

# Leitrim County Council

## Climate Change Risk Assessment



KPMG  
Sustainable  
Futures

LACAP

Final Report  
23<sup>rd</sup> January 2023



Future Analytics

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# Executive Summary

# Executive Summary

## Context and Scope of this Report

Climate change poses a critical challenge for Leitrim County Council. It will result in a wide range of impacts across Leitrim, from damaging infrastructure such as roads and bridges, to uncontrolled fires and limits on water supply. These bring substantial implications for Leitrim County Council.

Internationally, national and local governments are increasingly compelled to take ambitious action to increase resilience to climate change within their organisations and their functional areas through adaptation and mitigation measures.

Ireland's Climate Action and Low Carbon Development (Amendment) Act, 2021 highlights the role of the Local Authority in meeting national emission reductions targets and achieving climate resilience. The Act stipulates that local authorities need to prepare a Local Authority Climate Action Plan (LACAP) that will drive local response to the challenges posed by climate change, translating the national climate policy to the local level.

This report provides an assessment of Leitrim's climate change risks and impacts on the delivery of services by Leitrim County Council. The aim of the report is to provide the evidence base and inform the development of the LACAP for Leitrim County Council.

## Key Results and Findings

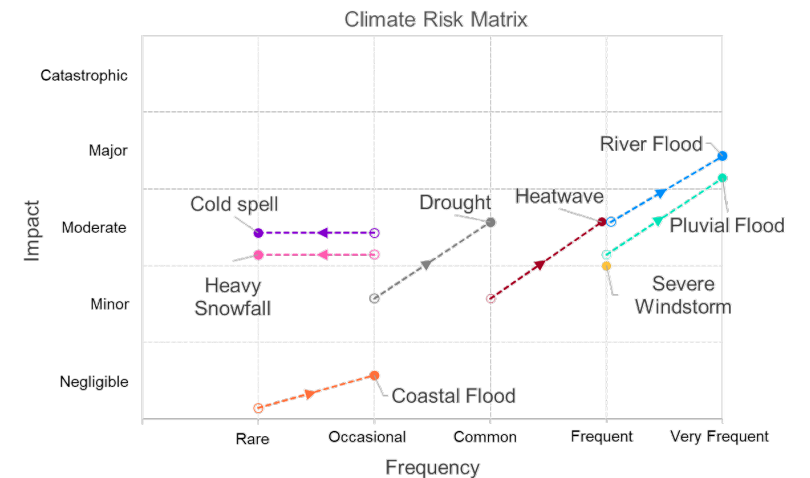
As illustrated in the climate risk matrix on the right the frequency and intensity of some hazards (e.g., river and

pluvial flooding, heatwaves and drought) will increase while others will remain the same (e.g., severe windstorms) with decreases expected for some hazards (e.g., cold spells and heavy snowfall).

- **Cold spells and heavy snowfalls** have a wide range of impacts across Leitrim, resulting in amongst others transport disruption and damage to critical infrastructure (e.g., roads and water). Projected increases in average temperature and decreases in the frequency of snowfall indicate a decrease in the frequency of cold spells and heavy snowfall and associated impacts.
- Recent experiences of **surface water and riverine flooding** events in 2020, 2021 and 2022 demonstrate the impacts for Leitrim including damage to bridge infrastructure, inundation of buildings and transport disruption. Projected increases in the frequency of extreme precipitation events will result in increased surface water and riverine flood risk for Leitrim.
- **Heatwaves and droughts** have resulted in damage to road surfaces across Leitrim, contributed to the development of uncontrolled fires and the imposition of restrictions on water supply. Projected increases in the frequency of heatwaves and in the frequency of drought conditions will mean that events currently experienced on an infrequent basis will become more frequent. As the population ages, there will also be an increase in the number of vulnerable people exposed.
- **Severe windstorms** are experienced on a frequent basis in Leitrim with wide ranging impacts, projections indicate no significant change in their frequency.

- Leitrim has 4.6 km of coastline, and impacts associated with **coastal flooding** are currently limited. However, projected sea level rise for the region will mean that impacts related to coastal flooding will become more frequent and impactful.

To increase resilience and through the LACAP, Leitrim County Council will need to proactively plan for and adapt to the current and future climate change risks identified through this report.



The risk matrix above shows the current and future level of risk associated with climate hazards for Leitrim. The hollow marker showing the current level of risk and the solid marker the future level of risk. The dotted line shows the change between the current and future risk.

02

# Introduction

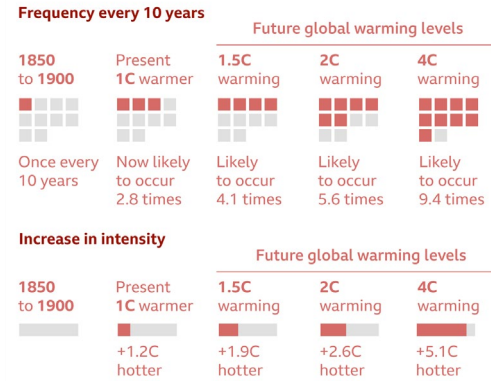


# Global Response to the Challenge of Climate Change

## Global Climate Change Challenge

### Extreme heat becomes more frequent

Projected increase in frequency and intensity of high temperatures which only occurred once in every 10 years on average in a climate without human influence



It is unequivocal that human influence has warmed the atmosphere, land and ocean since pre-industrial times, affecting many weather and climate extremes in every region across the globe. Each of the last four decades have been successively warmer than any decade preceding it since 1850.

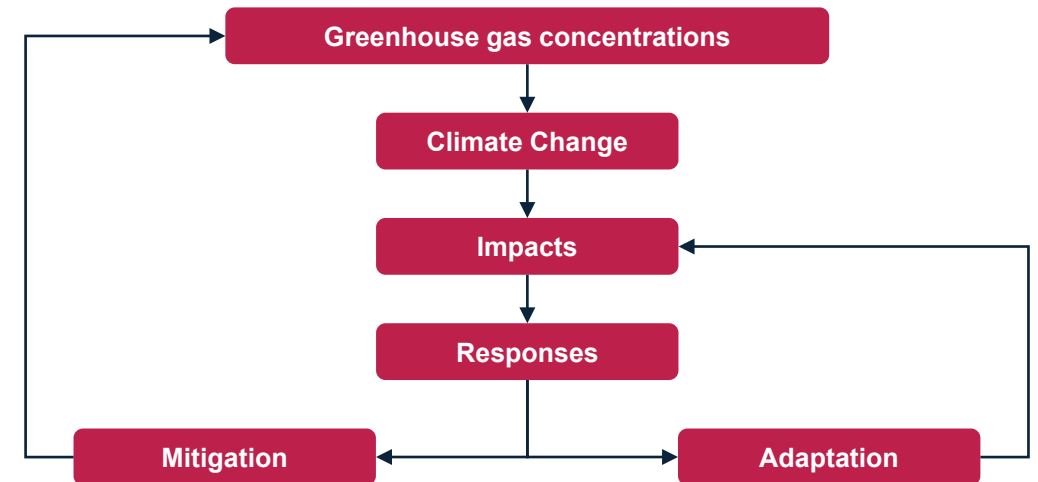
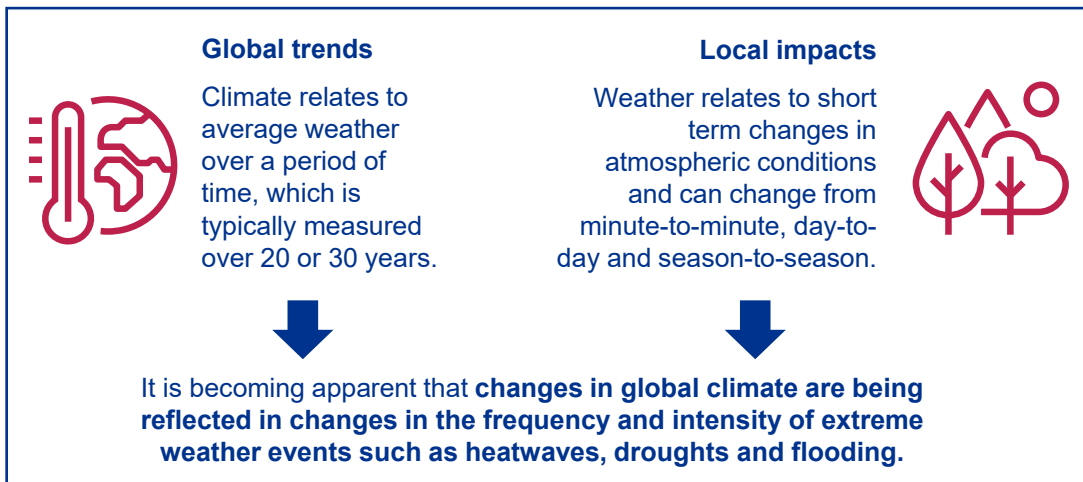
Since 1990, the IPCC have published a series of assessment reports which provide a synthesis of the most up-to-date science and evidence of climate change. The most recent assessment report shows that the global average temperatures have increased by 1.1°C when compared with pre-industrial conditions (1850-1900).

## Global Climate Change Response Framework

In response to the challenges posed by climate change, two complementary approaches are being adopted.

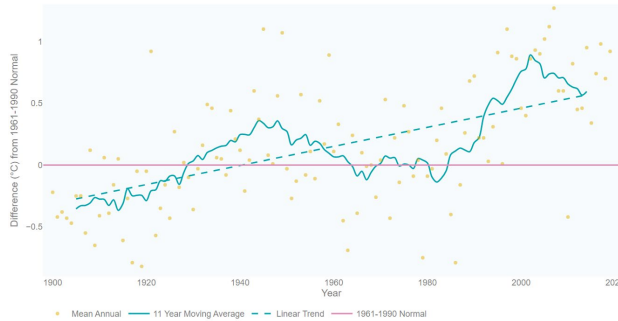
**Mitigation:** Making the impacts of climate change less severe by preventing or reducing the emission of greenhouse gases (GHG) into the atmosphere. Mitigation is achieved either by reducing the sources of these gases (e.g. by increasing the share of renewable energies, or establishing a cleaner mobility system), or by enhancing the storage of these gases (e.g. by increasing the size of forests). In short, mitigation is a human intervention that reduces the sources of GHG emissions and/or enhances the sinks.

**Adaptation:** Anticipating the adverse effects of climate change and taking appropriate action to prevent or minimise the damage they can cause, or taking advantage of opportunities that may arise. Examples of adaptation measures include large-scale infrastructure changes, such as building defences to protect against sea-level rise, as well behavioural shifts, such as individuals reducing their food waste. In essence, adaptation can be understood as the process of adjusting to the current and future effects of climate change.



# Ireland's Challenge of Climate Change

## Observed Impacts of Climate Change on Ireland



The mean annual observed temperature for Ireland (1900-2019) Source: Cármaro García and Dwyer, (2021)

According to the Environmental Protection Agency (EPA) Ireland's climate is changing in line with global trends, with a temperature increase of, on average, by 0.8 Celsius. Since the 1980s, each successive decade has been warmer than any preceding since 1850. In the mean time, the island has seen an increase in average annual national rainfall of approx. 5% in 1981-2010, compared to 1961-1990. Concurrently, the rate of global sea level rise for 2006/2015 is about 2.5 times the rate of 1901-1990.



- Surface air temperature has increased, on average, by 0.9 Celsius during the past 120 years.



- Yearly precipitation was, on average, 6% higher in the 30 years from 1989-2018 as compared to 1961-1990.
- 2006 to 2015 was shown to be the wettest in Ireland since records began.



- Due to limited analysis, no long-term wind trends have been observed.



- There has been a rise in sea level of approximately 2-3 mm per annum since 1990.
- Sea temperature at Malin Head has been, on average, 0.47 Celsius over the past years as compared to the period 1980 to 2001.

## Projected Impacts of Climate Change on Ireland

Climate projections suggest that these observed impacts will continue and likely worsen into the future. It is expected that Ireland's climate will become warmer and drier out towards 2050, its sea levels will continue to increase at a faster rate and its extreme weather events will occur more frequently. Even if mitigative action is taken over the next 30 years, certain projected impacts are locked in for the foreseeable future as a result of past actions, and surface temperatures will increase globally until at least 2050, even under low emissions scenarios



- By 2050, average annual temperatures are expected to increase by 1-1.2 Celsius under an intermediate emissions scenario.
- Heatwave events are set to increase, with an expected extra 1-8 heatwave events between 2041 to 2060 under an intermediate emission scenario.



- Summer precipitation levels are expected to decrease by a maximum 0-11% under an intermediate emissions scenario.
- During winter and autumn months, there is expected to be an increase of 5-19% in the occurrence of heavy precipitation events.



- Projections indicate a small reduction in wind speed of between 1-2.7% under an intermediate emissions scenario.
- There is an expected easterly extension of severe windstorms across Ireland.



- The expected average global sea level rise by the year 2100, under an intermediate emissions scenario, is between 0.44-0.76 metres.
- Projections indicate that the Irish Sea could warm by a further 1.9 Celsius before the end of the 21st Century

# National and Local Response

## Paris Agreement, 2015

The Paris Agreement, adopted in 2015 provides an internationally accepted and legally binding global framework to addressing climate change challenges. It has two clearly defined goals aimed at supporting progressive and ambitious climate action to avoid dangerous climate change:

- I. holding global average temperature increase to well below 2°C and pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels (i.e. **mitigation**);
- II. increasing the ability to adapt to the adverse impacts of climate change and foster climate resilience (i.e. **adaptation**).

## European Climate Law, 2021

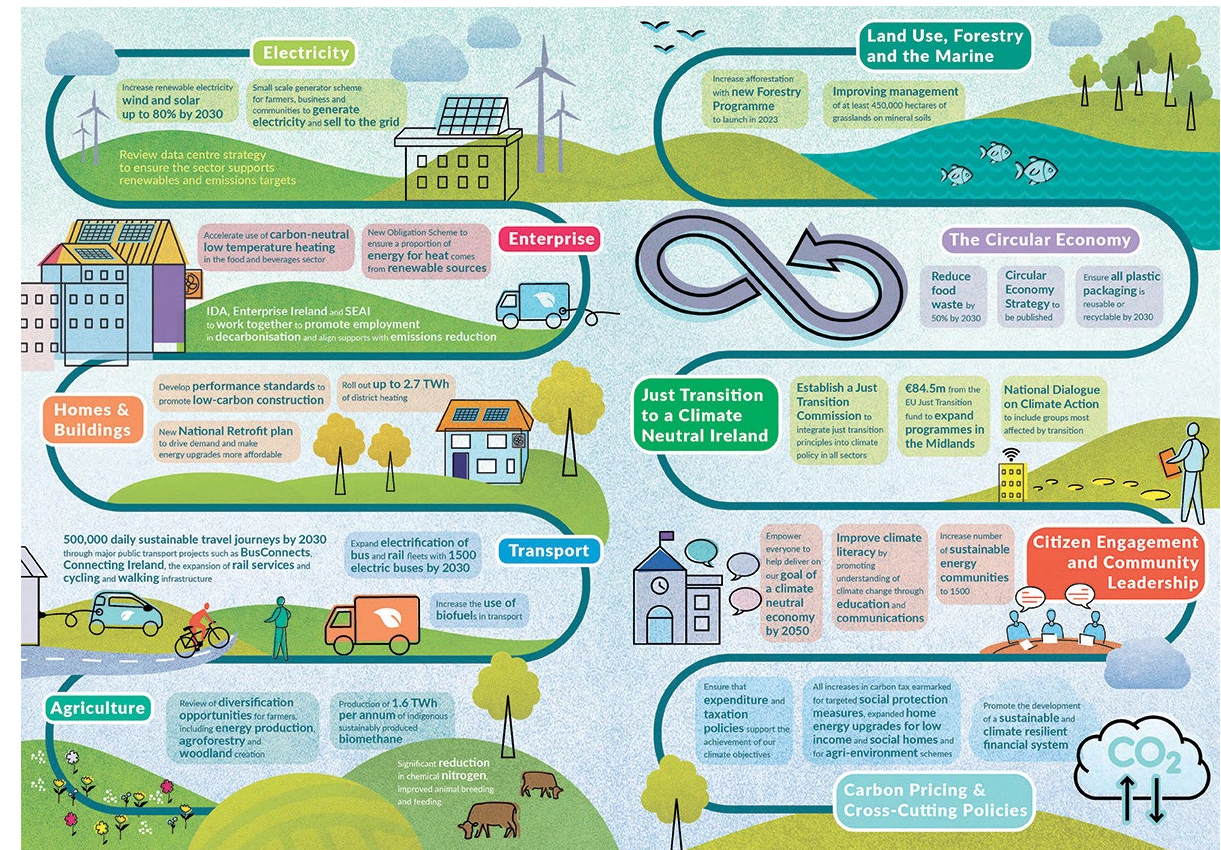
The EU adopted a legislative proposal for the European Climate Law in June 2021 to frame the climate neutrality objective by 2050 across the EU with an intermediate target of **reducing net greenhouse gas emissions by at least 55% by 2030**. The European Commission (EC) is clear in the commitment required by all Member States, and the use of all policy levers and instruments, to fight against the urgent challenge of climate change and to activate leadership efforts to reach climate neutrality by 2050.

## Climate Action and Low Carbon Development (Amendment) Act, 2021

Climate policy in Ireland reflects the ambition of the EU and that required to confront the challenges of climate change. The Climate Action and Low Carbon Development (Amendment) Act, 2021 frames Ireland's legally binding climate ambition to delivering a **reduction in greenhouse gas emissions of 51% by 2030**, to achieve climate neutrality by the end of 2050.

Through progressive economy-wide carbon budgets, sectoral ceilings, a suite of strategies devised to promote a **combination of adaptation and mitigation measures**, and robust oversight and reporting arrangements, climate policy is working to scale up efforts across all of society and deliver a step change on ambitious and transformative climate action to 2030 and beyond to 2050.

## Climate Action Plan 2021- Infographic





# Project Overview



## Legislative context

Climate Policy in Ireland is aligned with the EU's ambitions to combat Climate Change. The Climate Action and Low Carbon Development (Amendment) Act 2021 enshrines the National Climate Objective to “pursue and achieve, by no later than the end of 2050, the transition to a climate resilient, biodiversity rich, environmentally sustainable and climate neutral economy.”

The importance of place-based approaches and the role of the Local Authority is highlighted in the Act, which stipulates that “each local authority shall prepare and make a plan relating to a period of five years (in this section referred to as a ‘local authority climate action plan’) which shall specify the **mitigation measures** and the **adaptation measures** to be adopted by the local authority.”

These plans will drive the mitigation and adaptation measures at the local level and see Local Authorities translate national climate policy to local circumstances and to support the delivery of the National Climate Objective at local and community levels.



## Preparing local authorities' climate action plans

To support local authorities in meeting their legislative requirements, the Climate Action Regional Offices (CAROs) developed the draft Local Authority Climate Action Plan (LACAP) Guidelines.

These guidelines structure the development and implementation of climate action plans (CAPs) around a 4-step cycle, which is supported by four technical annexes<sup>1</sup>:

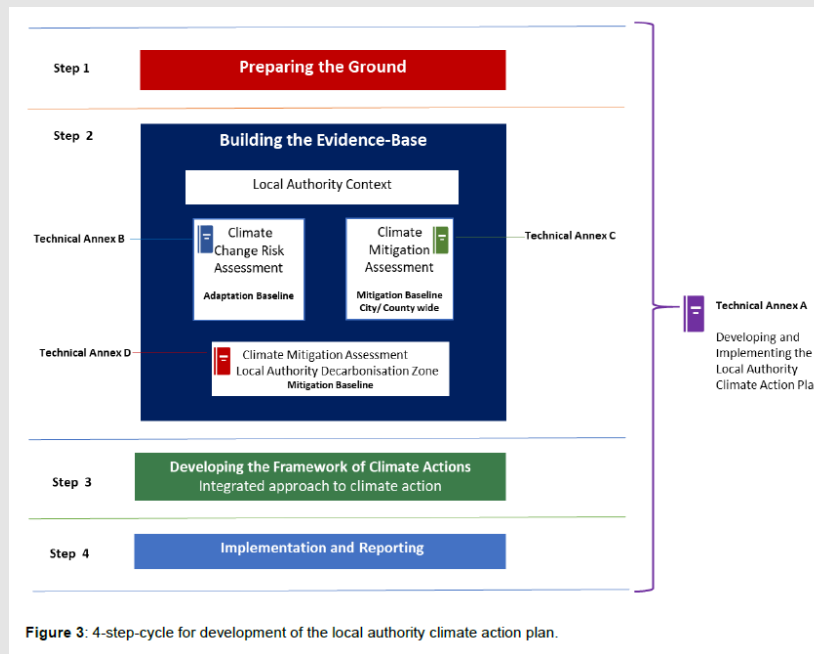


Figure 3: 4-step-cycle for development of the local authority climate action plan.

<sup>1</sup> Source: *Local Authority Climate Action Plan Guidelines*, page 5.



## Scope of this report

Per Leitrim County Council's request, the KPMG team is supporting the council in Step 2 to build the adaptation baseline and develop a climate change risk assessment (CCRA) following **Technical Annex B of the LACAP Guidelines** in order to understand the current and future risks posed by climate change to County Leitrim and Leitrim County Council.

03

# Climate Change Risk Assessment (CCRA)



# 3.1 Introduction, Scope and Methodology

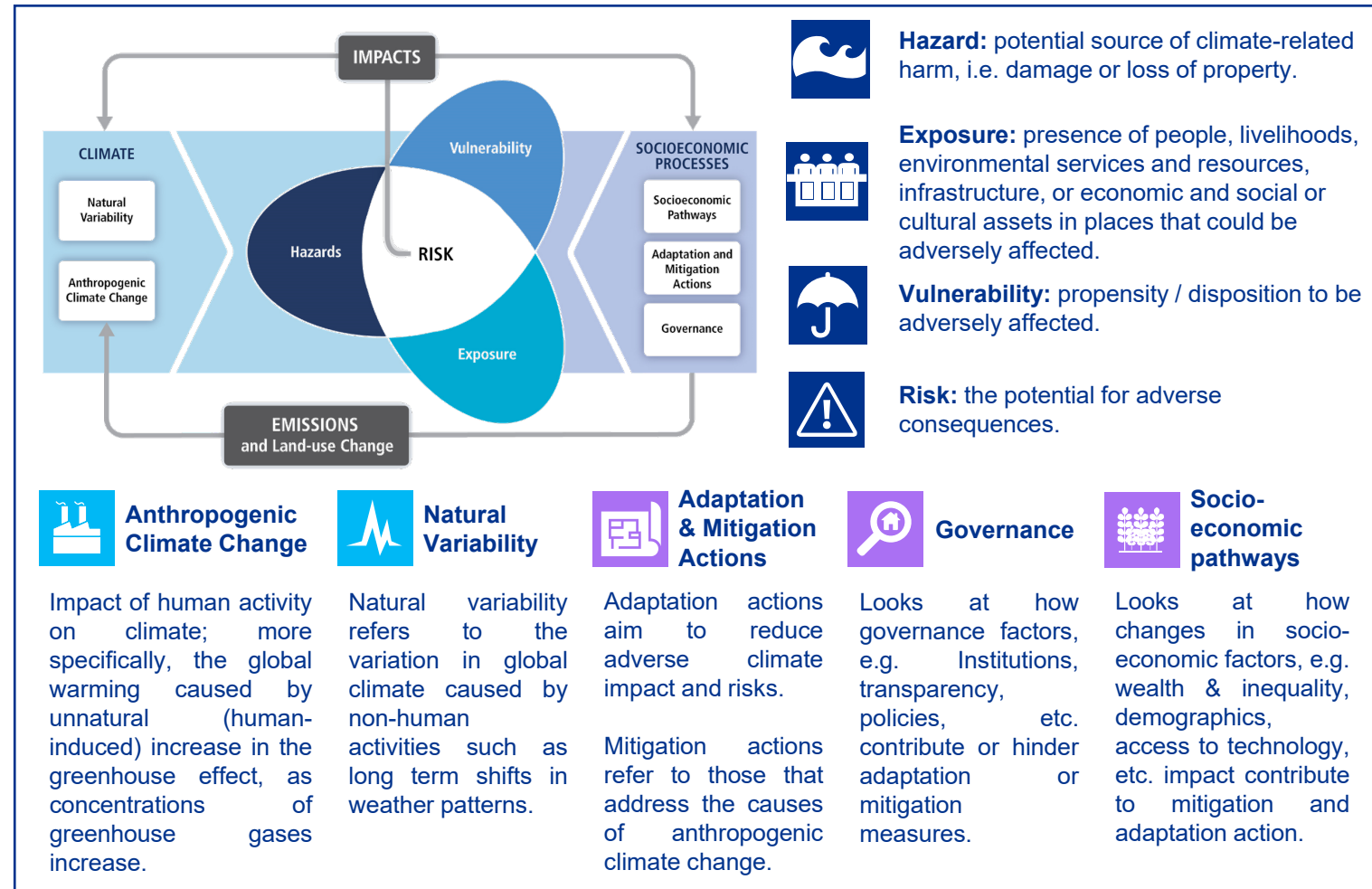
# Understanding of Climate Risk Assessment

## Purpose of Climate Risk Assessment

As detailed in the introduction to this report, the response to climate change entails both mitigation and adaptation actions. The aim of adaptation is to reduce the risks posed by climate change to County Leitrim's environment, society and economy and increase resilience. In order to know how County Leitrim needs to adapt to observed and projected changes to the climate, KPMG conducted a Climate Change Risk Assessment (CCRA).

## Nature of Climate Risk Assessment

Conventional 'predict and act' approaches to risk assessment are challenged by the inherent uncertainty associated with climate change, the spatial and temporal dynamics of climate change, the amplification of risk through societal preferences and values and through the interaction of multiple risk factors. In assessing climate change risk we have adopted the risk assessment framework of the Intergovernmental Panel on Climate Change (IPCC). This framework identifies three key components of climate risk: hazards, exposures and vulnerabilities. Details of the framework are explained to the right.



Source: Local Authority Climate Action Plan Guidelines, Technical Annex B, Figure 1. (page 5)

# Methodology of Climate Risk Assessment (CRA)

## Qualitative Assessment

This Climate Change Risk Assessment has been undertaken in accordance with Technical Annex B Climate Change Risk Assessment of the Local Authorities Climate Action Plan Guidelines and provides a qualitative assessment of climate risk for Leitrim County Council.

A qualitative risk assessment provides the evidence base to identify potential climate risks through an impact and risk analysis on the assets and service delivery function of a local authority and its administrative area.

The Technical Annex B provides a stepped approach to carrying out a climate change risk assessment:

1. Assess climate impact baseline, identifying, assessing and characterising the climate and weather-related impacts already being experienced by the authority, and
2. Identify and assess potential future climate impacts and risks.

In assessing climate change risk, we employ climate information derived from *Nolan (2020)* and *Climate Ireland* for two climate scenarios, RCP4.5 and RCP 8.5 in our assessments.

- RCP4.5 represents an 'intermediate emissions' scenario with an average global warming of 1.4°C for the 2046-2065 period.
- RCP8.5 represents a 'very high emissions' scenario with an average global warming of 2°C for the 2046-2065 period.

The RCP8.5 scenario was used as it is the best match to the mid-century current and stated policies. It is also the 'worst-case' scenario which allows for a conservative risk assessment approach.

### Qualitative

- A qualitative assessment is based on available information and supports a screening of climate change related hazards and risks.
- This type of assessment helps to:
  - Prioritise systems that need further assessment risk;
  - Communicate identified risks to relevant stakeholders
  - Identify which stakeholders to engage in a semi-quantitative risk assessment; and
  - Provide a broad understanding of where adaptation actions could be required.

### Semi-quantitative

- A semi-quantitative risk assessment uses nationally available data along with expert judgement to explore potential risks of prioritised decision areas, sectors, systems, etc. in further detail to understand the wider impact.
- This type of assessment helps to:
  - Identify climate change risks across relevant sectors of the organisation;
  - Identify any cross linkages of impacts
  - Identify the organisation's capacity to adapt; and
  - Generate a list of risks that should be prioritised

### Quantitative

- A quantitative risk assessment uses site-specific data and expert knowledge to establish a detailed understanding of risks and identify the point in time in the future when the risk will pass the tolerable limit and an implementation of your planned action will be necessary.
- This type of assessment helps to:
  - Detail an estimation of rate of change (when the risk will cross the limit and need action); and
  - Identify the extent of impact (how badly it will affect the system).

# Methodology Overview

As detailed below, **Technical Annex B Climate Change Risk Assessment** provides for a proportionate and stepped approach for undertaking a Tier 1 Climate Change Risk Assessment. An assessment of the current climate hazards, exposure, vulnerabilities and impacts leads to the '**Current Climate Risks and Impacts**'. This is followed by an assessment of future climate risks and impacts, resulting in the '**Future Climate Risks and Impacts**'. The detailed steps for both current and future climate risk and impacts are discussed in further pages.

## 1. Current Climate Risks and Impacts

- Develop Profile of Climate Hazards
- Characterise Climate Hazards Frequency
- Exposure, Vulnerability and Impacts (Physical, Social and Environmental)
- Impact Assessment (Service Delivery)
- Overall Impact on Leitrim County Council (e.g., Asset Damage, Health and Wellbeing, Environment, Social, Financial, Reputation, Cultural Heritage and Cultural Premises).

## 2. Future Climate Risks and Impacts

- Assess Future Changes in Climate Hazards Frequency and Intensity
- Assess Future Change in Exposure and Vulnerability
- Uncertainty Assessment
- Assess Emerging Hazards and Potential Future Climate Risks
- Overall Impact on Leitrim County Council

# Step 1: Assess Current Climate Risks and Impacts

In assessing current climate risks and impacts, developing an understanding of the range of climate and weather related events with current impacts for Leitrim County Council is essential. To achieve this, a number of steps have been undertaken and as detailed below:

## 1.1

### Develop Profile of Climate Hazards

The climate hazard profile provides an overview of climate and weather-related hazards to have impacted the Local Authority.

We have updated the climate hazard profile developed through the existing Local Authority Climate Adaptation Strategy (2018) in accordance with recent experiences of extreme weather and climate variability.

## 1.2

### Characterise Climate Hazards-Frequency

On the basis of the most up-to-date information on extreme weather events and observed climate changes for Ireland, the frequency of occurrence of the climate hazards identified through the climate hazard profile has been assessed according to the criteria provided through **Technical Annex B: Climate Change Risk Assessment**.

## 1.3

### Exposure, Vulnerability and Impacts

For each of the identified climate hazards identified through the climate hazard profile, an assessment of the local-scale impacts, exposure, and vulnerability has been performed based on reported impacts and in discussion with the local authority.

## 1.4

### Impact Assessment (Service Delivery)

The level of disruption to the delivery of services by the council has been assessed for each of the identified climate hazards following the criteria provided through **Technical Annex B: Climate Change Risk Assessment**.

## 1.5

### Overall Impact on Leitrim County Council

The overall impact of the identified climate hazards on Assets, Health and Wellbeing, Environment, Reputation, Cultural Heritage and Cultural Premises and Social and Financial impacts has been assessed and a summary of current climate impacts has been provided through a current climate risk matrix.

# Step 2: Assess Future Climate Risks and Impacts

Building on the assessment of current climate impacts, assessing future climate risks and impacts is concerned with understanding and characterising how projected changes in the frequency and intensity of climate hazards may exacerbate existing climate impacts and risks faced by the Local Authority. To achieve this, a number of steps have been undertaken and as detailed below:

## 2.1

### Assess Future Changes in Climate Hazards- Frequency and Intensity

The most up- to-date climate change projections have been employed to assess the changes in frequency and intensity of climate hazards identified through our assessment of current climate impacts.

## 2.2

### Assess Future Change in Exposure and Vulnerability

To identify and assess the potential future changes in exposure and vulnerability, projections of potential future changes in non-climatic factors (e.g. *County Development Plans, Regional Social and Economic Strategies*) have been examined. The assessment of the projected future impacts and risks and the rationale behind this have been provided.

## 2.3

### Uncertainty Assessment

In assessing future climate risks, there will be uncertainty in how hazards, exposure, and vulnerability will change. The level of uncertainty in projected changes in climate hazards, exposure, and vulnerability is assessed.

## 2.4

### Assess Emerging Hazards and potential Future Climate Risks

In addition to those hazards and impacts identified through the current climate impact and risk assessment. Projected climate change may result in new or emerging risks. Emerging risks for County Leitrim have been identified and considered as part of the CCRA.

## 2.5

### Overall Impact on Leitrim County Council

Accounting for projected changes in hazard, exposure and vulnerability, the overall future impact on Asset, Health and Wellbeing, Environment, Reputation, Cultural Heritage and Cultural Premises and Social and Financial impacts is assessed and a summary of potential future climate impacts have been provided through a future climate risk matrix.



# Data and Information Sources

As detailed below, a wide range of qualitative and quantitative and information was employed to inform the development of the CCRA for Leitrim County Council. The Leitrim Council Adaptation Strategy (2018) was reviewed and updated using a range of national and local data sources. Climate Ireland was employed to access data and information on projected changes in the frequency and intensity of climate hazards accessed while the National Planning Framework, Leitrim County Council Development Plan 2022-2028 and the Regional Spatial and Economic Strategy for the Northern and Western Region were employed to assess future development patterns. In addition, a stakeholder workshop was held to garner further insights from Leitrim County Council.

Report Section	Sources
<b>Introduction and scope</b>	<ul style="list-style-type: none"> <li>Local Authority Climate Action Plan Guidelines, Technical Annex</li> </ul>
<b>Step 1: Current Climate Risks and Impacts</b>	<ul style="list-style-type: none"> <li>Environmental Protection Agency (EPA)</li> <li>Catchments.ie (EPA)</li> <li>Climate Status Report 2020 (<a href="#">Cámaro García and Dwyer, 2021</a>)</li> <li>Floodinfo.ie (Office of Public Works)</li> <li>Data.gov.ie</li> <li>Department of Transport</li> <li>Department of Housing, Local Government and Heritage</li> <li>DHLGH 'Locations of Fires Statistics'</li> <li>Department of Transport, Sport and Tourism</li> <li>National Directorate for Fire and Emergency Management</li> <li>Teagasc</li> <li>Leitrim County Council Website</li> <li>Leitrim County Council Adaptation Strategy (2018)</li> <li>Sectoral Climate Change Adaptation Strategies (2018)</li> <li>Stakeholder Workshop</li> <li>Met Éireann</li> <li>RTE News</li> <li>Irish Independent</li> <li>Irish Examiner</li> <li>The Irish Times</li> <li>The Journal</li> <li>Irish Mirror</li> <li>Shannonside FM</li> <li>The Farmers Journal</li> <li>Ocean FM</li> <li>Leitrim Live</li> <li>Anglo-Celt</li> <li>Leitrim Observer</li> </ul>
<b>Step 2: Future Climate Risks and Impacts</b>	<ul style="list-style-type: none"> <li>High-resolution Climate Projections for Ireland – A Multi-model Ensemble Approach (<a href="#">Nolan and Flanagan, 2020</a>) accessed via Climate Ireland</li> <li>Regional Spatial &amp; Economic Strategy for the Northern and Western Region</li> </ul>

# 3.2

# Current Climate Risks and Impacts

# 3.2.1 Profile of Climate Hazards (incl. Frequency)

# Characteristics of County Leitrim

Leitrim County Council is a member of the Eastern and Midlands Climate Action Regional Office (CARO) and it serves 35,087 people (2022 Census). It is the least populated county in the country and the smallest of Connacht's five counties in both size and population and is characterised by numerous lakes and rivers, including Lough Allen.

## Physical & Environmental Characteristics

County Leitrim covers an area of 1,590 km<sup>2</sup> making it the 26th largest of Ireland's thirty-two counties. It is the smallest of Connacht's five counties in both size and population. Leitrim is bounded by counties Cavan and Longford to the east, Roscommon to the south, Sligo to the west and Donegal and Fermanagh to the north. Leitrim is also home to the shortest stretch of coastline in Ireland at 4.6km long where the county touches the Atlantic Ocean.

Leitrim is characterised by numerous lakes and rivers including Lough Allen which covers the centre of the county. County Leitrim can generally be divided into a northern and southern half, with Lough Allen acting as the dividing point. The northern half of the county is characterised by mountains, expansive lakes and deep glacial valleys which forms a scenic landscape. The southern part of the county is a lowland covered by glacial drifts; most of it is used as farmland, though there are peat bogs and many small lakes. At Drumshanbo, close to Lough Allen, the terrain changes to a series of plateaus, mainly 1,400 to 1,800 feet (425 to 550 metres) high. There are relics of past ironworks in the south and some coal seams, with many traces of past mining.

## Socioeconomic Characteristics

County Leitrim benefits from its strategic location and is very accessible with road, rail and air links to the major cities of Dublin, Belfast, Derry and Sligo. Leitrim also enjoys significant economic, social and cultural connections with Northern Ireland. Many of these are historic and traditional but others are more recent, reflecting modern opportunities for joint-working, sharing and achieving economies of scale. Consistent EU support over more than four decades has created and sustained many of these connections.

Carrick-on-Shannon is the largest town and the only defined urban centre in County Leitrim. Including Cortober in neighbouring county Roscommon, Carrick-on-Shannon has a combined population of 4,066 (2016 Census). It is strategically positioned on the N4 Dublin to Sligo National Primary Road and on the Dublin to Sligo rail line. Ballinamore and Manorhamilton are classified as Sub Regional Growth Towns with significant employment supporting services and community facilities.

The two largest employment sections in County Leitrim are 'Health and social work' and 'Wholesale and Retail'. Reflective of the high level of commuting outside the county, many of those who work in health and social areas

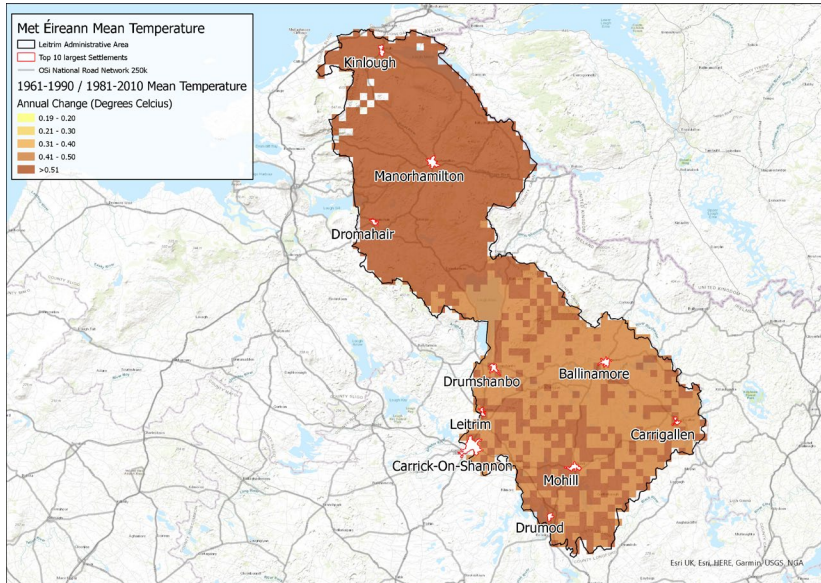
commute outside of Leitrim - typically to County Sligo (Sligo University Hospital). Agriculture in Leitrim supports thousands of jobs in the rural economy, both directly in food and drink processing and also in the wider agri-industry. Agriculture's share of employment in Leitrim is nearly double the national average.

The 2016 Census indicated that Leitrim has one of the highest rates of car dependence in the country. Approximately 69.1% of commuters travelling to work by car or as a passenger in a car (65.6% nationally) and only 1.1% of people commute using public transport (9.3% nationally).

County Leitrim has an important industrial heritage with many historic structures, including examples of churches, castles, shops, railway stations, bridges, lodges, artisan dwellings, mills and canals. Notable protected structures include Lough Rynn House, Roosky Bridge, Rossinver Church of Ireland Church and Swiss Cottage in Clooncahir. There are approximately 1,400 Recorded Monuments within the County, including examples of megalithic tombs, churches, castles, linear earthwork and ringforts. Sites of particular archaeological significance in the County include the Iron Age linear earthworks of the Black Pig's Dyke.



# Observed Changes in Leitrim's Climate



In line with global trends, the climate of Ireland and Leitrim is changing, temperatures are increasing and patterns of precipitation are changing. These changes are projected to continue and intensify with a wide range of impacts for Leitrim and Leitrim County Council. A summary of key climate and weather-related changes already observed for County Leitrim are detailed below. As there is no long term weather station currently located in Leitrim the Clones long term weather station situated in County Monaghan was used for baseline assessment.

## Highlights of Observed Climate Change for Ireland and Leitrim

### Droughts

The 2018 summer drought was the second longest running absolute drought (24 days) after the 1955 summer drought (30 days)\*\*

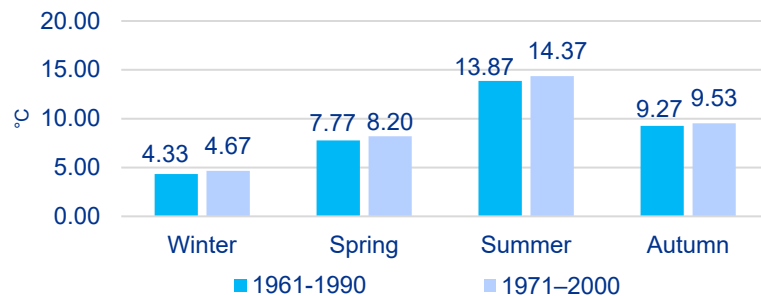
### Rainfall

Average annual rainfall increased by 1.3% for the most recent 30 year period on record (1971-2000) when compared to the baseline period 1961-1990\*

# 0.4°C

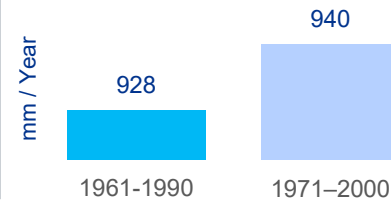
Average temperature increase for the 1971-2000 baseline when compared to the 1961-1990 baseline.\*

Mean Seasonal Temperatures\*



# 29.8°C

Highest temperature on record recorded on Jul 21<sup>st</sup> 2021 at Ballinamore



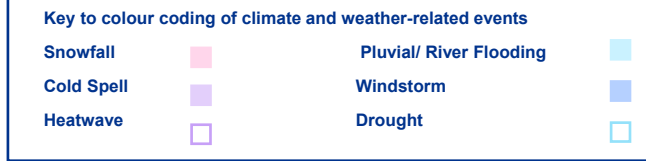
Over the Past 10 years Leitrim has experienced 5 of its wettest winters since 1941\*\*



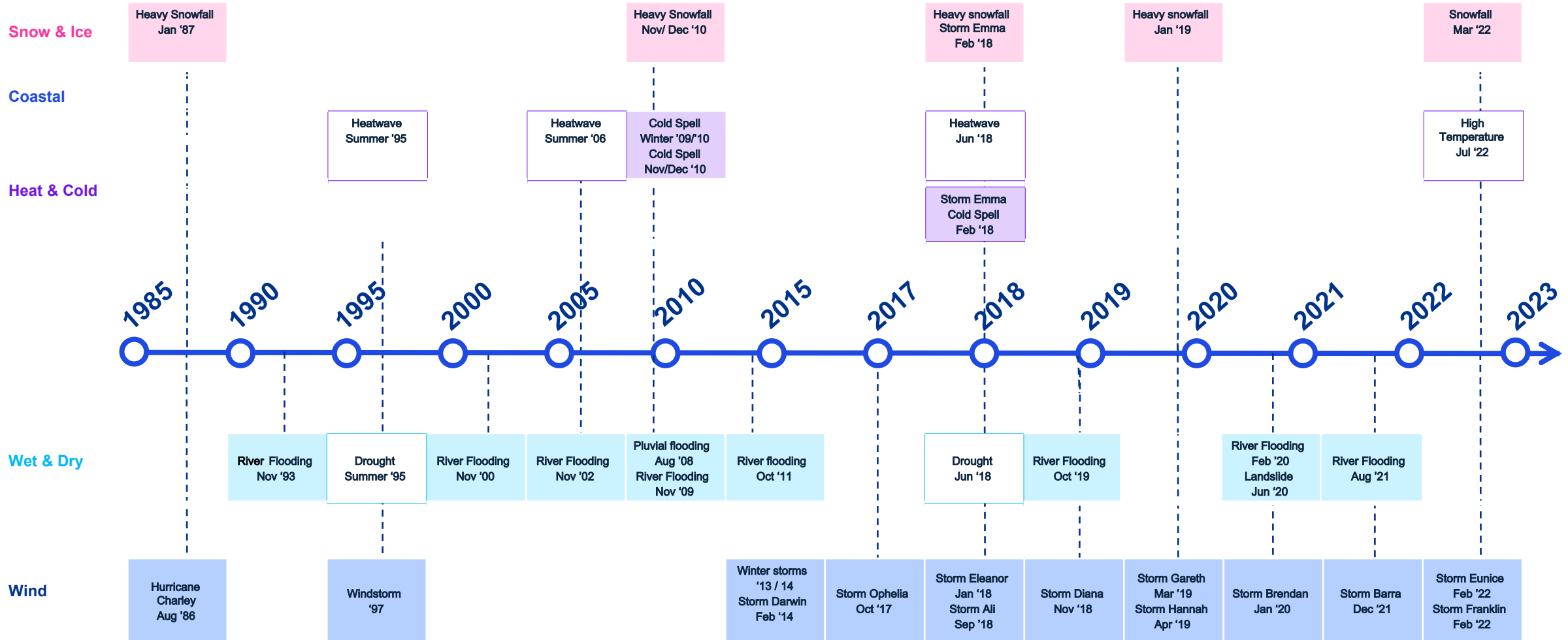
Heavy rainfall In June 2020 led to a 160,00 tonne landslide at Greaghmagh causing over €4 Million worth of damage and affecting farmers

\*Source: Clones long-term weather station  
\*\* Source: Met Éireann daily weather station data

# Climate Hazard Timeline



In addition to observed changes in Leitrim’s climate, we have identified significant climate and weather-related events to have impacted on County Leitrim over the period 1986-2022. To do this, we have further developed the existing climate hazard profile developed through the existing Leitrim County Council Adaptation Strategy (2018) and expanded the analysis to cover the period 2018-2022.



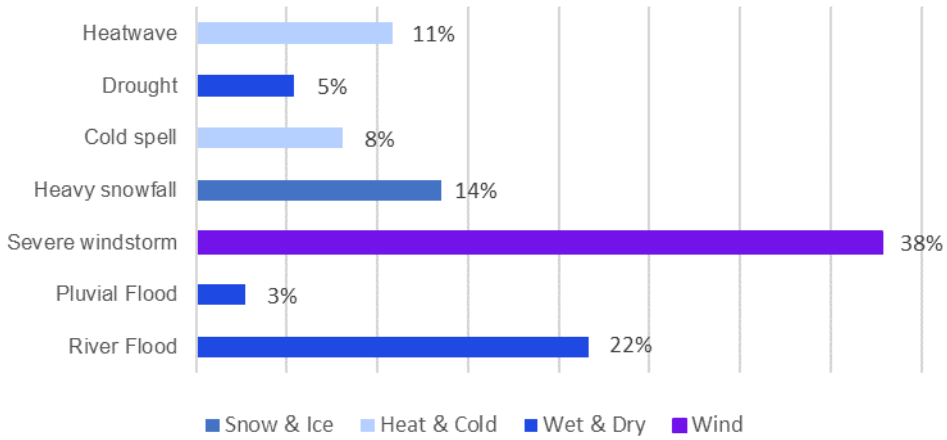
# Frequency of Climate Hazards

For each of the climate hazards that have been identified through the climate hazard profile, an assessment of their frequency of occurrence has been conducted. Each hazard was assigned a frequency category according to Table 2 of the **Technical Annex B Climate Change Risk Assessment Guidelines** (top right).

Based on the climate hazard baseline, storm events have impacted upon County Leitrim most frequently over the period 1986-2022, with river flooding also affecting the County on a number of occasions. Heatwaves, droughts, cold spells, snowfall events and pluvial flooding, have also impacted County Leitrim, but less frequently. Although individual events were not identified in the timeline, coastal flooding has occurred within County Leitrim.

The hazard frequency for each hazard is shown in the bottom right table, informed by past event occurrence and information received from Leitrim County Council.

**Frequency of Identified Events According to Category (1986-2022)**



**Frequency classification from Technical Annex B Climate Change Risk Assessment Guidelines**

Frequency	Frequency Occurrence in a Year	Description
Very Frequent	> 100%	Occurs several times in a single year
Frequent	50 to 100%	Occurs once in a 1-to-2-year period
Common	10 to 50%	Occurs once in a 2-to-10 years period
Occasional	1 to 10%	Occurs once in a 10-to-100-year period
Rare	< 1%	Occurs once in over 100 years

**Current hazard frequency for County Leitrim, based upon analysis of past events and workshop feedback**

Hazard Type	Current Frequency
Heatwave	Common
Drought	Occasional
Cold Spell	Occasional
Heavy Snowfall	Occasional
Severe Windstorm	Frequent
Coastal Flood	Rare
Pluvial Flood	Frequent
River Flood	Frequent

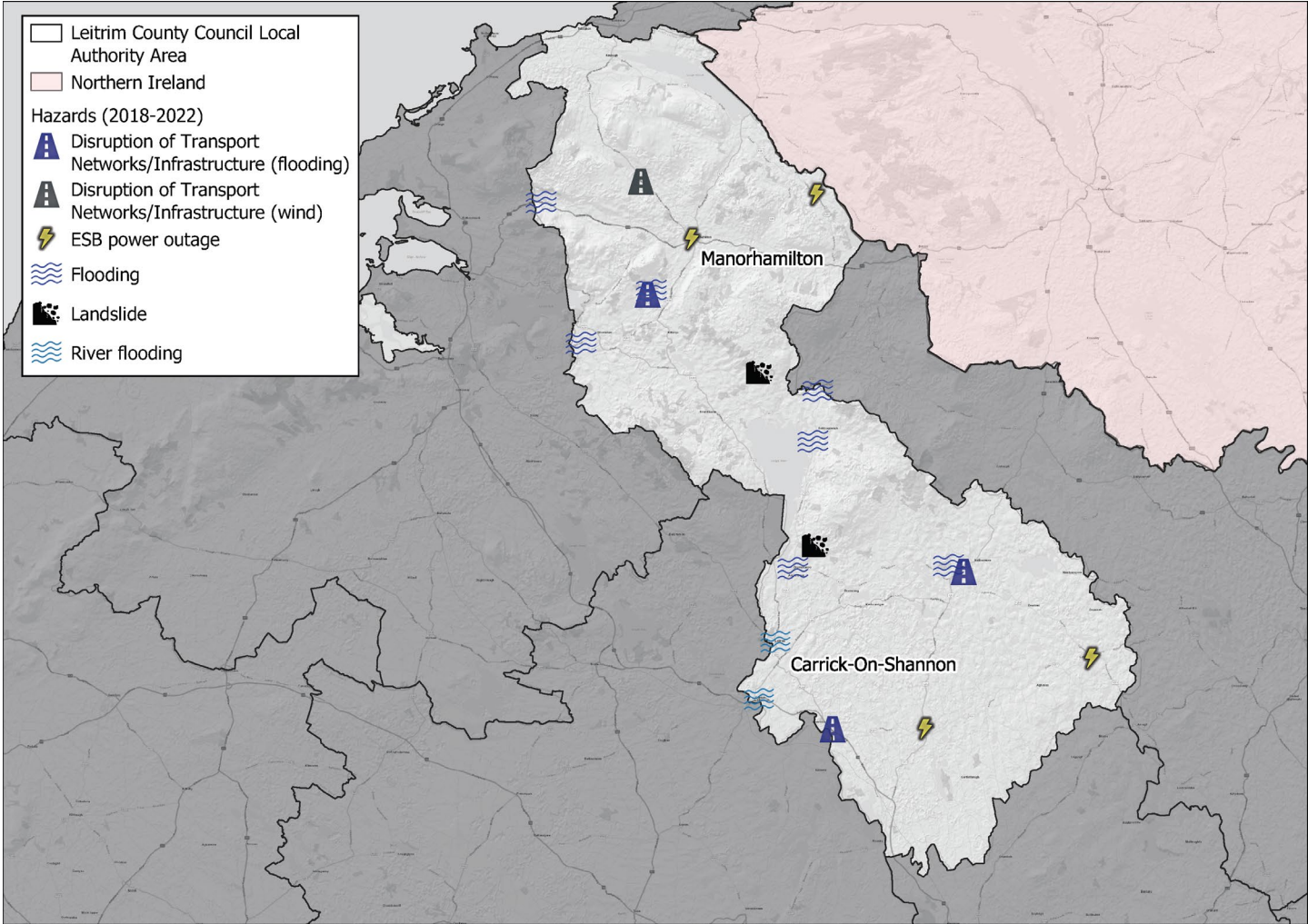
# 3.2.2 Exposure, Vulnerability and Impacts



# Characterising Exposure, Vulnerability and Impacts of Climate Hazards

Employing and integrating information derived from previous events (sources of information are detailed on page 17), we have characterised the exposures, vulnerabilities, and impacts of the hazard events experienced in County Leitrim since 2018. Below and to the right we provide an example of exposures and impacts of hazard events already experienced.

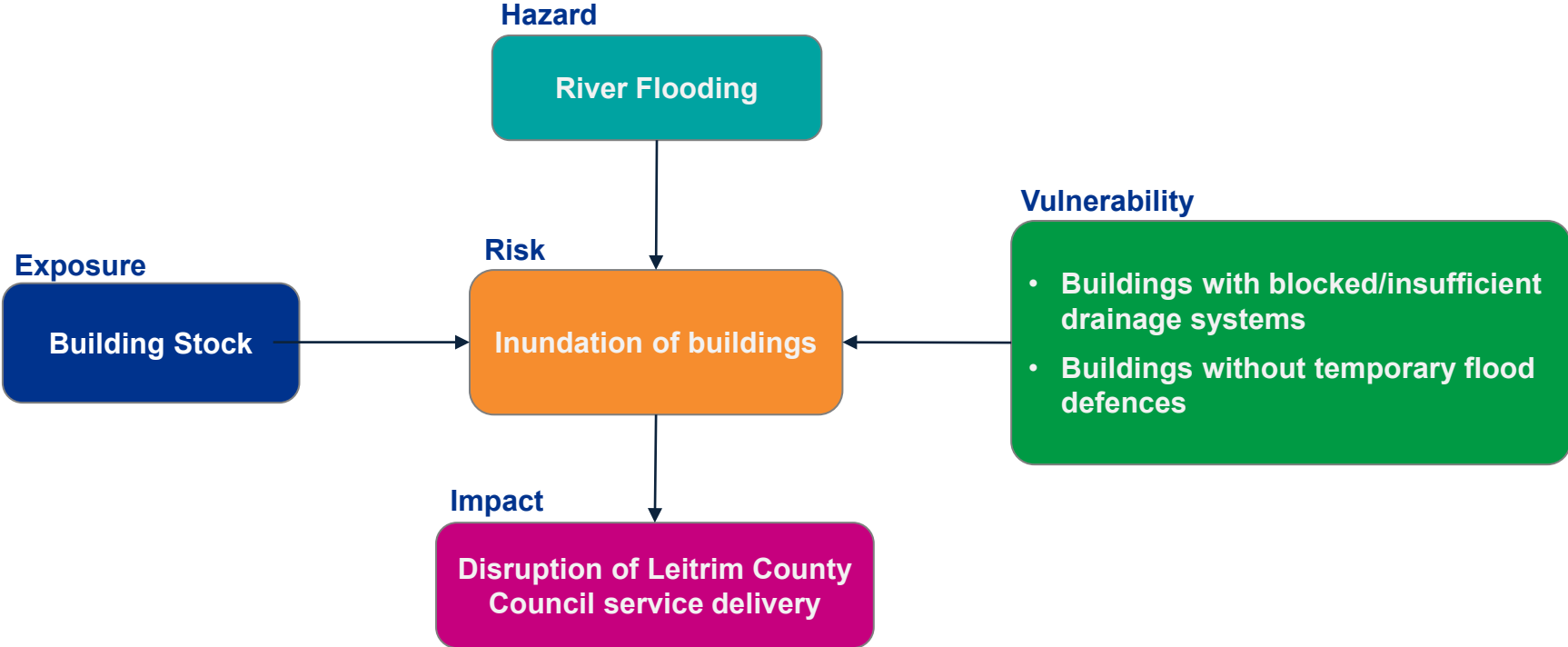
- **Storm Barra** in 2021 brought power outages to homes throughout the county, with communities in Manorhamilton and Arigna being primarily affected.
- During **Storm Hannah** in 2019, the ESB reported that **over 600 houses** were left without power across the county.
- In February 2020 heavy rainfall led to **the river Shannon bursting its banks**, topping quay walls and flooding Leitrim village and Carrick-on-Shannon. Over 6,000 acres of farmland along the Shannon were underwater with flooding reaching levels close to record highs observed in 2015-2016.
- In June 2020, **heavy rainfall** led to a major landslide where 160,000 tonnes of peatland 'slipped' at Greaghnaglogh. This covered 43ha of land with debris, affecting 12 farmers, and blocked local roads including that over the Dawn of Hope bridge. The cost of removal was estimated at between €3-4 million, with remedial works at €1.4-2.7 million.
- Flash flooding arising from **heavy rainfall** caused damage to the Ballinaglera bridge in August 2021, requiring repair works costing €150,000
- In 2019, County Leitrim fire services were called out to **12 wildfires**, followed by **57** in 2020 and **18** in 2021.



# Climate Risk and Impacts

For County Leitrim and for each of the identified climate hazards, we characterised the exposures, vulnerabilities, and impacts associated with the relevant hazard events. For example, below shows the three risk components for a river flooding hazard which would pose an inundation risk to Leitrim County Council buildings. The buildings with insufficient drainage and with no temporary flood defences would be considered more vulnerable to this hazard. Consequently, if Leitrim County Council buildings were to be flooded, one of the possible impacts would be the disruption of Leitrim County Council’s ability to deliver its services. This process was undertaken for each hazard and a range of exposures were identified along with their associated vulnerabilities.

The following pages summarise the exposures, vulnerabilities and impacts for the hazards that exist within the County Leitrim region.



# Impacts of climate hazards (1/4)

The table below shows the key impacts and exposures associated with each climate and weather-related hazard. Detailed information on exposure specific vulnerabilities (physical, social and environmental) are provided in the associated impacts and risks spreadsheet.

Hazard	Key Impacts	Key Exposures (and Key Vulnerabilities)
Heatwave	<ul style="list-style-type: none"> <li>• Hot and uncomfortable working/living conditions</li> <li>• Increased demand on recreational areas</li> <li>• Damage to road surface, hazardous driving conditions and impact on road surface maintenance</li> <li>• Disruption of Public Transport Networks</li> <li>• Heat stress for animals and livestock resulting in the adoption of unsustainable mitigation measures</li> <li>• Increased frequency of beach/swimming area closures</li> <li>• Increased demand on available water resources, leading to increasing pressure to share resources</li> <li>• Increase in the frequency of uncontrolled fire</li> <li>• Detrimental impacts on freshwater quality for fish populations</li> <li>• Increased strain on natural biodiversity</li> </ul>	<ul style="list-style-type: none"> <li>• Housing, buildings, outdoor workers (elderly, with limited access to water, shade and sunscreen), care home/leisure centres/recreational facilities</li> <li>• Lakes, Parks (with easy access to urban areas)</li> <li>• Local Roads (surface-dressed roads, located in areas of high solar radiation)</li> <li>• National Railway Network</li> <li>• Pasture (in marginal areas of production)</li> <li>• Beaches/Swimming areas</li> <li>• Reservoirs/lakes</li> <li>• European/Irish designated sites (SPAs, SACs, Ramsar sites, NHAs)</li> <li>• Emergency response services (areas of growing vegetation)</li> </ul>
Drought	<ul style="list-style-type: none"> <li>• Decreased grass growth and increased supplementary feed requirements for cattle</li> <li>• Increased demand on available water resources, leading to increasing pressure to share resources</li> <li>• Increase in the frequency of uncontrolled fire</li> <li>• Increased strain on natural biodiversity</li> <li>• Reduced river flow</li> <li>• Increased degradation rates</li> </ul>	<ul style="list-style-type: none"> <li>• Pasture (in marginal areas of production)</li> <li>• Reservoirs/lakes/groundwater supplies (already depleted/under stress)</li> <li>• Emergency response services (areas of growing vegetation)</li> <li>• Natural Areas incl. European / Irish designated sites (SPAs, SACs, Ramsar sites, NHAs)</li> <li>• Biodiversity (water bodies, areas with diverse wildlife populations)</li> <li>• Cultural Heritage (wooden/decomposable material based assets)</li> </ul>

# Impacts of climate hazards (2/4)

The table below shows the key impacts and exposures associated with each climate and weather-related hazard. Detailed information on exposure specific vulnerabilities (physical, social and environmental) are provided in the associated impacts and risks spreadsheet.

Hazard	Key Impacts	Key Exposures (and Key Vulnerabilities)
<p><b>Cold Spell</b></p>	<ul style="list-style-type: none"> <li>•Extreme cold results in increased requirement for heating and associated economic costs</li> <li>•Cold conditions result in increased damage to vehicles</li> <li>•Disruption to road networks, including increases in costs associated with gritting fuel and overtime</li> <li>•Disruption to public transport networks</li> <li>•Cold conditions leading to damage of road surfaces (i.e., freeze thaw)</li> <li>•Increase in the frequency of trips and falls</li> <li>•Reduction in agricultural production</li> <li>•Difficulties in accessing land</li> <li>•Freeze thaw damage to critical infrastructure</li> <li>•Impacts on water resources</li> <li>•Increases in cold-related mortality and morbidity</li> <li>•Delay of infrastructure/development projects</li> <li>•Increased strain on natural biodiversity</li> <li>•Damage and disruption of electricity supply</li> <li>•Damage to built heritage</li> </ul>	<ul style="list-style-type: none"> <li>•Buildings (poorly insulated, with elderly residents, in isolated locations)</li> <li>•Public/private transport vehicles (exposed vehicles)</li> <li>•Transport Network (Road and Rail)</li> <li>•Public/staff (elderly populations, people with pre-existing conditions)</li> <li>•Crops, livestock (cold-sensitive crops, areas with low solar radiation)</li> <li>•Land (marginal farms, areas of low solar radiation)</li> <li>•Water infrastructure/pipes (older pipes, in areas of freezing soil conditions)</li> <li>•Water resources (waterbodies in lower altitudes)</li> <li>•People at high risk of exposure to cold (people in insulated buildings, vulnerable communities)</li> <li>•Development projects (ongoing construction with loose materials)</li> <li>•European/Irish designated sites (SPAs, SACs, Ramsar sites, NHAs)</li> <li>•Homes/Businesses/Local Govt Office (without on-site electricity generation)/Agriculture Sites</li> </ul>
<p><b>Heavy Snowfall</b></p>	<ul style="list-style-type: none"> <li>•Damage to buildings</li> <li>•Disruption of transport network and isolation of communities</li> <li>•Freezing conditions impacting on livestock</li> <li>•Snow melt resulting in increased risk of flooding</li> <li>•Disruption to energy supply</li> <li>•Disruption to waste collection</li> </ul>	<ul style="list-style-type: none"> <li>•Buildings (vacant/flat roof properties, higher elevation, elderly residents), Offices (incl. LA) (single story/flat roof, higher elevation, impervious surfaces)</li> <li>•Transport network (Road and Rail) (in terrain with a with higher propensity of snow drifts, isolated roads)</li> <li>•Agricultural sites (livestock unprotected) (farms at higher elevations, marginal farms)</li> <li>•Energy</li> <li>•Waste collection routes (in terrain with a with higher propensity of snow drifts)</li> </ul>

# Impacts of climate hazards (3/4)

The table below shows the key impacts and exposures associated with each climate and weather-related hazard. Detailed information on exposure specific vulnerabilities (physical, social and environmental) are provided in the associated impacts and risks spreadsheet.

Hazard	Key Impacts	Key Exposures (and Key Vulnerabilities)
<b>Severe Windstorm</b>	<ul style="list-style-type: none"> <li>•Direct wind damage to buildings and infrastructure</li> <li>•Disruption of communications infrastructure</li> <li>•Wind damage to crops and forestry</li> <li>•Disruption of wind energy generation</li> <li>•Disruption to Energy supply</li> <li>•Disruption of Transport Networks</li> <li>•Closure of Parks and Public Buildings</li> <li>•Disruption to waste collection</li> <li>•Disruption to water quality monitoring</li> </ul>	<ul style="list-style-type: none"> <li>•Buildings, development sites (buildings w. rooftop equip., vulnerable populations, high-rise structures)</li> <li>•Overhead powerlines (situated in upland and exposed sites)</li> <li>•Crops and livestock</li> <li>•Wind turbines (turbines with lower shut-down thresholds for high winds)</li> <li>•Power supply (infrastructure in exposed locations, vulnerable populations, isolated communities)</li> <li>•Road and Rail Network</li> <li>•Parks, public buildings (populations requiring essential council services, exposed, locations)</li> <li>•Waste collection routes (terrain with a with higher propensity of snow drifts)</li> <li>•Waterbodies (exposed waterbodies and waterbodies in need of water quality monitoring)</li> </ul>
<b>Coastal Flood</b>	<ul style="list-style-type: none"> <li>•No current Impact</li> </ul>	<ul style="list-style-type: none"> <li>•Road Network</li> </ul>

# Impacts of climate hazards (4/4)

The table below shows the key impacts and exposures associated with each climate and weather-related hazard. Detailed information on exposure specific vulnerabilities (physical, social and environmental) are provided in the associated impacts and risks spreadsheet.

Hazard	Key Impacts	Key Exposures (and Key Vulnerabilities)
<p><b>Pluvial Flood</b></p>	<ul style="list-style-type: none"> <li>•Direct rain and surface water damage to buildings and infrastructure</li> <li>•Damage to amenities and recreational areas</li> <li>•Disruption of Transport Networks/Infrastructure</li> <li>•Surface water (run-off) pollutants</li> <li>•Impact on business and local economy</li> <li>•Heavy rainfall triggering landslips</li> </ul>	<ul style="list-style-type: none"> <li>•Buildings (poorly insulated, with elderly residents, in isolated locations), Local Authority Offices, Heritage Sites</li> <li>•Recreational Amenities (low-lying parks and other amenities, locate near water bodies such as lakes and rivers)</li> <li>•Road/Railways (low lying roads/railways, located near water bodies, limited drainage)</li> <li>•Natural Resources/Sensitive materials (Enviro. sensitive areas, heavily fertilised agric. land close to water bodies)</li> <li>•Employers, Employees, Customers, Students (business in low-lying areas, lacking remote work/study options, etc.)</li> </ul>
<p><b>River Flood</b></p>	<ul style="list-style-type: none"> <li>•Flood damage to buildings and infrastructure</li> <li>•Damage to amenities and recreational areas</li> <li>•Disruption of Transport Networks/Infrastructure</li> <li>•Surface water (run-off) pollutants</li> <li>•Impact on business and local economy</li> <li>•Damage/degradation to automobiles and public transport</li> <li>•Potential Bridge Failure</li> <li>•Farmland Erosion</li> </ul>	<ul style="list-style-type: none"> <li>•Buildings, Local Authority Offices, Heritage Sites (blocked drainage, loc. on floodplains, vulnerable residents)</li> <li>•Recreational Amenities (low-lying parks, located near water bodies, parks and amenities in need of investment)</li> <li>•Road/Railways (low lying roads/railways, located near water bodies, limited drainage)</li> <li>•Natural Resources/Sensitive materials (Env. Sensitive areas, networks with polluting vehicles, near waterbodies)</li> <li>•Employers, Employees, Customers, Students (located in at-risk areas, lack of access to early warning systems)</li> <li>•Council Fleets, Public Transport, Private vehicles (underground/low-lying carparks, fleets sensitive to submergence)</li> <li>•Bridges (older bridges, bridges in need of investment and maintenance)</li> <li>•Farmland situated on riverbanks (economically marginalised farmers, rivers susceptible to soil bank erosion, etc)</li> </ul>

# 3.2.3

# Impacts of Current Climate Risks (Service Delivery)

# Summary of Service Level Impacts

Key to colour coding of impact ratings

Catastrophic
Major
Moderate
Minor
Negligible

Below we provide a summary of the impacts on the delivery of services of Leitrim County Council as a result of the climate hazards identified within the climate hazard profile. This assessment was undertaken in accordance with the criteria provided through **Technical Annex B: Climate Change Risk Assessment (see appendix 1)**, with each service delivery area assigned an impact category of either negligible, minor, moderate, major, or catastrophic. The following pages provide the detailed information that informed this assessment.

Hazard	Business Services	Roads, footpaths, bridges: construction and maintenance	Building Stock	Community Infrastructure	Cultural Heritage	Stormwater / Sewerage	Wastewater	Water Supply	Water Quality	Biodiversity	Community Development	Emergency Response
Heatwave	Minor	Minor	Minor	Minor	None	None	None	Minor	None	Moderate	Minor	Minor
Drought	None	None	None	None	Minor	None	None	Minor	Moderate	Moderate	Minor	Moderate
Cold Spell	Minor	Moderate	Moderate	Moderate	Minor	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Heavy Snowfall	Moderate	Minor	Moderate	Moderate	Moderate	None	Moderate	Moderate	None	Minor	Moderate	Moderate
Severe Windstorm	Moderate	Moderate	Moderate	Moderate	Moderate	None	Moderate	Moderate	Minor	Moderate	Moderate	Moderate
Coastal Flood	None	Negligible	Negligible	None	None	None	None	None	None	None	None	None
Pluvial Flood	Minor	Moderate	Minor	Minor	Minor	Minor	Minor	Minor	Moderate	Minor	Minor	Moderate
River Flood	Minor	Moderate	Moderate	Moderate	Moderate	Minor	Minor	Minor	Minor	Minor	Moderate	Moderate



# Service Level Impacts (Heatwaves & Drought)

Key to colour coding of impact ratings

Catastrophic
Major
Moderate
Minor
Negligible

The impact of heatwaves on the services areas provided by Leitrim County Council was identified as minor for Business Services, Roads, Building Stock, Community Infrastructure, Water Supply, Community Development, and Emergency Response, with services affected at a localised level. Heatwaves were identified as having a moderate impact on the provision of Biodiversity services, with appreciable declines in service provision across the county.

Drought was identified as putting Water Quality, Biodiversity, and Emergency Response services provided by Leitrim County Council under severe pressure, with impacts felt across the county. The impact of drought on Cultural Heritage, Water Supply, and Community Development services was identified as minor, with impacts occurring at a localised level.

	Heatwaves	Drought
<b>Business Services</b>	<ul style="list-style-type: none"> <li>Decreased staff productivity and increased staff and customer discomfort.</li> </ul>	None
<b>Roads, footpaths, bridges, construction and maintenance</b>	<ul style="list-style-type: none"> <li>Increased costs associated with repair of localised road surfaces.</li> <li>Increased health and safety risk for outdoor staff members in local areas. across the county.</li> </ul>	None
<b>Building Stock</b>	<ul style="list-style-type: none"> <li>Increased requirement for cooling in council offices/buildings.</li> </ul>	None
<b>Community Infrastructure</b>	<ul style="list-style-type: none"> <li>Increased requirement for waste collection and traffic management at key recreational sites.</li> </ul>	None
<b>Cultural Heritage</b>	None	<ul style="list-style-type: none"> <li>Localised degradation of cultural heritage sites due to drying out.</li> <li>Increased requirements for monitoring and maintenance of cultural heritage sites.</li> </ul>
<b>Stormwater / Sewerage</b>	None	None
<b>Wastewater</b>	None	None
<b>Water Supply</b>	<ul style="list-style-type: none"> <li>Increased supply demand for water to cool infrastructure, communities, and livestock.</li> <li>Implementation of water conservation measures (e.g., hosepipe bans).</li> </ul>	<ul style="list-style-type: none"> <li>Increased requirement to support provision of water to communities suffering loss of water supply (e.g., Tankering).</li> </ul>
<b>Water Quality</b>	None	<ul style="list-style-type: none"> <li>Reduced water flows impacting on water quality across the county with increased requirement for monitoring and remediation.</li> </ul>
<b>Biodiversity</b>	<ul style="list-style-type: none"> <li>Decreased ecosystem health across the county with potential for loss of priority habitats resulting in increased requirement for monitoring and remediation.</li> </ul>	<ul style="list-style-type: none"> <li>Reduced water flows impacting on biodiversity with potential for loss of priority species and habitats necessitating increased monitoring and remediation.</li> </ul>
<b>Community Development</b>	<ul style="list-style-type: none"> <li>Increased requirement for management at congested sites.</li> </ul>	<ul style="list-style-type: none"> <li>Reduced grass growth causing increased supplementary feed requirement for cattle reducing farm incomes and the wider industry.</li> </ul>
<b>Emergency Response</b>	<ul style="list-style-type: none"> <li>Increase in number of wildfire call-outs in local areas.</li> <li>Increase in number of call out to bathing areas in local areas.</li> </ul>	<ul style="list-style-type: none"> <li>Increase in number of uncontrolled fire call-outs across the county.</li> </ul>
<b>Crosscutting</b>	<ul style="list-style-type: none"> <li>Health and Safety of Staff</li> </ul>	



# Service Level Impacts (Cold Spell & Heavy Snowfall)

**Key to colour coding of impact ratings**

- Catastrophic
- Major
- Moderate
- Minor
- Negligible

The impact of Cold Spells on the service areas provided by Leitrim County Council was identified as moderate and resulting in an appreciable decline in the provision of Roads, Building Stock, Community Infrastructure, Stormwater/ Sewerage, Wastewater, Water Supply, Water Quality, Community Development, and Emergency Response services. The impact of Cold Spell on the provision of Business Services and Cultural heritage was identified as localised and minor.

In addition, the impact of Heavy Snowfall on the service areas provided by Leitrim County Council was identified as moderate for Business Services, Building Stock, Community Infrastructure, Cultural Heritage, Wastewater, Water Supply, Community Development, and Emergency Response services. Heavy Snowfall was also identified to have a localised and minor impact on the provision of Roads services provided by the council.

	Cold Spell	Heavy Snowfall
<b>Business Services</b>	<ul style="list-style-type: none"> <li>Closure of business services in local areas.</li> <li>Health and safety risks for public and staff.</li> </ul>	<ul style="list-style-type: none"> <li>Closure of business services across the County</li> <li>Health and safety risks for public and staff</li> </ul>
<b>Roads, footpaths, bridges, construction and maintenance</b>	<ul style="list-style-type: none"> <li>Increased costs associated with gritting and salting roads across the county.</li> <li>Increased repair and maintenance costs.</li> </ul>	<ul style="list-style-type: none"> <li>Transport disruption and road closures</li> <li>Increased costs associated with gritting and salting roads and footpaths in local areas.</li> </ul>
<b>Building Stock</b>	<ul style="list-style-type: none"> <li>Increased energy costs for buildings county wide.</li> <li>Increased health and safety risks for public and staff countywide.</li> </ul>	<ul style="list-style-type: none"> <li>Increased energy costs for buildings county wide.</li> <li>Increased health and safety risks for public and staff countywide.</li> </ul>
<b>Community Infrastructure</b>	<ul style="list-style-type: none"> <li>Increased energy costs in community buildings across the county.</li> <li>Increased health and safety risks for public and staff working in community buildings.</li> </ul>	<ul style="list-style-type: none"> <li>Increased health and safety risks for public and staff.</li> <li>Closure of services throughout the county.</li> </ul>
<b>Cultural Heritage</b>	<ul style="list-style-type: none"> <li>Increased energy costs for cultural heritage sites.</li> <li>Increased health and safety risks for public and staff at community heritage sites.</li> </ul>	<ul style="list-style-type: none"> <li>Increased health and safety risks for public and staff.</li> <li>Localised closure of sites.</li> </ul>
<b>Stormwater / Sewerage</b>	<ul style="list-style-type: none"> <li>Reduced capacity for drainage resulting in standing water due to post cold spell events.</li> <li>Damage to stormwater infrastructure with increased requirement for maintenance and repair across the county.</li> </ul>	<ul style="list-style-type: none"> <li>Impact on biodiversity. Heavy snowfall coverage can result in a lack of food for wild animals.</li> </ul>
<b>Wastewater</b>	<ul style="list-style-type: none"> <li>Overland flows of pollutants due to post freezing events, causing contamination of water supplies necessitating increased monitoring and remediation.</li> <li>Damage to wastewater infrastructure with increased requirement for maintenance and repair.</li> </ul>	<ul style="list-style-type: none"> <li>Damage to wastewater infrastructure with increased requirements for maintenance and repair.</li> </ul>
<b>Water Supply</b>	<ul style="list-style-type: none"> <li>Countywide water supply issues due to damaged water supply infrastructure (e.g., burst pipes).</li> <li>Increased maintenance and repair costs of water service infrastructure across the county.</li> </ul>	<ul style="list-style-type: none"> <li>Countywide water supply issues due damaged water supply infrastructure (e.g., burst pipes).</li> <li>Increased maintenance and repair costs of water service infrastructure.</li> </ul>
<b>Water Quality</b>	<ul style="list-style-type: none"> <li>Reduction and disruption of water supplies across the county due to decreased water quality necessitating increased requirement on council to supply water to affected communities.</li> </ul>	<ul style="list-style-type: none"> <li>None</li> </ul>
<b>Biodiversity</b>	<ul style="list-style-type: none"> <li>Prolonged cold spells impacting species not protected from the frigid temperatures countywide requiring increased monitoring and remediation.</li> </ul>	<ul style="list-style-type: none"> <li>Lack of food for wild animals.</li> </ul>
<b>Community Development</b>	<ul style="list-style-type: none"> <li>Increased instances of community isolation across the county.</li> <li>Significant impact on the county's economy.</li> </ul>	<ul style="list-style-type: none"> <li>Increased instances of community isolation across the county.</li> <li>Significant impact on the economy of communities countywide.</li> </ul>
<b>Emergency Response</b>	<ul style="list-style-type: none"> <li>Increased pressure on emergency response units across the county.</li> </ul>	<ul style="list-style-type: none"> <li>Increased pressure on emergency response units across the county.</li> <li>Increase in response times due to heavy snowfall on roads around the county.</li> </ul>
<b>Crosscutting</b>	<ul style="list-style-type: none"> <li>Redeployment of staff</li> </ul>	



# Service Level Impacts (Severe Windstorm)

Severe Windstorms were identified as having a moderate impact on the provision of Business Services, Roads, Building Stock, Community Infrastructure, Cultural Heritage, Wastewater, Water Supply, Biodiversity, Community Development, and Emergency Response services provided by Leitrim County Council, with severe pressure on services across the county. The impact of severe windstorms on Water Quality services was identified as minor and at a localised level.

Key to colour coding of impact ratings

- Catastrophic
- Major
- Moderate
- Minor
- Negligible

	Severe Windstorm
<b>Business Services</b>	<ul style="list-style-type: none"> <li>Widespread closure of business services.</li> <li>Health and safety risks for public and staff.</li> </ul>
<b>Roads, footpaths, bridges, construction and maintenance</b>	<ul style="list-style-type: none"> <li>Countywide transport disruption and road closures affecting the wider community and local authority operations.</li> <li>Increased clean-up and repair costs after an event.</li> </ul>
<b>Building Stock</b>	<ul style="list-style-type: none"> <li>Closure of buildings and disruption of services as a result of direct damage to buildings and disruption of power.</li> </ul>
<b>Community Infrastructure</b>	<ul style="list-style-type: none"> <li>Disruption to delivery of community services across the county.</li> <li>Increased clean-up and repair costs after an event.</li> </ul>
<b>Cultural Heritage</b>	<ul style="list-style-type: none"> <li>Increased maintenance and repair costs due to storm damage to cultural heritage sites.</li> </ul>
<b>Stormwater / Sewerage</b>	None
<b>Wastewater</b>	<ul style="list-style-type: none"> <li>Increased maintenance due to treefall and leaf/debris disrupting wastewater systems.</li> </ul>
<b>Water Supply</b>	<ul style="list-style-type: none"> <li>Increased pressure on water supply services due to contaminated water bodies.</li> </ul>
<b>Water Quality</b>	<ul style="list-style-type: none"> <li>Disruption to water quality monitoring.</li> </ul>
<b>Biodiversity</b>	<ul style="list-style-type: none"> <li>High winds result in damage to habitats.</li> <li>Increased cost to protect habitats from wind damage.</li> </ul>
<b>Community Development</b>	<ul style="list-style-type: none"> <li>Increased power outages and damages to infrastructure result in an impact on local economy.</li> </ul>
<b>Emergency Response</b>	<ul style="list-style-type: none"> <li>Widespread increased pressure on emergency services.</li> <li>Increase in response times due to fallen trees and debris on roads around the county.</li> </ul>
<b>Crosscutting</b>	<ul style="list-style-type: none"> <li>Staff redeployment.</li> </ul>



# Service Level Impacts (Coastal Flood)

Coastal Floods were identified as having an appearance of threat but no actual impact on the service provisions of Roads, and Building Stock services, provided by Leitrim County Council.

*Key to colour coding of impact ratings*

- Catastrophic
- Major
- Moderate
- Minor
- Negligible

	Coastal Flood
Business Services	None
Roads, footpaths, bridges, construction and maintenance	<ul style="list-style-type: none"> <li>•Potential for transport disruptions and road closures across the county</li> <li>•Potential for increase in the cost of clean-up and repairs.</li> </ul>
Building Stock	None
Community infrastructure	None
Cultural Heritage	None
Stormwater / Sewerage	None
Wastewater	None
Water Supply	None
Water Quality	None
Biodiversity	None
Community Development	None
Emergency Response	None
Crosscutting	None



# Service Level Impacts (Pluvial & River Flood)

Key to colour coding of impact ratings

Catastrophic
Major
Moderate
Minor
Negligible

Pluvial flooding was identified as having a minor and localised impact on the provision of Business Services, Building Stock, Community Infrastructure, Cultural Heritage, Stormwater/ Sewerage Wastewater, Water Supply, and Community Development services by Leitrim County Council. The impact of pluvial flooding on the provision of Roads, Water Quality, and Emergency Response services was identified as moderate, with an appreciable decline in the provision of services across the county.

In addition, the impact of river flooding on the provision of service areas provided by County Leitrim was identified as moderate for Roads, Building Stock, Community Infrastructure, Cultural heritage, Community Development, and Emergency Response, with services under severe pressure due to floods. River flooding was identified as having a minor and localised impact on the provision of Business Services, Wastewater, Water Supply, Water Quality, and Biodiversity.

	Pluvial Flood	River Flood
<b>Business Services</b>	<ul style="list-style-type: none"> <li>Localised disruption and closure of local authority services</li> </ul>	<ul style="list-style-type: none"> <li>Localised disruption and closure of local authority services</li> </ul>
<b>Roads, footpaths, bridges, construction and maintenance</b>	<ul style="list-style-type: none"> <li>Widespread transport disruption and road closures</li> <li>Increased clean-up and repair costs after an event</li> </ul>	<ul style="list-style-type: none"> <li>Widespread transport disruption and road closures</li> <li>Increased clean-up and repair costs after an event</li> </ul>
<b>Building stock</b>	<ul style="list-style-type: none"> <li>Increased maintenance and repair costs</li> <li>Increased requirement for flood defence measures</li> </ul>	<ul style="list-style-type: none"> <li>Increased maintenance and repair costs</li> <li>Increased requirement for flood defence measures</li> </ul>
<b>Community infrastructure</b>	<ul style="list-style-type: none"> <li>Closure of community infrastructure and services at a localised level.</li> <li>Increased repair and maintenance costs</li> </ul>	<ul style="list-style-type: none"> <li>Countywide closure of community infrastructure and services</li> <li>Increased repair and maintenance costs</li> </ul>
<b>Cultural Heritage</b>	<ul style="list-style-type: none"> <li>Damage to heritage sites due to pluvial flooding requiring repair work</li> <li>Increased maintenance and repair costs</li> </ul>	<ul style="list-style-type: none"> <li>Damage to heritage sites due to river flooding requiring repair work</li> <li>Increased maintenance and repair costs</li> </ul>
<b>Stormwater / Sewerage</b>	<ul style="list-style-type: none"> <li>Reduced capacity for drainage resulting in standing water</li> <li>Damage to stormwater infrastructure at a localised level</li> <li>Increased maintenance and repair costs</li> </ul>	<ul style="list-style-type: none"> <li>Reduced capacity for drainage resulting in standing water</li> <li>Damage to stormwater infrastructure at a localised level</li> <li>Increased maintenance and repair costs</li> </ul>
<b>Wastewater</b>	<ul style="list-style-type: none"> <li>Damage to wastewater treatment plants</li> <li>Increased maintenance and repair costs</li> </ul>	<ul style="list-style-type: none"> <li>Damage to wastewater treatment plants</li> <li>Increased maintenance and repair costs</li> </ul>
<b>Water Supply</b>	<ul style="list-style-type: none"> <li>Water supply issues at a localised level requiring supplemental water provision (e.g., tankering)</li> <li>Increased water treatment costs</li> </ul>	<ul style="list-style-type: none"> <li>Water supply issues at a localised level requiring supplemental water provision (e.g., tankering)</li> <li>Increased water treatment costs</li> </ul>
<b>Water Quality</b>	<ul style="list-style-type: none"> <li>Widespread deterioration of water quality due to overland flow of pollutants resulting in water supply issues and environmental degradation and an increased requirement for monitoring and remediation</li> </ul>	<ul style="list-style-type: none"> <li>Localised deterioration of water quality due to overland flow of pollutants resulting in water supply issues and an increased requirement for monitoring and remediation</li> </ul>
<b>Biodiversity</b>	<ul style="list-style-type: none"> <li>Flood damage to habitats - Flooding will damage habitats within and beside the river</li> <li>Isolated and limited damage to environmentally sensitive areas requiring monitoring and/or restoration work</li> </ul>	<ul style="list-style-type: none"> <li>Flood damage to habitats- Flooding will damage habitats within and beside the river</li> <li>Isolated and limited damage to environmentally sensitive areas requiring monitoring and/or restoration work</li> </ul>
<b>Community Development</b>	<ul style="list-style-type: none"> <li>Inhibited development of communities at a localised level</li> <li>Damage to buildings and travel disruptions impact on local economies</li> </ul>	<ul style="list-style-type: none"> <li>Inhibited development of communities at a countywide level</li> <li>Damage to buildings and travel disruptions impact on local economies in Leitrim County Council at a localised level</li> </ul>
<b>Emergency Response</b>	<ul style="list-style-type: none"> <li>Localised increased pressure on emergency response</li> </ul>	<ul style="list-style-type: none"> <li>Localised increased pressure on emergency response</li> </ul>
<b>Crosscutting</b>	<ul style="list-style-type: none"> <li>Staff redeployment</li> </ul>	



# 3.2.4 Overall Impacts of Current Climate Risks

# Impacts of Current Climate Risks on the Local Authority

*Key to colour coding of impact ratings*

- Catastrophic
- Major
- Moderate
- Minor
- Negligible

Following on from characterising the frequency of the hazard, exposure, vulnerability, and the associated level of impact to the local authority, the overall impact on key risk areas of Leitrim County Council was assessed according to the criteria provided through Technical Annex B: Climate Change Risk Assessment (catastrophic, major, moderate, minor and negligible) (see appendix 2). Below we provide a summary of impacts across the ten climate hazards identified. The following pages provide the information that informed this assessment.


Hazard	Current Frequency	Assets	Health and Wellbeing	Environment	Social	Cultural Heritage	Financial	Reputational	Overall Impact Score
Heatwave	Common	Minor	Minor	Minor	Negligible	Minor	Negligible	Negligible	1.6
Drought	Occasional	Negligible	Negligible	Moderate	Minor	Minor	Negligible	Negligible	1.6
Cold Spell	Occasional	Moderate	Minor	Moderate	Moderate	Minor	Minor	Minor	2.4
Heavy Snowfall	Occasional	Moderate	Minor	Moderate	Negligible	Minor	Minor	Minor	2.1
Severe Windstorm	Frequent	Moderate	Minor	Negligible	Minor	Minor	Minor	Minor	2.0
Coastal Flood	Rare	Negligible	None	None	None	None	None	None	0.1
Pluvial Flood	Frequent	Moderate	Minor	Moderate	Minor	Negligible	Minor	Minor	2.1
River Flood	Frequent	Major	Minor	Minor	Moderate	Minor	Moderate	Minor	2.6

# Impacts of Current Climate Risks – Heatwaves & Drought

County Leitrim has been exposed to heatwave events (defined as 5 consecutive days with temperatures >25 deg. C) over the period 1985-2022 with a wide range of impacts across the county. The most notable impacts relates to responding to uncontrolled fires. In addition, County Leitrim has experienced drought conditions over the period as exemplified by the drought events in 1995 and 2018.

Key to colour coding of impact ratings
Catastrophic
Major
Moderate
Minor
Negligible

Hazard & Frequency	Exposure	Impact Description	Rating
 Heatwave  Common	<b>Assets</b>	<ul style="list-style-type: none"> <li>High temperatures have resulted in localised damage to road surfaces (tar and chip) across the County. Melting of road surfaces was reported across Co. Leitrim during the 2018 heatwave.</li> </ul>	Minor
	<b>Health and Well being</b>	<ul style="list-style-type: none"> <li>High indoor temperatures have resulted in uncomfortable working conditions for staff and public. This has resulted in the increased requirement for active/mechanical cooling.</li> </ul>	Minor
	<b>Environment</b>	<ul style="list-style-type: none"> <li>Heat waves provide suitable conditions for the ignition of uncontrolled fires, with high temperatures in 2021 leading to 18 wild fires reported throughout the county.</li> <li>High water temperatures associated with heatwave events have also had significant impacts on freshwater and marine environments. In 2021, Keeldra Lough in Co. Leitrim was closed for over 100 days due to a toxic algal bloom associated with high temperatures.</li> </ul>	Minor
	<b>Social</b>	<ul style="list-style-type: none"> <li>Heatwaves have resulted in congestion at key recreational areas with facilities (e.g., litter collection and parking) overwhelmed. In September 2022, 185kg of litter was removed from Leitrim beaches</li> </ul>	Negligible
	<b>Cultural Heritage</b>	<ul style="list-style-type: none"> <li>Extreme temperatures are recognised as contributing to the increased weathering of cultural heritage sites.</li> </ul>	Minor
	<b>Financial</b>	<ul style="list-style-type: none"> <li>The financial implications of heatwaves are primarily associated with road maintenance and repair.</li> </ul>	Negligible
	<b>Reputational</b>	<ul style="list-style-type: none"> <li>Heatwaves have had a negligible reputational impact for Leitrim County Council</li> </ul>	Negligible

 Drought  Occasional	<b>Assets</b>	<ul style="list-style-type: none"> <li>Drought conditions (e.g. Summer 2019) resulted in the imposition of restrictions on water supply on a national and county basis with implications for building operation.</li> </ul>	Negligible
	<b>Health and Well being</b>	<ul style="list-style-type: none"> <li>Water restrictions, particularly in combination with extreme heat, have the potential to result in dehydration, this is particularly the case for vulnerable populations and outdoor workers.</li> </ul>	Negligible
	<b>Environment</b>	<ul style="list-style-type: none"> <li>High temperatures and dry conditions, often compounded by high levels of ignition activity, have resulted in uncontrolled fires. In 2021 this led to 18 wild fires throughout the county.</li> </ul>	Moderate
	<b>Social</b>	<ul style="list-style-type: none"> <li>Water restrictions can lead to inconvenience for local businesses and resident.</li> </ul>	Minor
	<b>Cultural Heritage</b>	<ul style="list-style-type: none"> <li>Drought conditions results in damage to cultural heritage sites due to drying out of substrate.</li> </ul>	Minor
	<b>Financial</b>	<ul style="list-style-type: none"> <li>The financial implications of drought are limited and restricted to responding to wildfire and supporting the provision of water (e.g., tankering).</li> </ul>	Negligible
	<b>Reputational</b>	<ul style="list-style-type: none"> <li>The reputational impacts of drought conditions are limited and localised.</li> </ul>	Negligible




# Impacts of Current Climate Risks – Cold Spells & Heavy Snowfall

County Leitrim has experienced significant extreme cold/cold spell and heavy snowfall events over the period 1985-2022 with significant events reported for 2009, 2010, 2018 (the ‘Beast from the East’), 2019 and 2022. These events have wide ranging impacts across the County including disruption of transport routes, damage to buildings, and isolation of communities.

Key to colour coding of impact ratings

Catastrophic
Major
Moderate
Minor
Negligible

Hazard & Frequency	Exposure	Impact Description	Rating
 Cold spell Occasional	Assets	<ul style="list-style-type: none"> <li>Cold spells have resulted in road closure, transport disruption and increased maintenance and repair costs across the county.</li> <li>Freeze thaw action has resulted in damage to critical infrastructure (e.g., water infrastructure) and building stock.</li> <li>Extreme cold conditions in combination with snowfall have resulted in the widespread closure of business (incl. LA business services).</li> </ul>	Moderate
	Health and Well being	<ul style="list-style-type: none"> <li>Extreme cold has resulted in treacherous conditions and increased incidence of slips and falls.</li> <li>Exposure to extreme cold has had detrimental impacts for outdoor workers and vulnerable populations.</li> </ul>	Minor
	Environment	<ul style="list-style-type: none"> <li>Cold spells have led to decreased water availability and have detrimental impacts for biodiversity and habitats, resulting in a decrease of ecosystem health.</li> </ul>	Moderate
	Social	<ul style="list-style-type: none"> <li>Road closures have resulted in social isolation for remote communities.</li> <li>Elderly and vulnerable populations are required to stay in place resulting in isolation.</li> </ul>	Moderate
	Cultural Heritage	<ul style="list-style-type: none"> <li>Freeze thaw has been identified as having detrimental impacted on the structural integrity of cultural heritage sites.</li> </ul>	Minor
	Financial	<ul style="list-style-type: none"> <li>The financial implications of cold spells are primarily associated with maintenance and repair costs for local and regional roads, buildings and assets, and can be significant.</li> </ul>	Minor
	Reputational	<ul style="list-style-type: none"> <li>Isolation of communities and council response (e.g., gritting) across the county receives media attention but with limited reputational impact for County Leitrim.</li> </ul>	Minor

 Heavy snowfall Occasional	Assets	<ul style="list-style-type: none"> <li>Heavy snowfall has resulted in road closures and transport disruption as evidenced by Heavy snowfall in February 2022 which led to the R283 between Manorhamilton and Kiltyclogher becoming impassable</li> <li>Accumulations of snowfall on roofs results in damage to of closure buildings, as with civic amenity sites at Mohill and Manorhamilton in February 2022. Flooding post-heavy snowfall events results in the flooding of assets (e.g., roads and infrastructure).</li> </ul>	Moderate
	Health and Well being	<ul style="list-style-type: none"> <li>Heavy snowfall has resulted in treacherous conditions and increased incidence of slips and falls amongst public and staff.</li> </ul>	Minor
	Environment	<ul style="list-style-type: none"> <li>Flooding post-heavy snowfall event results in overland flow of pollutants to habitats and ecosystems with detrimental effects. Impact on the food sources for wild animals.</li> </ul>	Moderate
	Social	<ul style="list-style-type: none"> <li>Road closures can result in significant social isolation for remote communities.</li> </ul>	Negligible
	Cultural Heritage	<ul style="list-style-type: none"> <li>Accumulations of heavy snowfall can result in damage to cultural heritage sites.</li> </ul>	Minor
	Financial	<ul style="list-style-type: none"> <li>The financial implications of cold spells are primarily associated with maintenance and repair costs for local and regional roads, buildings and assets</li> </ul>	Minor
Reputational	<ul style="list-style-type: none"> <li>Isolation of communities and council response (e.g., gritting) across the county receives media attention but with limited reputational impact for the county.</li> </ul>	Minor	




# Impacts of Current Climate Risks - Windstorms

County Leitrim has been frequently exposed to wind storms over the period 1985-2022, notable examples being Storms Eleanor, Barra and Franklin. Impacts have been experienced across the county and relate to disruption of transport, electricity and communication networks. Severe windstorms also result in a range of environmental impacts

*Key to colour coding of impact ratings*

- Catastrophic
- Major
- Moderate
- Minor
- Negligible


Hazard & Frequency	Exposure	Impact Description	Rating
 Severe windstorm Frequent	<b>Assets</b>	<ul style="list-style-type: none"> <li>Windstorms has caused direct damage to building stock and other assets.</li> <li>Windstorm damage to power and communication transmission infrastructure (e.g., tree fall on overhead lines) has resulted in disruption of communications and energy supply. During Storm Barra in 2021 power was lost in multiple locations around the country, affecting 52 homes in Manorhamilton and a further 107 homes in Arigna. Storm Hannah in 2019 brought power disruption to over 600 homes throughout the county.</li> <li>Windstorms have caused disruption of transport routes as a result of treefall. In March 2019 fallen trees blocked roads around Willowfield.</li> </ul>	<b>Moderate</b>
	<b>Health and Well being</b>	<ul style="list-style-type: none"> <li>Windstorms posed a health and safety risk with potential for injury</li> </ul>	<b>Minor</b>
	<b>Environment</b>	<ul style="list-style-type: none"> <li>Windstorms have resulted in loss of trees and this is particularly the case for vulnerable tree species.</li> <li>Windstorms prevent council staff from safely taking accurate water samples from lakes, hindering monitoring of water quality.</li> </ul>	<b>Negligible</b>
	<b>Social</b>	<ul style="list-style-type: none"> <li>Severe windstorms and disruption of transport and communication networks has resulted in isolation of communities. During Storm Ali in 2018, 40 to 50 trees fell from a private forest blocking road access to two homes.</li> </ul>	<b>Minor</b>
	<b>Cultural Heritage</b>	<ul style="list-style-type: none"> <li>Severe wind storms can cause structural damage to cultural heritage sites.</li> </ul>	<b>Minor</b>
	<b>Financial</b>	<ul style="list-style-type: none"> <li>The financial impacts of severe wind storm are associated with clean-up and repair cost.</li> </ul>	<b>Minor</b>
	<b>Reputational</b>	<ul style="list-style-type: none"> <li>Reputational damage as a result of wind storms is limited and associated with short term media reporting on council preparedness and response.</li> </ul>	<b>Minor</b>

# Impacts of Current Climate Risks – Coastal Flooding

County Leitrim is exposed to coastal storms which could result in the inundation of coastal assets. The Leitrim coast comprises of 5km of coastline, however, to date there is no record of impact as a result of this hazard on the local authority.

*Key to colour coding of impact ratings*



- Catastrophic
- Major
- Moderate
- Minor
- Negligible

Hazard & Frequency	Exposure	Impact Description	Rating
 <p>Coastal flood Common</p>	<b>Assets</b>	<ul style="list-style-type: none"> <li>Coastal flooding has the potential to result in direct damage to roads, however, to date there is no record of impact as a result of this hazard on the local authority</li> </ul>	Negligible
	<b>Health and Well being</b>	<ul style="list-style-type: none"> <li>None</li> </ul>	None
	<b>Environment</b>	<ul style="list-style-type: none"> <li>None</li> </ul>	None
	<b>Social</b>	<ul style="list-style-type: none"> <li>None</li> </ul>	None
	<b>Cultural Heritage</b>	<ul style="list-style-type: none"> <li>None</li> </ul>	None
	<b>Financial</b>	<ul style="list-style-type: none"> <li>None</li> </ul>	None
	<b>Reputational</b>	<ul style="list-style-type: none"> <li>None</li> </ul>	None

# Impacts of Current Climate Risks - Pluvial and Fluvial Flooding

For County Leitrim in the period 1985-2022, pluvial and fluvial flooding have occurred on a frequent basis. Areas of exposure to fluvial flooding are limited geographically but with the potential for frequent exposure for fluvial flooding. Notable flooding events including the pluvial flooding of Leitrim village in 2020 and the fluvial flooding of Carrick-on-Shannon in 2020 and 2021.

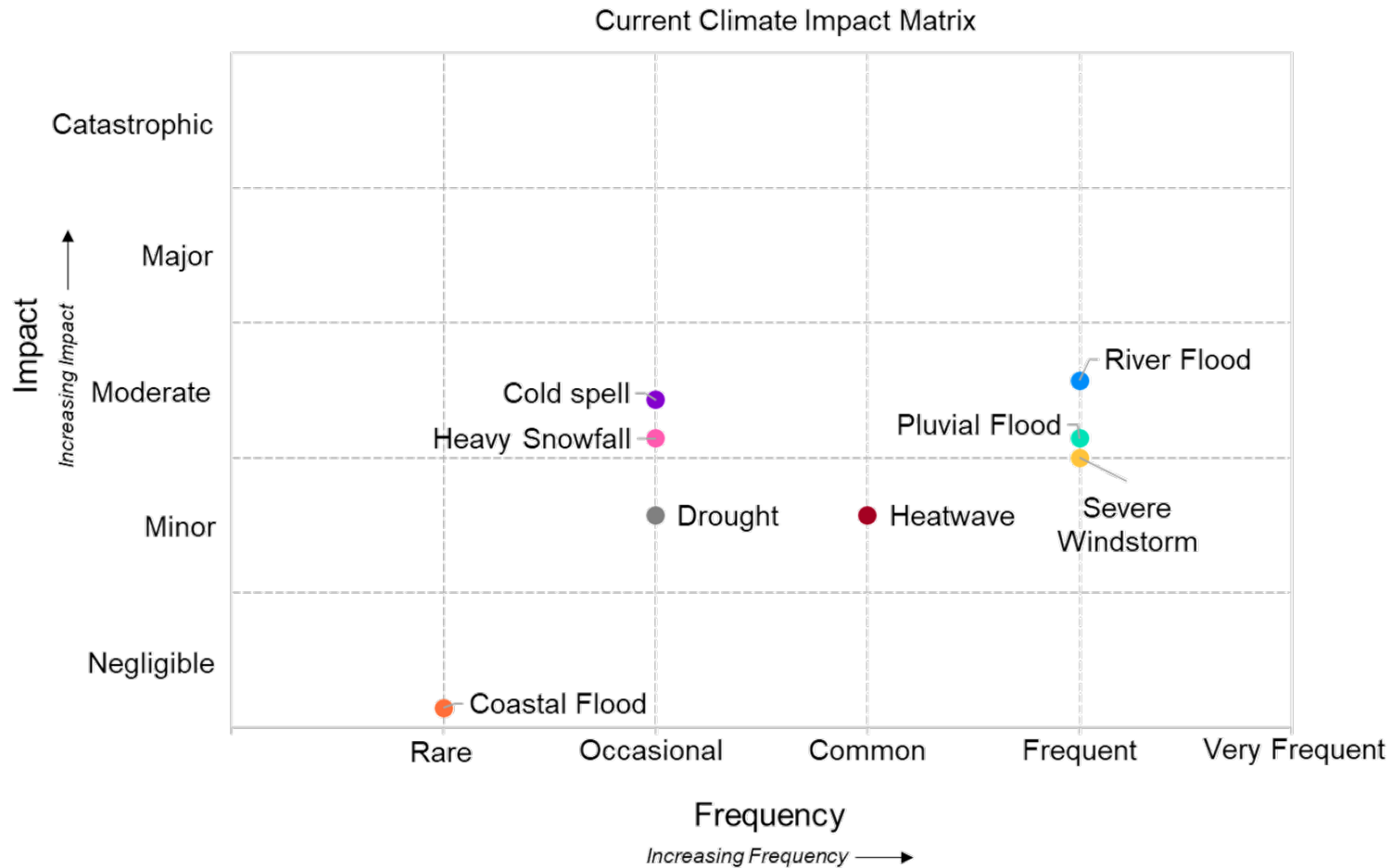
Key to colour coding of impact ratings
Catastrophic
Major
Moderate
Minor
Negligible

Hazard & Frequency	Exposure	Impact Description	Rating
 Pluvial flood Frequent	Assets	<ul style="list-style-type: none"> <li>Pluvial flooding has resulted in the temporary inundation of assets. In February 2020, heavy rainfall led to flooding of green spaces around the canal in Leitrim village.</li> <li>Pluvial flooding results in damage to road surfaces and other infrastructure. Flash flooding arising from heavy rainfall in August 2021 caused damage to the Ballinaglera bridge, requiring repair works costing €150,000</li> </ul>	Moderate
	Health and Well being	<ul style="list-style-type: none"> <li>Heavy precipitation and floodwater leads to dangerous driving conditions for both council staff and public. In June 2020 heavy rainfall led to roads being impassable at Sox, Parkes Castle and other locations and to commuters, requiring rescue from trapped vehicles on the R280</li> </ul>	Minor
	Environment	<ul style="list-style-type: none"> <li>Pluvial flooding has resulted in the overland flow of pollutants (nutrients, sediment and pesticides) with impacts on terrestrial and freshwater ecosystems.</li> <li>Pluvial flooding can cause landslides and damage to local habitats. In June 2020, heavy rainfall led to a major landslide where 160,000 tonnes of peatland 'slipped' at Greaghmagh, causing significant damage to the county's environmental heritage.</li> <li>Pluvial flooding causes damage to habitats.</li> </ul>	Moderate
	Social	<ul style="list-style-type: none"> <li>Road closures can result in significant social isolation for communities.</li> </ul>	Minor
	Cultural Heritage	<ul style="list-style-type: none"> <li>Pluvial flooding puts built heritage with stone cavities at risk of soakage and leakage.</li> </ul>	Negligible
	Financial	<ul style="list-style-type: none"> <li>The financial implications of emergency response (e.g. pumping and emergency co-ordination, clean-up and repair) can be significant.</li> <li>Increased budget pressure to adapt to impact of climate change, e.g. flood protection measures and upgrading of existing drainage systems.</li> </ul>	Minor
	Reputational	<ul style="list-style-type: none"> <li>Pluvial flooding issues are localised but can result in reputational damage to the council.</li> </ul>	Minor
 River flood Frequent	Assets	<ul style="list-style-type: none"> <li>River flooding has resulted in the temporary inundation of buildings and damage to infrastructure. In October 2022, high velocity flow of the Aghagrania river following heavy rainfall led to the collapse of roadside embankment and 50m of verge, leading to the closure of the L7306.</li> <li>River flooding results in transport disruption and road closures. In October 2019, heavy rainfall led to north Leitrim experiencing severe road flooding around the Shanvaus and Diffreen rivers, forcing diversions on the N16.</li> </ul>	Major
	Health and Well being	<ul style="list-style-type: none"> <li>Heavy precipitation and floodwater leads to dangerous driving conditions for both council staff and public</li> <li>Fluvial floods can carry debris which can lead to injury of residents and pedestrians</li> </ul>	Minor
	Environment	<ul style="list-style-type: none"> <li>River flooding can result in the overland flow of pollutants (nutrients, sediment and pesticides) with impacts on terrestrial and freshwater ecosystems.</li> </ul>	Minor
	Social	<ul style="list-style-type: none"> <li>Road closures can result in significant social isolation for communities</li> <li>Inhibited development of communities as a result of frequent river flooding</li> </ul>	Moderate
	Cultural Heritage	<ul style="list-style-type: none"> <li>A number of the county's cultural heritage and archaeological sites are situated near river systems and are particularly exposed to river flooding.</li> </ul>	Minor
	Financial	<ul style="list-style-type: none"> <li>The financial implications of fluvial flooding are associated with increased costs associated with preparedness (e.g., sandbags and demountable defences), emergency response (e.g. pumping and emergency co-ordination), clean-up and repair.</li> </ul>	Moderate
	Reputational	<ul style="list-style-type: none"> <li>For areas that are subject to frequent inundation, there is the potential for localised reputational damage.</li> </ul>	Minor



# Current Climate Impact Matrix

Based on frequency of hazard occurrence and level of impact, we have developed a current climate impact matrix for Leitrim County Council. Our assessment identified heatwaves, drought, severe windstorms, cold spells, heavy snowfall, and river, pluvial and coastal flooding hazards have occurred within the region. Pluvial and river flooding and severe windstorms were assessed as being the hazards occurring most often and with a moderate impact on County Leitrim. Coastal flooding has the potential to occur however, to date there is limited record of impact as a result of this hazard on the local authority



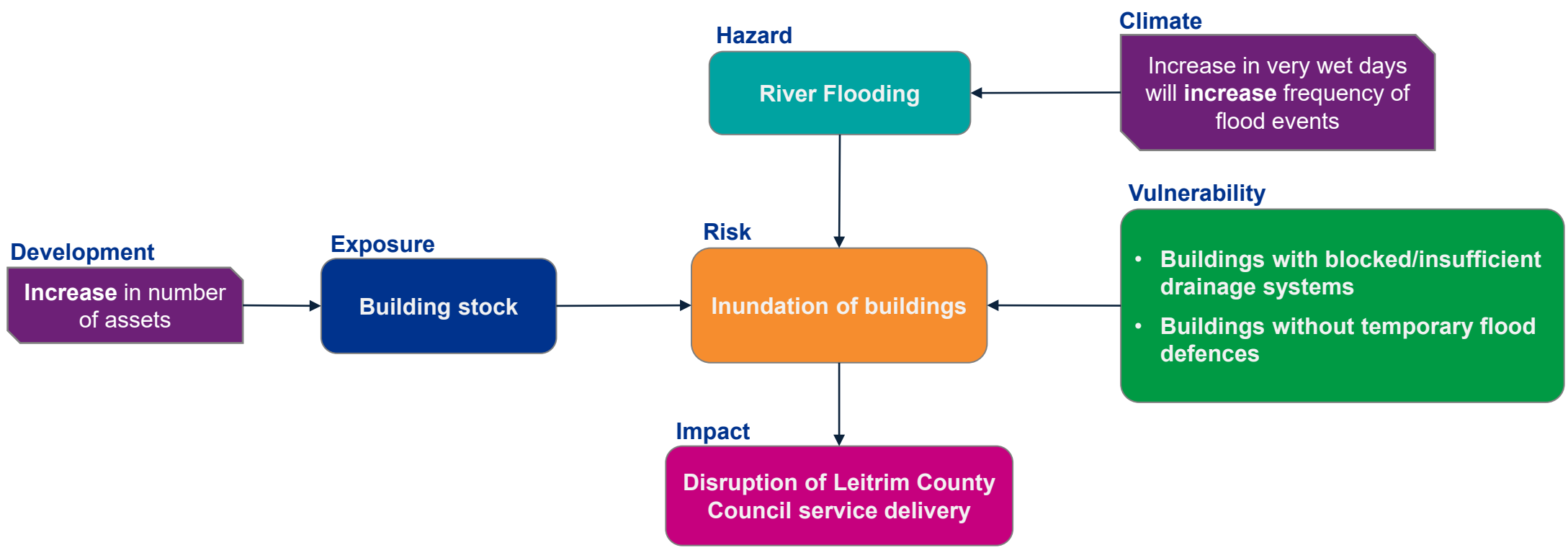
# 3.3 Future Climate Risks and Impacts

# 3.3.1 Future Changes in Climate Hazards

# Future Climate Risk and Impact

Climate risks may increase, decrease, or emerge in the future due to a change in either the frequency and severity of climate hazards and/or changes in exposure and vulnerability. In the example below, the risk of inundation due to river flooding will increase due to an increase in the number of very wet days (> 30 mm precipitation) leading to an increase in the frequency of river flood events. Furthermore, there is likely to be an increased population in the region, possibly resulting in new buildings being constructed. This will potentially increase the number of assets exposed to river flooding. Therefore, due to changes in both the hazard and exposure, the risk of inundation of Leitrim County Council buildings will increase in the future.











In the following sections, we provide an assessment of potential future changes in the climate of County Leitrim by 2050 and its effects on the frequency of hazard occurrence. An assessment of the future changes in the population and development in the region by 2050 that could affect exposure and vulnerability was also undertaken. Finally, considering all three components, the future climate risk was assessed.

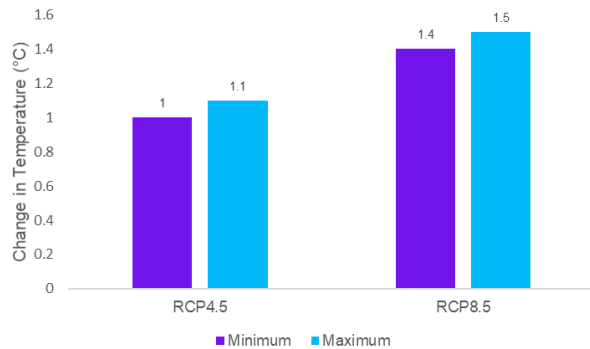




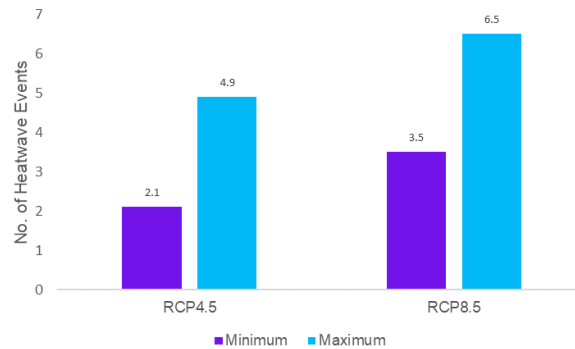
# Climate Projections for County Leitrim in 2050 (1/2)

Having identified and assessed the range of climate hazards already experienced by Leitrim County Council, the projected changes in the frequency and intensity of climate hazards was assessed to understand how existing climate impacts and risks faced by Leitrim County Council may be exacerbated.

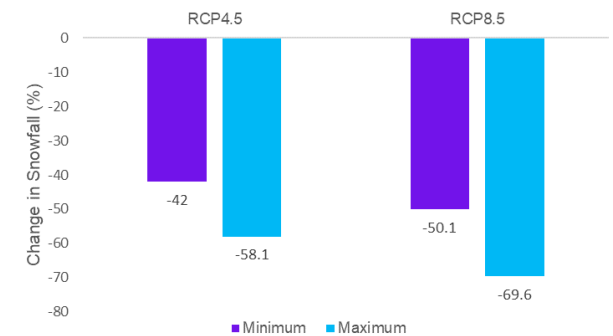
Hazard	Projected Change	Future Frequency
 <b>Heatwaves</b>	<ul style="list-style-type: none"> <li>Projections indicate an <b>overall increase in average temperature</b> (bottom left) of between 1.0 and 1.5°C for County Leitrim relative to the 1981-2000 period.</li> <li>Under a high emission scenario, projections indicate that <b>heatwaves will become more frequent</b> (bottom middle) by mid-century.</li> </ul>	Frequent 
 <b>Droughts</b>	<ul style="list-style-type: none"> <li><b>Summer rainfall is expected to decrease</b> by between 5 and 12% in the future when compared with the baseline period of 1981-2000, in both the RCP4.5 and RCP8.5 scenario contributing to potential drought conditions.</li> </ul>	Common 
 <b>Cold Spell</b>	<ul style="list-style-type: none"> <li>As a consequence of the increasing temperatures and for both the RCP4.5 and RCP8.5 scenario, a <b>decrease in the number of frost days and ice days is expected</b> for the future period when compared with the baseline period of 1981 to 2000.</li> </ul>	Rare 
 <b>Heavy Snowfall</b>	<ul style="list-style-type: none"> <li>The annual <b>snowfall</b> in the region is projected to decrease substantially by the middle of the century for the RCP4.5 and RCP8.5 scenarios (bottom right).</li> </ul>	Rare 
 <b>Severe Windstorms</b>	<ul style="list-style-type: none"> <li><b>Projections of storms are subject to a high level of uncertainty.</b> By mid century, projections indicate that average wind speed will remain similar to those currently experienced but an increase in more intense storms which are currently rare events is projected.</li> </ul>	Frequent 



The projected minimum and maximum increase in the **mean annual temperature** for the area of County Leitrim for the period 2041-2060 compared to 1981-2000 for the medium (RCP4.5) and high (RCP8.5) emissions scenario (Source: Nolan and Flanagan, 2020).









The projected minimum and maximum **number of heatwaves** for the area of County Leitrim for the period 2041-2060 compared to 1981-2000 for the medium (RCP4.5) and high (RCP8.5) emissions scenario (Source: Nolan and Flanagan, 2020).

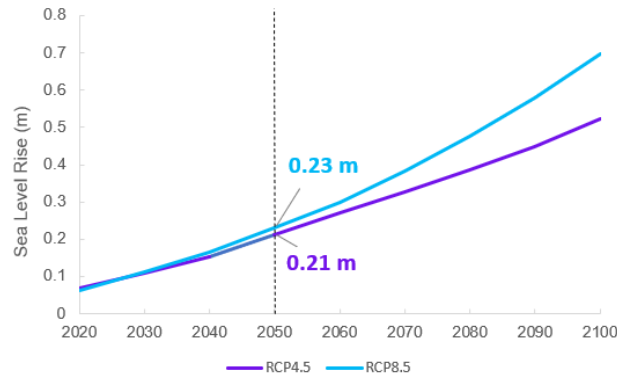


The projected reduction in **snowfall (> 30 mm)** for the area of County Leitrim for the period 2041-2060 compared to 1981-2000 for a medium (RCP4.5) and high (RCP8.5) emissions scenario (Source: Nolan and Flanagan, 2020).

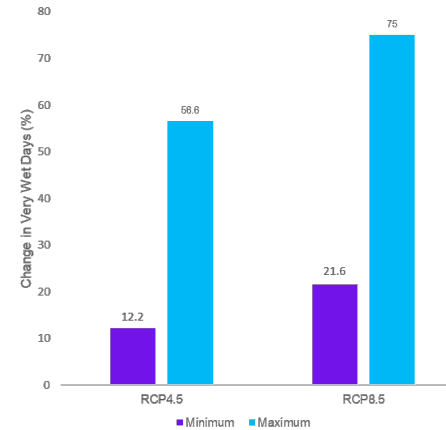
# Climate Projections for County Leitrim in 2050 (2/2)

Having identified and assessed the range of climate hazards and impacts already experienced by Leitrim County Council, the projected changes in the frequency and intensity of climate hazards (acute and chronic) were assessed to understand how existing climate impacts and risks faced by Leitrim County Council may be exacerbated.

Hazard	Projected Change	Future Frequency
 Coastal Flood	<ul style="list-style-type: none"> <li>Rising sea levels projections under a high emissions scenario indicate an increase in sea level of up to 0.23 m by 2050 which will <b>increase the frequency of coastal inundation</b> for County Leitrim (bottom left)</li> </ul>	Frequent 
 Pluvial Flood	<ul style="list-style-type: none"> <li>Projections indicate an <b>increase in the frequency of heavy rainfall days</b> (days with precipitation &gt;30mm) for County Leitrim with some areas projected to see an increase of up to 75% (bottom right). This will likely result in an increased frequency of associated fluvial and pluvial flooding.</li> </ul>	Very Frequent 
 River Flood		Very Frequent 



The median projected **increase in sea level** for the medium (RCP4.5) and high (RCP8.5) emissions scenario offshore of County Leitrim (Grid Reference: 54,-11) (Source: IPCC AR6 Sea-Level Rise Projections).



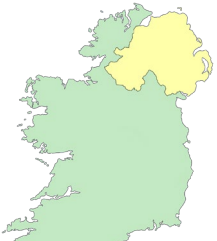
The projected minimum and maximum **increase in very wet days (> 30 mm)** for the area of County Leitrim for the period 2041-2060 compared to 1981-2000 for a medium (RCP4.5) and high (RCP8.5) emissions scenario (Source: Nolan and Flanagan, 2020).

## 3.3.2

# Future Changes in Exposure and Vulnerability (incl. Emerging Risk)

# Projected Changes in Exposure and Vulnerability

In the future, County Leitrim will also change in terms of its population and developments. This will potentially affect the exposure and vulnerability of people and assets within the region. National, regional and local strategies that outlined expected and possible sociodemographic and infrastructure developments within County Leitrim were reviewed to understand how exposure and vulnerability may change by 2050. A summary of the results of this review are shown below.



## How is Ireland projected to change by 2040?

- Extra **1m population**, 500,000 in rural areas / regional centres
- Extra 660,000 jobs




- Extra **550,000 homes**
- 'Housing for All' promotes a 'town centre first' approach

### Cross-Sectoral National Priorities:

- Infrastructure and Services
- Climate Change Adaptation & Mitigation
- Regeneration, Repopulation, Resilience



## How is County Leitrim projected to change?

- Population to increase from **32,000 to 36-37,000** between 2016 and 2031 (NPF)
- **1,667** projected new household demand 2017-2031 (ESRI NPF scenario)
- Leitrim's total road network of **2,157km**, consists of 56km national roads, 332km regional roads and 1,769km local roads

*"To deliver at least 30% of all new homes that are targeted in Carrick-on-Shannon, Ballinamore and Manorhamilton within the existing built-up footprints on infill and/or brownfield sites with a reduced target of 20% for the remaining lower tier settlements in the Settlement Hierarchy.."*

*Draft Leitrim County Development Plan (2023-29)*

## Planning for adaptation

### Flood Defence Schemes:

The council is working with the Office of Public Works (OPW) on projects for Leitrim Village, Mohill, Dromod and Carrick-on-Shannon Flood Relief Scheme (which aims to protect 76 properties).

### Key national road infrastructure projects for council in collaboration with Transport Infrastructure Ireland:

- N16 Munakill Upgrade
- N16 Future Upgrade
- N4 Carrick-on-Shannon to Dromod Project



### Notable renewable energy initiatives include:

- 12 Sustainable Energy Community (SEC) (e.g. Carrick-on-Shannon Solar Community)
- The county's existing windfarms include: Carrickeeny, Tullynamoyle and Black Banks



## Planning for mitigation



## Case Study in Urban Planning: Regeneration

### Projects in 2022

**Leitrim Council secured €10 million** funding through the Rural Regeneration and Development Fund for two projects.

- This funding will underpin the purchase and re-development of the 112,611 sq. ft. former MBNA campus in **Carrick-on-Shannon** and the development of an enterprise campus at the site to contribute to growth in rural employment in the region.
- **Drumshanbo Food Enterprise Zone** will be home to 10 additional food tech and innovation R&D units, food service laboratory suites and 3<sup>rd</sup> level access training facilities

# Future Exposure and Vulnerability (1/2)

In addition to the changes in the frequency of hazard events, future risk is also driven by the changes in exposure and vulnerability of assets. In order to estimate the potential change in risk, a number of assumptions have been made in relation to the seven impact areas, which are outlined below.

<h2>Assets</h2>	<ul style="list-style-type: none"> <li>• Due to the expected increase in County Leitrim’s population, there will be an <b>increase in the associated households and infrastructure</b> resulting in an increase in the number of assets exposed to hazard events</li> <li>• Due to the expected increase in the frequency of heatwaves, <b>road assets will be more regularly exposed to melting and drought</b> conditions will result in <b>shrinkage of peatland</b> and increased damage to roads as a result</li> <li>• Pluvial and river flooding events that were once considered extreme, will become more frequent. This will <b>increase damage in the areas already exposed to these hazards</b> and will also expose new areas and therefore assets that were previously unaffected</li> </ul>
<h2>Health and Wellbeing</h2>	<ul style="list-style-type: none"> <li>• Due to the expected increase in the elderly population in County Leitrim there will be a <b>greater number of vulnerable people who are more sensitive to hazards</b>, particularly heatwaves</li> <li>• Pluvial and river flood events that were once considered extreme, will become more frequent. Consequently, people will be more frequently exposed to flooding hazards, and higher flood levels which will mean <b>people previously unaffected by flooding may become exposed</b>. This could impact on both physical and mental health and wellbeing</li> </ul>
<h2>Environment</h2>	<ul style="list-style-type: none"> <li>• The potential increasing occurrence of heatwaves and drought conditions within County Leitrim will mean <b>increased temperatures in water bodies and lower water levels</b> which can decrease water quality resulting in short and long term impacts on the environment</li> <li>• Due to the potential increased frequency of exposure to hazards in County Leitrim, there could be an <b>increase in the impact on environmental assets</b> as the time/ability for the habitat/environment to recover is reduced</li> <li>• Pluvial and river flooding events that were once considered extreme, will become more frequent. Consequently, environmental assets will be more frequently exposed to flooding hazards, and higher flood levels will mean <b>environmental assets previously unaffected by flooding may become exposed</b> - resulting in short and long term damage to habitats/environment by these hazards</li> </ul>

# Future Exposure and Vulnerability (2/2)

In addition to the changes in the frequency of hazard events, future risk is also driven by the changes in exposure and vulnerability of assets. In order to estimate the potential change in risk, a number of assumptions have been made in relation to the seven impact areas, which are outlined below.

<p><b>Social</b></p>	<ul style="list-style-type: none"> <li>• Due to the expected increase in the total and elderly population in County Leitrim there will be an <b>increase in the number of people affected by social isolation during some hazard events</b></li> <li>• In response to heatwaves, there will be an increased use of blue/green spaces by the public <b>putting increased pressure on local amenities</b> e.g. littering, traffic problems</li> </ul>
<p><b>Cultural Heritage</b></p>	<ul style="list-style-type: none"> <li>• Due to the potential increase in frequency of heatwave and drought events, <b>degradation rates will potentially increase resulting in an increase in the impact of climate and weather-related events on cultural heritage assets</b></li> <li>• Pluvial and river flood events that were once considered extreme, will become more frequent. Consequently, <b>cultural heritage assets will be more frequently exposed to flooding hazards</b>, and higher flood levels will mean cultural heritage assets previously unaffected by flooding may become exposed resulting in short and long term damage to habitats/environment by these hazards</li> </ul>
<p><b>Financial</b></p>	<ul style="list-style-type: none"> <li>• Due to the potential increase in frequency of hazard events and exposure across County Leitrim, there will be an <b>associated increase in the actions the local authority takes before, during, and after an event.</b></li> <li>• As a consequence, there will be an <b>increase in the costs associated with dealing with the events</b>, e.g. air conditioning, emergency service response, temporary and permanent flood defences, staff, training, and equipment purchase/maintenance</li> </ul>
<p><b>Reputational</b></p>	<ul style="list-style-type: none"> <li>• Due to the potential increase in frequency of hazard events and exposure across County Leitrim during an event there will be an <b>increasing demand/pressure on services/resources</b> potentially reducing the level of service delivery and harming the reputation of the local authority</li> <li>• For hazards which are existing long-term issues in County Leitrim, e.g. river flooding, if the response to the increased frequency and severity events is deemed insufficient by the public, this <b>may negatively impact on the reputation of the local authority</b></li> </ul>

# Future Impacts

Taking into account the changes in exposure and vulnerability, the future change in impacts for each of the eight hazards was assessed. The potential future changes in impact are outlined below with the change in impact shown in bold.

Hazard	Assets		Health and Wellbeing		Environment		Social		Cultural Heritage		Financial		Reputational	
	Current	Future (2050)	Current	Future (2050)	Current	Future (2050)	Current	Future (2050)	Current	Future (2050)	Current	Future (2050)	Current	Future (2050)
Heatwave	Minor	<b>Moderate</b>	Minor	<b>Moderate</b>	Minor	<b>Moderate</b>	Negligible	<b>Minor</b>	Minor	<b>Moderate</b>	Negligible	<b>Minor</b>	Negligible	<b>Minor</b>
Drought	Negligible	<b>Minor</b>	Negligible	<b>Minor</b>	<b>Moderate</b>	<b>Major</b>	Minor	<b>Moderate</b>	Minor	<b>Moderate</b>	Negligible	<b>Minor</b>	Negligible	<b>Minor</b>
Cold Spell	Moderate	Moderate	Minor	Minor	Moderate	Moderate	Moderate	Moderate	Minor	Minor	Minor	Minor	Minor	Minor
Heavy Snowfall	Moderate	Moderate	Minor	Minor	Moderate	Moderate	Negligible	Negligible	Minor	Minor	Minor	Minor	Minor	Minor
Severe Windstorm	Moderate	Moderate	Minor	Minor	Negligible	Negligible	Minor	Minor	Minor	Minor	Minor	Minor	Minor	Minor
Coastal Flood	Negligible	<b>Minor</b>	<b>None</b>	<b>Negligible</b>	None	None	None	None	<b>None</b>	<b>Negligible</b>	None	None	None	None
Pluvial Flood	Moderate	<b>Major</b>	Minor	<b>Moderate</b>	<b>Moderate</b>	<b>Major</b>	Minor	<b>Moderate</b>	Negligible	<b>Minor</b>	Minor	<b>Moderate</b>	Minor	<b>Moderate</b>
River Flood	Major	Major	Minor	<b>Moderate</b>	Minor	<b>Moderate</b>	<b>Moderate</b>	<b>Major</b>	Minor	<b>Moderate</b>	<b>Moderate</b>	<b>Major</b>	Minor	<b>Moderate</b>

# 3.3.3

# Overall Future Impact on Leitrim County Council



# Climate Risk Matrix

The future changes in the hazard, exposure, and vulnerability, combine to form an assessment of future risks across County Leitrim. The risk matrix on the right shows the future change in risk with the hollow marker showing the current risk and the solid marker the future risk. The dotted line shows the change between the current and future risk.

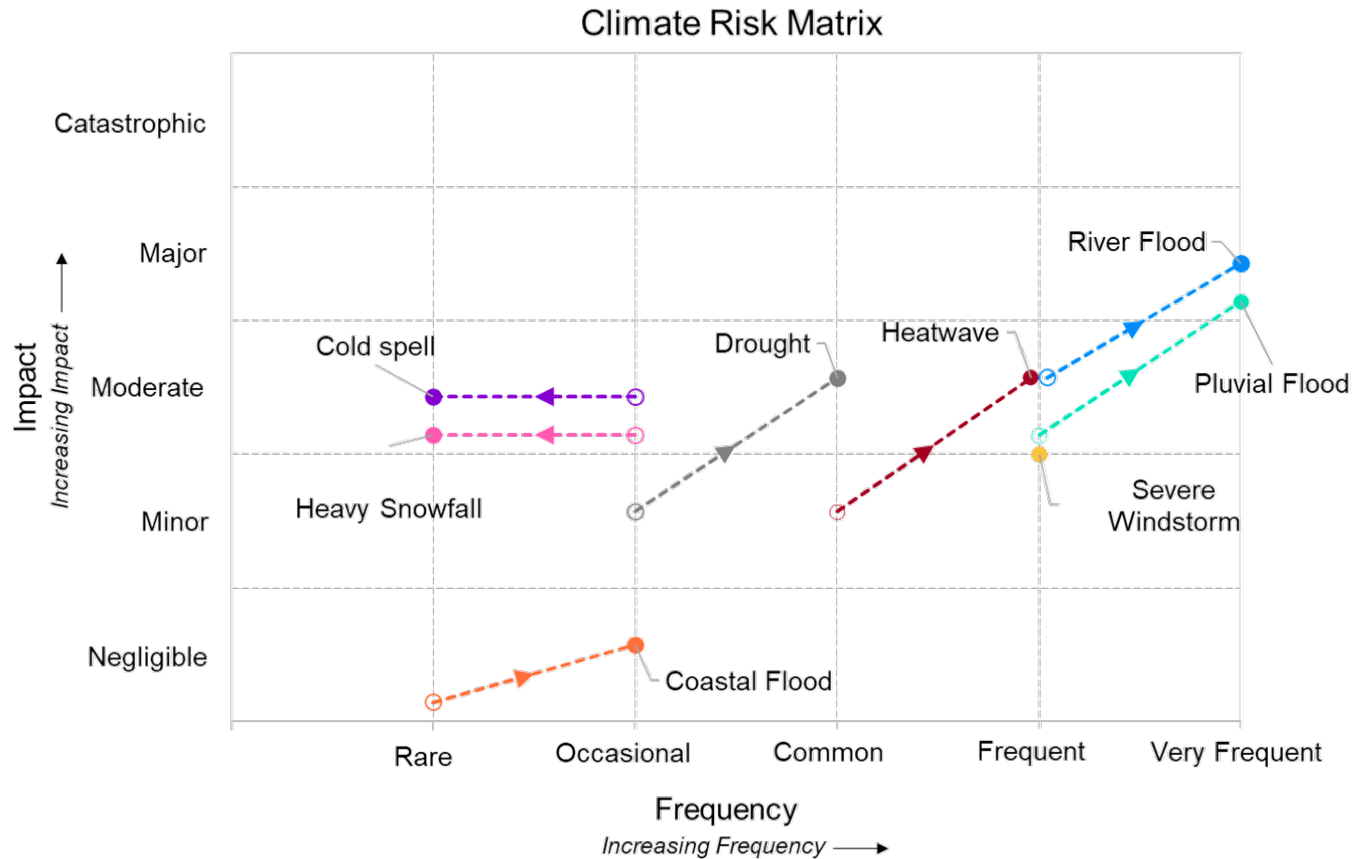
The **risks** of existing hazards such as **river and pluvial flooding** are likely to **increase** in the future because of changes in both hazard frequency as a result of climate change and impacts due to changes in exposure and vulnerability.

**Heatwaves and droughts** although already experienced in County Leitrim, are expected to occur more frequently due to climate change and with a greater impact on County Leitrim in the future. These hazards can be therefore be considered as **emerging risks** for the region.

**Coastal flooding** risk will **increase slightly** due to changes in the frequency of flooding events, however, due to the relatively small area affected by coastal flooding there will only by a small increase in the overall impact.

Although the frequency and impact of **severe windstorms** is thought to be **unchanged in the future**, these events will remain a risk for County Leitrim.

The impact of **heavy snowfall and cold spells** on County Leitrim remains constant, however, due to the potential decrease in hazard frequency, the overall risk of these hazards is likely to reduce in the future, resulting in less risk.



The risk matrix above shows the future changes in risk for the identified hazards within County Leitrim. For each hazard there is a solid marker, which identifies the future risk, and a hollow marker showing the current risk. The dotted line in between these markers shows the change between the current and future risk.

# 3.3.4 Uncertainty Assessment

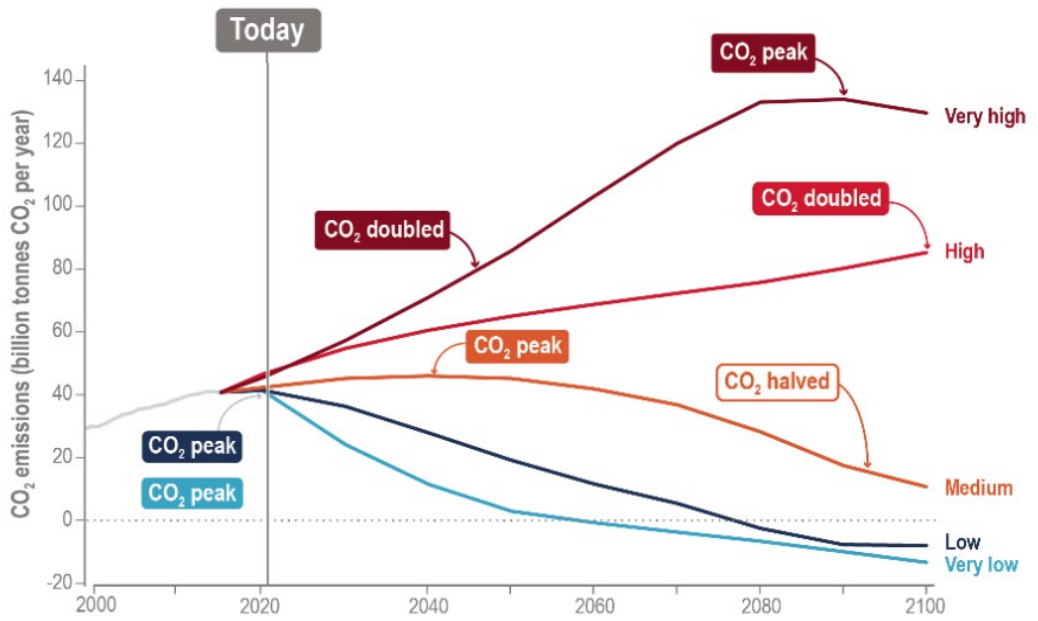
# Uncertainty

In assessing future climate risks there are levels of uncertainty related to each of the three elements of risk, i.e., not only the magnitude and frequency of hazards but also the exposure and vulnerability to any given hazard.

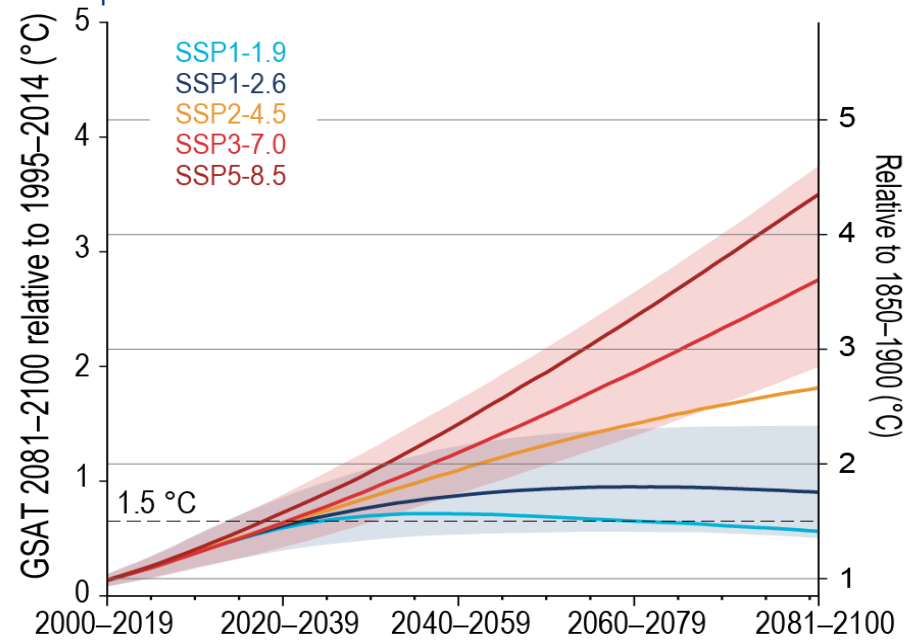
Different social and economic developments can lead to substantially different future emissions of carbon dioxide and other greenhouse gases (bottom left) resulting in uncertainty in what the future global climate will be. As an example of the possible future ranges in mean global surface temperature (bottom right) vary from below 1.5°C to over 4°C by 2100.

As a result of this uncertainty, climate projections include a range of scenarios, with SSP5-8.5 (AR6) or RCP8.5 (AR5) being the highest emission scenario and therefore the greatest change in future climate. When assessing climate risks with a qualitative approach, it is best practice to take a conservative or ‘worst case scenario’ to ensure that climate risks are not underestimated and dismissed as low or no risk. Climate risks identified within a qualitative risk assessment should be subsequently assessed using semi-quantitative or quantitative approaches to evaluate the risk in further detail.

Uncertainty also exists in relation to how County Leitrim will develop into the future. Although, in the near-term there is relatively good understanding as a result of strategies, such as the Leitrim County Development Plan 2022-2028, developments up to 2050 are less certain. A ‘worst case scenario’ approach has been taken here also, with the potential future impact being increased according to the indicative near-term trend and the assumption that adaptation actions are not implemented.



Annual emissions of CO<sub>2</sub> for the five core Shared Socio-economic Pathway (SSP) scenarios (very low: SSP1-1.9, low: SSP1-2.6, intermediate: SSP2-4.5, high: SSP3-7.0, very high: SSP5-8.5) (Source: IPCC AR6 Infographic TS.1).



Assessed projected change in mean global surface temperature for five future climate scenarios. Future global temperatures can vary from below 1.5°C to over 4°C by 2100 depending on the amount of future emissions (Source: IPCC AR6 Cross-Chapter Box TS.1, Figure 1).



# 3.4 Summary

# Summary

This CCRA detailed above provides an assessment of County Leitrim’s climate change risks to support Leitrim County Council’s efforts to prepare its LACAP. The CCRA has been carried out in line with the Local Authority Climate Action Plan Guidelines, Technical Annex B, drafted by the Climate Action Regional Offices (CAROs). The key results are summarised below:

- 
  - **Cold spells and heavy snowfalls** have a wide range of impacts across County Leitrim, resulting in amongst others transport disruption and damage to critical infrastructure (e.g., roads and water). Projected increases in average temperature and decreases in the frequency of snowfall indicate a decrease in the frequency of cold spells and heavy snowfall and associated impacts.
- 
  - Recent experiences of **river flooding and pluvial flooding** events in 2020, 2021 and 2022 demonstrate the impacts for County Leitrim including damage to bridge infrastructure, inundation of buildings and transport disruption. Projected increases in the frequency of extreme precipitation events will result in increased surface water and riverine flood risk for County Leitrim.
- 
  - **Heatwaves and droughts** have resulted in damage to road surfaces across County Leitrim, contributed to the development of uncontrolled fires and the imposition of restrictions on water supply. Projected increases in the frequency of heatwaves and in the frequency of drought conditions will mean that events currently experienced on an infrequent basis will become more frequent. As the populations ages, there will also be an increase in the number of vulnerable people exposed.
- 
  - **Severe windstorms** are experienced on a frequent basis in County Leitrim. Projections indicate no significant change in the frequency of windstorms for County Leitrim. However, there is the potential for increases in the frequency of windstorms that are currently considered as very rare.
- 
  - County Leitrim has the shortest stretch of coastline of Ireland’s coastal counties measuring 4.6 km. Currently, impacts associated with **coastal flooding** are limited. However, projected sea level rise for the region will mean that impacts related to coastal flooding will become more frequent and impactful.

To increase resilience and through the LACAP, Leitrim County Council will need to proactively plan for and adapt to the current and future climate change risks identified through this CCRA.

04

# Appendices



# Appendix 1 - Glossary

**Biodiversity:** The variability among living organisms from terrestrial, marine and other ecosystems. Biodiversity includes variability at the genetic, species and ecosystem levels

**Climate:** The long-term average weather of area, usually taken over 30 years

**Climate projection:** A climate projection is the simulated response of the climate system to a scenario of future emission or concentration of greenhouse gases (GHGs) and aerosols, generally derived using climate models

**Coastal erosion** is the breaking down of land and removal of sediment and rocks by coastal processes. Factors affecting the rate of coastal erosion include sea level rise, strong wave action, and storms

**Cold Spell:** A sustained period of cold weather, where extreme low temperatures are recorded

**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 over the coast

**Drought:** A period of abnormally dry weather long enough to cause a serious hydrological imbalance

**Exposure:** The presence of people, livelihoods, species or ecosystems, environmental functions, services, and resources, infrastructure, or economic, social, or cultural assets in places and settings that could be adversely affected

**Extreme weather event:** An extreme weather event is an event that is rare at a particular place and time of year

**Fluvial flooding** occurs when rivers and streams break their banks and water flows out onto the adjacent low-lying areas (the natural floodplains)

**Groundwater flooding** occurs when the water table rises above the land surface. It generally requires sustained rainfall over relatively longer duration than other forms of flooding, its location is discontinuous, and they can last for weeks or months

# Appendix 1 - Glossary

**Hazard:** The potential occurrence of a natural or human-induced physical event or trend or physical impact that may cause loss of life, injury, or other health impacts, as well as damage and loss to property, infrastructure, livelihoods, service provision, ecosystems and environmental resources.

**Heat wave:** A period of abnormally and uncomfortably hot weather

**Heavy Snowfall:** A substantial prolonged snowfall event resulting in substantial accumulations of snow on the ground over a period of consecutive days.

**Landslide** describes a wide variety of processes that result in the downward and outward movement of materials under the force of gravity

**Pluvial flooding** occurs when the amount of rainfall exceeds the capacity of urban storm water drainage systems or the ground to absorb it

**Representative Concentration Pathways (RCPs):** Scenarios that include time series of emissions and concentrations of the full suite of greenhouse gases (GHGs) and aerosols and chemically active gases, as well as land use/land cover

**RCP4.5 and RCP6.0:** Two intermediate stabilization pathways in which radiative forcing is stabilized at approximately 4.5 W/m<sup>2</sup> and 6.0 W/m<sup>2</sup> after 2100 (the corresponding ECPs assuming constant concentrations after 2150)

**RCP8.5** One high pathway for which radiative forcing reaches >8.5 W/m<sup>2</sup> by 2100 and continues to rise for some amount of time (the corresponding ECP assuming constant emissions after 2100 and constant concentrations after 2250)

**Risk:** The potential, when the outcome is uncertain, for adverse consequences on something of value (lives, ecosystems, assets, services, etc.)

**Severe Windstorm:** A windstorm is a wind that can cause at least light damage to trees and buildings, typically exceeds 34 mph (55 km/h), and may or may not be accompanied by rain

**Vulnerability:** The propensity or predisposition to be adversely affected. Vulnerability encompasses a variety of concepts and elements including sensitivity or susceptibility to harm and lack of capacity to cope and adapt



# Appendix 2 – Service Area Descriptions

Acronym	Full form
<b>Business Services</b>	Corporate and customer facing services.
<b>Roads, footpaths, bridges, construction and maintenance</b>	Road and active travel, bridges, piers and harbours.
<b>Building Stock</b>	Local Authority buildings and social housing stock.
<b>Community infrastructure</b>	Recreation (incl. libraries and parks), tourism and economic development infrastructure.
<b>Cultural Heritage</b>	Arts and heritage protection.
<b>Stormwater / Sewerage</b>	Stormwater and sewerage infrastructure.
<b>Wastewater</b>	Foul and surface water sewers, water treatment plants and wastewater pumping stations.
<b>Water Supply</b>	Public water supply network (with Irish Water), public water treatment plant and pumping stations (with Irish Water) .
<b>Water Quality</b>	Water quality (rivers, lakes and marine).
<b>Biodiversity</b>	Biodiversity and habitat protection.
<b>Community Development</b>	Community development and co-ordination.
<b>Emergency Response</b>	Fire and water safety services, emergency response during severe weather response.

# Appendix 3 – Acronyms

Acronym	Full form
CAPS	Climate Action Plans
CAROs	Climate Action Regional Offices
CCRA	Climate Change Risk Assessment
CDP	County Development Plan
CRA	Climate Risk Assessment
EPA	Environmental Protection Agency
EU	European Union
GHG	Greenhouse gases
IPCC	Intergovernmental Panel on Climate Change
LA	Local Authority
NHA	National Heritage Area
RCP	Representative Concentration Pathways
SACs	Special Area of Conservation
SPAs	Special Protection Areas
URDF	Urban Regeneration Development Fund
WTP	Water Treatment Plant

# Appendix 4 – Description of the levels of impact due to disruption of Local Authority Services (Source: Technical Annex B: Climate Risk Assessment)

Impact	Description	Level of Impact
Catastrophic	Widespread service failure with services unable to cope with wide-scale impacts	5
Major	Services seen to be in danger of failing completely with severe widespread decline in service provision	4
Moderate	Service provision under severe pressure. Appreciable decline in service provision at community level	3
Minor	Isolated but noticeable examples of service decline	2
Negligible	Appearance of threat but no actual impact on service provision	1

# Appendix 5 – Characterisation of the magnitude of impact across various risk areas

## (Source: Technical Annex B: Climate Risk Assessment)

Risk Area	Negligible (Score: 1)	Minor (Score: 2)	Moderate (Score: 3)	Major (Score: 4)	Catastrophic (Score:5)
<b>Asset Damage</b>	Impact can be absorbed through normal activity	An adverse event that can be absorbed by taking business continuity action	A serious event that requires additional emergency business continuity actions	A critical event that requires extraordinary/ emergency business continuity actions	Disaster with the potential to lead to shutdown or collapse or loss of assets/ network
<b>Health and Wellbeing</b>	First aid case	Minor physical injury or mental health impact, medical treatment required	Serious physical or mental health impact, or lost work	Major or multiple injuries or mental health impact, permanent or physical disability	Single or multiple fatalities
<b>Environment</b>	No impact on baseline environment. Localised in the source area. No recovery required	Localised within site boundaries. Recovery measurable within one month of impact	Moderate harm with possible wider effect. Recovery in one year	Significant harm with local effect. Recovery longer than one year. Failure to comply with environmental regulations/ consent	Significant harm with widespread effect. Recovery longer than year. Limited prospect of full recovery
<b>Social</b>	No negative social impact.	Localised, temporary social impacts	Local, long-term impact on public opinion with adverse local media coverage	Failure to protect poor or vulnerable groups. National, long- term social impacts	Loss of social licence to operate. Community protests
<b>Financial (for single extreme event or annual average impact)</b>	x % IRR < 2% of turnover	x % IRR 2- 10% of turnover	x % of IRR 10-25% of turnover	x % IRR 25-50% of turnover	x % IRR > 50% of turnover
<b>Reputation</b>	Localised, temporary impact on public opinion	Localised, short-term impact on public opinion	Local, long-term impact on public opinion with adverse local media coverage	National, short-term impact on public opinion; negative media coverage	National, long-term impact with potential to affect stability of the government
<b>Cultural Heritage</b>	Insignificant impact	Short term impact. Possible recovery or repair	Serious damage with wider impact to tourism industry	Significant damage with national and international impact	Permanent loss with resulting impact on society



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