Comhairle Contae Thiobraid Árann
Tipperary County Council

CARO

An Roinn Comhshaoil,
Aeráide agus Cumarsáide
Department of the Environment,
Climate and Communications

MAKING COMPLEX EASY

TIER 1 CLIMATE CHANGE RISK ASSESSMENT

Tipperary County Council

IE000586A
IE000586A-RPS-RP-03-0001-A1-C01
07 June 2023

Document status

Version	Purpose of document	Authored by	Reviewed by	Approved by	Review date
D01	Draft	JP/TC			02/12/2022
S3-P02	Review and Comment	JP/TC	TC/BB	BB	08/02/2023
S5-P01	Review and Acceptance	JP/TC	BB	BB	05/05/2023
A1-C01	Authorized and Accepted	JP	TC	BB	07/06/2023

Approval for issue

BB		7 June 2023

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Prepared for:

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ACKNOWLEDGEMENTS

This Report was developed through collaboration with Tipperary County Council and the collective input by the Eastern & Midlands Climate Action Regional Office County Councils of Wexford, Waterford, Kilkenny, and Carlow. We wish to acknowledge the following:

Regional Working Group comprised of the Climate Action Officers/Co-ordinators of Wexford, Waterford, Tipperary, Kilkenny, and Carlow Councils:

Clare Kelly, Grainne Kennedy, Jannette O'Brien, Dearbhala Ledwidge, Orla Kelly, and Marion O'Neill.

Participation of Council staff from all sections who attended the workshops:

Aine Brett, Clare Lee, Damien Dullaghan, Eddie Meegan, Eddie Ryan, Ger Walsh, Kathleen Prendergast, Kieran Malone, Kieran McKenna, Liam Ryan, Marie O'Donnell, Marion O'Neill, Michael Tierney, Orla Kelly, Triona Collins

Coordination of the preparation of the report by Marion O'Neill and Orla Kelly, Climate Action Coordinators.

Funding from the Department of the Environment, Climate and Communications supported by the East-Midlands Climate Action Regional Office.

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1 EXECUTIVE SUMMARY

On behalf of Tipperary County Council (TCC), RPS has prepared a Tier 1 Qualitative Local Authority Climate Change Risk Assessment (CCRA) to support the development of the Local Authority Climate Action Plan (LACAP) 2024-2029. In accordance with the methodology provided in Annex B of the LACAP guidelines, this report provides an assessment of the current and future climate risks and impacts on the operations and delivery of services by TCC. The assessment of these risks will raise awareness of the consequences of climate change, help to prioritise risks and help to monitor and track changes in climate risks. This CCRA will inform the adaptation section of the new Tipperary County Council Climate Action Plan which will constitute part of the National Adaptation Framework.

The review undertaken for this CCRA included the consideration of existing regional and national level data relating to climate events, followed by a multi-party workshop with key service area stakeholders within Tipperary County Council. The workshop facilitated review of historic climate events, hazards, impacts, exposures, and vulnerabilities affecting the local authority services and function. This CCRA also builds on the previous risk assessment carried out as part of the Climate Adaptation Strategy[1] (CAS) in 2019. The climate data and impacts on council services mentioned in this CAS are brought in line with the Annex B guidelines and incorporated into this CCRA.

This process resulted in the development of a climate hazard profile for County Tipperary. Following an assessment of the nature and frequency of climate hazards, a qualitative assessment of the overall impact based on the level of disruption to the delivery of local authority services and functions was assessed for both current and future climate events. Based on the qualitative risk assessment, as presented in this report, the most significant current climate risks in County Tipperary were identified as:

- **River Flooding;**
- **Extreme Precipitation;**
- **Drought.**

Increasing impacts are envisaged for future climate events across most climate hazards, however future projections indicate that flooding is likely to remain as the most significant.

As a Tier 1 assessment, this CCRA can be used to inform general strategies to mitigate current and future impacts, providing a broad understanding of climate change risk. To further support the effective implementation and management of adaptation action in the future, there is a need to carry out semi-quantitative (Tier 2) to quantitative (Tier 3) approaches to risk assessment, with each step providing greater level of information on which to base adaptation decisions.

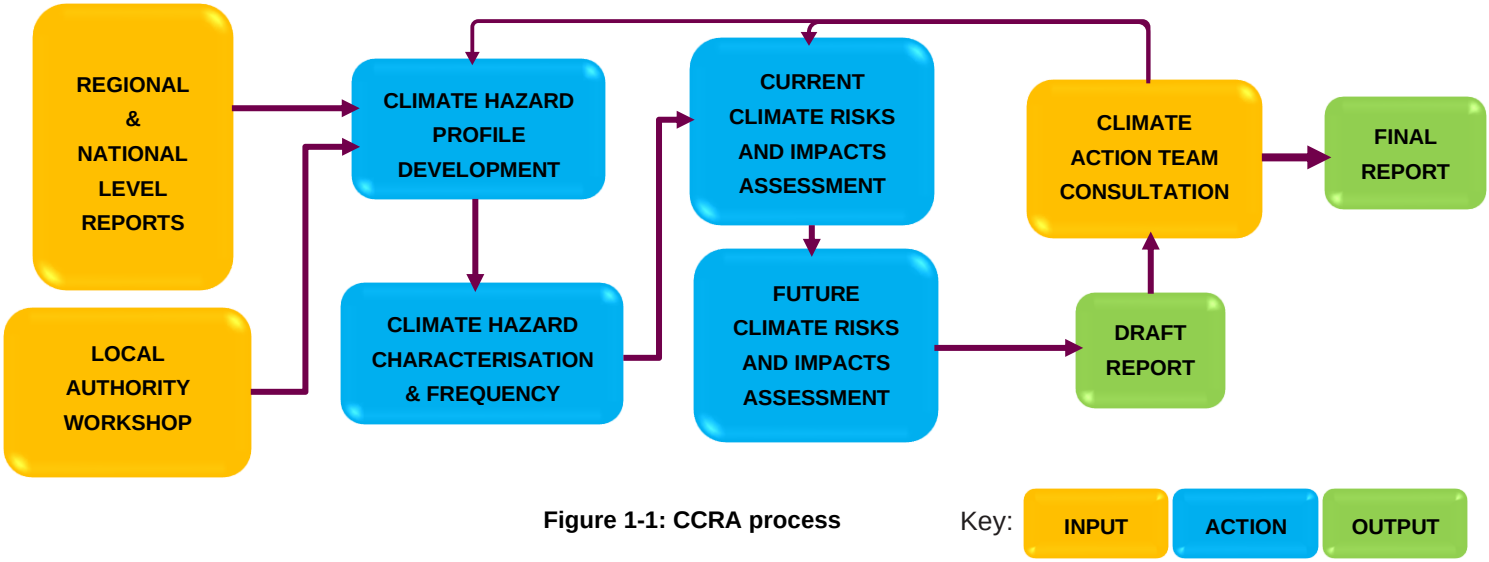
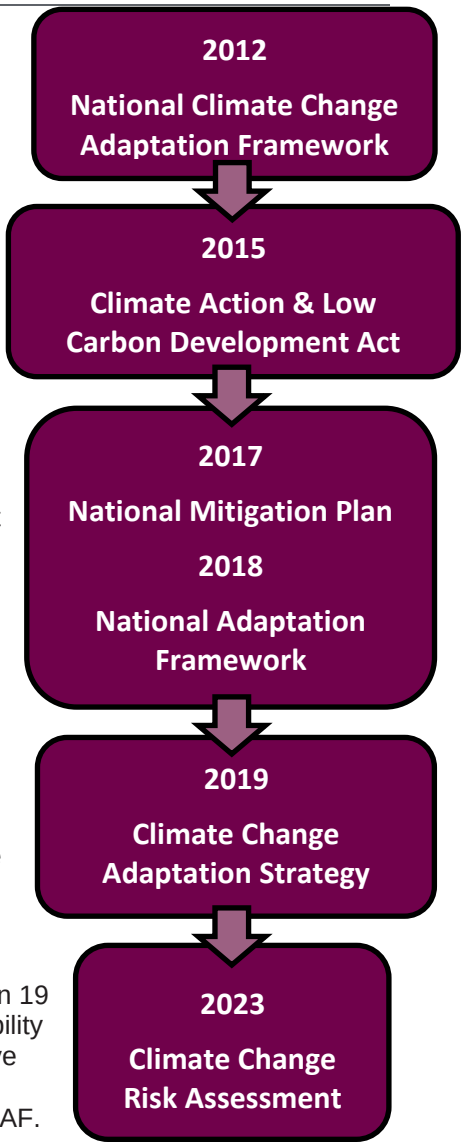


Figure 1-1: CCRA process

[1] TCC. Tipperary County Council Climate Adaptation Strategy 2019-2024. 2019

2 CONTEXT



The National Climate Change Adaptation Framework (NCCAF) developed in 2012 provided a strategic policy focus to ensure adaptation measures were taken across different sectors and levels of government to reduce Ireland's vulnerability to the negative impacts of climate change. The aim of the NCCAF was to ensure that an effective role was played by all stakeholders in putting in place an active and enduring adaptation policy regime. The governance structure provided for climate change adaptation to be addressed at national and local level, consistent with the approach being taken at EU level in the White Paper on Adaptation

The first phase focused on identifying national vulnerability to climate change, based on potential impacts relative to current adaptive capacity. Reliable information on the range of socio-economic vulnerabilities, the costs and benefits, and the options available and appropriate to Ireland, were key elements to inform effective adaptation planning. A key component was to provide the evidence base necessary to inform development of the national agenda.

The second phase involved the development and implementation of sectoral and local adaptation action plans to form part of the comprehensive national response to the impacts of climate change. Sectoral plans are prepared by the relevant Department or Agency and are adopted by the relevant Minister. Draft sectoral plans should be reviewed at least every 5 years.

The Climate Action and Low Carbon Development Act 2015 was a landmark national milestone in the evolution of climate change policy in Ireland. It provides the statutory basis for the national transition objective laid out in the National Policy Position. Further to this, it made provision for, and gave statutory authority to both the National Mitigation Plan (NMP), published in 2017 and the National Adaptation Framework (NAF).

Ireland's first statutory NAF was published by Minister Denis Naughten TD on 19 January 2018. The NAF sets out the national strategy to reduce the vulnerability of the country to the negative effects of climate change and to avail of positive impacts. The NAF was developed under the Climate Action and Low Carbon Development Act and built upon the work already carried out under the NCCAF.

The annual review of the adaptation progress in Ireland[2] gives a summary of the progress made by various sectors on the adaptive capacity, resource and mainstreaming, and governance of the implementation of climate change adaptations. The Climate Action Regional Offices (CARO) and Local Authorities are listed under the Local Government Sector, which has shown good overall progress in 2022. The key challenge remains the resourcing of dedicated staff to ensure consistency, coordination, and implementation. The realised desire noted for closer working with national agencies on risk assessments, adaptation policies and tools for use by local authorities is essential to enabling progress on adaptation by the local authorities and national agencies. This is highlighted again in the CARO progress report[3] where delays in the delivery of implementation are due to lengthy stakeholder consultation processes; capacity and capability constraints across the public sector; and desires for alignment with other measures to enhance impact.

CCRAs aim to further our understanding of the risks posed from the changing climate and form an integrated part of any climate change adaptation planning process. CCRAs provide a basis for making decisions on whether risks, and what level of those risks, are acceptable to society or the community by obtaining, collating and analysing information on the projected impacts and consequences of climate change. This Climate Change Risk Assessment (CCRA) will inform the adaptation section of the new Tipperary County Council Climate Action Plan which will constitute part of the NAF.

[2] ECOPRO Project. Climate Change Advisory Council - Annual Review 2022. 2022

[3] CARO. CARO - Progress Report 2022 Implementation of Actions for Climate Change Adaptation Strategy. 2022

3 INTRODUCTION

RPS was contracted in November 2022 to carry out a Tier 1 Qualitative Local Authority Climate Change Risk Assessment (CCRA) for Tipperary County Council, as part of the development of their Local Authority Climate Action Plan (LACAP), in accordance with the methodology provided in Annex B of the Local Authority Climate Action Plan Guidelines. The CCRA focuses on the delivery of services and functions by the local authority.

In line with the methodology provided within Annex B of the Guidelines, the CCRA provides for:

- Current Climate Risks and Impacts Assessment i.e. An assessment of the current climate hazards, exposure and vulnerabilities of climate change on the operations and efficient delivery of services by the local authority.
- Future Climate Risks and Impacts Assessment i.e. An assessment of future climate risks and impacts on the operations and efficient delivery of services by the local authority.

3.1 Tier 1 Assessment

Climate change risk assessments can be qualitative (Tier-1), semi-quantitative (Tier-2), or fully quantitative (Tier-3), with each tier building on the previous and requiring an increasing level of data, information, and complexity to develop[4]. This climate risk assessment uses a qualitative (Tier-1) approach.

A first-pass assessment (Tier 1) is a rapid qualitative process that can be carried out without detailed local data to develop a preliminary understanding of the climate change risks over a range of scales, from local to regional. This process helps users to screen climate-related hazards and identify specific risks that may arise from these hazards, and which should be investigated further (through second- and third-pass risk assessments). This first-pass screening is ideal when carrying out a CCRA with resource constraints, including limited data and information. It also allows integration of data and information from a variety of (qualitative and quantitative) sources. This is an important early step in climate adaptation planning. Usually, the initial first-pass risk assessment is conducted with limited project-specific data, instead using qualitative information, evidence from published literature and available data such as default national figures. The outcome of a first-pass risk assessment provides a broad understanding of the impacts of climate change in a specific context (be that a region, sector or business).

Appendix A further clarifies the different characteristics and requirements of each of the three risk assessment tiers.

3.2 Approach

Assessment of climate change risk underpins evidence-based adaptation planning and implementation. Climate change risks differ from other risks as it can be difficult or even impossible to quantify short-term or long-term probabilities. As a result, conventional risk assessments that use statistical probabilities can be ineffective.

To assess climate change, risk is composed of three inter-related components[5]:

- **Hazards:** Refers to potential source of harm in terms of damage/loss of property/infrastructure, potential injury, loss of life or other health impacts, livelihoods, service provision, ecosystems, and environmental resources. In this document, this term refers to climate-related physical events or trends or their physical impacts.
- **Exposure:** Refers to the presence of assets, infrastructure, property, people, livelihoods, species or ecosystems, environmental functions, services, resources in places or settings that could be affected. It is important to note that exposure can change over time, e.g., because of land use change.

[4] Stephen Flood et al., National Risk Assessment of Impacts of Climate Change: Bridging the Gap to Adaptation Action, Report 346 (EPA Research, 2020).

[5] ISO, “Adaptation to Climate Change – Guidelines on Vulnerability, Impacts and Risk Assessment (14091),” vol. ISO 14091:, 2021.

- **Vulnerability:** Refers to the propensity or predisposition to be adversely affected. This encompasses sensitivity (which refers to the degree to which an exposure will be adversely or beneficially affect by climate hazards) and adaptive capacity which refers to ability of systems, institutions, humans, and other organisms to adjust to potential damage, to take advantage of opportunities, or to respond to consequences.

Figure 3-1 shows the direct and indirect interconnections between the three components of climate risk and highlights the need to understand elements of both climate and socioeconomic processes to assess risk. Therefore, to understand the possible impacts of climate change, a climate change risk assessment is required. It has been acknowledged that the Sixth Assessment Report was published on the 20 March 2023, however this report refers to the Fifth IPCC Assessment Report as this was available at the date of completing the CCRA.

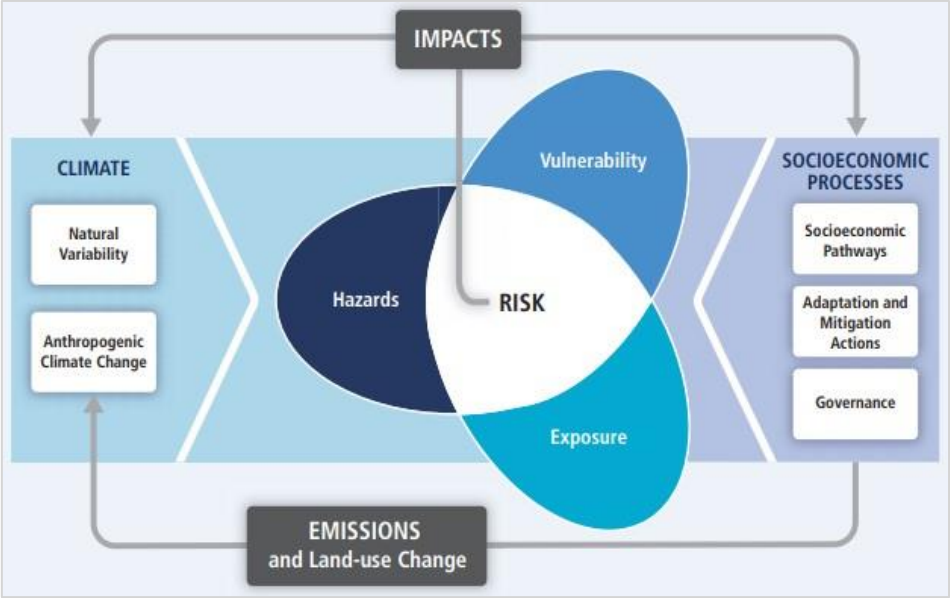


Figure 3-1: The Intergovernmental Panel on Climate Change Assessment Report 5 Framework of Climate Risk which shows how the three components of risk (hazards, exposure, vulnerability) are connected to climate and socioeconomic processes[6]

Climate risk assessments provide several benefits:

- Raising awareness: Risk assessments help increase awareness of the consequences of climate change.
- Identification and prioritisation of risks: Many factors can contribute to a climate risk, and climate change risk assessments provide insight into these factors, and this helps the organisation to prioritise the risks to be addressed.
- Identification of entry points for climate change adaptation intervention: The results and the process of risk assessment can help identify possible adaptation responses. Risk assessments can show where early action is required, e.g., to avoid locking-in future impacts and to highlight the need for development of adaptive capacity.

[6] IPCC, Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change, ed. C.B. Field et al., Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 2014), papers2://publication/uuid/B8BF5043-C873-4AFD-97F9-A630782E590D.

- Tracking changes in risk, and monitoring and evaluating adaptation: Repeating risk assessments can help to track changes over time and generate knowledge on the effectiveness of adaptation.

This Report provides a qualitative (Tier-1) climate change risk assessment undertaken for County Tipperary and was developed based on the existing local authority adaptation strategy guidelines[7] , along with the *'Adaptation to climate change - Guidelines on vulnerability, impacts and risk assessment'* International Standard[8] , guidance on the climate proofing of infrastructure[9] , the National Risk Assessment of Impacts of Climate Change[10] , and ongoing risk assessment research.

In addition, the approach outlined within this Report builds upon the data and information produced within the previous TCC Climate Adaptation Strategy 2019-2024. **Figure 3-2** provides an overview of the key stages of developing the CCRA. 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'.

A workshop was held with multi-party input across a wide range of services areas within Tipperary County Council, where historic climate events, existing hazards, exposures and vulnerabilities were discussed.

Figure 3-2: Overview of the stages of the Climate Change Risk Assessment Spreadsheet

[7] DCCAE, "Local Authority Adaptation Strategy Development Guidelines," 2018.

[8] ISO, "Adaptation to Climate Change - Guidelines on Vulnerability, Impacts and Risk Assessment (14091)."

[9] European Commission, "Technical Guidance on the Climate Proofing of Infrastructure in the Period 2021-2027," 2021.

[10] Flood et al., National Risk Assessment of Impacts of Climate Change: Bridging the Gap to Adaptation Action.

4 COUNTY TIPPERARY

Tipperary is a landlocked county located within the province of Munster covering an area of 4,282 km^2 with a population of over 159,000 people. The main urban settlements are Clonmel, Carrick-on-Suir, Cashel, Nenagh, Roscrea, Thurles, Tipperary Town and Templemore. The county has a diverse and notable topography, including several mountain ranges: The Comeraghs, Knockmealdowns, and the Galtees. Mountain lakes are also a feature of the uplands: Lough Curra, Lough Diheen, Lough Muskry and Borheen Lough.

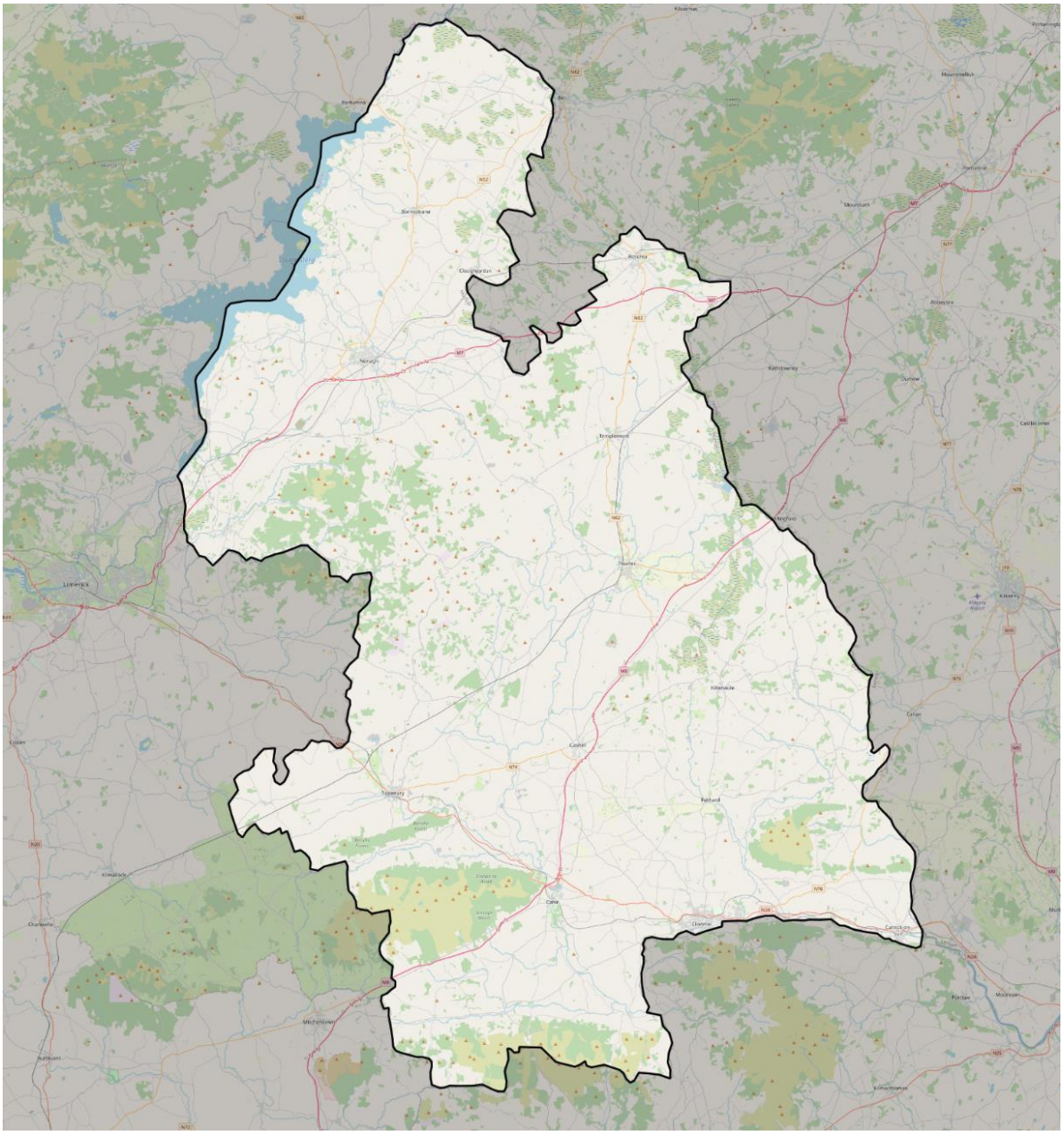
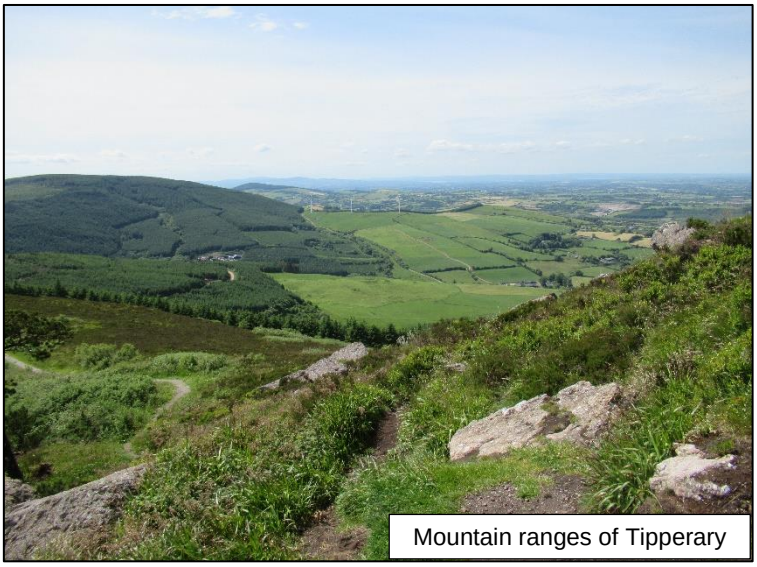


Figure 4-1: Characteristics of Tipperary



Mountain ranges of Tipperary

Lough Derg, the third largest lake in Ireland is situated between Tipperary, Limerick, Clare and Galway. The principal rivers found in Tipperary are the Shannon and the river Suir. The Shannon flows along the western boundary of the County, while the Suir flows through the county. Other areas are drained by tributaries of the Shannon, Nore and Blackwater. Water and wastewater services to homes and businesses are currently served by the Public Water Supplies and Wastewater Agglomerations are the responsibility of Irish Water.

Land area of almost **428,200 ha**

Over **5,900km** of road

Population: 149,722

0 to 24 Years: 33.3%

65 and over: 14.7%

Source: CSO 2016

The road Network in Tipperary consists of 122km of Motorway, 210km of national roads. 900km of Regional roads, and 4,600km of Local roads. The two motorways include the M7, which crosses the north of the County through Roscrea and Nenagh, and the M8 motorway, which bisects the county from north of Two-Mile Borris to the County Limerick border. Railways that stop within Tipperary include the Dublin-Cork, Dublin-Limerick, and Limerick-Waterford lines.

The population of the County stood at 167,661 in 2022, an increase of 17,939 from 2016. According to the 2016 Census, the population aged 0 to 20 years represents 27.8% of the total population, and the over 65 years represents 15% of the total population living in the County. Water is provided through a network of Regional Water Supply Schemes and group schemes[11]. The County is also served by a network of Public Wastewater Treatment Plants. Irish Water is currently responsible for addressing the water and wastewater infrastructural needs of the County. The county's economic profile is that of a rural economy with FDI and indigenous enterprises – micros-enterprises and SMEs – which operate across a range of sectors[11]. Examples include a manufacturing enterprise, a life sciences/Bio Pharma Hub around Clonmel, and Tourism which offers significant potential for the rural economy.

The infrastructure, environment, and population of County Tipperary can be affected by climate hazards and are subject to greater impacts due to climate change, hence the need to assess the associated risks.

Patricks Well, Clonmel

Blueway, Clonmel

[11] TCC. Co. Tipperary Local Economic and Community Plan (LECP) 2015-2020. 2016

5 WORKSHOP

RPS facilitated a workshop with Tipperary County Council on Wednesday 23rd November 2022.

The workshop was useful for introducing the local authority teams to the CCRA process, in relation to previous risk assessment and adaptation planning, and cementing understanding and support for the CCRA.

Critical to the success of developing a CCRA is ensuring multi-party input to the process to ensure that all relevant triggers, events and receptors are suitably captured and addressed. The workshop served as the key medium to engage with all service departments within Tipperary County Council and allow for a multi-expert input to the final risk classifications. The collected notes from the workshop are provided in **Appendix B**. As noted by the guidance, the CCRA process focuses on the delivery of services and functions by the local authority.

The following TCC services were represented within the workshop:

- Tourism
- Roads
- Business
- Environment
- Community
- Planning and Building
- Water
- Leisure and Recreation
- Governance and Administration
- Heritage, Arts and Culture
- Housing
- Fire and Emergency Services
- I.T.
- Finance
- Library Services
- Human Resources
- Civil Defence
- Landfills & Energy

The risk assessment tables, and output matrices produced within the appendices of this report were guided by national level risk assessment and further developed through both objective and anecdotal evidence brought forward by Tipperary County Council at this workshop (**Appendix B**), to create a bespoke but consistent CCRA output that meets the needs at a local authority level.

6 ASSESSING CURRENT CLIMATE RISKS AND IMPACTS

Understanding current climate impacts is critical to developing an understanding of future climate risks. Assessment of the current climate impacts involved:

- Identifying the range of climate hazards that have previously affected Tipperary and its administrative area, and
- Assessing the exposures and vulnerabilities of the local authority and its administrative area to these hazards.

6.1 Climate Hazards Profile

In collaboration and consultation with Tipperary County Council, and with the collective input by the Eastern & Midlands CARO County Councils of Wexford, Waterford, Kilkenny, and Carlow, a timeline of climate hazards historically affecting the local authority area have been identified and developed within this report. Climate hazards include extreme weather events and periods of climate variability, for example:

- Extreme weather events, e.g., extreme rainfall, flooding, storms, extreme heat, or drought.
- Deviations from average climatic conditions over a given period of time, e.g., periods of above or below average conditions in the spatial and/or temporal distribution of precipitation, or changes in average temperature.

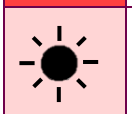
It is important to consider and identify, that many climate hazards are created or exacerbated by a pre-condition, e.g., a heavy rainfall event on saturated soils resulting in flooding. In addition, it is important to consider that the co-occurrence of multiple climate hazards can directly or indirectly exacerbate existing hazards or create new hazards, e.g., a storm causing a coastal storm surge and precipitation resulting in high river and coastal water levels resulting in fluvial and coastal flooding, or a heavy rainfall event after a period of drought creating surface water flooding.

The climate hazards profile presented in **Figure 6-1** provides a review of the extreme weather events in County Tipperary over the past 30 years. All climate hazards identified within a single event are noted within the profile. An expanded summary of each event is provided in **Appendix C**.

Table 6-1 lists the climate hazard types identified as providing existing risk to County Tipperary. This hazard type classification was adapted from IPCC[12].

[12] "Summary for Policymakers." In Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change, edited by V. Masson-Delmotte, P. Zhai, A. Pirani, S. L. Connors, C. Péan, S. Berger, N. Caud, et al. Cambridge University Press, Cambridge, 2021. https://www.ipcc.ch/report/ar6/wg1/.

Table 6-1: Climate Hazards Identified for Tipperary County

Type	Climate Hazards	
Heat and Cold		Above Average Surface Temperature
		Heatwave
		Drought
		Cold Spell
Wet and Dry		Above Average Precipitation
		Extreme Precipitation
		River Flood
		Pluvial Flood
Wind		Severe Windstorms
Snow and Ice		Heavy Snowfall
Coastal		Increase in Relative Sea Level

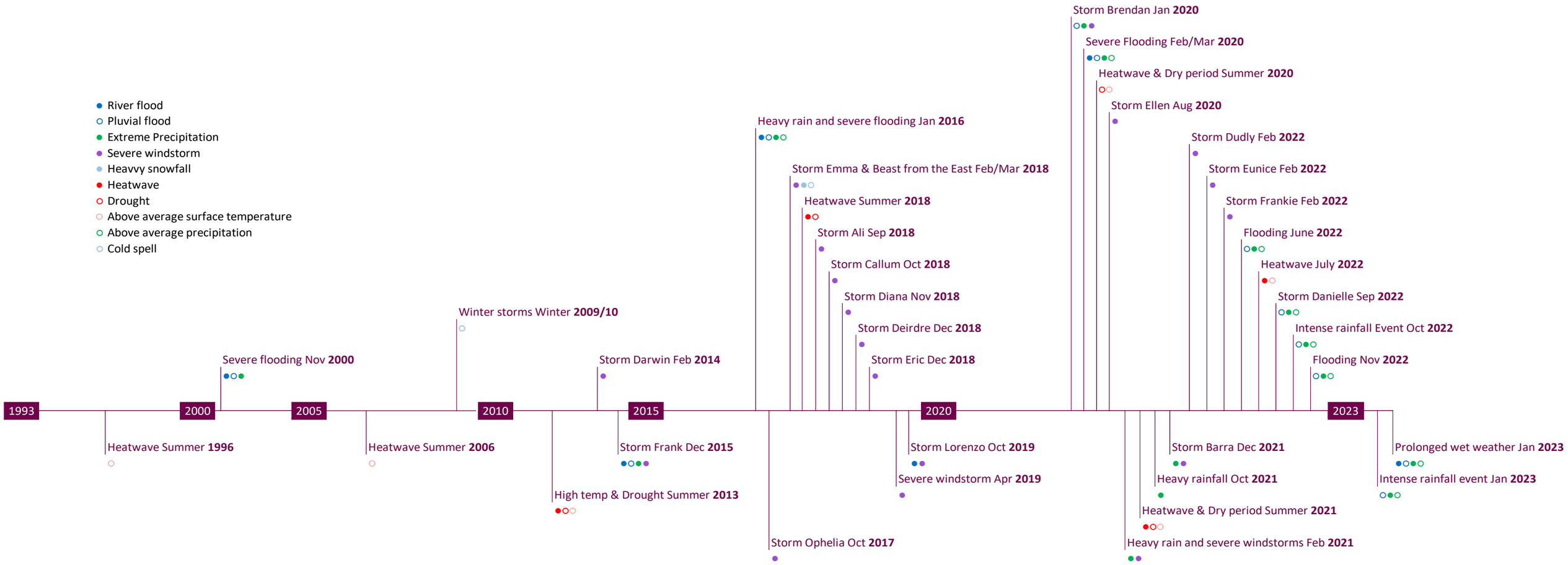


Figure 6-1: Profile of Climate Hazards in County Tipperary in the last 30 years: Representative timeline of climate hazards illustrated to show type of hazard and frequency

6.2 Characterising Climate Hazards

Understanding the nature and frequency of the identified climate hazards helps to produce a deeper appreciation of the scale of risk presented by each hazard type.

6.2.1 Description

A character profile was developed from available information for each of the identified hazard types. Whilst keeping to the scale of a Tier 1 assessment, geographical and spatial characteristics, including relevant specific details associated with past hazards events are included where possible.

6.2.1.1 Flooding

The *National Risk Assessment of Impacts of Climate Change: Bridging the Gap to Adaptation Action*[13] indicates that flooding represents one of the most immediate risks on a national basis, highlighting the significance of this hazard. According to *Climate Change Adaptation: Risks and Opportunities for Irish Businesses*[14], research in 2016 concluded that based on European projections, damage from flooding could amount to €1bn per year in Ireland.

In acknowledgement of the magnitude of risk that flooding presents to the county, Tipperary County Council developed a Major Emergency Plan which covers advanced preparation, pre-flood actions, and flood awareness, highlighting the presence of flood risk[15].

6.2.1.1.1 River Flooding

River Flooding

River flooding occurs when the capacity of a river channel is exceeded, leading to rivers bursting their banks. This can be exacerbated by high tide levels impeding the flow of the river out into the sea. Factors influencing the severity of the flood include the size and slope of the catchment, the physical qualities of the soil and underlying rock, surface run-off, and drainage network.

River Suir flooding in Clonmel

A number of occurrences of significant river flooding in County Tipperary are noted within the 30-year profile of climate hazards. Local impacts of flooding noted within the County include damage to critical infrastructure, reduced function of transport routes, increased maintenance and repair works, water quality impacts, environmental contamination, stress on biodiversity and environmentally sensitive areas in additional to ongoing socio-economic implications and pressure on overworked emergency response staff over prolonged periods.

In 2011, as a requirement of the EU 'Floods' Directive, the National Preliminary Flood Risk Assessment (PFRA) identified areas where the risks associated with flooding might be significant. Areas for Further Assessment (AFA) were progressed to the Catchment Flood Risk Assessment and Management (CFRAM) Studies in 2016, where more detailed assessment was undertaken to assess the extent and degree of flood risk more accurately. Where the significance of the risk was

[13] Stephen Flood et al., National Risk Assessment of Impacts of Climate Change: Bridging the Gap to Adaptation Action, Report 346 (EPA Research, 2020).

[14] Karen Deignan et al., Climate Change Adaptation: Risks and Opportunities for Irish Businesses, Report 402 (EPA Research, 2022).

[15] TCC. Tipperary County Council Major Emergency Plan. 2014

confirmed, possible measures to manage and reduce the risk were identified. Nineteen locations in County Tipperary were designated AFAs[16], these were:

Ardfinnan, Ballyporeen, Bansha, Borrisokane, Borrisoleigh, Caher, Carrick-On-Suir, Clonmel, Fethard, Golden, Marlfield, Mullinahone, Nenagh, Newcastle, Newport, Roscrea, Templemore, Thurles, and Tipperary Town.

A Flood Risk Management Plan (FRMP) for the Suir River Basin and an FRMP for the Shannon Upper and Lower River Basin were completed in 2018[17]. The plan set out the strategy, including a set of measures, for the cost effective and sustainable, long-term management of flood risk in the respective River Basin, including the areas where the flood risk has been determined as being potentially significant. The Plans includes feasible measures developed through a range of programmes or policy initiatives including: Non-structural flood risk prevention and preparedness measures, structural flood protection measures for communities at significant flood risk, aimed at reducing the likelihood and/or degree of flooding, as identified through the National Catchment Flood Risk Assessment and Management (CFRAM) Programme.

Feb/Mar 2020

Elevated levels in Lough Derg led to closing the N65 Birr to Portumna

In addition to the above FRMP, a total of 663 properties in Tipperary were protected by four Flood Relief Schemes (FRS), the latest of which was completed in 2013, at an estimated cost of €53.7mn[17]. An additional 181 properties are also due to be protected through the ongoing Golden FRS, Holycross FRS, Knocklofty FRS, Nenagh FRS, and River Mall (Templemore) FRS. Outside of these larger schemes, minor mitigation works undertaken since 2009 include 60 no. projects at a combined cost of €2,069,175 across County Tipperary. Future schemes include Ardfinnan FRS, Borrisoleigh FRS, Cahir FRS, Fethard FRS, Newcastle FRS, Roscrea FRS, and Thurles FRS.

6.2.1.1.2 Pluvial Flooding

Pluvial Flooding

Pluvial flooding occurs when the amount of rainfall exceeds the capacity of urban storm water drainage systems or the ground to absorb it. As a result, there is overland flow of excess water leading to ponding in depressions in the ground, behind obstructions, or in man-made hollows. This type of flooding typically arises as a rapid response to intense rainfall before the flood waters eventually enter a piped or natural drainage system.

December 2015

Rainfall resulted in blockage on N24

The collated record of hazard events for Tipperary identifies multiple instances of pluvial flooding in the past 30 years. Pluvial flooding is typically more localised than river flooding and occurs over a shorter time span. The impacts of this event are similar to river flooding where critical infrastructure is disrupted, incurring post event clean-up and repair costs, and overworking emergency services staff.

[16] OPW. The National Preliminary Flood Risk Assessment (PFRA).

[17] www.floodinfo.ie

6.2.1.2 Extreme Precipitation

Extreme Precipitation

Extreme precipitation events are periods of rainfall occurring at a higher frequency and intensity than normal, usually leading to flooding. There is a high risk of flooding due to the extreme rainfall. There is also the possibility of water bodies being contaminated and having increased turbidity, reducing the water quality. The extreme precipitation may also lead to the cancellation of any outdoor events. Ireland has been monitoring rain levels since the late 1700s with two monitoring stations and has reached almost 500 rain gauges to this day[18].

A number of instances of extreme precipitation events are noted in the hazard events record, highlighting its regular occurrence. It is important to note that these events can be local and difficult to predict and capture which can lead to an inaccurate assessment of this type of event.

Jan 2023

Extreme rainfall at Ballina, Co Tipperary resulting in flooding of 4 premises, closure of R494 regional road for 3 days, overnight closure of R494 north of Ballina

6.2.1.3 Severe Windstorm

Severe Windstorm

Severe windstorms are strong wind events which may or may not be accompanied by precipitation. Infrastructure is particularly vulnerable to severe windstorms as strong winds can damage building facades or destroy habitats. The fallen debris can then be carried away and act as projectiles leading to further damage or serious injury. In the *National Risk Assessment of Impacts of Climate Change: Bridging the Gap to Adaptation Action*[19], windstorms are listed as one of the priority climate risks in Ireland. The hazard events record identifies many severe windstorm events in County Tipperary, the most regularly occurring event in the County.

Consequences of storm

February 2021

Gale force winds up to 120km/h according to Met Eireann 2021

[18] www.met.ie

[19] Stephen Flood et al., National Risk Assessment of Impacts of Climate Change: Bridging the Gap to Adaptation Action, Report 346 (EPA Research, 2020).

6.2.1.4 Heavy Snowfall

Heavy Snowfall

Heavy snowfall is the large accumulation of snow usually accompanied with snow drifts. This can lead to precarious footing, potential road or building closure, or damage to infrastructure through excessive roof loading. A major concern from large amounts of snowfall is the serious damage to overhead powerlines and communication lines. This event is becoming less frequent, as the general warming of the atmosphere and oceans has reduced the volume of snow and ice[20]. January and February are the typical months when snow is experienced, but it is not uncommon for snow to be present in the period from November to April[21].

A heavy snowfall event was recorded was in February/March 2018 during Storm Emma and the Beast from the East. Met Eireann issued a red warning, leading to school and business closures.

Feb/Mar 2018

Heavy snow resulted in School and Business closures

6.2.1.5 Heatwave

Heatwave

Brownstown & Woodville bog fire

The working national definition of a heatwave is five consecutive days or more with maximum temperature over 25 degrees Celsius[21]. Heatwaves can lead to a few issues, such as uncomfortable working conditions and the potential for heat stroke if there are inadequate measures in place to counteract the heat. There is a chance of a reduction in water quality as waterbodies may have a high concentration of dissolved material due to evaporation, and an increase in the risk of fires. The Fires, Land and Atmospheric Remote Sensing of Emissions (FLARES) project records wildfires throughout Ireland, providing a useful source of data[22].

In addition, heatwaves usually place recreational areas under stress, putting pressure on existing infrastructure. Another impact due to heatwaves is the altering of the road constitution, where the bitumen in the roads melt. A major concern with predicted changes in heatwaves is the cascading biophysical consequences they may have nationally and locally, e.g., a change in the growing season and changing the habitats that species depend on[21]. In the last 30 years, a few significant heatwave events were experienced in Tipperary, as noted in the hazard events record.

July 2022

Temperatures of 25-30°C with fire safety warnings issued

[20] Stephen Flood et al., National Risk Assessment of Impacts of Climate Change: Bridging the Gap to Adaptation Action, Report 346 (EPA Research, 2020).

[21] www.met.ie

[22] CCC, EPA, UCC, DOECC. Fire, Land & Atmospheric, Remote Sensing of Emissions (FLARES)

6.2.1.6 Drought

Drought

Drought refers to the lack of access to water due to reduced water levels from high temperatures because of evaporation. This lack of water can prove to be detrimental to the county as drought is usually accompanied by high temperatures, and with it, high demand for water. If there is an inadequate supply of water, it will have to be imported by water tankers, which is a high-cost affair. With drought, there is also an increased risk in the transmission of diseases and a risk of treating water with too high a concentration of organic material. Additional emergency response callouts may also be experienced, leading to overworked employees, who are also being exposed to the impacts of drought, based on information received from the workshop.

Summer 2020

Water shortages in Tipperary

There are a few records of droughts being experienced in Tipperary in the last 30 years within the hazard events record.

6.2.1.7 Above Average Surface Temperature

Above Average Surface Temperature

Above average surface temperatures are periods of heat exceeding the average temperatures of the given period over an extended span of time. Risks related to this event include the same risks found in both drought and heatwave events, but with more emphasis on increased stress on recreational areas, and less so on reduced water quality and supply. There is the same concern for the ecological structure of the county, as growing seasons will change, causing a shift from normal seasonal activities seen in nature, such as pollination and/or hibernation.

Through the workshop it was also noted that increased humidity and above average temperatures increase algal and vegetation growth which increases the potential to undermine vulnerable heritage structures.

Summer 2006

warmest summer since 1996 according to Met Eireann 2006

In the last 30 years, there were a number of events in the hazard events record where above average surface temperatures were noticed. It is important to note that above average temperatures are not limited to summer. Drops in the frequency and/or intensity of snowfall events and the presence of warmer winters are linked to the increase in average surface temperatures[23].

[23] Stephen Flood et al., National Risk Assessment of Impacts of Climate Change: Bridging the Gap to Adaptation Action, Report 346 (EPA Research, 2020).

6.2.1.8 Increase in Relative Sea Level

Increase in Relative Sea Level

Garrykennedy Harbour, Tipperary

An increase in relative sea level refers to the gradual increase in baseline conditions of sea levels. Some rivers have a tidal influence, making this hazard a vulnerability to the likes of river flooding. Studies from the *National Risk Assessment of Impacts of Climate Change: Bridging the Gap to Adaptation Action*[24] also indicate that sea level rise is amongst the highest priority climate risks on a national basis.

The River Suir is tidally influenced near Carrick-On-Suir, and is therefore impacted by rises in sea levels with the potential to exacerbate river flooding[25].

6.2.1.9 Above Average Precipitation

Above Average Precipitation

Above average precipitation events are periods of rainfall exceeding the average rainfall of the given period over an extended span of time. Above average precipitation can lead to more time spent indoors which can affect mental health. A decrease in active travel may also be present which leads to increased use of vehicles running on fossil fuels. Drainage systems may be at risk of reaching capacity as they would be designed for a lower level of precipitation. Observations from the *National Risk Assessment of Impacts of Climate Change: Bridging the Gap to Adaptation Action*[24] indicate that average levels of national rainfall have increased by approximately 60mm (5%) for the period from 1981 to 2010 compared with the period from 1961 to 1990.

Feb/Mar 2020

Over 3 times the average rainfall recorded at Gurteen met station

Multiple events in the hazard events record indicates above average precipitation levels in Tipperary. Increased average precipitation levels can also increase in the risk of both pluvial and river flooding. Saturated soils exacerbate surface water run-off leading to increased overland flow. This can place pressure on urban drainage systems and natural channel capacity.

[24] Stephen Flood et al., National Risk Assessment of Impacts of Climate Change: Bridging the Gap to Adaptation Action, Report 346 (EPA Research, 2020).

[25] www.floodinfo.ie

6.2.1.10 Cold Spell

Cold Spell

Cold spells are events where temperatures reach record low temperatures over a short period of time. Cold spells can lead to uncomfortable working conditions if there is a lack of heat sources. Mental health is again a possible issue as less time would be spent outdoors. Water supply may be affected due to frozen water bodies or distribution lines. Cold stress on buildings is another possible risk of cold spells, causing infrastructure to crack. Based on Climate Indices from Met Eireann, cold extremes are becoming both less severe and less frequent[26].

Cold spells are noted a few times in the historic events record for the last 30 years. Prolonged cold spells place pressure on treatment on rural road networks within the county and increases risk of burnout of staff and working crews throughout the duration of the cold spell.

Winter 2009/2010

Coldest winter in almost 50 years with temperatures below -10°C

[26] www.met.ie

6.2.2 Frequency

Through development of the Climate Hazards Profile, the frequency of climate hazard types affecting County Tipperary becomes more apparent. Using the classification categories adopted from Annex B shown in **Table 6-2**, the frequency of existing climate hazard types can be grouped into 5 broad categories. These have then been applied to the hazard types historically affecting County Tipperary. The recorded information indicated that Severe Windstorms often combined with Extreme Precipitation, are the most frequently occurring climate hazards for County Tipperary. **Table 6-3** presents the categorised frequency for each of the identified hazard types.

Table 6-2: Classifying the frequency of occurrence of climate hazards

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

Table 6-3: Frequency of Current Hazards in County Tipperary

	Climate Hazards	Frequency
	**Severe Windstorm**	**Frequent**
	**Extreme Precipitation**	**Frequent**
	**Pluvial Flooding**	**Common**
	**Above Average Surface Temperature**	**Common**
	**Above Average Precipitation**	**Common**
	**River Flooding**	**Common**
	**Heatwave**	**Common**
	**Drought**	**Common**
	**Cold Spell**	**Occasional**
	**Heavy Snowfall**	**Occasional**
	**Increase in Relative Sea Level**	**Occasional**

6.3 Overall Impact to the Tipperary County council

For each of the climate hazards identified, the overall severity of impact for the following risk areas were estimated:

- Asset Damage,
- Health and Wellbeing,
- Environment (including biodiversity),
- Social,
- Financial,
- Reputation, and
- Cultural Heritage.

The criteria for assessment, as taken from Annex B, is provided in **Table 6-4**. The resultant current impact summary matrix showing the impact versus the frequency for the current climate risks is included in **Appendix E.** The overall level of impact is calculated as the average of impacts across the risk areas.

After producing the current impact summary matrix, the current climate impacts of hazards identified can be illustrated according to the current frequency of the hazard, as illustrated in **Figure 6-2**. This allows a simple visual communication of the key risks for the County and a starting point of which events to prioritise.

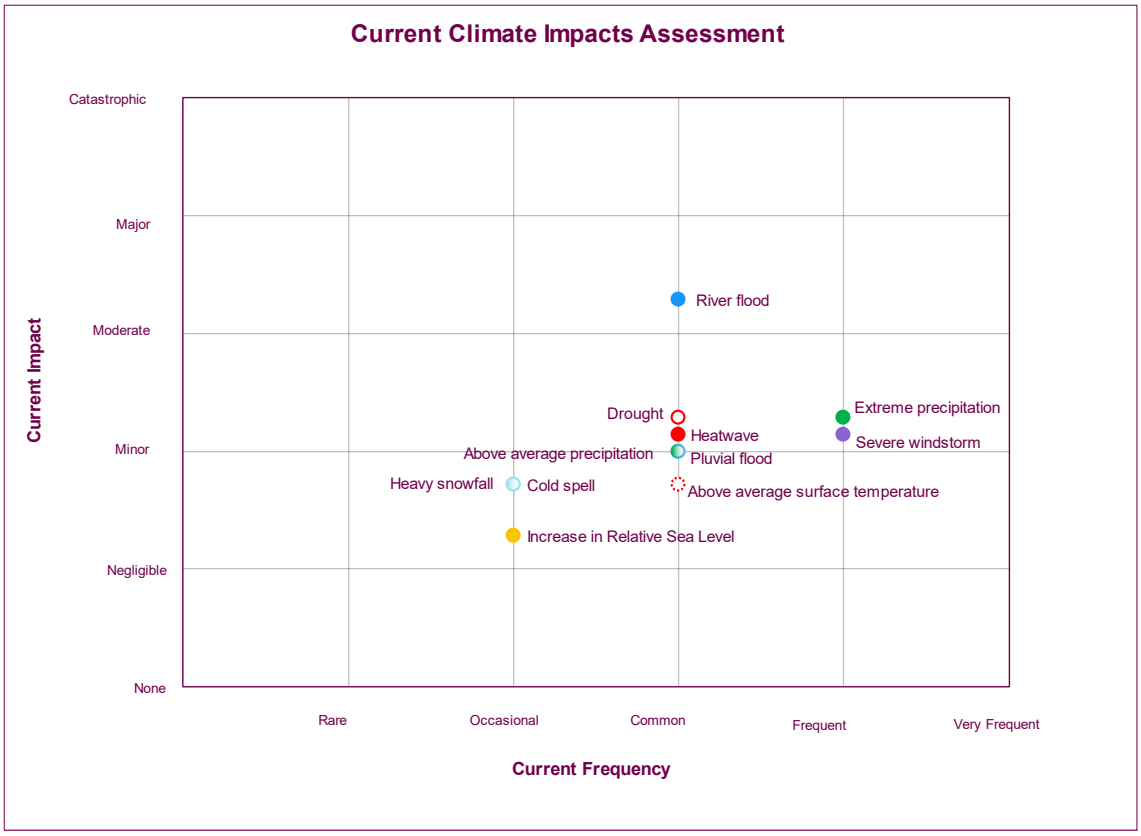


Figure 6-2: Current Climate Impacts Assessment for County Tipperary

Table 6-4: Magnitude of impact across various risk areas. Adapted from European Commission (2021)

Risk Area	Impact Level				
	Negligible (Score: 1)	**Minor (Score: 2)**	**Moderate (Score: 3)**	**Major (Score: 4)**	**Catastrophic (Score: 5)**
Asset Damage	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 shut down or collapse or loss of assets/network
Health and Wellbeing	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 physical or disability	Single or multiple fatalities
Environment	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 one year. Limited prospect of full recovery
Social	No negative social impact	Localised, temporary social impacts	Localised, long- term social impacts	Failure to protect poor or vulnerable groups. National, long- term social impacts	Loss of social licence to operate. Community protests
Financial (for single extreme event or annual average impact)	< 2% of turnover	2-10% of turnover	10-25% of turnover	25-50% of turnover	> 50% of turnover
Reputation	Localised, temporary impact on public opinion	Localised, short-term impact on public opinion	Local, long-term impact on public opinion with adverse local media coverage	National, short- term impact on public opinion; negative national media coverage	National, long- term impact with potential to affect the stability of the government
Cultural Heritage	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

6.4 Characterising Impacts, Exposures, and Vulnerabilities

Throughout **Section 6.2** each of the identified climate hazards were characterised to provide on overall appreciation for the nature and scale of each hazard type. Through this characterisation, the national level research, local level environmental and engineering research and reports, the workshop held with the input from Tipperary County Council Service Areas, and the developed climate history were all used to inform the Impacts, Exposures and Vulnerabilities at the local scale. **Appendix D** presents this collation of information into a tabular output.

For each of the extreme weather events and periods of climate variability identified through the climate hazards characterisation:

1. The impacts of the hazard are identified and described.
2. Specific exposures within each identified climate impact are detailed.
3. For each of the exposures, the associated physical, environmental, and socioeconomic vulnerabilities to the impact were assessed.

Table 6-5 describes each of the three vulnerabilities in more detail. It is important to note that vulnerability can increase or decrease the risk associated with a specific exposure.

Table 6-5: Vulnerability Types

Vulnerability Type	Description
Physical vulnerability	Properties of an asset related to the structure or facilities can exacerbate/reduce the impacts before, during, or after a hazard event, e.g., poor design and construction of building, provision of active cooling. **OR** Ability of a population/persons to access equipment or resources that can exacerbate/reduce the impacts before, during, or after a hazard event.
Environmental Vulnerability	Properties of the environment surrounding the asset/persons that exacerbate/reduce the impacts before, during, or after a hazard event, e.g., limited access to green space that provides respite during heatwave events.
Socioeconomic vulnerability	Properties of a population/persons related to the society, demographics, and economy that can exacerbate/reduce the impacts before, during, or after a hazard event e.g., low income, age, health, English language ability.

6.5 Impact Assessment

This CCRA is focused on the delivery of services and functions of Tipperary County Council. For each of the identified climate hazard exposures, the level of disruption to the delivery of services and functions are identified and assessed. The impact assessment is provided within **Appendix D** and includes the perceived degree of impact on the delivery of services by Tipperary County Council for each exposure in accordance with the high-level criteria for assessment shown in **Table 6-6**[27]. An overall impact score is calculated for each exposure based on a weighted average across each of the Service Areas. The higher the impact score, the greater the overall impact on service delivery and functions of Tipperary County Council. This can be used to inform priority actions to address exposures which provide the greatest impact. The key to which, can be to increase resilience through mitigation of the vulnerabilities which increase the severity of risks associated with a particular exposure.

As a Tier 1 qualitative study, this is a first-pass risk assessment to develop a quick and broad understanding of climate change risk. It is intended to provide the means to identify a need for strategic and ongoing responses/ commitments, to identify key localities for attention and to build awareness of risk among community and senior management. As it is a high-level screening, it is therefore not suitable for making any final decisions on adaptation actions but should be used to inform the general actions required.

Table 6-6: Description of the levels of impact due to the disruption of Local Authority Services

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

[27] Edinburgh Adapts Steering Group, “Edinburgh Adapts: Climate Change Adaptation Action Plan 2016-2020,” 2016.

7 ASSESSING FUTURE CLIMATE RISKS AND IMPACTS

Understanding how climate change risks are likely to evolve in the future is crucial to identify how existing risks may be exacerbated by climate change or give rise to the emergence of new risks. To understand how climate change risks, and the subsequent impacts, might change into the future, it is useful to first consider how the frequency of climate hazards might change and how levels of impact may also change as a result of changes in the hazard, exposure, and vulnerability components of risk.

7.1 Future Changes in Climate Hazards

Any identification of climate hazards that are likely to be of significance in the future should begin with those that are significant in the present. To understand how levels of climate hazards might change in the future, available climate projection information needs to be examined to understand how the frequency and intensity of extreme weather events and periods of climate variability might change in the future.

For the purposes of adaptation strategy development, fine scale climate information and data is not required. National statements of projected climate changes and impacts are considered appropriate. More detailed assessment and appraisal should be employed when specific plans or measures are to be implemented and more detailed information is necessary.

The information required has been produced through nationally funded research projects, e.g., Nolan and Flanagan[28] and Desmond[29], and is summarised and available online through Climate Ireland.

National level information on projected changes in Ireland's Climate can be accessed through Climate Ireland's Essential Climate Information Tool.

National level information on projected changes in the biophysical impacts of climate change can be accessed through Climate Ireland's Climate Hazard Scoping Tool.

For each of the climate hazards identified through the assessment of current climate hazards and impacts, and on the basis of available projection data, the projected frequency of each of the identified climate hazards was estimated. See **Appendix F** for projected frequencies of climate hazards.

7.2 Future Changes in Exposure and Vulnerability

Climate risks may develop or increase in the future because of the change in frequency and intensity of climate hazards. However, changes in exposure and vulnerability also affect future climate risks.

In order to establish future levels of impacts, available projections of non-climatic factors on a local level (e.g., County Development Plan, Local Area Plans, Local Economic and Community Plan etc.) were examined to assess potential changes in levels of exposure and vulnerability. Sources include the Tipperary County Development Plan 2022-2028[30], the Tipperary County Local Economic and Community Plan 2023-2028 Vision and High-Level Goals[31], and River Basin Management Plans for the River Suir and Shannon Upper & Lower[32]. For some impacts, there was little existing information to support future impact and vulnerability assessment, resulting in estimates based on available information. See **Appendix F** for the assessment of projected changes in exposure and vulnerability.

[28] Nolan and Flanagan (2020) Research 339: High-resolution Climate Projections for Ireland – A Multimodel Ensemble Approach

[29] "National Preparedness to Adapt to Climate Change: Analysis of State of Play," 2018, https://www.epa.ie/pubs/reports/research/climate/Research_Report_256.

[30] TCC. Tipperary County Development Plan 2022-2028. 2022.

[31] TCC. Tipperary Local Economic and Community Plan 2023-2028 Vison and High-Level Goals. 2023.

[32] www.floodinfo.ie

7.3 Uncertainty

In assessing the future climate risks, there was a degree of uncertainty in how hazards, exposure, and vulnerability will change. Uncertainty is the state, even partial, of deficiency of information related to, understanding or knowledge of an event, its consequence, or likelihood. A range of data and information sources were used in order to mitigate uncertainty in the future risk assessment, but there is still a varying degree of uncertainty present. In addition, extreme precipitation events can include cloud bursts which can be difficult to predict and capture, leading to an inaccurate assessment of this type of event. Therefore, when selecting evidence to inform the climate risk assessment, information related to the uncertainty of projected changes in climate hazards, exposure, and vulnerability are noted within the Rationale column of **Appendix F**.

7.4 Emerging Hazards and Climate Change Risks

Although some activities and services may not currently be affected by climate hazards, it is important to consider the full range of projected changes to hazard, exposure, and vulnerability as these changes may result in increased risk, leading to an exacerbation of impacts to the Local Authority. Following discussion with Tipperary County Council and considering the character of Tipperary and its assets, risks associated with the phenology of the county are likely to emerge in the years ahead. The increased surface temperatures are becoming more frequent, which has emerging risks associated with these changes. Invasive species are becoming a bigger problem as the changing environment promotes their growth. In addition, the seasonal changes are a significant emerging risk to pollination, as pollinators are showing signs of becoming offset from the time for pollination.

7.5 Overall Future Impact on the Local Authority

For each hazard and each impact category (Asset Damage, Health and Wellbeing, Environment, Social, Cultural Heritage, Financial, and Reputational), the projected level of impact has been estimated and the rationale for this provided using the national level research. This future impact assessment accounts for projected changes in hazard, exposure and vulnerability and assumes that no additional adaptation actions are taken to offset future impacts. See **Appendix G** for the Future Impact Summary Matrix showing the projected impact versus the projected frequency for the future climate risks. The level of impact is calculated as the average level of impact across the impact categories of Asset Damage, Health and Wellbeing, Environment, Social, Financial, Reputation, and Cultural Heritage.

7.6 Future Climate Impacts Assessment Summary

After producing the Future Impact Summary Matrix, the future climate impacts of hazards projected to impact Tipperary's Local Authority can be presented according to the future frequency and future level of impact of the hazard, see **Figure 7-1**. The level of future impact is calculated as the average level of impact across the impact categories of Asset Damage, Health and Wellbeing, Environment, Social, Financial, Reputation, and Cultural Heritage. This allows for the simple communication of the key risks that are projected for the County and how to prioritise them.

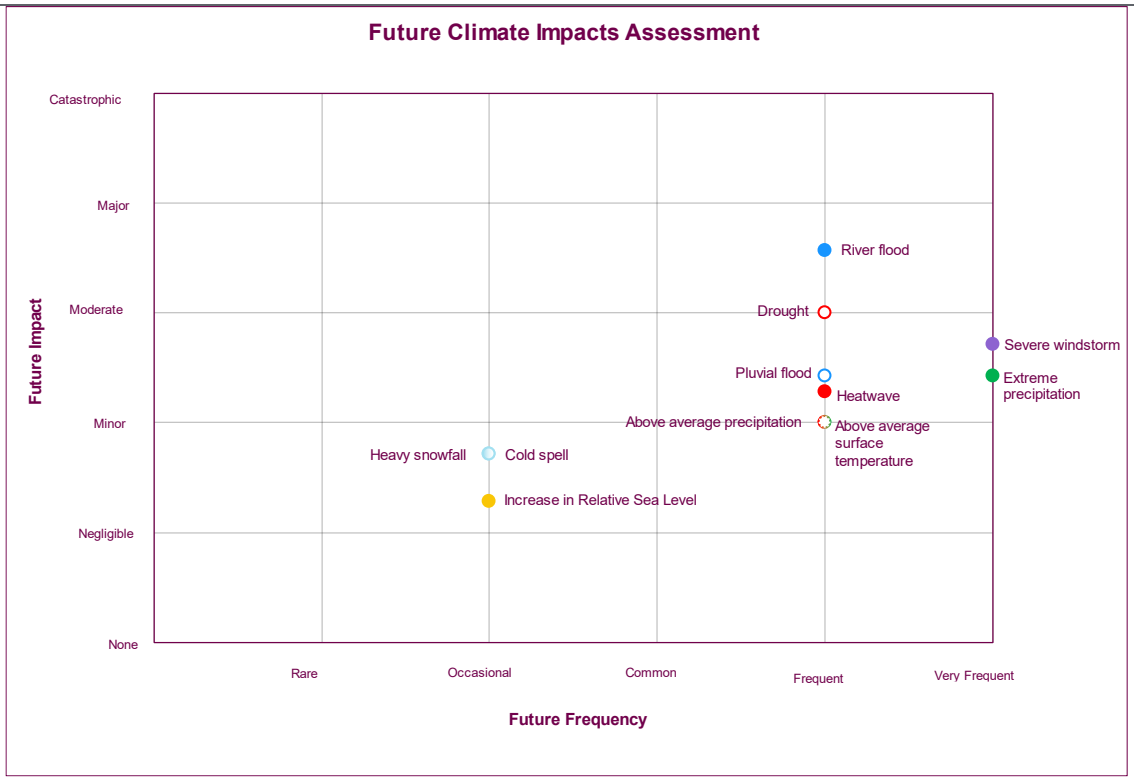


Figure 7-1: Future Climate Impacts Assessment Chart of County Tipperary

8 SUMMARY AND CONCLUSION

This CCRA Report summarises the steps undertaken to assess the climate change risks within Tipperary County Council. The more detailed tabular risk assessment outputs are included in the Appendices.

A CCRA is integral to informing the preparation of the Local Authority Climate Action Plan by identifying and prioritising current and future risks. It assists in the identification of possible adaptation responses to reduce or remove climate change risks within the Local Authority. Accordingly, the climate change risk assessment sits as part of the evidence base to support the local authority climate action plan.

As a Tier 1 qualitative study, this is a first-pass risk assessment to develop a quick and broad understanding of climate change risk. It is intended to provide the means to identify:

- a need for strategic and ongoing responses/commitments
- key localities for attention and
- to build awareness of risk among community and senior management.

As it is a high-level screening, it is therefore not suitable for making any final decisions on specific adaptation measures but should be used to inform the general actions required. Carrying out a semi-quantitative (Tier-2) or quantitative (Tier-3) risk assessment would provide a greater level of information and support on which to base adaptation decisions.

Key Climate Hazards identified for County Tipperary:

River Flooding

Extreme Precipitation

Drought

Throughout this CCRA, the publicly accessible national level research, local level environmental and engineering research and reports, the workshop held with the input from Tipperary County Council Service Areas, and the developed climate history formed the evidentiary basis for assessment.

Future projections of climate change indicate that Increase in Relative Sea Level, Prolonged Cold Periods and Heavy Snowfall will remain relatively consistent with existing conditions. However, risk is predicted to increase for all other identified climate hazards, with River Flooding remaining the perceived highest risk to County Tipperary.

8.1 Recommendations

1. This assessment has developed a quick high-level understanding of climate change risk. However, to support the effective implementation and management of adaptation action, future risk assessments should transition from a qualitative (Tier-1) study to a semi-quantitative (Tier-2) or quantitative (Tier-3) approach, to provide a greater level of information on which to base adaptation decisions.
2. It was noted during the workshop that most costs due to the resultant impacts of climate hazards are not typically budgeted for and it would be very helpful to provide a separate operational cost code for emergency or repair works due to certain events be provided to each service. This will allow the true cost of storm events and climate events to be calculated and facilitate future contingencies in budgets and climate adaptation funding etc. Currently, Tipperary County Council has set up specific codes for recording costs associated with major weather events (OPCODES) since 2017 which helps to capture the costs of the hazard events, as well as provide a record of these events.
3. The data gathering phase of this assessment identified that there is no systematic approach within Tipperary County Council to record climate related observations and records in an indexed or easily accessible method. It would be recommended that all Service Areas within the TCC adopt a consistent approach to recording service disruptions, mitigation and recovery measures implemented, and associated costs for any areas within their remit, and that Tipperary County Council produce an annual summary report documenting all climate hazard impacts across all Service Areas.

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www.floodinfo.ie

www.met.ie

Appendix A Risk Assessment Tiers

	First-pass risk assessment	Second-pass risk assessment	Third-pass risk assessment
Objective	Develop a quick high-level understanding of climate change risk to determine whether or not further research or adaptation planning is required at this time	Conduct a risk assessment (generally involving expert judgement) to identify specific risks that may become problematic under future climate change	Understand the vulnerability of different systems exposed to climate change-related hazards using more detailed and finer scale data; conduct a detailed risk assessment (quantitative or qualitative) to identify specific risks of different systems
Time and resource requirement	Minimum	Moderate	High
Data requirement	Nationally available datasets, which may be in published sources (e.g. summary regional projections and/or visualisations of climate and sea level variables). Available localised mapping and information. Data should be available at no cost	Nationally available climate change datasets, both observed and projected (e.g. from national meteorological centres), together with existing information available from government (e.g. local municipality) studies and/or expert knowledge. Data should be available at no or low cost	Some site-specific data (depending on the objective of the assessment and may not be necessary every time), e.g. lidar (light detection and ranging) data, in conjunction with high-resolution (daily, spatially explicit) climate scenario data and local expert knowledge to understand the exact scale of the risk. A substantial cost may be involved
Base knowledge requirement	• Minimum expertise required to acquire data • Local knowledge required to interpret data • Some understanding of climate change and its potential risks (readily available in many decision support tools such as Climate Ireland)	• Moderate knowledge required to acquire appropriate data • Moderate expertise required to interpret data • Moderate expertise required to understand the consequences of a specific climate risk	• High level of expertise required to acquire site-specific data (may not be necessary for all assessments) • High level of expertise required to apply data and analyse and interpret results • High level of expertise required to understand how a given climate risk can translate into a number of consequences for business
When should it be used?	• To develop a quick and broad understanding of climate change risk • To identify a need for strategic and ongoing responses/ commitments • To identify key localities for attention • To build awareness of risk among community and senior management • To seek a social and organisational licence to act on adaptation	• To develop a more detailed understanding of climate change risk and opportunities for a community or organisation • To identify key risk localities with follow-up resourcing requirements (e.g. new data, new study) • To get buy-in from community or senior management for developing an adaptation strategy or plan • To produce targeted climate risk communication materials • To identify adaptation options and support development of a plan or strategy	• To produce detailed impact studies of climate change effects on specific installations and activities, with a full understanding of the probabilities and uncertainties involved • To estimate the costs of adaptation action and prioritise resource allocation • To confirm emergency response procedures/requirements • To develop strategic and economic evaluations of adaptation options • To develop adaptation action plans for specific issues, including supporting detailed design
Limitations	Based on high-level screening and therefore not suitable for making any final decisions on adaptation actions	Based primarily on qualitative expert judgement of risk and therefore the results are as good as the qualitative judgement of the experts	Resource and time intensive, therefore requires expert input

Source: National Risk Assessment of Impacts of Climate Change: Bridging the Gap to Adaptation Action (EPA, 2020)

Appendix B Workshop Notes

Notes

Innishmore, Ballincollig
Co. Cork P31 KR68
T +353 21 466 5900

Reference:	IE000586A
Workshop Name:	CCRA Workshop Notes - Tipperary County Council
Workshop date:	23 November 2022
Workshop location:	TCC Civic Offices, Clonmel

Attendees

Name	Initials	Sector/Service
Aine Brett	AB	Environment & Climate Action
Clare Lee	CL	Planning
Damien Dullaghan	DD	Libraries & Cultural Services
Eddie Meegan	EM	Community & Enterprise
Eddie Ryan	ER	Fire Services
Ger Walsh	GW	Corporate Services / A/ Environment & Climate Action
Kathleen Prendergast	KP	Community & Economic Development
Kieran Malone	KM	Roads Section
Kieran McKenna	KMcK	Landfills & Energy, Environment & Climate Action
Liam Ryan	LR	Housing
Marie O'Donnell	MOD	Clonmel Borough District
Marion O'Neill	MON	Environment & Climate Action
Michael Tierney	MT	Roads Section
Orla Kelly	OK	Environment & Climate Action
Triona Collins	TC	Group Water Schemes / Environment & Climate Action
Tim Cooke	TC	RPS
James Peters	JP	RPS
Aidan Ware	AW	RPS

Notes

Effects on Services:

TC invited each attendee to discuss what they saw as the biggest impacts on their service due to climate change and were asked to identify the hazards impacts, exposures and vulnerabilities.

It was mentioned that since 2014 (the amalgamation of the two councils) there have been minutes recorded for each time the Emergency Response Team was gathered and give a good outline of the impacts of each event. These can be sent on to inform the CCRA.

Housing:

- It was noted that things that weather events seen nowadays were not seen in the past and are becoming more frequent and more severe.
- LA are at the fore in terms of retrofitting their existing housing stock and ensuring that all new construction is to an acceptable standard and BER rated.
- Chimneys are being phased out of housing stock and heat sources are moving away from burning of fossil fuels and there is limited resistance being seen to this which is being taken a s a huge positive. However, it was noted that the reliance on electricity to power heating systems is a large risk a there is no alternative heat source during power outages.
- There is a growing awareness in the community of the need to do better to protect the environment and try and reduce the impact of climate change and it is outweighing personnel needs and wants and LA meeting little resistance in retrofits and more sustainable building practices.
- Any new social housing scheme that is being developed is being planned with a 1:100 flood event in mind and FRA & flood mapping used to assess suitable of sites for LA housing schemes. This limits available land area for development and the planning department have a very large role in strategic planning and do a very good job.
- The existing housing stock the LA are responsible for in general is an aging housing stock and in relatively poor condition. There is an ongoing retrofit programme in place with 200-300 house being completed per year with the goal of having all LA housing to B1-B2 within 6-7 years.
- In terms of flooding, it is not seen a very large risk in the housing sector, whether it was by design or luck the majority of the existing housing stock is not very vulnerable to flooding and all new housing is planned to mitigate against flood risks.
- The main challenge that is seen is in the heating and the cooling of buildings going into the future and how this can be done in a sustainable way.
- It was noted that there has been some mudslides in recent times coming off mountain sides that impact on services, mostly impacts on roads and access to areas and can be a significant impact on access for emergency services if required.
- Wind affecting derelict/ dangerous sites by dislodging tiles.

Heritage:

- Heavy rain and winds have a significant impact on historic sites and structures, graveyards were mentioned as being particularly vulnerable as there is usually ruins of old structures on site that are in poor condition.
- Older heritage structures (200+ in county) are very vulnerable to extreme weather events as well as prolonged wet conditions.
- Longer growing season is seeing more impact of vegetation growth on structures. The growth of vegetation on older structures in particularly ruins increases their vulnerability to damage form high winds and they can have a sail effect. In addition, the ingress of root structures can comprise the structural stability of building and structures. Ruins in historical graveyards are noted as being particularly at risk.
- The increase in warmer and wetter weather is having an impact on built heritage, it is causing increased growth of mould and different types of mould and insects that are that are difficult to treat for and can cause considerable damage to heritage structures.

Notes

- There is difficulty in ensuring protection of privately owned heritage and protected structures as they are becoming more vulnerable to climate hazards.
- The nature of the majority of heritage structures and sites make them vulnerable to the elements and the increased severity and frequency of events will have a direct impact on the efforts required to preserve the historic material of these sites.

Libraries & Museums:

- There are over 500,000 visitors to the 12 libraries within the county every year.
- Flagship library was damaged during Storm Emma in 2018. And the libraries are exposed to damage from high winds and storm events in particular form falling objects and debris.
- A lot of the libraries are older buildings that have very poor heating and cooling systems. During the summer of this year temperatures reached in excess of 35^{o}C in some of the libraries and they had to be closed for the H&S of staff and the public. This issue is expected to get worse in the coming years with temperatures set to increase on the whole and for longer hot spells to be experienced.
- Water supply ahs not been a notable issue for the library service.
- If there is loss of power the libraries and museums must close until power is restored. Any closure of these facilities can have an adverse impact on the community and the suers of the services. Even though closures are typically short term they can have a negative impact on reputation. The libraries in the county are social hubs and used for many functions not just your typical library. Typically, the immediate effect of closures is seen form social media and emails from the general public and more long-term effects form complaints through local council etc.
- Source Library houses the local history archive and water ingress due to issues with the zinc roof has caused some damage to the records and they have had to be moved. The zinc roof is deteriorating due to changing weather conditions in particularly the long periods of wet persistent rain.
- It was noted that the museums are climate controlled in order to maintain a climate that aids in preserving the artefacts housed in the buildings. The changing climate may require more energy to maintain this steady climate or upgrades to the climate control systems in place.
- There is no back-up energy generation for the museums however it would have to be weeks rather than days for the climate control system to be out of action to cause any lasting damage.
- In the last year Clonmel library has had to close for 2 days due to high temperatures and 1 day was lost in a museum due to power outages.

Planning:

- The planning framework strategy accounts for climate change and is to the fore of the planning process.
- Flooding is common on developed and zoned lands as well as town centres that would have been built along rivers in low lying areas.
- Zoning land correctly and re-categorising already zoned lands due to new flood risks is a critical part of the planning strategy to ensure lands at risk of flooding are not heavily developed as may have been done in the past.
- There is a need for planning for future needs in what type of housing units that should be built with an eye to future climates and the heating and cooling requirements that will be needed.
- In a changing climate the approach to marketing traditional “greener” tourism in Ireland such as walking trails, forests, coastal amenities may need to be altered due to the changing climate and the effects it has on the landscape.
- 27% of over 65’s live alone and with the expected population trends this is only going to rise. A shift in planning needs to be adopted to provide better suited accommodation for this population that is closer to services, suited for single occupancy, closer to communities to prevent isolation etc. How to cater for our changing population profile is critical in the planning strategy.
- Development of communities around existing and planned infrastructure in order to optimise its use and move people to central hubs can have a significant impact in reducing commuting traffic, encouraging active travel, reducing urban sprawl.

Notes

- The planning process can be quite slow and once granted can last 2-5years (potentially 10 years in the near future) and this in itself can cause problems as public opinion changes and things that may have been “acceptable” at the time of granting may be out of date once the development is actually being built and public opinion or technology changes could make the proposed development obsolete or not fit for purpose any more but it will still get built.
- It was noted that the projected population growth and changing age profile of the population is a key metric used in the strategic planning at a local, regional and national level.
- As the population demographic change sit may start making more sense to be building smaller units more suited to smaller families and independent living, smaller units will be easier to heat and cool as well as be more environmentally friendly to construct.
- The County Plan must adhere to National & Regional Plans to project what infrastructure is needed and where main developments and strategic services will be required, there is a linked up thinking to a national scale in order to accommodate the projected needs of the country in the future accounting for population growth, climate change and numerous other factors.
- The Planning Framework in place is aligned with the challenges of climate change and the impacts being experienced at present and those expected in the future.
- In terms of public perception/acceptance of zoning/re-zoning of lands based on climate change impacts is mixed depending on personnel opinion. Zoning to facilitate compact growth can attract some negative feed back but typically once explained correctly to the public they can be quite accepting and understanding, communication and transparency is key.

Roads:

- Flood defence installed in Clonmel (on the River Suir) in 2017, prior to this there used to be major flooding experienced every 5-6 years. The scheme consists of demountable barriers, and they typically have approx. 24hrs notice to any potential flood event.
- Roads are very susceptible to flooding and can cause road closures for days at a time. Depending on the type of flooding roads getting closed and reopened a number of times over a 24-48hr period is commonplace.
- Climate change adoption funds are becoming more available in order to adapt legacy/non-deigned roads to mitigate against the effects of flooding. Typically, tertiary roads with limited to no drainage systems in place are the most at risk and closing of these roads can cut off rural communities with limited alternative routes that may add hours to journey times.
- There is business continuity plans in place to identify roads that are at risk due to impacts of climate change in particular flooding risk that would not have been an issue in the past and developing solutions to adapt to the changing climate. There is communication with the OPW where applicable to identify flood defence works that could be implemented. Works planned on a yearly basis to get the worst affected done first and works on going.
- A large portion of the road network is non-deigned/legacy roads that is just years of layers of surface dressing being built up on. Typically rural and tertiary roads.
- Prolonged rain periods can increase the risk of flooding to roads, the ground is saturated, and rainfall has nowhere to go so runs off adjacent land and onto road surfaces and floods road, this is a particular problem for tertiary road (typically un designed with no drainage network, relying on drainage ditches or drainage to adjacent land or gravel drains).
- Pluvial and intense rain fall events have a significant effect on legacy/non-designed roads resulting in road surface slippage and washing away of surface material and side slope destabilisation. Where older roads are submerged under flood waters for prolonged periods these issues are aggravated.
- Warmer weather that is being experienced these days does affect the road surfaces and their life span. The road surfaces used in this country are designed for the climate we used to have and with warmer conditions being experienced and set to increase in the future different road surfaces need to be explored.
- The winter maintenance programme has to focus on the major/strategic road network, similar to other counties rural road networks can remain untreated in cold spells and can isolate communities.

Notes

- The roads department has 2 main depots and smaller yards around the county. In terms of scheduling crews they have a 6 week scheduling programme in place and try there best to reduce the risk of burn out by rotating crews and not to be dependent on the same people all the time.
- Prolonged periods of wet weather can result in the destabilisation and washing out of the road structure which can be made worse if the roads are under flood water for long periods of time.
- The largest concern with windstorm is the knocking of trees and the blocking of roads, it was noted that approx. 1/3 of trees that are knocked due to wind take out an overhead power line or communications line. Hedge cutting and tree maintenance schedule is critical in trying to mitigate against this risk.
- The snowstorms in 2018 resulted in very large snow drifts that needed extensive resources to move as the thaw was so slow.
- Bridge structures are becoming more vulnerable due to increased flows passing under them, more debris in flood waters, increased flood levels that all increase the risk of the bridge structure being compromised. The effects may not be immediate but over time they will degrade the bridge and weaken its structural integrity shortening the bridges life span. Higher flows through the eye of bridges can wash out the foundations of bridges.
- Road vulnerability to exposed slopes. Clay being washed onto roads can block channels.
- Poor water management from Coillte forests leads to debris being washed onto roads in times of flooding. There is a vulnerability to affected services that this is uncontrollable due to the responsibility lying with Coillte.

Fire Services:

- Call outs to storm events have become more frequent and they are experience more severe impacts making going out in them more dangerous.
- As a direct result there has been a change in procedures to adapt to this risk and only responds to calls if there is life at risk during storm events. They will only react to nonlife threatening emergencies such as the clearing of trees, pumping out of areas, general debris clearing etc after the weather event has passed to reduce the risk to the crews.
- Historically wildfires have not been a big issue in the county however moving forward with a warmer climate predicated and longer dry spell there is a significant potential for these to become more of an issue.
- It was again noted as it was in other counties, that the effect of dry spells and heatwaves can have a impact on the occurrence significant fires due to farmers clearing for new growth, as farmers are waiting to burn off until the dry spell is over, this subsequently leads to larger stockpiles and areas to be burned off as they build up and then result in a larger amount of “controlled” burn offs by farmers becoming out of control.
- Fire buffers in forested areas may need to be increased in order to protect against future wildfires in particularly as forestry activities increase in the coming years.
- The switch form diesel powered fire trucks/engines to electric is something that will need significant R&D in order to ensure it is suitable given the reliance on the engines for pumping of water, powering of tools, ladder access etc.
- 3 of the main fire stations in the county have back up generators and the alert system across the board has a 24-48hr battery back up providing resilience to power outages form a communications perspective.
- When queried about the availability of water during extreme weather events that may affect water networks it was stated that they will find a source and draw water from wherever it is available, and they are used to working in isolated areas without mains supply and can draw from local water bodies or any source they can find. They have contingency plans in place and are quite resilient from this aspect.
- They are very reliant on the fire engine itself as it does all the pumping of water, even when connected to mains supply, powers hydraulic tools, field communications etc. The move away from diesel to electric powered vehicles I none of concern and needs a lot of testing before it can be done.

Community:

Notes

- The council have grant schemes in place to support community evets, action plans and policies and they have worked in recent years to have the award criteria take into account sustainable efforts, biodiversity, environmentally friendly projects, health & wellbeing, climate action etc. As such grants and funding would be more accessible for communities with a more sustainable approach.
- Approx. €700,000 per annum is granted for community action plans and projects with a focus on climate action.
- Community can play a very large part in adapting to climate change and mitigating against effects. They can be self driven if funding made available and allow smaller local scale projects be completed at a quicker scale and not reliant on the council and the slow progress of getting projects through approvals etc.
- The business community can be significantly impacted by weather events especially flooding where they can experience prolonged closures due to flood damage and awaiting works to repair damage etc.
- There is a lack of understanding amongst business as to the potential opportunities that exists around climate change and an awareness programme could be highly beneficial in educating the business community and allowing them to adapt to the changing climate in appositive fashion.
- SWOT reports have been carried out by the council on this topic and could be made available to RPS for use in the CCRA.

Group Water Schemes:

- There are a large number of group water schemes within the county.
- There is a large issue with the turbidity in water sources following intense rainfall and flooding events, it was noted that TCC have a process in place on each GWS to deal with this event.
- In general there is action plans in place for most severe weather events, droughts, heat waves etc in order to build up a resilience to the impact of climate change.
- There are stresses starting to be observed on water sources on amore regular basis with one source or a GWS failing this summer, this was temporarily fixed by connecting to a neighbouring GWS.
- There has been a noted increase in manganese content I water sources being drawn from aquifers. It is though that this is due to the aquifer levels never fully recovering after the drought experienced in 2018 and there is more concentrated minerals in the water being abstracted as a result.
- Similar effects are being seen on other ground water sources where changes in the soil chemistry is being picked up in water abstractions.
- The more intense rainfall we are experiencing in the country now is not replenishing ground water sources as much as one would think, the intensity of the rain means the majority of the rainfall runs off the surface and does not have time to penetrate into the ground water sources.

Landfill:

- There is an increased fire risk due to longer dry spells and hotter temperatures being experienced that are drying out areas of landfill.
- Capped landfills within the county flare off the collected gas as it is not of good enough quality for power generation.
- The leachate management systems in place collect the leachate and store it on site for off-site removal or treatment. There is no on-site treatment at risk of failure due to increased rainfall events, reed bed die off etc.
- Increased rainfall events and prolonged wet spells does increase the amount of leachate coming off the landfills and the SS concentration within the leachate, just results in more frequent collections for off-site treatment.

Environment:

- The issue of increased run off from forestry areas came up again with the same impacts being seen in Tipperary as in other counties impacting on water quality of water bodies, impacting on the quality of

Notes

water abstracted for drinking water, exacerbating flooding in areas downstream etc. 41% Moderate, 59% Poor.

- The legislation is not keeping up with the ever-changing climate impacts and as such it makes enforcement very difficult for the councils to try and prevent and mitigate against climate changes and environmental damage.
- The Councils are the last stop and people will end up going to them to get issues solved even if it is not their responsibility they are seen as the place to go to at least get the ball rolling and as such there is ever increasing pressure on services and more issues arise due to climate change.
- Noticeable increase in diseases found in fauna, overwhelming vet clinics
- Investment in infrastructure to meet challenges/goals is prevented due to uncertainty in climate change.
- Invasive species are becoming a bigger problem as the changing environment promotes their growth.
- Seasonal changes are affecting pollinators.

Community Action:

- Increased instances of flooding directly related to drainage networks not being able to keep up with surface run-off. This is increasing instances of localised flooding in some cases one off houses that resolving the issue can be quite difficult.
- Even with the flood defences in place there is still requirements to close roads and bridges during flooding events, this needs to be clearly communicated to the community as transparency is key, if they know why the roads are being closed then they will in most cases be understanding and it will protect the council's reputation.
- Communication and community engagement is key and communicating to the community how they can help and why things are being done plays a huge part, TC gave examples how this is done in Australia very effectively.

Appendix C Hazard Events Record

Hazard Events Record - County Tipperary				Hazard Type									
Year	Date	Event	Summary	River flood	Pluvial flood	Extreme precipitation	Severe windstorm	Heavy snowfall	Heatwave	Drought	Above average surface temperature	Above average precipitation	Extended Cold spell
2023	12th January	Prolonged wet weather	Prolonged wet weather resulted in a rise in water levels of Lough Derg on the River Shannon. This resulted in the closure of N65 Birr to Portumna National Road at Carrigahorig for 4 days.	■	■	■						■	
2023	11th January	Intense rainfall event	Extreme rainfall at Ballina, Co Tipperary resulting in flooding of 4 premises, closure of R494 regional road for 3 days, overnight closure of R494 north of Ballina		■	■						■	
2022	2nd November	Flooding	Flooding of 4 commercial premises in Ballina Town during intense short duration cloud burst. Cloudburst at Ballina Town, Co Tipperary.		■	■						■	
2022	16th October	Intense rainfall event	Intense rainfall event at Grennanstown, Templederry, Co Tipperary resulting in the River Clodagh overflowing. One house flooded to a depth of 300 mm, boundary wall collapsed. One elderly woman rescued from her home.		■	■						■	
2022	4th - 7th September	Storm Danielle and Heavy Rainfall Event	Severe weather event		■	■						■	
2022	July	Heatwave	Prolonged extreme heat of 25-30°C. Extreme and prolonged temperatures, fire safety warnings issued by Fire Department and Department of Agriculture						■		■		
2022	4th June	Flooding	One commercial property flooded due to uncontrolled flow of water from higher ground to the south of Ballina. Cloudburst at Ballina Town, Co Tipperary		■	■						■	
2022	Feb	Storm Frankie	All areas on alert				■						
2022	17th February	Storm Eunice	Yellow/orange alert for severe wind. Severe weather plan in place.				■						
2022	15th February	Storm Dudly	Status orange Wind warning				■						
2021	6-8th December	Storm Barra	Yellow alert issued, but presence of fallen trees, slight flooding from River Suir, power outages at water treatment plants, and high winds.			■	■						
2021	10th October	Heavy rainfall	Snowfall expected, but heavy rainfall was experienced.			■							
2021	Summer	Heatwave & prolonged Dry period	loss of water supplies in private wells. Some supply interruptions due to high demand.						■	■	■		
2021	22-23rd February	Severe windstorms and heavy rainfall	Orange alert for heavy rainfall and strong winds. Action plan fully activated, but short of level 3 (evacuation). Pumps set up to prevent flooding. Main issue was wind damage.			■	■						
2020	20th August	Storm Ellen	Orange alert for severe winds. Several downed trees and road closures.				■						
2020	Summer	Heatwave & Prolonged dry period	Water shortages							■	■		
2020	24th Feb/Mar	Severe Flooding	There was over 3 times the average rainfall recorded at Gurteen met station during February 2020. This resulted in elevated levels in Lough Derg closing the N65 Birr to Portumna for 4 weeks. The Little Brosna overflowed at the R438 Athlone Road resulting in the road being closed for 2 weeks. The Ballyfinbouy river recorded its highest ever level resulting in the closure of the R493 for 2 weeks. several more minor roads were also impacted.	■	■	■						■	
2020	13th January	Storm Brendan	Orange alert for severe winds. Fallen trees noted. Some surface water flooding but no road closures.		■	■	■						
2019	2-4th October	Storm Lorenzo	Yellow alert for severe winds and gusts. Fallen trees present. Minor flooding experienced in few areas.	■			■						
2019	26th April	Severe windstorm	Orange alert for severe winds and gusts. Severe weather plan in place.				■						
2018	Dec	Storm Eric	All areas on alert				■						
2018	Dec	Storm Deirdre	All areas on alert				■						
2018	Nov	Storm Diana	All areas on alert				■						
2018	October	Storm Callum	All areas on alert				■						
2018	September	Storm Ali	Orange Wind Warning - gale-force winds of up to 120km/h, stormy conditions				■						
2018	Summer	Heat wave	High temperatures, heat wave and drought						■	■			
2018	February/ March	Storm Emma/ Beast from the East	Met Éireann issued a red warning with school and business closures. Temperatures of -7°C with heavy snowfall.				■	■					■
2017	October	Storm Ophelia	The storm caused major power outages, lifted roofs, and felled countless trees. Closure of schools and business and fatalities.				■						
2016	2-3rd January	Heavy rainfall and flooding	High water levels in rivers due to persistent and extreme rainfall led to the need for pumps to manage water levels. Precipitation levels were above seasonal averages. Irish Army was dispatched to man pumps. Evacuation protocols initiated to prepare for evacuation of Suir Island, Convent Road, Church Road, and Marfield.	■	■	■						■	
2015	December	Storm Frank	Extreme heavy rainfall (85mm of rain) resulted in blockage of the N24 at Carrick on Suir	■	■	■	■						
2014	14th February	Storm Darwin	Winds in the region of 80-90 km/h, gusts 130-170 km/h causing widespread damage.				■						
2013	Summer	High temperatures and Drought	High temperatures accompanied with drought conditions were experienced in Tipperary with major impacts to agriculture.						■	■	■		
2009/ 2010	Winter	Winter Storms	Coldest winter for a 50-year period with temperatures falling below -10°C.										■
2006	Summer	Heat wave	Warmest summer since record breaking 1996.								■		
2000	November	Severe Flooding	70-98mm rainfall large areas flooded.	■	■	■							
1996	Summer	Heatwave	Temperatures reach 2°C above normal and with daily temperatures exceeding 30°C for a number of consecutive days.								■		
1987	January	Heavy Snowfall	Snowfall of between 6-12cm recorded.					■					

Appendix D Characterisation of Climate Hazards, Impacts, Exposures, Vulnerabilities and Assessment

Hazard Event:	**River Flood**
Frequency of Occurrence:	Common
Description of the Hazard Event: (Including relevant meteorological / climatological conditions and locations affected)	Rivers exceeding the capacity of their river banks. Bursting of river banks. Riverside infrastructure particularly affected.

Hazard Impact	Impact Description:	Exposure	Vulnerability		Service Areas: Level of Disruption																		Impact Score
			Type	Description	Archives	Arts and Culture	Business and Economy	Community	Emergency Services	Environment and Natural Heritage	Finance	Governance and Administration	Built Heritage and Conservation	Housing	Human Resources	Information Technology	Leisure and Recreation	Libraries and Museums	Planning and Building	Roads and Transport	Tourism	Water Services	
Damage to infrastructure	Flood water affecting built environment. Can lead to closure of facilities	LA buildings	Physical	Use of material Built Heritage Fixed or manual flood defences Flooded outfalls Structural loading	Moderate	None	Negligible	None	None	None	Minor	None	Minor	None	Negligible	Minor	None	None	None	None	None	None	0.61
			Environmental	Impermeability of surface Ground elevation and gradient relative to surrounding area Proximity to rivers																			
			Socioeconomic	None																			
		Roads & Bridges	Physical	Use of material Built Heritage Structural loading	None	None	None	None	None	None	Moderate	None	Minor	None	None	None	None	None	None	Moderate	None	None	0.44
			Environmental	Proximity to rivers																			
			Socioeconomic	None																			
		Railway	Physical	None	None	None	None	None	None	None	Minor	None	None	None	None	None	None	None	None	Moderate	None	None	0.28
			Environmental	Proximity to rivers																			
			Socioeconomic	None																			
		Housing	Physical	Use of material Built Heritage Fixed or manual flood defences Flooded outfalls Structural loading	None	None	None	Negligible	None	None	Minor	None	None	Moderate	Negligible	None	None	None	None	None	None	None	None	0.39
			Environmental	Impermeability of surface Ground elevation and gradient relative to surrounding area Proximity to rivers																			
			Socioeconomic	None																			
		Construction sites	Physical	Security of materials Silt netting	None	None	Minor	None	None	None	Negligible	None	None	None	None	None	None	None	None	None	None	None	0.17
			Environmental	Impermeability of surface Ground elevation and gradient relative to surrounding area Proximity to rivers																			
			Socioeconomic	None																			
		Commerce	Physical	Storage of stock/ equipment	Negligible	None	Minor	None	None	None	Negligible	None	None	None	None	Minor	None	None	None	None	Minor	None	0.44
			Environmental	Proximity to rivers																			
			Socioeconomic	None																			
		Agricultural land	Physical	Efficiency of drainage network Flooded outfalls	None	None	Minor	None	None	Negligible	Negligible	None	None	None	None	None	None	None	None	None	None	None	0.22
			Environmental	Proximity to rivers																			
			Socioeconomic	None																			
		Drainage networks	Physical	Capacity Build up of silt	None	None	None	None	None	Minor	Negligible	None	None	None	None	None	None	None	None	None	None	None	0.17
			Environmental	None																			
			Socioeconomic	None																			
		Land use suitability	Physical	Adequacy of drainage network	None	None	None	None	None	None	Negligible	None	None	None	None	None	None	None	Moderate	None	None	None	0.22
			Environmental	Proximity to rivers																			
			Socioeconomic	None																			
		Power supply	Physical	Fixed or manual flood defences Flooded outfalls Structural loading Backup generator availability	Negligible	Negligible	Moderate	Negligible	Moderate	Negligible	Minor	Negligible	Negligible	Negligible	Minor	Moderate	Negligible	Negligible	Negligible	Moderate	Negligible	Moderate	1.67
			Environmental	Ground elevation and gradient relative to surrounding area Proximity to rivers																			
			Socioeconomic	None																			
Damage to environment	Loss of biodiversity	SAC/SPA/natural habitats	Physical	Flora sensitivity to saturation - some plants may die from oversaturated soil Robustness of flora	None	None	None	None	None	Major	Negligible	None	None	None	None	None	None	None	None	None	None	None	0.28
			Environmental	Ground elevation and gradient relative to surrounding area Proximity to rivers Presence of rare species																			
			Socioeconomic	None																			
Damage to riverside amenities	Damage to amenities on riverbanks, leading to closure for public safety	Walkways and trails	Physical	None	None	None	None	Minor	None	None	Negligible	None	None	None	None	None	Minor	None	None	None	Minor	None	0.39
			Environmental	Ground elevation and gradient relative to surrounding area Proximity to rivers																			
			Socioeconomic	None																			
Unusable roads	Roads will become inundated with water and become inaccessible	Road network	Physical	Efficiency of drainage network Flooded outfalls	None	None	Negligible	Negligible	Major	None	Negligible	Negligible	None	None	None	None	Negligible	None	None	Moderate	Negligible	None	0.72
			Environmental	Impermeability of surface Ground elevation and gradient relative to surrounding area Proximity to rivers																			
			Socioeconomic	None																			
		Pathways/ cycle lanes	Physical	Drainage network	None	None	None	Minor	None	None	Negligible	None	None	None	None	None	Minor	None	None	Moderate	Negligible	None	0.50
			Environmental	Impermeability of surface Ground elevation and gradient relative to surrounding area Proximity to rivers																			
			Socioeconomic	None																			
		General public	Physical	None	None	None	None	None	None	None	Negligible	None	None	None	None	None	Negligible	None	None	None	Minor	None	0.22
			Environmental	Road congestion																			
			Socioeconomic	Exposure to warnings/ alerts																			
		Emergency responders	Physical	None	None	None	Minor	None	Major	None	Negligible	None	None	None	None	None	None	None	None	None	None	None	0.39
			Environmental	Road congestion																			
			Socioeconomic	Reliance on TII for alerts on National roads Extended workload and overtime leading to burnout and availability of monitoring staff																			

Hazard Impact	Impact Description:	Exposure	Vulnerability		Service Areas: Level of Disruption																		
			Type	Description	Archives	Arts and Culture	Business and Economy	Community	Emergency Services	Environment and Natural Heritage	Finance	Governance and Administration	Built Heritage and Conservation	Housing	Human Resources	Information Technology	Leisure and Recreation	Libraries and Museums	Planning and Building	Roads and Transport	Tourism	Water Services	Impact Score
Reduced water quality	Foreign substances entering water systems. Boil water notices issued in some cases	Water bodies	Physical	Sewage overflow inputs into water bodies Water turbidity Combined foul and surface system	None	None	Negligible	None	None	Major	Negligible	None	None	None	None	None	None	None	None	None	None	Major	0.56
			Environmental	Impermeability of surface Ground elevation and gradient relative to surrounding area Proximity to rivers Presence of rare species																			
			Socioeconomic	None																			
		Water supply distribution	Physical	Back up generator availability	None	None	Negligible	Negligible	Major	None	Minor	None	None	Negligible	Negligible	None	None	None	None	None	None	Major	0.78
			Environmental	Impermeability of surface Ground elevation and gradient relative to surrounding area Proximity to rivers																			
			Socioeconomic	Extended workload and overtime leading to burnout and availability of monitoring staff Responsibility (Irish Water)																			
Inundated wastewater treatment systems	Private systems located in poor drainage areas and/or flood zones become inundated	Wastewater infrastructure	Physical	Capacity and fullness of septic tanks	None	None	None	Minor	None	None	Minor	None	None	None	None	None	None	None	None	None	None	Major	0.44
			Environmental	Water table level Proximity to rivers																			
			Socioeconomic	None																			
Temporary housing	Relocation of homeless and residents of flooded properties	General public	Physical	None	None	None	None	None	None	None	Negligible	Negligible	None	Moderate	Minor	None	Negligible	None	None	None	Minor	None	0.56
			Environmental	Proximity to rivers																			
			Socioeconomic	Population age Population constitution Housing availability																			
		LA staff	Physical	None	None	None	None	None	None	None	Negligible	Negligible	None	Moderate	Minor	None	None	None	None	None	Negligible	None	0.44
			Environmental	Proximity to rivers																			
			Socioeconomic	Population age Population constitution Housing availability																			
		Homeless	Physical	None	None	None	None	None	None	None	Negligible	Negligible	None	Moderate	Minor	None	None	None	None	None	None	None	0.39
			Environmental	Proximity to rivers																			
			Socioeconomic	Population age Population constitution Housing availability																			
Health and Safety risks	Drowning/ presence of submerged hazards leading to injury or death	General public	Physical	None	None	None	Minor	None	Moderate	None	Negligible	None	None	None	None	None	Negligible	None	None	None	Minor	None	0.50
			Environmental	Proximity to rivers																			
			Socioeconomic	Human desire to watch the event from an unsafe location Population age Population constitution Exposure to warnings/ alerts																			
		Council staff	Physical	None	None	None	Minor	None	Moderate	None	Negligible	Negligible	None	None	None	None	None	Minor	None	None	Negligible	None	0.56
			Environmental	Proximity to rivers																			
			Socioeconomic	Population age Population constitution																			
		Homeless	Physical	None	None	None	None	None	Moderate	None	Negligible	None	None	None	None	None	None	None	None	None	None	None	0.22
			Environmental	Proximity to rivers																			
			Socioeconomic	Population age Population constitution																			
Cancellation/ postponing of cultural events	Adverse weather disrupting ability to hold a cultural event	Cultural events	Physical	None	None	Moderate	Negligible	None	None	None	Negligible	None	None	None	None	None	Negligible	None	None	None	Minor	None	0.44
			Environmental	Proximity to rivers																			
			Socioeconomic	None																			

Hazard Event:	**Extreme Precipitation**
Frequency of Occurrence:	Frequent
Description of the Hazard Event: (including relevant meteorological / climatological conditions and locations affected)	An unusually large volume of rainfall in a short period of time. Red Warning 70mm or greater in 24 hours. Orange Warning 50-70mm in 24 hours. Yellow Warning 30-50mm in 24 hours.

Hazard Impact	Impact Description:	Exposure	Vulnerability		Service Areas: Level of Disruption																		Impact Score
			Type	Description	Archives	Arts and Culture	Business and Economy	Community	Emergency Services	Environment and Natural Heritage	Finance	Governance and Administration	Built Heritage and Conservation	Housing	Human Resources	Information Technology	Leisure and Recreation	Libraries and Museums	Planning and Building	Roads and Transport	Tourism	Water Services	
Flooding	Excessive rainfall resulting in flooding, causing damage. Can lead to closure of facilities	LA buildings	Physical	Use of material Built Heritage Fixed or manual flood defences Flooded outfalls Structural loading	Moderate	None	Negligible	None	None	None	Minor	None	Minor	None	Negligible	Moderate	None	None	None	None	None	None	0.67
			Environmental	Impermeability of surface Ground elevation and gradient relative to surrounding area Proximity to urban environment																			
			Socioeconomic	None																			
		Roads & Bridges	Physical	Use of material Built Heritage Adequacy of drainage systems	None	None	None	None	None	None	Minor	None	Minor	None	None	None	None	None	None	Moderate	None	None	0.39
			Environmental	Faster rate of deterioration in roads due to prolonged exposure of road surfaces to flooding																			
			Socioeconomic	None																			
		Housing	Physical	Use of material Built Heritage Fixed or manual flood defences Flooded outfalls Structural loading	None	None	None	Negligible	None	None	Minor	None	None	Moderate	Negligible	None	None	None	None	None	None	None	0.39
			Environmental	Impermeability of surface Ground elevation and gradient relative to surrounding area Proximity to urban environment																			
			Socioeconomic	None																			
		Construction sites	Physical	Security of materials Silt netting	None	None	Minor	None	None	None	Negligible	None	None	None	None	None	None	None	None	None	None	None	0.17
			Environmental	Impermeability of surface Ground elevation and gradient relative to surrounding area Proximity to urban environment																			
			Socioeconomic	None																			
		Commerce	Physical	Storage of stock/ equipment	Negligible	None	Minor	None	None	None	Negligible	None	None	None	None	Minor	None	None	None	None	Minor	None	0.44
			Environmental	Proximity to urban environment																			
			Socioeconomic	None																			
		Drainage networks	Physical	Capacity Build up of silt	None	None	None	None	None	Minor	Negligible	None	None	None	None	None	None	None	None	None	None	None	0.17
			Environmental	None																			
			Socioeconomic	None																			
		SAC/SPA/natural habitats	Physical	Flora sensitivity to saturation - some plants may die from oversaturated soil Robustness of flora	None	None	Minor	None	None	Moderate	Negligible	None	None	None	None	None	None	None	None	None	None	None	0.33
			Environmental	Ground elevation and gradient relative to surrounding area Proximity to urban environment Presence of rare species																			
			Socioeconomic	None																			
		Agricultural land	Physical	Efficiency of drainage network Flooded outfalls	None	None	Minor	None	None	Negligible	Negligible	None	None	None	None	None	None	None	None	None	None	None	0.22
			Environmental	Proximity to urban environment																			
			Socioeconomic	None																			
		Land use suitability	Physical	Adequacy of drainage network	None	None	None	None	None	None	Negligible	None	None	None	None	None	None	None	Moderate	None	None	None	0.22
			Environmental	Proximity to urban environment																			
			Socioeconomic	None																			
Unusable roads	Roads will become inundated with water and become inaccessible	Road network	Physical	Efficiency of drainage network	None	None	None	Minor	Major	None	Negligible	None	None	None	None	None	Negligible	None	Negligible	Moderate	Negligible	None	0.72
			Environmental	Impermeability of surface Ground elevation and gradient relative to surrounding area Proximity to urban environment																			
			Socioeconomic	None																			
		Pathways/ cycle lanes	Physical	None	None	None	None	Minor	None	None	Negligible	None	None	None	None	None	Minor	None	None	Moderate	Minor	None	0.56
			Environmental	Impermeability of surface Ground elevation and gradient relative to surrounding area Proximity to urban environment																			
			Socioeconomic	None																			
		General public	Physical	None	None	Negligible	Minor	Minor	Minor	None	Negligible	None	None	None	None	None	Negligible	None	None	None	Minor	None	0.61
			Environmental	Road congestion																			
			Socioeconomic	Exposure to warnings/ alerts																			
		Emergency responders	Physical	None	None	None	Moderate	Minor	Major	None	Negligible	None	None	None	None	None	None	None	None	None	None	None	0.56
			Environmental	Road congestion																			
			Socioeconomic	Reliance on TII for alerts on National roads Extended workload and overtime leading to burnout and availability of monitoring staff																			
Reduced water quality	Washed out nutrients/chemicals from surface run off entering water bodies. Boil water notices issued in some cases	Water bodies	Physical	Sewage overflow inputs into water bodies Gradient of ground Water turbidity Capacity	None	None	None	None	None	Moderate	Negligible	None	None	None	None	None	None	None	None	None	None	Major	0.44
			Environmental	Impermeability of surface Ground elevation and gradient relative to surrounding area Proximity to urban environment Presence of rare species																			
			Socioeconomic	None																			
		Water supply distribution	Physical	Increase in peak flows Back up generator availability	None	None	None	Minor	Major	None	Negligible	None	None	None	None	None	None	None	None	None	None	Major	0.61
			Environmental	Impermeability of surface Ground elevation and gradient relative to surrounding area Proximity to urban environment																			
			Socioeconomic	Extended workload and overtime leading to burnout and availability of monitoring staff Responsibility (Irish Water)																			
Inundated wastewater treatment systems	Private systems located in poor drainage areas and/or flood zones become inundated	Wastewater infrastructure	Physical	Capacity and fullness of septic tanks	None	None	None	Minor	None	None	Negligible	None	None	None	None	None	None	None	None	None	None	Major	0.39
			Environmental	Water table level Proximity to urban environment																			
			Socioeconomic	None																			

Hazard Impact	Impact Description:	Exposure	Vulnerability		Service Areas: Level of Disruption																			
			Type	Description	Archives	Arts and Culture	Business and Economy	Community	Emergency Services	Environment and Natural Heritage	Finance	Governance and Administration	Built Heritage and Conservation	Housing	Human Resources	Information Technology	Leisure and Recreation	Libraries and Museums	Planning and Building	Roads and Transport	Tourism	Water Services	Impact Score
Health and Safety risks	Heavy rain affects safe travel and poses a risk of injury from uncertain footing	General public	Physical	None	None	Negligible	Minor	Minor	Minor	None	Negligible	None	None	None	None	None	Negligible	None	None	None	None	None	None	0.50
			Environmental	Available cover Proximity to urban environments Adequacy of drainage systems																				
			Socioeconomic	Population age Population constitution																				
		Council staff	Physical	None	None	None	Moderate	None	Moderate	None	Negligible	Negligible	None	None	None	None	None	Minor	None	None	None	None	None	0.56
			Environmental	Available cover Proximity to urban environments Adequacy of drainage systems																				
			Socioeconomic	Population age Population constitution																				
		Outdoor workers	Physical	Transport method used	None	None	Minor	Minor	Minor	None	Negligible	None	None	None	None	None	None	None	None	None	None	None	None	0.39
			Environmental	Available cover Proximity to urban environments Adequacy of drainage systems																				
			Socioeconomic	Population age Population constitution																				
Land erosion	Rainfall causing ground saturation, weakening ground strength	Saturated cliffs	Physical	Soil properties	None	None	None	Minor	None	Moderate	Negligible	None	None	None	None	None	None	None	None	Negligible	None	None	None	0.39
			Environmental	Ground elevation and gradient relative to surrounding area Proximity to urban environment																				
			Socioeconomic	None																				
Erosion of structures	Chemical reaction dissolving structures/ scour	LA buildings	Physical	Use of material Built Heritage	None	None	None	None	None	None	Negligible	None	Minor	None	None	None	None	None	None	None	None	None	None	0.17
			Environmental	None																				
			Socioeconomic	None																				
		Road network	Physical	Use of material Built Heritage	None	None	Negligible	None	None	None	Negligible	None	None	None	None	None	None	None	None	Moderate	None	None	None	0.28
			Environmental	None																				
			Socioeconomic	None																				
		Housing	Physical	Use of material Built Heritage	None	None	None	None	None	None	Negligible	None	None	Minor	None	None	None	None	None	None	None	None	None	0.17
			Environmental	None																				
			Socioeconomic	None																				
Cancellation/ postponing of cultural events	Adverse weather disrupting ability to hold a cultural event	Cultural events	Physical	Available cover	None	Moderate	Negligible	None	None	None	Negligible	None	None	None	None	None	Negligible	None	None	None	Minor	None	0.44
			Environmental	Proximity to urban areas																				
			Socioeconomic	None																				

Hazard Event:	**Severe Windstorm**
Frequency of Occurrence:	Frequent
Description of the Hazard Event: (including relevant meteorological / climatological conditions and locations affected)	Red Warning indicating mean gusts >80km/h. Gusts in excess of 130km/h Orange Warning indicating mean gusts of 65-80km/h. Gusts ranging between 110-130km/h Yellow Warning indicating mean gusts of 50-65km/h. Gusts ranging between 90-110km/h

Hazard Impact	Impact Description:	Exposure	Vulnerability		Service Areas: Level of Disruption																		Impact Score
			Type	Description	Archives	Arts and Culture	Business and Economy	Community	Emergency Services	Environment and Natural Heritage	Finance	Governance and Administration	Built Heritage and Conservation	Housing	Human Resources	Information Technology	Leisure and Recreation	Libraries and Museums	Planning and Building	Roads and Transport	Tourism	Water Services	
Damage to infrastructure	Wind causing damage to infrastructure. Can lead to closure of facilities	LA buildings	Physical	Use of material Built Heritage Structural loading Building heights	Negligible	None	Moderate	Minor	None	None	Minor	None	Moderate	Minor	Negligible	None	None	Minor	Negligible	None	Negligible	None	1.00
			Environmental	Proximity to vegetation Wind tunnels in urban environments																			
			Socioeconomic	None																			
		Bridges	Physical	Use of material Built Heritage Structural loading	None	None	None	None	None	None	Negligible	None	Moderate	None	None	None	None	None	None	Moderate	None	None	0.39
			Environmental	None																			
			Socioeconomic	None																			
		Housing	Physical	Use of material Built Heritage Structural loading Building heights	None	None	None	Minor	Minor	None	Minor	None	None	Minor	None	None	None	None	None	None	None	None	0.44
			Environmental	Proximity to vegetation Wind tunnels in urban environments																			
			Socioeconomic	None																			
		Commerce	Physical	None	Negligible	None	Moderate	None	None	None	Negligible	Negligible	None	None	None	Negligible	None	Negligible	None	None	Moderate	None	0.61
			Environmental	Proximity to vegetation Wind tunnels in urban environments																			
			Socioeconomic	Nature of business																			
		Telemetry	Physical	None	None	None	Moderate	Moderate	Moderate	None	Negligible	Negligible	None	None	Negligible	Moderate	Minor	Negligible	None	Minor	Minor	Minor	1.33
			Environmental	Proximity to vegetation																			
			Socioeconomic	None																			
		Water abstraction and wastewater infrastructure	Physical	Integrity of treatment plant infrastructure	None	None	None	None	None	None	Negligible	None	None	None	None	None	None	None	None	None	None	Moderate	0.22
			Environmental	Proximity to vegetation																			
			Socioeconomic	None																			
Damage to environment	Loss of biodiversity	SAC/SPA/natural habitats	Physical	Integrity of habitats Available shelter	None	None	None	None	None	Moderate	Negligible	None	None	None	None	None	None	None	None	None	Minor	None	0.33
			Environmental	Level of exposure to wind																			
			Socioeconomic	None																			
Loose debris/material	Debris picked up by wind creating blockages and causing damage to infrastructure and population	LA buildings	Physical	Use of material Built Heritage	Negligible	None	Moderate	Minor	None	None	Negligible	None	Minor	Minor	None	None	None	Minor	Negligible	None	Negligible	None	0.83
			Environmental	Proximity to vegetation Wind tunnels in urban environments																			
			Socioeconomic	None																			
		Bridges	Physical	Use of material Built Heritage	None	None	None	None	Minor	None	Negligible	None	Minor	None	None	None	None	None	None	Moderate	Minor	None	0.56
			Environmental	Proximity to vegetation Wind tunnels in urban environments																			
			Socioeconomic	None																			
		Construction sites	Physical	Use of material Security of materials Potential to compromise scaffolding	Negligible	None	Moderate	Minor	None	None	Negligible	None	None	Minor	None	None	None	None	Moderate	None	None	None	0.67
			Environmental	Proximity to vegetation Wind tunnels in urban environments																			
			Socioeconomic	None																			
		Derelict buildings	Physical	Use of material Built Heritage	None	None	None	Minor	Minor	None	Negligible	None	None	None	None	None	None	None	Minor	None	None	None	0.39
			Environmental	Proximity to vegetation Wind tunnels in urban environments																			
			Socioeconomic	None																			
		Water treatment plants	Physical	Contamination prevention/ mitigation measures	None	None	None	None	None	None	Negligible	None	None	None	None	None	None	None	None	None	None	Moderate	0.22
			Environmental	Proximity to vegetation																			
			Socioeconomic	None																			
		Water bodies	Physical	Size of water body Contamination prevention/ mitigation measures	None	None	None	None	None	Moderate	Negligible	None	None	None	None	None	None	None	None	None	None	Moderate	0.39
			Environmental	Proximity to vegetation																			
			Socioeconomic	None																			
Health and Safety risks	High winds affect safe travel and poses a risk of injury	General public	Physical	None	None	Negligible	Minor	Minor	Moderate	None	Negligible	None	None	None	None	None	None	Negligible	None	None	None	None	0.56
			Environmental	Available shelter Wind tunnels in urban environments																			
			Socioeconomic	Human desire to watch the event from an unsafe location Population age Population constitution Homeless																			
		Council staff	Physical	None	None	None	Moderate	None	Moderate	None	Negligible	Negligible	None	None	None	None	None	Minor	None	None	None	None	0.56
			Environmental	Available shelter Wind tunnels in urban environments																			
			Socioeconomic	Population age Population constitution																			
		Outdoor workers	Physical	Transport method used	None	None	Minor	Minor	Minor	None	Negligible	None	None	None	None	None	None	None	None	None	None	None	0.39
			Environmental	Available shelter Wind tunnels in urban environments																			
			Socioeconomic	Population age Population constitution																			

Hazard Impact	Impact Description:	Exposure	Vulnerability		Service Areas: Level of Disruption																		
			Type	Description	Archives	Arts and Culture	Business and Economy	Community	Emergency Services	Environment and Natural Heritage	Finance	Governance and Administration	Built Heritage and Conservation	Housing	Human Resources	Information Technology	Leisure and Recreation	Libraries and Museums	Planning and Building	Roads and Transport	Tourism	Water Services	Impact Score
Power supply cuts	Damage to powerlines leading to loss of power to urban and regional centres	Commerce	Physical	Presence of overhead lines Backup generator availability	Negligible	None	Moderate	None	None	None	Negligible	None	None	None	None	None	None	None	None	None	Moderate	None	0.44
			Environmental	Proximity to vegetation																			
			Socioeconomic	None																			
		LA buildings	Physical	Presence of overhead lines Backup generator availability	Negligible	None	Moderate	Minor	Moderate	None	Negligible	Negligible	Moderate	Minor	None	Minor	None	Minor	Minor	None	Moderate	None	1.39
			Environmental	Proximity to vegetation																			
			Socioeconomic	None																			
		Housing	Physical	Presence of overhead lines Backup generator availability	None	None	None	Minor	Minor	None	Negligible	None	None	Minor	None	None	None	None	None	None	None	None	0.39
			Environmental	Proximity to vegetation																			
			Socioeconomic	Population age Population constitution																			
		Hospital/Health Centres	Physical	Presence of overhead lines Backup generator availability	Negligible	None	None	Minor	Moderate	None	Negligible	None	None	None	None	None	None	None	None	None	None	None	0.39
			Environmental	Proximity to vegetation																			
			Socioeconomic	None																			
		Communication/ servers	Physical	Presence of overhead lines Backup generator availability	Minor	Negligible	Minor	Minor	Major	Minor	Minor	Minor	Minor	Minor	Minor	Moderate	Negligible	Minor	Minor	Moderate	Moderate	Minor	2.17
			Environmental	Proximity to vegetation																			
			Socioeconomic	None																			
		Water and wastewater treatment plants	Physical	Presence of overhead lines Backup generator availability Emergency supply storage Overflow from wastewater systems due to power outage	None	None	None	None	Moderate	None	Negligible	None	None	None	None	None	None	None	None	None	None	Moderate	0.39
			Environmental	Proximity to vegetation																			
			Socioeconomic	None																			
Falling trees/ branches	Wind destroying trees and carrying material leading to a variety of disruption to services	Outdoor workers	Physical	Personal Protective Equipment	None	Negligible	Moderate	Minor	Minor	None	Negligible	None	None	None	Minor	None	None	None	None	None	None	None	0.61
			Environmental	Influenced by time of year Proximity to/ volume of vegetation Available cover																			
			Socioeconomic	Population age Population constitution																			
		Emergency services	Physical	Personal Protective Equipment	None	Negligible	Moderate	Minor	Moderate	None	Negligible	None	None	None	Minor	None	None	None	None	None	None	None	0.67
			Environmental	Influenced by time of year Proximity to/ volume of vegetation Available shelter																			
			Socioeconomic	Population age Population constitution																			
		Parks	Physical	Soil properties	None	None	None	Minor	None	Moderate	Negligible	None	None	None	None	None	Minor	None	None	None	Moderate	None	0.61
			Environmental	Influenced by time of year Proximity to/ volume of vegetation																			
			Socioeconomic	None																			
		Transport infrastructure including roads, rail, and pathways	Physical	Use of material Built Heritage	None	None	None	Minor	Minor	None	Negligible	None	None	None	None	None	Negligible	None	Negligible	Moderate	Minor	None	0.67
			Environmental	Influenced by time of year Proximity to/ volume of vegetation																			
			Socioeconomic	Remote working Alternate transport methods Reliance on TII for alerts on National roads																			
		Water and wastewater treatment plants	Physical	Debris management measures	None	None	None	None	Minor	None	Negligible	None	None	None	None	None	None	None	None	None	None	Moderate	0.33
			Environmental	Influenced by time of year Proximity to/ volume of vegetation																			
			Socioeconomic	Extended workload and overtime leading to burnout and availability of monitoring staff																			
Cancellation/ postponing of cultural events	Adverse weather disrupting ability to hold a cultural event	Cultural events	Physical	Available shelter	None	Major	Negligible	Minor	None	None	Negligible	None	None	None	None	None	None	None	None	None	Minor	None	0.56
			Environmental	Level of exposure to wind																			
			Socioeconomic	None																			

Hazard Event:	**Pluvial Flood**
Frequency of Occurrence:	Common
Description of the Hazard Event: (Including relevant meteorological / climatological conditions and locations affected)	Period of wet weather resulting in saturated soils. Heavy precipitation levels causes surface water flooding. Precipitation levels exceeding historic levels.

Hazard Impact	Impact Description:	Exposure	Vulnerability		Service Areas: Level of Disruption																		Impact Score
			Type	Description	Archives	Arts and Culture	Business and Economy	Community	Emergency Services	Environment and Natural Heritage	Finance	Governance and Administration	Built Heritage and Conservation	Housing	Human Resources	Information Technology	Leisure and Recreation	Libraries and Museums	Planning and Building	Roads and Transport	Tourism	Water Services	
Damage to infrastructure	Flood water affecting built environment. Can lead to closure of facilities	LA buildings	Physical	Use of material Built Heritage Adequacy of drainage network Flooded outfalls Structural loading	Moderate	None	Negligible	None	None	None	Minor	None	Minor	None	Negligible	Moderate	None	None	None	None	None	None	0.67
			Environmental	Impermeability of surface Ground elevation and gradient relative to surrounding area Proximity to vegetation																			
			Socioeconomic	None																			
		Roads & Bridges	Physical	Use of material Built Heritage Adequacy of drainage network Structural loading	None	None	None	None	None	None	Moderate	None	Minor	None	None	None	None	None	None	Moderate	None	None	0.44
			Environmental	Proximity to vegetation																			
			Socioeconomic	None																			
		Housing	Physical	Use of material Built Heritage Fixed or manual flood defences Flooded outfalls Structural loading	None	None	None	Negligible	None	None	Minor	None	None	Moderate	Negligible	None	None	None	None	None	None	None	None	0.39
			Environmental	Impermeability of surface Ground elevation and gradient relative to surrounding area Proximity to vegetation																			
			Socioeconomic	None																			
		Construction sites	Physical	Security of materials Silt netting	None	None	Minor	None	None	None	Negligible	None	None	None	None	None	None	None	None	None	None	None	0.17
			Environmental	Impermeability of surface Ground elevation and gradient relative to surrounding area Proximity to vegetation																			
			Socioeconomic	None																			
		Commerce	Physical	Storage of stock/ equipment	Negligible	None	Minor	None	None	None	Negligible	None	None	None	None	Minor	None	None	None	None	Minor	None	0.44
			Environmental	Proximity to urban environment																			
			Socioeconomic	None																			
		Drainage networks	Physical	Capacity Build up of silt/leaves	None	None	None	None	None	Minor	Negligible	None	None	None	None	None	None	None	None	None	None	None	0.17
			Environmental	Proximity to vegetation																			
			Socioeconomic	None																			
		Agricultural land	Physical	Adequacy of drainage network Flooded outfalls	None	None	Minor	None	None	Negligible	Negligible	None	None	None	None	None	None	None	None	None	None	None	0.22
			Environmental	Proximity to urban environment																			
			Socioeconomic	None																			
		Power supply	Physical	Fixed or manual flood defences Flooded outfalls Structural loading Backup generators	Negligible	Negligible	Major	Negligible	Moderate	Negligible	Negligible	Negligible	Negligible	Negligible	Minor	Moderate	Negligible	Negligible	Negligible	Moderate	Negligible	Moderate	1.67
			Environmental	Ground elevation and gradient relative to surrounding area Proximity to urban environment																			
			Socioeconomic	None																			
Damage to environment	Loss of biodiversity	SAC/SPA/natural habitats	Physical	Flora sensitivity to saturation - some plants may die from oversaturated soil Robustness of flora	None	None	None	None	None	Major	Negligible	None	None	None	None	None	None	None	None	None	None	None	0.28
			Environmental	Ground elevation and gradient relative to surrounding area Proximity to urban environment Presence of rare species																			
			Socioeconomic	None																			
Unusable roads	Roads will become inundated with water and become inaccessible	Road network	Physical	Efficiency of drainage network Flooded outfalls	None	None	Negligible	Negligible	Major	None	Negligible	Negligible	None	None	None	None	Negligible	None	None	Moderate	Negligible	None	0.72
			Environmental	Impermeability of surface Ground elevation and gradient relative to surrounding area Proximity to urban environment																			
			Socioeconomic	None																			
		Pathways/ cycle lanes	Physical	Drainage network	None	None	None	Minor	None	None	Negligible	None	None	None	None	None	Minor	None	None	Moderate	Negligible	None	0.50
			Environmental	Impermeability of surface Ground elevation and gradient relative to surrounding area Proximity to urban environment																			
			Socioeconomic	None																			
		General public	Physical	None	None	None	None	None	None	None	Negligible	None	None	None	None	None	Negligible	None	None	None	Minor	None	0.22
			Environmental	Road congestion																			
			Socioeconomic	Exposure to warnings/ alerts																			
		Emergency responders	Physical	None	None	None	Minor	None	Major	None	Negligible	None	None	None	None	None	None	None	None	None	None	None	0.39
			Environmental	Road congestion																			
			Socioeconomic	Reliance on TII for alerts on National roads Extended workload and overtime leading to burnout and availability of monitoring staff																			
Reduced water quality	Vegetation debris or leachate from surface run off entering water systems. Boil water notices issued in some cases	Water bodies	Physical	Sewage overflow inputs into water bodies Water turbidity Combined foul and surface system	None	None	Negligible	None	None	Major	Negligible	None	None	None	None	None	None	None	None	None	None	Major	0.56
			Environmental	Impermeability of surface Ground elevation and gradient relative to surrounding area Proximity to urban environment Proximity to agricultural land Presence of rare species																			
			Socioeconomic	None																			
		Water supply	Physical	None	None	None	Negligible	Negligible	Major	None	Negligible	None	None	Negligible	Negligible	None	None	None	None	None	None	Major	0.72
			Environmental	Impermeability of surface Ground elevation and gradient relative to surrounding area Proximity to urban environment																			
			Socioeconomic	Extended workload and overtime leading to burnout and availability of monitoring staff Responsibility (Irish Water)																			
Inundated wastewater treatment systems	Private systems located in poor drainage areas and/or flood zones become inundated	Wastewater infrastructure	Physical	Capacity and fullness of septic tanks	None	None	None	Minor	None	None	Minor	None	None	None	None	None	None	None	None	None	None	Major	0.44
			Environmental	Water table level Proximity to urban environment																			
			Socioeconomic	None																			

Hazard Impact	Impact Description:	Exposure	Vulnerability		Service Areas: Level of Disruption																	
			Type	Description	Archives	Arts and Culture	Business and Economy	Community	Emergency Services	Environment and Natural Heritage	Finance	Governance and Administration	Built Heritage and Conservation	Housing	Human Resources	Information Technology	Leisure and Recreation	Libraries and Museums	Planning and Building	Roads and Transport	Tourism	Water Services	Impact Score
Temporary housing	Relocation of homeless and residents of flooded properties	General public	Physical	None	None	None	None	None	None	None	Negligible	Negligible	None	Moderate	Minor	None	Negligible	None	None	None	Minor	None	0.56
			Environmental	Proximity to urban environment																		
			Socioeconomic	Population age Population constitution Housing availability																		
		LA staff	Physical	None	None	None	None	None	None	None	Negligible	Negligible	None	Moderate	Minor	None	None	None	None	None	Negligible	None	0.44
			Environmental	Proximity to urban environment																		
			Socioeconomic	Population age Population constitution Housing availability																		
		Homeless	Physical	None	None	None	None	None	None	None	Negligible	Negligible	None	Moderate	Minor	None	None	None	None	None	None	None	0.39
			Environmental	Proximity to urban environment																		
			Socioeconomic	Population age Population constitution Housing availability																		
Health and Safety risks	Drowning/ presence of submerged hazards leading to injury or death	General public	Physical	None	None	None	Minor	None	Minor	None	Negligible	None	None	None	None	None	Negligible	None	None	None	Minor	None	0.44
			Environmental	Proximity to urban environment																		
			Socioeconomic	Human desire to watch the event from an unsafe location Population age Population constitution Exposure to warnings/ alerts																		
		Council staff	Physical	None	None	None	Minor	None	Moderate	None	Negligible	Negligible	None	None	None	None	None	Minor	None	None	Negligible	None	0.56
			Environmental	Proximity to urban environment																		
			Socioeconomic	Population age Population constitution																		
		Homeless	Physical	None	None	None	None	None	Minor	None	Negligible	None	None	None	None	None	None	None	None	None	None	None	0.17
			Environmental	Proximity to urban environment																		
			Socioeconomic	Population age Population constitution																		
Cancellation/ postponing of cultural events	Adverse weather disrupting ability to hold a cultural event	Cultural events	Physical	None	None	Moderate	Negligible	None	None	None	Negligible	None	None	None	None	None	Negligible	None	None	None	Minor	None	0.44
			Environmental	Proximity to urban environment																		
			Socioeconomic	None																		

Hazard Event:	**Heavy Snowfall**
Frequency of Occurrence:	Occasional
Description of the Hazard Event: (Including relevant meteorological / climatological conditions and locations affected)	Red warning: significant falls of snow likely to cause accumulations of 8cm or greater below 250m above mean sea level. Orange warning: significant falls of snow likely to cause accumulations of 3cm or greater below 250m above mean sea level. Yellow warning: scattered snow showers giving accumulations of less than 3cm below 250m above mean sea level.

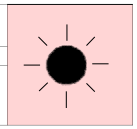
Hazard Impact	Impact Description:	Exposure	Vulnerability		Service Areas: Level of Disruption																		Impact Score
			Type	Description	Archives	Arts and Culture	Business and Economy	Community	Emergency Services	Environment and Natural Heritage	Finance	Governance and Administration	Built Heritage and Conservation	Housing	Human Resources	Information Technology	Leisure and Recreation	Libraries and Museums	Planning and Building	Roads and Transport	Tourism	Water Services	
Damage to infrastructure	Heavy build-up of snow exceeding structural limits	LA Buildings	Physical	Use of material Built Heritage Structural loading Time to thaw	Minor	None	Minor	Minor	None	None	Minor	Negligible	Minor	None	None	None	None	Minor	None	None	Minor	None	0.83
			Environmental	Ground elevation relative to sea level																			
			Socioeconomic	None																			
		Housing	Physical	Use of material Built Heritage Structural loading Time to thaw	None	None	None	Minor	Minor	None	Minor	None	None	Minor	None	None	None	None	None	None	None	None	0.44
			Environmental	Ground elevation relative to sea level																			
			Socioeconomic	None																			
		Bridges	Physical	Use of material Built Heritage Structural loading Time to thaw	None	None	Negligible	None	Negligible	None	Negligible	None	Negligible	None	None	None	None	None	None	Moderate	None	None	0.39
			Environmental	Ground elevation relative to sea level																			
			Socioeconomic	None																			
		Power supply	Physical	Presence of overhead lines Time to thaw	Negligible	Negligible	Major	Negligible	Moderate	Negligible	Negligible	Negligible	Negligible	Negligible	Minor	Moderate	Negligible	Negligible	Negligible	Moderate	Negligible	Moderate	2.33
			Environmental	Ground elevation relative to sea level																			
			Socioeconomic	None																			
		Water and wastewater treatment plants	Physical	Use of material Built Heritage Structural loading Back up generator availability Time to thaw	None	None	Minor	None	Minor	None	Negligible	None	None	None	Minor	None	None	None	None	None	Negligible	Major	
			Environmental	Ground elevation relative to sea level																			
			Socioeconomic	None																			
		Telemetry	Physical	Structural loading Backup generators Time to thaw	Negligible	Negligible	Major	Negligible	Minor	Negligible	Minor	Negligible	Negligible	None	Minor	Moderate	Negligible	Negligible	Negligible	Moderate	Negligible	Moderate	1.61
			Environmental	Proximity to vegetation																			
			Socioeconomic	None																			
Damage to environment	Erosion due to freeze-thaw action	SAC/SPA/natural habitats	Physical	Cliff stability	None	None	None	None	None	Moderate	Negligible	None	None	None	None	None	Negligible	None	None	None	Negligible	None	0.33
			Environmental	Elevation relative to sea level																			
			Socioeconomic	None																			
Disruption to infrastructure/ facilities	Snow build-up disrupting transport networks, building access, amenity access, and water treatment processes	Transport infrastructure	Physical	Time to thaw	None	None	Moderate	Minor	Major	None	Negligible	None	None	None	Negligible	None	Minor	None	None	Moderate	Moderate	None	1.06
			Environmental	Ground elevation relative to sea level																			
			Socioeconomic	Snow removing measures High impact for people who reside in isolated locations who are cut off with no access to services																			
		Buildings	Physical	Time to thaw	None	None	Minor	Minor	None	None	Negligible	Negligible	None	None	None	None	Negligible	Minor	None	None	Minor	None	0.61
			Environmental	Ground elevation relative to sea level																			
			Socioeconomic	None																			
		Amenities	Physical	Time to thaw	None	None	None	Moderate	None	None	Negligible	None	None	None	Negligible	None	Minor	Moderate	None	None	Minor	None	0.67
			Environmental	Ground elevation relative to sea level																			
			Socioeconomic	Snow removing measures																			
		Water and wastewater treatment systems	Physical	Time to thaw	None	None	Negligible	None	Minor	None	Minor	None	None	None	Minor	None	None	None	None	None	Negligible	Major	0.67
			Environmental	Ground elevation relative to sea level																			
			Socioeconomic	Snow removing measures																			
		Schools	Physical	Time to thaw	None	None	Minor	Moderate	None	None	Negligible	None	None	None	Negligible	None	None	None	None	None	None	None	0.39
			Environmental	Ground elevation relative to sea level																			
			Socioeconomic	Snow removing measures																			
Health and Safety risks	Heavy snowfall affects safe travel and poses a risk of injury	General public	Physical	None	None	Negligible	Minor	Minor	Minor	None	Negligible	None	None	None	None	None	None	None	None	None	None	None	0.44
			Environmental	Available cover Proximity to urban environments																			
			Socioeconomic	Population age Population constitution																			
		Council staff	Physical	None	None	None	Moderate	None	Moderate	None	Negligible	Negligible	None	None	None	None	None	Minor	None	None	None	None	0.56
			Environmental	Available cover Proximity to urban environments																			
			Socioeconomic	Population age Population constitution Training required to operate vehicles/equipment to aid in emergency events																			
		Outdoor workers	Physical	Transport method used	None	None	Minor	Minor	Moderate	None	Negligible	None	None	None	None	None	None	None	None	None	None	None	0.44
			Environmental	Available cover Proximity to urban environments																			
			Socioeconomic	Population age Population constitution Training required to operate vehicles/equipment to aid in emergency events																			
Minor flooding issues	Fast thawing of large amounts of snow can lead to excessive amounts of surface run off	Drainage network	Physical	Capacity of drainage network	None	None	Negligible	None	None	None	Negligible	None	None	None	None	None	None	None	None	Minor	None	None	0.22
			Environmental	None																			
			Socioeconomic	None																			
Reduced air quality	Heavy snow leads to less active travel and the need for more heat in buildings, increasing burning of fossil fuels	Air	Physical	Level of insulation of buildings	None	None	None	None	None	Minor	Negligible	None	None	None	None	None	None	None	None	None	None	None	0.17
			Environmental	Proximity to urban environment																			
			Socioeconomic	None																			
		People	Physical	None	None	None	None	Negligible	Negligible	None	Negligible	None	None	None	Negligible	None	None	None	None	None	None	None	None	0.22
			Environmental	None																			
			Socioeconomic	Population age Population constitution																			
Frostbite	Exposure to snow can lead to frostbite	People	Physical	None	None	None	Minor	Minor	Moderate	None	Negligible	None	None	None	Minor	None	Minor	None	None	None	Minor	None	0.78
			Environmental	Proximity to urban environment Available cover																			
			Socioeconomic	Human desire to watch the event from an unsafe location Population age Population constitution Homeless																			

Hazard Event:	**Heatwave**
Frequency of Occurrence:	Common
Description of the Hazard Event: (Including relevant meteorological / climatological conditions and locations affected)	Record high temperatures with temperatures exceeding 30°C over a number of consecutive days. Urban areas particularly affected.

Hazard Impact	Impact Description:	Exposure	Vulnerability		Service Areas: Level of Disruption																		Impact Score
			Type	Description	Archives	Arts and Culture	Business and Economy	Community	Emergency Services	Environment and Natural Heritage	Finance	Governance and Administration	Built Heritage and Conservation	Housing	Human Resources	Information Technology	Leisure and Recreation	Libraries and Museums	Planning and Building	Roads and Transport	Tourism	Water Services	
Hot and uncomfortable working conditions	High temperatures in homes and office causing discomfort	Outdoor workers	Physical	None	None	None	Moderate	None	None	None	Negligible	None	None	None	Moderate	None	None	None	None	None	None	Minor	0.50
			Environmental	Limited access to green areas/ areas of shade Inadequate access to water/ sun screen/ cooling apparatus																			
			Socioeconomic	Population age Population constitution																			
		Indoor workers	Physical	None	None	None	Moderate	None	None	None	Negligible	None	None	None	Moderate	None	None	Minor	None	None	None	Minor	0.61
			Environmental	Limited access to green areas/ areas of shade Inadequate access to water/ cooling apparatus																			
			Socioeconomic	Population age Population constitution																			
Risk of fires	Wildfires or domestic fires are easily started in heatwaves due to the dryness of the environment	People	Physical	Campfires going out of control BBQ's in urban areas gives off stray flame	None	None	None	None	Moderate	None	Negligible	None	None	None	None	None	Negligible	None	None	None	None	None	#DIV/0!
			Environmental	Proximity to fire Exposure to fire																			
			Socioeconomic	Population age Population constitution																			
		Environment	Physical	None	None	None	None	None	Moderate	Moderate	Negligible	None	None	None	None	None	None	None	None	None	None	None	#DIV/0!
			Environmental	Proximity to fire Upland areas and gorse areas typically affected Areas of conservation Presence of rare species																			
			Socioeconomic	None																			
		LA Buildings	Physical	Structural integrity Fire proofing of buildings Built Heritage	Negligible	None	Minor	None	Moderate	None	Negligible	None	Minor	None	None	None	None	Minor	None	None	None	None	#DIV/0!
			Environmental	Proximity to fire																			
			Socioeconomic	None																			
		Housing	Physical	Structural integrity Fire proofing of buildings Built Heritage	None	None	None	Minor	Moderate	None	Negligible	None	None	Minor	None	None	None	None	None	None	None	None	#DIV/0!
			Environmental	Proximity to fire																			
			Socioeconomic	None																			
Heat stroke	High heat can lead to heat stroke if careless	People	Physical	None	None	None	Negligible	Minor	Major	None	Negligible	None	None	None	Moderate	None	Negligible	None	None	None	Minor	Major	1.00
			Environmental	Limited access to green areas/ areas of shade Inadequate access to water and sun screen																			
			Socioeconomic	Population age Population constitution Homeless																			
Agricultural pressure	Issues with provision of water for animals, insufficient water for crops, and reduced grass	Farm animals	Physical	Status of water supply system Number of farm animals present	None	None	Minor	None	None	None	Negligible	None	None	None	None	None	None	None	None	None	None	None	0.17
			Environmental	Water source location																			
			Socioeconomic	Type of farm animals present																			
		Crops	Physical	Irrigation infrastructure	None	None	Minor	None	None	None	Negligible	None	None	None	None	None	None	None	None	None	None	None	0.17
			Environmental	None																			
			Socioeconomic	None																			
Pressure on recreational areas	High temperatures promotes the use of recreational facilities and puts pressure on existing infrastructure and emergency rescue services	Green areas	Physical	Access to recreational areas Capacity	None	None	Negligible	Minor	Moderate	Minor	Negligible	None	None	None	None	None	Moderate	None	None	Minor	Moderate	Moderate	1.11
			Environmental	Proximity to urban environment Water and waste services																			
			Socioeconomic	Resourcing of staff																			
Heat stress on buildings/ infrastructure	High temperatures resulting in structures being warped/ road surfaces being damaged	Roads and Bridges	Physical	Surface dressed roads susceptible to boiling of bitumen Built Heritage	None	None	None	None	None	None	Negligible	None	None	None	None	None	None	None	None	Moderate	None	None	0.22
			Environmental	Available shade cover Proximity to urban environment																			
			Socioeconomic	None																			
		LA Buildings	Physical	Material properties Built Heritage	None	None	None	None	None	None	Negligible	None	Minor	Minor	None	None	None	Minor	None	None	None	None	0.39
			Environmental	Available shade cover Proximity to urban environment																			
			Socioeconomic	None																			
		Housing	Physical	Material properties Built Heritage	None	None	None	None	None	None	Negligible	None	Minor	Minor	None	None	None	None	None	None	None	None	0.28
			Environmental	Available shade cover Proximity to urban environment																			
			Socioeconomic	None																			
		Pavements	Physical	Historical mixes of concrete prone to heaving	None	None	None	Minor	None	None	Negligible	None	None	None	None	None	Minor	None	None	Minor	None	None	0.39
			Environmental	Located within areas of high solar radiation																			
			Socioeconomic	None																			
Damage to monuments	Drying out of soil can destabilise monuments	Built heritage	Physical	Use of material Built heritage	None	None	None	None	None	None	Negligible	None	Minor	None	None	None	None	None	None	None	Negligible	None	0.22
			Environmental	Located within areas of high solar radiation																			
			Socioeconomic	None																			

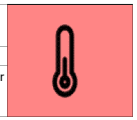
Hazard Impact	Impact Description:	Exposure	Vulnerability		Service Areas: Level of Disruption																	
			Type	Description	Archives	Arts and Culture	Business and Economy	Community	Emergency Services	Environment and Natural Heritage	Finance	Governance and Administration	Built Heritage and Conservation	Housing	Human Resources	Information Technology	Leisure and Recreation	Libraries and Museums	Planning and Building	Roads and Transport	Tourism	Water Services	Impact Score
Reduced water quality and supply	Water supplies drawing from water with high levels of dissolved material due to evaporation of water sources and water supply plants	Water bodies	Physical	Capacity Concentration of dissolved material	None	None	None	None	None	Moderate	Negligible	None	None	None	Minor	None	Moderate	None	None	None	Moderate	Major	0.89
			Environmental	Presence of shade Located within areas of high solar radiation Presence of rare species																			
			Socioeconomic	None																			
		Water supply plants	Physical	Backup water supply	None	None	Moderate	None	Major	None	Negligible	None	None	None	None	None	Moderate	None	None	None	Moderate	Major	1.00
			Environmental	Presence of shade Located within areas of high solar radiation																			
			Socioeconomic	None																			
Damaged water treatment plants	Flows to treatment plants experiencing large amounts of organic loading due to evaporation, disrupting the treatment plant	Wastewater treatment plants	Physical	Capacity Concentration of dissolved material Combined foul and surface system	None	None	None	None	None	None	Negligible	None	None	None	None	None	None	None	None	None	None	Major	0.28
			Environmental	Proximity to urban environment Water and waste services																			
			Socioeconomic	None																			
Damage to environment	High temperatures can cause vegetation to dry up and die	SAC/SPA/natural habitats	Physical	Vegetation sensitivity to heat	None	None	None	Minor	None	Moderate	Negligible	None	None	None	None	None	None	None	None	None	None	None	0.33
			Environmental	Influenced by time of year Proximity to water bodies Presence of rare species																			
			Socioeconomic	None																			

Hazard Event:	**Drought**
Frequency of Occurrence:	Common
Description of the Hazard Event: (including relevant meteorological / climatological conditions and locations affected)	Restrictions on water use. Low rainfall during periods of high temperatures or freezing of water sources/ distribution. There is evidence of a decreasing trend in summer rainfall.



Hazard Impact	Impact Description:	Exposure	Vulnerability		Service Areas: Level of Disruption																		Impact Score
			Type	Description	Archives	Arts and Culture	Business and Economy	Community	Emergency Services	Environment and Natural Heritage	Finance	Governance and Administration	Built Heritage and Conservation	Housing	Human Resources	Information Technology	Leisure and Recreation	Libraries and Museums	Planning and Building	Roads and Transport	Tourism	Water Services	
Hot and uncomfortable working conditions	High temperatures in homes and office causing discomfort	Outdoor workers	Physical	None	None	None	Moderate	None	None	None	Negligible	None	None	None	Moderate	None	None	None	None	None	None	Minor	0.50
			Environmental	Limited access to green areas/ areas of shade Inadequate access to water/ sun screen/ cooling apparatus																			
			Socioeconomic	Population age Population constitution																			
		Indoor workers	Physical	None	None	None	Moderate	None	None	None	Negligible	None	None	None	Moderate	None	None	None	None	None	None	Minor	0.50
			Environmental	Limited access to green areas/ areas of shade Inadequate access to water/ cooling apparatus																			
			Socioeconomic	Population age Population constitution																			
Pressure on recreational areas	High temperatures promotes the use of recreational facilities and puts pressure on existing infrastructure	Green areas	Physical	Access to recreational areas Capacity	None	None	Negligible	Minor	Minor	Minor	Negligible	None	None	None	None	None	Major	None	None	Minor	Major	Moderate	1.17
			Environmental	Proximity to urban environment Water and waste services																			
			Socioeconomic	None																			
Agricultural pressure	Issues with provision of water for animals, insufficient water for crops, and reduced grass	Farm animals	Physical	Status of water supply system Number of farm animals present	None	None	Minor	None	None	None	Negligible	None	None	None	None	None	None	None	None	None	None	None	0.17
			Environmental	Water source location																			
			Socioeconomic	Type of farm animals present																			
		Crops	Physical	Irrigation infrastructure	None	None	Minor	None	None	None	Negligible	None	None	None	None	None	None	None	None	None	None	None	0.17
			Environmental	None																			
			Socioeconomic	None																			
Risk of fires	Wildfires or domestic fires are easily started in drought conditions due to the dryness of the environment	People	Physical	Campfires going out of control BBQ's in urban areas gives off stray flame	None	None	None	None	Moderate	None	Negligible	None	None	None	None	None	Negligible	None	None	None	None	None	#DIV/0!
			Environmental	Proximity to fire Exposure to fire																			
			Socioeconomic	Population age Population constitution																			
		Environment	Physical	None	None	None	None	None	Moderate	Moderate	Negligible	None	None	None	None	None	None	None	None	None	None	None	None	#DIV/0!
			Environmental	Proximity to fire Upland areas and gorse areas typically affected Areas of conservation Presence of rare species																			
			Socioeconomic	None																			
		LA Buildings	Physical	Structural integrity Fire proofing of buildings Built Heritage	Negligible	None	Minor	None	Moderate	None	Negligible	None	Minor	None	None	None	None	Minor	None	None	None	None	#DIV/0!
			Environmental	Proximity to fire																			
			Socioeconomic	None																			
		Housing	Physical	Structural integrity Fire proofing of buildings Built Heritage	None	None	None	Minor	Moderate	None	Negligible	None	None	Minor	None	None	None	None	None	None	None	None	None	#DIV/0!
			Environmental	Proximity to fire																			
			Socioeconomic	None																			
Heat stress on buildings/ infrastructure	High temperatures resulting in structures being warped/ road surfaces being damaged	Transport infrastructure	Physical	Material properties Built Heritage	None	None	None	None	None	None	Negligible	None	None	None	None	None	None	None	None	Moderate	None	None	0.22
			Environmental	Available shade cover Proximity to urban environment																			
			Socioeconomic	None																			
		Buildings	Physical	Material properties Built Heritage	None	None	None	None	None	None	Negligible	None	Minor	Minor	None	None	None	None	None	None	None	None	0.28
			Environmental	Available shade cover Proximity to urban environment																			
			Socioeconomic	None																			
Reduced water quality and supply	Water supplies drawing from water with high levels of dissolved material due to evaporation of water sources and water supply plants	Water bodies	Physical	Capacity Concentration of dissolved material Availability of groundwater	None	None	None	None	None	Moderate	Negligible	None	None	None	Minor	None	Moderate	None	None	None	Moderate	Major	0.89
			Environmental	Presence of shade Located within areas of high solar radiation																			
			Socioeconomic	None																			
		Water supply plants	Physical	Backup water supply Odour issues First flush due to rainfall after drought	None	None	Moderate	None	Major	None	Negligible	None	None	None	None	None	Moderate	None	None	None	Moderate	Major	1.00
			Environmental	Presence of shade Located within areas of high solar radiation																			
			Socioeconomic	Responsibility (Irish Water)																			
Damaged water treatment plants	Flows to treatment plants experiencing large amounts of organic loading due to evaporation, disrupting the treatment plant	Wastewater treatment plants	Physical	Capacity Concentration of dissolved material Combined foul and surface system First flush due to rainfall after drought	None	None	None	None	None	None	Negligible	None	None	None	None	None	None	None	None	None	None	Major	0.28
			Environmental	Proximity to urban environment Water and waste services																			
			Socioeconomic	None																			
Damage to environment	High temperatures can cause vegetation to dry up and die	SAC/SPA/natural habitats	Physical	Vegetation sensitivity to heat Lowered water levels	None	None	None	Minor	None	Moderate	Negligible	None	None	None	None	None	Minor	None	None	None	Minor	None	0.56
			Environmental	Influenced by time of year Proximity to water bodies Presence of rare species																			
			Socioeconomic	None																			

Hazard Event:	**Above Average Surface Temperature**
Frequency of Occurrence:	Common
Description of the Hazard Event: (Including relevant meteorological / climatological conditions and locations affected)	Prolonged periods of higher than average temperatures. Observations indicate an increase in the surface temperature for Ireland of 0.9◦C over the last 120 years. Urban areas particularly affected.



Hazard Impact	Impact Description:	Exposure	Vulnerability		Service Areas: Level of Disruption																		
			Type	Description	Archives	Arts and Culture	Business and Economy	Community	Emergency Services	Environment and Natural Heritage	Finance	Governance and Administration	Built Heritage and Conservation	Housing	Human Resources	Information Technology	Leisure and Recreation	Libraries and Museums	Planning and Building	Roads and Transport	Tourism	Water Services	Impact Score
Change in biodiversity	Changes in surface temperatures leads to a promotion in growth of invasive species to the detriment to native species	Invasive species	Physical	Growing conditions required of the invasive flora	None	None	None	None	None	Moderate	Negligible	None	None	None	None	None	None	None	None	None	None	None	0.22
			Environmental	Influenced by time of year																			
			Socioeconomic	Invasive Alien Plant Species protocols in place to reduce the spread of invasive species																			
		Native species	Physical	Growing conditions required of the native flora	None	None	None	None	None	Moderate	Negligible	None	None	None	None	None	None	None	None	None	None	None	0.22
			Environmental	Influenced by time of year																			
			Socioeconomic	None																			
Change in phenology	Changes in surface temperatures leads to a disruption to the phenology cycle, affecting pollinators and seasonal interactions	Pollinators	Physical	Sensitivity of pollinators to changes in temperatures	None	None	None	None	None	Moderate	Negligible	None	None	None	None	None	None	None	None	None	None	None	0.22
			Environmental	None																			
			Socioeconomic	None																			
Mold growth	Increased temperatures encourages algae growth in heritage structures, causing irreparable damage	Heritage structures	Physical	Ventilation in structures	None	Minor	None	None	None	None	Negligible	None	None	None	None	None	Minor	Minor	None	None	Minor	None	0.50
			Environmental	Humidity																			
			Socioeconomic	None																			
Hot and uncomfortable working conditions	High temperatures in homes and office causing discomfort	Dwellings	Physical	Inadequate cooling mechanisms	None	None	None	Minor	None	None	Negligible	None	None	Minor	None	None	None	None	None	None	None	Minor	0.39
			Environmental	Proximity to high density urban areas																			
			Socioeconomic	None																			
		Outdoor workers	Physical	None	None	None	Moderate	None	None	None	Negligible	None	None	None	Moderate	None	None	None	None	None	None	Minor	0.50
			Environmental	Limited access to green areas/ areas of shade Inadequate access to water/ sun screen/ cooling apparatus																			
			Socioeconomic	Population age Population constitution																			
		Indoor workers	Physical	None	None	None	Moderate	None	None	None	Negligible	None	None	None	Moderate	None	None	Minor	None	None	None	Minor	0.61
			Environmental	Limited access to green areas/ areas of shade Inadequate access to water/ cooling apparatus																			
			Socioeconomic	Population age Population constitution																			
Agricultural pressure	Issues with provision of water for animals, insufficient water for crops, and reduced grass	Farm animals	Physical	Status of water supply system Number of farm animals present	None	None	Minor	None	None	None	Negligible	None	None	None	None	None	None	None	None	None	None	None	0.17
			Environmental	Water source location																			
			Socioeconomic	Type of farm animals present																			
		Crops	Physical	Irrigation infrastructure	None	None	Minor	None	None	None	Negligible	None	None	None	None	None	None	None	None	None	None	None	0.17
			Environmental	None																			
			Socioeconomic	None																			
Risk of fires	Wildfires or domestic fires are easily started in hotter temperatures due to the dryness of the environment	People	Physical	Campfires going out of control BBQ's in urban areas dives off stray flame	None	None	None	None	Moderate	None	Negligible	None	None	None	None	None	Negligible	None	None	None	None	None	#DIV/0!
			Environmental	Proximity to fire Exposure to fire																			
			Socioeconomic	Population age Population constitution																			
		Environment	Physical	None	None	None	None	None	Moderate	Moderate	Negligible	None	None	None	None	None	None	None	None	None	None	None	#DIV/0!
			Environmental	Proximity to fire Upland areas and gorse areas typically affected Areas of conservation Biodiversity present																			
			Socioeconomic	None																			
		LA Buildings	Physical	Structural integrity Fire proofing of buildings Built Heritage	Negligible	None	Minor	None	Moderate	None	Negligible	None	Minor	None	None	None	None	Minor	None	None	None	None	#DIV/0!
			Environmental	Proximity to fire																			
			Socioeconomic	None																			
		Housing	Physical	Structural integrity Fire proofing of buildings Built Heritage	None	None	None	Minor	Moderate	None	Negligible	None	None	Minor	None	None	None	None	None	None	None	None	None	#DIV/0!
			Environmental	Proximity to fire																			
			Socioeconomic	None																			
Pressure on recreational areas	High temperatures promotes the use of recreational facilities and puts pressure on existing infrastructure	Green areas	Physical	Access to recreational areas Capacity	None	None	Negligible	Minor	Minor	Minor	Negligible	None	None	None	None	None	Moderate	None	None	Minor	Moderate	Moderate	1.06
			Environmental	Proximity to urban environment Water and waste services																			
			Socioeconomic	None																			
Heat stress on buildings/ infrastructure	High temperatures resulting in structures being warped/ road surfaces being damaged	Transport infrastructure	Physical	Material properties Built Heritage	None	None	None	None	None	None	Negligible	None	None	None	None	None	None	None	None	Moderate	None	None	0.22
			Environmental	Available shade cover Proximity to urban environment																			
			Socioeconomic	None																			
		Buildings	Physical	Material properties Built Heritage	None	None	None	None	None	None	Negligible	None	Minor	Minor	None	None	None	Minor	None	None	None	None	0.39
			Environmental	Available shade cover Proximity to urban environment																			
			Socioeconomic	None																			

Hazard Impact	Impact Description:	Exposure	Vulnerability		Service Areas: Level of Disruption																		
			Type	Description	Archives	Arts and Culture	Business and Economy	Community	Emergency Services	Environment and Natural Heritage	Finance	Governance and Administration	Built Heritage and Conservation	Housing	Human Resources	Information Technology	Leisure and Recreation	Libraries and Museums	Planning and Building	Roads and Transport	Tourism	Water Services	Impact Score
Reduced water quality and supply	Water supplies drawing from water with high levels of dissolved material due to evaporation of water sources and water supply plants	Water bodies	Physical	Capacity Concentration of dissolved material	None	None	None	None	None	Moderate	Negligible	None	None	None	Minor	None	Moderate	None	None	None	Moderate	Moderate	0.83
			Environmental	Presence of shade Located within areas of high solar radiation																			
			Socioeconomic	None																			
		Water supply plants	Physical	Backup water supply	None	None	Moderate	None	Major	None	Negligible	None	None	None	None	None	Moderate	None	None	None	Moderate	Moderate	0.94
			Environmental	Presence of shade Located within areas of high solar radiation																			
			Socioeconomic	Responsibility (Irish Water)																			
Damaged water treatment plants	Flows to treatment plants experiencing large amounts of organic loading due to evaporation, disrupting the treatment plant	Wastewater treatment plants	Physical	Capacity Concentration of dissolved material Combined foul and surface system	None	None	None	None	None	None	Negligible	None	None	None	None	None	None	None	None	None	None	Moderate	0.22
			Environmental	Proximity to urban environment Water and waste services																			
			Socioeconomic	None																			
Damage to environment	High temperatures can cause vegetation to dry up and die	SAC/SPA/natural habitats	Physical	Vegetation sensitivity to heat	None	None	None	Minor	None	Moderate	Negligible	None	None	None	None	None	Minor	None	None	None	Minor	None	0.56
			Environmental	Influenced by time of year Proximity to water bodies Presence of rare species																			
			Socioeconomic	None																			

Hazard Event:	**Increase in Relative Sea Level**
Frequency of Occurrence:	Occasional
Description of the Hazard Event: (Including relevant meteorological / climatological conditions and locations affected)	Satellite observations indicate that sea level around Ireland has risen by approximately 2-3mm per year since the early 1990s. This increases the risk of river flooding as River Suir has tidal stetches which influence the level of flooding.

Hazard Impact	Impact Description:	Exposure	Vulnerability		Service Areas: Level of Disruption																		
			Type	Description	Archives	Arts and Culture	Business and Economy	Community	Emergency Services	Environment and Natural Heritage	Finance	Governance and Administration	Built Heritage and Conservation	Housing	Human Resources	Information Technology	Leisure and Recreation	Libraries and Museums	Planning and Building	Roads and Transport	Tourism	Water Services	Impact Score
Increased risk of river flooding	Higher sea levels affect the baseline water levels of tidally influenced rivers	Rivers	Physical	River bank protection	None	None	None	None	None	Minor	Negligible	None	None	None	None	None	None	None	None	None	None	None	0.17
			Environmental	Level of influence from tides																			
			Socioeconomic	None																			

Hazard Event:	**Above Average Precipitation**
Frequency of Occurrence:	Common
Description of the Hazard Event: (Including relevant meteorological / climatological conditions and locations affected)	Prolonged periods of rainfall. Change in pattern of typical rainfall periods.

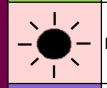
Hazard Impact	Impact Description:	Exposure	Vulnerability		Service Areas: Level of Disruption																		Impact Score
			Type	Description	Archives	Arts and Culture	Business and Economy	Community	Emergency Services	Environment and Natural Heritage	Finance	Governance and Administration	Built Heritage and Conservation	Housing	Human Resources	Information Technology	Leisure and Recreation	Libraries and Museums	Planning and Building	Roads and Transport	Tourism	Water Services	
Reduced water quality	Vegetation debris or leachates from surface run off entering water systems	Water bodies	Physical	Sewage overflow inputs into water bodies Gradient of ground Water turbidity Capacity	None	None	None	Minor	None	Minor	Negligible	None	None	None	None	None	None	None	None	None	None	Moderate	0.44
			Environmental	Impermeability of surface Ground elevation and gradient relative to surrounding area Proximity to urban environment																			
			Socioeconomic	None																			
		Water supply distribution	Physical	None	None	None	None	Minor	Major	None	Negligible	None	None	None	None	None	None	None	None	None	None	Moderate	0.56
			Environmental	Impermeability of surface Ground elevation and gradient relative to surrounding area Proximity to urban environment																			
			Socioeconomic	Extended workload and overtime leading to burnout and availability of monitoring staff Resoonsibility (Irish Water)																			
Land erosion	Rainfall causing ground saturation, weakening ground strength	Land/cliffsides	Physical	Soil properties	None	None	None	None	Moderate	Moderate	Negligible	None	None	None	None	None	None	None	Negligible	None	None	None	0.44
			Environmental	Ground elevation and gradient relative to surrounding area Proximity to urban environment																			
			Socioeconomic	None																			
More time spent indoors	Increased rainfall dissuading people to be outdoors	Mental health	Physical	None	None	None	Minor	Moderate	None	None	Negligible	None	None	None	Moderate	None	None	None	None	None	None	None	0.50
			Environmental	Proximity to facilities																			
			Socioeconomic	Population age Population constitution Home dynamics - living alone or with family																			
		Commerce	Physical	None	None	None	Moderate	None	None	None	Negligible	None	None	None	None	Minor	Moderate	None	None	None	Moderate	None	0.67
			Environmental	Ground elevation and gradient relative to surrounding area Proximity to urban environment																			
			Socioeconomic	None																			
Erosion of structures	Chemical reaction dissolving structures/ scour	LA buildings	Physical	Use of material Built Heritage	None	None	None	None	None	None	Negligible	None	Minor	None	None	None	None	None	None	None	None	None	0.17
			Environmental	None																			
			Socioeconomic	None																			
		Road network	Physical	Use of material Built Heritage	None	None	None	None	None	None	Negligible	None	None	None	None	None	None	None	None	Negligible	None	None	0.11
			Environmental	None																			
			Socioeconomic	None																			
		Housing	Physical	Use of material Built Heritage	None	None	None	None	None	None	Negligible	None	None	Negligible	None	None	None	None	None	None	None	None	0.11
			Environmental	None																			
			Socioeconomic	None																			

Hazard Event:	**Cold Spell**
Frequency of Occurrence:	Occasional
Description of the Hazard Event: (Including relevant meteorological / climatological conditions and locations affected)	Record low temperatures with temperatures between 0 and -10 degrees C throughout Winter.

Hazard Impact	Impact Description:	Exposure	Vulnerability		Service Areas: Level of Disruption																		Impact Score
			Type	Description	Archives	Arts and Culture	Business and Economy	Community	Emergency Services	Environment and Natural Heritage	Finance	Governance and Administration	Built Heritage and Conservation	Housing	Human Resources	Information Technology	Leisure and Recreation	Libraries and Museums	Planning and Building	Roads and Transport	Tourism	Water Services	
Cold and uncomfortable working conditions	Low temperatures in homes and office causing discomfort	Outdoor workers	Physical	None	None	None	Moderate	None	None	None	Negligible	None	None	None	Moderate	None	None	None	None	None	None	Minor	0.50
			Environmental	Limited access to heating apparatus/ shelter																			
			Socioeconomic	Population age Population constitution																			
		Indoor workers	Physical	None	None	None	Moderate	None	None	None	Negligible	None	None	None	Moderate	None	None	None	None	None	None	Minor	0.50
			Environmental	Limited access to heating apparatus																			
			Socioeconomic	Population age Population constitution																			
Frostbite	Low temperatures can lead to frostbite if careless	People	Physical	None	None	None	Negligible	Minor	Major	None	Negligible	None	None	None	Moderate	None	None	None	None	None	None	Major	0.83
			Environmental	Proximity to urban environment																			
			Socioeconomic	Population age Population constitution Homeless																			
Cold stress on buildings/ infrastructure	Low temperatures resulting in structures being warped/ road surfaces being damaged	Transport infrastructure	Physical	Material properties Built Heritage Changes in rates of deterioration - faster rate of deterioration in areas subject to sustained low temperatures	None	None	None	None	None	None	Negligible	None	None	None	None	None	None	None	None	Moderate	None	None	0.22
			Environmental	Proximity to urban environment																			
			Socioeconomic	None																			
		LA Buildings	Physical	Material properties Built Heritage	None	None	Minor	None	None	None	Negligible	None	Minor	Minor	None	None	None	None	None	None	None	None	0.39
			Environmental	Proximity to urban environment																			
			Socioeconomic	None																			
		Housing	Physical	Material properties Built Heritage	None	None	None	None	Minor	None	Negligible	None	Minor	Minor	None	None	None	None	None	None	None	None	0.39
			Environmental	Proximity to urban environment																			
			Socioeconomic	Requirement for additional heat and additional insulation of housing stock																			
Reduced water quality and supply	Frozen water restrict extraction and distribution of water	Water bodies	Physical	Depth of water	None	None	None	None	None	Major	Negligible	None	None	None	Minor	None	Moderate	None	None	None	Moderate	Major	0.94
			Environmental	Elevation in relation to sea level																			
			Socioeconomic	None																			
		Water supply infrastructure	Physical	Backup water supply Air volume in pipes	None	None	Moderate	None	Major	None	Negligible	None	None	None	None	None	Moderate	None	None	None	Moderate	Major	1.00
			Environmental	Elevation in relation to sea level																			
			Socioeconomic	None																			
Damaged water supply and treatment plants	Frozen water damaging treatment systems	Water and wastewater treatment plants	Physical	Air volume in pipes Combined foul and surface system	None	None	None	None	None	None	Negligible	None	None	None	None	None	None	None	None	None	None	Major	0.28
			Environmental	Elevation in relation to sea level																			
			Socioeconomic	None																			
Change in phenology	Changes in surface temperatures leads to a disruption to the phenology cycle	River habitats	Physical	Low temperatures bring about changes in species distribution and phenology of river systems	None	None	None	None	None	Moderate	Negligible	None	None	None	None	None	None	None	None	None	None	None	0.22
			Environmental																				
			Socioeconomic	None																			
More time spent indoors	Cold temperatures dissuades people from going outdoors	Mental health	Physical	None	None	None	Minor	Moderate	None	None	Negligible	None	None	None	Moderate	None	None	None	None	None	None	None	0.50
			Environmental	Proximity to facilities																			
			Socioeconomic	Population age Population constitution Home dynamics - living alone or with family																			
Reduced air quality	Low temperatures lead to less active travel and the need for more heat in buildings, increasing burning of fossil fuels	Air	Physical	Level of insulation of buildings	None	None	None	None	None	Minor	Negligible	None	None	None	None	None	None	None	None	None	None	None	0.17
			Environmental	Proximity to urban environment																			
			Socioeconomic	None																			
		People	Physical	None	None	None	None	Negligible	Negligible	None	Negligible	None	None	None	Negligible	None	None	None	None	None	None	None	0.22
			Environmental	None																			
			Socioeconomic	Population age Population constitution Homeless																			
Damage to environment	Low temperatures can cause vegetation to freeze and die	SAC/SPA/natural habitats	Physical	Vegetation sensitivity to cold	None	None	None	None	None	Moderate	Negligible	None	None	None	None	None	None	None	None	None	None	None	0.22
			Environmental	Prolonged road salting affecting salinity of surrounding ground Influenced by time of year																			
			Socioeconomic	None																			
		Agricultural land	Physical	None	None	None	Negligible	Minor	Minor	Minor	Negligible	None	None	None	None	None	Major	None	None	Minor	Major	Moderate	1.17
			Environmental	Prolonged road salting affecting salinity of surrounding ground Influenced by time of year																			
			Socioeconomic	None																			

Appendix E Current Impact Summary Matrix

CURRENT IMPACTS

	Hazard Type	Current Frequency	Current Frequency (Score)	Asset Damage	Health and Wellbeing	Environment	Social	Financial	Reputation	Cultural Heritage	Current Impact
	River flood	Common	3	Major	Major	Moderate	Moderate	Moderate	Moderate	Moderate	3.29
	Extreme precipitation	Frequent	4	Moderate	Minor	Minor	Minor	Minor	Minor	Moderate	2.29
	Drought	Common	3	Minor	Moderate	Moderate	Moderate	Minor	Minor	Negligible	2.29
	Severe windstorm	Frequent	4	Minor	Moderate	Moderate	Minor	Negligible	Negligible	Moderate	2.14
	Heatwave	Common	3	Minor	Moderate	Moderate	Minor	Negligible	Negligible	Moderate	2.14
	Pluvial flood	Common	3	Moderate	Minor	Minor	Minor	Negligible	Minor	Minor	2.00
	Above average precipitation	Common	3	Moderate	Minor	Minor	Minor	Negligible	Negligible	Moderate	2.00
	Above average surface temperature	Common	3	Negligible	Negligible	Major	Negligible	Negligible	Negligible	Moderate	1.71
	Cold spell	Occasional	2	Minor	Minor	Negligible	Minor	Minor	Negligible	Minor	1.71
	Heavy snowfall	Occasional	2	Minor	Minor	Minor	Negligible	Minor	Negligible	Minor	1.71
	Increase in Relative Sea Level	Occasional	2	Negligible	Negligible	Minor	Negligible	Negligible	Negligible	Minor	1.29

Appendix F Assessment of Future Climate Hazards and Impacts

Assessment of Future Climate Hazards					
Hazard No.	Hazard Type		Current Frequency	Projected Frequency	Evidence Base
1		River flood	Common	Frequent	An analysis of river flows over a period of more than 50 years of data (1972-2017) indicates an increase in river flows across most of the country (Status of Ireland's Climate, EPA) and an increase in the projected frequency of very wet days (>30mm of precipitation) which will likely increase the frequency of flood events (www.climateireland.ie).
2		Pluvial flood	Common	Frequent	When compared with an annual average rainfall of 1186mm for the period 1961-1990, the thirty year period 1990-2019 shows a 70mm or almost 7% increase in rainfall (Status of Ireland's Climate, EPA) and an increase in the projected frequency of very wet days (>30mm of precipitation). Projections of precipitation indicate that precipitation is expected to become more variable with increases in dry periods in the summer and heavy precipitation in winter (www.climateireland.ie).
3		Above average precipitation	Common	Frequent	When compared with an annual average rainfall of 1186mm in the period 1961-1990, the thirty year period 1990-2019 shows a 70mm or almost 7% increase in rainfall. The last decade from 2006 - 2015 has been the wettest period in the period 1711- 2016 and there is evidence of an increasing trend in winter rainfall and a decreasing trend in summer rainfall (Status of Ireland's Climate, EPA).
4		Extreme precipitation	Frequent	Very Frequent	There is an increase in the projected frequency of very wet days (>30mm of precipitation) (Status of Ireland's Climate, EPA) and observed increases in the levels of winter rainfall but a decrease in summer rainfall (www.climateireland.ie).
5		Severe windstorm	Frequent	Very Frequent	No long-term trend in wind speed can be determined with confidence based on the limited analysis carried out to date. Climate projections (www.climateireland.ie) indicate an decrease in the number of less intense storms but an increase in the storms which are rare events. Due to a limited number of studies, these projections should be considered with a high level of caution (A Multi-model ensemble approach, EPA).
6		Increase in Relative Sea Level	Occasional	Occasional	Satellite observations indicate that sea levels around Ireland have increased by approximately 2-3 mm per year since the 1990s (The Status of Ireland's Climate, EPA). The effects on river flooding as a result are not expected to raise the frequency to Common.
7		Heatwave	Common	Frequent	Climate projections (www.climateireland.ie) indicate an increase in the average surface air temperatures across all seasons which will likely increase the intensity and frequency of heatwaves. There has been an increase in the number of warm days (temperature > 20°C). This is in line with trends evident for the rest of Western Europe (Status of Ireland's Climate, EPA).
8		Drought	Common	Frequent	Climate projections (www.climateireland.ie) indicate an increase in the average surface temperature as well as a decrease in the levels of summer rainfall (Status of Ireland's Climate, EPA) which will likely increase the intensity and frequency of droughts in the summer. An analysis on river flows over a period from 1992-2017 suggests an increase in drought conditions in the summer, particularly in the east of the country (Status of Ireland's Climate, EPA).
9		Above average surface temperature	Common	Frequent	Climate projections (www.climateireland.ie) indicate an increase in the average surface air temperatures across all seasons which will likely increase the intensity and frequency of heatwaves. There has been an increase in the number of warm days (temperature > 20°C). This is in line with trends evident for the rest of Western Europe (Status of Ireland's Climate, EPA).
10		Cold spell	Occasional	Occasional	There has been a decrease in the number of frost days (temperatures below 0°C) and a shortening of the frost season duration (www.climateireland.ie).
11		Heavy snowfall	Occasional	Occasional	Snowfall is projected to decrease substantially by the middle of the century (Nolan and Flanagan), but not to the extent where the frequency is considered rare.

Assessment of Future Climate Impacts - Asset Damage					
Hazard No.	Hazard Type		Current Asset Damage	Projected Change	Rationale
1		River flood	Major	Major	Densification of urban areas to deliver compact growth will potentially increase the amount of properties at risk of flooding. However, the Tipperary CDP outlines an objective to ensure vulnerable developments are directed away from areas at risk of flooding. Works will also be continued with OPW to develop flood relief schemes and maintain existing defences. There is a likely increase in river flows across most of the country leading to an increase in severity of flooding (Climate Ireland).
2		Pluvial flood	Moderate	Moderate	Similarly to river flooding, densification of urban areas will potentially increase the amount of properties at risk. Adaptation and spatial planning goals include the conversion of land at risk of flooding to less vulnerable uses e.g. parks, gardens and open spaces for natural habitats (Tipperary CDP). Works will also be continued with OPW to develop flood relief schemes and maintain existing defences. When compared with an annual average rainfall of 1186mm for the period 1961-1990, the thirty year period 1990-2019 shows a 70mm or almost 7% increase in rainfall (Status of Ireland's Climate, EPA).
3		Above average precipitation	Moderate	Moderate	Future developments will be required to utilise sustainable urban drainage systems to control the release of water runoff in a managed way (Tipperary CDP). The last decade from 2006 - 2015 has been the wettest period in the period 1711- 2016 and there is evidence of an increasing trend in winter rainfall and a decreasing trend in summer rainfall (Status of Ireland's Climate, EPA). This implies there is an increase in severity in winter periods but a reduction in summer periods.
4		Extreme precipitation	Moderate	Moderate	Future developments will be required to utilise sustainable urban drainage systems to control the release of water runoff in a managed way (Tipperary CDP). When compared with an annual average rainfall of 1186mm for the period 1961-1990, the thirty year period 1990-2019 shows a 70mm or almost 7% increase in rainfall (Status of Ireland's Climate, EPA).
5		Severe windstorm	Minor	Moderate	Current predictions indicate an increase in the intensity of windstorms (Climate Ireland), increasing the impacts involved.
6		Increase in Relative Sea Level	Negligible	Negligible	Satellite observations indicate that sea levels around Ireland have increased by approximately 2-3 mm per year since the 1990s (The Status of Ireland's Climate, EPA). However, this will unlikely increase the impact.
7		Heatwave	Minor	Minor	Average surface air temperatures are expected to increase across all seasons which will likely increase the intensity of heatwaves (Climate Ireland). New building regulations and materials will be required for use in new developments to accommodate this, but there will also be an increase in the impact of heatwaves due to more compacted urban areas (Tipperary CDP).
8		Drought	Minor	Moderate	Average surface temperature are expected in increase, as well as a decrease in the levels of summer rainfall (Status of Ireland's Climate, EPA), leading to an increase in the impact of droughts.
9		Above average surface temperature	Negligible	Negligible	Average surface air temperatures across all seasons are expected to increase (Climate Ireland). New building design and materials will be introduced to accommodate hotter summers without compromising resilience to other climate changes, but densification of urban areas will potentially increase the solar radiation of urban areas (Tipperary CDP).
10		Cold spell	Minor	Minor	No changes in the assets affected. There has been a decrease in the number of frost days (temperatures below 0°C) and a shortening of the frost season duration, with projections to be in line with current trends (Climate Ireland). However, the impact remains as a minor impact.
11		Heavy snowfall	Minor	Minor	No changes in the assets affected. Snowfall is projected to decrease substantially by the middle of the century (Nolan and Flanagan), but impacts will remain the same.

Assessment of Future Climate Impacts - Health and Wellbeing					
Hazard No.	Hazard Type		Current Health and Wellbeing Impact	Projected Change	Rationale
1		River flood	Major	Major	Densification of urban areas to deliver compact growth will potentially increase the amount of properties at risk of flooding. However, the Tipperary CDP outlines an objective to ensure vulnerable developments are directed away from areas at risk of flooding. Works will also be continued with OPW to develop flood relief schemes and maintain existing defences. There is a likely increase in river flows across most of the country leading to an increase in severity of flooding (Climate Ireland).
2		Pluvial flood	Minor	Minor	The Tipperary CDP outlines an objective to ensure vulnerable developments are directed away from areas at risk of flooding. Compared with an annual average rainfall of 1186mm for the period 1961-1990, the thirty year period 1990-2019 shows a 70mm or almost 7% increase in rainfall (Status of Ireland's Climate, EPA).
3		Above average precipitation	Minor	Minor	No change in health and wellbeing. The last decade from 2006 - 2015 has been the wettest period in the period 1711- 2016 and there is evidence of an increasing trend in winter rainfall and a decreasing trend in summer rainfall (Status of Ireland's Climate, EPA). This implies there is an increase in severity in winter periods but a reduction in summer periods.
4		Extreme precipitation	Minor	Minor	When compared with an annual average rainfall of 1186mm for the period 1961-1990, the thirty year period 1990-2019 shows a 70mm or almost 7% increase in rainfall (Status of Ireland's Climate, EPA). This increase in rainfall intensity is seen during the winter season while summers will see a decrease in the level of precipitation, balancing one another.
5		Severe windstorm	Moderate	Major	Changing demographics with an increase in elderly population and densification of urban areas will potentially increase exposure and vulnerability (Tipperary CDP). Current predictions indicate an increase in the intensity of windstorms (Climate Ireland), increasing the impacts involved.
6		Increase in Relative Sea Level	Negligible	Negligible	Satellite observations indicate that sea levels around Ireland have increased by approximately 2-3 mm per year since the 1990s (The Status of Ireland's Climate, EPA). However, this will unlikely increase the impact.
7		Heatwave	Moderate	Moderate	Average surface air temperatures are expected to increase across all seasons which will likely increase the intensity of heatwaves (Climate Ireland). Protecting and expanding green infrastructure will help to reduce the increase in intensity of this event (Tipperary CDP).
8		Drought	Moderate	Major	Changing demographics with an increase in elderly population and densification of urban areas will potentially increase exposure and vulnerability (Tipperary CDP). Average surface temperature are expected in increase, as well as a decrease in the levels of summer rainfall (Status of Ireland's Climate, EPA).
9		Above average surface temperature	Negligible	Negligible	Average surface air temperatures across all seasons are expected to increase (Climate Ireland). Adaptation goals for County Tipperary include the expansion of the county's green infrastructure, reducing any impacts to health and wellbeing by ensuring the presence of facilities to use in high temperatures (Tipperary CDP).
10		Cold spell	Minor	Minor	Increase in vulnerable population, e.g., elderly population, may increase the possible impacts (Tipperary CDP). However, there has been a decrease in the number of frost days (temperatures below 0°C) and a shortening of the frost season duration, with projections to be in line with current trends (Climate Ireland). However, the impact remains as a minor impact.
11		Heavy snowfall	Minor	Minor	The increasing elderly population increases the possible impacts of heavy snowfalls (Tipperary CDP). However, snowfall is projected to decrease substantially by the middle of the century (Nolan and Flanagan), but impacts will remain the same.

Assessment of Future Climate Impacts - Environment					
Hazard No.	Hazard Type		Current Environment Impact	Projected Change	Rationale
1		River flood	Moderate	Moderate	Actions to mitigate impacts include managing development in flood risk areas and requiring SuDS to be used in all relevant developments to avoid surface water run-off and pollutants entering watercourses (Tipperary CDP). There is a likely increase in river flows across most of the country leading to an increase in severity of flooding (Climate Ireland).
2		Pluvial flood	Minor	Moderate	Actions to mitigate impacts include managing development in flood risk areas and requiring SuDS to be used in all relevant developments to avoid surface water run-off and pollutants entering watercourses (Tipperary CDP). When compared with an annual average rainfall of 1186mm for the period 1961-1990, the thirty year period 1990-2019 shows a 70mm or almost 7% increase in rainfall (Status of Ireland's Climate, EPA).
3		Above average precipitation	Minor	Minor	Requirement for the use of SuDS in new developments mitigate the effects of impacts to the environment (Tipperary CDP). The last decade from 2006 - 2015 has been the wettest period in the period 1711- 2016 and there is evidence of an increasing trend in winter rainfall and a decreasing trend in summer rainfall (Status of Ireland's Climate, EPA). This implies there is an increase in severity in winter periods but a reduction in summer periods.
4		Extreme precipitation	Minor	Moderate	Requirement for the use of SuDS in new developments mitigate the effects of impacts to the environment (Tipperary CDP). When compared with an annual average rainfall of 1186mm for the period 1961-1990, the thirty year period 1990-2019 shows a 70mm or almost 7% increase in rainfall (Status of Ireland's Climate, EPA).
5		Severe windstorm	Moderate	Major	Current predictions indicate an increase in the intensity of windstorms (Climate Ireland), increasing the impacts involved. Protection measures are being implemented on ecosystems such as dune habitat systems (Tipperary CDP).
6		Increase in Relative Sea Level	Minor	Minor	Satellite observations indicate that sea levels around Ireland have increased by approximately 2-3 mm per year since the 1990s (The Status of Ireland's Climate, EPA). However, this will unlikely increase the impact.
7		Heatwave	Moderate	Major	Changes in phenology are projected to be experienced as average surface air temperatures are expected to increase across all seasons which will likely increase the intensity of heatwaves (Climate Ireland). This will affect the blooming seasons of flora, affecting the pollinating cycle.
8		Drought	Moderate	Major	Given the overall effect of climate change on environmental assets, many will be stressed from a range of factors, reducing the capacity of these assets to sustain acute and chronic events leading to an expected increase in impact. Average surface temperature are expected in increase, as well as a decrease in the levels of summer rainfall (Status of Ireland's Climate, EPA).
9		Above average surface temperature	Major	Catastrophic	Changes in phenology are projected to be experienced as average surface air temperatures across all seasons are expected to increase (Climate Ireland). This will affect the blooming seasons of flora, affecting the pollinating cycle.
10		Cold spell	Negligible	Negligible	There has been a decrease in the number of frost days (temperatures below 0°C) and a shortening of the frost season duration, with projections to be in line with current trends (Climate Ireland). However, the impact remains negligible.
11		Heavy snowfall	Minor	Minor	Snowfall is projected to decrease substantially by the middle of the century (Nolan and Flanagan), but impacts will remain the same.

Assessment of Future Climate Impacts - Social					
Hazard No.	Hazard Type		Current Social Impact	Projected Change	Rationale
1		River flood	Moderate	Moderate	Actions to avoid locating vulnerable developments in areas at risk of flooding are envisaged (Tipperary CDP). There is a likely increase in river flows across most of the country leading to an increase in severity of flooding (Climate Ireland).
2		Pluvial flood	Minor	Minor	Actions to avoid locating vulnerable developments in areas at risk of flooding are envisaged (Tipperary CDP). When compared with an annual average rainfall of 1186mm for the period 1961-1990, the thirty year period 1990-2019 shows a 70mm or almost 7% increase in rainfall (Status of Ireland's Climate, EPA).
3		Above average precipitation	Minor	Minor	Addressing the need for adequate availability/knowledge of greater physical activity (Tipperary LECP) if stuck indoors. The last decade from 2006 - 2015 has been the wettest period in the period 1711- 2016 and there is evidence of an increasing trend in winter rainfall and a decreasing trend in summer rainfall (Status of Ireland's Climate, EPA). This implies there is an increase in severity in winter periods but a reduction in summer periods.
4		Extreme precipitation	Minor	Minor	Addressing the need for adequate availability/knowledge of greater physical activity (Tipperary LECP) if stuck indoors. When compared with an annual average rainfall of 1186mm for the period 1961-1990, the thirty year period 1990-2019 shows a 70mm or almost 7% increase in rainfall (Status of Ireland's Climate, EPA).
5		Severe windstorm	Minor	Minor	Changing demographics with an increasing elderly population and densification of urban areas will potentially increase exposure and vulnerability (Tipperary CDP). Current predictions indicate an increase in the intensity of windstorms (Climate Ireland), increasing the impacts involved for the vulnerable population, e.g., the homeless.
6		Increase in Relative Sea Level	Negligible	Negligible	Satellite observations indicate that sea levels around Ireland have increased by approximately 2-3 mm per year since the 1990s (The Status of Ireland's Climate, EPA). However, this will unlikely increase the impact.
7		Heatwave	Minor	Minor	Changing demographics with an increasing elderly population and densification of urban areas will potentially increase exposure and vulnerability (Tipperary CDP). Average surface air temperatures are expected to increase across all seasons which will likely increase the intensity of heatwaves (Climate Ireland).
8		Drought	Moderate	Moderate	Changing demographics with an increasing elderly population and densification of urban areas will potentially increase exposure and vulnerability however, not enough to make this a moderate future impact. Average surface temperature are expected in increase, as well as a decrease in the levels of summer rainfall (Status of Ireland's Climate, EPA).
9		Above average surface temperature	Negligible	Minor	Average surface air temperatures across all seasons are expected to increase (Climate Ireland). Uncomfortable conditions for more vulnerable population may be at risk of an increased impact.
10		Cold spell	Minor	Minor	There has been a decrease in the number of frost days (temperatures below 0°C) and a shortening of the frost season duration, with projections to be in line with current trends (Climate Ireland). However, the impact remains as a minor impact.
11		Heavy snowfall	Negligible	Negligible	Snowfall is projected to decrease substantially by the middle of the century (Nolan and Flanagan), but impacts will remain the same.

Assessment of Future Climate Impacts - Financial					
Hazard No.	Hazard Type		Current Financial Impact	Projected Change	Rationale
1		River flood	Moderate	Major	The increase in impact across a range of areas of the local authority could lead to an increasing financial burden on the local authority (Tipperary CDP). There is a likely increase in river flows across most of the country leading to an increase in severity of flooding (Climate Ireland).
2		Pluvial flood	Negligible	Minor	The increase in impact across a range of areas of the local authority could lead to an increasing financial burden on the local authority (Tipperary CDP). When compared with an annual average rainfall of 1186mm for the period 1961-1990, the thirty year period 1990-2019 shows a 70mm or almost 7% increase in rainfall (Status of Ireland's Climate, EPA).
3		Above average precipitation	Negligible	Negligible	The last decade from 2006 - 2015 has been the wettest period in the period 1711- 2016 and there is evidence of an increasing trend in winter rainfall and a decreasing trend in summer rainfall (Status of Ireland's Climate, EPA). This implies there is an increase in severity in winter periods but a reduction in summer periods. It is unlikely the financial burden will be increased.
4		Extreme precipitation	Minor	Minor	When compared with an annual average rainfall of 1186mm for the period 1961-1990, the thirty year period 1990-2019 shows a 70mm or almost 7% increase in rainfall (Status of Ireland's Climate, EPA).
5		Severe windstorm	Negligible	Minor	The increase in impact across a range of areas of the local authority could lead to an increasing financial burden on the local authority (Tipperary CDP). Current predictions indicate an increase in the intensity of windstorms (Climate Ireland), increasing the impacts involved.
6		Increase in Relative Sea Level	Negligible	Negligible	Satellite observations indicate that sea levels around Ireland have increased by approximately 2-3 mm per year since the 1990s (The Status of Ireland's Climate, EPA). However, this will unlikely increase the impact.
7		Heatwave	Negligible	Negligible	Average surface air temperatures are expected to increase across all seasons which will likely increase the intensity of heatwaves (Climate Ireland). Use of new materials to accommodate higher temperatures are unlikely to increase the financial burden to the point where the impacts are minor (Tipperary CDP).
8		Drought	Minor	Moderate	Average surface temperature are expected in increase, as well as a decrease in the levels of summer rainfall (Status of Ireland's Climate, EPA). Drier summers result in an increasing financial burden for the provision of water.
9		Above average surface temperature	Negligible	Negligible	Average surface air temperatures across all seasons are expected to increase (Climate Ireland). A possible increase in the measures to protect and enhance green infrastructure to accommodate this increase in baseline temperatures may lead to an increased burden on finances, but not enough to create minor impacts.
10		Cold spell	Minor	Minor	There has been a decrease in the number of frost days (temperatures below 0°C) and a shortening of the frost season duration, with projections to be in line with current trends (Climate Ireland). However, the impact remains as a minor impact.
11		Heavy snowfall	Minor	Minor	Snowfall is projected to decrease substantially by the middle of the century (Nolan and Flanagan), but impacts will remain the same.

Assessment of Future Climate Impacts - Reputational				
Hazard No.	Hazard Type	Current Reputational Impact	Projected Change	Rationale
1	River flood	Moderate	Moderate	There is a likely increase in river flows across most of the country leading to an increase in severity of flooding (Climate Ireland). The local authority has a role in addressing these issues, and could therefore suffer reputational damage from local, national, and international perspectives. The CARO progress report 2022 indicates progress has been made with regards to climate change adaptation implementation with this event.
2	Pluvial flood	Minor	Minor	When compared with an annual average rainfall of 1186mm for the period 1961-1990, the thirty year period 1990-2019 shows a 70mm or almost 7% increase in rainfall (Status of Ireland's Climate, EPA). The local authority has a role in addressing these issues, and could therefore suffer reputational damage from local, national, and international perspectives. The CARO progress report 2022 indicates progress has been made with regards to climate change adaptation implementation with this event.
3	Above average precipitation	Negligible	Negligible	The last decade from 2006 - 2015 has been the wettest period in the period 1711- 2016 and there is evidence of an increasing trend in winter rainfall and a decreasing trend in summer rainfall (Status of Ireland's Climate, EPA). This implies there is an increase in severity in winter periods but a reduction in summer periods. The local authority has a role in addressing these issues, and could therefore suffer reputational damage from local, national, and international perspectives. The CARO progress report 2022 indicates progress has been made with regards to climate change adaptation implementation.
4	Extreme precipitation	Minor	Minor	When compared with an annual average rainfall of 1186mm for the period 1961-1990, the thirty year period 1990-2019 shows a 70mm or almost 7% increase in rainfall (Status of Ireland's Climate, EPA).The local authority has a role in addressing these issues, and could therefore suffer reputational damage from local, national, and international perspectives. The CARO progress report 2022 indicates progress has been made with regards to climate change adaptation implementation.
5	Severe windstorm	Negligible	Negligible	Current predictions indicate an increase in the intensity of windstorms (Climate Ireland), increasing the impacts involved. The local authority has a role in addressing these issues, and could therefore suffer reputational damage from local, national, and international perspectives. The CARO progress report 2022 indicates progress has been made with regards to climate change adaptation implementation.
6	Increase in Relative Sea Level	Negligible	Negligible	Satellite observations indicate that sea levels around Ireland have increased by approximately 2-3 mm per year since the 1990s (The Status of Ireland's Climate, EPA). However, this will unlikely increase the impact.
7	Heatwave	Negligible	Negligible	Average surface air temperatures are expected to increase across all seasons which will likely increase the intensity of heatwaves (Climate Ireland). The local authority has a role in addressing these issues, and could therefore suffer reputational damage from local, national, and international perspectives. The CARO progress report 2022 indicates progress has been made with regards to climate change adaptation implementation.
8	Drought	Minor	Moderate	Average surface temperature are expected in increase, as well as a decrease in the levels of summer rainfall (Status of Ireland's Climate, EPA).The local authority has a role in addressing these issues, and could therefore suffer reputational damage from local, national, and international perspectives.
9	Above average surface temperature	Negligible	Negligible	Average surface air temperatures across all seasons are expected to increase (Climate Ireland). The local authority has a role in addressing these issues, and could therefore suffer reputational damage from local, national, and international perspectives. The CARO progress report 2022 indicates progress has been made with regards to climate change adaptation implementation.
10	Cold spell	Negligible	Negligible	There has been a decrease in the number of frost days (temperatures below 0°C) and a shortening of the frost season duration, with projections to be in line with current trends (Climate Ireland). However, the impact remains negligible.
11	Heavy snowfall	Negligible	Negligible	Snowfall is projected to decrease substantially by the middle of the century (Nolan and Flanagan), but impacts will remain the same.

Assessment of Future Climate Impacts - Cultural Heritage					
Hazard No.	Hazard Type		Current Cultural Heritage Impact	Projected Change	Rationale
1		River flood	Moderate	Major	There could be an increase in the number of cultural heritage assets exposed to river flooding due to an increase in severity of flooding events. There is a likely increase in river flows across most of the country leading to an increase in severity of flooding (Climate Ireland). The objective is to continue to work alongside OPW to carry out flood relief schemes and maintain existing defences (Tipperary CDP).
2		Pluvial flood	Minor	Moderate	There could be an increase in the number of cultural heritage assets exposed to pluvial flooding due to an increase in severity of flooding events, and an increase in the overall impact is expected. When compared with an annual average rainfall of 1186mm for the period 1961-1990, the thirty year period 1990-2019 shows a 70mm or almost 7% increase in rainfall (Status of Ireland's Climate, EPA). The objective is to continue to work alongside OPW to carry out flood relief schemes and maintain existing defences (Tipperary CDP).
3		Above average precipitation	Moderate	Moderate	Above average precipitation does not impact the majority of cultural heritage assets so a significant increase in overall impact is not envisaged. The last decade from 2006 - 2015 has been the wettest period in the period 1711- 2016 and there is evidence of an increasing trend in winter rainfall and a decreasing trend in summer rainfall (Status of Ireland's Climate, EPA). This implies there is an increase in severity in winter periods but a reduction in summer periods.
4		Extreme precipitation	Moderate	Moderate	Extreme precipitation does not impact the majority of cultural heritage assets so a significant increase in overall impact is not envisaged. When compared with an annual average rainfall of 1186mm for the period 1961-1990, the thirty year period 1990-2019 shows a 70mm or almost 7% increase in rainfall (Status of Ireland's Climate, EPA).
5		Severe windstorm	Moderate	Moderate	The projected changes in severe windstorms indicate a reduction in lesser storms but an increase in major storms. The overall impact is expected to remain relatively unchanged as storms may be less frequent but the damage caused may increase. Current predictions indicate an increase in the intensity of windstorms (Climate Ireland), increasing the impacts involved.
6		Increase in Relative Sea Level	Minor	Minor	Satellite observations indicate that sea levels around Ireland have increased by approximately 2-3 mm per year since the 1990s (The Status of Ireland's Climate, EPA). However, this will unlikely increase the impact.
7		Heatwave	Moderate	Moderate	Areas of cultural heritage may have an increase in visitors during these events, increasing pressure on these areas, but not enough to increase the impact. Average surface air temperatures are expected to increase across all seasons which will likely increase the intensity of heatwaves (Climate Ireland).
8		Drought	Negligible	Negligible	Droughts do not impact the majority of cultural heritage assets so a significant increase in overall impact is not envisaged (Tipperary CDP). Average surface temperature are expected in increase, as well as a decrease in the levels of summer rainfall (Status of Ireland's Climate, EPA).
9		Above average surface temperature	Moderate	Moderate	Areas of cultural heritage may have an increase in visitors as a result of increased average surface temperatures, increasing pressure on these areas, but not enough to increase a major impact. Average surface air temperatures across all seasons are expected to increase (Climate Ireland).
10		Cold spell	Minor	Minor	Cold spells do not impact the majority of cultural heritage assets so a significant increase in overall impact is not envisaged. There has been a decrease in the number of frost days (temperatures below 0°C) and a shortening of the frost season duration, with projections to be in line with current trends (Climate Ireland). However, the impact remains as a minor impact.
11		Heavy snowfall	Minor	Minor	Heavy snowfalls do not impact the majority of cultural heritage assets so a significant increase in overall impact is not envisaged. Snowfall is projected to decrease substantially by the middle of the century (Nolan and Flanagan), but impacts will remain the same.

Appendix G Future Impact Summary Matrix

FUTURE IMPACTS

	Hazard Type	Projected Frequency	Projected Frequency (Score)	Asset Damage	Health and Wellbeing	Environment	Social	Financial	Reputation	Cultural Heritage	Projected Impact
	River flood	Frequent	4	Major	Major	Moderate	Moderate	Major	Moderate	Major	3.57
	Drought	Frequent	4	Moderate	Major	Major	Moderate	Moderate	Moderate	Negligible	3.00
	Severe windstorm	Very Frequent	5	Moderate	Major	Major	Minor	Minor	Negligible	Moderate	2.71
	Extreme precipitation	Very Frequent	5	Moderate	Minor	Moderate	Minor	Minor	Minor	Moderate	2.43
	Pluvial flood	Frequent	4	Moderate	Minor	Moderate	Minor	Minor	Minor	Moderate	2.43
	Heatwave	Frequent	4	Minor	Moderate	Major	Minor	Negligible	Negligible	Moderate	2.29
	Above average precipitation	Frequent	4	Moderate	Minor	Minor	Minor	Negligible	Negligible	Moderate	2.00
	Above average surface temperature	Frequent	4	Negligible	Negligible	Catastrophic	Minor	Negligible	Negligible	Moderate	2.00
	Cold spell	Occasional	2	Minor	Minor	Negligible	Minor	Minor	Negligible	Minor	1.71
	Heavy snowfall	Occasional	2	Minor	Minor	Minor	Negligible	Minor	Negligible	Minor	1.71
	Increase in Relative Sea Level	Occasional	2	Negligible	Negligible	Minor	Negligible	Negligible	Negligible	Minor	1.29