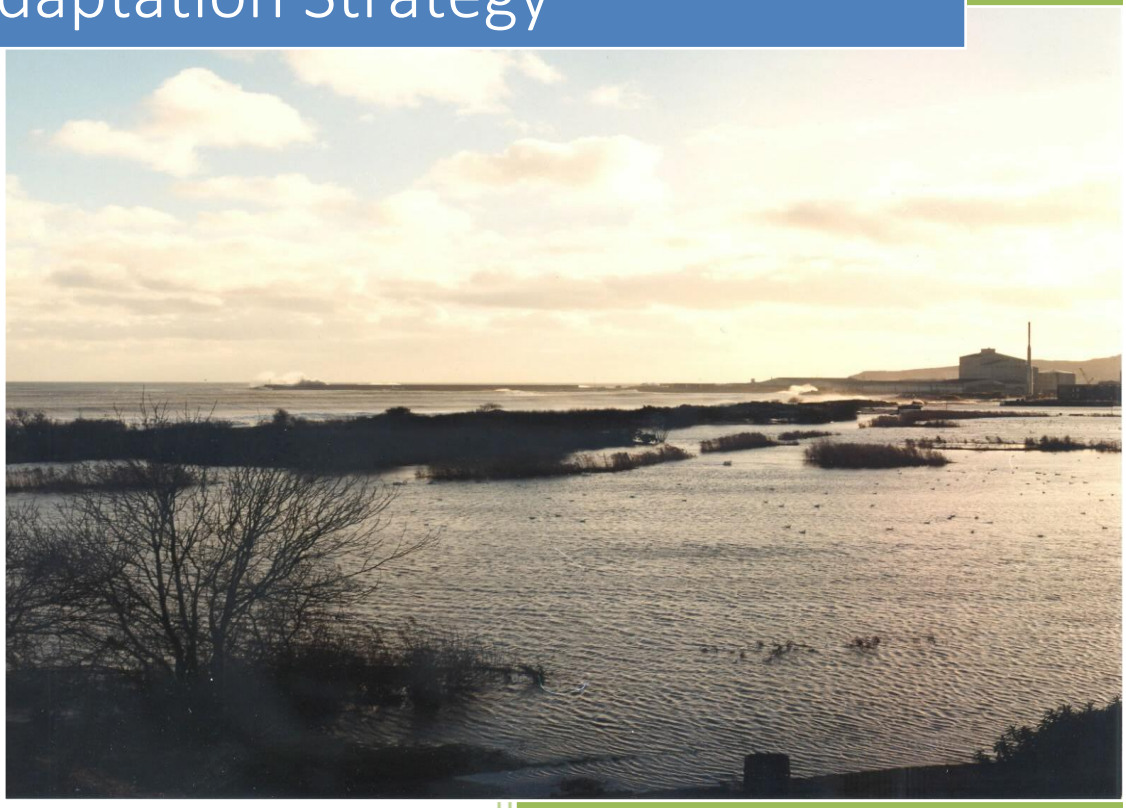
September 2019

Rev 4.0

Wicklow County Council Climate Change Adaptation Strategy



WICKLOW
CILL MHANTÁIN

ENDLESS OPPORTUNITIES
DEISEANNA SÍORAÍ

DOCUMENT CONTROL SHEET

Issue No.	Date	Description of Amendment
Rev 1.0	Apr 2019	Draft – Brought to Council 29th April 2019
Rev 2.0	May 2019	Number of formatting changes and word changes to a number of actions: Actions Theme 1: 13, 14 and 15 and Theme 5: Actions 1 and 2
Rev 2.0	May 2019	Circulated to Statutory Consultees
Rev 2.0	June 2019	Public Display with SEA and AA Screening Reports from 7th June 2019 to 5th July 2019.
Rev 3.0	August 2019	Additions and Amendments as per Chief Executive's Report on Submissions.
Rev 4.0	Sept 2019	Revision 4.0 adopted by Wicklow County Council on 2nd September 2019.

ACKNOWLEDGEMENTS

Wicklow County Council wishes to acknowledge the guidance and input from the following:

- The Eastern & Midlands Climate Action Regional Office (CARO), based in Kildare County Council for their technical and administrative support and training.
- Neighbouring local authorities for their support in the development of this document, sharing information and collaborating on the formulation of content and actions..
- Climateireland.ie website for providing information on historic weather trends, current trends and projected weather patterns.
- Staff of Wicklow County Council who contributed to the identification of vulnerabilities at local level here in County Wicklow and identification of actions which will enable Wicklow County Council to fully incorporate Climate Adaptation as key priority in all activities and services delivered by Wicklow County Council. Staff from all services contributed ensuring the document has reach across all relevant services.

FOREWORD – CHIEF EXECUTIVE AND CATHOIRLEACH

Ireland is at an early stage of a long and challenging process of transitioning to a low-carbon, climate resilient and environmentally sustainable economy. Wicklow County Council is undertaking a programme of measures to mitigate against Climate Change and reduce our energy consumption. We must also take steps to adapt our services to ensure Wicklow can meet the challenges it brings, strengthen our ability to respond, and build a resilient future for all in the county.

Irish people have experienced firsthand the potential impacts of climate change including increased temperatures, changes in precipitation, sea level rise, changes in the variability and extremes of storms, flooding and flash floods, all of which have resulting impacts on our environment, society and economy. Events like these are expected to increase in frequency highlighting the need for adaptation measures to help the country cope with the effects of climate change.

The National Adaptation Framework (NAF) sets out a clear pathway for Ireland to become a resilient economy and society, capable of dealing with the enormous complexities and challenges climate change is likely to present. The NAF sets out the National Adaptation Strategy which aims to reduce Ireland's vulnerability to these impacts. It also identifies the role of key sectors including local government in developing climate resilience while also recognising the need to ensure coordination of adaptation actions across sectors and Government Departments and Agencies.

The requirement for a comprehensive response to climate change at local and regional level makes local government critical to the delivery of national and international policies. The establishment of the four Climate Action Regional Offices (CAROs), as Centres of Excellence, based on distinct geographical/topographical characteristics are key to enabling local authorities develop and roll out climate action strategies in a coordinated response to national and regional policy at a local level.

The youth of County Wicklow have been vocal in recent months demonstrating that they are concerned about their future and the action we must take on Climate Change. Wicklow County Council will take the lead on Climate Change for the county. We will work through our services delivery and with the people of Wicklow to ensure we deliver a better future for all. We will need the support of every community across the county to make real change, that will build our new low carbon resilient economy, while delivering on our hopes of creating opportunities for everyone.

Wicklow County Council is committed to mainstreaming Climate Change in the delivery of its services and affecting change in terms of both mitigation and adaptation.

Frank Curran
Chief Executive

Cllr Irene Winters
Cathoirleach

Table of Contents:

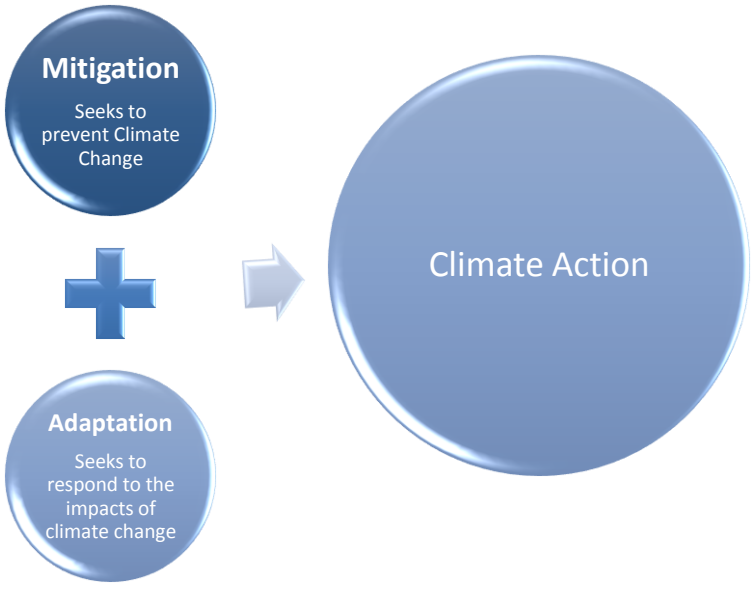
EXECUTIVE SUMMARY

The impacts of climate change are already visible today and are expected to intensify over the coming decades. This Climate Adaptation Strategy for County Wicklow developed by Wicklow County Council under the guidance of the Climate Action Regional Office (CARO) is a response to the impact that the climate change is having and will continue to have on the County of Wicklow and its citizens. It addresses how Wicklow County as an organisation responds to the impacts of Climate Change. It does not look directly at the work being done to prevent or mitigate Climate Change. It is a part of the combined effort we must make on Climate Action to both prevent it happening and also prepare for how it will impact on us in the coming years. To date, the focus when addressing Climate Change has been almost entirely on mitigation through reducing our carbon emissions. It is now timely that through this strategy we also plan for the impacts it will bring to Wicklow.

Road washed away in fluvial flooding.

Why Now?

On The 29th of April 2019 Wicklow County Council declared a Climate and Biodiversity emergency. This emergency will require action on Adaptation and Mitigation of Climate Change and on Biodiversity. This strategy sets out the approach for adaptation to Climate Change. A Climate and Biodiversity Special Policy Committee, SPC, has been established, which will play a key role in guiding the implementation of this strategy as part of Wicklow County Council's response to Climate Change and Biodiversity loss.



The Background

Chapter 1 of this strategy sets out the purpose of the strategy, the science of Climate Change and the international and national policy framework that guides policy. It explains Climate Adaptation and how it both differs and relates to Climate Mitigation. The two combined give us Climate Action. As the level of government closest to local communities and businesses and as first responders at local level for many emergencies Wicklow County Council can play an important role helping to limit the impact of Climate Change on our livelihoods, local community resources and natural resources.

The Plans aims to:

- make Wicklow a stronger county by reducing impacts of future climate change related events.
- fully consider and mainstream climate adaptation in the day to day delivery of services by Wicklow County Council.
- actively engage with and inform citizens and communities in Wicklow about the impacts of climate change. Public awareness is key to developing effective climate adaptation measures.

Climate can be described as the average in weather, what we can expect to receive with seasonal variation. Climate Change is a significant change in weather patterns such as rainfall, temperature or wind that occurs over extended periods of time measured in decades. While some natural change in Climate is to be expected over time, we are living in a time of rapid change in Climate, for which there is unequivocal evidence, and which the scientific community has attributed to human induced warming with greenhouse gases. Records in Ireland show a warming of our climate by 0.8^{o} C since 1900 and sea level rise of 3.5cm per decade observed since 1990.

The Irish Government passed legislation in 2015 through the Climate Action and Low Carbon Development Act requiring local authorities and twelve key bodies to adopt Climate Adaptation strategies by September 2019.

Climate adaptation is about planning to take action and make adjustments that will help to minimise or avoid where possible harm caused by Climate Change and prepare measures that will help us to respond better in emergency situations. It is important that through adaptation planning we ensure that responding to changing climate and its impacts influences all our decision making processes and is incorporated into all our work programmes.


Sandbagging in preparation for a storm surge on Bray Promenade

How Wicklow responds will be part of a National Adaptation Framework, NAF, working with other local authorities and alongside national sectoral strategies to ensure a coordinated approach which is adapted to local circumstances.

While this strategy is focused on adaptation Wicklow County Council notes its commitment in Chapter 1 to energy reduction targets under the Public Sector Energy Efficiency Strategy and those contained in the new Climate Action Plan. It gives new targets which Wicklow County Council will either directly meet or play a role in through collaborating with other bodies in implementation. Wicklow County Council is undertaking over forty projects in eleven of its buildings to improve their energy performance in 2019, is working with SEAI to support the development of Sustainable Energy Communities, building better homes and working to deliver more sustainable transport for the county.

Chapter 2 sets out the local context of County Wicklow looking at the Topography, Rivers and drainage, Natural Heritage, Population and Socio-Economic Development in County Wicklow.

The Impacts

The most immediate risks to Wicklow which are influenced by climate change are predominantly those which are due to changes in extremes such as floods, precipitation, storms and higher sea levels. Some weather events in recent years such as ex hurricane Ophelia in 2017, the heavy snowfall in February/March 2018 and the heat wave of the summer of 2018 fit closely with predictions for Climate Change. All three of the above events had a very significant impact on service delivery for Wicklow County Council and required significant human and financial resources.

Chapter 3 sets out a baseline of how weather events have impacted on County Wicklow. Significant weather events which caused disruption in County Wicklow were identified. They were classified by type into strong winds, extreme rainfall, heavy snowfall/low temperatures, sea level rise, drought and heat waves. The data collected was circulated among staff and discussed in workshops to identify how these weather events impacted on services and operations of Wicklow County Council, the impact on communities and infrastructure and the use of emergency services required to deal with the events. As a follow up, some case studies were developed detailing the impacts of specific events, how Wicklow County Council responded and the costs involved.

This led to the creation of a detailed baseline assessment identifying under each type of weather event what impacts have been observed, how exposed County Wicklow is to the impacts, how we respond, how serious the consequences are for operations and communities and also what other agencies or bodies are involved in dealing with the impacts. All known impacts from small to large were recorded.

Snow Plough Storm Emma 2018

The adaptation baseline gives us a picture of how weather affects us now but extreme events can also assist us in identifying where the key threats will be going forward.

Identifying Future Risk

Chapter 4 focuses on Climate Risk Identification for the future. It looks at how risk is evolving in the short term i.e. the 2020's and also projected risks out to 2050. The adaptation baseline has identified that the effects of climate change are already impacting on Wicklow at a significant rate and are very likely to increase in their frequency and intensity.

The number of days with heavy rainfall has increased and the amount of storms causing flooding and coastal erosion has risen in the last 10 years. Wicklow also experienced increased temperatures over the same period as witnessed most recently in 2018, with Met Éireann issuing a yellow warning for snow in February and March followed by one of the hottest summers on record just three months later. All of these extreme weather events clearly highlight the need to reduce impacts that climate change is having on the environment, the economy and the citizens of Wicklow.

Risk is scored measuring the impact against the likelihood. Climate Ireland who research Irelands changing climate has produced predictions for how Climate is changing based on observed patterns of change over the

last few decades. For each type of weather event they have predicted how it will evolve in the coming years based on those trends.

All the impacts under each of the type of weather events identified in Chapter 3 were assessed and scored for future risk. Colour coding of risk as well as the actual score are recorded so that we can identify risks that need to be given the highest priority versus those that will be lower priority going forward.

Measuring future risk allows us to identify all areas where we will be vulnerable in the future, how those vulnerabilities will evolve but most importantly helps us to identify the highest priority for action.

Taking Action

The actions of this strategy have been developed to close the gap between the current baselines with associated responses, projected risks and the resultant actions that will be required to deal with increased impact as well as preventive measures that can build resilience. Chapter 5, which outlines these actions, will be a dynamic part of the document with regular updates. These actions have many benefits such as a better environment through habitat protection, stronger community participation and a stronger economy with new markets and job opportunities. Wicklow County Council acknowledges the key role it has to play in climate adaptation through its own activities and how it works with communities and the business sector.

The actions are set in a framework of six key themes with an overarching goal for each theme. This Climate Adaptation Strategy features a range of actions across the following sectors:

Theme 1: Local Adaptation Governance and Business Operations

Goal: Climate Change adaptation considerations are mainstreamed and integrated successfully into all functions and activities of the local authority ensuring operational protocols, procedures and policies implement an appropriate response in addressing the diversity of impacts associated with climate change

Theme 2: Infrastructure and Built Environment

Goal: Increased capacity for climate resilient structural infrastructure is centred around the effective management of climate risk, informed investment decisions and positive contribution towards a low carbon society

Theme 3: Land use and development

Goal: Sustainable policies and measures are devised influencing positive behavioural changes, supporting climate adaptation actions and endorsing approaches for successful transition to low carbon and climate resilient society.

Theme 4: Drainage and Flood Management

Goal: Great understanding of risks and consequences of flooding and successful management of a co-ordinated approach to drainage and flooding

Theme 5: Natural Resources and Cultural Infrastructure

Goal: Fostering meaningful approaches to protecting natural and key cultural assets through an appreciation for the adaptive capacity of the natural environment to absorb the impacts of climate change.

Theme 6: Community Health and Wellbeing

Goal: Empowered and cohesive communities with strong understanding of climate risks, increased resilience to impacts of climate change with capacity to champion climate action at local level

Theme 1 addresses how Wicklow County Council will operate, bringing Climate Action to the top of the agenda in the delivery of all services. It mandates the setting up of a steering group led by senior management which will ensure that Climate Adaptation is delivered across the organisation, mainstreamed as a consideration in the Corporate Development Plan and that action cascades down into every service. It creates a Climate and Biodiversity Special Policy Committee. A Climate Action Officer will be appointed. It will provide training, address procurement issues and ensure that funding of projects is done taking account of climate impact. Structures will be developed to work closely with other bodies to deliver a coordinated approach to Climate Action.

Theme 2 is focused on infrastructure and the built environment. It will ensure that the risk to buildings and infrastructure is fully assessed. Going forward it will ensure that climate considerations are fully integrated into the planning of new projects and their design. It will require better monitoring of the impact of weather on our buildings and infrastructure so that we can build better and respond better. It will require us to follow best practice in line with national policy and avail of developments in technology. The risk of flooding to buildings and infrastructure will be a key concern. Coastal inundation or erosion needs to be reviewed and monitored with appropriate action taken.


Drought during summer 2018

Theme 3 looks at land use and development. Climate Change will be fully integrated as a concern in all relevant plans and policies that influence planning and development. It will ensure that the County Development Plan and associated plans focus on delivering sustainable communities with climate smart buildings and infrastructure. It will ensure the continuing focus on protecting habitats in the planning system and also recognises their role in protecting against Climate Change threats.

Theme 4 addresses measures to prevent and respond to flooding. It looks at actions to plan for efficient drainage in our communities taking account of previous flooding events and zones at risk from flooding. It will build on the work done through Sustainable Urban Drainage Systems. It includes measures that recognise that green infrastructure both on a small scale and larger scale can help to prevent heavy rainfall leading to flooding. It aims to ensure that we have precise information mapped and used in decision making. Wicklow County Council will work with the River Basin Management Coordinators to ensure our rivers and their surrounds are managed to reduce flooding risk and maintain good water quality.

Theme 5 focuses on our built cultural and natural heritage. It aims to ensure that full consideration is given to the need to protect the county's cultural, built and archaeological heritage. Protecting biodiversity, threatened through wider issues of biodiversity loss, resource depletion, use of pesticides, poor management practice, declining environmental quality and habitat loss is a key concern linked to climate change. Biodiversity loss is part of the emergency declared by Wicklow County Council. The Biodiversity Plan is the more appropriate place to deal with all aspects of this loss. The strategy will look at how Biodiversity and habitats can help to build resilience through the protection and enhancement of natural buffers, maximising scope to provide opportunity for biodiversity on council property. Trees play a vital role contributing to both Climate Mitigation and Adaptation. Invasive species are a growing threat. Wetlands are particularly vulnerable to rising sea levels.

Theme 6 looks at building community resilience to Climate Change, how Wicklow County interacts with different sectors of society and how we engage people in actions. It contains a very broad range of actions. It addresses how we will ensure a good flow of information and build communications. We will work with key partners including the Public Participation Network, schools, Tidy Towns and the local business community. There will be key roles for Community, Social and Economic Development, the Local Enterprise Office and the Environmental Awareness Office. Communities will play a greater role helping us create more sustainable communities that are energy smart, use more sustainable transport, creating healthier, stronger places to live. Funding will need to be used more wisely to ensure it contributes to Climate Action rather than causing more damage. Food was a recurring theme in submissions during public consultation showing how critical it is that we refocus on delivering the best from our county but in a more sustainable manner. Wicklow County Council will identify and celebrate best practice throughout the county recognising that we take up the challenge of Climate Action together with the people and local groups. We will find innovative amazing solutions to bring us forward.

Public awareness is key to developing effective climate adaptation and mitigation, Wicklow County Council will, through this strategy, commit to address the current knowledge gap and will work with community groups and citizens to act on climate change through a range of awareness and behavioural change actions. Working with affected communities is vital, as the costs of maintaining a managed approach to the impacts of climate change will continue to increase as extreme weather events become more severe and gaps between events shorten. This will also likely reduce the economic, physical and psychological capacity of affected communities to recover between events.

Implementing the Plan

Chapter 6 looks at implementing the plan. The actions of this strategy will be continuously monitored, reviewed and updated by a dedicated climate action team within WCC. This will be assisted by CARO, which will ensure that the overall plan is fully updated every 5 years to reflect the latest policy, technology and climate related impacts. The implementation will require the prioritisation of measures and building teams across every service to deliver on the actions. Wicklow County Council will take a collaborative approach to working with other local authorities and relevant bodies. Monitoring and evaluation systems will be defined with the Climate and Biodiversity SPC playing a key role. An annual report will be produced.

Conclusion

As a local authority, Wicklow County Council has a key role to play in addressing and leading in its response to climate change. This strategy sets out a vision of how we might effect a transition towards a more climate resilient future. As a local authority we are uniquely placed to effect real positive change on the ground. It is hoped that through the actions outlined in this strategy, that Wicklow County Council will contribute to the delivery of the national objective of transitioning to a low carbon climate resilient economy in the long term and also improving our ability to plan for, and respond to, severe weather events in the shorter term.

Wicklow County Council will, through its commitment to facing up to the challenge of climate change, lead by example in tackling this global issue at local level.

This strategy has been developed following an extensive process of research, policy analysis and workshops with staff and regional working groups. It follows on from the publication of Local Authority Adaptation Strategy Development Guidelines published in December 2018 by the Department of Communications, Climate Action and the Environment. Workshops were facilitated by, and the WCC team liaised with, staff of the Eastern & Midlands Climate Action Regional Office (CARO).

CHAPTER 1: INTRODUCTION & BACKGROUND

1.1 INTRODUCTION:

The Earth's Climate is changing. While natural fluctuations in climate are considered normal, emerging research and observational records from across the world show rates of change that are far greater than those experienced in recent history. Global temperatures have risen and are projected to rise further bringing changes in weather patterns, rising sea levels and increased frequency and intensity of extreme weather. Ireland's climate is changing in line with global patterns and these changes are bringing significant and wide ranging economic, environmental and social impacts.

Climate change is now recognised as a global challenge with policy responses required in terms of both mitigating the causes of climate change and in adapting to the now inevitable consequences of our changing climate. Action at local level is vitally important to help reduce the risks and impacts of climate change across communities.

This first Climate Change Adaptation Strategy is the start of the process of adaptation planning in Wicklow County Council and it is the first step in increasing knowledge and understanding of our changing climate, growing resilience, and enabling effective responses to the threats posed by climate change.

1.2 PURPOSE OF THIS STRATEGY:

This Wicklow County Council Climate Change Adaptation Strategy forms part of the National Adaptation Framework (NAF) which was published in response to the provisions of the Climate Action and Low Carbon Development Act 2015.

As the level of government closest to local communities and enterprise and as first responders in many emergencies Wicklow County Council are uniquely placed to effect real positive change with respect to delivery of the national transition objective to a low carbon and a climate resilience future.

The local authority adaptation strategy takes on the role as the primary instrument at local level to:

- ensure a proper comprehension of the key risks and vulnerabilities of climate change
- bring forward the implementation of climate resilient actions in a planned and proactive manner
- ensure that climate adaptation considerations are mainstreamed into all plans and policies and integrated into all operations and functions of the local authority

This adaptation strategy serves Wicklow County Council in its two capacities namely:

- As an organisation or entity with an obligation towards customer service, a focus on effectiveness in business, improving efficiencies and maintaining staff welfare and
- In the delivery of services and functions across the administrative and geographical area of County Wicklow

In accordance with the provisions of the Climate Action and Low Carbon Development Act 2015 this adaptation strategy is required to be adopted by members of Wicklow County Council before the 30th September 2019.

The Challenge of Climate Change:

Climate is described as the average weather prevailing in an area over a period of time. *Climate Change* is a significant change in weather patterns such as rainfall, temperature, and / or wind, which continue over an extended period of time (i.e. over decades or longer). The Earth's climate is constantly changing. Climatic fluctuations are known to occur from natural causes including the Earth's orbit and tilt, volcanic eruptions, variations in solar energy and other phenomena such as the El Nino effect[1]. However, in more recent times, there are growing concerns that natural fluctuations in climate are being overtaken by rapid human-related activities which are negatively influencing climate variability and giving rise to serious implications for the rate of global warming.

Scientific evidence for warming of the climate system is unequivocal. According to the Intergovernmental Panel on Climate Change (IPCC)[2] warming of the climate system is attributable to human activities as a consequence of greenhouse gas emissions[3] from:

- Burning of fossil fuels such as oil, gas, peat, and coal resulting in carbon dioxide emissions,
- Agricultural activities that lead to methane and nitrous oxide emissions,
- Emissions from changes in land use such as urbanization, deforestation, reforestation and desertification.

Emissions from these activities are proven to impact the atmosphere by trapping the suns radiation and reflecting it back to the earth giving rise to global warming. The term greenhouse effect has been coined to describe this occurrence.

The effects of global warming are observed through reductions in snow and ice in polar regions, increase in global mean surface temperatures, rise in sea levels and changes in some climate extremes i.e. weather events. Scientists state these changes are occurring rapidly, are considerable, and will have consequences for this and future generations. Some impacts of global warming such as sea level rise and coastal flooding are already locked in and unavoidable. The full impacts of current warming have not yet been seen, since ice sheets and oceans take many decades to fully react to higher temperatures.

Climate change is one of the most pressing global policy challenges facing governments needing immediate commitment to action.

The Challenge for Ireland:
There is evidence that Irelands climate is changing in line with global trends of climate change. Over the last few decades our climate has warmed, sea-levels have risen, rainfall patterns have changed and we have been impacted by frequent, intense and more extreme weather events. Temperatures have increased by 0.8^0C since 1900 and sea level rises of about 3.5cm per decade have been observed since 1990. Climate change has diverse and wide ranging impacts on Ireland's economic and natural resources including:

- More intense storms and rainfall events giving rise to disruption to society
- Increased river and coastal flooding
- Water shortages in summer
- Increased risk of new pests and diseases

[1] El Nino is a climate cycle in the Pacific Ocean with a global impact on weather patterns.
[2] The IPCC was created in 1988. One of its key objectives is to provide governments at all levels with scientific information that they can use to develop climate policies. IPCC reports are a key input into international climate change negotiations.
[3] Greenhouse Gases include: water vapour, carbon dioxide (CO2), methane CH4), nitrous oxide (N20) and industrial gasses: Hydrofluorocarbons HFCs), Perfluorocarbons (PFCs), Sulphur Hexaflouride (SF6), and Nitrogen Triflourise (NF3). Carbon Dioxide emissions in the atmosphere are the main greenhouse gas caused by human activity

- Adverse impacts on water quality
- Changes in the distribution and phenology of plant and animal species on land and in the oceans[4]

The impacts of climate change are felt more acutely at the local level.

Nationally, climate projections for the next century indicate that the climate trends observed over the last century will continue and intensify over the coming decades i.e.:

- Increase in average temperatures across all seasons. Heat waves are expected to occur more frequently.
- Significant reductions are expected in average levels of spring and summer rainfall with a substantial increase in the frequency of heavy precipitation events in Winter and Autumn
- Decrease in wind speed and an increase in extreme wind speeds. The number of very intense storms is projected to increase over the North Atlantic region.
- Sea levels will continue to rise for all coastal areas. The south of Ireland will likely feel the impacts of these rises first. Sea surface temperatures are projected to continue warming for the coming decade.

This Local Authority Climate Change Adaptation Strategy is set against the background of increasing risks associated with climate change and seeks to reduce and manage these risks at local level through a combination of mitigation and adaptation responses.

All local authorities including Wicklow County Council provide a wide range of services, many of which are already and will increasingly be affected by climate change. It is most likely that we will continue to play a critical role in responding to the impacts of extreme weather events and other impacts that are likely to emerge over the coming decades through various implementation tools available as a local authority[5].

1.3 WHAT IS CLIMATE ADAPTATION?

Climate Adaptation can be best described as planning proactively to take action and make adjustments to minimise or avoid the existing and anticipated impacts from climate change. The Intergovernmental Panel on Climate Change (IPCC), in 2014, defined climate adaptation as:

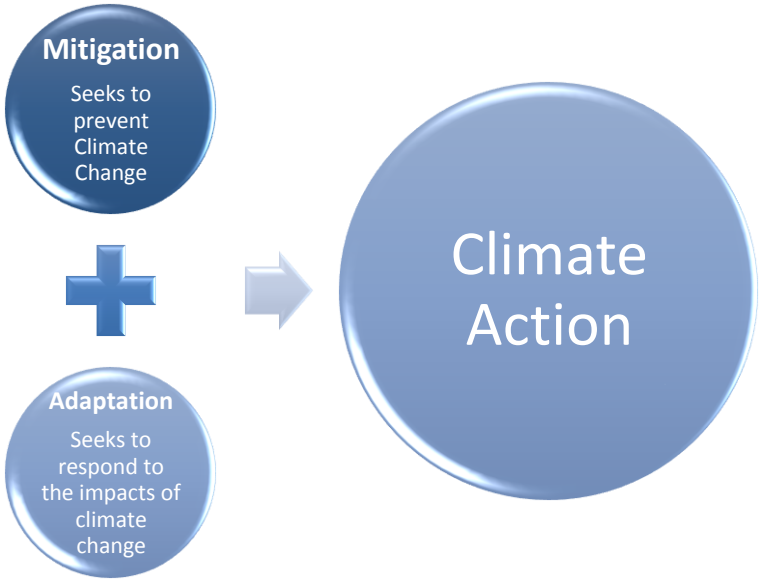
"it is the process of adjustment to actual or expected climate and its effects. In human systems, adaptation seeks to moderate or avoid harm or exploit beneficial opportunities. In some natural systems, human intervention may facilitate adjustment to expected climate and its effects."

Climate adaptation aims to build climate resilient communities, to protect people, ecosystems, businesses, infrastructure and buildings from the negative impacts of climate change. As a Local Authority we play a pivotal role in planning for, and responding to, emergency situations. We are best placed to react faster and more effectively to local climate events given our close relationship with communities and extensive knowledge of the local natural and built environment. This is demonstrated by our prompt and unrelenting emergency responses to varying and more frequent extreme weather events.

Our climate is changing and we as a local authority need to ensure that we adapt to climate change. It is crucial that climate change adaptation is mainstreamed into our decision making processes and implemented proactively in the performance of our duties. In addition, the benefits and opportunities that may arise as a result of climate change must be capitalised upon in respect of cost savings and new ways to foster environmental sustainability.

[4] EPA Research, A summary of the state of knowledge on Climate Change Impacts for Ireland, Report No. 223, 2014.
[5] Including: Spatial Planning, development consent, asset management and natural resource protection.

ADAPTATION AND MITIGATION:



Adaptation refers to efforts to manage the risks and impacts associated with existing or anticipated impacts of climate change.

Mitigation refers to the efforts to reduce the emission of greenhouse gases and reduces the severity of future climate change impacts.

This Local Authority Climate Change Adaptation Strategy forms part of Ireland's national strategy for climate adaptation as set out in the National Adaptation Framework (NAF) which was produced under the provisions of the Climate Action and Low Carbon Development Act 2015.

This Strategy is tasked with mainstreaming climate change adaptation over time into all functions, operations and services of the local authority. It seeks to inform or 'climate proof' existing plans and policies produced and implemented by the local authority. This ensures a considered, consistent and coherent approach, facing ahead on the challenges of a changing climate. Crucially, it also helps in building resilience within the local authority organisation itself as well as across all communities.

While there is strong emphasis on local authorities through the NAF to develop and implement adaptation measures and actions, mitigation measures and actions that seek to combat, reduce or eliminate the emissions of greenhouse gases are also hugely important. Local authorities have a significant role to play in actively implementing mitigation actions through measures including the design and construction of flood defences, retrofitting of building stock, energy efficient projects, promoting sustainable energy communities and encouraging sustainable transport and landuse.

There are positive interactions between adaptation and mitigation measures. Employing both adaptation and mitigation measures represents a robust climate action response in addressing the challenges associated with climate change at local level. The actions set out in Chapter 5 of this strategy reflect both adaptation and mitigation measures as a considered, relevant and integrated approach to combating the effects of climate change in County Wicklow.

1.4 ADAPTATION POLICY CONTEXT

This Local Authority Climate Change Adaptation Strategy is set within a policy framework at International, European and National level.

International Context:
The United Nations Framework Convention on Climate Change (UNFCCC) is an international environmental treaty adopted in May 1992. The framework's objective is "to stabilize greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system." The framework set non-binding limits on greenhouse gas emissions and contained no enforcement mechanisms. However the framework outlined how specific international treaties may negotiate further action towards its key objective. **The Paris Agreement 2015** is a protocol set within the context of the UNFCC (ratified by Ireland on 4th November 2016) and it is aimed at:

- limiting global warming to less than 2^0C above pre-industrial level and pursue efforts to limit the temperature increase to 1.5^0C
- Increasing the ability to impact of climate change and foster climate resilience

The agreement states the need for Parties to formulate and implement National Adaption Plans.

EU Context:
The 2013 EU Strategy on Adaptation to Climate Change encouraged all Member states to adopt comprehensive adaptation strategies. It sought for better informed decision making through the identification and addressing of gaps in knowledge about adaptation. The European Climate Adaptation Platform, Climate-ADAPT, was developed as a resource mechanism to help users access and share information on adaptation.

The Global Covenant of Mayors for Climate and Energy is a voluntary, bottom up, approach for cities and local governments to combat Climate Change and move towards a low emission, resilient society. The Global Covenant of Mayors for Climate and Energy brought the Compact of Mayors and the EU Covenant of Mayors under one international body in January 2017 incorporating over 9,000 cities and local governments. Wicklow County Council is working towards becoming a party to the Covenant of Mayors.

National Context:
The 2012 National Climate Change Adaptation Framework (NCCAF) was Ireland's first step in developing a national policy on adaptation actions to combat the impacts of climate change.

The National Policy Position on Climate Action and Low Carbon Development 2014 restated the policy position of the NCCAF, 2012. Greenhouse gas mitigation and adaption to the impacts of climate change were to be addressed in parallel national plans under an evolving climate policy to 2050.

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 (as per above). 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) published in 2018. This Local adaptation Strategy forms part of the National Adaptation Framework.

The Local Authority Adaptation Strategy Development Guidelines 2018 provides guidance to Local Authorities to develop their own Climate Action Adaptation Strategy. In developing this adaptation strategy Wicklow County Council has been consistent with these guidelines.

1.5 METHODOLOGY

The Strategy was developed in Wicklow County Council by a core team of staff from the Planning, Development and Environment Directorate. Senior staff from all key services were consulted and invited to contribute experiences of climate related events, its impacts on services and suggestions on how to prepare going forward. Four staff undertook training by CARO. CARO also facilitated a workshop for senior staff within the organisation. The preparation was guided by the County Development Plan, The Local Economic Development Plan and web based tools like Climateireland.ie

The draft strategy was placed on public display in County Building, the five Municipal district offices and on the Wicklow County Council website in line with the provisions of public consultation from 7th June 2019 to 5th July 2019. Notice of the public consultation was made through advertisement in local papers, through the public notification on East Coast Radio FM and through the Public Participation Network.

Consultation with prescribed environmental authorities for the purposes of Strategic Environmental Assessment was undertaken in accordance with the provisions of the European Communities (Environmental Assessment of Certain Plans and Programmes) Regulations 2004 (S.I. 435 of 2004 as amended by S.I. 200 of 2011).

1.6 ENVIRONMENTAL ASSESSMENT SEA/AA:

SCREENING OVERVIEW FOR SEA:

Under the European Communities (Environmental Assessment of Certain Plans and Programmes) Regulations 2004 (S.I. 435 of 2004 as amended by S.I. 200 of 2011), all plans which are likely to have a significant effect on the environment must undergo screening to determine whether a Strategic Environmental Assessment (SEA) is required. “Screening” is the process for making a determination as to whether a particular plan, would be likely to have significant environmental effects, and would thus warrant SEA. This strategy has been screened for SEA and it is determined that full SEA is not required. The screening report accompanies this strategy.

SCREENING OVERVIEW FOR AA:

Screening of this strategy will be undertaken in accordance with the requirements of Article 6(3) of the EU Habitats Directive (directive 92/43/EEC) to determine if the Climate Change Adaptation Strategy is likely to significantly affect Natura 2000 sites (i.e. Special Areas of Conservation (SAC) and Special Protection Areas (SPA)) within or surrounding the strategy area. An AA Screening Report was prepared and finalised post consultation and accompanies this strategy.

1.7 MITIGATION IN WICKLOW COUNTY COUNCIL:

It is not possible to develop a Climate Action Adaptation Strategy without discussing measures pertaining to climate mitigation. Mitigation has been described as the efforts made to reduce the severity of future climate change impacts by reducing the emission of greenhouse gases.

Wicklow County Council has a key leadership role to play locally in terms of climate mitigation.

As previously detailed, The Climate Action and Low Carbon Development Act 2015 made provision for, and gives statutory authority to, both the National Mitigation Plan (NMP) which was published in 2017 and the National Adaptation Framework (NAF) published in 2018. The national policy context is to achieve a deep decarbonisation of the economy by the year 2050 and the NAF has been flagged a work in progress reflecting the reality of where we are, nationally, in our decarbonisation transition to a more climate resilient economy.

ENERGY REDUCTION TARGETS

The Government of Ireland has committed to wider climate change goals whereby one of these goals is to achieve a 33% energy efficiency improvement by all Irish public bodies by the year 2030, as defined by SI 426 of 2014. This target was reinforced in 2017 through the publication of the "Public Sector Energy Efficiency Strategy". In its latest performance report entitled "Annual Report 2018 on Public Sector Energy Efficiency Performance", the Sustainable Energy Authority of Ireland (SEAI) have credited Wicklow County Council 11.3% energy savings against its 2009 energy usage baseline.

WICKLOW COUNTY COUNCIL MITIGATION ACTIVITIES

The Council is committed to mitigating the causes of climate change and to decreasing the organisations dependency on fossil fuels. To that end, the council have appointed an Energy Performance Office at Director of Service level and he is supported by a cross functional energy team. Together, they have identified over 50 energy efficiency and renewable projects for 2019 that will save over 1m kWh – roughly the equivalent of the annual electricity use of 200 Irish homes.

The council will endeavour to build on this activity, in addition to developing new and innovative policies to promote energy efficiency and innovation within the county.

In addition, the council is working with local community groups to expand the number of Sustainable Energy Communities in collaboration the Sustainable Energy Authority of Ireland.

In addition to the ongoing work packages Wicklow County Council is committed to further developing polices to promote cross sectoral sustainability in areas such as transport and housing by, for example, using the spatial planning process to encourage a modal shift towards sustainable transport and by piloting energy reduction retrofitting schemes within local authority housing stock.

MITIGATION IN ACTION

Sustainable Energy Communities: A sustainable Energy Community (SEC) is a community in which everyone works together to develop a sustainable energy system for the benefit of the community. They aim to be as energy efficient as possible, to use renewable energy where feasible and to develop decentralized energy supplies. The sustainable energy community can include all the different energy users including homes, community centres, sports clubs, businesses and churches.

Wicklow County Council has agreed to support new Sustainable Energy Communities to carry out community-wide Energy Masterplans (EMP's), through leading applications for funding with SEAI, contracting EMP-specialist consultants and other support where appropriate.

CHAPTER 2 REGIONAL AND LOCAL CONTEXT:

2.1 COUNTY WICKLOW:

County Wicklow is known as the garden of Ireland. Geographically the county is dominated by the Wicklow Mountains. It has the largest mountain area and the largest national park in Ireland. It is located thirty minutes south of Dublin. It's unique landscape including distinctive features such as the Sally Gap, Powerscourt, the Bray to Greystones Cliff Walk and the early monastic site of Glendalough, make it a popular tourist and recreational user destination.

County Wicklow experiences a maritime temperate climate modified by the North Atlantic Current with mild, damp summers and cool, wet winters. The average temperature is 9.8˚C with an average daily high of 15.4 in July and average of 5.2 in January. Annual rainfall reaches 2,000 mm (79 inches) on the highest mountains with the more westerly peaks getting the most rainfall (for example, Djouce mountain, in the east, receives c. 1,630 mm (64 inches) whereas Duff Hill, in the west, receives c. 1,950 mm (77 inches) a year). Less than 1000 mm of rainfall can occur in some parts of the east of the county in the rain shadow of the mountains. June and July are generally the driest months and there is an average of four hours of sunshine a day over the entire year. Snow cover in winter can reach an average of 50 days a year on the highest peaks. Strong winds are an important factor in peat erosion on the summits.

2.2 TOPOGRAPHY:

The Wicklow Mountains are the dominant topographical feature in County Wicklow forming the largest continuous upland area in the Republic of Ireland. The uplands occupy the largest part of the county stretching north to south through its centre and into surrounding counties including Dublin, Wexford and Carlow. The highest peak is Lugnaquilla at 925m (3035ft). There are 39 peaks over 600m (2,000ft). The mountains are primarily composed of granite surrounded by an envelope of mica-schist and much older rock such as quartzite.

There are only three passes through the mountains under 600m (2,000ft) with the Sally Gap (498m (1,634ft)) and the Wicklow Gap (478 meters (1,567ft)) being the highest road passes in the country.

To the east and west of the uplands the county is characterised by foot hills and valleys with few area of flat terrain most of which is found in the flood plains of rivers. Most of the settlement in the county is found in this

lower lying terrain to the East, West and South of the uplands. These lower lying areas have the best lands with soils and climate most suited to agriculture and human settlement.

The coastal zone in County Wicklow stretches the length of the county over 60 kms. The coastline of Wicklow varies greatly in appearance and in physical composition as one travels from north to south. The northern end of the coast is dominated by the rocky outcrop of Bray Head and the sea cliffs between the towns of Bray and

The Murrough, Wicklow, Summer 2018

Greystones. South of here the coast is characterised by a long straight shingle beach, stretching as far as Wicklow Town, inland of which occurs the largest Wetland complex on the East coast of Ireland. Wicklow Head and sea cliffs form the easternmost point of Ireland, which moving south, gives way to low boulder clay promontories (headlands) interspersed with small shingly coves and the extensive sandy beaches and dunes for which the Brittas Bay area is best known. The Wicklow stretch of coastline ends just south of Arklow with Arklow rock being a notable headland. Active coastal erosion occurs on many parts of the coast, particularly between Greystones and Wicklow and the Brittas Bay area.

2.3 HYDROLOGY:

The Wicklow Mountains are the source of many river systems some of which are large and of regional importance. The River Liffey, rises in the county, and is a major source of water for Greater Dublin. The River Dargle runs to the Irish Sea at Bray. The Avoca River forms from the confluence of the Avonmore and Avonbeg and is joined by the Aughrim river before discharging at Arklow. The River Slaney drains a significant part of the west and southwest of the county. One of the smaller rivers of the county, the River Vartry is also important to Dublin's water supply. East Wicklow has a number of smaller rivers that drain directly from the uplands to the Irish Sea.

Bog fires in Wicklow Uplands 2018

The blanket bogs of the Wicklow mountains have limited capacity to store water and many of the rivers coming off the hills and uplands exhibit a strong spate flow with river basins filling rapidly after heavy rainfall and peak flows can arrive in short time frames to lower lying areas. Pluvial flooding is likely when flow exceeds capacity while a river is in spate flow.

Lakes are small but numerous, located mainly in mountain valleys or glacial corries. They include Lough Dan, Lough Tay, Lough Brae and the lakes of Glendalough.

Two of County Wicklow rivers have been dammed to provide drinking water reservoirs for the Greater Dublin region The first of these was the River Vartry, dammed to create the Varty reservoir near Roundwood in the 1860s. A second dam was added in 1924 to increase capacity. The Poulaphuca reservoir forming the Blessington lakes on the River Liffey was constructed between 1938 and 1940. There are also two hydroelectric plants at Poulaphouca, constructed during the 1940s. A pumped storage hydro-electric plant was constructed at Turlough Hill between 1968 and 1974. Water is pumped up from Lough Nanahangan, a natural corrie lake, into an artificial reserveoir on Tomaneena Mountain and released at times of peak electricity demand.

Bray Head Special Area of Conservation fire, 2018

As well as rivers and lakes Wicklow's water systems contain such features as ponds, aquifers, bogs, springs, coastal waters, wetlands some of which are recognised as being of local, national and EU importance, and many are designated for preservation under national and/or EU legislation. The County Wicklow Wetlands Surveys provide information on the ecological status, of all known and potential freshwater wetlands in the County.

Fire damage Wicklow Mountains National Park 2018

The EU Water Framework Directive (WFD) is an important piece of EU environmental legislation which aims at improving our aquatic environment. It requires governments to take a holistic approach to managing their waters. It applies to rivers, lakes, groundwater, estuaries and coastal waters. For the purpose of implementing the WFD, Ireland has been divided into eight river basin districts or areas of land that are drained by a large river or number of rivers and the adjacent estuarine / coastal areas. The management of water resources will be on these river basin districts. Wicklow has territory in both the Eastern River Basin District (ERBD) and South Eastern River Basin District (SERBD). Within each River Basin District - for the purpose of assessment, reporting and management - water has been divided into groundwater, rivers, lakes, estuarine waters and coastal waters which are in turn divided into specific, clearly defined water bodies. River Basin Management Plans list the current status of our waters and detail the measures needed to protect and improve their status.

2.4 NATURAL HERITAGE:

Wicklow supports a good diversity of natural and semi natural habitats such as marine, coastal, wetland, woodland, lake, river and uplands that in turn support a wide range of associated wild plant and animal species. There are also many geological heritage sites of interest in the County which are an important element of the natural heritage.

The conservation and management of the natural environment must be viewed as a central element in the long term economic and social development of the County. Protecting and enhancing biodiversity and

landscapes is vital for the health, well-being and quality of life of communities today and will also be vitally important in the future in adapting to climate change.

The entire upland area is designated as a Special Area of Conservation and as a Special Protection Area under European Union law.

The Wicklow Mountains National Park was established in 1991 to conserve the local biodiversity and landscape. The dominant habitat of the uplands consists of blanket bog, heath and upland grassland. Mountain blanket bog is found in areas above 200 metres (660 feet) in altitude and where there are more than 175 days rainfall a year. Due to drainage of water from the bogs as a result of human activity, most of Wicklow's peat has dried out too much for Sphagnum mosses to grow and moorland and heath vegetation has taken over. Active peat building is still occurring at some sites, most notably the Liffey Head Bog. The uplands support a number of bird species, including merlin and peregrine falcon.

Air Corp Fire Fighting, Bray Head SAC, 2018

The valleys in the uplands are a mixture of coniferous and deciduous woodland with both types of forest cover extending into lower lying hills along with agriculture where grass based systems predominate. Some tillage is practiced in lower lying areas.

The County Development Plan 2016 to 2022 sets out the strategy for protecting the natural heritage of County Wicklow. Wicklow hosts a wealth of wildlife including a range of threatened habitats and species which are protected by law and are recognised as being of local, national and EU importance. Many habitats and species are designated for protection / preservation under national and/or EU legislation. County Wicklow has one National Park, 17 Special Areas of Conservation5 (SAC), 35 (proposed) Natural Heritage Areas (NHAs), 4 Special Protection Areas (SPA), and 6 Nature Reserves (as set out in Schedules 10.04, 10.05, 10.06 & 10.07 and Maps 10.04, 10.05, 10.06 & 10.07 of the County Development Plan 2016 - 2022).

The Wicklow County Development Plan 2016-2022 also notes the occurrence of protected flora and fauna species is not confined to protected sites. Protected birds, bats, otters and badgers for example are frequently found in the wider countryside, together with a wide range of common plants and animals which are all part of the interrelated natural fabric of the landscape. Rivers and streams and their associated riparian wetlands and habitats are home to a variety of habitats and species. Collectively, these various natural landscape features function as ecological corridors which enable wildlife to exist, move and flourish.

Landslide following heavy rainfall Enniskerry

The coastal areas of County Wicklow are amongst the most sensitive and valuable resources in the County, both in terms of habitats, scenic beauty and recreation. They provide a destination for tourists and attractive settlement areas. A number of areas along the coast are designated protected sites under the Habitats Directive and/or the Birds Directive and therefore any plans or projects with the identified potential to impact on one of these sites should include Appropriate Assessment screening or full Appropriate Assessment and / or an EIS. Seven core objectives for the management and protection of the coastal zone are set in the County Development Plan.

2.5 DEMOGRAPHY:

County Wicklow is populated by 142,425 people (2016 census) and covers a land area of approximately 2,024,000 hectares. The county experienced a population increase of 8.3% between 2006 and 2011. 35% of the population of the County are under the age of 25 years, while 11% are aged over 65 years. CSO data shows that between 1991 and 2011, the largest change in population occurred in the 45 to 64 age group, with an increase of 93% in this age cohort. This will have significant impact on the County's development over the coming years with regard to health care services demand, dependency and housing with the largest concentration along the N11 corridor coastal zone. Approximately 36,800 of the County's population live in rural areas (areas outside of the designated county towns and villages), and while the proportion living in rural areas has declined, County Wicklow's rural population has experienced an increase in population between 2006 and 2011, albeit at a slower rate than urban areas, with a growth of 3.9%. Bray is the largest settlement with 22% of the County's population residing here, followed by proportion of population by Wicklow-Rathnew, Arklow, Greystones-Delgany and Blessington.

Within the county there are 4 main towns:

- Bray (population 32,600),
- Wicklow (10,584) and
- Arklow (population 13,163).
- Greystones and Delgany (population 18,140)

Blessington has a population of 5,520. No other town has a population greater than 5,000. Nine towns, from Kilcoole (population 4,239) down to Kilmacanogue (population 1,043) have between 1,000 and 5,000 people. Approximately 2/3 of the population live in towns and villages. Further and more detailed information on the profile of the county is available in the County Development Plan.

2.6 SOCIO ECONOMIC DEVELOPMENT:

Situated on the east coast of Ireland, County Wicklow's location within the Greater Dublin Area (GDA) and proximity to County Dublin are of key contextual importance in the socio-economic development of the county. Historically, the settlement patterns and economic development of the County have been heavily influenced by the construction of key infrastructure, notably the N11, and railway, which are located close to the east coast and N81 in the west of the county.

A high proportion of the County's working population commute outwards from the County for employment. There is a large component of County Wicklow residents (21,050persons) commuting out of the County for employment, highlighting that Wicklow has a close functional and economic relationship with its surrounding Counties, in particular the connection with the Dublin region.

The highest number of Wicklow residents are working in non-manual sectors (31%) followed by 21% working as employers and managers, while 16% of workers describe themselves as farmers and 8% of workers are higher professionals. Upon review of the employment composition of the various industrial groups, c.30% of working Wicklow residents are employed in the Wholesale, Retail Trade, Transportation and Storage' sector, while a further quarter are employed in Education, Human Health and Social Work related roles.

Wicklow possesses a very high rate of persons commuting outwards from the County for employment, of which 88% are commuting to the Dublin region, demonstrating strong economic interconnections with the Dublin region. Wicklow also provides considerable employment to persons from outside of the County.

There are over 5,300 micro-enterprises operating in County Wicklow (based on CSO 2012 data), incorporating a diverse range of sectors.

2.7 ASSETS AND INFRASTRUCTURE:

Transport in County Wicklow is predominantly by road. Key road infrastructure includes the M11/N11 and the N81 which are the two primary route connecting the county north to south with neighbouring counties and national routes. The uplands are crossed east to west by three regional routes. There is an extensive network of regional and local roads connecting all towns and communities. Bus services link the larger towns and commuter routes into Dublin. Dublin Bus operate services in the north of the county servicing larger commuter communities.

The Dublin to Rosslare railway connects the town of Bray, Greystones, Kilcoole, Wicklow, Rathdrum and Arklow with commuter services and cargo trains operating. Greystones and Bray are also serviced by the DART.

Rural connectivity is an important consideration in County Wicklow connecting smaller towns and the rural hinterland, which is predominantly by road.

County Wicklow has ports in Wicklow and Arklow both under the ownership of Wicklow County Council and has harbours in Bray and Greystones. Both ports are well connected to the national road network via the M11.

Algal bloom, Blessington lakes reservoir.

Wicklow has a growing renewable energy sector with wind energy production both onshore and offshore. Hydro power is generated in Turlough Hill. Plans to extend the offshore capacity will result in County Wicklow being an important contributor into the national grid. The electricity supply network servicing the county and crossing the county is also a key asset.

Water supply and water infrastructure are key regional assets within County Wicklow. Wicklow contains two water supply reservoirs of importance to the Greater Dublin region.

Road lost due to fluvial flooding. Before and after event.

CHAPTER 3: ADAPTATION BASELINE ASSESSMENT INCLUDING CASE STUDIES

Assessment of Baseline provides an understanding of how well adapted Wicklow County Council is to current climate hazards which include extreme weather events and periods of climate variability. This process is a crucially important first step in developing an adaptation strategy that is relevant and responds specifically to the impacts of climate change experienced locally. The assessment takes account of a range of climate hazards that have affected County Wicklow in the past, specifically in respect of local level vulnerability and the impacts and consequences for the delivery of services and functions across the County. While past and recent experiences of climate hazards may not entirely be representative of the longer term climate reality, it is a useful point in the assessment of impacts on local authority services which can further be examined in the context of the identification of future risk, (Chapter 4). Conducting this assessment will illustrate Wicklow County Council's capacity to cope with existing extreme weather events and periods of climate variability and identify the resilience of key services.

3.1 MAJOR METEOROLOGICAL EVENT TIMELINE TO AFFECT COUNTY WICKLOW

Table 3.0 shows information in relation to the date, type and description of each type of climate event which occurred in Ireland from Hurricane Charley in 1986 to present day and which affected County Wicklow and in particular the services being provided by Wicklow County Council.

EXTREME WEATHER EVENTS WHICH AFFECTED COUNTY WICKLOW (*LIST IS NON EXHAUSTIVE)*

YEAR	DATE	EVENT TYPE/NAME	OUTLINE DESCRIPTION	CLIMATE EVENT					
				STRONG WINDS	EXTREME RAINFALL	HEAVY SNOWFALL/LOW TEMPS	SEA LEVEL RISE	DROUGHT	HEATWAVE
2018	September	Storm Ali	Orange wind warning - gale force winds of up to 120km/h, stormy conditions.						
2018	Summer	High Temperatures Heat wave and Drought	High temperatures, heat wave and drought. Interruption to water supply due to lack of raw water storage. Gorse fires - power cuts. Emergency services deployed to fighting gorse fires.						
2018	February/ March	Storm Emma and Best from	Blizzard / Heavy Snowfall / Widespread heavy						

		the East	snow drifting. Disruption to business, water supply, emergency services, power cuts etc.						
2017	21st October	Storm Brian	High Sea levels - Damage to Murrough north of Wicklow Town.						
2017	16th October	Storm Ophelia (Ex-Hurricane Ophelia)	Red warning - Gale Force winds, heavy rain and storm surges along some coasts (flooding). Disruption to business, power cuts etc. Damage to Murrough north of Wicklow Town. Risk to damage of Wexford - Dublin Rail Line.						
2016	January	Heavy Rain	Wettest January on record - 126% of monthly average.						
2015	December	Storm Frank	Orange Wind Warning - Roads impassable - Murrough Damaged - Landslide in Wicklow Town.						
2015	November	Storm Barney	Short term gale force winds. Damage to Wicklow swimming pool roof and Rathnew GAA Clubhouse roof. Widespread water outages due to power cuts.						
2014	12th February	Storm Darwin	Orange warning for strong winds - classified as a 1 in 20 year event.						
2014	5th January	Storm Christine	Orange Warning - High Tides and coastal flooding.						
2013/ 2014	Winter	Winter Storms	Winter Storms - serious coastal damage and widespread, persistent flooding. West Wicklow badly hit with a large number of trees down.						
2011	24th October	Heavy Rain and Flooding	Heavy Rain in County Wicklow. 66mm in 9 hours in Casement Aerodrome approaching 1 in 100 year probability						

			event. Extreme flooding caused.						
2010	November / December	Winter Cold Spell	Lowest Temperatures on record in Dublin Airport (-8.4°C)						
2009/ 2010	Winter	Winter Cold Spell	Coldest Winter in almost 50 years according to Met Éireann.						
2009	November	Severe Flooding	Rainfall totals were highest on record, extensive flooding.						
2008	August	Heavy Rain and Flooding	Heavy rain and extensive flooding.						
2006	Summer	High Temperatures and Heat wave.	Warmest Summer since record breaking 1996						
2002	14th November	Heavy Rain and Severe Flooding	Severe flooding in Eastern Areas. Wettest month on record at Casement Aerodrome.						
2002	1st February	Coastal Flooding	Eastern and Southern coasts - highest tide in 80 years.						
2000	5th November	Severe Flooding	11 - 112mm rainfall Wicklow/Dublin						
1997	24th December	Windstorm	Windstorm						
1995	Summer	High Temperatures Heat wave and Drought	Warmest Summer on record. Mean temperatures over 2°C above normal. Temp rises to 30deg C over a number of consecutive days.						
1993	11th November	Severe Flooding	In excess of 100mm of rain in 24 hour period in East and Midlands.						
1987	12th 13th January	Heavy Snowfall	12 - 19mm snow in the East and Midlands.						
1986	August	Hurricane Charley	Strong winds and rain, worst flooding in 100 years.						

The impacts of climate hazards identified in the table above experienced within County Wicklow have varying and far reaching consequences for the delivery of services and functions by Wicklow County Council both during and in the aftermath of extreme weather events and as a result of periods of climate variability. These consequences have seen widespread services disruption whereby all services and operations closed/ceased for example, during Storm Emma, in 2018. For other events such as heavy or prolonged rainfall events or heat

wave events as in the Summer of 2018, individual services and operations can be put under increased pressure i.e. emergency response, municipal districts and roads sections.

Below are three case studies describing the affect of three different types of weather events:

- Case Study 1: Storms Barney, Desmond, Eva and Frank 2015
- Case Study 2: Storm Emma with snow from 1/03/18 to 7/03/18
- Case Study 3: Heat wave and Drought Summer 2018

3.2 Case Study 1: Storms Barney, Desmond, Eva and Frank 2015

Type of event: The storm season of 2015/2016 was very active particularly in November and December. Four storms in close succession with high rainfall led to very significant flooding in parts of Ireland and the UK with some localised flooding in County Wicklow. Storm Barney on the 17th of November was the first of the four storms that came in quick succession and was notable for its strong gales with gusts of 110 to 130KM/hour causing significant damage and power outages. Storm Desmond followed on the 5th of December with heavy rain and gales. There was a red rainfall warning for parts of the country. Storm Eva on the 22 of December brought gales which were followed by persistent rain. Storm Frank brought severe gales with persistent heavy rain. While gales particularly during Storm Barney caused notable damage it was the impact of high rainfall on saturated lands that was particularly damaging.

Impact of event: The four storms had a wide range of impacts over all five municipal districts and required the mobilisation of significant staff resources, the meeting of the crisis management team from the 30th of December to the 3rd of January and the engagement of 18 Civil Defense volunteers with more on standby. Throughout the overall period the Fire Service reported 14 flood calls.

An example of activity by Wicklow Council at a given point on the 31/12/15 is:

@31/12/15	Sandbags Filled	Staff availability to assist with flooding
Arklow MD	2,400	10 staff &4 contractors
Baltinglass MD	930	GSS & 2/3 staff per area
Bray MD	Not counted	GSS &staff &1 contractor
Greystones MD	500	4/5 staff & 2 contractors
Wicklow MD	450	10 staff & contractor

Works involved preparation works for flood prevention, clean up and immediate repair activities, urgent repairs scheduled after the event and long term rehabilitation and protection measures. Eight homes were flooded but many more and many businesses required sandbagging. Road flooding and closures occurred in all

districts. Road culverts and drains were damaged and clogged with debris, several wall collapses and landslides happened, coastal erosion occurred on Bray seafront, The Murrough Wicklow Town and at Brittas Bay, damage occurred to several reservoirs, the roof was badly damaged on Wicklow Town swimming pool, the weir in Ashford was severely damaged, road margins were washed out in many areas and much minor damage to council properties resulted. On a more positive note it was reported that recent works on the River Slaney had succeeded in protecting the town of Baltinglass.

Road washed away by fluvial flooding , before and after

Cost of event: In the UK and Ireland Barney is estimated to have cost €198 million, Desmond €970 million, Eva €2.2 billion and Frank €310 million. The highest costs occurred as flood levels reached their peak in late December following Storm Eva. Wicklow County Council had a certified expenditure of €2,418,968 for storm damages that could not be met from existing approved resources. The range of damage done to infrastructure was large covering most services in the organisation. Key costs included the repair to Wicklow Town Swimming Pool, €190,000, the damage done to the weir in Ashford, Brittas Bay and the Murrough estimated to cost €954,680, replacement of a bridge paraphet €95,000, extensive repairs required on drains and culverts, carparks, road edges, etc. in five municipal districts €1,355,000, repair of council house roofs €38,000, retained fire crews €24,388, damage to Wicklow library €1,000.

3.3 Case Study 2: Storm Emma Snow 1/03/18 to 7/03/18

Type of event: Storm Emma was one of the most significant snow fall events in recent years. It occurred from 27th February to 7th March 2018. It involved a blocking high pressure system bringing cold winds with sub zero temperatures day and night. It was a depression which formed in the Bay of Biscay and brought moisture laden air northwards over Ireland. When the moisture laden air of Storm Emma met the cold air from the east, heavy precipitation occurred in the form of snow.

Accumulations of 10 to 20 cm occurred countywide but with much higher levels in places. The highest recorded accumulation nationwide was 69 cm in Glenmacnass. On the 2nd of March there were blizzard conditions. Drifting of snow, up to 2 metres, was widespread and in places reached up to 4 metres. The blizzards caused power outages in many areas and the felling of trees and branches.

Climate Change is predicted to increase winter precipitation and may increase the intensity of upper stratosphere heating over Polar Regions. Upper stratosphere heating over the North Pole creating a large blocking high pressure system and a depression with high humidity levels were prominent causes of this weather event.

Melt water Arklow, Storm Emma 2018

Impact of event: Power outages were reported in many areas of the county with the ESB reporting a total of 100,000 homes and businesses affected nationwide. Eir reported a loss of service to 10,000 customers nationwide and Irish Water reported that 18,000 homes were without water in the country.

The Severe Weather Coordination group first met on the 26th of February and met a total of 9 times up to the 7th of March. Most roads in the county were impassable with the N11 down to a single lane and the N81 closed with deep drifts.

Work to clear roads commenced immediately prioritising access to medical services, with the Civil Defence playing a key role in the movement of patients. Support from the defence forces was requested. As well as mobilising all local authority resources, additional plant and equipment was sought from contractors, farmers, quarries etc. Over 90 items of plant were in use at the peak of road clearance activities. All roads were cleared to at least a single track by the 7th of March.

The Fire services dealt with 21 incidents between the 28/2/18 and the 5/3/18. Retained fire crews were on standby for the event.

Boil water notices were issued from Aughrim, Annacurra and Barndarrig following the mechanical failure of chlorine pumps. Water restrictions were put in place for the Greater Dublin region as treated water supplies ran low.

Clearing the roads during Storm Emma.

Monitoring for flooding was undertaken in all areas with flood plans put into operation in Bray and Arklow. The storm surge caused flooding of three houses in Wicklow Town and some damage to the coast. The Murrough recycling centre suffered minor flooding.

Work was undertaken to assist homeless people in the county. Night shelters were provided. Extra hours were resourced for the Homeless Day service provided by the Five Loaves in Bray. Individuals who did not wish to access services were provided with essential supplies.

Cost of event: The principle costs for Storm Emma were related to snow clearance. €677,830 of certified expenditure was recorded on the clearance of snow from the road network. The highest expenditure was in the hire of external contractors with plant and machinery. Staff overtime to maintain gritting and ploughing through the night time and over the weekend was also notable. The Fire service also had very significant costs.

Erosion from Storm surge, Storm Emma.

Damage to the road network by the freezing weather and the thaw was the biggest cost. Each of the municipal districts estimated the costs of damage to the road network in their areas as shown below. The Tinahely area recorded the most damage followed by the Blessington area. The total estimate for repairs came to €5,938,839.50.

Tinahely	€2,538,750.00
Blessington	€1,480,895.00
Arklow	€753,000.00
Wicklow	€728,394.50
Greystones	€380,000.00
Bray	€57,800.00
	€5,938,839.50

The council has liaised with the OPW in relation to possible inclusion of the harbour area of Wicklow Town which was affected by flooding in a minor works programme.

Emergency repairs were undertaken to repair the roof of the Bray recycling centre damaged by the accumulation of snow but more extensive repairs are needed in the future.

3.4 CASE STUDY 3: HEAT WAVE AND DROUGHT SUMMER 2018

Type of event: The summer of 2018 was notable for warmer than average temperatures, close to records achieved in 1976, and lower than average rainfall with less than a third of normal amounts. After a very cold spell in March temperatures were above average in April and May before becoming very warm through June, July and into August. A heat wave was declared on the 22nd of June with temperatures above 30.C. On the 5th of July an absolute drought was declared leading to a nationwide hosepipe ban. Rainfall, when it did come later in July and August, was more notable in the northwest of the country with low rainfall levels persisting in the south east. The hose pipe ban was kept in situ for the Greater Dublin region until September. Lower than average rainfall and then a heat wave created a significant fire risk. A red warning was issued by the Department of Agriculture for forest fires nationwide. On a more positive note it also created more demand for rural and coastal tourism and recreation.

Fire Services at scene of fire on Bray Head 2018

Low water levels in Vartry reservoir and algal bloom in Blessington lakes, 2018

Impacts and Cost of event: Gorse, forest, grass and dune fires became the biggest issue as a result of prolonged low rainfall and high temperatures. In a typical year such fires would be more common in early spring when land is being cleared of gorse for cultivation. Data supplied by Wicklow Fire service shows a significant anomaly in 2018 as activity which was normal in April, then showed a doubling of incidents over what should be expected in May. The number of fires in June, when little activity would be expected, rose to unprecedented levels.

Month	Number of incidents	Costs
April	19	€12,540
May	33	€37,125
June	132	€84,288

Protecting houses,
Bray Head Fire, 2018

This trend continued through the summer and early autumn particularly in early July and it is estimated that the fires cost Wicklow County Council an additional €170,000 to operate Fire services above normal expenditure.

The scale and extent of fires had other highly significant impacts, some involving risks to life and property. Not all impacts were measured or fully costed.

A fire on Bray head on the 14th of July was particularly significant. Several homes had to be evacuated. The Dart service had to be suspended for a day due to poor visibility. The Air Corps were called in and dumped 150,000 litres of water on the fire. The extent of the fire covered a large part of Bray Head and did significant damage to biodiversity in a Special Area of Conservation. Several homes were threatened by the fire and needed to be evacuated. In Kilmacanogue on June the 28th a school and housing estate were threatened by a gorse fire. The school and several houses were evacuated. On that day Fire services were also dealing with serious fires in Windgates, Greystones, Kippure, and Glencree. Gardai had to issue a warning about poor visibility in the Wicklow uplands on July the 2nd due to the large extent of fires.

Fire Services and Air Corp fighting bog fires in the Wicklow Uplands

On the 5th of July a state of absolute drought was declared. Irish Water introduced a national water conservation order commonly known as a hosepipe ban on the 6th of July. This restricted use of water for certain activities including watering the garden or washing vehicles. Many Tidy Towns groups adapted their watering programmes seeking water from supplies other than mains.

The drought also had a significant impact in Wicklow on fodder production. In some case farmers had to graze livestock on lands intended for silage production. Horticultural suppliers in the county were also challenged to maintain sufficient irrigation for their production.

The good weather brought increased visitor numbers, which proved a welcome boost for many local businesses. Key sites however were often challenged in the management of parking and litter control, including beaches, the Blessington lakes, Glendalough and the uplands. Brittas Bay was busy and as parking filled local properties provided an alternative with parking on the road causing congestion. Litter management was also a concern on the Blue Flag beaches of Brittas Bay. The skips at Brittas Bay required emptying every second day at the peak of the heat wave. Litter left on the beach became a daily problem. Local volunteers with Coast care played a role in cleaning the beach daily.

Litter collected on Brittas Bay Beach following a busy day with visitors during Summer 2018.

3.5: Method of Assessing Current Baseline

LEVEL	CONSEQUENCE	DESCRIPTION
5	Catastrophic	Widespread service failure with services unable to cope with wide-scale impacts. Irrecoverable environmental damage. Large numbers of serious injuries or loss of life.
4	Major	Services seen to be in danger of failing completely with severe/widespread decline in service provision and quality of life. Severe loss of environmental amenity. Isolated instances of serious injuries.
3	Moderate	Service provision under severe pressure. Appreciable decline in service provision at community level. Isolated but significant instances of environmental damage that could be reversed. Small number of injuries.
2	Minor	Isolated but noticeable examples of service decline. Minor environmental damage
1	Negligible	Appearance of threat but no actual impact on service provision.

CLIMATE HAZARD (EVENT):	Heatwaves and drought					
Meteorological / Climatological Conditions:	On a national basis, temperatures were above normal with heat wave conditions recorded at various times and stations between the 24th of June and 4th July. Absolute drought conditions were reported at 21 stations (22nd May to 14th July) with partial drought conditions being reported for some stations between the 18th June to 14th July (Source: Met Éireann)					
Operational Area	**Impact**	**Exposure & Sensitivity**	**Existing Adaptive Response**	**Consequence**		**Other Relevant Actors**
				Level	**Description**	
GOVERNANCE AND BUSINESS OPERATIONS						
Governance	More call outs for emergency services.	Upland areas of gorse, forest and bog. Coastal dune systems	Emergency response by fire services.	3	Loss of priority habitat. Temporary closure DART. Impact on businesses. Increased call outs emergency services	NPWS. Coillte. DART. Gardaí.
	Pressure on recreational and tourism resources	Blue Flag beaches. National Park heritage sites.	Litter warden visits. Staff monitoring visits. Increased clean ups.	2	Damage to amenity. Clean up costs. Traffic and parking management.	NPWS, Gardaí, Coast care Group.
	Staff welfare	Working outdoors leading to dehydration, sun exposure	Provision advice water, sun glasses and sunscreen.	1	Increased cost for protection. Staff fatigue.	

Operational Area	Impact	Exposure & Sensitivity	Existing Adaptive Response	Consequence		Other Relevant Actors
				Level	Description	
Business Operations	Increase in visitors due to good weather	Creation of business opportunities due to increased visitor activity	Business support through LEO and Leader	1	Increased revenue for businesses and demand for accommodation	Fáilte Ireland.
INFRASTRUCTURE AND BUILT ENVIRONMENT						
Roads/ Footpaths, bridges, projects construction and maintenance	Faster rate of deterioration due to melting tar.	Local roads comprising of tarred and chipped surfaces. Cracking due to shrinkage.	Chipping and emergency works. Scheduling of more intensive repair.	2	Increased costs and staff overtime. Reputational damage.	TII
	Roads closed due to fires or tree fall.	Temporary closure of roads. Accident risk.	Call out of fire service and municipal district staff	3	Increased costs and staff overtime. Risk to life.	Emergency Services.
	Slippery roads due to build up of residues	Risk of accidents when drivers unprepared.	Road safety advisory notices	1	Risk to life. Planned notification.	RSA
Public Transport Services.	Extra demand on services from recreational users	Delays to service	Consultation with key partners	1	Insufficient Public Transport. Car parking facilities overloaded.	Gardaí, Iarnród Éireann, TII, Private Bus Operators.
Building Stock - LA Buildings and social housing stock.	Damage and deterioration of housing stock due to shrinkage.	Housing Stock. LA tenants.	Possible re-housing of tenants. Programming of repairs	1	Repair costs. Disruption to tenants.	LA Tenants.

Operational Area	Impact	Exposure & Sensitivity	Existing Adaptive Response	Consequence		Other Relevant Actors
				Level	Description	
Community Infrastructure	Increased users and demand for recreational resources including swimming pools, parks, beaches, playgrounds.	Wear and tear on infrastructure including both natural and built. Litter management issues.	Clean up and repair	2	Positive for local businesses. Increased repair and maintenance issues.	NPWS. Coast care groups, Garda
	Water use restrictions in drought.	Scarcity of water for maintenance of public spaces, swimming pools	Reduce water consumption. Use of river water sources	1	Challenging for community groups such as Tidy Towns	Tidy Towns
	Public safety	Water safety on blue flag beaches. Public safety with car parking issues. Risk to life at undesignated bathing spots.	Monitoring of issues	2	Growing visitors numbers need to be managed	NPWS, Water Safety Authority
	E-coli or Algal bloom health concerns	Beach closure due to Algal bloom or e-coli outbreak	Monitoring of water quality with closure of beaches if required	2	Loss of recreational resource. Environmental water quality decline. Threat of Blue Flag loss	An Taisce
WATER AND SEWERAGE SERVICES						
Storm water/ Sewerage	Change in water levels in rivers and groundwater.	Can affect capacity to absorb run off and to cope with environmental pollution.	Monitoring of Water quality with reporting of pollution incidents	2	Pollution of rivers and coastal waters. Threat to Blue flag beaches.	An Taisce, EPA

Operational Area	Impact	Exposure & Sensitivity	Existing Adaptive Response	Consequence		Other Relevant Actors
				Level	Description	
	Reduced capacity of soil to absorb rain following drought	Can lead to increased runoff and increased pressure on drains	Maintenance of drains and storm water channels	2	Flooding at end of drought event	
Wastewater	Interruption to anaerobic process	Decrease in plant efficiency	Monitoring	1	Decreased efficiency. Complaints.	Irish Water
Water Supply	Increased demand and water scarcity	Reduced availability for all sectors	Awareness campaigns. Adaptation work programmes to reduce consumption	2	Hose pipe bans. Impact on town team activities and management of landscaped areas	Irish Water
Water Quality	Deterioration in water quality	Runoff from land following dry period or due to low water levels may increase nutrient load and affect species distribution and phenology. Impact on Blue Flag beaches	Monitoring of water quality.	2	Loss of Blue Flag. Loss of Biodiversity.	EPA
NATURAL RESOURCES AND FLOOD MANAGEMENT						
Biodiversity	Increased number of gorse, forest, bog and sand dune fires	Damage to sensitive ecosystems. Loss of biodiversity. Threat to property and life. Air quality.	Emergency response by fire services.	3	Significant damage to environment. Can result in injury and some disruption to services.	Gardai, Iarnrod Eireann, NPWS, Coillte

Operational Area	Impact	Exposure & Sensitivity	Existing Adaptive Response	Consequence		Other Relevant Actors
				Level	Description	
	Increased pressure on dune systems and some upland habitats leading to erosion.	High level of damage to dune systems. Erosion on walking trails in some upland sites	Monitoring of dunes and public notices. Maintenance access routes to beach. Trail repairs.	3	Loss of vegetation on dunes leading to rapid erosion. Scarring on popular mountain routes	NPWS
	Shift in distribution of plant and animal species leading to loss of biodiversity	Change in ecosystem composition in sensitive habitats including bogs and dune systems. Loss of trees due to soil shrinkage and stress.	None currently	2	Risk of habitat loss and loss of biodiversity	NPWS
Weed/Pest Management - Area Offices	Change rate of coverage and spatial distribution for invasive species	Rapid expansion of some species endangering habitats, marine and freshwater environments, and built environment	Monitoring of distribution of key species including Giant Hogweed and Japanese Knotweed with signage used for awareness and pilot control measures in public realm	2	Habitat and environmental damage	NPWS, Coillte
Coastal Management	Increased pressure on dune systems leading to erosion.	High level of damage to dune systems.	Monitoring of dunes and public notices. Maintenance access routes to beach. Trail repairs.	3	Loss of vegetation on dunes leading to rapid erosion.	NPWS
COMMUNITY HEALTH AND WELLBEING						
Community and Economic Development	Deterioration in agricultural productivity	Fodder shortage and loss of income in rural farming communities	Rural employment diversification	2	Loss of livelihood in rural areas	IFA

Operational Area	Impact	Exposure & Sensitivity	Existing Adaptive Response	Consequence		Other Relevant Actors
				Level	Description	
	Pressure on drinking water supplies affecting householders and local businesses	Limitations on water usage. Restrictions affecting businesses in the hospitality sector	Public advisory notices. Hosepipe bans.	2	Low water availability	Irish Water

CLIMATE HAZARD (EVENT):	Strong Winds and Storms					
Meteorological / Climatological Conditions:	Winter of 2013 -2014: A run of winter storms, culminating in serious coastal damage and widespread, persistent flooding. Storm force winds occurred on 12 different days. Rainfall amounts of 1 ½ to 2 times above the normal and to saturated or waterlogged ground throughout the Country. Wind speeds above average for winter.					
Operational Area	**Impact**	**Exposure & Sensitivity**	**Existing Adaptive Response**	**Consequence**		**Other Relevant Actors**
				Level	**Description**	
GOVERNANCE AND BUSINESS CONTINUITY						
Governance	Building Closure and damage. Cancellation of work. Emergency protocol in operation.	Unsafe travel conditions for staff and public. Damage to public building stock.	Non critical staff and public advised not to travel when weather warnings warrant such action. Major emergency team deployed.	3	Buildings close due to risk of injury if travelling in high winds. Emergency call outs. Repair costs.	Gardai, Ambulance service.
	Loss of electricity and mobile network	Closure of buildings. Impact on IT and central server. Loss of broadband and mobile services. Loss of water and recycling services	Dependence on own personal services. Generators for key sites. Public notices.	3	Loss of communication and operating systems	Irish Water, ESB.
Asset Management.	Damage community amenities.	Clean up and repair of damage done to community amenities	Staff engaged in cleanup and repair. Cost	1	Staff redeployment	Community Groups.

Operational Area	Impact	Exposure & Sensitivity	Existing Adaptive Response	Consequence		Other Relevant Actors
				Level	Description	
INTRASTRUCTURE AND BUILT ENVIRONMENT						
Roads/Footpaths, bridges, projects construction and maintenance.	Road closures due to tree fall and blockage.	Temporary closure of roads. Accident risk.	Call out of fire service and municipal district staff.	3	Increased costs and staff overtime. Risk to life.	Emergency services. Gardaí.
	Suspension of construction projects.	Temporary closure of projects. Accident risk.	Secure and shut down projects.	1	Staff safety concerns. Risk form debris	
	Road traffic incidents.	Call out of fire services. Temporary road closures.	Fire and emergency service deployment.	2	Risk to life. Traffic disruption	Emergency services. Gardaí.
Public Transport Services.	Closure or delay to public transport services.	Commuters unable to travel to work. Rural communities isolated.	Non critical staff and public advised not to travel when weather warnings warrant such action. Major emergency team deployed.	2	Lack of Public Transport. Road network overloaded.	Gardaí, Armed Forces, Civil Defence, Iarnród Éireann, TII, Private Bus Operators.

Operational Area	Impact	Exposure & Sensitivity	Existing Adaptive Response	Consequence		Other Relevant Actors
				Level	Description	
Surface Water Drainage	Exceedance in drainage capacity causing localised and larger scale flooding.	Flooding to business and domestic properties. Road closure. Water Quality affected due to combined sewer overflows.	Fire Service and Civil Defence Deployed.	3	Blocked/Closed Roads. Difficulty in obtaining insurance cover. Over stretched resources. Challenges to Wastewater infrastructure.	Gardaí, Civil Defence, Irish Water.
Building Stock - LA Buildings and social housing stock.	Damage and deterioration of housing stock and LA buildings due to storm damage. Building closure.	La Housing Stock and LA Building Stock.	Possible re-housing of tenants. Repairs	2	Repair costs. Disruption to tenants. Loss of service due to building closure.	LA Tenants.
Flood Defences and Coastal Infrastructure	Exceedance of existing flood defences through combination tides and wind.	Coastal flooding causing damage to property and coastal infrastructure.	Sandbagging of properties and cleanup operations. Temporary closure of facilities. Coastal defence works.	4	Threat to property and key infrastructure. Risk to life.	Iarnroid Eireann, OPW, Civil Defence.
	Increased Coastal Erosion and Inundation	Coastal flooding causing damage to property and coastal infrastructure.	Sandbagging of properties and cleanup operations. Temporary closure of facilities. Coastal defence works.	4	Threat to property and key infrastructure. Risk to life.	Iarnroid Eireann, OPW, Civil Defence.

Operational Area	Impact	Exposure & Sensitivity	Existing Adaptive Response	Consequence		Other Relevant Actors
				Level	Description	
	Destruction, damage and disturbance to Council managed Port and marine facilities	Damage to property and infrastructure	Cleanup and repair operations	2	Insurance premiums and repair costs.	Management companies for marinas.
Community Infrastructure	Damage to community infrastructure	Damage to green infrastructure and built recreational facilities	Closure and advisory notice to prevent risk to life. Clean up.	3	Loss of green infrastructure increases risk to built infrastructure. Repair and maintenance.	
	Damage to heritage sites	Storm damage to natura sites	Monitoring. Repair works	2	Loss or damage to heritage	OPW, NPWS
Electricity Supply	Loss of Power.	Building Closure due to loss of power, IT systems, heating and communication systems. Economic impact across county.	Emergency Response Team Members being able to communicate via conference call etc. from home.	2	Service closure. Communication challenges	ESB
Cultural/Heritage	Damage to cultural and heritage assets.	Loss or damage to assets of national intrinsic historical importance. Disruption to services with loss of tourism revenue.	Maintenance of historic buildings owned by the council. County Heritage plan.	2	Risk of damage or loss of historic, natural and cultural heritage	OPW, NPWS DCHG, Heritage Council
	Cancellation of events	Disruption to events impacting on number of visitors and users	Bad weather planning and rescheduling	1	Loss of revenue. Threat to viability.	Local groups funded by WCC

Operational Area	Impact	Exposure & Sensitivity	Existing Adaptive Response	Consequence		Other Relevant Actors
				Level	Description	
WATER AND SEWERAGE SERVICES						
Storm water/ Sewerage	Inundation of storm water and sewage infrastructure	Can cause flooding or pollution of waterway with sewage	Monitoring of water quality. Diversion of storm waters from sewage system	2	Significant pollution threat	Irish Water.
	Loss of Power.	Shut down of pumping stations and treatment plants	Collaboration with Irish Water	3	Threat to plant function. Risk of pollution incident.	Irish Water
Wastewater	Inflow and infiltration to wastewater network	Excess demand on operation capacity of plant	Diversion of storm water. Coordination with Irish Water.	2	Pollution threat	Irish Water
Water Supply	Contamination due to salinisation of surface water and ground water supplies during storm surges or flooding of waste water treatment.	Cause flooding or pollution of waters with salt water or sewage.	Monitoring of water quality. Diversion of storm waters from sewage system	2	Significant pollution threat	Irish Water.
NATURAL RESOURCES AND FLOOD MANAGEMENT						
Biodiversity	Damage to habitats	Most noticeable in dune estuarine and coastal habitats but can affect all habitats type. Loss of biodiversity and tree cover. Erosion of soils.	Monitoring. Repair works on council properties	3	Erosion and habitat loss	NPWS

Operational Area	Impact	Exposure & Sensitivity	Existing Adaptive Response	Consequence		Other Relevant Actors
				Level	Description	
Coastal Management	Inundation, leading to coastal erosion, loss of infrastructure, and damage to property and assets.	Cost of urgent repairs and clean ups. Loss of services. High cost of remedial action to prevent further inundation. Impact on tourism. Loss of biodiversity	Clean up and repair. Public advisory notice.	3	Damage to property and assets. Risk to life.	Iarnroid Eireann, OPW.
	Change to wetland and coastal sites through saltwater intrusion	Impact on water quality and biodiversity. Increased vulnerability to erosion.	Monitoring water quality	2	Loss of water quality. Habitat loss.	NPWS
LANDUSE AND DEVELOPMENT POLICY						
Spatial Planning and Land use	Limitation on suitability of land for urban expansion	Increased risk for development near coastal areas	Planning	3	Land vulnerable to increasing risk of flooding and erosion.	
	Increasing uncertainty over long term land use planning and infrastructure design	Changing design standards, changing ability to cope with weather events. Loss of or damage to property and community assets.	Planning guidelines	3	Increased restrictions on location and design standards	
	Wear and tear on infrastructure	Early retirement or increased maintenance of infrastructure due to extreme weather.	Long term planning and financial accounting	2	Risk of infrastructure failure	
COMMUNITY HEALTH AND WELLBEING						
Community and Economic Development	Damage to property streetscapes and community assets	Cost of repairs and risk of injury	Monitoring of community assets. Maintenance and repair	2	Costs and risk of injury	

Operational Area	Impact	Exposure & Sensitivity	Existing Adaptive Response	Consequence		Other Relevant Actors
				Level	Description	
	Destruction community assets and private property through erosion	Loss or damage to property and infrastructure in coastal zone.	Repairs to community assets	2	Repairs and replacement	
	Risks to local commuters and pedestrians from debris or slippery conditions	Risk of injury from debris, slippery roads and footpaths and high winds.	Public advisory notice not to travel	3	Danger of injury or loss of life. Pressure on emergency services	
	Deterioration in agricultural productivity	Fodder shortage and loss of income in rural farming communities	Rural employment diversification	2	Loss of livelihood in rural areas	IFA

CLIMATE HAZARD (EVENT):	Snow and Ice / Low Temperatures					
Meteorological / Climatological Conditions:	March 2018, Storm Emma: Widespread heavy falls of drifting snow occurred on 3 consecutive days with accumulations of up to 69cm in the Wicklow Mountains. Widespread snowfalls also occurred again 2 weeks later.					
Operational Area	**Impact**	**Exposure & Sensitivity**	**Existing Adaptive Response**	**Consequence**		**Other Relevant Actors**
				Level	**Description**	
GOVERNANCE AND BUSINESS OPERATIONS						
Governance	Building Closure and damage. Cancellation of work. Emergency protocol in operation.	Unsafe travel conditions for staff and public. Damage to public building stock.	Non critical staff and public advised not to travel when weather warnings warrant such action. Major emergency team meet.	3	Buildings close due to risk of injury if travelling in high winds. Emergency call outs. Repair costs. Loss to business, Retail and Agricultural Sectors.	Gardaí, ambulance service.
	Gritting operations.	Health and well being of key staff involved in gritting.	Monitoring of staff rotation and scheduling.	4	Serious disruption and loss of access to communities. High dependence on key staff and services. Increased operating costs.	Gardaí, ambulance service, Civil Defence, Armed Forces.

Operational Area	Impact	Exposure & Sensitivity	Existing Adaptive Response	Consequence		Other Relevant Actors
				Level	Description	
	Loss of electricity and mobile network.	Closure of buildings. Impact on IT and central server. Loss of broadband and mobile services. Loss of water and recycling services.	Dependence on own personal services. Generators for key sites. Public notices.	3	Loss of communication and operating systems.	Irish Water, ESB.
Asset Management.	Damage community amenities.	Clean up and repair of damage done to community amenities.	Staff engaged in cleanup and repair. Additional costs.	1	Staff redeployment.	Community Groups.
INFRASTRUCTURE AND BUILT ENVIRONMENT						
Roads/Footpaths, bridges, projects construction and maintenance.	Faster rate of deterioration due to freeze thaw.	Local roads comprising of tarred and chipped surfaces. Erosion of loosened material during thaw.	Chipping and emergency works. Scheduling of more intensive repair.	2	Increased costs and staff overtime. Reputational damage.	TII
	Road closures due to blockage from snow.	Temporary closure of roads. Accident risk.	Staffing of ploughing and gritting . Civil defence engagement. Emergency Team coordination.	4	Increased costs and staff overtime. Risk to life. Rural isolation.	Emergency services, civil defence, armed forces.
	Slippery footpath and surfaces.	Risk of injury to pedestrians. Elderly confined.	Public notices to clear footpaths and look out for house bound neighbours. Deployment of staff, civil defence, armed forces to clear paths.	3	Coordination of response. Risk of injury. Staff costs.	Civil defence, local radio, Armed forces.

Operational Area	Impact	Exposure & Sensitivity	Existing Adaptive Response	Consequence		Other Relevant Actors
				Level	Description	
Public Transport Services.	Closure or delay to public transport services.	Commuters unable to travel to work. Rural communities isolated.	Non critical staff and public advised not to travel when weather warnings warrant such action. Major emergency team deployed.	2	Lack of Public Transport. Road network overloaded.	Gardaí, Armed Forces, Civil Defence, Iarnród Éireann, TII, Private Bus Operators.
Surface Water Drainage	Exceedance in drainage capacity causing localised and larger scale flooding following a thaw.	Flooding to business and domestic properties. Road closure. Water Quality due to combined sewer overflows.	Fire Service and Civil Defence Deployed.	3	Blocked/Closed Roads. Difficulty in obtaining insurance cover. Over stretched resources. Challenges to Wastewater infrastructure.	Gardaí, Civil Defence, Irish Water.
Building Stock - LA Buildings and social housing stock.	Damage and deterioration of housing stock and LA buildings due to storm damage. Building closure.	La Housing Stock and LA Building Stock.	Possible re-housing of tenants. Closure of LA Buildings for repairs.	2	Repair costs. Disruption to tenants. Loss of service due to building closure.	LA Tenants.
	Increased need for heat.	LA Tenants	Increased Fuel Allowance from Central Govt.	1		

Operational Area	Impact	Exposure & Sensitivity	Existing Adaptive Response	Consequence		Other Relevant Actors
				Level	Description	
Community Infrastructure	Damage to community infrastructure	Damage to green infrastructure and built recreational facilities	Closure and advisory notice to prevent risk to life. Clean up.	3	Deterioration of green infrastructure increases risk to built infrastructure. Repair and maintenance.	
Electricity Supply	Loss of Power.	Building Closure due to loss of power, IT systems, heating and communication systems. Economic impact across county. Access to key infrastructure.	Emergency Response Team Members being able to communicate via conference call etc. from home.	2	Service closure. Communication challenges	ESB
WATER AND SEWERAGE SERVICES						
Stormwater/Sewerage	Loss of Power.	Shut down of pumping stations and treatment plants	Collaboration with Irish Water	3	Threat to plant function. Risk of pollution incident.	Irish Water
Water Supply	Leakage of water through freeze damage	Loss of water supply to individual properties. Demand can exceed treatment capacity	Collaboration with Irish Water	1	Emergency repairs under Service level agreements with Irish Water.	Irish Water
NATURAL RESOURCES AND FLOOD MANAGEMENT						
Biodiversity	Falling trees	Falling trees or tree branches due to weight of snow	Promotion of tree planting. Participation in National Tree Week	1	Loss of mature trees	

Operational Area	Impact	Exposure & Sensitivity	Existing Adaptive Response	Consequence		Other Relevant Actors
				Level	Description	
	Reduced resilience of habitats and change in distribution of species	Damage to ecosystems and habitats	None at present	1	Habitat loss	NPWS
Weed/Pest Management - Area Offices	Changed rate of coverage and spatial distribution for invasive species	Rapid expansion of some species endangering habitats, marine and freshwater environments, and built environment	Monitoring of distribution of key species including Giant Hogweed and Japanese Knotweed with signage used for awareness and pilot control measures in public realm	2	Habitat and environmental damage	NPWS, Coillte
COMMUNITY HEALTH AND WELLBEING						
Community and Economic Development	Risks to local commuters and pedestrians from debris or slippery conditions	Risk of injury from debris, slippery roads and footpaths. Roads or footpaths impassable.	Public advisory notice not to travel	3	Danger of injury or loss of life. Pressure on emergency services	
	Isolation of communities	Social exclusion and isolation particularly for elderly. Food supplies and access to medical services may be difficult	Public advisory notice. Call out of civil defence	3	Danger of injury or loss of life. Pressure on emergency services	Civil defence, local radio, Armed forces.
	Deterioration in agricultural productivity	Fodder shortage and loss of income in rural farming communities	Rural employment diversification	2	Loss of livelihood in rural areas	IFA

CLIMATE HAZARD (EVENT):	High Sea Levels and Coastal Flooding					
Meteorological / Climatological Conditions:	A combination of high winds, heavy rainfall and tide surges resulting in increased high sea levels and subsequent coastal erosion. Storm Frank in Dec 2015 and Storm Ophelia in October 2017 were examples of this combination which resulted in coastal erosion to the Murrough, North of Wicklow Town.					
Operational Area	**Impact**	**Exposure & Sensitivity**	**Existing Adaptive Response**	**Consequence**		**Other Relevant Actors**
				Level	**Description**	
GOVERNANCE AND BUSINESS OPERATIONS						
Governance	Coastal Flooding	Damage to properties, sea defences, critical infrastructure, services.	Emergency response by Fire services and LA staff, deployment of sandbags. Closure of services. Cautionary advice to public.	3	Call out fire service and other services. Staff fatigue. Cost. Safety.	Iarnród Éireann. Irish Water.
Asset Management	Damage community amenities.	Clean up and repair of damage done to community amenities	Staff engaged in cleanup and repair. Cost	1	Staff redeployment	Community Groups
Public Transport Services.	Closure or delay to public transport services.	Commuters unable to or delayed in travelling to work.	Major emergency team deployed.	2	Lack of Public Transport. Road network overloaded.	Iarnród Éireann.

Operational Area	Impact	Exposure & Sensitivity	Existing Adaptive Response	Consequence		Other Relevant Actors
				Level	Description	
Surface Water Drainage	Exceedance in drainage capacity causing localised and larger scale flooding	Flooding to business and domestic properties. Road closure. Water Quality due to combined sewer overflows.	Fire Service and Civil Defence Deployed.	2	Blocked/Closed Roads. Difficulty in obtaining insurance cover. Over stretched resources. Challenges to Wastewater infrastructure.	Gardaí, Civil Defence, Irish Water.
INFRASTRUCTURE AND BUILT ENVIRONMENT						
Building Stock - LA Buildings and social Housing Stock.	Damage and deterioration of housing stock and LA buildings due to storm damage. Building closure.	La Housing Stock and LA Building Stock.	Possible re-housing of tenants. Closure of LA Buildings for repairs.	2	Repair costs. Disruption to tenants. Loss of service due to building closure.	LA Tenants.
Flood Defences & Coastal Infrastructure.	Lower threshold for exceedance of existing flood defences through combination tides and wind.	Coastal flooding causing damage to property and coastal infrastructure.	Sandbagging of properties and cleanup operations. Temporary closure of facilities. Coastal defence works.	4	Threat to property and key infrastructure. Risk to life.	Iarnród Éireann, OPW, Civil Defence.
	Increased Coastal Erosion and Inundation	Coastal flooding causing damage to property and coastal infrastructure.	Sandbagging of properties and cleanup operations. Temporary closure of facilities. Coastal defence works.	4	Threat to property and key infrastructure. Risk to life.	Iarnród Éireann, OPW, Civil Defence.
	Destruction, damage and disturbance to Council managed Port and marine facilities	Damage to property and infrastructure	Cleanup and repair operations	2	Insurance premiums and repair costs.	Management companies for marinas.

Operational Area	Impact	Exposure & Sensitivity	Existing Adaptive Response	Consequence		Other Relevant Actors
				Level	Description	
Community Infrastructure.	Damage to community infrastructure	Damage to green infrastructure and built recreational facilities	Closure and advisory notice to prevent risk to life. Clean up.	3	Loss of green infrastructure increases risk to built infrastructure.	
	Damage to heritage sites	Storm damage to natura sites and built heritage	Monitoring. Repair works	2	Loss or damage to heritage	OPW, NPWS
Cultural/Heritage.	Damage to cultural and heritage assets.	Loss or damage to assets of national intrinsic historical importance. Disruption to services with loss of tourism revenue.	Maintenance of historic buildings owned by the council. County Heritage plan.	2	Risk of damage or loss of historic, natural and cultural heritage	OPW, NPWS DCHG, Heritage Council
WATER AND SEWERAGE SERVICES						
Stormwater/Sewerage.	Inundation of storm water and sewage infrastructure	Can cause flooding or pollution of waterway with sewage	Monitoring of water quality. Diversion of storm waters from sewage system	2	Significant pollution threat	Irish Water.
Wastewater	Inundation of storm water and sewage infrastructure	Can cause flooding or pollution of waterway with sewage	Monitoring of water quality. Diversion of storm waters from sewage system.	2	Significant pollution threat	Irish Water.
Water Supply	Contamination due to salinisation of surface water and ground water supplies.	Cause flooding or pollution of waters with saltwater.	Monitoring of water quality.	2	Pollution threat	Irish Water.

Operational Area	Impact	Exposure & Sensitivity	Existing Adaptive Response	Consequence		Other Relevant Actors
				Level	Description	
Water Quality	Saline intrusion of water.	Sea level rise and storm surges	Monitoring.	2	Impact on biodiversity and loss of green infrastructure	
NATURAL RESOURCES AND FLOOD MANAGEMENT						
Biodiversity	Saline intrusion of water.	Sea level rise and storm surges	Monitoring.	2	Impact on biodiversity and loss of green infrastructure	
Coastal Management	Inundation, leading to coastal erosion, loss of infrastructure, and damage to property and assets.	Cost of urgent repairs and clean ups. Loss of services. High cost of remedial action to prevent further inundation. Impact on tourism. Loss of biodiversity	Clean up and repair. Public advisory notice.	3	Damage to property and assets. Risk to life.	Iarnród Éireann, OPW.
	Change to wetland and coastal sites through saltwater intrusion	Impact on water quality and biodiversity. Increased vulnerability to erosion.	Monitoring water quality.	2	Loss of water quality. Habitat loss.	NPWS
LANDUSE AND DEVELOPMENT POLICY						
Spatial Planning and Land use	Limitation on suitability of land for urban expansion	Increased risk for development near coastal areas.	Planning.	3	Land vulnerable to increasing risk of flooding and erosion.	

Operational Area	Impact	Exposure & Sensitivity	Existing Adaptive Response	Consequence		Other Relevant Actors
				Level	Description	
	Increasing uncertainty over long term land use planning and infrastructure design	Changing design standards, changing ability to cope with weather events. Loss of or damage to property and community assets.	Planning guidelines.	3	Increased restrictions on location and design standards	
	Wear and tear on infrastructure	Early retirement or increased maintenance of infrastructure due to extreme weather.	Long term planning and financial accounting.	2	Risk of infrastructure failure	
COMMUNITY HEALTH AND WELLBEING						
Community and Economic Development	Destruction community assets and private property through erosion	Loss or damage to property and infrastructure in coastal zone.	Repairs to community assets.	2	Repairs and replacement.	
	Freshwater contamination	Water contaminated through flooding and saltwater intrusion affecting water supplies.	Monitoring water quality.	2	Risk to supply.	Irish Water, EPA

CLIMATE HAZARD (EVENT):	**Heavy Rainfall**					
Meteorological / Climatological Conditions:	Rainfall in Ireland during January 2016 was 126% the Long Term Average (1981 – 2010). Dublin reported 200% of their Long Term Average Rainfall.					
Operational Area	**Impact**	**Exposure & Sensitivity**	**Existing Adaptive Response**	**Consequence**		**Other Relevant Actors**
				Level	**Description**	
GOVERNANCE AND BUSINESS OPERATIONS						
Governance	Building damage. Emergency protocol in operation.	Unsafe travel conditions for staff and public. Damage to public building stock. Flooding.	Public advised not to travel when weather warnings warrant such action. Major emergency team meet. Fire service call out. Civil Defence assist with deployment of sand bags.	2	Buildings close due to risk of injury if travelling in high winds. Emergency call outs. Repair costs.	Gardaí, Ambulance Service, Civil Defence.
Asset Management	Damage to community amenities.	Clean up and repair of damage done to community amenities.	Staff engaged in cleanup and repair. Additional cost.	1	Staff redeployment	Community Groups.

Operational Area	Impact	Exposure & Sensitivity	Existing Adaptive Response	Consequence		Other Relevant Actors
				Level	Description	
INFRASTRUCTURE AND BUILT ENVIRONMENT						
Roads/ Footpaths, bridges, projects construction and maintenance	Faster rate of deterioration due to flood water erosion of margins and potholes.	Local roads comprising of tarred and chipped surfaces. Erosion of loosened material and margins.	Chipping and emergency works. Scheduling of more intensive repair.	2	Increased costs and staff overtime. Reputational damage.	TII
	Road closure due to high water level or blockage with debris	Temporary closure of roads. Accident risk.	Road closure by municipal staff. Pumping and drain clearance. Maintenance of drains network.	3	Risk of injury to staff and public. Cost of staff deployment	Fire and Emergency Services.
	Slippery road surfaces	Risk to drivers when unprepared or travelling to fast.	Public advisory notices from road safety campaign. Call out fire and emergency services.	2	Cost of Fire Service deployment.	Emergency Services
Public Transport Services.	Closure or delay to public transport services.	Commuters unable to travel to work. Rural communities isolated.	Non critical staff and public advised not to travel when weather warnings warrant such action. Major emergency team deployed.	2	Lack of Public Transport. Road network overloaded.	Gardaí, Armed Forces, Civil Defence, Iarnród Éireann, TII, Private Bus Operators.

Operational Area	Impact	Exposure & Sensitivity	Existing Adaptive Response	Consequence		Other Relevant Actors
				Level	Description	
Surface Water Drainage	Exceedance in drainage capacity causing localised and larger scale flooding	Flooding to business and domestic properties. Road closure. Water Quality due to combined sewer overflows.	Fire Service and Civil Defence Deployed.	3	Blocked/Closed Roads. Difficulty in obtaining insurance cover. Over stretched resources. Challenges to Wastewater infrastructure.	Gardaí, Civil Defence, Irish Water.
Building Stock - LA Buildings and social housing stock.	Damage and deterioration of housing stock and LA buildings due to flood damage or water ingress through built fabric.	La Housing Stock and LA Building Stock.	Possible re-housing of tenants. Repairs	2	Repair costs. Disruption to tenants.	LA Tenants.
Community Infrastructure	Closure and flood damage	Flooding and loss of service. Lower visitor numbers	Closure of service. Repairs	2	Loss of service	
Electricity Supply	Loss of Power.	Building Closure due to loss of power, IT systems, heating and communication systems. Economic impact across county. Access to key infrastructure.	Emergency Response Team Members being able to communicate via conference call etc. from home.	2	Service closure. Communication challenges	ESB

Operational Area	Impact	Exposure & Sensitivity	Existing Adaptive Response	Consequence		Other Relevant Actors
				Level	Description	
Cultural/Heritage	Damage to cultural and heritage assets. Cancellation of events.	Loss or damage to assets of national intrinsic historical importance. Disruption to services with loss of tourism revenue.	Maintenance of historic buildings owned by the council. County Heritage plan.	2	Risk of damage or loss of historic, natural and cultural heritage	OPW, NPWS DCHG, Heritage Council
	Cancellation of events	Disruption to events impacting on number of visitors and users.	Bad weather planning and rescheduling	1	Loss of revenue. Threat to viability.	Local groups funded by WCC
WATER AND SEWERAGE SERVICES						
Storm water/ Sewerage	Inundation of storm water and sewage infrastructure	Can cause flooding or pollution of waterway with sewage.	Monitoring of water quality. Diversion of storm waters from sewage system.	2	Significant pollution threat	Irish Water.
Wastewater	Inflow and infiltration to wastewater network	Excess demand on operation capacity of plant.	Diversion of storm water. Coordination with Irish Water.	2	Pollution threat	Irish Water
Water Supply	Flooding and inundation of water sources.	Reduced water quality.	Monitoring of water quality.	1	Pollution threat	Irish Water

Operational Area	Impact	Exposure & Sensitivity	Existing Adaptive Response	Consequence		Other Relevant Actors
				Level	Description	
NATURAL RESOURCES AND FLOOD MANAGEMENT						
Biodiversity	Falling trees	Falling trees or tree branches due to weight of snow.	Promotion of tree planting. Participation in National Tree Week	1	loss of mature trees	
Coastal Management	Flooding in estuarine sites.	Cost of repairs and clean ups. Damage to habitats.	Clean up and repair.	2	Damage to habitats	
LANDUSE AND DEVELOPMENT POLICY						
Spatial Planning and Land use	Limitation on suitability of land for urban expansion	Increased risk for development near flood plains and in coastal areas	Planning	3	Land vulnerable to increasing risk of flooding and erosion.	
	Increasing uncertainty over long term land use planning and infrastructure design	Changing design standards, changing ability to cope with weather events. Loss of or damage to property and community assets.	Planning guidelines	3	Increased restrictions on location and design standards	
	Wear and tear on infrastructure	Early retirement or increased maintenance of infrastructure due to extreme weather.	Long term planning and financial accounting	2	Risk of infrastructure failure	

Operational Area	Impact	Exposure & Sensitivity	Existing Adaptive Response	Consequence		Other Relevant Actors
				Level	Description	
COMMUNITY HEALTH AND WELLBEING						
Community and Economic Development	Damage to property streetscapes and community assets.	Cost of repairs and risk of injury	Monitoring of community assets. Maintenance and repair.	2	Costs and risk of injury	
	Freshwater contamination	Water contaminated through flooding and saltwater intrusion affecting water supplies	Monitoring water quality	2	Risk to supply	Irish Water, EPA
	Risks to local commuters and pedestrians from debris or slippery conditions	Risk of injury from debris, slippery roads and footpaths.	Public advisory notice not to travel	3	Danger of injury or loss of life. Pressure on emergency services	
	Deterioration in agricultural productivity.	Fodder shortage and loss of income in rural farming communities	Rural employment diversification	2	Loss of livelihood in rural areas	IFA

CHAPTER 4: CLIMATE RISK IDENTIFICATION.

Now that the adaptation baseline assessment is complete the next important step is to identify future risk to Wicklow County Council of projected climate hazards. This process identifies potential future local level vulnerabilities and sensitivities of, and risks to, the Local Authority and is based on the most up to date available climate projections. These projections describe a range of possible future climate scenarios from which potential impacts can be identified. It was important to consider the full range of events to ensure all potential risks are considered. Using the information attained in the previous section, Chapter 3, in assessing the current baseline, and considering future projections, a future risk analysis has been carried out to identify potential future impacts and vulnerabilities to County Wicklow.

Climate projections were obtained from the Climate Ireland website.

To identify whether a risk is low, medium or high priority a 5 x 5 risk matrix was applied to each risk with the *exposure(priority)* being the *impact* x *likelihood.*

LEVEL OF PRIORITY		IMPACT				
		1	2	3	4	5
LIKELIHOOD	1	1	2	3	4	5
	2	2	4	6	8	10
	3	3	6	9	12	15
	4	4	8	12	16	20
	5	5	10	15	20	25

LOW PRIORITY	MEDIUM PRIORITY	HIGH PRIORITY

4.1 HEAT WAVES AND DROUGHT:

Projected Changes for the Period 2041 – 2060 (relative to 1981 – 2000)

- Projections suggest average temperatures will continue to increase, with warming across all seasons. Areas to the East are expected to see the strongest increase over the coming decades.
- Levels of warming are greater for the extremes (i.e. hot and cold days), the number of warm days are expected to continue to increase and heat waves are expected to occur more often.
- Increases in minimum temperatures will mean that frost (days when minimum temperature is less than 0^{o}C) and ice days (days when the maximum temperatures are less than 0^{o}C) are expected to occur less often.
- Increasing temperatures will mean that the growing season will occur earlier and extend further; projections for mid-century indicate an increase of 35-40 days.

	CLIMATE HAZARD (EVENT):		**4.1: Heat waves and Drought**									
	Meteorological / Climatological Conditions:		On a national basis, temperatures were above normal with heat wave conditions recorded at various times and stations between the 24th of June and 4th July. Absolute drought conditions were reported at 21 stations (22nd May to 14th July) with partial drought conditions being reported for some stations between the 18th June to 14th July (Source: Met Éireann)									
	Operational Area	**Impact**	**Exposure & Sensitivity**	**Consequence**		**Other Relevant Actors**	**Gross Risk Short Term 2020's**			**Gross Risk Medium Term 2050**		
				Level	**Description**							
	GOVERNANCE AND BUSINESS OPERATIONS						**Impact**	**Likelihood**	**Exposure**	**Impact**	**Likelihood**	**Exposure**
4.1.1	Governance	More call outs for emergency services.	Upland areas of gorse, forest and bog. Coastal dune systems	3	Loss of priority habitat. Temporary closure of DART. Impact on	NPWS. Coillte. DART. Gardaí.	3	2	6	3	5	15

					businesses. Increased call outs emergency services.							
4.1.2		Pressure on recreational and tourism resources	Blue Flag beaches. National Park heritage sites.	2	Damage to amenities. Clean up costs. Traffic and parking management	NPWS, Gardaí, Coastcare Group.	2	2	4	2	4	8
4.1.3		Staff welfare	Working outdoors leading to dehydration, sun exposure	1	Increased cost for protection. Staff fatigue.		1	2	2	1	4	4
4.1.4	Business Operations	Increase in visitors due to good weather	Creation of business opportunities due to increased visitor activity	1	Increased revenue for businesses and demand for accommodation	Fáilte Ireland.	1	2	2	1	4	4
INFRASTRUCTURE AND BUILT ENVIRONMENT												
4.1.5	Roads/ Footpaths, bridges, projects construction and maintenance	Faster rate of deterioration due to melting tar.	Local roads comprising of tarred and chipped surfaces. Cracking due to shrinkage.	2	Increased costs and staff overtime. Reputational damage.	TII	2	2	4	2	4	8
4.1.6		Roads closed due to fires or tree fall.	Temporary closure of roads. Accident risk.	3	Increased costs and staff overtime. Risk to life.	Emergency Services.	3	2	4	3	4	12

4.1.7		Slippery roads due to build up of residues	Risk of accidents when drivers unprepared.	1	Risk to life. Planned notification.	RSA	1	2	2	1	4	4
4.1.8	Public Transport Services.	Extra demand on services from recreational users	Delays to service	1	Insufficient Public Transport. Car parking facilities overloaded.	Gardaí, Iarnród Éireann, TII, Private Bus Operators	1	2	2	1	4	4
4.1.9	Building Stock - LA Buildings and social housing stock.	Damage and deterioration of housing stock due to shrinkage.	Housing Stock. LA Tenants.	1	Repair costs. Disruption to tenants.	LA Tenants.	1	2	2	1	3	3
4.1.10	Community Infrastructure	Increased users and demand for recreational resources including swimming pools, parks, beaches, playgrounds.	Wear and tear on infrastructure including both natural and built. Litter management issues.	2	Positive for local businesses. Increased repair and maintenance issues.	NPWS. Coastcare groups, Gardai	2	2	4	2	4	8
4.1.11		Water use restrictions in drought.	Scarcity of water for maintenance of public spaces, swimming pools	1	Challenging for community groups such as Tidy Towns	Tidy Towns	1	2	2	1	4	4
4.1.12		Public safety	Water safety on blue flag beaches. Public safety with car parking issues. Risk to life at undesignated bathing spots.	2	Growing visitors numbers need to be managed	NPWS, Water Safety Authority	2	2	4	2	4	8

4.1.13		E-coli or Algal bloom health concerns	Beach closure due to Algal bloom or e-coli outbreak	2	Loss of recreational resource. Environmental water quality decline. Threat of Blue Flag loss	An Taisce	2	2	4	2	5	10
WATER AND SEWERAGE SERVICES												
4.1.14	Storm water/ Sewerage	Change in water levels in rivers and groundwater	Can affect capacity to absorb run off and to cope with environmental pollution.	2	Pollution of rivers and coastal waters. Threat to Blue flag beaches.	An Taisce, EPA	2	2	4	2	5	10
4.1.15		Reduced capacity of soil to absorb rain following drought	Can lead to increased runoff and increased pressure on drains	2	Flooding at end of drought event		2	2	4	2	5	10
4.1.16	Wastewater	Interruption to anaerobic process	Decrease in plant efficiency	1	Decreased efficiency. Complaints.	Irish Water	1	2	2	1	4	4
4.1.17	Water Supply	Increased demand and water scarcity	Reduced availability for all sectors	2	Hose pipe bans. Impact on town team activities and management of landscaped areas	Irish Water	2	2	4	2	5	10

4.1.18	Water Quality	Deterioration in water quality	Runoff from land following dry period or due to low water levels may increase nutrient load and affect species distribution and phenology. Impact on Blue Flag beaches	2	Loss of Blue Flag. Loss of Biodiversity.	EPA	2	2	4	2	5	10
NATURAL RESOURCES AND FLOOD MANAGEMENT												
4.1.19	Biodiversity	Increased number of gorse, forest, bog and sand dune fires	Damage to sensitive ecosystems. Loss of biodiversity. Threat to property and life. Air quality	3	Significant damage to environment. Can result in injury and some disruption to services.	Gardai, Iarnrod Éireann, NPWS, Coillte	3	2	6	3	5	15
4.1.20		Increased pressure on dune systems and some upland habitats leading to erosion.	High level of damage to dune systems. Erosion on walking trails in some upland sites	3	Loss of vegetation on dunes leading to rapid erosion. Scarring on popular mountain routes	NPWS	3	2	6	3	4	12
4.1.21		Shift in distribution of plant and animal species leading to loss of	Change in ecosystem composition in sensitive habitats	2	Risk of habitat loss and loss of biodiversity	NPWS	2	2	4	2	5	10

		biodiversity	including bogs and dune systems. Loss of trees due to soil shrinkage and stress.									
4.1.22	Weed/Pest Management - Area Offices	Change rate of coverage and spatial distribution for invasive species	Rapid expansion of some species endangering habitats, marine and freshwater and environment	2	Habitat and environmental damage	NPWS, Coillte	2	2	4	2	5	10
4.1.23	Coastal Management	Increased pressure on dune systems leading to erosion.	High level of damage to dune systems.	3	Loss of vegetation on dunes leading to rapid erosion.	NPWS	3	2	6	3	5	15
COMMUNITY HEALTH AND WELLBEING												
4.1.24	Community and Economic Development	Deterioration in agricultural productivity	Fodder shortage and loss of income in rural farming communities	2	Loss of livelihood in rural areas	IFA	2	2	4	2	4	8
4.1.25		Pressure on drinking water supplies affecting householders and local businesses	Limitations on water usage. Restrictions affecting businesses in the hospitality sector	2	Low water availability	Irish Water	2	2	4	2	5	10

4.2 Strong Winds and Storms: Projected Changes for the Period 2041 – 2060 (relative to 1981 – 2000)

- Projected change information relates to levels of wind power at a height of 60m, useful in the context of projecting future wind energy resources.
- Projections indicate an overall decrease in wind power over the entire year and during the spring, summer and autumn months by mid-century.
- For winter, projections show a large range (increase or decrease) of change and should be viewed with caution.
- An increase in extreme wind speeds is expected during winter, which may impact on turbines and the continuity of power supply.
- The number of very intense storms is expected to increase in the North Atlantic Region.
- Projections indicate that the winter tracks of these very intense storms may extend further south than the current situation, meaning that more of these storms (e.g. winter 2012/2013) will reach Ireland. However, due to our limited understanding and high variability in tracking, further work is required to increase confidence in these projections.

	CLIMATE HAZARD (EVENT):		**4.2 Strong Winds and Storms**									
	Meteorological / Climatological Conditions:		Winter of 2013 -2014: A run of winter storms, culminating in serious coastal damage and widespread, persistent flooding. Storm force winds occurred on 12 different days. Rainfall amounts of 1 ½ to 2 times above the normal and to saturated or waterlogged ground throughout the Country. Wind speeds above average for winter.									
	Operational Area	**Impact**	**Exposure & Sensitivity**	**Consequence**		**Other Relevant Actors**	**Gross Risk Short Term 2020's**	**Gross Risk Medium Term 2050**				
				Level	**Description**							
	GOVERNANCE AND BUSINESS OPERATIONS						**Impact**	**Likelihood**	**Exposure**	**Impact**	**Likelihood**	**Exposure**
4.2.1	Governance	Building Closure and damage. Cancellation of work. Emergency protocol in operation.	Unsafe travel conditions for staff and public. Damage to public building stock.	3	Buildings close due to risk of injury if travelling in high winds. Emergency call outs. Repair costs.	Gardai, HSE.	3	2	6	3	4	12

4.2.2		Loss of electricity and mobile network	Closure of buildings. Impact on IT and central server. Loss of broadband and mobile services. Loss of water.	3	Loss of communication and operating systems	Irish Water, ESB.	3	2	6	3	4	12
4.2.3	Asset Management.	Damage community amenities.	Clean up and repair of damage done to community amenities	1	Staff redeployment	Community Groups.	1	2	2	1	4	4
INTRASTRUCTURE AND BUILT ENVIRONMENT												
4.2.4	Roads/ Footpaths, bridges, projects construction and maintenance.	Road closures due to tree fall and blockage.	Temporary closure of roads. Accident risk.	3	Increased costs and staff overtime. Risk to life.	Emergency services. Gardaí.	3	3	9	3	5	15
4.2.5		Suspension of construction projects.	Temporary closure of projects. Accident risk.	1	Staff safety concerns. Risk form debris		1	2	2	1	4	4
4.2.6		Road traffic incidents.	Call out of fire services. Temporary road closures.	2	Risk to life. Traffic disruption	Emergency services. Gardaí.	2	2	4	2	5	10

4.2.7	Public Transport Services.	Closure or delay to public transport services.	Commuters unable to travel to work. Rural communities isolated.	2	Lack of Public Transport. Road network overloaded.	Gardaí, Armed Forces, Civil Defence, Iarnród Éireann, TII, Private Buses.	2	3	6	2	5	10
4.2.8	Surface Water Drainage	Exceedance in drainage capacity causing localised and larger scale flooding.	Flooding to business and domestic properties. Road closure. Water Quality affected due to combined sewer overflows.	3	Blocked/Closed Roads. Difficulty in obtaining insurance cover. Over stretched resources. Challenges to Wastewater infrastructure.	Gardaí, Civil Defence, Irish Water.	3	2	6	3	4	12
4.2.9	Building Stock - LA Buildings and social housing stock.	Damage and deterioration of housing stock and LA buildings due to storm damage. Building closure.	La Housing Stock and LA Building Stock.	2	Repair costs. Disruption to tenants. Loss of service due to building closure.	LA Tenants.	2	2	4	2	4	8
4.2.10	Flood Defences and Coastal Infrastructure	Exceedance of existing flood defences through combination tides and wind.	Coastal flooding causing damage to property and coastal infrastructure.	4	Threat to property and key infrastructure. Risk to life.	Iarnroid Eireann, OPW, Civil Defence	4	2	8	4	5	20
4.2.11		Increased Coastal Erosion and Inundation	Coastal flooding causing damage to property and coastal infrastructure.	4	Threat to property and key infrastructure. Risk to life.	Iarnroid Eireann, OPW, Civil Defence.	4	2	8	4	5	20

4.2.12		Destruction, damage and disturbance to Council managed Port and marine facilities	Damage to property and infrastructure	2	Insurance premiums and repair costs.	Management companies for marinas.	2	3	6	2	5	10
4.2.13	Community Infrastructure	Damage to community infrastructure	Damage to green infrastructure and built recreational facilities	3	Loss of green infrastructure increases risk to built infrastructure. Repair and maintenance.		3	3	9	3	5	15
4.2.14		Damage to heritage sites	Storm damage to natura sites	2	Loss or damage to heritage	OPW, NPWS	2	3	6	2	5	10
4.2.15	Electricity Supply	Loss of Power.	Building Closure due to loss of power, IT systems, heating and communication systems. Economic impact across county.	2	Service closure. Communication challenges	ESB	2	3	6	2	5	10
4.2.16	Cultural /Heritage	Damage to cultural and heritage assets.	Loss or damage to assets of national intrinsic historical importance. Disruption to services with loss of tourism revenue.	2	Risk of damage or loss of historic, natural and cultural heritage	OPW, NPWS DCHG, Heritage Council	2	2	4	2	4	8

4.2.17		Cancellation of events	Disruption to events impacting on number of visitors and users	1	Loss of revenue. Threat to viability.	Local groups funded by WCC	1	2	2	1	4	4
WATER AND SEWERAGE SERVICES												
4.2.18	Storm water /Sewerage	Inundation of storm water and sewage infrastructure	Can cause flooding or pollution of waterway with sewage	2	Significant pollution threat	Irish Water.	2	2	4	2	4	8
4.2.19		Loss of Power.	Shut down of pumping stations and treatment plants	3	Threat to plant function. Risk of pollution incident.	Irish Water	3	3	9	3	5	15
4.2.20	Wastewater	Inflow and infiltration to wastewater network	Excess demand on operation capacity of plant	2	Pollution threat	Irish Water	2	2	4	2	4	8
4.2.21	Water Supply	Contamination due to salinisation of surface water and ground water supplies during storm surges or flooding of waste water treatment.	Cause flooding or pollution of waters with salt water or sewage.	2	Significant pollution threat	Irish Water.	2	2	4	2	4	8

NATURAL RESOURCES AND FLOOD MANAGEMENT												
4.2.22	Biodiversity	Damage to habitats	Most noticeable in dune estuarine and coastal habitats but can affect all habitats type. Loss of biodiversity and tree cover. Erosion of soils.	3	Erosion and habitat loss	NPWS	3	3	9	3	5	15
4.2.23	Coastal Management	Inundation, leading to coastal erosion, loss of infrastructure, and damage to property and assets.	Cost of urgent repairs and clean ups. Loss of services. High cost of remedial action to prevent further inundation. Impact on tourism. Loss of biodiversity	3	Damage to property and assets. Risk to life.	Iarnrod Éireann, OPW.	3	3	9	3	5	15
4.2.24		Change to wetland and coastal sites through saltwater intrusion	Impact on water quality and biodiversity. Increased vulnerability to erosion.	2	Loss of water quality. Habitat loss.	NPWS	2	1	3	2	4	8
LANDUSE AND DEVELOPMENT POLICY												
4.2.25	Spatial Planning and Land use	Limitation on suitability of land for urban expansion	Increased risk for development near coastal areas	3	Land vulnerable to increasing risk of flooding and erosion.		3	1	3	3	4	12

4.2.26		Increasing uncertainty over long term land use planning and infrastructure design	Changing design standards, changing ability to cope with weather events. Loss of or damage to property and community assets.	3	Increased restrictions on location and design standards		3	2	6	3	5	15
4.2.27		Wear and tear on infrastructure	Early retirement or increased maintenance of infrastructure due to extreme weather.	2	Risk of infrastructure failure		2	3	6	2	5	10
COMMUNITY HEALTH AND WELLBEING												
4.2.28	Community and Economic Development	Damage to property streetscapes and community assets	Cost of repairs and risk of injury	2	Costs and risk of injury		2	3	6	2	5	10
4.2.29		Destruction community assets and private property through erosion	Loss or damage to property and infrastructure in coastal zone.	2	Repairs and replacement		2	2	4	2	5	10
4.2.30		Risks to local commuters and pedestrians from debris or slippery conditions	Risk of injury from debris, slippery roads and footpaths and high winds.	3	Danger of injury or loss of life. Pressure on emergency services		3	3	9	3	5	15

4.2.31		Deterioration in agricultural productivity	Fodder shortage and loss of income in rural farming	2	Loss of livelihood in rural areas	IFA	2	2	4	2	4	8	

4.3 SNOW AND ICE / LOW TEMPERATURES:

Projected Changes for the Period 2041 – 2060 (relative to 1981 – 2000)

- Increases in minimum temperatures will mean that frost (days when minimum temperature is less than 0°C) and ice days (days when the maximum temperatures are less than 0°C) are expected to occur less often.
- For winter and autumn, projections indicate an increase in average precipitation.
- Where increased precipitation meets with weather systems pulling colder air down from arctic regions high snowfall will result.

	CLIMATE HAZARD (EVENT):	**4.3: Snow and Ice/Low Temperatures**										
	Meteorological / Climatological Conditions:	March 2018, Storm Emma: Widespread heavy falls of drifting snow occurred on 3 consecutive days with accumulations of up to 69cm in the Wicklow Mountains. Widespread snowfalls also occurred again 2 weeks later.										
	Operational Area	**Impact**	**Exposure & Sensitivity**	**Consequence**		**Other Relevant Actors**	**Gross Risk Short Term 2020's**			**Gross Risk Medium Term 2050**		
				Level	**Description**							
	GOVERNANCE AND BUSINESS OPERATIONS						**Impact**	**Likelihood**	**Exposure**	**Impact**	**Likelihood**	**Exposure**
4.3.1	Governance	Building Closure and damage. Cancellation of work. Emergency protocol in operation.	Unsafe travel conditions for staff and public. Damage to public building stock.	3	Buildings close due to risk of injury if travelling in high winds. Emergency call outs. Repair costs. Loss to business, Retail and Agricultural Sectors.	Gardaí HSE.	3	2	6	3	4	12

4.3.2		Gritting operations.	Health and well being of key staff involved in gritting.	3	Serious disruption and loss of access to communities. High dependence on key staff and services. Increased operating costs.	Gardaí HSE, Civil defence, Armed forces.	3	3	9	3	2	6
4.3.3		Loss of electricity and mobile network.	Closure of buildings. Impact on IT and central server. Loss of broadband and mobile services. Loss of water and recycling services.	3	Loss of communication and operating systems.	Irish Water, ESB.	3	2	6	3	3	9
4.3.4	Asset Management.	Damage community amenities.	Clean up and repair of damage done to community amenities.	1	Staff redeployment.	Community Groups.	1	2	2	1	3	3
INFRASTRUCTURE AND BUILT ENVIRONMENT												
4.3.5	Roads/ Footpaths, bridges, projects construction and maintenance.	Faster rate of deterioration due to freeze thaw.	Local roads comprising of tarred and chipped surfaces. Erosion of loosened material during thaw.	2	Increased costs and staff overtime. Reputational damage.	TII	2	4	8	2	3	6
4.3.6		Road closures due to blockages from snow.	Temporary closure of roads. Accident risk.	4	Increased costs and staff overtime. Risk to life. Rural isolation.	Emergency services, civil defence, armed forces.	4	2	8	4	4	16

INFRASTRUCTURE AND BUILT ENVIRONMENT (Cont'd)												
4.3.7		Slippery footpath and surfaces.	Risk of injury to pedestrians. Elderly confined.	3	Coordination of response. Risk of injury. Staff costs.	Civil defence, local radio, Armed forces.	3	3	9	3	2	6
4.3.8	Public Transport Services.	Closure or delay to public transport services.	Commuters unable to travel to work. Rural communities isolated.	2	Lack of Public Transport. Road network overloaded.	Gardaí, Armed Forces, Civil Defence, Iarnród Éireann, TII, Private Bus Operators.	2	2	4	2	3	6
4.3.9	Surface Water Drainage	Exceedance in drainage capacity causing localised and larger scale flooding following a thaw.	Flooding to business and domestic properties. Road closure. Water Quality due to combined sewer overflows.	3	Blocked/Closed Roads. Difficulty in obtaining insurance cover. Over stretched resources. Challenges to Wastewater infrastructure.	Gardaí, Civil Defence, Irish Water.	3	1	3	3	2	6
4.3.10	Building Stock - LA Buildings and social housing stock.	Damage and deterioration of housing stock and LA buildings due to storm damage. Building closure.	La Housing Stock and LA Building Stock.	2	Repair costs. Disruption to tenants. Loss of service due to building closure.	LA Tenants.	2	1	2	2	2	4
4.3.11		Increased need for heat.	LA Tenants	1			1	2	2	1	1	1

INFRASTRUCTURE AND BUILT ENVIRONMENT (Cont'd)												
4.3.12	Community Infrastructure	Damage to community infrastructure	Damage to green infrastructure and built recreational facilities	3	Deterioration of green infrastructure increases risk to built infrastructure. Repair and maintenance.		3	1	3	3	2	6
4.3.13	Electricity Supply	Loss of Power.	Building Closure due to loss of power, IT systems, heating and communication systems. Economic impact across county. Access to key infrastructure.	2	Service closure. Communication challenges	ESB	2	2	4	2	3	6
WATER AND SEWERAGE SERVICES												
4.3.14	Storm water/ Sewerage	Loss of Power.	Shut down of pumping stations and treatment plants	3	Threat to plant function. Risk of pollution incident.	Irish Water	3	2	6	3	3	9
4.3.15	Water Supply	Leakage of water through freeze damage	Loss of water supply to individual properties. Demand can exceed treatment capacity	1	Emergency repairs under Service level agreements with Irish Water.	Irish Water	1	3	3	1	2	2
NATURAL RESOURCES AND FLOOD MANAGEMENT												
4.3.16	Biodiversity	Falling trees	Falling trees or tree branches due to weight of snow	1	Loss of mature trees		1	2	2	1	3	3

4.3.17		Reduced resilience of habitats and change in distribution of species	Damage to ecosystems and habitats	1	Habitat loss	NPWS	1	2	2	1	4	4
4.3.18	Weed/Pest Management - Area Offices	Changed rate of coverage and spatial distribution for invasive species	Rapid expansion of some species endangering habitats, marine and freshwater environments, and built environment	2	Habitat and environmental damage	NPWS, Coillte	2	2	4	2	4	8
COMMUNITY HEALTH AND WELLBEING												
4.3.19	Community and Economic Development	Risks to local commuters and pedestrians from debris or slippery conditions	Risk of injury from debris, slippery roads and footpaths. Roads or footpaths impassable.	3	Danger of injury or loss of life. Pressure on emergency services		3	3	9	3	2	6
4.3.20		Isolation of communities	Social exclusion and isolation particularly for elderly. Food supplies and access to medical services may be difficult	3	Danger of injury or loss of life. Pressure on emergency services	Civil defence, local radio, Armed forces.	3	2	6	3	4	12
4.3.21		Deterioration in agricultural productivity	Fodder shortage and loss of income in rural farming communities	2	Loss of livelihood in rural areas	IFA	2	2	4	2	4	8

4.4 High Sea Levels and Costal Flooding:

Projected Changes for the Period 2041 – 2060 (relative to 1981 – 2000)

- Sea levels will continue to rise for all Irish coastal areas and by up to 0.81m by the end of the century with implications for coastal inundation extents.
- Increases will be greatest in the South of the country, this is due to the fact that the north of the country is still rising after the last ice age.
- Increased sea levels will result in increased levels of high tide and when combined with storm surge, significant increases in levels of coastal inundation and erosion can be expected.
- Projections of average significant wave height for Ireland suggest a decrease in annual and seasonal wave heights for both the medium-low and high emission scenarios.
- Projected changes in sea level in combination with projected increases in the severity of coastal storms will exacerbate coastal erosion risk and it is thought that Ireland's coastal wetlands will be the first to be affected in Europe.
- Locations currently vulnerable to coastal erosion will likely see rates of erosion increase.

	CLIMATE HAZARD (EVENT):		4.4: High Sea Levels and Coastal Flooding									
	Meteorological / Climatological Conditions:		A combination of high winds, heavy rainfall and tide surges resulting in increased high sea levels and subsequent coastal erosion. Storm Frank in Dec 2015 and Storm Ophelia in October 2017 were examples of this combination which resulted in coastal erosion to the Murrough, North of Wicklow Town.									
	Operational Area	Impact	Exposure & Sensitivity	Consequence		Other Relevant Actors	Gross Risk Short Term 2020's			Gross Risk Medium Term 2050		
				Level	Description							
	GOVERNANCE AND BUSINESS OPERATIONS						Impact	Likelihood	Exposure	Impact	Likelihood	Exposure
4.4.1	Governance	Coastal Flooding	Damage to properties, sea defences, critical infrastructure, services.	3	Call out fire service and other services. Staff fatigue. Cost. Safety.	Iarnród Éireann. Irish Water	3	2	6	3	4	12

4.4.2	Asset Management	Damage community amenities.	Clean up and repair of damage done to community amenities	1	Staff redeployment	Community Groups	1	2	2	1	4	4
4.4.3	Public Transport Services.	Closure or delay to public transport services.	Commuters unable to or delayed in travelling to work.	2	Lack of Public Transport. Road network overloaded.	Iarnród Éireann.	2	2	4	2	5	10
4.4.4	Surface Water Drainage	Exceedance in drainage capacity causing localised and larger scale flooding	Flooding to business and domestic properties. Road closure. Water Quality due to combined sewer overflows.	2	Blocked/Closed Roads. Difficulty in obtaining insurance cover. Over stretched resources. Challenges to Wastewater infrastructure.	Gardaí, Civil Defence, Irish Water.	2	2	4	2	5	10
4.4.5	Building Stock - LA Buildings and social Housing Stock.	Damage and deterioration of housing stock and LA buildings due to storm damage. Building closure.	La Housing Stock and LA Building Stock.	2	Repair costs. Disruption to tenants. Loss of service due to building closure.	LA Tenants.	2	1	2	2	5	10
4.4.6	Flood Defences & Coastal Infrastructure.	Lower threshold for exceedance of existing flood defences through combination tides and wind.	Coastal flooding causing damage to property and coastal infrastructure.	4	Threat to property and key infrastructure. Risk to life.	Iarnroid Eireann, OPW, Civil Defence.	4	2	8	4	5	20

4.4.7		Increased Coastal Erosion and Inundation	Coastal flooding causing damage to property and infrastructure.	4	Threat to property and key infrastructure. Risk to life.	Iarnroid Eireann, OPW, Civil Defence.	4	2	8	4	5	20
4.4.8		Destruction, damage and disturbance to Council managed Port and marine facilities	Damage to property and infrastructure	2	Insurance premiums and repair costs.	Management companies for marinas.	2	1	2	2	4	8
4.4.9	Community Infrastructure.	Damage to community infrastructure	Damage to green infrastructure and built recreational facilities	3	Loss of green infrastructure increases risk to built infrastructure. Repair and maintenance.		3	3	9	3	5	15
4.4.10		Damage to heritage sites	Storm damage to natura sites and built heritage	2	Loss or damage to heritage	OPW, NPWS	2	3	6	2	5	10
4.4.11	Cultural/ Heritage.	Damage to cultural and heritage assets.	Loss or damage to assets of national intrinsic historical importance. Disruption to services with loss of tourism revenue.	2	Risk of damage or loss of historic, natural and cultural heritage	OPW, NPWS DCHG, Heritage Council	2	1	2	2	3	6
WATER AND SEWERAGE SERVICES												
4.4.12	Storm water/ Sewerage.	Inundation of storm water and sewage infrastructure	Can cause flooding or pollution of waterway	2	Significant pollution threat	Irish Water.	2	1	2	2	4	8

4.4.13	Wastewater	Inundation of storm water and sewage infrastructure	Can cause flooding or pollution of waterway with sewage	2	Significant pollution threat	Irish Water.	2	1	2	2	4	8
4.4.14	Water Supply	Contamination due to salinisation of surface water and ground water supplies	Cause flooding or pollution of waters with saltwater.	2	Pollution threat	Irish Water.	2	1	2	2	4	8
4.4.15	Water Quality	Saline intrusion of water.	Sea level rise and storm surges	2	Impact on biodiversity and loss of green infrastructure		2	2	4	2	5	10
NATURAL RESOURCES AND FLOOD MANAGEMENT												
4.4.16	Biodiversity	Saline intrusion of water.	Sea level rise and storm surges	2	Impact on biodiversity and loss of green infrastructure		2	2	4	2	5	10
4.4.17	Coastal Management	Inundation, leading to coastal erosion, loss of infrastructure, and damage to property and assets.	Cost of urgent repairs and clean ups. Loss of services. High cost of remedial action to prevent further inundation. Impact on tourism. Loss of biodiversity	3	Damage to property and assets. Risk to life.	Iarnróid Éireann, OPW.	3	3	9	3	5	15

4.4.18		Change to wetland and coastal sites through saltwater intrusion	Impact on water quality and biodiversity. Increased vulnerability to erosion.	2	Loss of water quality. Habitat loss.	NPWS	2	2	4	2	5	10
LANDUSE AND DEVELOPMENT POLICY												
4.4.19	Spatial Planning and Land use	Limitation on suitability of land for urban expansion	Increased risk for development near coastal areas.	3	Land vulnerable to increasing risk of flooding and erosion.		3	3	9	3	5	15
4.4.20		Increasing uncertainty over long term land use planning and infrastructure design	Changing design standards, changing ability to cope with weather events. Loss of or damage to property and community assets.	3	Increased restrictions on location and design standards		3	2	6	3	4	12
4.4.21		Wear and tear on infrastructure	Early retirement or increased maintenance of infrastructure due to extreme weather.	2	Risk of infrastructure failure		2	3	6	2	5	10
COMMUNITY HEALTH AND WELLBEING												
4.4.22	Community and Economic Development	Destruction community assets and private property	Loss or damage to property and infrastructure in coastal zone.	2	Repairs and replacement.		2	3	6	2	5	10

4.4.23		Freshwater contamination	Water contaminated through flooding and saltwater intrusion affecting water supplies.	2	Risk to supply.	Irish Water, EPA	2	1	2	2	4	8

4.5 HEAVY RAINFALL:

Projected Changes for the Period 2041 – 2060 (relative to 1981 – 2000)

- Significant reductions are expected in average levels of annual, spring and summer precipitation and are largest for summer (0-20%)
- Dry periods are expected to occur more often and particularly in summer (12-40%)
- For winter and autumn, projections indicate an increase in average precipitation, particularly for the high scenario.
- However due to the large spread in the range of projected changes, these projections should be viewed with a low level of confidence and with a higher degree of confidence, projections indicate a substantial increase in the occurrence of heavy precipitation events, particularly during winter and autumn (approx. 20%).

	CLIMATE HAZARD (EVENT):	**Heavy Rainfall**										
	Meteorological / Climatological Conditions:	Rainfall in Ireland during January 2016 was 126% the Long Term Average (1981 – 2010). Dublin reported 200% of their Long Term Average Rainfall.										
	Operational Area	**Impact**	**Exposure & Sensitivity**	**Consequence**		**Other Relevant Actors**	**Gross Risk Short Term 2020's**			**Gross Risk Medium Term 2050**		
				Level	**Description**							
	GOVERNANCE AND BUSINESS OPERATIONS						**Impact**	**Likelihood**	**Exposure**	**Impact**	**Likelihood**	**Exposure**
4.5.1	Governance	Building damage. Emergency protocol in operation.	Unsafe travel conditions for staff and public. Damage to public building stock. Flooding.	2	Buildings close due to risk of injury if travelling in high winds. Emergency call outs. Repair costs.	Gardaí, HSE, Civil Defence.	2	2	4	2	3	6

4.5.2	Asset Management	Damage to community amenities.	Clean up and repair of damage done to community amenities.	1	Staff redeployment	Community Groups.	1	2	2	1	3	3
INFRASTRUCTURE AND BUILT ENVIRONMENT												
4.5.3	Roads/Footpaths, bridges, projects construction and maintenance	Faster rate of deterioration due to flood water erosion of margins and potholes.	Local roads comprising of tarred and chipped surfaces. Erosion of loosened material and margins.	2	Increased costs and staff overtime. Reputational damage.	TII	2	2	4	2	4	8
4.5.4		Road closure due to high water level or blockage with debris	Temporary closure of roads. Accident risk.	3	Risk of injury to staff and public. Cost of staff deployment	Fire and Emergency Services.	3	2	6	3	4	12
4.5.5		Slippery road surfaces	Risk to drivers when unprepared or travelling to fast.	2	Cost of Fire Service deployment.	Emergency Services	2	2	4	2	4	8
4.5.6	Public Transport Services.	Closure or delay to public transport services.	Commuters unable to travel to work. Rural communities isolated.	2	Lack of Public Transport. Road network overloaded.	Gardaí, Armed Forces, Civil Defence, Iarnród Éireann, TII, Private Bus Operators.	2	2	4	2	4	8

4.5.7	Surface Water Drainage	Exceedance in drainage capacity causing localised and larger scale flooding	Flooding to business and domestic properties. Road closure. Water Quality due to combined sewer overflows.	3	Blocked/Closed Roads. Difficulty in obtaining insurance cover. Over stretched resources. Challenges to Wastewater infrastructure.	Gardaí, Civil Defence, Irish Water.	3	2	6	3	5	15
4.5.8	Building Stock - LA Buildings and social housing stock.	Damage and deterioration of housing stock and LA buildings due to flood damage or water ingress through built fabric.	La Housing Stock and LA Building Stock.	2	Repair costs. Disruption to tenants.	LA Tenants.	2	2	4	2	4	8
4.5.9	Community Infrastructure	Closure and flood damage	Flooding and loss of service. Lower visitor numbers	2	Loss of service		2	2	4	2	3	6
4.5.10	Electricity Supply	Loss of Power.	Building Closure due to loss of power, IT systems, heating and communication systems. Economic impact across county. Access to key infrastructure.	2	Service closure. Communication challenges	ESB	2	2	4	2	3	6

4.5.11	Cultural/Heritage	Damage to cultural and heritage assets. Cancellation of events.	Loss or damage to assets of national intrinsic historical importance. Disruption to services with loss of tourism revenue.	2	Risk of damage or loss of historic, natural and cultural heritage	OPW, NPWS DCHG, Heritage Council	2	2	4	2	3	6
4.5.12		Cancellation of events	Disruption to events impacting on number of visitors and users.	1	Loss of revenue. Threat to viability.	Local groups funded by WCC	1	2	2	1	3	3
WATER AND SEWERAGE SERVICES													
4.5.13	Storm water/ Sewerage	Inundation of storm water and sewage infrastructure	Can cause flooding or pollution of waterway with sewage.	2	Significant pollution threat	Irish Water.	2	3	6	2	5	10
4.5.14	Wastewater	Inflow and infiltration to wastewater network	Excess demand on operation capacity of plant.	2	Pollution threat	Irish Water	2	3	6	2	5	10
4.5.15	Water Supply	Flooding and inundation of water sources.	Reduced water quality.	1	Pollution threat	Irish Water	1	2	2	1	3	3
NATURAL RESOURCES AND FLOOD MANAGEMENT													
4.5.16	Biodiversity	Falling trees	Falling trees or tree branches due to weight of snow	1	loss of mature trees		1	1	1	1	2	2

4.5.17	Coastal Management	Flooding in estuarine sites.	Cost of repairs and clean ups. Damage to habitats.	2	Damage to habitats		2	1	2	2	3	6
LANDUSE AND DEVELOPMENT POLICY												
4.5.18	Spatial Planning and Land use	Limitation on suitability of land for urban expansion	Increased risk for development near flood plains and in coastal areas	3	Land vulnerable to increasing risk of flooding and erosion.		3	3	9	3	5	15
4.5.19		Increasing uncertainty over long term land use planning and infrastructure design	Changing design standards, changing ability to cope with weather events. Loss of or damage to property and community assets.	3	Increased restrictions on location and design standards		3	3	9	3	5	15
4.5.20		Wear and tear on infrastructure	Early retirement or increased maintenance of infrastructure due to extreme weather.	2	Risk of infrastructure failure		2	3	6	2	5	10
COMMUNITY HEALTH AND WELLBEING												
4.5.21	Community and Economic Development	Damage to property streetscapes and community assets.	Cost of repairs and risk of injury	2	Costs and risk of injury		2	3	6	2	5	10
4.5.22		Freshwater contamination	Water contaminated through flooding and saltwater intrusion affecting water supplies.	2	Risk to supply	Irish Water, EPA	2	2	4	2	5	10

4.5.23		Risks to local commuters and pedestrians from debris or slippery conditions	Risk of injury from debris, slippery roads and footpaths.	3	Danger of injury or loss of life. Pressure on emergency services		3	2	6	3	4	12
4.5.24		Deterioration in agricultural productivity.	Fodder shortage and loss of income in rural farming communities	2	Loss of livelihood in rural areas	IFA	2	3	6	2	5	10

CHAPTER 5: ADAPTATION GOALS, OBJECTIVES AND ACTIONS.

5.1 STRATEGIC VISION FOR CLIMATE ADAPTATION:

Wicklow County Council will fulfil a leadership role in learning about and responding to the impacts of climate change, be fully engaged with the risks and opportunities of a changing climate and build a resilient future for and together with, the communities of County Wicklow

5.2 THEMATIC AREAS – HIGH LEVEL GOALS

This adaptation strategy is based around six thematic areas that are developed further as High Levels Goals. These goals identify the desired outcomes anticipated through the effective implementation of the climate change adaptation strategy. They are supported by specific objectives and adaptation actions to achieve their desired outcomes.

Theme 1: Local Adaptation Governance and Business Operations

Goal: Climate Change adaptation considerations are mainstreamed and integrated successfully into all functions and activities of the local authority ensuring operational protocols, procedures and policies implement an appropriate response in addressing the diversity of impacts associated with climate change

Theme 2: Infrastructure and Built Environment

Goal: Increased capacity for climate resilient structural infrastructure is centred around the effective management of climate risk, informed investment decisions and positive contribution towards a low carbon society

Theme 3: Land use and development

Goal: Sustainable policies and measures are devised influencing positive behavioural changes, supporting climate adaptation actions and endorsing approaches for successful transition to low carbon and climate resilient society.

Theme 4: Drainage and Flood Management

Goal: Great understanding of risks and consequences of flooding and successful management of a co-ordinated approach to drainage and flooding

Theme 5: Natural Resources and Cultural Infrastructure

Goal: Fostering meaningful approaches to protecting natural and key cultural assets through an appreciation for the adaptive capacity of the natural environment to absorb the impacts of climate change.

Theme 6: Community Health and Wellbeing

Goal: Empowered and cohesive communities with strong understanding of climate risks, increased resilience to impacts of climate change with capacity to champion climate action at local level

5.3 AIMS OF HIGH LEVEL GOALS

Through its six thematic areas and high level goals, the local authority Climate Change Adaptation Strategy is designed to guide a planned and coherent response to the effects of climate change. However, four principle aims (guiding principles) thread through and underpin these goals:

1. **Mainstream Adaptation**: That climate change adaptation is a core consideration and is mainstreamed in all functions and activities across the local authority. In addition, ensure that local authority is well placed to benefit from economic development opportunities that may emerge due to a commitment to proactive climate change adaptation and community resilience.

2. **Informed decision making**: That effective and informed decision making is based on reliable and robust evidence base of the key impacts, risks and vulnerabilities of the area. This will support long term financial planning, effective management of risks and help to prioritise actions.

3. **Building Resilience**: That the needs of vulnerable communities are prioritised and addressed, encourage awareness to reduce and adapt to anticipated impacts of climate change and promote a sustainable and robust action response.

4. **Capitalising on Opportunities**: Projected changes in climate may result in additional benefits and opportunities for the local area and these should be explored and capitalised upon to maximise the use of resources and influence positive behavioural changes.

5.4 OBJECTIVES AND ACTIONS:

THEME 1: LOCAL ADAPTATION GOVERNANCE AND BUSINESS OPERATIONS

Objective: To ensure that climate adaptation is mainstreamed into all activities and operations of the Local Authority.

No.	Action	Lead & Partner(s)	Budgeted	Timeframe S/M/L
1.1	Establish a Climate Action Steering Group, chaired by a Climate Adaptation Champion at Director of Services level with representatives from across key functions of local authority and the Chair of the Planning, Development and Environmental SPC, to: Ensure the successful implementation of the actions of this Climate Change Adaptation Plan and to report on progress. Set Strategic Direction and assist in policy formation. Encourage local innovation.	**Management Team**	✓	Short
1.2	Mainstream Climate Action policy as integral consideration in the Corporate Plan objectives providing for the all local authority activities and the delivery of functions and services across the administrative area.	**Corporate Services**	✓	Short
1.3	Ensure that Climate Action is listed as a standing item on the agenda of the Management Team meetings.	**Management Team**	✓	Short
1.4	Integrate Climate Action into the Service Delivery Programme and provide for its translation to Team Development Plans and Personal Development Plans to enable actions to be directly pursued per operational area.	**Management Team** Line Managers Human Resources	✓	Short
1.5	Compile a list of local service indicators to be used to track and monitor the progress of adaptation actions	**Climate Action Steering Group**	✓	Short
1.6	Appoint a Climate Action Officer (CAO) with responsibility for climate related activity within the County administrative area	**Management Team**	x	Short
1.7	Explore the potential for Wicklow County Council to expand its service delivery to include Climate Action considerations with the scope to inform on local climate change issues, climate action measures, run awareness campaigns and manage funding for climate action projects.	**Management Team** Climate Action Steering Group All Sections Heads	✓	Short – Long
1.8	Liaise, collaborate and work in partnership with the Eastern & Midlands CARO in the delivery of adaptation actions from this strategy	**Climate Action Steering Group** E&M CARO	✓	Short - Long

No.	Action	Lead & Partner(s)	Budgeted	Timeframe S/M/L
1.9	Undertake and implement a Business Continuity Plan to identify and address specifically, the impacts associated with extreme weather events on all functions/services of the local authority including: Preparing for critical services disruptions, Mitigating/Minimising the impact of service disruption and, Improving the capacity/ability to recover.	**Climate Action Steering Group** **CAO** All Section Heads	✓	Short
1.10	Ensure that all safety statements assess climate related risks and identify measures to ensure staff safety	**H&S Officer**	✓	Short
1.11	Develop a Weather Events Communication Strategy as part of WCC Communication policy. Part of this strategy should delineate actions the public can take and actions the Local Authority services can take.	**IT Department** Communication Working Group	✓	Short
1.12	Develop an IT system to allow access to remote data including CCTV coverage, rainfall and flow gauges to allow key staff to safely monitor and assess risks during weather events.	**IT Department** Communication Working Group	x	Medium
1.13	Integrate Climate Change in all funding applications provided by WCC.	**Head of Finance** **All Section Heads**	✓	Short
1.14	Develop a programme to increase the number of electric vehicles in the Council Fleet.	**Roads and Transportation**	x	Short
1.15	Undertake a staff commuter survey, with results used to assess the feasibility of remote working days, promotion of car pooling, cycling and walking to work.	**CAO**	X	Short
1.16	Develop a template to capture impacts, responses and costs for all major climate events. This template should incorporate a post incident review. Annual costs related to weather events should be reported by Finance to the Members of Wicklow County Council	**All Section Heads.**	x	Short
1.17	Train outdoor staff on working in adverse weather related situations to include flood waters, high winds and icy conditions.	**Corporate Affairs** **Municipal Districts**	x	Short
1.18	Liaise, collaborate and work in partnership with the sectors identified in the NAF, subject to funding and resources, in the delivery of the Government approved sectoral adaptation actions, where they relate and are relevant to the functions and activities of the council at local level/in local communities.	**All Section Heads**	✓	Short - long
1.19	Engage with the Eastern Midlands Waste Regional Office to ensure the upcoming review of the regional waste management plan gives fuller consideration of climate action and the development of the circular economy in the formulation of policy and actions.	**Waste Management**	✓	Short
1.20	Assess the range and scope of existing mitigation measures already undertaken by WCC and those that will be required under the Climate Action Plan.	**CAO** Environment Housing	x	Short
1.21	Develop and deliver training and awareness campaigns on climate action for WCC staff, elected representatives and communities.	**CAO** **EAO**	x	Short
1.22	Develop a green procurement strategy for WCC, which will stipulate where specific conditions are to be assessed prior to procurement.	**Corporate Services** **Finance**	x	Medium

No.	Action	Lead & Partner(s)	Budgeted	Timeframe S/M/L
1.23	Create a climate and biodiversity special policy committee (SPC), to examine climate and biodiversity policy, advise and monitor the work of WCC on climate action and implementation of this strategy. The SPC should have representation from the elected members of WCC and other stakeholders in the County.	**Corporate Services**	✓	Short
1.24	Provide an update on progress with the Climate Adaptation Strategy and on climate mitigation measures in the CE's Monthly Report.	**Corporate Services**	✓	Short
1.25	Liaise, collaborate and work in partnership with the sectors identified in the NAF, subject to funding and resources in the delivery of the Government approved sectoral adaptation actions, where they relate to and are relevant to the functions and activities of the council at local level or in local communities.	**CAO**	✓	Short

THEME 2: INFRASTRUCTURE AND BUILT ENVIRONMENT

Objective: To ensure and increase the resilience of infrastructural assets and inform investment decisions

No.	Action	Lead & Partner(s)	Budgeted	Timeframe S/M/L
2.1	Apply a robust risk assessment and management framework to Local Authority owned buildings and properties to identify and protect against the key vulnerabilities to the impacts of climate change and mitigate against service disruption.	**CAO** All Section Heads	x	Short
2.2	Develop a climate change risk map with scenarios for the county.	**CAO** **IT Section**	x	Long
2.3	Integrate climate considerations into the design, planning and construction of all roads, footpaths, bridges, roundabouts, amenity areas, recreational trails, public realm and other construction projects. Make provision to incorporate green infrastructure as a mechanism for carbon offset.	**Roads & Transportation** Municipal Districts NTA	✓	S/M/L
2.4	Integrate climate considerations into the design, planning and construction of multilevel developments to take account of predicted flood events.	**Planning**	✓	Short
2.5	Undertake a Risk Assessment of road infrastructure in the area to identify the severity of climate change risks on their function and condition. The risk assessment should provide for an understanding and quantification of risks posed. The findings should be integrated into decision making processes, road infrastructure programmes and investment strategies.	**Roads & Transportation** Municipal Districts NTA Local Communities.	✓	Medium

No.	Action	Lead & Partner(s)	Budgeted	Timeframe S/M/L
2.6	Create a post incident review following all major weather events Report on all weather related damage and repair costs to infrastructure Report on number of call outs of emergency services Document and evaluate lessons learnt during weather events in Wicklow and other Las particularly in relation to Health and Safety Statements. Collate all post incident review data in an annual report.	**All Section Heads** **CAO**	x	Short
2.7	Create a database of Council owned buildings and infrastructure at risk from coastal flooding.	**CAO**	x	Short
2.8	Develop a protocol for operations during a heat wave including servicing of key sites, public advisory notices and liaison with other relevant actors.	**Municipal Districts,** **Environment**	✓	Short
2.9	All new buildings to be built by WCC or on it's behalf to consider best available practice in ensuring buildings contribute to climate action through their design; considering a range of design options that will include, but not be restricted to, use of low carbon materials, insulation of the building fabric, green roofs, use of photovoltaics and rainwater harvesting, taking account of government policy, design standards and guidelines.	**Housing** Planning, Development and Environment	x	Short
2.10	Engage with Irish Water to ensure collaboration on the provision of sustainable water services and the maintenance of good water quality.	**Planning, Development and Environment** **Irish Water**	✓	Short
2.11	Undertake a review of the current status of coastal erosion and protection measures, identifying areas that are vulnerable to increasing sea levels through CEFRAM Maps in order to assess the effects of increasing tidal levels and inundation events.	**Planning, Development and Environment**	x	Medium
2.12	Discuss with the OPW implementing a monitoring and inspection programme for vulnerable areas of coast, coastal protection works, exposed roads and railways, harbours, piers, marinas and quays, to identify works that would protect them against rising sea levels.	**Planning, Development and Environment**	x	Short
2.13	Collaborate with relevant external agencies to identify, fund and programme works to protect coastal infrastructure assets.	**Planning, Development and Environment**	x	Medium
2.14	Develop a Sustainable Transport Plan which will address public transport, cycling and pedestrian infrastructure, measures to reduce car dependence and measure to reduce carbon emissions from transport.	**Roads and Transportation** Community Cultural and Social Development. Tourism.	x	Medium

THEME 3: LANDUSE AND DEVELOPMENT Objective: To Integrate climate action considerations into landuse planning policy and influence positive behaviour				
No.	**Action**	**Lead & Partner(s)**	**Budgeted**	**Timeframe S/M/L**
3.1	Identify and integrate climate change as a critical consideration and guiding principle informing core strategy of the County Development Plan, Local Area Plans, Heritage Plans, Transportation Plans, Tourism and Economic Plans incorporating best practice as a guiding principle where feasible and appropriate.	**Planning, Roads & Transportation, Community Cultural and Social Development.**	✓	Short
3.2	Integrate and promote climate-smart building and urban design performance outcomes in development standards through the development management process.	**Planning Housing**	✓	Short
3.3	Promote the integrated planning, design and delivery of green infrastructure (including urban greening) through appropriate provisions in planning policies, development standards, infrastructural, public realm and community projects.	**Planning** Community Cultural and Social Development. Tourism. Economic Development. Housing. Environment. Roads & Transportation	✓	Short – Long
3.4	Research and incorporate, in the content of the County Development Plan, measures in accordance with section 10 (n) of the Planning and Development Acts 2000 (as amended) for: (*n*) the promotion of sustainable settlement and transportation strategies in urban and rural areas including the promotion of measures to—(i) reduce energy demand in response to the likelihood of increases in energy and other costs due to long-term decline in non-renewable resources, (ii) reduce anthropogenic greenhouse gas emissions, and (iii) address the necessity of adaptation to climate change; in particular, having regard to location, layout and design of new development;	**Planning Department** in consultation with external agencies and key stakeholders including E&M CARO.	X	Short
3.5	Assess the role of Natura Sites, Natural Heritage Areas (NHAs) and other locally important biodiversity areas in creating a more climate resilient environment and undertake a public awareness campaign to highlight their role	**Planning** Environment CAO NPWS	x	Medium
3.6	Undertake the identification, recording and mapping of wetlands and other locally important biodiversity areas and use this information to inform landuse decisions.	**Planning, Development and Environment**	✓	Medium
3.7	Prepare a map of County Wicklow the projects increased tidal levels heights at the year 2050.	**Planning, Development and Environment** IT Department	x	Medium

THEME 4: DRAINAGE AND FLOOD MANAGEMENT Objective: To manage the risk of flooding through a variety of responses				
No.	**Action**	**Lead & Partner(s)**	**Budgeted**	**Timeframe S/M/L**
4.1	Undertake and implement a surface water management plan for the assessment and management of flood risks with the aim of reducing the adverse consequences of flooding, to prioritise projects to reduce surface water flood risk and provide for detailed mapping of areas prone to surface water and groundwater flood risk.	**Environment** Municipal Districts Water Services	x	Short
4.2	Stipulate the requirement for the design and specification of urban storm water drainage systems for new development to take account of the potential future impact of climate change.	**Environment** Planning Municipal Districts	✓	Short
4.3	Draw up a Sustainable Urban Drainage Systems (SuDs) Policy and ensure the incorporation of the requirement for SuDs in local authority projects and private development sites.	**Environment** Planning Municipal Districts	✓	Short
4.4	Promote and encourage Community involvement in the retrofit of SuDs in existing developments.	**Environment** CAO Municipal Districts Community, Cultural and Social Development	x	Medium
4.5	Investigate best practice in storm runoff attenuation through the use of green infrastructure in urban open spaces.	**Environment** CAO	✓	Short – Medium
Objective: To mitigate the risk and impact of flooding				
4.6	Incorporate considerations of the impact of climate change into proposals submitted under the Minor Works Programme to ensure that measures proposed are adaptable to future changes.	**Environment** OPW	✓	Short-Long
4.7	Ensure that potential future flood information is obtained / generated by way of a Flood Risk Assessment (FRA) and used to inform suitable adaptation requirements within the Development Management process in line with the Guidelines for Planning Authorities on Flood Risk Management (DoECLG & OPW, 2009).	**Planning**	✓	Short-long
4.8	Coordinate with River Basin Coordinators regarding measures and funding/incentives for riparian buffers in priority water bodies.	**Environment**	x	Medium
4.9	Develop a scheme to ensure clearing and repairing of gullies and drains in all municipal districts.	**Roads & Transportation**	✓	Short

THEME 5: NATURAL RESOURCES AND CULTURAL INFRASTRUCTURE Objective: To provide for enhancement of natural environment to work positively towards climate action.				
No.	**Action**	**Lead & Partner(s)**	**Budgeted**	**Timeframe S/M/L**
5.1	Develop a strategy to undertake and implement an active Tree Planting programme with mapping of sites suitable for planting in the context of climate adaptation in conjunction with an awareness campaign that informs of the benefits to communities in improving air quality, offsetting carbon emissions, promoting biodiversity, limiting flood risk, reducing urban heat, as well aesthetic value.	**Environment**, Community, Cultural and Social Development, Planning IT Department	x	Medium
5.2	Integrate natural borders/buffers as an integral component of the design of greenways, tracks and trails and amenity areas to promote natural enhancement.	**Roads & Transportation** CAO	x	Short – Long
5.3	Incorporate best practice on biodiversity for all planting schemes on municipal properties and in the public realm.	**Municipal Districts** **Housing**	x	Short
5.4	Develop a tree policy which identifies the benefits of trees for climate action and also addresses maintenance concerns and facilitates good planning for the accommodation of trees as they mature.	**Corporate Estate** Environment CAO Municipal Districts	✓	Short
Objective: To promote effective bio-diversity management and enhance protection of natural habitats and landscapes				
5.5	Review Bio-diversity Plans / habitat conservation strategies, plans and projects to ensure that: all risks from adverse climate change have been identified; future changes are assessed and measures employed to address issues identified carbon capture within habitats is considered.	**Planning** NPWS	✓	Short-Long
5.6	Research and map areas considered beneficial for use as local carbon offset through carbon sequestration and include in Green Infrastructure strategy.	**Planning** Environment	x	Short-long
5.7	Ensure adequate scoping for climate impacts in Strategic Review of the Maritime for County Wicklow.	**Environment**	✓	Short
5.8	Appoint consultants to produce an Invasive Alien Species Plan.	**Environment** Roads & Transportation	X	Medium
5.9	Appoint Consultants to undertake an assessment of the impact of climate change on biodiversity and ecosystems services in the County.	**Environment** Planning	x	Medium

No.	Action	Lead & Partner(s)	Budgeted	Timeframe S/M/L
5.10	Undertake a study to identify natural corridors in County Wicklow and measures that can be taken to improve connectivity along these corridors and increase connectivity between corridors.	**Planning, Development and Environment. IT Department**	x	Medium
5.11	Appoint consultants to carry out an assessment of works necessary to protect wetland and dune system sites identified as vulnerable which act as a natural defence to rising sea levels.	**Planning, Development and Environment.**	x	Medium
Objective: To protect Heritage and Cultural Infrastructure				
5.12	Undertake and audit of natural and cultural heritage assets, identifying those areas most vulnerable to climate change risks and identifying mitigating measures as relevant.	**Planning**	x	Medium

THEME 6: COMMUNITY HEALTH AND WELLBEING **Objective: To build capacity and resilience within communities**				
No.	**Action**	**Lead & Partner(s)**	**Budgeted**	**Timeframe S/M/L**
6.1	Through Public Participation Network (PPN) raise awareness of the impacts of climate change and ways for communities to increase response and resilience to these impacts.	**PPN** Community, Cultural and Social Development	x	Short
6.2	Assess communities across the county in the context of their vulnerability to the impacts of climate change. Identify vulnerable communities and the risks to the community.	**Municipal Districts** Community, Cultural and Social Development	✓	Short
6.3	For identified vulnerable communities, develop and implement a programme to enhance their capacity to respond to and recover from extreme weather events with specific aims to: help the vulnerable community to develop a stronger facilitating role for mitigating risks provide advice on the risk of extreme events affecting their locality Devise mitigating actions to enhance preparedness provide support to develop appropriate resilience arrangements to enable response and recovery	**Municipal Districts** Community, Cultural and Social Development. Community.	X	Medium
6.4	Identify and integrate climate change as a consideration and guiding principle informing core strategy of LECP.	**Community, Cultural and Social Development** CAO	x	Medium
6.5	Ensure that grants to communities fund climate resilient projects.	**Community, Cultural and Social Development. Environment**	x	Short – long

No.	Action	Lead & Partner(s)	Budgeted	Timeframe S/M/L
6.6	Develop a Local Climate Adaptation Enterprise Plan which will meet the following: Identifying business opportunities and the production of local products for Wicklow that can help to build resilience. Identify measures to allow people to work at home or closer to home.			
6.7	Facilitate small business innovation and research on climate adaptation solutions.	**Local Enterprise Office**	x	Medium
6.8	Assess feasibility of augmenting public transport, pedestrian routes, cycle routes and park and rides within the County, identifying key priorities for each of the five Municipal Districts. Action to be taken on at least three identified priorities in each municipal district over the lifetime of this strategy with a timeframe for addressing other identified priorities.	**Municipal Districts** **Roads and Transport** Town Teams	x	Medium
6.9	Engagement with citizens on sustainable travel initiatives and schemes.	**Community, Cultural and Social Development**	x	Medium
6.10	An awareness campaign on the role of waste prevention, resource efficiency and the circular economy in climate action to demonstrate how it can assist in creating a more efficient and resilient local authority and strengthen the resilience of the Wicklow communities.	**Environmental Awareness Office**	x	Short
6.11	Develop a steering group to explore and develop common goals and objectives between Wicklow County Council and representatives from the farming, forestry, NPWS and land owners in rural and upland areas of the county.	**CAO** Environment	x	Short
6.12	Support the delivery of climate action awareness and education in County Wicklow schools through Green Schools and associated environmental awareness initiatives.	**EAO**	✓	Short
6.13	Review Wicklow Food Strategy to assess which goals and actions, including those developing local products, local markets and allotments, can help delivery on climate action.	**Community, Cultural and Social Development** LEO	✓	Short
6.14	Support local groups in undertaking suitable climate action projects through advice, information, grants and service support.	**EAO,** **Community, Cultural and Social Development,** PPN	x	Short
6.15	Expand the reach of WCC's annual Tidy Towns and Environmental Awards to engage a greater range of groups, give greater recognition to work done by schools and recognise a greater range of environmental activities that help to address climate change.	**EAO,** Community, Cultural and Social Development PPN	✓	Short

No.	Action	Lead & Partner(s)	Budgeted	Timeframe S/M/L
6.16	Facilitate cooperation between the CCSD SPC, the Economic and Enterprise SPC and the Transportation , Water and Emergency Services SPC, to ensure they coordinate measures to reduce dependence by the public on commuting for work, identifying measures to provide car independent work opportunities.	**Community, Cultural and Social**	✓	Short
6.17	Develop a section of the Wicklow.ie website to provide information on climate change, the Climate Adaptation Strategy, climate mitigation measures and to report on progress towards targets.	**IT Department** CAO	✓	Short
6.18	Create a database of clean technologies operating in Wicklow, technologies offered elsewhere in Ireland and new technologies being developed outside of Ireland as a tool to focus attention on developing this sector in County Wicklow.	**LEO**	✓	Short

CHAPTER 6: IMPLEMENTATION MONITORING AND EVALUATION

6.1 GOVERNANCE AND BUSINESS OPERATIONS

Local adaptation governance and business operations aim, through its first objective to establish a framework within the organization, to support the successful and practical implementation of adaptation actions. Given that this strategy represents all functions and operations of Wicklow County Council, it is important that the Climate Action Steering Group brings together representatives from all key functional areas with various technical, operational and management expertise who can successfully carry out the necessary tasks and implement the actions contained within strategy. The Management Team will nominate representation to the Climate Action Steering Group and assign its Chair. The Climate Action Steering Group will meet quarterly.

The tasks of the group are as follows:

- Prioritise actions within the short, medium and long term delivery timeframes,
- Develop an approach and initiate implementation of the actions,
- Liaise with other stakeholders and sectors, both locally and regionally, where required for the implementation of actions,
- Monitor and evaluate implementation of the actions and,
- Report on Progress to the Environment SPC and subsequently to full council.

The Eastern and Midland Climate Action Region Offices (E&M CARO) will continue to assist and provide guidance where possible in the practical implementation of the actions of this strategy. Wicklow County Council will continue the positive relationship, collaborate and engage with the E&M CARO as is necessary throughout the lifetime of this strategy. This will include submitting the annual progress report to the CARO if required.

6.1.1: PRIORITISE ACTIONS

The purpose of this task is to prioritize adaptation actions for delivery within the short, medium and long term timelines as defined in the strategy document. Actions are to be assigned timeframes for implementation and furthermore assigned owners for delivery. Progress reporting will be aligned to this prioritisation.

Short Term: 1-2 year timeframe
Medium Term: 2-4 year timeframe
Long Term: 3-5 year timeframe

6.1.2: DEVELOP AN APPROACH AND INITIATE IMPLEMENTATION

The purpose of this task is to break down the adaptation framework into what actions will be taken and when, and who will carry out the actions by way of an Implementation Plan. The steering group will devise a methodology for implementation that includes:

- Who is responsible for implementing the adaptation actions,
- Identify funding required for the adaptation measures,
- Identify/establish key indicators or targets as mechanisms for measuring outcomes
- Collaboration required with other stakeholders,

- Identification of where adaptation measures could be incorporated into existing plans, policies and budgets,
- Timeframe that measures will be implemented,
- Identify risks to the implementation of actions.
- It is recommended to expand out the actions into the implementation plan. Once complete, key personnel can assume responsibility and begin implementing the adaptation actions.

6.1.3: Liaise with other Stakeholders/Sectors

At times, the local authority will be required, as considered necessary, to liaise with other key stakeholders to provide for the delivery of actions. Conversely, the sectors, as identified in the National Adaptation Framework, will engage and liaise with Local Authorities in the delivery of sectoral adaptation actions stemming from their respective adaptation plans.

6.1.4: Monitor and Evaluate Implementation

Monitoring and evaluating the implementation of actions is critical to ensure the long-term success of climate adaptation actions. It is essential in tracking the performance of activities within the lifetime of this strategy, in determining whether planned outcomes from adaptation actions have been achieved and in determining whether new adaptation actions should be undertaken.

The climate action steering group is encouraged to use results from the monitoring and evaluating program to:

- Revisit vulnerability and risk assessments conducted as part of adaptation actions,
- Make changes where appropriate based on monitoring results,
- Update observed changes,
- Include new climate science and recent extreme climatic hazards/events,
- Factor in changes to exposure and/or adaptive capacity, and
- Evaluate the success or outcome of completed actions.

This ensures an iterative process and allows actions to be informed by latest climate change data and projections. In this way monitoring and evaluation can help improve the efficiency and effectiveness of adaptation efforts in the council.

6.1.5: Report on Progress

The Climate Action Steering Group should develop and agree appropriate and continuous timeframes and mechanisms to report on the progress of the practical implementation of actions of this strategy to the Environment SPC, Management Team and Elected Members/Full Council as considered appropriate.

Reporting on progress i.e. Climate Change Adaptation Progress Report should be prepared **annually,** (based on the initial date of the adoption of the strategy)**,** for input by the Management Team and SPC and review by the Elected Members.

The progress report should provide for, inter alia:

- Progress achieved on actions to that point (including key indicators as established)
- Extent to which actions have achieved and built new relationships with key stakeholders, agencies, communities and identified new or emerging opportunities.
- Identification of funding streams used
- Inspired or encouraged positive community engagement
- Reports on the outcomes of efforts to change behaviour
- Report on barriers, obstacles and unexpected outcomes.

The requirement to report on progress on an **annual** basis is also informed by the following:

Under section 15 of the Climate Action and Low Carbon Development Act 2015, local authorities may be required to report on progress in meeting the terms of the National Adaptation Framework and Sectoral Adaptation Plans.

Local Authorities have been identified by many national sectors under the National Adaptation Framework as a key stakeholder responsible for implementing adaptation actions in their local area and ensuring coordination and coherence with the sectors identified in the NAF. Cooperation and collaboration between Local Authorities and the sectors is encouraged strongly. Under Section 14 of the Climate Action and Low Carbon Development Act 2015, Sectors may be required to report on progress made with adaptation actions and present annual sectoral adaptation statements to each House of the Oireachtas by the relevant Minister or by the Minister for DCCAE.