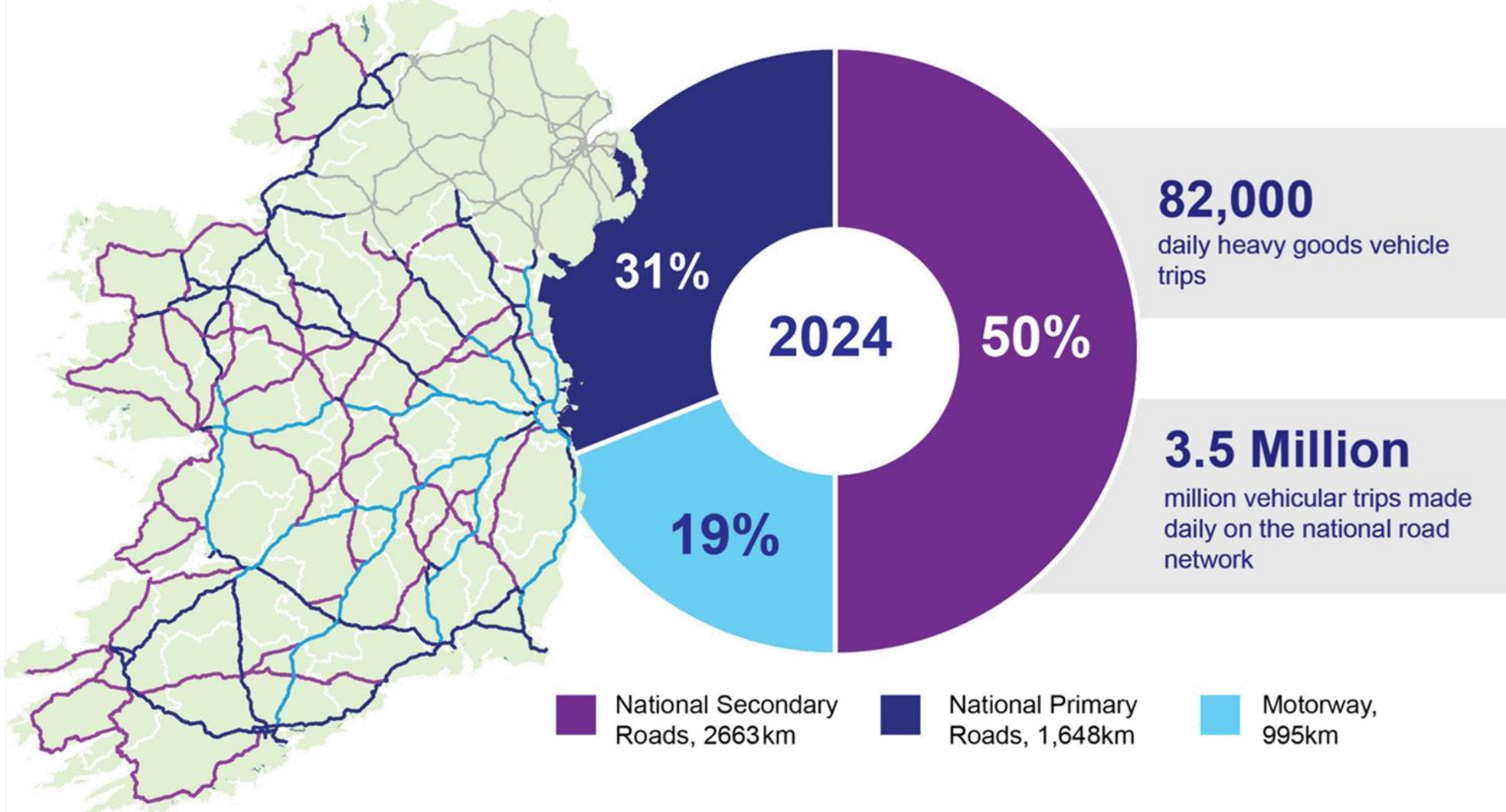


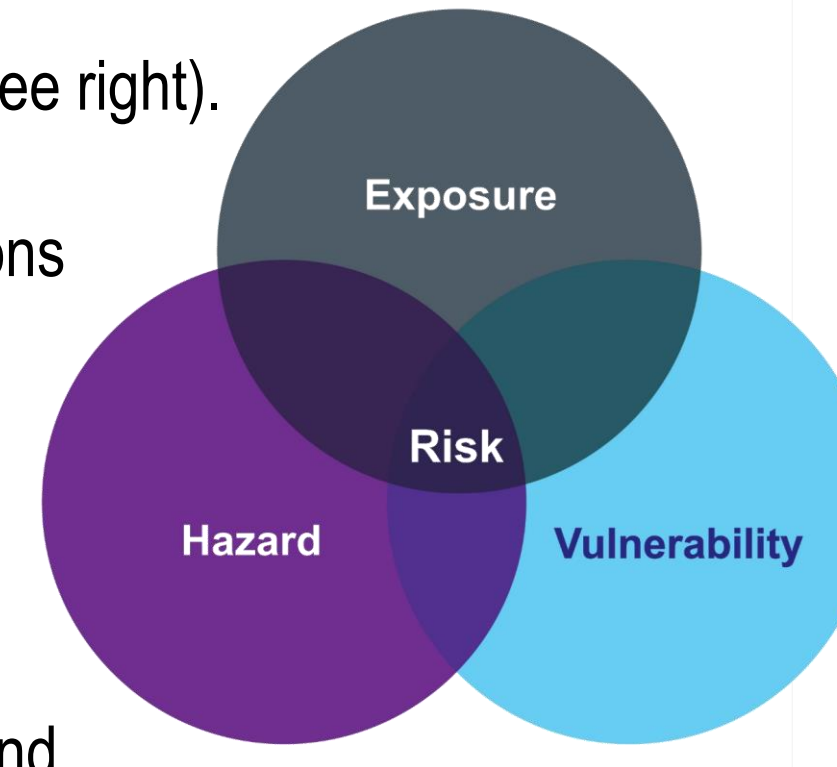
The National Roads network in Ireland

Transport Infrastructure Ireland (TII) is responsible for the planning, development, operation and maintenance of Ireland's National Roads, comprising nearly 5,300 km of network.



A risk-based approach to climate resilience

The Plan adopts a risk-based framework (see right). Risk provides a robust foundation for understanding where adaptation interventions may be required. Climate projections have been used to determine whether assets are exposed to a hazard and how they may be impacted in future scenarios and time periods. Representative Concentration Pathways (RCPs) RCP4.5 and RCP8.5 have been used, aligned with international best practice. The Plan is therefore considered robust and resilient under a range of future climates.



However, moving from risk assessment to implementation requires a set of practical criteria for prioritising sites for investment in both the short, immediate and long-term (see below).

Adaptation cost estimates under uncertainty

Ireland's *Transport Sectoral Adaptation Plan (T-SAP II)* requires TII to account for the costs of climate change and factor them into operational costs and business cases for adaptation. Globally, development of **costing methodologies for adaptation measures remains limited and immature**. This is due to several interrelated factors, including:

- Variability and unpredictability of future climate impacts.
- Site-specific conditions across the National Roads network.
- Range of potential adaptation measures and policy choices.
- Limited precedent and guidance available in the emerging field of climate adaptation costing.
- Selection of the appropriate physical measure and then the associated design, procurement and construction costs.

TII developed an internal *Climate Adaptation Costing Methodology* to bring greater accuracy and reliability of cost estimates across TII's suite of adaptation workstreams. Cost estimates are based on staff availability, expertise and the duration required to complete various tasks.

Reassessing the cost profile at optioneering

The adaptation measures set out in the Plan focus on enabling measures that will support improved identification of the physical measures that will define future iterations of the Plan, with the first review scheduled for 2028. Given that physical measures are contingent upon the progress or completion of enabling measures, **cost estimates for climate adaptation works will be further refined as the Plan evolves**. As the Plan progresses, and proposed measures move through the project lifecycle, the level of uncertainty will reduce, improving accuracy and reliability of cost profiles.

The need for climate adaptation

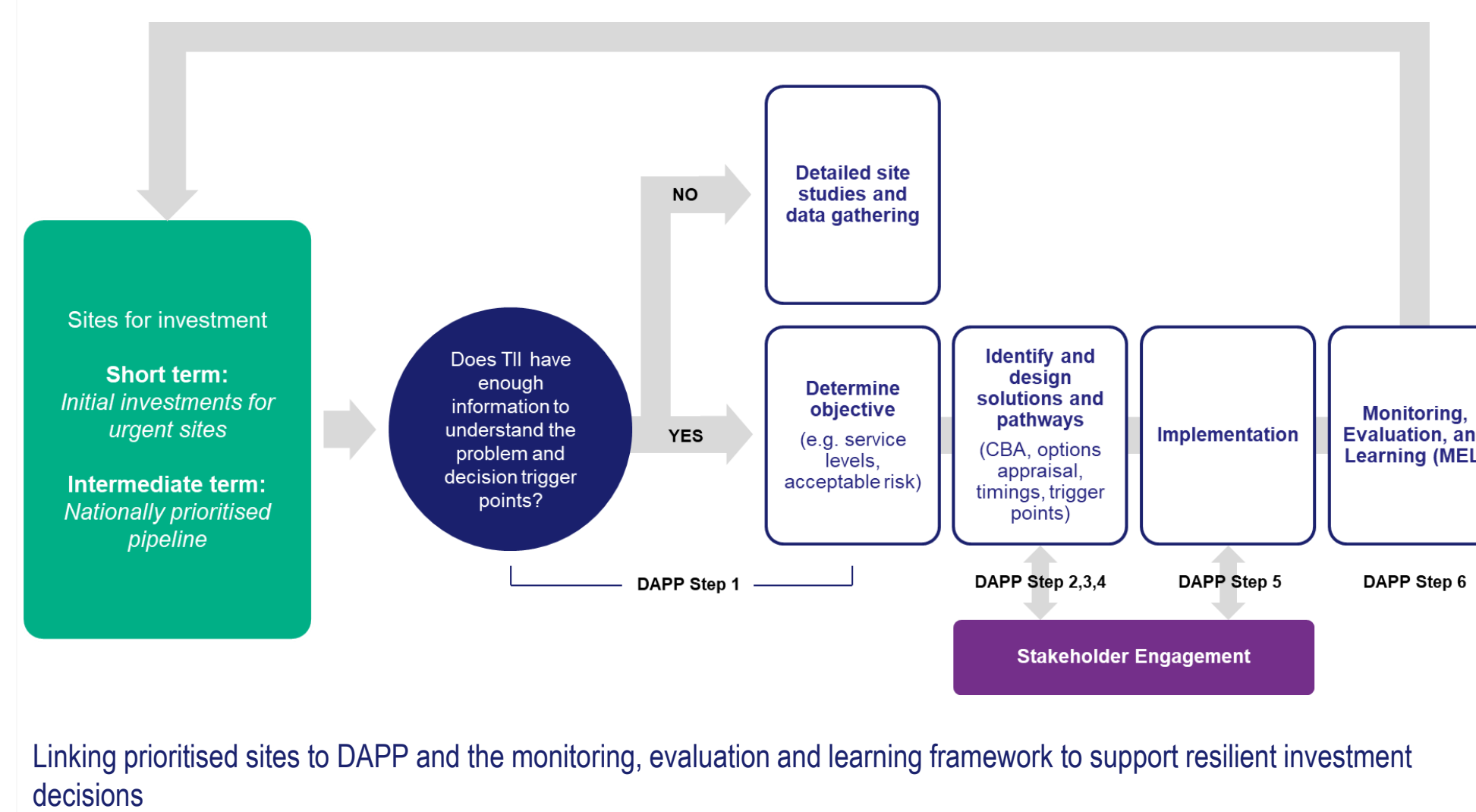
Ireland's climate is changing. The country is, and will continue to, experience more severe weather including flood events, intense rainfall, earthworks instability, higher temperatures and rising sea levels (below). **The National Roads network was not designed or built to perform under these emerging conditions**. TII faces increasing challenges from climate change impacts, exacerbating by ageing infrastructure, asset deterioration and rising demand. Given this and other safety, reputational and environmental impacts, it is essential for TII to assess and manage its climate risks.

Extreme weather events cause an estimated **€1.8 billion** in annual damage to Europe's road infrastructure, a figure expected to rise by **20% by 2050**.

Recent weather-related incidents on the National Roads network, clockwise from left: Flooding on the M11, 2013; Landslide at Moll's Gap, 2016; Retaining walls works at Caha which failed in 2020 and were remediated in 2021



Recent weather-related incidents on the National Roads network, clockwise from left: Flooding on the M11, 2013; Landslide at Moll's Gap, 2016; Retaining walls works at Caha which failed in 2020 and were remediated in 2021



Proposed measures

The Plan sets out 20 individual adaptation measures, covering the following seven groups:

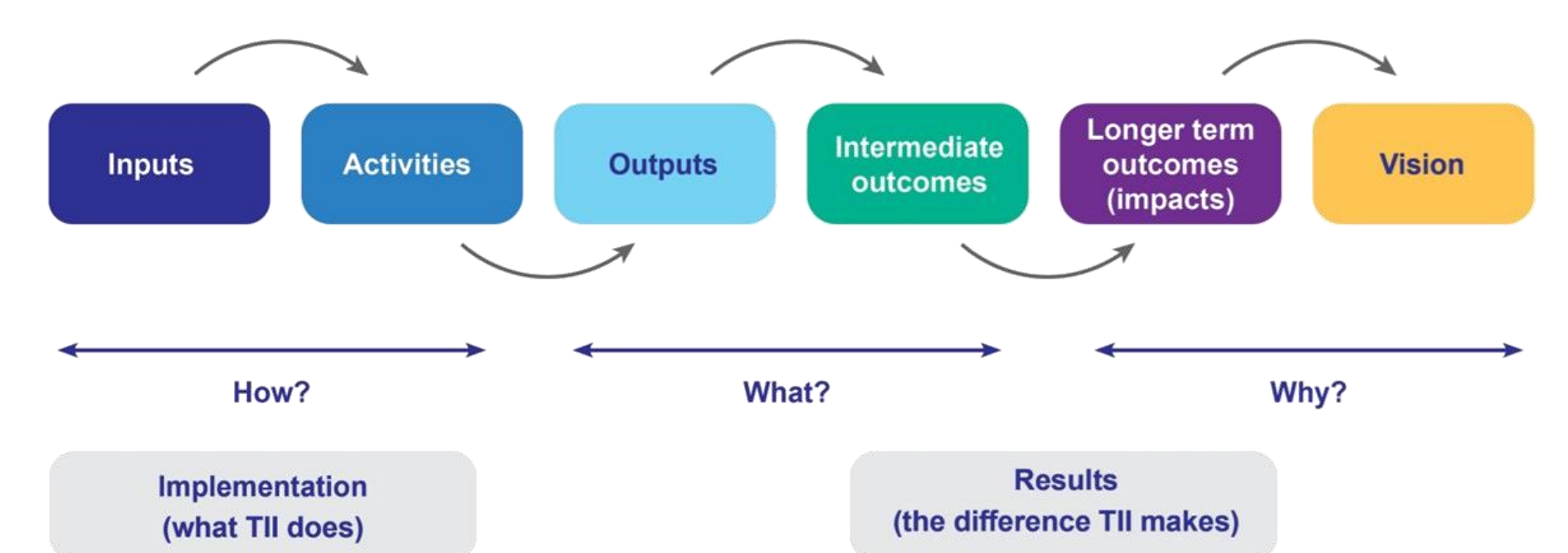


The Plan acknowledges that the National Roads network does not operate in isolation and may affect other sectors, organisations and projects. To ensure the proposed measures are not maladaptive for infrastructure, services and agencies that intersect with National Roads, **TII is committed to the stakeholder collaboration necessary for success**. Each individual measure identifies Local Authorities, private organisations and other State agencies that either have a role in managing, or interact with, the National Roads network and outline the necessary communication and engagement with these stakeholders to ensure their effective delivery.

Monitoring, evaluation and learning

The Plan outlines a monitoring, evaluation and learning (MEL) framework to support effective, accountable and adaptive implementation of climate resilience strategies. This aligns with the DAPP principles, which emphasise the ongoing monitoring of key indicators to inform reassessment and timely adjustments.

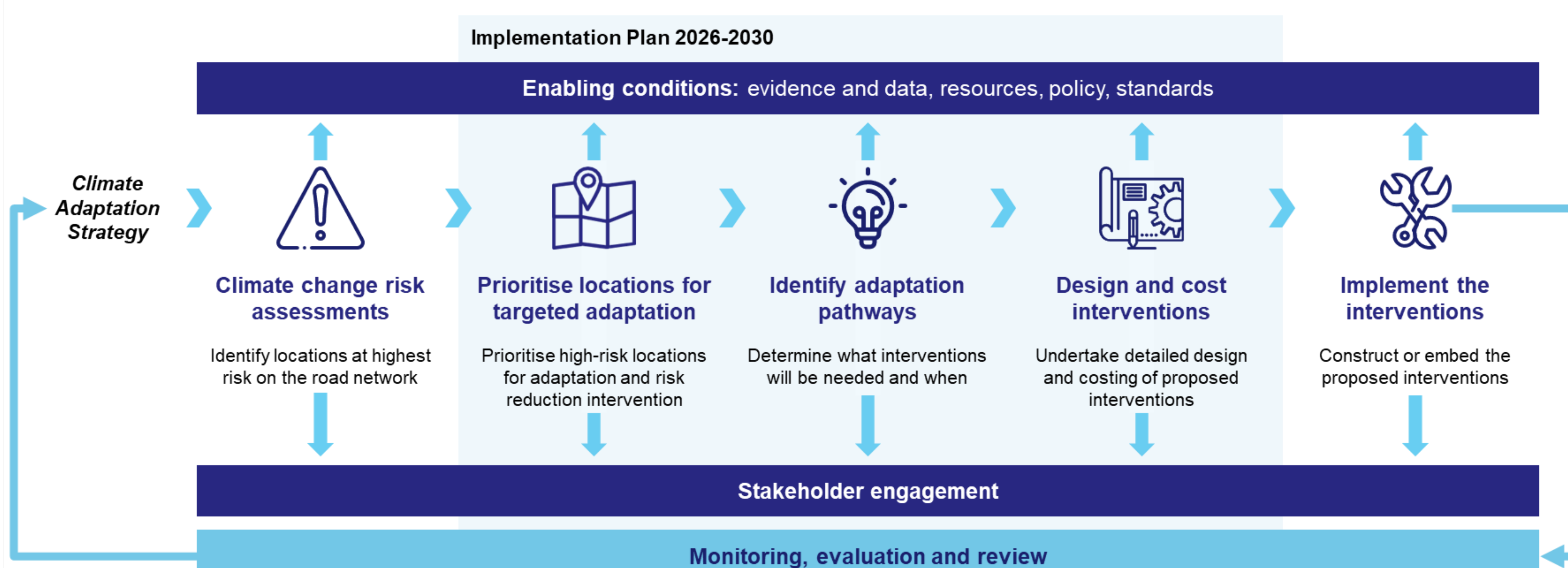
The development of the MEL framework requires the relationships between inputs, measures, outputs, outcomes and impacts to be clearly mapped and relationship understood for the successful delivery of TII's vision, as shown below.



Conceptual overview of the monitoring framework

TII's approach to adaptation planning

TII's *Climate Adaptation Implementation Plan for National Roads* has been developed at an operational level to support and advance the goals set out in their *Climate Adaptation Strategy*. The Plan outlines TII's approach to strengthening the resilience of the National Roads network by investing in increased data collection and interpretation, standards reviews, improving processes and increasing institutional capacity – **the enabling conditions that allow climate risks to be understood, managed and integrated into decision-making**. This will allow TII to deliver targeted infrastructure interventions and enhanced operational capacity at specific locations where the National Roads network is most exposed and vulnerable to climate hazards. The Plan prioritises early-stage measures that strategically enhance TII's understanding of climate hazards, risks and vulnerabilities. TII aims to strengthen the evidence base for informed decision-making and lay the groundwork for more targeted future interventions, as shown below.



TII's approach to climate adaptation on the National Roads network

The exact timing, severity and spatial distribution of future climate hazards is uncertain. Adaptation planning must accommodate a range of possible futures and retain flexibility to adjust decisions over time as more information arises. A Dynamic Adaptive Policy Planning (DAPP) approach was used to develop the Plan. The Plan incorporates road network **criticality to support prioritisation**. Not all sections of the National Roads network contribute equally to network functionality, economic performance or community access. TII's internal assessment of criticality (which is still evolving) and the published *National Roads 2040* informed the Plan's understanding of physical and functional importance, as well as social importance.

Conclusion and next steps

The measures within the Plan will help ensure Ireland's National Roads network is more resilient to severe weather and climate change. It demonstrates the need for climate adaptation funding and a coordinated approach to climate adaptation costing. **The Plan is intended to be a 'live' and evolving document**, allowing an adaptive approach to proposed measures and priorities depending on the context of the specific project, or in response to the evolution of climate science, engineering approaches and technological solutions.

The success of the Plan is contingent on adequate funding for climate adaptation activities. The effectiveness of the measures set out in this Plan will be compromised without adequate funding allocation. Progress has, however, been made at a national level in Ireland in terms of introducing funding mechanisms to support investment in climate-related activities with the establishment of the *National Development Plan* and *Transport Sectoral Adaptation Plan*.

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Scan to read the published *Climate Adaptation Implementation Plan for National Roads* on TII's website