

CLIMATE READY DONEGAL

ENGAGE | PLAN | ADAPT





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Grateful acknowledgement is made to the Climate Action Regional Office - Atlantic Seaboard North Region with regard to the development of the Draft Donegal County Council Climate Adaptation Strategy. In addition, Donegal County Council would also like to express gratitude to the following sources for their assistance and contributions to draft strategy:

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- The Department of Communications, Climate Action and Environment.
- The Regional Climate Action Steering Group and the Climate Adaptation Team Leaders from Mayo County Council, Sligo County Council, Galway County Council and Galway City Council.



FOREWORD



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Donegal has a temperate maritime climate with an abundance of rain and no extreme temperature variations, much like the rest of Ireland. It has a vibrant people, culture, heritage and biodiversity located in a stunning landscape of mountains, rivers, lakes, cliffs and beaches. Communities and businesses located throughout the county are supported by an array of infrastructure and services including roads, drinking water, waste water and energy networks. It is this combination of communities, landscape, heritage, economy and climate that ensured Donegal was labelled the “Coolest Place on the Planet” recently by the National Geographic magazine.

Over the past century, rainfall patterns, sea level rise, warmer temperatures and more extreme weather events have been observed in the county and these changes have been measured and documented. There has been a notable increase in the frequency of extreme weather events in recent years that have brought strong winds, low temperatures and high rainfall and at other times high temperatures and low rainfall. Each of these events creates specific impacts and risks for the county. The occurrence of simultaneous and or consecutive extreme weather events has had unprecedented consequences for the county. Evidence shows that the increased frequency and intensity of such events can be attributed to a climate change.

Donegal’s communities have seen the significant impacts of wildfires, landslides, floods, damage to infrastructure, disruption to services and damage to biodiversity and ecosystems. These events present risks and challenges to people, communities, businesses and Donegal County Council in maintaining, repairing and restoring services and infrastructure. It is imperative that we put in place actions and measures to enable all of us adapt to prepare better for the projected climate changes. Proactive adaptation to such changes is necessary and critical to ensuring that Donegal’s economy, environment and communities are resilient to climate change into the future. It also provides an opportunity to embrace the positives climate change may bring to the county through longer growing

seasons and warmer temperatures which will benefit the agricultural and tourism sectors and improve the local economy.

Two simultaneous approaches, mitigation and adaptation, are required to address climate change. Mitigation is focused on reducing carbon pollution and greenhouse gas emissions in order to limit the extent to which our climate changes in the future. This approach includes actions such as improving the energy efficiency of our homes and buildings, switching to more sustainable energy sources and trapping and storing carbon in vegetation and soils. A National Mitigation Plan will set out strategies that must be embraced by individuals, businesses and the public sector alike. Adaptation actions are also required to address the consequences and challenges of climate change. These actions will allow us prevent or minimise the impacts of climate change (e.g. new flood defences) but also take advantage of opportunities and benefits that climate change brings (e.g. new low carbon innovation and economy).

This draft Strategy sets out a framework of actions and measures that Donegal County Council proposes to undertake to further embed climate adaptation into all local authority areas of responsibility and to assist communities in adapting to climate change. This is the first step to ensure Donegal and its citizens develop a sustainable future that is resilient to the impacts of climate change.

CONTENTS

INTRODUCTION.

STATUTORY CONTEXT.

ROLES & RESPONSIBILITIES.

REGIONAL & COUNTY PROFILES.

OBSERVED & PROJECTED CLIMATE CHANGE.

THE ADAPTATION STRATEGY PROCESS.

STEP 1: PREPARING THE GROUND.

STEP 2: ASSESSING THE CURRENT
BASELINE.

STEP 3: IDENTIFICATION OF CLIMATE
RISKS & OPPORTUNITIES.

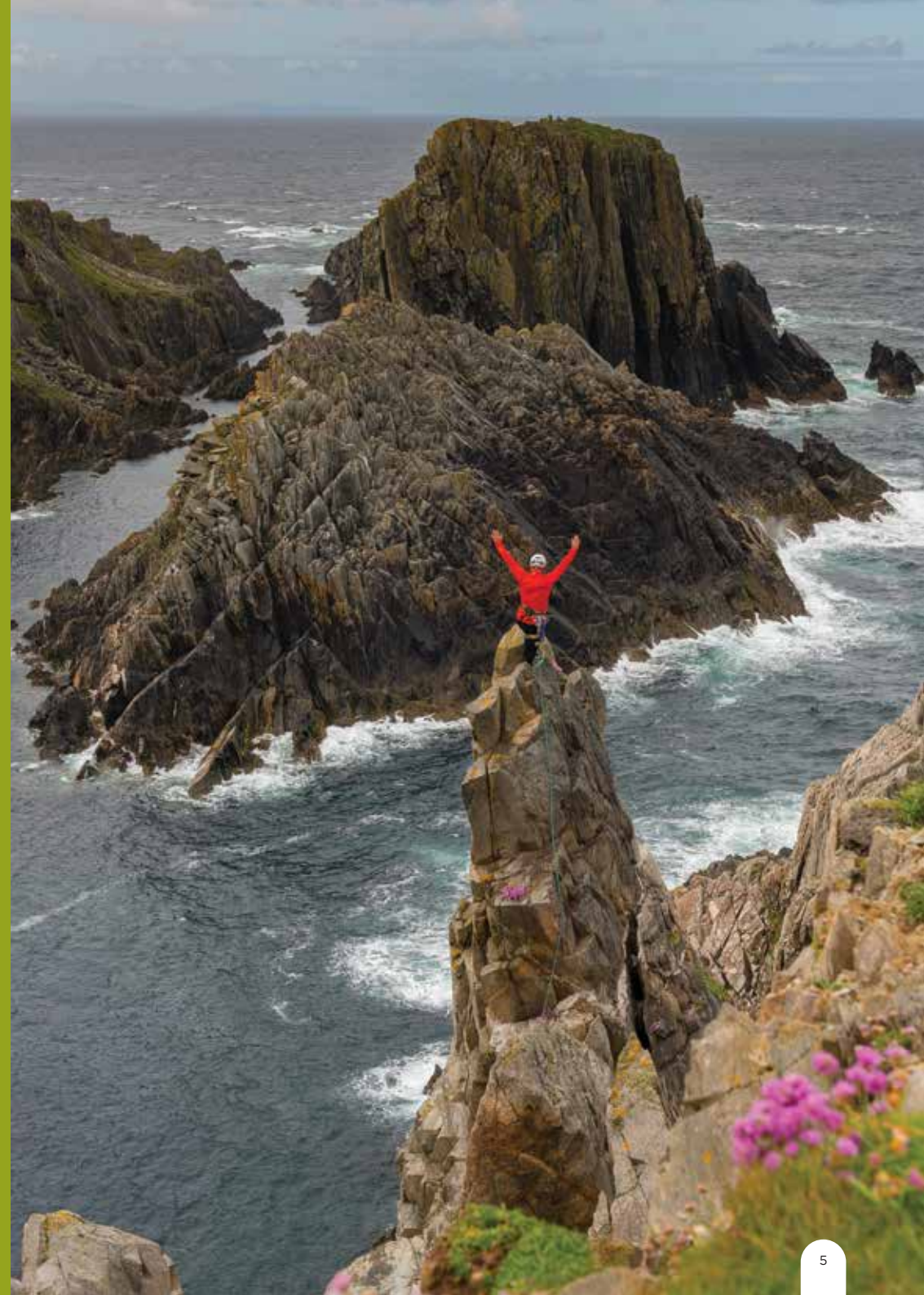
STEP 4: GOALS, OBJECTIVES
& ACTIONS.

STEP 5: IMPLEMENTATION.

MITIGATION.

BIBLIOGRAPHY.

APPENDIX



INTRODUCTION



Climate change is a critical challenge for Donegal as it is for countries globally. It will result in a range of impacts across a wide number of sectors that are likely to exacerbate existing vulnerabilities.

Taking proactive action to adjust and prepare for anticipated changes will reduce losses, improve our environment and provide a host of community benefits. Global momentum is building for national and local governments to take ambitious action that builds resilience to climate change within their organisations and functional areas via adaptation and mitigation measures. The Paris Agreement expresses an international commitment to enhance adaptive capacity, strengthen resilience and reduce vulnerability to climate change. Developing a robust approach to adaptation is the first step on this journey.



Donegal County Council's Climate Change Adaptation Strategy 2019-2024 (the Adaptation Strategy) sets out our strategic priorities, measures and responses for adaptation in County Donegal over the next five years; as required by the Climate Action and Low Carbon Development Act 2015.

While the Adaptation Strategy recognises and builds on adaptation action already underway, it also lays the groundwork for a new, integrated approach to adaptation under the National Adaptation Framework.

The Climate Action and Low Carbon Development Act 2015 also requires climate change principles and objectives to be considered in all our policies and programs. In doing so, the Strategy will provide an opportunity to not only enhance our adaptive capacity and resiliency but also an opportunity to reduce the long-term costs and impacts associated with climate change.

The aim of this first strategy is to identify the risks, challenges and opportunities that need to be considered and to take coherent coordinated action. The Strategy is based on four main themes: Critical Buildings and Infrastructure, Natural and Cultural Capital, Water Resource & Flood Risk Management and Community Services and provides for many actions that will be developed and implemented over the next five years. Priority is awarded to actions where severe weather has impacted the safety of citizens and critical infrastructure, however assets which are currently or may in the future be susceptible to severe weather impacts are also considered.

These actions will be driven by Senior Management and Elected Members via existing Strategic Policy Committees (SPCs).

Climate Action Regional Office – Atlantic Seaboard North

The newly established Climate Action Regional Office – Atlantic Seaboard North is one of four regional climate change offices that have been set up in response to Action 8 of the 2018 National Adaptation Framework – Planning for a Climate Resilient Ireland.

Mayo County Council is the lead authority for the Atlantic Seaboard North Region, which consists of Donegal County Council, Sligo County Council, Mayo County Council, Galway County Council and Galway City Council.

OUR APPROACH



ENGAGE

The first key step in our approach is improving our understanding and communication of the risks from a changing climate across the Local Authority departments, businesses, communities and individuals. The Strategy aims to engage with communities and place them at the centre of this adaptation process, and to encourage broad participation and collective decision making on how our citizens want to adapt to the challenges and opportunities, and how we as a Local Authority can support this change. Tailored training and development programs will be essential components to aid the delivery of the plan.



PLAN

The planning process will include details on how our climate is changing, potential impacts and opportunities, as well as the identification of areas at risk to inform planning and decision-making. The compilation of inventories and baselines with the assistance of relevant state agencies and third level academic institutions will assist operations as the adaptation journey of Donegal County Council progresses. The integration of climate change principles throughout future plans and procedures will be fundamental in strengthening our resilience.



ADAPT

The success of this plan will be measured by our ability to develop and implement co-ordinated responses to climate risk where needed. Many adaptation actions are already underway at Donegal County Council and mainstreaming adaptation measures into all levels of operations and policies within Donegal County Council will be an important aspect of implementing climate action at local level. The team will develop a progress report to document observed climatic changes or impacts in the County; successfully implemented actions; barriers to the implementation of actions; new sources of funding; and windows of opportunity for climate action.

ADAPTION & MITIGATION

Climate change **Adaptation** and **Mitigation** are distinct but complementary activities.

Adaptation means anticipating the adverse effects of climate change and taking appropriate action to prevent or minimize the damage that it causes, additionally it means taking advantage of opportunities that may arise. This includes green growth, innovation, jobs and ecosystem enhancement as well as improvements in areas such as water and air quality, the natural and built environment.

Mitigation is the process of reducing carbon pollution and greenhouse gas emissions to limit the extent to which our climate changes in the future. It involves improving energy efficiency, switching to more sustainable energy sources and trapping and storing carbon in vegetation and soils.

Substantial and sustained reductions in GHG emissions are required to limit the extent of climate change and reduce the likelihood of encountering severe, irreversible changes (IPPC, 2013). This needs to be accompanied with action to prepare for the effects of climate change, as the world will continue to warm for several decades.

This Strategy is concerned with preparing for the changes that a changing climate will bring through climate adaptation. The process involves developing a comprehensive understanding of how changes will affect Donegal County Council and the communities within its functional areas as well as actively working to reduce our exposure to new and increased risks.



STATUTORY CONTEXT



STATUTORY CONTEXT

A key driver for the development of Donegal County Councils Climate Adaptation Strategy is the need to respond to International, European and National Climate Change action through a wide range of agreements, directives, legislation and regulations. This includes the Irish Government’s Climate Action and Low Carbon Development Act 2015, National Mitigation Plan, National Adaptation Framework and National Planning Framework.

International and European Policies & Agreements

United Nations Framework Convention on Climate Change - 1992
 The UNFCCC is an international environmental treaty adopted on 9 May 1992. It entered into force on 21 March 1994 with the objective of “stabilizing greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system”

Kyoto Protocol - 1997
 The Protocol is based on the principle of common but differentiated responsibilities: it acknowledges that individual countries have different capabilities in combating climate change, owing to economic development, and ergo puts the obligation to reduce current emissions on developed countries on the basis that they are historically responsible for the current levels of greenhouse gases in the atmosphere by Ireland.

EU Adaptation Strategy -2013
 A White Paper an EU framework for adaptation to climate change was produced in 2009 which led to a comprehensive EU adaptation strategy in April 2013. The EU Adaptation Strategy has an overall aim of contributing to a more climate resilient Europe.

Paris Agreement - 2015
 The Paris Agreement was adopted in 2015. The aims of the Agreement are to hold the increase in the global average temperature to well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5°C above pre-industrial levels. There are 195 Parties to the UNFCCC.

National Policies & Agreements

Climate Action and Low Carbon Development Act 2015

- National Mitigation Plan (2017)**
 Initial step to set us on a pathway to achieve the level of decarbonisation required.
- National Adaptation Framework (2018)**
 Sets out the potential implications of climate change for Ireland and specifies the national strategy for the development of adaptation measures by key sectors and by local authorities.
- Climate Change Advisory Council**
 Has several reporting obligations, including Annual and Periodic Reviews of progress towards meeting the national transition objective.

National Planning Framework - Ireland 2040
 The transition to a Low Carbon and Climate Resilient Society is one of ten key national strategic outcomes which will guide the implementation of the new National Planning Framework. The National Development Plan 2018-2027 brings almost €22 billion between Exchequer and non-Exchequer resources to addressing the transition to a low-carbon and climate resilient society.

SECTORAL ADAPTATION PLANNING

Under the National Adaptation Framework – Planning for a Climate Resilient Ireland, seven Government Departments (or Agencies, where appropriate) with responsibility for twelve priority sectors are required to prepare sectoral adaptation plans.

The broad objective of the sectoral plans will be for government departments and relevant agencies to consider their own vision for a climate resilient future which will have a sector specific focus. This is essential in terms of understanding the key risks that face each sector. The National Adaptation Framework aims to present an overarching view of how each sector can contribute to a climate resilient Ireland in line with National, European and International policy.

The National Adaptation Framework has grouped the sectors into four key thematic areas:

1. Critical Infrastructure and Buildings

2. Natural & Cultural Capital

3. Water Resources & Flood Risk Management

4. Public Health

This approach reflects trends at EU level which incorporate a thematic focus on climate adaptation which may be expanded upon in future National Adaptation Frameworks. Our Strategy has adopted these thematic areas to facilitate potential synergies and efficiencies that can be achieved in bringing forward coherence between sectoral adaptation policies and measures.

The Donegal County Council Adaptation Strategy will facilitate partnerships via the Climate Action Regional Office with key stakeholders in the twelve priority areas to ensure that our adaptive actions are complementary, mutually reinforcing and avoid conflicting outcomes.

Theme	Sector Level	Lead Department for Sectoral Adaptation Plans
Natural and Cultural Capital	Seafood	Department of Agriculture, Food and the Marine
	Agriculture	
	Forestry	
	Biodiversity	Department of Culture, Heritage and the Gaeltacht
	Built & Archaeological Heritage	
Critical Infrastructure	Transport infrastructure	Department of Transport, Tourism and Sport
	Electricity and Gas Networks	
	Communications networks	Department of Communications, Climate Action and Environment
Water Resources and Flood Risk management	Flood Risk Management	Office of Public Works
	Water Quality	
	Water Services Infrastructure	Department of Housing, Planning and Local Government
Public Health	Health	Department of Health

SUSTAINABLE DEVELOPMENT GOALS

In September 2015, Transforming Our World, the 2030 Agenda for Sustainable Development (the 2030 Agenda) was adopted by all 193 Members States of the United Nations (UN). The 2030 Agenda aims to deliver a more sustainable, prosperous and peaceful future for the entire world and sets out a framework for how to achieve this by 2030.

17 Goals to Transform Our World

The Agenda is made up of 17 Sustainable Development Goals (SDGs) which cover the social, economic and environmental requirements for a sustainable future. Ireland is fully committed to achieving the SDGs and the National Implementation Plan 2018-2020 represents Ireland's initial framework for doing so. It is the first in what will be a series of SDG Implementation Plans in the period to 2030.

The SDGs address the global challenges we face, including those related to poverty, inequality, climate, environmental degradation, prosperity, peace and justice.

Climate change presents the single biggest threat to sustainable development everywhere and its widespread, unprecedented impacts disproportionately burden the poorest and most vulnerable. Urgent action to halt climate change and deal with its impacts is integral to the successful implementation of the SDGs.

Goal 13. Climate Action: Take urgent action to combat climate change and its impacts, focuses on the integration of climate change measures into national policies, the improvement of education, awareness-raising and institutional capacity on climate change mitigation, adaptation, impact reduction and early warnings.



ROLES & RESPONSIBILITIES



SHARED RESPONSIBILITY

The impacts and opportunities of climate change are complex and cover many cross sectoral issues. It is important to recognise that the response to climate change requires a whole of society approach and that the implementation and monitoring of this Strategy will involve working collaboratively with several agents. Partnership is key, as this Strategy taken in isolation is not going to provide solutions for all of society's adaptation needs.

Climate change will impact both the services and assets that Donegal County Council manage and the local communities within our functional area. Local Authorities play an influential role in preparing communities for climate change through the services they deliver, such as planning and development, critical infrastructure, environmental facilities and socio-economic programmes. However working together with government departments and agencies, local businesses, communities and individuals will be essential in achieving the ambitions of this Climate Adaptation Strategy, with each sector having different but complementary and important roles to play in managing climate risks.

Crucially however one of Donegal's great strengths is its communities (third level, business, voluntary, other government agencies) and their support is vital to the success of this Strategy. Action at a local level will have a significant impact on our overall ability to meet our climate targets and will extend and complement action being undertaken at national and international levels.

The local communities that will be most impacted by climate change are also best placed to identify the opportunities they have in the future. It is in our best interest to ensure that these communities are empowered and enabled to play an effective role and that policies where possible, encourage 'place-based' initiatives.

Community groups are often led by volunteers who tap into the resources of their local community to achieve effective on-the-ground results. Donegal County Council recognises the importance of this type of community action and proposes to support these initiatives.

CLIMATE READY DONEGAL



ROLES & RESPONSIBILITIES

Governments at all levels, businesses, households and the community each have important, complementary and differentiated roles in adapting to the impacts of climate change.



Government Departments & Agencies

Some climate change risks have the long-term potential to undermine the national economy or affect critical infrastructure and natural systems of national significance. Addressing risks, as well as managing and adapting to climate change impacts will be a long-term obligation for all levels of government.

Government departments and agencies will work collaboratively with all stakeholders to evaluate adaptation tasks to effectively manage climate change risks to public infrastructure and the environment, deliver government services and create the regulatory environment that supports and promotes resilience and action among individuals and groups. One of the most important roles of government is to ensure that society has the information required to make informed decisions and to adjust its behaviour for positive climate action.



Donegal County Council

Donegal County Council is responsible for a broad range of services, the administration of a range of EU and National legislation as well as the management of a substantial number of assets and infrastructure of local, regional and national significance. We are on the frontline in dealing with the impacts of climate change and have a critical role to play in ensuring that local circumstances are adequately considered in the overall adaptation process and in involving the local community directly in efforts to facilitate effective change. We are strongly positioned to inform government departments and agencies about the needs of local communities, to communicate directly with communities and to local extreme weather events.

Climate Action Regional Office

The CARO will coordinate a consistent approach in terms of adaptation strategies at local authority level in the Atlantic Seaboard North Region, assisting the local authorities to prepare and implement their own Climate Adaptation Strategies. In addition they will collaborate with government agencies and third level institutes on research, information and resources on climate change adaptation.



Businesses

To enable businesses to manage the risks to their own assets and activities from climate change, they will need to be aware of the risks, their responsibility and supports available. In addition it is necessary for this sector to take steps to understand the magnitude and nature of the specific risks to their assets and activities and to develop strategies and actions to manage the risks. Businesses will need to consider climate risk in plans and investments but simultaneously they can identify and invest in emerging opportunities that our changing climate will bring.



Academia

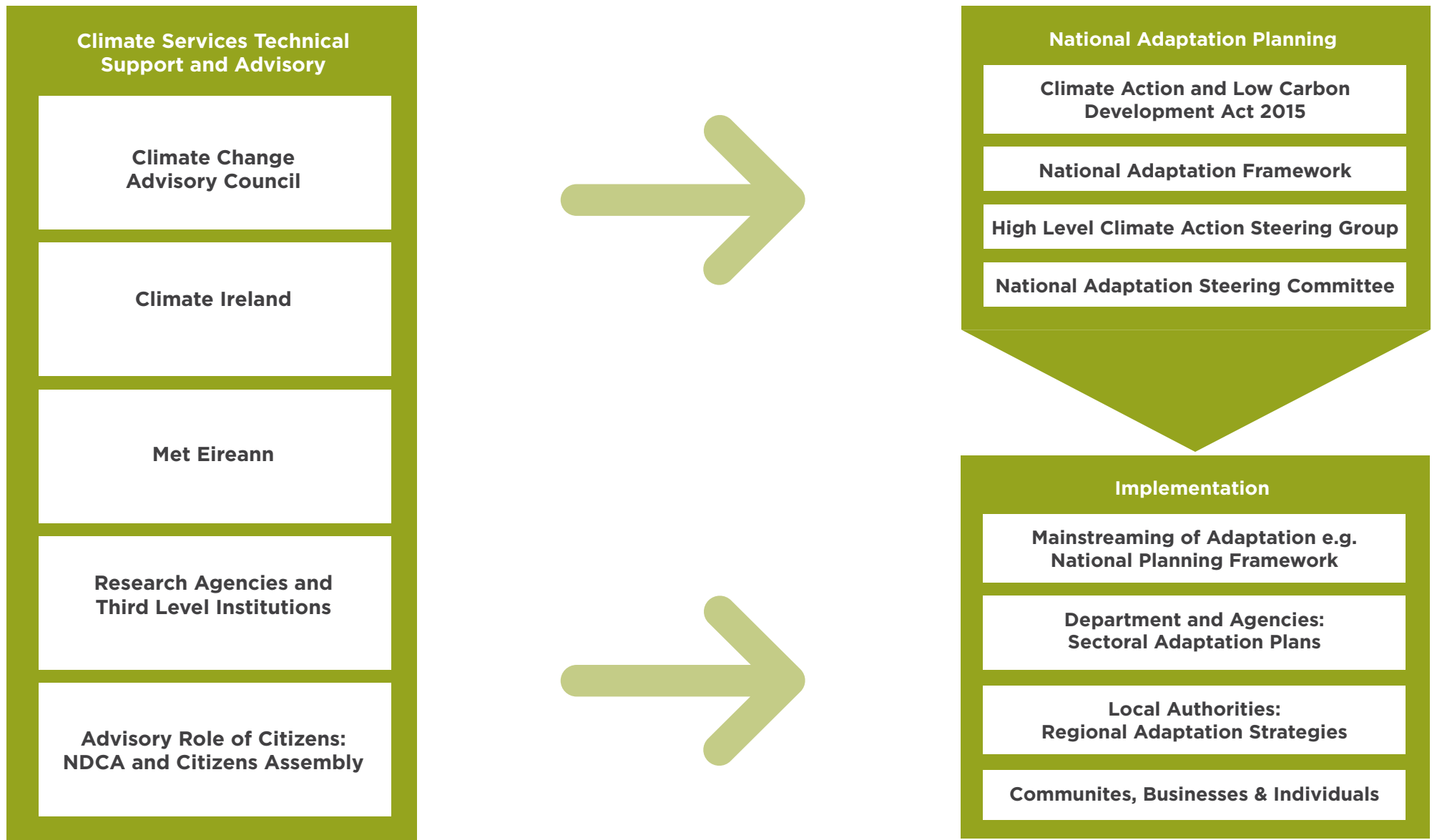
Academia have a critical role to play in preparing society to adapt to the impacts of climate disruption by providing research and education around adaptation strategies. Communicating and translating science and big data into information that policymakers, businesses and communities can apply to their work.



Communities & Individuals

Community based adaptation to climate change focuses on empowering communities and individuals to use their knowledge and decision-making processes for action on climate change. To achieve this communities need to engage with the other stakeholders to build awareness and understanding of climate change, to consider the risks and opportunities, to develop local resilience and response plans to emerging risks.

NATIONAL ADAPTATION GOVERNANCE STRUCTURE



REGIONAL & COUNTY PROFILES



ATLANTIC SEABOARD NORTH REGION

The Atlantic Seaboard North Region (ASBN), consists of the counties of Donegal, Sligo, Mayo and Galway. Its geographic area covers 18,354 km² and a population of 613,292 persons based on the Central Statistics Office data from Census 2016. The counties of Mayo and Donegal have the second and third highest dependency ratios respectively in the country; with 15.7% of Donegal's population is over 65 and 22% is under 15 years of age.

Natural & Cultural Capital

The ASBN region is home to half of the State's National Parks, with many other outstanding assets, including blue flag beaches, forest parks, trails, and a growing number of established Greenways and Blueways, with additional projects in development. A significant area of the Region is subject to conservation including SACs, SPAs, NHAs or proposed NHAs and hosts extensive areas of peatlands which are of high biodiversity value as well as important carbon sinks.

There is also rich built and cultural heritage throughout this region that creates a link to our past and fosters our sense of place and wellbeing. The protection of our built and natural environment against the impacts of climate change will contribute to the retention of a sense of continuity with our history and the attractiveness of our region as a place to live, work and enjoy.

Transport Infrastructure

Travel in the region is primarily by private vehicle with the quality of the national road network substantially improved over the last two decades. Intercity rail offers sustainable travel alternatives for longer distance trips to the region, except for county Donegal, which does not have a rail service. International air connectivity is provided at Ireland West Airport Knock (IWAK) and Donegal Airport. The region does not have a port of "National Significance", at Tier 1 or Tier 2 levels however the Port of Galway is categorised as a Port of Regional Significance, (Tier 3) while ports such as Killybegs, Sligo, Greencastle and Ros an Mhíl perform specific roles.

Atlantic Seaboard North Region

Local Authorities in the Region

Donegal Co Co, Sligo Co Co, Mayo Co Co, Galway Co Co and Galway City Council.

Regional Profile

Area: 18,354 km²

Coastline Length: 2,702km, which is 48% of the country's coastline

Length of Coastline which is deemed at risk of erosion – 1,011km (Ecopro, 1996)

Total Population: 613,292, of which 305,151 live within 5km of the coast

Major Towns and Cities: Letterkenny, Bunclara, Galway City, Sligo City, Ballina, Castlebar, Tuam, Ballinasloe,

18 inhabited offshore islands that contain some of our most vibrant and culturally distinctive communities, with many areas forming part of the Gaeltacht

Natural & Cultural Capital

Significant number of **Natura 2000 sites**

National Parks - Glenveagh National Park (Co. Donegal), Ballycroy National Park (Co. Mayo); Connemara National Park (Co. Galway);

30 Blue Flag Beaches and 2 Blue Flag Marinas
2.1 million overseas tourists in 2015

Transport Infrastructure

Ports: Galway Port (Tier 3), Killybegs, Sligo, Greencastle and Ros a Mheal perform specific roles
International Air Connectivity – Ireland West Airport Knock (770,000 passengers in 2018) and Donegal Airport

COUNTY DONEGAL

Coastline

Donegal has a coastline with 1,132 km of shoreline or 20% of the country's total coastline. There are 11 Blue Flag Beaches in Donegal, 2 Blue Flag Marina and 4 beaches achieving Green Coast Awards.

Archaeological Heritage

The archaeological heritage of County Donegal is a tangible reminder of past societies and ways-of-life. Most of the 3,400 known archaeological monuments in County Donegal on the Record of Monuments & Places are in private ownership. There are 17 National Monuments in state care while hundreds of shipwrecks have been identified in the waters around our coast.

Built Heritage

County Donegal is home to one of the largest concentrations of vernacular buildings in Ireland. Formal architecture receives expression in the streetscapes of our towns and villages, industrial heritage and estate houses. There are 474 Protected Structures in County Donegal protected under the Planning & Development Act (2000) and the National Inventory of Architectural Heritage has identified over 2,000 structures recommended for statutory protection. Traditional field boundaries, such as stone walls and hedgerows, lend character to our rural landscapes and provide clues to traditional ways-of-life and agrarian practices.

Tourism

County Donegal, encapsulates the Wild Atlantic Way, beautiful beaches, spectacular mountains including Errigal Mountain and the spectacular rugged Sliabh Liag cliffs. Other points of interest include Fanad Lighthouse, Lough Swilly, Mulroy Bay, Glenveagh National Park, Malin Head – the most northerly point in Ireland, Grianán of Aileach hilltop fort and many islands.

Economy

Donegal's four largest employment sectors are Wholesale & Retail (13.5%), Health & Social Work (12.7%), Education (10.8%) and Industry (9.2%). Accommodation & Food Services and Agriculture account for 7.9% and 6.8% of employment in the county respectively. However Information & Communications enjoyed the county's strongest employment growth. (census Data, 2016).

County Donegal County Profile

Area: 4,861 km²

Coastline Length: 1,132km

Highest mountain is Errigal (751m).

Total Population: 159,192 of which 73% live in rural areas.

Major Towns: : Letterkenny, An Clochán Liath (Dunglow), Ballybofey-Stranorlar, Ballyshannon, Buncrana, Bundoran, Carndonagh, Donegal Town, Killybegs, An Fál Carrach (Falcarragh), Dunfanaghy, Glenties, Lifford, Moville

Agriculture: 9,240 farms in Donegal, average farm size is 28 ha (CSO, 2010).Gaeltacht: 935 km²

Natural & Cultural Capital

Natura 2000 sites: 26% of the county is designated for the protection of flora and fauna..

Glenveagh National Park: 9,440 hectares of Atlantic blanket bog, and Lough Veagh and is home to a small number of breeding pairs of Golden Eagles.

The abundance of wildlife habitats and species in County Donegal testify to the quality of Donegal's physical landscape not least of all in the 46 Special Areas of Conservation, 26 Special Protection Areas, 14 Natural Heritage Areas, 10 Nature Reserves, 6 Wildfowl Sanctuaries, 4 Ramsar wetland sites and Glenveagh National Park. Within and outside these areas, the natural heritage provides a wildness to the character of our landscape, the Wild Atlantic Way and forms the basis of the county's recognition in 2017 as National Geographic's coolest place on the planet.

Transport Infrastructure

Road Network: 6,334 km of roads (151 km of National Primary, 155 km National Secondary, 784 km Regional, and 5,335 km Local).

Donegal Airport: serving Dublin and Glasgow

100 (approx) piers and harbours maintained by Donegal County Council

Greenways: 326km of Integrated cycle lanes and 36km of segregated cycle lanes

OBSERVED & PROJECTED CLIMATE CHANGE

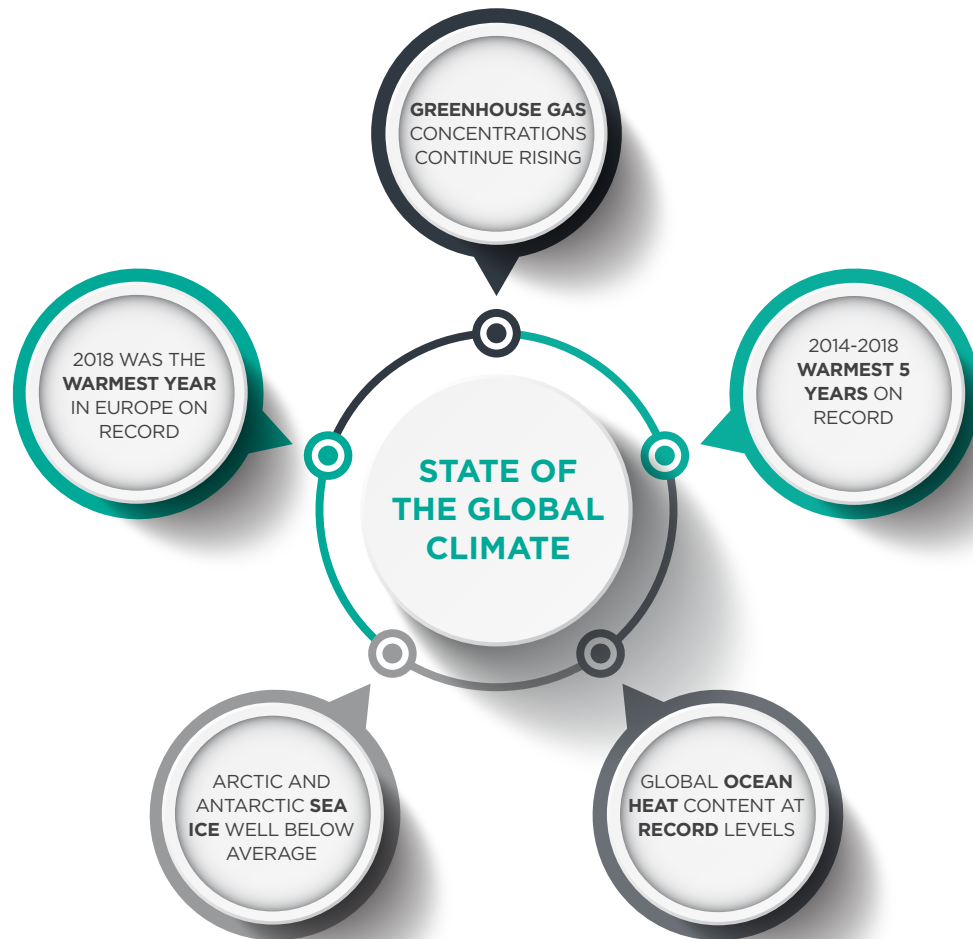


OBSERVED CLIMATE CHANGE

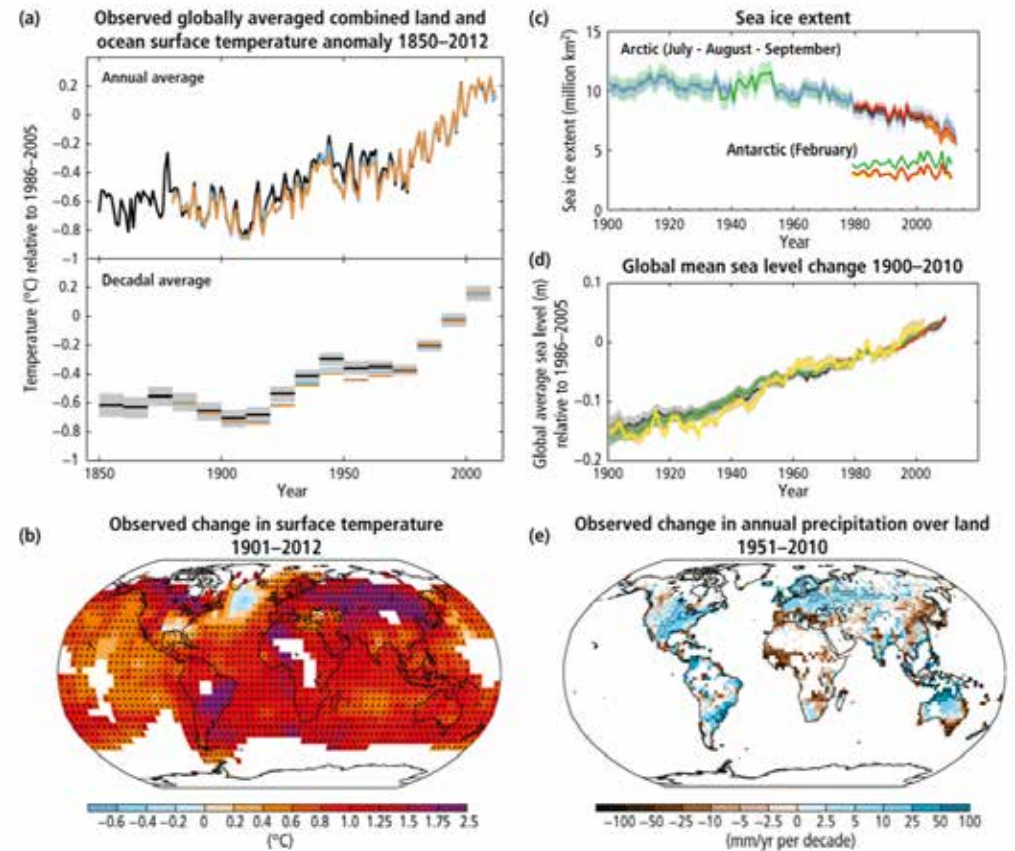
Global Climate Indicators

The Global Climate Indicators are a set of parameters that describe the changing climate. They comprise key information for the most relevant domains of climate change: temperature and energy, atmospheric composition, ocean and water as well as the cryosphere (part of the earth's surface where water exists as ice).

Analysis of these different indicators and independent data sets unequivocally point to one thing: the world has warmed since the late 19th century.



Source: WMO, 2019



“Warming of the climate system is unequivocal, and since the 1950s, many of the observed changes are unprecedented over decades to millennia. The atmosphere and ocean have warmed, the amounts of snow and ice have diminished, and sea level has risen”. [IPCC AR5]

Source: IPCCAR5

OBSERVED CLIMATE CHANGE

Overview of 2018 Global Temperatures

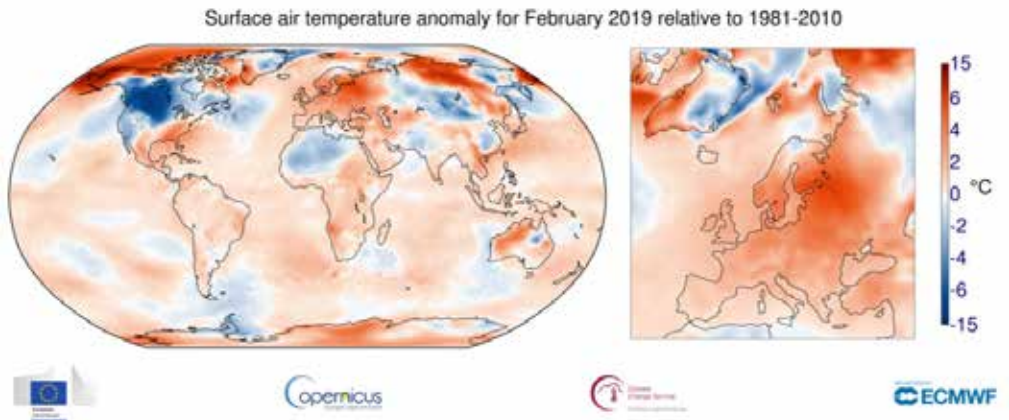
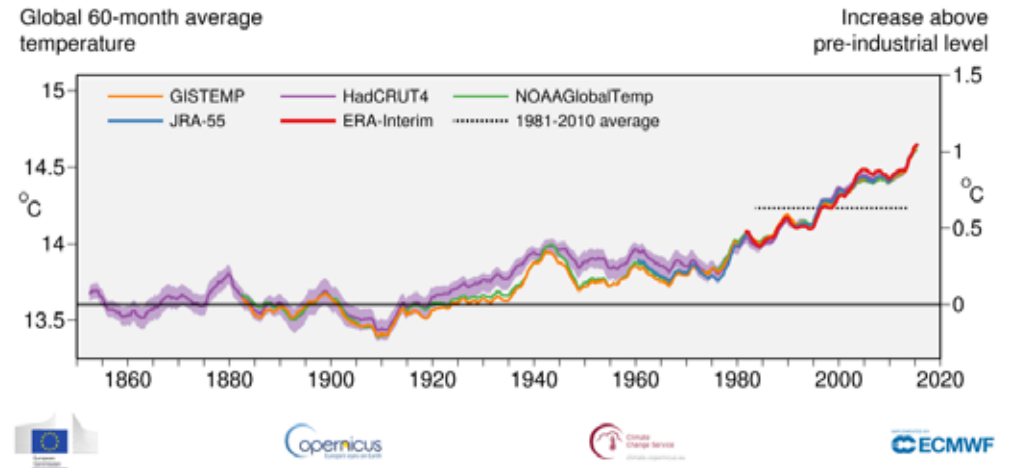
Data released by the Copernicus Climate Change Service (C3S) show that 2018 was the fourth in a series of exceptionally warm years and together with the Copernicus Atmosphere Monitoring Service (CAMS), C3S reports that atmospheric CO₂ concentrations have continued to rise.

The Copernicus C3S data show that 2018 surface temperatures were more than 0.4°C higher than the long-term average recorded over the period 1981-2010. The most pronounced warming compared to the long-term average occurred in the Arctic. Most land areas were warmer than average, especially Europe, the Middle East and the western USA.

Apart from a relatively cold February and March 2018, Europe saw above average temperatures during all months of the year. Starting at the end of spring and continuing well into autumn and even winter, northern and central Europe experienced weather conditions that were persistently warmer and drier than average.

Copernicus is the European Union's Earth Observation programme, looking at our planet and its environment for the ultimate benefit of all European citizens. It offers information services based on satellite **Earth Observation and in situ (non-space) data**.

The C3S mission is to support adaptation and mitigation policies of the European Union by providing consistent and authoritative information about climate change.



OBSERVED CLIMATE CHANGE

Observed Global Climate Change

Warming of the global climate system has been observed via global average air and ocean temperatures, the widespread melting of snow and ice, the rising sea level and the more frequent occurrence of extreme weather events.



Surface Temperature

- Each of the last three decades has been successively warmer at the Earth's surface than any of the preceding decades since 1850.
- In the Northern Hemisphere, 1983-2012 was likely the warmest 30-year period of the last 1400 years (NAF, 2018).
- In 2017, global mean temperatures were $1.1\text{ °C} \pm 0.1\text{ °C}$ above pre-industrial levels, and it was one of the three warmest years on record (WMO, 2018).
- The increase in global temperature is closely correlated to the increase in greenhouse gas emissions. Levels of greenhouse gases are now 30% higher than any time during the last 800,000 years, thus enhancing the greenhouse gas effect resulting in global warming.



Shrinking Ice Sheets & Glaciers

- Over the period 1992 to 2011, the Greenland and Antarctic ice sheets have been losing mass, likely at a larger rate over 2002 to 2011. Glaciers have continued to shrink almost worldwide.
- Data from NASA's Gravity Recovery and Climate Experiment show Greenland lost an average of 281 billion tons of ice per year between 1993 and 2016, while Antarctica lost about 119 billion tons during the same time period.



Ocean Warming & Sea Level Rise

- Ocean warming dominates the increase in energy stored in the climate system, accounting for more than 90% of the energy accumulated between 1971 and 2010 with only about 1% stored in the atmosphere.
- “Thermal Expansion” of the ocean has contributed about half of the 70mm of global mean sea level rise we've seen over the last 25 years.
- The rate of SLR is nearly double that of the last century and is accelerating slightly every year.
- Estimates derived from satellite measurements for the period 1993 to 2012 indicate a rise in global average sea level rise of 3.18 mm per year.
- Over the period 1901 to 2010, global mean sea level rose by 0.19m. The rate of sea level rise since the mid-19th century has been larger than the mean rate during the previous two millennia.
- Oceanic uptake of CO₂ has also resulted in acidification of the ocean; the pH of ocean surface water has decreased by 0.1, corresponding to a 26% increase in acidity, measured as hydrogen ion concentration.

OBSERVED & PROJECTED CLIMATE CHANGE

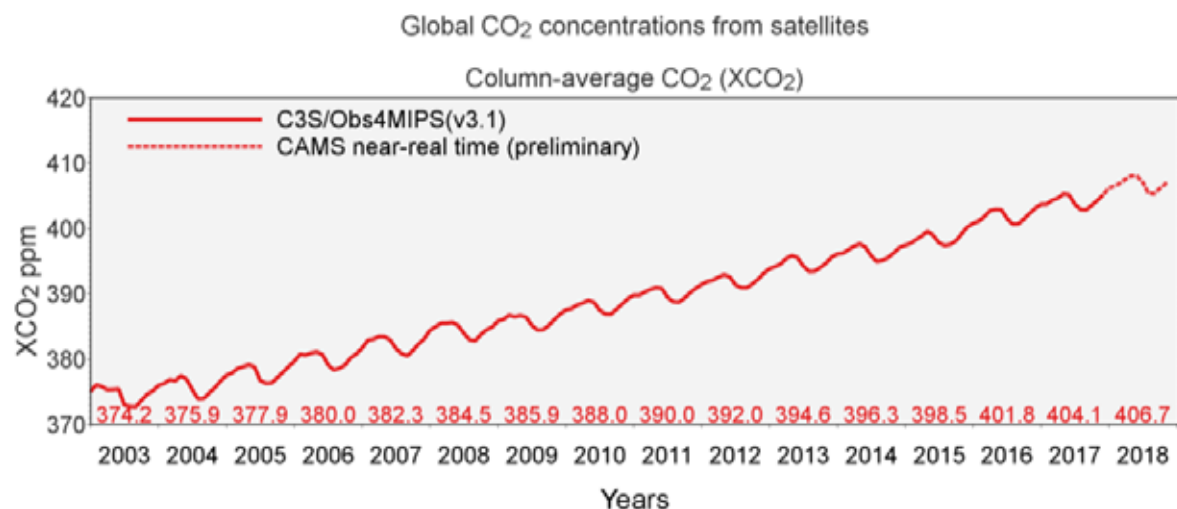
Projecting Climate Change

In order to predict the potential impacts of climate change in the future, many different variables must be considered. One of the key pieces of data is the emission of greenhouse gases, including carbon dioxide. This in turn must take account of several other factors which affect these emissions such as; population, economic activity, lifestyle, energy use, land use patterns, technology and climate policy.

The analysis of satellite data from the Copernicus Climate Change Service indicates that carbon dioxide concentrations have continued to rise in recent years, including in 2018. The recent special report 'Global warming of 1.5°C' by the Intergovernmental Panel on Climate Change (IPCC) further underlines the urgency of implementing effective measures to mitigate climate change.

The estimated annual mean XCO₂ growth rate for 2018 is 2.5 +/- 0.8 ppm/year. This is larger than the growth rate in 2017, which was 2.1 +/- 0.5 ppm/year

Continued emission of greenhouse gases will cause further warming and long-lasting changes in all components of the climate system, increasing the likelihood of severe, pervasive and irreversible impacts for people and ecosystems. Limiting climate change would require substantial and sustained reductions in greenhouse gas emissions which, together with adaptation, can limit climate change risks" [IPCC, AR5]



OBSERVED & PROJECTED CLIMATE CHANGE

Representative Concentration Pathways (RCPs)

RCPs are scenarios that describe alternative trajectories for carbon dioxide emissions and the resulting atmospheric concentration from 2000 to 2100. They encompass the range of possible climate policy outcomes for the 21st century.

As part of the IPCC's Fifth Assessment Report (AR5), 4 Representative Concentration Pathway scenarios (**RCP2.6**, **RCP4.5**, **RCP6.0** and **RCP8.5**) were selected for climate modeling and research based on different assumptions about population, economic growth, energy consumption and sources and land use over this century.

RCP 2.6

Global CO₂ emissions peak by 2020 and decline to around zero by 2080. Concentrations in the atmosphere peak at around 440ppm in mid-century and then start slowly declining.

RCP 4.5

Emissions peak around mid-century at around 50% higher than 2000 levels and then decline rapidly over 30 years and then stabilise at half of 2000 levels. CO₂ concentration continues to trend to about 520ppm in 2070 and continues to increase but more slowly.

RCP 6

Emissions double by 2060 and then dramatically fall but remain well above current levels. CO₂ concentration continues increasing, though at a slower rate in the latter parts of the century, reaching 620ppm by 2100.

RCP 8.5

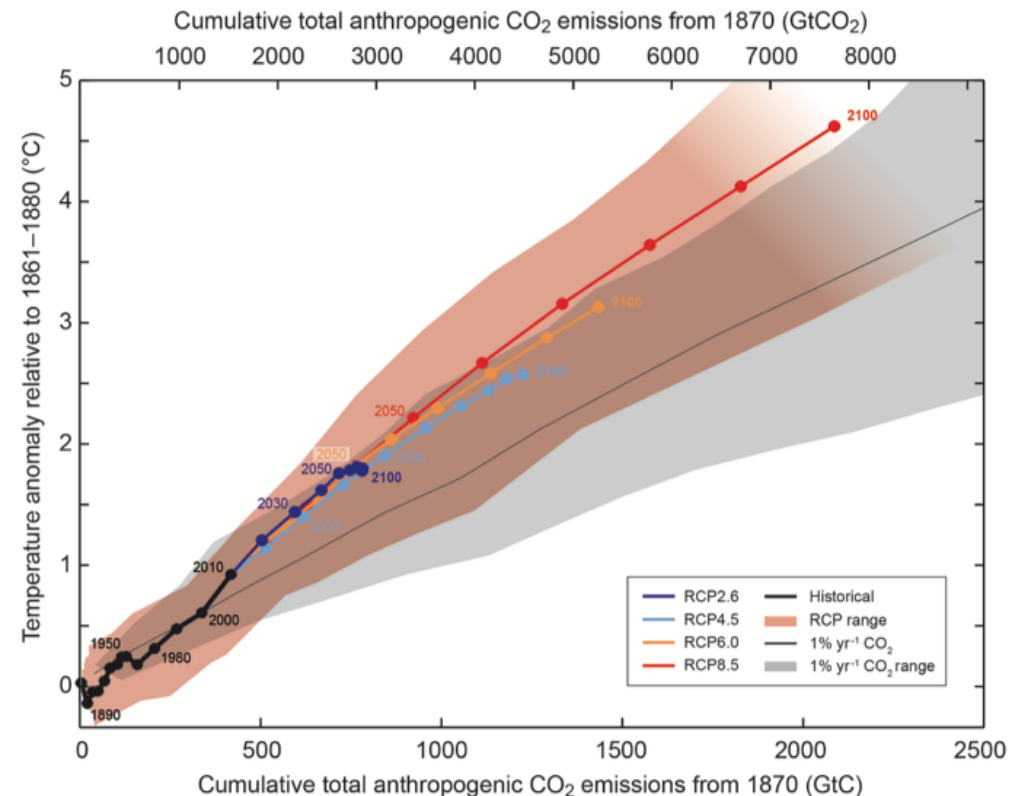
Emissions continue to increase rapidly through the early and mid-parts of the century. By 2100 annual emissions have stabilised at just under 30 giga tonnes of carbon compared to around 8 giga tonnes in 2000. Concentrations of CO₂ in the atmosphere accelerate and reach 950 ppm by 2100 and continue increasing for another 100 years.

Climate Forecasts

The IPCC's AR5 report forecasts temperature change under these scenarios, from best (RCP2.6) and worst (RCP8.5) scenario.

Scenario	2046-2065	2081-2100
	Mean and Likey Range	Mean and Likey Range
RCP2.6	1.0° (0.4 to 1.6)	1.0° (0.3 to 1.7)
RCP4.5	1.4° (0.9 to 2.0)	1.8° (1.1 to 2.6)
RCP6.0	1.3° (0.8 to 1.8)	2.2° (1.4 to 3.1)
RCP8.5	2.0° (1.4 to 2.6)	3.7° (2.6 to 4.8)

AR5 global warming increase (°C) projections



Source: IPCCAR5

OBSERVED & PROJECTED CLIMATE CHANGE

Global Projections (IPCC AR5)

Surface Temperature (Global)

The global averaged combined land and ocean temperature data indicate a warming of 0.85°C, over the period 1880 – 2012 and surface temperature is expected to rise over the 21st century. Relative to 1850-1900, temperatures at the end of the 21st century (2081-2100) are expected to be 1.5°C - 2.0°C higher, depending on the greenhouse gas concentration scenario used. It is very likely that heatwaves will be more frequent and last longer. It is virtually certain that there will be more hot weather extremes and fewer cold weather extremes over most land areas on daily and seasonal timescales. Occasional cold winter extremes will continue to occur.

Precipitation (Global)

Changes in precipitation will not be uniform. In many mid-latitude and subtropical dry regions, mean precipitation will likely decrease, while in many mid-latitude wet regions, precipitation will very likely become more intense and more frequent.

Sea Level Rise (Global)

Ocean thermal expansion and glacier melting have been the dominant contributors to 20th century global mean sea level rise. Observations since 1971 indicate that thermal expansion and glaciers (excluding Antarctic glaciers peripheral to the ice sheet) explain 75% of the observed rise. The global ocean will continue to warm during the 21st century, with the strongest warming projected for the surface in the Tropic and Northern Hemisphere Subtropical region. Global mean sea level rise will continue during the 21st century, very likely at a faster rate than observed from 1971 to 2010. For the period 2081–2100 relative to 1986–2005, the rise will likely be in the ranges of 0.26 to 0.55 m for RCP2.6, and of 0.45 to 0.82 m for RCP8.5 (medium confidence). Earth System Models project a global increase in ocean acidification for all RCP scenarios by the end of the 21st century, with a slow recovery after mid-century under RCP2.



Rising Sea Level

Sea Level is projected to rise by up to 0.82m relative to 1986-2005.



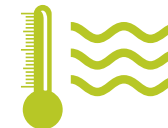
Higher Temperatures

Maximum and minimum average temperatures are projected to rise



Hotter & More Frequent Hot Days

Increase in temperatures reached on hottest days, and an increase in frequency of hot days.



Warmer & More Acidic Ocean

Sea surface temperatures are expected to increase, and the ocean will become more acidic.



Fewer Frost

A decrease in the frequency of frost risk is projected.



More Frequent Sea Level Extremes

Higher sea levels will increase the risk of coastal storm surge and storm tide inundation.



More Intense Rainfall Events

High variability in rainfall, with the intensity of heavy rainfall events likely to increase.

OBSERVED & PROJECTED CLIMATE CHANGE FOR IRELAND SUMMARY

Observed Changes

Ireland's climate is changing in line with global patterns:

- Temperatures are rising across all seasons.
- The timing and spatial distributions of precipitation is changing.
- Sea levels are rising.
- The frequency and intensity of extreme weather events are changing.

These changes are expected to continue and intensify into the future with a wide range of economic, environmental and social impacts.

For Ireland, the key long term climate change trends are:

- Temperatures are increasing and are expected to continue to increase everywhere and across all seasons.
- When compared with temperature, projections of precipitation are less certain. However, significant reductions in levels of average precipitation are expected in Spring and Summer while projections indicate the increased occurrence of extreme precipitation events, particularly during winter.
- Projections show little change in average wind speed and direction. The frequency of extreme wind conditions are expected to increase, particularly during winter.
- Sea levels will continue to increase by up to 0.81m by 2100.

We can also expect to see:

- Increases in the frequency and intensity of summer heat waves, extreme temperatures and drought.
- Reductions in the frequency of frost and snowfall.
- An increase in the duration of the growing season (phenological cycle).
- Increases in the frequency and intensity of coastal inundation and erosion.



PROJECTED CLIMATE CHANGE FOR IRELAND

SEA LEVEL RISE

- Sea levels are expected to increase for all Irish coastal areas. Projected changes in sea level will magnify the impacts of changing storm surge and wave patterns in coastal areas.
- Decrease in mean and extreme wave heights by the end of the century. Increase in magnitude and intensity of storm wave heights

WIND

- An increase in the intensity of extreme wind storms is expected.
- Decrease in wind speeds for summer and increases for winter rainfall events is likely.

PHENOLOGY

- An increase in the duration of the growing season is likely with spring occurring earlier.
- Projections indicate that bud burst will continue to advance until at least 2100.

PRECIPITATION

- An increase in seasonality in precipitation can be expected with significant decreases projected for spring and summer and increases for winter.
- An increase in the occurrence of extreme rainfall events is likely.

SURFACE AIR TEMP

- Average surface air temperatures are expected to increase everywhere and across all seasons.
- An increase in the intensity and duration of heatwaves is expected.

HYDROLOGY

- Increasing seasonality in hydrological regimes can be expected with decreased summer and increased winter flows likely.
- Flood risk will increase due to a combination of higher river-flows and increases in extreme precipitation events.



OBSERVED & PROJECTED CLIMATE CHANGE FOR IRELAND - TEMPERATURE

Observed Changes



Average annual temperatures have increased by 0.8 °C nationally since 1900.



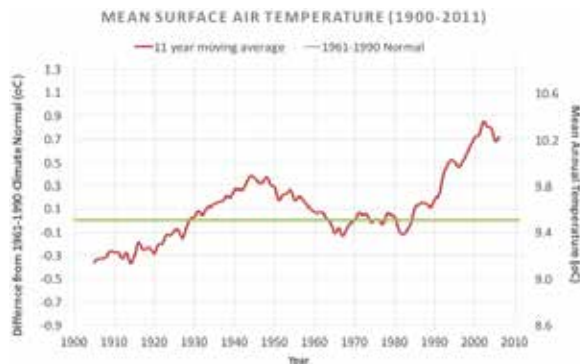
The number of warm days (>20 °C) has increased while the number of frost days (<0°C) has decreased.



There has been an increase in the duration of the growing season.

Temperature Projections for mid-century (2041-2060) compared with the baseline period (1981-2000)

- Projections suggest average temperatures will continue to increase, with warming across all seasons. Future climate simulations indicate a rise of 1 to 1.6°C in mean annual temperatures.
- 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 heatwaves are expected to occur more often.
- The warmest 5% of daily maximum summer temperatures are projected to increase by 0.7-2.6°C.
- The coldest 5% of winter night time temperatures are projected to increase by 1.1-3.1°C.
- Increases in minimum temperatures will mean that frost days (days when minimum temperature is less than 0°C) and ice days (days when maximum temperatures are less than 0 °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.



A time series graph of mean annual observed temperature for Ireland (1900-2011). The green bar shows the mean temperature for the period 1961-1990 (Dwyer, 2012)

OBSERVED & PROJECTED CLIMATE CHANGE FOR IRELAND - PRECIPITATION

Observed Changes



When compared with the period 1961-1990, average annual rainfall has increased by 5% (60mm) for the period 1981-2010.



The largest increases are observed over the western half of the country.



There is no consistent trend in the frequency



Annual average rainfall totals (right axis) and the annual anomalies, or differences from the 1961 to 1990 average (left axis) (Dwyer, 2012).

Precipitation Projections for mid-century (2041-2060) compared with the baseline period (1981-2000)

- Changes in precipitation over the course of the present century are likely to have a greater impact on Ireland than changes in temperature, due to the potential of increased flooding during the winter months and reductions in river flow during the summer months. Projected changes in precipitation suggest that there will be wetter winters and drier summers and a change in the spatial distribution of rainfall we receive is likely for all future time periods.
- For winter and autumn, projections indicate an increase in average precipitation, particularly for the high scenario.
 - Increase in the number of “wet days” (>20mm rainfall) for winter (mean value 24%) and autumn (mean value 18%).
 - Increase in the number of “very wet days” (>30mm rainfall) for winter (mean value 24%) and autumn (mean value 49%).
- 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% reduction).
- Increases in dry periods (> 5 consecutive days with less than 1mm rainfall) are largest for summer.
- An increase in the number of dry periods (> 5 consecutive days with less than 1mm rainfall) are projected across all seasons with largest increase projected for summer with likely values ranging from 12% to 40% .

OBSERVED & PROJECTED CLIMATE CHANGE FOR IRELAND - WIND

Observed Changes



No long-term change in average wind speed can be determined with confidence



Similarly, there is no long-term change evident in number of gale gusts (a wind speed of >17.5m/sec).



Wind direction has remained stable



Wind Projections for mid-century (2041-2060) compared with the baseline period (1981-2000)

Projected change information relate to levels of wind power at 60m, useful in the context of projecting future energy resources.

- Projections indicate a decrease in wind speeds for spring, summer and autumn months.
- For winter, projections show a large range (increase and decrease) of change and should be viewed with caution.
- Small increases in extreme wind speeds over Ireland projected. A small increase in extreme wind speeds is expected during winter, which may impact on turbines and the continuity of power supply.
- Projections indicate an overall decrease in wind power over the entire year and during the spring, summer and autumn months by mid-century.
- Projections of wind direction show no substantial change.

OBSERVED & PROJECTED CLIMATE CHANGE FOR IRELAND - STORMS

Observed Changes



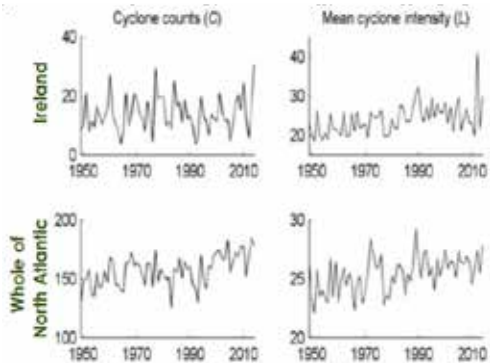
The number of storms (“cyclones”) in the North Atlantic has increased by approx. 3 storms per decade (1950-2012)



The intensity of North Atlantic Storms has also increased.



The number of these storms tracking over Ireland has remained variable.



Left: Count of storms for Ireland (Top) and the whole North Atlantic (Bottom) during winter Right: Mean intensity of storms for Ireland and whole North Atlantic - modified from Mathews et al. (2014)

Storm Track Projections for mid-century (2041-2060) compared with the baseline period (1981-2000)

Storms are rare events and projections should be considered with a level of caution.

- 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, further work is required to increase confidence in these projections.



Tracks of storms with a core MSLP of less than 940 hPa and with a lifetime of at least 12 hours. Left: Past RCM 18km simulations (1981-2000); Right: RCP 8.5 18-km simulations (2041-2060) (Nolan, 2015)

OBSERVED & PROJECTED CLIMATE CHANGE FOR IRELAND - SEA LEVEL

Observed Changes



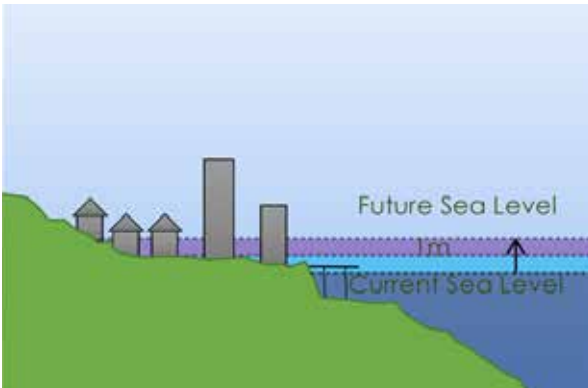
Sea levels are rising at around 3.5 cm per decade in the marine territories surrounding Ireland.



Increasing Sea Levels are resulting in record high tides (>2.9m)



Increases are greatest for the Irish sea. This is due to a more pronounced warming of the Irish sea which contributes to sea level rise due to thermal expansion



Conceptual outline of simple coastal inundation due to relative sea level rise

Sea Level Projected Changes for the Period 2081-2100 (relative to 1986-2005)

Sea levels are rising primarily because of thermal expansion due to increasing global temperatures but also due to melting ice sources (e.g. glaciers and ice sheets).

Regional projections of sea level rise are subject to a high degree of uncertainty as warming of the surface layers of the oceans is not likely to be uniformly distributed across the ocean surface. Regional changes in atmospheric pressure and ocean circulation will also affect the distribution of sea level rise (Hulme et al., 2002). Determining future changes in sea level around the Irish coast is further complicated due to isostatic rebound, i.e. post-glacial changes in the elevation of the land relative to the sea. Combining these sea level projections with isostatic rebound rates for Ireland means that projected rates of relative sea level will vary substantially around the Irish coast.

- Sea levels will continue to rise for all Irish coastal areas i.e. up to 0.81m by the end of the century.
- Increases will be greatest in the south of Ireland. This is because the north of Ireland 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.
- The projected increase in relative sea level is likely to result in an increase in wave energy being transmitted to the shoreline.

OBSERVED & PROJECTED CLIMATE CHANGE FOR IRELAND - WAVE HEIGHT

Observed Changes



Analysis of data from satellite altimetry shows a general increase in wave heights in the Northeast Atlantic for the period 1988-2002.



Data from the Irish buoy network covers a relatively short period and there is no observable change.



Irish Marine Data Buoy Observation Network

Source: Climate Ireland

Wave Height Projected Changes for the Period 2077-2099 (relative to 1980-2009)

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.

- The largest decreases are expected for summer (up to 15%), particularly off the south coast, and for winter (up to 10%), particularly off the west coast.
- Projected changes for autumn and spring are small and considered less robust than those for winter and summer so should be treated with caution.
- Further work is required to improve the estimates and to further clarify uncertainties in projected changes.

Irish Marine Weather Buoy Network

The Irish Marine Weather Buoy Network is the result of successful collaboration between the Marine Institute, Met Eireann, The UK Met Office and the Irish Department of Transport joint.

The project is designed to improve weather forecasts and safety at sea around Ireland, and provides vital data for weather forecasts, shipping bulletins, gale and swell warnings as well as data for general public information and research.

THE ADAPTATION STRATEGY PROCESS



OUR APPROACH TO DEVELOPING THE STRATEGY

The approach to the development of the Climate Adaptation Strategy for Donegal County Council follows a five-step process provided for within the Local Authority Adaptation Strategy Development Guidelines (DCCAE, 2018).

The Climate Action Regional Office supported the process by providing workshop presentations, materials and templates, as well as providing a link to other Sectors involved in preparing Climate Adaptation Strategies.






Climate Adaptation Team

Local Government has a very broad remit undertaking many actions on behalf of Central Government Departments and Agencies. Given this broad scope of operations it was necessary to form a Climate Adaptation Team with a representative across all departments, in order to assess the current adaptation baseline for climate change.

Activities included some workshops, which allowed for inter-departmental dialogue on both qualitative and quantitative how extreme weather events of the past had created challenges and opportunities for Donegal County Council.

Having now drafted the Strategy we are at 'Step 5' in the Implementation and Monitoring Phase of the Strategy.

Step 2 Assessing the Current Baseline on Past Events

-  Extreme Cold Weather & Low Temperatures
-  High Temperature & Low Rainfall
-  Sea Level Rise & Coastal Flooding
-  Strong Winds
-  Extreme Rainfall

Step 4 Identifying, Assessing and Prioritising Adaptation Actions

Step 1 Preparing the Ground

Adaptation Team

-  Critical Buildings & Infrastructure
-  Natural and Cultural Capital
-  Water Resources and Flood Risk Management
-  Community Services

Step 3 Identifying Future Climate Impacts, Vulnerabilities & Risk

Step 5 Drafting, Implementing and Monitoring Strategy

STEP 1: PREPARING THE GROUND

STEP 2: BASELINE ASSESSMENT

STEP 3: FUTURE CLIMATE RISKS

STEP 4: GOALS, OBJECTIVES & ACTIONS

STEP 5: IMPLEMENTATION

STEP 1: PREPARING THE GROUND



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STEP 4: GOALS, OBJECTIVES & ACTIONS

STEP 5: IMPLEMENTATION

PREPARING THE GROUND

Climate Change has an impact on all functional areas of Donegal County Council. A Climate Adaptation Team was convened from a broad cross-section of operations, drawing on various skills and experience from the organisation.

The various departments within Donegal County Council can be aligned to the four Operational Themes, set out in the National Adaptation Framework;

-  **Governance**
-  **Critical Infrastructure & Buildings**
-  **Natural & Cultural Capital**
-  **Water Resources & Flood Risk Management**
-  **Community Services***

* This theme is listed as 'Health' in the National Adaptation Framework, but 'Community Services' is more relevant to the Local Government sector.



STEP 2: ASSESSING CURRENT BASELINE



STEP 1: PREPARING THE GROUND

STEP 2: BASELINE ASSESSMENT

STEP 3: FUTURE CLIMATE RISKS

STEP 4: GOALS, OBJECTIVES & ACTIONS

STEP 5: IMPLEMENTATION

DONEGAL ADAPTATION BASELINE

Understanding how Donegal County Council has been impacted by climate hazards in the past is a crucial first step in the development of an Adaptation Strategy for the future.

A baseline assessment was carried out taking account of the range of climate hazards that have affected Donegal in the past and assess the consequences of these for services and functions of Donegal County Council.

Past Climate Events & Trends

The characteristics of County Donegal presents challenges and opportunities in terms of climate change which differ from urban areas due to; our extensive coastline, disperse settlement patterns, high level of natural heritage & conservation areas, as well unique groundwater systems which present diverse exposure and vulnerability factors.

The first step in the assessment of the adaptation baseline was the identification and compilation of past weather events, as well as periods of climate variability within Donegal County Council's functional region and its bordering counties. These events over the last 30 years were taken as the base period to establish and review the current state of play.

Event Type / Name	Year	Climate Hazards	Outline Description
Storm Ali	2018	Strong Winds	Orange Wind Warning - gale-force winds of up to 120km/h, stormy conditions
High Temperatures, Heatwave & drought	2018	High Temperature	High Temperatures, Heatwave and drought
Storm Hector	2018	Strong Winds	Heavy rain and gales
Storm Emma & Beast from the East	2018	Snowfall	Snowfall Blizzard / Heavy Snowfall
Storm Doris	2018	Strong Winds	Gale force winds, heavy rainfall, sleet and snow
Storm Elanor	2018	Strong Winds	Orange Warning - Westerly gale to storm winds together with high tides and exceptionally high seas - coastal damage and flooding.
Storm Dylan	2017	Strong Winds	Orange warning of "violent gusts" and coastal flooding from high seas. Strong Winds recorded at Mace Head in Co Galway (119 km/h) and Newport, Co Mayo (111 km/h)
Storm Ophelia (Ex-Hurricane Ophelia)	2017	Strong Winds	Red warning - gale force winds, heavy rain and storm surges along Strong Winds some coasts (flooding).
Heavy Rain	2017	Extreme Rainfall	Cloud Burst in Donegal Inishowen Flooding
Storm Jake	2016	Strong Winds	Orange wind warning and yellow snow-ice warning
Storm Frank	2015	Strong Winds	Red warning - gale force winds, heavy rain and storm surges along Strong Winds some coasts (flooding).
Storm Eva	2015	Strong Winds	Orange WW, strong winds
Storm Desmond	2015	Flooding	Extratropical cyclone with heavy rain, flooding, Flooding in Flooding Crossmolina / Teresa Mannion-Salthill
Storm Darwin	2015	High Temperature	Orange Warning for strong winds
Winter Storms	2013/4	Strong Winds	Winter storms - serious coastal damage and widespread, persistent Extreme Rainfall flooding.
Tropical Storm Katia	2011	Strong Winds	Met Eireann issued an extreme weather warning after predicting that storm gusts would reach up to 80mph, attacking mostly the west and northwest coasts. Sea Flooding. Strong Winds Trains and bus routes were cancelled as power lines were damaged and fallen trees blocked roads, which caused car crashes and road build-up
Winter Cold Spell	2010	Cold Snaps / Frost	Severe Cold Spell
Winter Cold Spell	2009 /10	Cold Snaps / Frost	Coldest winter in almost 50 years (Met Eireann)
Severe flooding	2009	Flooding	CS 6: Severe flooding
Heavy Rain & Flooding	2008	Extreme Rainfall	Heavy Rain & Flooding
High Temperature/ Heatwave	2006	High Temperature	Warmest summer since record breaking 1996
Heavy Rainfall / Cloud Burst	2003	Extreme Rainfall	Pollatomish Landslide
Hurricane force winds over north & northeast	1998	Strong Winds	Hurricane force winds over north and northeast
Windstorm	1997	Stong Winds	Windstorm
Hurricane Charley	1986	Strong Winds	Strong Winds and Rain

STEP 1: PREPARING THE GROUND

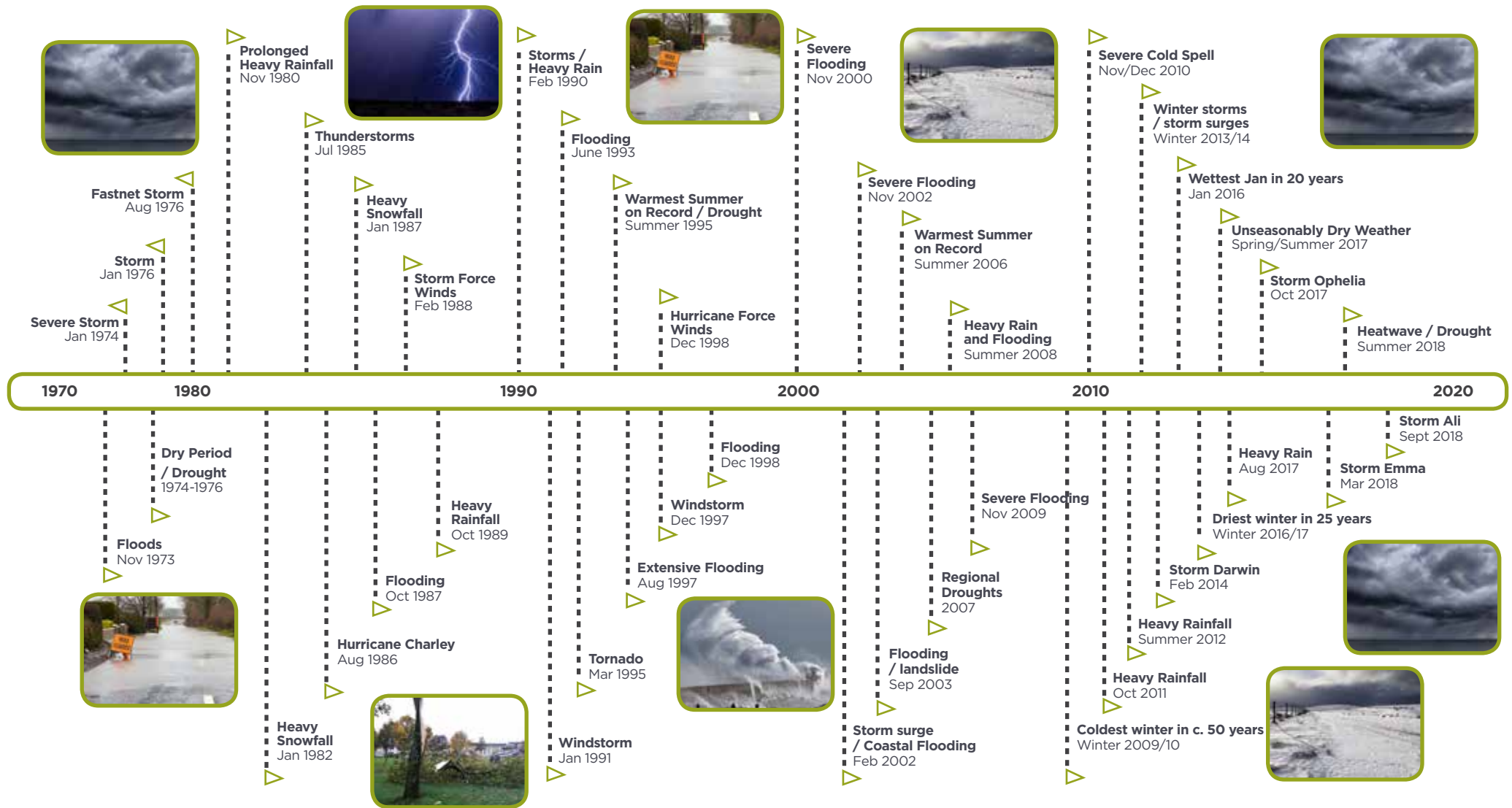
STEP 2: BASELINE ASSESSMENT

STEP 3: FUTURE CLIMATE RISKS

STEP 4: GOALS, OBJECTIVES & ACTIONS

STEP 5: IMPLEMENTATION

HISTORIC SEVERE WEATHER EVENTS IN COUNTY DONEGAL



DONEGAL ADAPTATION BASELINE

Through the identification and compilation of extreme weather events several event categories emerged, with some events occurring in combination.



Case Studies

To create a better understanding on how the climate trends and events have impacted County Donegal, the climate hazards were assessed through a series of case studies and data collated by the Climate Adaptation Team allowing for insight on local level of exposure and vulnerability to the impacts.

Case Study 1

Extreme Precipitation, November 2009

November 2009 is notable for the high rainfall recorded and the consequent severe flooding experienced in many parts of the country

Case Study 2

High Temperature (and low Precipitation), Summer 2018

Heat and drought conditions in the summer of 2018 affected many parts of the country.

Case Study 3

Strong Winds (and Extreme Precipitation), December 2015

Strom Desmond, 5th December 2015, was an extra tropical cyclone bringing heavy rains and severe gales with gusts up to 81mph.

Case Study 4

Sea Level Rise & Storm Surge, Winter 2013/2014

The winter of 2013/14 was severely affected by a run of winter storms, culminating in serious coastal damage and widespread flooding.

Case Study 5

Low Temperature, February/March 2018

Storm Emma and "The Beast from the East" pushed continental polar air across Ireland, bringing freezing temperatures and snow.

STEP 1: PREPARING THE GROUND

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CASE STUDY 1: EXTREME RAINFALL, WINTER 2009

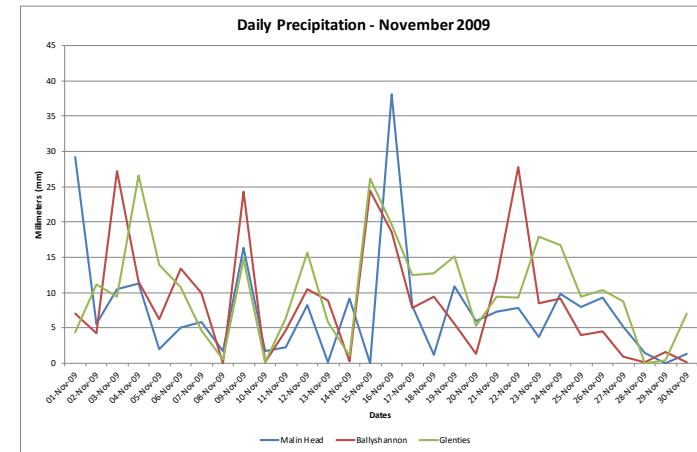
November 2009 is notable for the high rainfall recorded and the consequent severe flooding experienced in many parts of the country. Very unsettled weather began in the middle of October with rainfall totals for November the highest on record at most stations.

More than twice the average November amounts of rain were measured at almost all stations. The rainfall recorded in November 2009 was significantly higher than normal monthly averages.

The extremity of the weather becomes apparent when contrasted with the mean November rainfall for the 1981 to 2010 period at each of the stations.

- Glenties recorded 306.1mm, 176% of the station rainfall mean of 173.4mm
- Malin Head recorded 217.7mm, 208% of the station rainfall mean of 104.5mm
- Ballyshannon recorded 264.8mm, 253% of the station rainfall mean of 120.5mm

Highest daily rainfall total recordings in the county were in Malin Head on the 16th of November, with 38.1mm of rainfall.



Source Data: Met Eireann

Impacts:

- There was prolonged flooding of private property as well as critical infrastructure including national and primary routes.
- Surface water systems were overwhelmed in many places leading to issues due to little or no drainage, increased capacity required for slurry storage and waste water treatment systems affected with high risk of pollution and effluent ponding.
- There were animal welfare issues due to flooded and inaccessible lands.
- There was disruption to the structure or geomorphology of river and coastal units due to flooding.
- Sand bagging was required for private and public infrastructure.
- Emergency services were required to assist with evacuation of flooded properties, assisting persons in stranded cars, providing access through flooded routes and the facilitation of emergency accommodation.

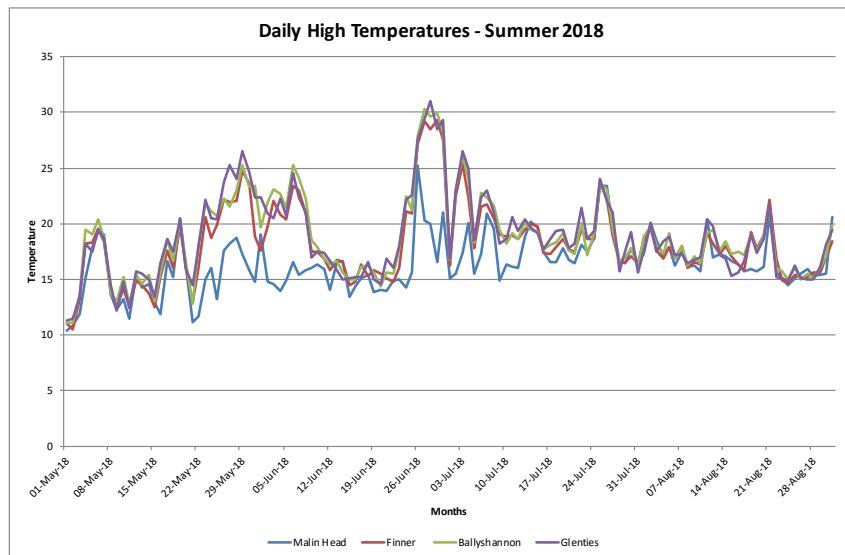
CASE STUDY 2: HIGH TEMPERATURES, SUMMER 2018

Heat and drought conditions affected many parts of the county.

Malin Head recorded the lowest rainfall with 21 consecutive days of zero rainfall and a total monthly rainfall for June of 41.5mm, well below the average of 57mm.

All monthly rainfall totals across the county were below their Long-Term Average (LTA) with drought conditions persisting until mid-July. Similarly, all mean air temperatures across the county were above their LTA.

The highest daily temperature was recorded at Ballyshannon at 30.3°C in June with the highest mean air temperature recorded at Ballyshannon at 20.4°C.



Source Data: Met Eireann



Impacts:

- Water conservation measures were put in place with a small number of areas issued with water restrictions.
- Road surface melt.
- Increased demand for air conditioning.
- Loss within the agricultural sector.
- Increased usage of natural and built amenities contributing to congested roads and parking, increase in littering in public spaces and damage to heritage sites.
- High river temperature and low water levels severely impacted on fisheries.
- Severe algae blooms on some piers and slipways.
- Increase in tourist numbers.

STEP 1: PREPARING THE GROUND

STEP 2: BASELINE ASSESSMENT

STEP 3: FUTURE CLIMATE RISKS

STEP 4: GOALS, OBJECTIVES & ACTIONS

STEP 5: IMPLEMENTATION

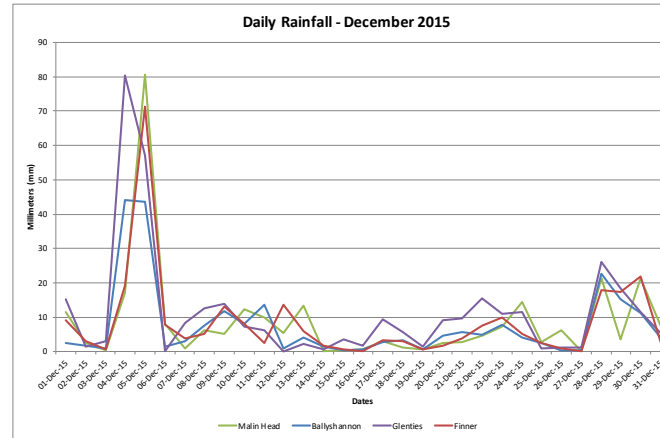
CASE STUDY 3: STORM DESMOND - STRONG WIND AND EXTREME PRECIPITATION

Storm Desmond, 5th December 2015 was an extra tropical cyclone bringing heavy rains and severe gales, with gusts up to 81 mph. It resulted in widespread flooding particularly along the Shannon river basin in the West and Midlands.

A level red rainfall and level orange wind warning was in place in Donegal.

Highest daily rainfall in Donegal was recorded in Malin Head with 80.6mm representing almost 30% of December 2015's total rainfall. The total monthly rainfall for December 2015 was well above average with Malin Head recording 272.9mm rainfall which was over twice the average.

The Finn Valley area was the worst affected by Storm Desmond. Emergency Services responded to calls in the Bundoran, Ballyshannon, Donegal Town, Ballybofey/Stranorlar, Glenties, Fahan, Creeslough, Kilmacrenan, Bunbeg and Lifford areas throughout the duration of the extreme event.



Source Data: Met Eireann

Impact of Event:
It's unprecedented
in terms of our
memory and
records – which
in some cases
go as far back as
100 years. Gerard
Fleming, Met
Éireann, 2015.

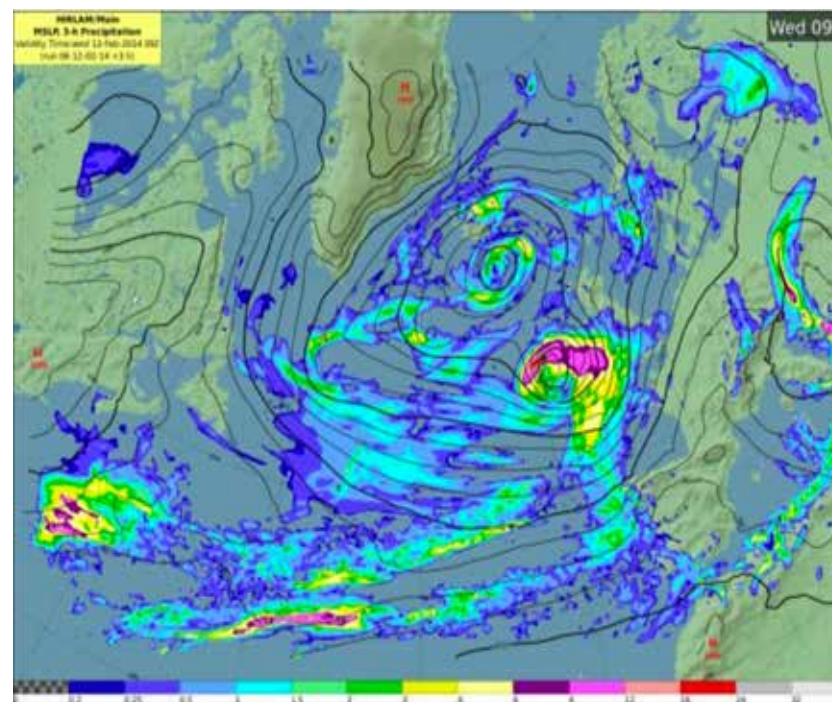
Impacts:

- Power outages were widespread.
- Surface water systems were overwhelmed in many places leading to issues such as prolonged delays in groundworks for construction projects and this was due to limited drainage.
- Increased capacity was required for slurry storage, waste water treatment systems were affected and there was a high risk of pollution and effluent ponding.
- There was prolonged flooding of private property as well as critical infrastructure including national and primary routes.
- There were animal welfare issues due to flooded and inaccessible lands.
- There was disruption to the structure or geomorphology of river and coastal units due to flooding.
- Sand bagging was required for private and public infrastructure.
- Emergency services were required to assist with evacuation of flooded properties, assisting persons in stranded cars, provide access through flooded routes and to facilitate emergency accommodation.

CASE STUDY 4: SEA LEVEL RISE & STORM SURGES, WINTER 2013/14

During the period from 13th December 2013 to 6th January 2014 there were storms in or around Ireland approximately once every three days. In addition to the very strong winds there were periods of extremely heavy rain (most short lived) and a lot of thunderstorm activity. These storms coincided with high tides and created severe conditions in several coastal areas. After a respite period of around three weeks the country was subjected to a second series of severe storms commencing on 27th January. This second spell of severe weather persisted until 17th February and included the extreme and highly destructive storm event of 12th February 2014. There was a constant threat in several river catchments of severe flooding arising from the rainfall. This series of storms led to an increase in rainfall amounts of between one and a half and two times above normal and led to saturated or waterlogged ground throughout the county. Over 50% of stations across the country reported the wettest winter on record.

A combination of strong winds, tidal surges, very high tides and high rainfall conspired to cause damage and flooding along the Donegal coastline causing disruption to individuals, business, infrastructure and habitats. The indicative estimated costs of repairs arising from severe weather of winter 2013-2014 for Donegal County Council was almost €2.2million.



Source: Met Eireann

Impacts:

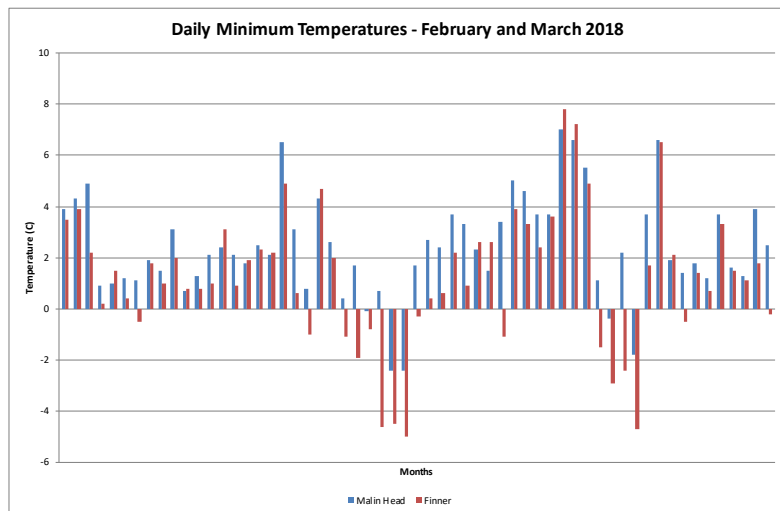
- Beaches damaged, coastal erosion accelerated, change to coastal geomorphology due to flooding and loss of coastal habitats.
- Damage to coastal infrastructure including piers, sea walls, navigational aids and car parks.
- Prolonged flooding of roads and consequently road diversions.
- Severe damage to road infrastructure including complete destruction of some bridges.
- Prolonged flooding of private and public infrastructure.
- Loss of beach infrastructure, blue flag status and tourist numbers.
- Emergency services and the Civil Defence were required to evacuate vulnerable and flooded properties.
- Resources allocated to remediation of flooding in urban and rural areas.

CASE STUDY 5: LOW TEMPERATURE, FEBRUARY/MARCH 2018

Storm Emma & 'Beast from the East' took place in February/March 2018. During the third and fourth week of February easterly winds pushed continental polar air across Ireland. Snow showers affected the country on the 27th and led to significant accumulations particularly in eastern and southern counties on the last day of the month.

In March, an exceptionally cold polar easterly airstream (continental) covered Ireland. In addition, Storm Emma tracked northwards from the Bay of Biscay during the first week of March. It yielded widespread snow, ice and low temperatures. It was extremely cold with widespread air and ground frosts.

Source Data: Met Eireann



“The jet stream is currently disrupted so we are getting storms from different regions. “Precipitation at the north of the storm will be met with the Siberian winds sweeping in from the east - and this will create snow.” forecaster Joanna Donnelly 2018

Impacts:

- Transport disruption on all roads, Knock airport, Irish Rail and Bus Éireann. Snow Ploughs, Salt Gritters and extra resources were required.
- Water treatment plants were under pressure in many parts of County Donegal keeping up with water supply demands. Many taps were left running to avoid freezing pipes.
- Minor power outages occurred.
- The freezing temperatures and snow impacted the farming community.
- Civil Defence required to assist vulnerable populations.
- Communities worked closely to resolve issues during this event both locally and nationally.

STEP 1: PREPARING THE GROUND

STEP 2: BASELINE ASSESSMENT

STEP 3: FUTURE CLIMATE RISKS

STEP 4: GOALS, OBJECTIVES & ACTIONS

STEP 5: IMPLEMENTATION

DONEGAL ADAPTATION BASELINE

Climate change is a major challenge that poses major risks to our communities, businesses, environment, and way of life. Observations show that temperatures are increasing, precipitation patterns are changing, and sea level is rising. Severe weather events that we have experienced over the past decade clearly illustrate the impacts that Donegal is likely to experience under climate change. These impacts are expected to intensify over the coming decades no matter how much we reduce our greenhouse gas emission.

Our own analysis in developing this baseline assessment seems to indicate that that strong wind events have emerged as an increasing issue in the region but the impacts are generally short lived and the clean up relatively quick.

Flooding is the largest source of climate-related impact and losses around the county, particularly around the towns in the Finn Valley and Inishowen that are exposed to fluvial flooding. Some coastal towns and villages, such as Donegal Town, Bunrana, Lisfannon, Maghera, Bunbeg-Derrybeg, Magheraroarty, Carrickfinn and the islands off the Donegal coast, have also been impacted by sea surge and coastal storms.

Our analysis also indicates that other impacts on our environment, economic and social activities are starting to emerge more slowly over time as a result of incremental changes in the climate. These include changes in the timing of seasonal life-cycle events for animals and plants, agricultural shifts affecting food production processes, and longer term impacts of precipitation, temperature change and extreme events on infrastructure, clean water and human well-being.

The economic and social costs associated with both slow and rapid weather events was also perceived to be rising.



STEP 3: IDENTIFICATION OF CLIMATE RISKS & OPPORTUNITIES

STEP 1: PREPARING THE GROUND

STEP 2: BASELINE ASSESSMENT

STEP 3: FUTURE CLIMATE RISKS

STEP 4: GOALS, OBJECTIVES & ACTIONS

STEP 5: IMPLEMENTATION

RISKS & OPPORTUNITIES

In preparing for climate change, Donegal County Council is faced with the challenge of responding to a broad range of uncertain risks. Although some services and activities may not currently be impacted by climate change, they may be sensitive to projected changes and may experience impacts in the future.

Climate change is creating new risks and exacerbating existing ones. Ecosystems will shift, food production will be placed under increasing pressure and some types of extreme weather events will increase in frequency and severity.

In developing an understanding of the levels of exposure to climate hazards, the Adaptation Team looked at the climate impacts that are of current significance, climate projections, and the consequences for the delivery of services by Donegal County Council. It also took account of non-climatic factors e.g. our aging population, which may result in a higher level of sensitivity to climate hazards such as heatwaves.

Opportunities

Projected changes in climate may also result in additional benefits and opportunities for Donegal. Adaptation measures can reduce costs of disruption to business operations and help to realise new business opportunities arising from climate change.

Climate Risk & Opportunities Register

The Climate Risk and Opportunities Register provides a list of Risk and Opportunity Statements, developed from the baseline and future vulnerability assessments, with associated timeframes and projections of future changes.



CLIMATE CHANGE IMPACTS



Increased incidence of heavy rainfall events, flooding and more severe storms with direct, and indirect, impacts on property, infrastructure, wildlife, community and economic function.



Increased temperatures with impacts on human wellbeing, including heat stress and expanded vectors for mosquito-borne and other diseases.



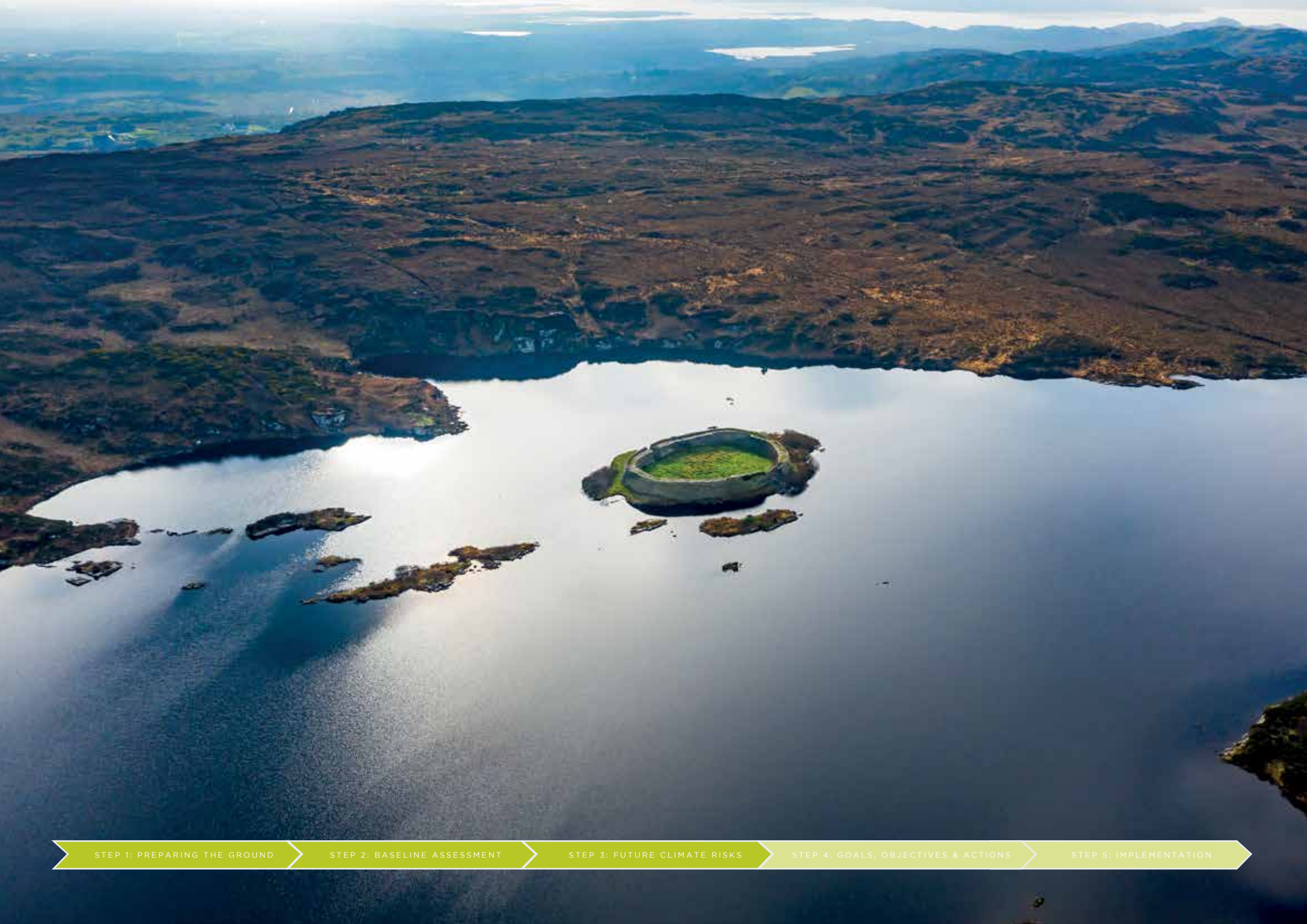
Changes to our natural ecosystems, including the distribution and abundance of pest plants and animals, and loss of climate-sensitive native species.



Ocean warming and acidification, with impacts on the health - of our marine - ecosystems, including our fisheries resources.



Sea-level rise and inundation of low-lying communities and habitats.



STEP 1: PREPARING THE GROUND

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OVERSIGHT

Adaptation to climate change raises important governance issues across the various functional areas of Donegal County Council. Proper oversight of the Adaptation Strategy will play a key role in promoting the transition from planning to implementation of adaptation and the mainstreaming of climate adaptation across the whole organisation.

The various departments of Donegal County Council operate within an existing hierarchy and reporting structure, but also to their own internal policies, regulations, objectives and priorities. A new supporting governance structure is required for the effective implementation of the Climate Adaptation Strategy, to ensure the horizontal coordination of different departments, and to assist in vertical coordination of various stakeholders from regional, national, to local actors.

The implementation of adaptation actions will be a dynamic iterative learning process, and Monitoring, Evaluation, Reporting, will play an important role in the Governance of the Adaptation Strategy.

- **Monitoring:** measuring whether the intended actions are undertaken, understanding whether progress is being made and whether it is suitable for reaching the desired results.
- **Reporting:** providing accountability and communicating information on progress towards adaptation or adaptation outcomes to key stakeholders.
- **Evaluation:** examining what has been achieved by a project or programme, whether it has been successful in delivering the desired outcomes and highlight lessons learned for future developments and plans.

Governance of the Adaptation Strategy will create the space and conditions to achieve the specific Goals and Objectives by aligning principles and norms for climate adaptation policy, decision-making procedures, and in providing overarching structure to address a challenge comprehensively across the organisation.



HEALTH & SAFETY

The effects of climate change are usually discussed in terms of impact on the natural environment and general human population. However, impacts of climate change on occupational health and safety of the Council's workforce has also been identified. Workers in specific areas are more vulnerable to the health impacts of climate change because they may experience longer and more intense exposures to climate change related hazards. These changes have the potential to both directly and indirectly affect the health and well-being of workers.

Increased Temperatures

Higher temperatures combined with longer and more frequent exposure to heat, will increase the risk of heat stress, air pollution and UV exposure, particularly among outdoor staff. This may lead to more cases of heat-related illnesses such as dehydration but can also have indirect impacts on injury caused by fatigue or negligence e.g. changes in the worker's emotional state, such as irritability.

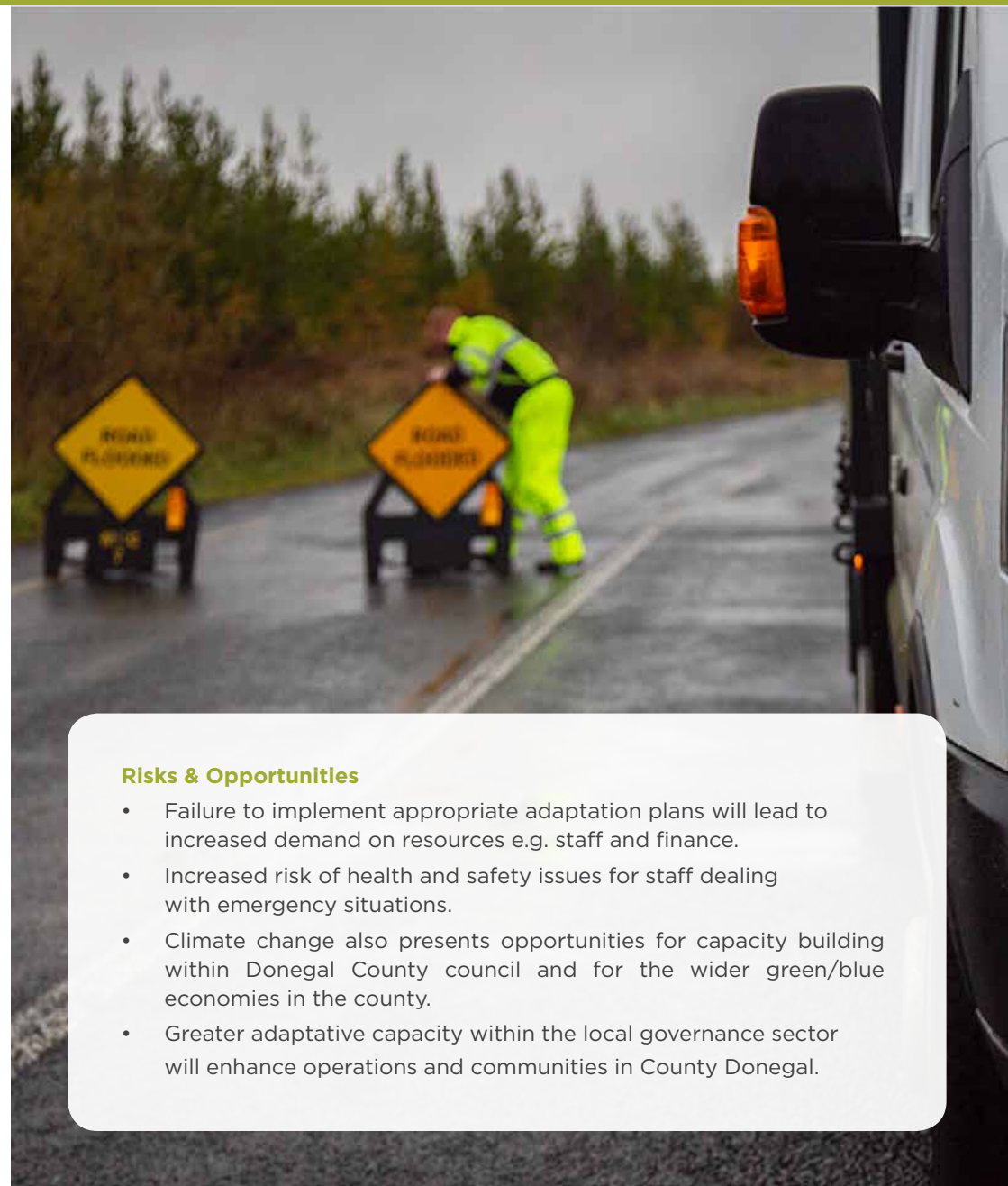
Overheating in buildings has also been identified as an issue during sunny and warm weather, as experienced in 2018. The inability to provide reasonably comfortable or safe temperatures may cause reduced working efficiencies and the closure of workplaces in the future.

Extreme Weather Events

Extreme weather events including flooding and storms, such as Storm Ophelia, which are projected to become more frequent and intense, can have multiple effects on occupational health and safety.

These extreme events affect staff involved in emergency, rescue and clean-up efforts delivered in high risk situations due to more frequent floods, landslides, storms, droughts, and wildfires. These issues are likely to increasingly affect outdoor staff whose welfare will need to be considered through regular review of their activities.

Policies to promote that awareness of the health and safety effects of climate change need to be developed and Health and Safety Plans need to integrate climate change risks into their assessments.



Risks & Opportunities

- Failure to implement appropriate adaptation plans will lead to increased demand on resources e.g. staff and finance.
- Increased risk of health and safety issues for staff dealing with emergency situations.
- Climate change also presents opportunities for capacity building within Donegal County council and for the wider green/blue economies in the county.
- Greater adaptive capacity within the local governance sector will enhance operations and communities in County Donegal.



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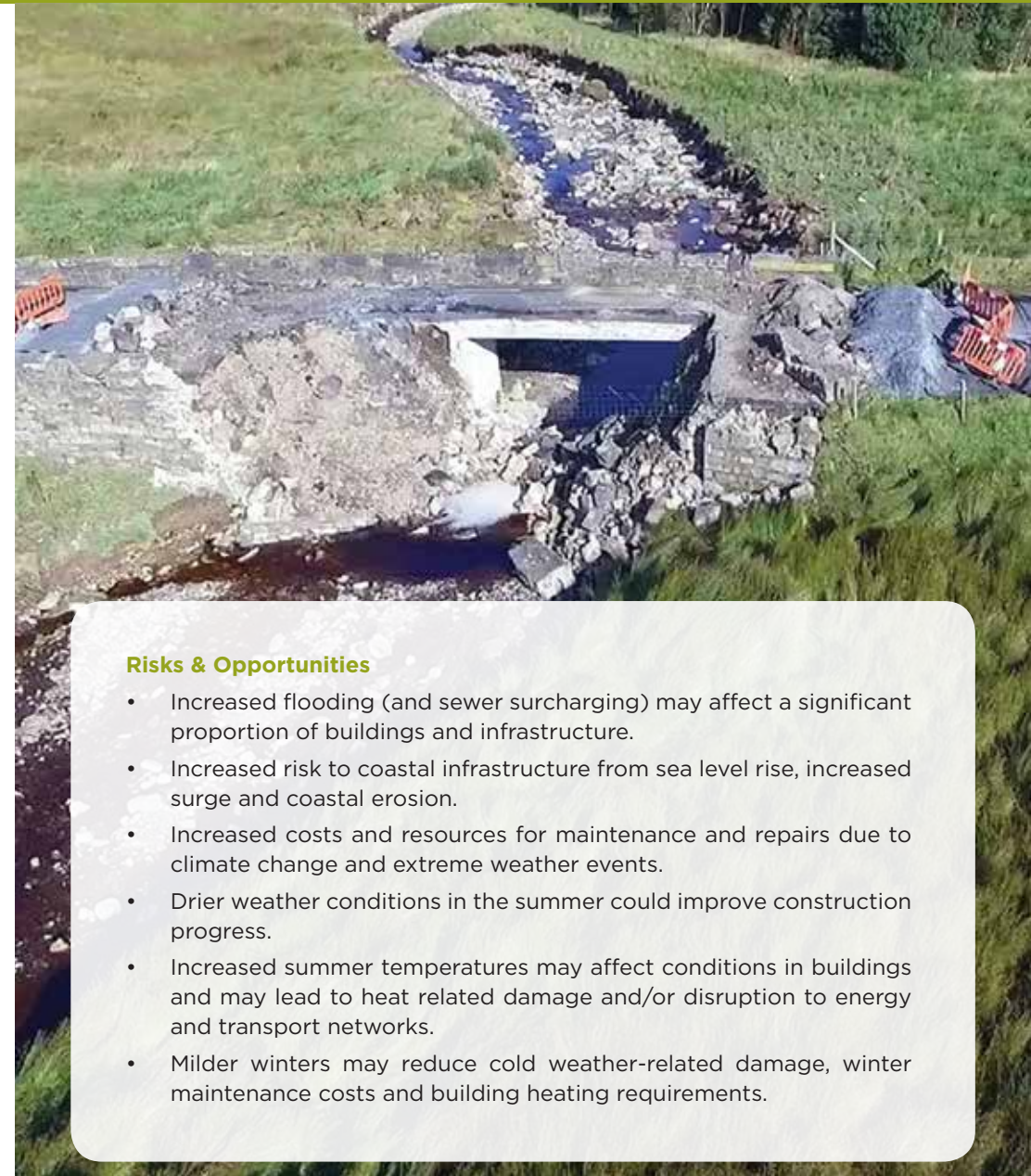
STEP 5: IMPLEMENTATION

RISKS TO CRITICAL INFRASTRUCTURE & BUILDINGS

Flooding already accounts for significant losses in infrastructure services and property damage, where damage caused by flooding tends to last longer than other weather-related hazards. The main flooding risks in Donegal are river (fluvial), coastal (tidal), local intense rainfall (pluvial), as well as combinations of these flooding types. The risk of river and surface water flooding is expected to rise, as patterns of rainfall become more intense. The projected increased rainfall intensity will also lead to overloading of surface water networks, therefore to more road and street flooding, overland flows and property flooding. The water network and wastewater treatment facilities will need to be adapted for this increased flows.

Donegal also has significant infrastructure and properties located in coastal areas which are exposed to both coastal flooding and erosion. Projected rises in mean sea level could increase the rate of erosion and the number of vulnerable areas. High winds emerged as having an impact, with 'risk to life' highlighted by the number of related fatalities around the country. Given the primarily rural context of County Donegal extreme wind events can cause disruption to road, sea, and air travel in the county. Issues regarding the safety of infrastructure and buildings adjacent to hazards (e.g. trees) should be informed by structural appraisals and surveys.

The cascading impact of power outages due to wind related damage to the electricity network can have an effect on most of the operational areas of the authority. Increased summer temperatures may affect conditions in buildings leading to heat related damage and/or disruption to energy and transport networks. Milder winters may reduce demand for heating, reducing costs for business and the public, as well as reducing carbon emissions. They may also reduce cold weather-related damage, delays, disruption and associated costs for infrastructure, business and the public (although extreme events may still occur). Importantly there may be further opportunities for innovative, sustainable building services, materials and urban planning.



Risks & Opportunities

- Increased flooding (and sewer surcharging) may affect a significant proportion of buildings and infrastructure.
- Increased risk to coastal infrastructure from sea level rise, increased surge and coastal erosion.
- Increased costs and resources for maintenance and repairs due to climate change and extreme weather events.
- Drier weather conditions in the summer could improve construction progress.
- Increased summer temperatures may affect conditions in buildings and may lead to heat related damage and/or disruption to energy and transport networks.
- Milder winters may reduce cold weather-related damage, winter maintenance costs and building heating requirements.

RISKS TO COASTAL & MARINE ENVIRONMENT

The Donegal coast is a dynamic system that is sensitive to environmental and climate changes, undergoing continual modification in response to the varying forces acting upon it. The impact of climate change on our coastline is already evident, and further increases in relative sea level will mean that coastal areas will be increasingly susceptible to permanent inundation and erosion. The risk of exposure of landforms which are currently sheltered from the effects of wind driven waves has also been identified.

Direct impacts from sea level rise and increased wave energy include flooding and displacement of wetlands, coastal erosion, increased salinity in estuaries, coastal aquifers and blocked drainage. Potential indirect impacts include changes in the distribution of sediment, changes in the functions of coastal ecosystems, and impacts on coastal heritage and human activities. These impacts are likely to be further exacerbated due to 'non-climate' pressures arising from increasing population and development within the coastal zone.

Important coastal habitats, such as salt-marsh and sand dunes that provide valuable natural buffering from wave energy, as well as being important for wildlife, are being impacted by both sea level rise and human activity. The widespread loss of these habitats, as they become squeezed between rising sea levels and man-made defence structures, will have implications for the long-term viability of coastal defences and the communities they protect.

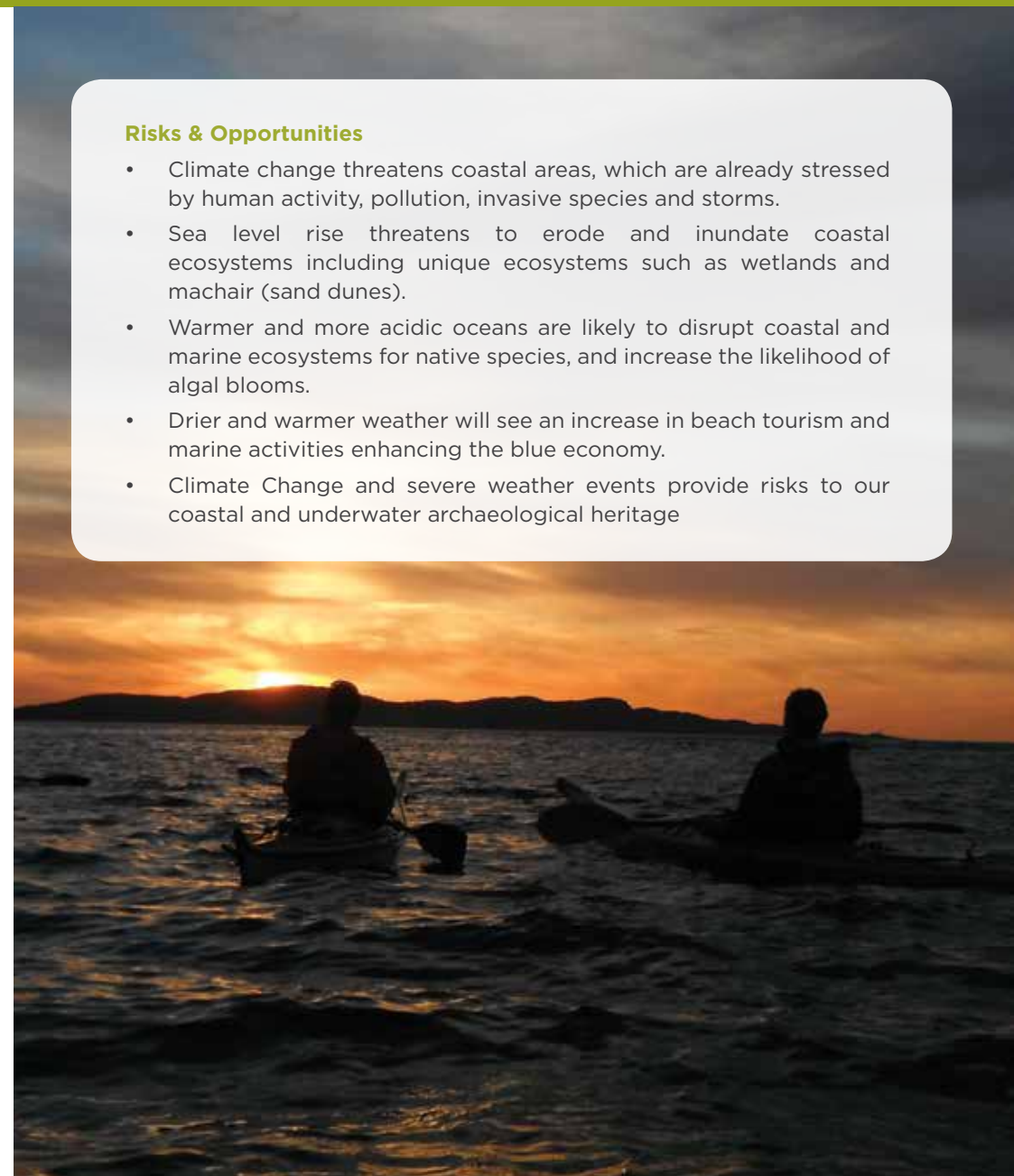
Sea level rise and increases in wave energy ultimately determines coastal morphology and coastal processes. These changes will have the most dramatic effects in low-lying vulnerable environments along the coast.

Temporary changes in extreme water levels resulting from storm surge events, particularly if coupled with high tides, are likely to also present additional potential for damage through overtopping of coastal defences. If model projections of storm intensity are realised, these storm surge events may have significant and lasting impact on the coastal morphology.

This increase in frequency and intensity of storms will present a problem for infrastructure built along the coast, particularly in soft coastal areas, rising sea levels could inundate the foundations of some fortifications and barriers and damage natural coastal protections.

Risks & Opportunities

- Climate change threatens coastal areas, which are already stressed by human activity, pollution, invasive species and storms.
- Sea level rise threatens to erode and inundate coastal ecosystems including unique ecosystems such as wetlands and machair (sand dunes).
- Warmer and more acidic oceans are likely to disrupt coastal and marine ecosystems for native species, and increase the likelihood of algal blooms.
- Drier and warmer weather will see an increase in beach tourism and marine activities enhancing the blue economy.
- Climate Change and severe weather events provide risks to our coastal and underwater archaeological heritage



RISKS TO COASTAL & MARINE ENVIRONMENT

The traditional local interventions of 'hard' and/or 'soft' engineering solutions to reduce vulnerability and preserve the present-day shoreline are unlikely to represent an optimum long-term management strategy for the coastal zone. More effective options will need to be developed that seek to manage change in the coastal system and allow it to adjust to climate change and the associated impacts. This will require a high level of understanding of the coastal system supported by effective monitoring of vulnerable locations, identifying where and when remedial action is necessary.

Planning and Development of the coastal zone may need to adopt 'set back' lines, seaward of which no development should be allowed. A precautionary approach should be used to determine these buffer zones taking account of future sea levels, erosion and landward migration of coastal landforms. Implementing an approach of shoreline realignment, or 'managed retreat', is likely to be contentious where economic losses are possible or where coastal archaeology or tourist sites exist. Nevertheless, "the extreme of abandonment may represent the most economic strategy where the cost of implementing coastal defences exceed the value of the structure(s) being protected". (Bird, 1993).



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RISKS TO BIODIVERSITY

On a global scale, it has been predicted that temperature elevation above 1.5 °C- 2.5°C could result in the extinction of 20-30% of species (IPCC AR5). An extinction of this magnitude would have far reaching consequences for ecosystem structure and function.

Donegal's wildlife, including all the plants and animals living in water or on land, thrive precisely because the climate suits them. They have adapted to the county's current patterns of temperature and rainfall. As these patterns change, some of these plants and animals may not be able to adapt or move or may become so stressed they become extinct.

These new climatic conditions may be more favourable to species of plants or animals that currently do not live here, but which may in time become invasive at the expense of existing species. This is already occurring e.g. on our inland waterways and the spread of Zebra Mussels.

Shifts in spatial range and changes in phenology will have implications for the ecological compositions of communities and habitats, with both winners and losers.

“Most plant species cannot naturally shift their geographical ranges sufficiently fast to keep up with current and high projected rates of climate change in most landscape”. [IPCC AR5]

The residual impact of climate change on habitats and biodiversity is a very complex one, as climate change affects organisms along many ecological axes simultaneously and includes secondary effects that result from altered species interactions.

Action is needed to firstly better understand the impacts of climate change on our biodiversity and then to bring climate and environmental change into conservation planning at site level and on a wider scale.

Risks & Opportunities

- Changes in the timings of seasonal events (phenological mismatch) may lead to disruption of food species and put species, as well as ecosystem services, at risk.
- New conditions may favour generalist species, pests, diseases and invasive non-native species, leading to a reduction in biodiversity and disrupting ecosystem services.
- Better conditions occurring for some flora and fauna.
- Increased productivity in forests and woodlands due to increased temperatures where drought, pests, pathogens and other pressures are not limiting factors.
- Changes in species range may present threats, but also some opportunities, for wider biodiversity and ecosystem services.

RISKS TO BIODIVERSITY

Two of the most productive ecosystems in Donegal i.e. peatlands and coastal habitats, may shrink significantly as a result of climate change.

Peatlands

Peatlands account for approximately 36% of land cover in Donegal. Climatic conditions that affect water availability will significantly influence the nature and function of specific peatlands and will impact the plant and animal species within them. The distribution and functions of peatlands in Donegal will be significantly impacted by a rise in temperatures and altered precipitation patterns, including more frequent droughts. Careful management of peatland systems is required in order to prevent such natural intact ecosystems becoming carbon sources as opposed to carbon sinks.

Climate change will make meeting existing conservation objectives increasingly challenging and potentially have implications for the provision of ecosystem services in the long-term, such as carbon storage, clean water provision and pollination. Shrinking of wetland habitats can impact some of Donegal's rare protected species, including Annex II listed species.

Coastal Habitats

Coastal areas are of concern through the combined effect of sea level rise and an increase in storm surges, resulting in eroding coastal habitats. Some habitat shift landwards is possible but may be inhibited in some places by man-made barriers i.e. urban development and infrastructure. In addition increasing sea temperatures and changing chemistry can lead to issues such as algal blooms.

Additional pressure on the freshwater wetlands in coastal areas is also expected due to predicted seawater inundation as a result of elevated sea water levels and increased storm surge. This could result in their conversion into salt marshes in affected areas.

Non-Native Species

- Changed conditions, especially rapid warming, have facilitated the establishment and spread of alien amphipods and non-native crayfish. These are already reported as 'nuisance' in the UK and Europe because of how they alter food web interactions.
- From a human perspective, alien species often cause management problems, an example of which is the fouling of underwater structures by zebra mussel (*Dreissena Polymorpha*) or blocking navigation channels as a result of thick growth of various macrophytes.
- Non-indigenous species have been shown to do better under warmer conditions experienced in recent years and their spread is expected to accelerate as a result of climate change.

Ecosystems and biodiversity can also play a significant role in influencing climate change. Trees and plants remove carbon dioxide from the atmosphere, regulate air temperatures and catch rainfall. Wetlands act as significant carbon sinks, store large volumes of water and slow down its flow.

CULTURE & BUILT HERITAGE

It is the wealth and diversity of our natural, built and cultural heritage that gives Donegal its unique identity and character and contributes to the economic and cultural well-being of the county.

Donegal's most prominent cultural asset is its landscape, which has been continually shaped by the sea and human activity. Inevitably, the character of Donegal's landscape will change in response to climate change. In most cases this landscape change is likely to be gradual and subtle.

Climate change predictions will exacerbate existing processes of decay and damage, but the greater frequency of extreme events e.g. flooding, may also result in abrupt intensification of these processes or irreparable damage to some elements.

Major impacts on coastal cultural heritage are likely to occur from projected sea level rise, increased coastal erosion and coastal flooding, more frequent storm events and greater wave energy. Coastal erosion will be one of the most widespread and demanding impacts of climate change, posing challenges across all sectors, including cultural and heritage.

It is anticipated that there will be a direct impact on cultural heritage, from changes to our current climate, and indirect impacts, including ones arising from cultural reactions and changes to natural habitats and landscapes. Indirect effects may arise from mitigation and adaptive responses e.g. the construction of windfarms and flood alleviation schemes.

As a first step to improving our capacity for the management of our cultural heritage (in light of climate change) we need to gather baseline data on our cultural heritage resources, develop vulnerability maps and a hierarchy of priorities for allocating resources. Furthermore there is a need to develop sustainable policies for climate change adaptation of the built and archaeological heritage in order to maintain Donegal's heritage for future generations and develop a better understanding of how the historic building stock and its adaptive reuse, contributes to sustainable communities.

Risks & Opportunities

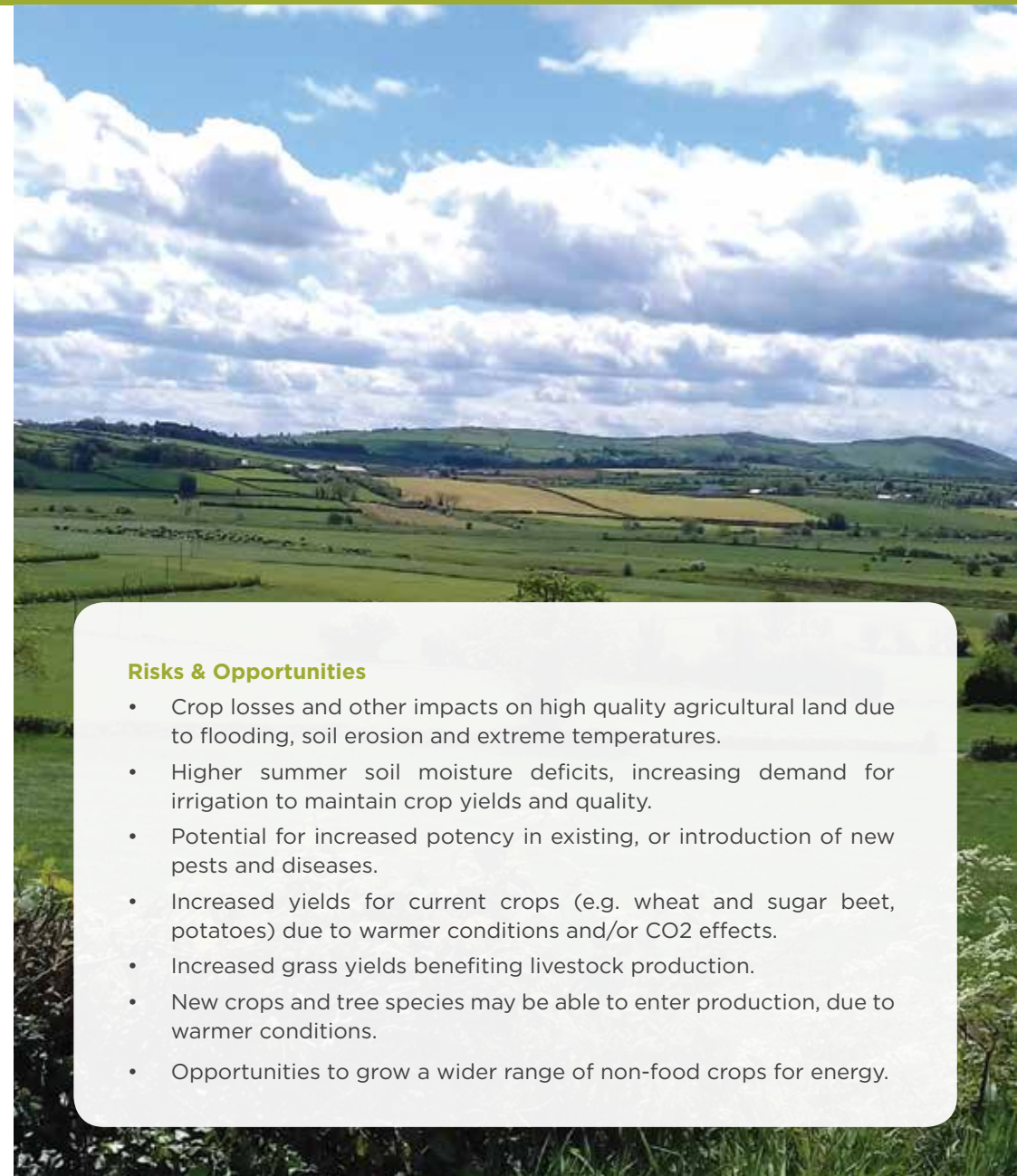
- Soil erosion and increase in weathering of buildings and monuments may lead to the loss of archaeological sites.
- Increased costs of maintaining built heritage and archaeological sites.
- Some coastal, intertidal and submerged archaeological sites may be completely lost due to sea level rise, storm surge, flooding.
- Rising soil temperatures accelerate microbiological and chemical processes which preserve buried archaeological heritage.
- New sites may be discovered or exposed from severe weather events e.g. high temperatures, coastal storms.

AGRICULTURE

The changes in temperature and rainfall and increase in extreme weather events will have a significant effect on agriculture, putting global food supply at increasing risk. Integrated farming systems and integrated cropping systems can vastly increase our adaptive capacity through protecting soil, water and other resources. These issues need to be addressed in the policy processes at national level, in consultation with relevant parties at national and local level.

Rural areas are expected to experience major impacts on water availability and supply, food security, infrastructure and agricultural incomes, including shifts in the production areas of food and non-food crops around the world (high confidence). [IPCC AR5]

The projected warmer drier summers and increased mean winter temperatures may be beneficial for agriculture. Warmer temperatures will undoubtedly be of benefit for grassland productivity, and the extended growing season may provide opportunities for longer outdoor grazing. At the same time this could be counteracted through increased and changing precipitation patterns in the winter, with increased problems with slurry storage and spreading in the wetter parts of the county. The drier summers could lead to water shortages, heat stress, and the drying out and deterioration of soil quality. 'The Impact of Climate Change on Irish Farming' report published by Teagasc in 2010, identified that cereal production in all regions would be negatively affected by changes in precipitation, air and soil temperature and extreme weather events. 'Food Wise 2025's guiding principal is to seek to embed, at all levels of the agri-food industry, that environmental protection and economic competitiveness are equal and complementary i.e. one will not be achieved at the expense of another.



Risks & Opportunities

- Crop losses and other impacts on high quality agricultural land due to flooding, soil erosion and extreme temperatures.
- Higher summer soil moisture deficits, increasing demand for irrigation to maintain crop yields and quality.
- Potential for increased potency in existing, or introduction of new pests and diseases.
- Increased yields for current crops (e.g. wheat and sugar beet, potatoes) due to warmer conditions and/or CO2 effects.
- Increased grass yields benefiting livestock production.
- New crops and tree species may be able to enter production, due to warmer conditions.
- Opportunities to grow a wider range of non-food crops for energy.

WATER & WASTEWATER SERVICES

Substantial reductions in summer and autumn flow could have potentially serious implications for water supply and water resource management.

It is likely that there will be a lot more pressure on drinking water in Donegal due to more droughts in the summer and an increase in global temperatures.

Conservation of water ,i.e. water usage and water delivery, will become increasingly important. The review of water supply vulnerability due to climate change identified that pressure will not just come from the domestic sector, but other sectors such as agriculture which are particularly sensitive to climate change.

Water supply interruptions can also be caused by flooding and cold weather, although the probability of cold events that cause problems with water supply is likely to decline in the long-term, as winters become warmer.

Soil moisture and groundwater will also be affected by climate change, which will impact supplies sourced from groundwater. This may have an impact on private Group Water Schemes.

Rising average temperatures are also expected to increase the temperature of surface waters, some of which are used as drinking water sources, which can change the water chemistry. This may have implications on the ability of current water treatment infrastructure to treat raw water and may require upgrading of facilities.

More regular flood events will put increasing pressure on sewage treatment and collection systems that integrate rainwater runoff. Water supply and wastewater treatment calculations will also need to be reviewed, especially in urban areas dependent on surface water collection.



Risks & Opportunities

- An overall decrease in levels of precipitation during the summer and autumn months will lead to significant decreases in annual effective runoff and the availability of water supply for all sectors.
- Extreme rainfall events can lead to flooding, placing water treatment facilities at risk from contamination and wastewater treatment facilities at risk of overloading. (Increased winter precipitation can place the water network under pressure).
- Decreased frost days reduce the risk of burst pipes and water leakage.
- Possible opportunities for innovation and technical design for climate change adaptation.

RISKS TO WATER QUALITY

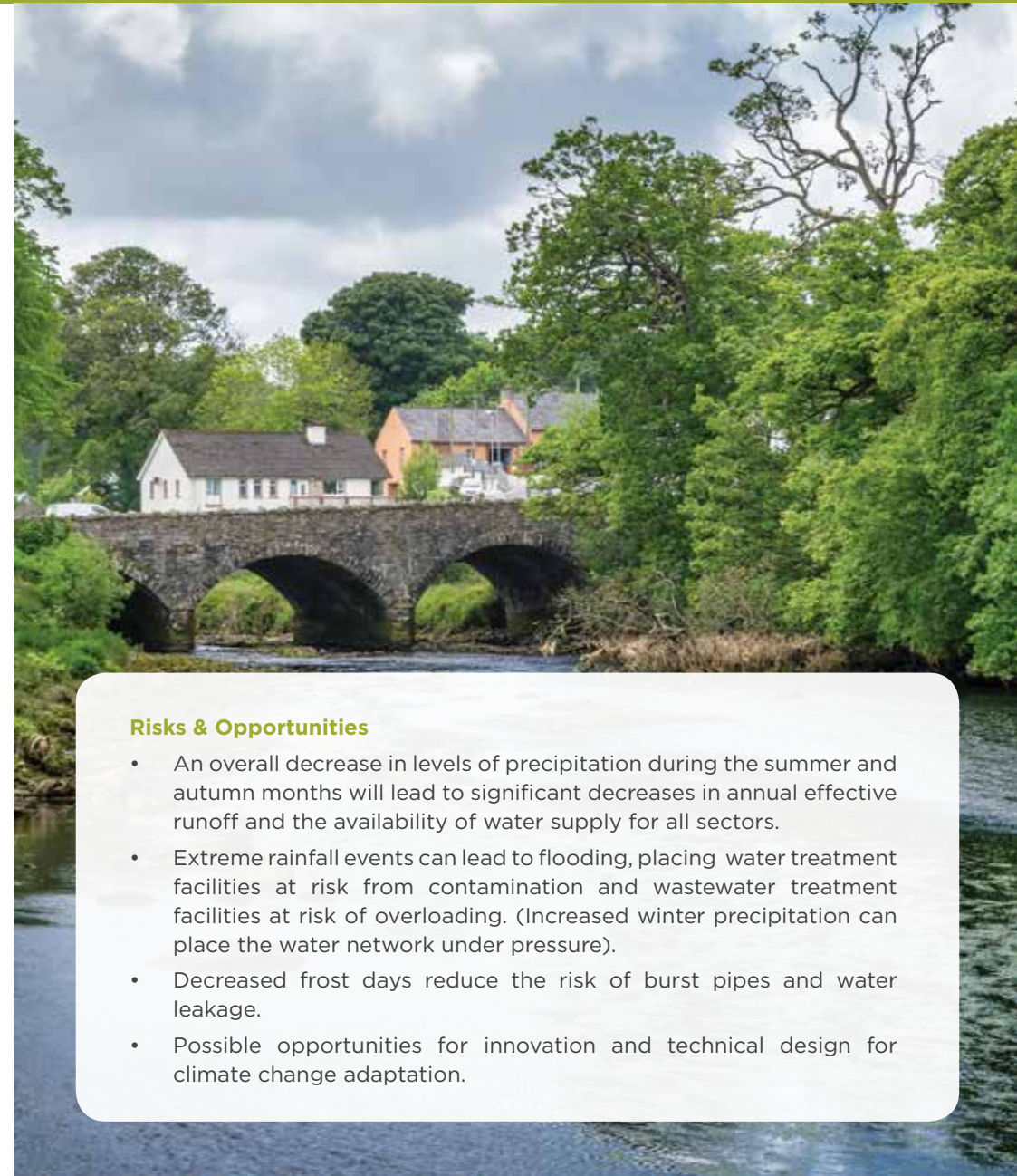
The effects of extreme events, such as storms and flooding and slow onset changes such as temperature rise, changes in precipitation patterns and sea level rise, will have a transformative effect on water quality in the county. This has potentially serious implications for water supply, water resource management and the successful implementation of the Water Framework Directive.

While increasing temperatures in Ireland are projected to occur in all seasons and time periods, it is likely that projected changes in the seasonal and spatial distribution of rain will present a much greater challenge for water quality.

An increase in the occurrence of river flooding is expected during winter months. In turn, the summer is likely to see more droughts resulting in low water flows. Changes in seasonal water levels and the occurrence of extreme high and low flow events will have direct impacts on the water quality of our rivers, lakes and coastal waters. More regular flood events and intense rainfall patterns are expected to result in increased runoff and an increase in discharge of untreated material directly into waterways.

This will carry increased sediment and nutrient loads into waterbodies, resulting in increased water turbidity and altered nutrient balance. Altered nutrient input is of concern when it occurs alongside a rise in temperature. Climate change could exacerbate the effects of nutrient enrichment, which is by far the most significant impact of human activity on the freshwater environment and is likely to remain so for the foreseeable future.

Reduced water quality may have a profound impact on the drinking water supply in certain areas. It may also render some waterbodies unsuitable for certain recreational purposes, including angling, bathing and other water based activities. It will be important to assess and manage these risks and ensure emergency and resilience plans minimise the risk of pollution.



Risks & Opportunities

- An overall decrease in levels of precipitation during the summer and autumn months will lead to significant decreases in annual effective runoff and the availability of water supply for all sectors.
- Extreme rainfall events can lead to flooding, placing water treatment facilities at risk from contamination and wastewater treatment facilities at risk of overloading. (Increased winter precipitation can place the water network under pressure).
- Decreased frost days reduce the risk of burst pipes and water leakage.
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RISKS TO FLOOD MANAGEMENT

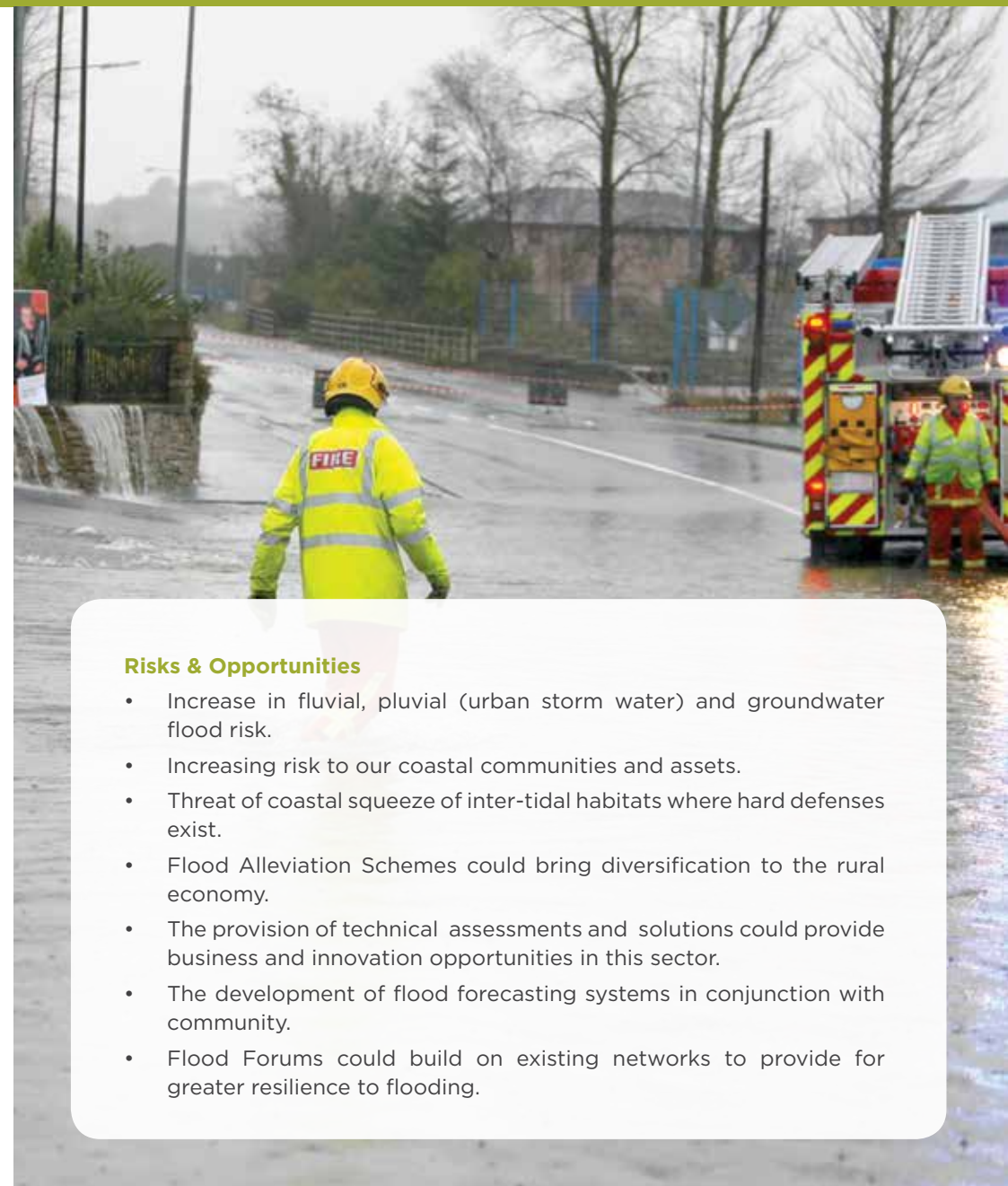
Due to rising sea levels and more intense rainfall projections, Donegal will face a greater risk of flooding, particularly from extreme and currently rare events. Risks from flooding and coastal changes have been identified across all operational areas as posing the greatest long-term risk from climate change to infrastructure and Donegal County Council's operations, and to local communities and business.

Damages and impacts from flooding are already high and current levels of adaptation are projected to be insufficient to avoid flooding and coastal erosion risk increasing with further warming. The projected changes raise concerns regarding the integrity of flood defences, the capacity of urban storm drainage systems, the need for better planning and development in vulnerable areas, as well as emergency response planning and resourcing.

Additional adaptation may be able to counter the increase in flood damage anticipated with the 2°C of global warming, at least in some parts of the county, but in others increasing flood risks appear inevitable, especially with 4°C or more of global warming. Communities and business operating in flood risk areas, are exposed to direct damage to buildings and assets, and indirect impacts on wellbeing, sales, supply chains and reputations. A better understanding of future flood risk and local impacts is needed for Donegal County Council to develop appropriate adaptation measures, as well as capacity building at community level.

New Approach

The Water Framework Directive has resulted in a shift in our approach; away from site specific hard engineering solutions, towards an integrated assessment of water resources and flood management at the catchment scale. The capacity to adapt to greater extremes in hydrological conditions will depend on our ability to apply integrated decision making, together with technology and systems that are appropriate and sustainable.



Risks & Opportunities

- Increase in fluvial, pluvial (urban storm water) and groundwater flood risk.
- Increasing risk to our coastal communities and assets.
- Threat of coastal squeeze of inter-tidal habitats where hard defenses exist.
- Flood Alleviation Schemes could bring diversification to the rural economy.
- The provision of technical assessments and solutions could provide business and innovation opportunities in this sector.
- The development of flood forecasting systems in conjunction with community.
- Flood Forums could build on existing networks to provide for greater resilience to flooding.

RISKS TO COMMUNITY & BUSINESS SUPPORT SERVICES

Community Engagement

Many of Donegal's communities and sporting organisation vulnerable to climate change impacts are already dealing with climate change and have experience of adapting.

A community in Buncrana, impacted by flooding, is a good example of people using their own knowledge and decision-making processes to act against flooding in advance of the major flood protection scheme being developed and implemented.

Donegal County Council has a key role to play in developing and supporting community and sports initiatives. Raising awareness of the risks and opportunities likely with climate change will help increase community resilience to the risks and inform our approach to how communities and sporting organisations should adapt in the future.

Business

Some of the impacts on business in Donegal are indirect e.g. how insurance firms assess flooding risk, while others are clearly direct, such as impacts on water quality, resources and services. These more immediate physical impacts are leading companies to invest in new processes and technologies to mitigate risks, and avail of opportunities.

There are also less intuitive impacts related to the transition to a carbon-free economy, as well as new trends in how customers, investors, business partners, and regulators make decisions

The Donegal Local Enterprise Office is a 'First Stop Shop' for anyone seeking information and support on starting or growing a business in Donegal. Building awareness of climate change will help businesses understand climate change risks, but also the opportunities it may bring in some sectors.



Risks & Opportunities

- Loss to productivity, economic confidence and wellbeing due to extreme events.
- Increased insurance premiums.
- Opportunity for growth of new economic programmes in tourism.
- Diversification of food production and growth in green economy/eco system services.
- Retailers that understand how weather affects sales and plan supply accordingly may benefit from climate-related impacts.
- Future increased volatility of commodity prices is expected in response to climate change impacts globally with opportunity to develop more local food production markets with changing climate conditions.
- Increased temperatures combined with increased periods of time spent outdoors could lead to increased vitamin D levels and improved individual physical and mental health.

RISKS TO TOURISM

Visitors to Donegal choose to visit for many reasons, among them being the richness of Donegal's cultural and natural heritage. As changes to the climate affect our natural heritage, this will have implications for Donegal's tourism industry. We need to build an understanding of the likely effects on tourism and what, if anything, we can do about it.

“As changes to the climate affect our natural and cultural heritage, then they will also have implications for Ireland's tourism industry”. [Failte Ireland]

While there are many issues relating to tourism and climate change that are difficult to predict in an Irish context, we can be certain that we will not be as adversely affected as other destinations around the world. Ireland's temperate climate should be capable of absorbing the predicted changes in climate over the next one hundred years without resulting in unacceptable comfort levels for visitors or taking away from the reasons that people choose to come to Donegal i.e. people, culture, landscape, sports tourism etc.

It is also likely that some of the predicted outcomes of climate change will have positive impacts on tourism in Donegal. For example, warmer drier summers e.g. 2018, will increase the appeal of many of Donegal's Blue Flag Beaches, as well as the appeal of our Greenways, our water-based and other outdoor activities. This will bring its own pressures on amenities, services and resources and it will be necessary to prepare for this.

Overall, while there may be gains to tourism from climate change, there are also several significant risks, and it is important to build an understanding and adapt to climate change risks and opportunities to ensure that Donegal's tourism offerings are of a consistently high quality, and that sustainable management policies and practices are put in place.



Risks & Opportunities

- Development and use of natural amenities will increase e.g. Greenways and beaches ,but changes in water availability, biodiversity loss, reduced landscape aesthetic, altered agricultural production (e.g. wine tourism), increased natural hazards, coastal erosion and inundation, damage to infrastructure will all impact tourism to varying degrees.
- The possibility of extending the tourist season in Donegal into the shoulder periods of April/May and October.
- The development and implementation of Beach Management Plans and Integrated Coastal Zone Management will enhance the tourism product in Donegal.
- Sustainable Hospitality Programmes can be beneficial in ensuring the long-term environmental and economic sustainability of hospitality premises (Sweeney 2007).
- Better design of sensitive and sustainable tourism developments in the context of climate change and natural, built and cultural heritage management informed by best conservation practice are needed.

RISKS TO EMERGENCY SERVICES

The role of emergency management in reducing current and future losses from floods is widely recognised however current resources and procedures may not be enough to address the events associated with the climate changes projected for the county.

The projected increases in frequency and severity of extreme weather events will increase the likelihood of Emergency Response personnel being exposed to these greater risks. The severity of these risks needs to be part of the assessment of the appropriate response and the implementation of suitable controls and procedures to prevent risk of injury/death. Flooding, for example, can cause site contamination and increase the risk of illness from poisoning or infection.

A review of plans and resources is required to plan and prepare for localised incidents and catastrophic emergencies, to identify potential risks and produce emergency plans to either prevent or mitigate the impact of any incident on their local communities.



Risks & Opportunities

- Increased risk to emergency staff in relation to climate related incidences, e.g. high winds, flooding, forest and peatland/gorse fires.
- Increasing temperature places pressure on water supply and increases the risk of wild fires.
- Increased demand on staff and equipment due to weather related events.
- Opportunities to incorporate climate change resilience into emergency management plans.

RISKS TO CORPORATE GOVERNANCE

The effects of climate change are usually discussed in terms of impact on the natural environment and general human population. However, impacts of climate change on occupational health and safety of the Council's workforce has also been identified. Workers in specific areas are more vulnerable to the health impacts of climate change because they may experience longer and more intense exposures to climate change related hazards. These changes have the potential to both directly and indirectly affect the health and well-being of workers.

Increased Temperatures

Higher temperatures combined with longer and more frequent exposure to heat, will increase the risk of heat stress, air pollution and UV exposure, particularly among outdoor staff. This may lead to more cases of heat-related illnesses such as dehydration but can also have indirect impacts on injury caused by fatigue or negligence e.g. changes in the worker's emotional state, such as irritability. Overheating in buildings has also been identified as an issue during sunny and warm weather, as experienced in 2018. The inability to provide reasonably comfortable or safe temperatures may cause reduced working efficiencies and the closure of workplaces in the future.

Extreme Weather Events

Extreme weather events including flooding and storms, such as Storm Ophelia, which are projected to become more frequent and intense, can have multiple effects on occupational health and safety. These extreme events affect staff involved in emergency, rescue and clean-up efforts delivered in high risk situations due to more frequent floods, landslides, storms, droughts, and wildfires. These issues are likely to increasingly affect outdoor staff whose welfare will need to be considered through regular review of their activities.

Policies to promote that awareness of the health and safety effects of climate change need to be developed and Safety and Health Plans need to integrate climate change risks into their assessments.



Risks & Opportunities

- Failure to implement appropriate adaptation plans will lead to increased demand on resources e.g. staff and finance.
- Climate change also presents opportunities for capacity building within Donegal County Council and for the wider green/blue economies in the county.
- Increased risk of health and safety issues for staff dealing with emergency situations.
- Greater adaptive capacity within the local governance sector will enhance operations and communities in County Donegal.



STEP 4: GOALS, OBJECTIVES & ACTIONS

STEP 1: PREPARING THE GROUND

STEP 2: BASELINE ASSESSMENT

STEP 3: FUTURE CLIMATE RISKS

STEP 4: GOALS, OBJECTIVES & ACTIONS

STEP 5: IMPLEMENTATION

OUR VISION FOR A CLIMATE READY DONEGAL

Ireland's climate is changing and the impacts on Donegal are already being felt. Sea levels are rising, and more extreme rainfall and storm events are becoming more frequent. Donegal County Council is already taking steps to improve our energy efficiency and reduce our carbon emissions, as part of the global fight against climate change.

While working to reduce our GHG emissions, our county must also prepare for the unavoidable impacts of climate change. The decisions and actions we take over the coming years to adapt will determine how we live with climate change in years to come.

Our Vision of a Climate Ready Donegal

A County that understands how climate change will affect the region, our communities, heritage, economic prosperity and well being and actively working together to reduce our exposure to climate risks and to capture new opportunities

A climate awareness programme and communication strategy has helped the public understand the reasons and benefits of adaptation improvements.

Donegal is building a reputation as a champion in climate adaptation (and mitigation), drawing international attention, and availing of funding and investment opportunities.

Empowered communities, responsible businesses and public sector organisations work together in trust and partnership to shape the future development of Donegal.

As Donegal faces new challenges and opportunities, all parties collaborate to ensure climate resilience is taken into account in plans, policies and investment decisions

STEP 1: PREPARING THE GROUND

STEP 2: BASELINE ASSESSMENT

STEP 3: FUTURE CLIMATE RISKS

STEP 4: GOALS, OBJECTIVES & ACTIONS

STEP 5: IMPLEMENTATION



OUR VISION OF A CLIMATE READY DONEGAL

CRITICAL INFRASTRUCTURE & BUILDINGS

Disruption to critical infrastructure is kept to a minimum despite an increase in extreme rainfall, storm events and sea level rise.

Smarter and sustainable transport continues to grow across the county, reducing pressure on the road network infrastructure, improving health and allowing for essential travel and haulage has become more efficient. Proactive road maintenance ensures road surfaces and foundations are resilient to new climate pressures.

New developments combine cutting edge technologies with green and blue architecture, to create demonstration sites and new buildings that are climate ready. By utilising natural systems this green and blue infrastructure is also delivering co-benefits for carbon reduction efforts, linking climate adaptation and mitigation.





OUR VISION OF A CLIMATE READY DONEGAL

WATER RESOURCES & FLOOD RISK MANAGEMENT

Regular monitoring of water quality and the implementation of adaptation measures have ensured our lakes, rivers, and beaches have maintained a good water quality status.

Through informed decision making, investing in targeted flood protection measures, early warning systems, land use planning, green infrastructure and catchment management, enables water to flow through the county in a controlled manner, reducing the potential of flooding and damage.





OUR VISION OF A CLIMATE READY DONEGAL

NATURAL & CULTURAL HERITAGE

Distribution and populations of plant and animals' species are changing across the county, but regular monitoring allow the county to protect important ecosystems from new pests and diseases. Wildlife corridors are maintained and protected to help animals move safely around the county and increase ecosystem resilience.

Important historical buildings and heritage sites are being maintained and protected to take account of the changing climate, safeguarding the county's heritage without altering its character and significance.

The county's vibrant green reputation is also attracting new families, tourists and new investment in the county.





OUR VISION OF A CLIMATE READY DONEGAL COMMUNITY SERVICES

Climate opportunities and risks are well communicated within the organisation and the communities it serves.

Businesses are benefiting from early identification of vulnerabilities, and investment in adaptation measures. Donegal is building a reputation for resilience, increasing confidence among citizens and investors, and encouraging new businesses to make Donegal their home.

Donegal has seized the opportunities afforded by changing tourism patterns and made sure its many festivals and celebrations are climate ready. Key events in Donegal's cultural and festival calendar are prepared for more frequent extreme weather, safeguarding the county's status as a destination.



GOALS FOR A CLIMATE READY DONEGAL

This first Climate Adaptation Strategy for the County is a starting point on our adaptation journey towards a Climate Ready Donegal. To achieve a Climate Ready Donegal, four Goals have been identified under this first Strategy, which are high level long-term statements

A Climate Ready Donegal

A county that understands how climate change will affect the region, our communities, heritage, economic prosperity and well being and actively working together to reduce our exposure to climate risks and to capture new opportunities

Increase the resilience of the following areas to climate change by planning and implementing appropriate adaptation measure and supporting opportunities

Governance



Goal 1
Critical
Infrastructure &
Buildings



Goal 2
Natural & Cultural
Capital



Goal 3
Water Resources
& Flood Risk
Management



Goal 4
Community
Services



STEP 1: PREPARING THE GROUND

STEP 2: BASELINE ASSESSMENT

STEP 3: FUTURE CLIMATE RISKS

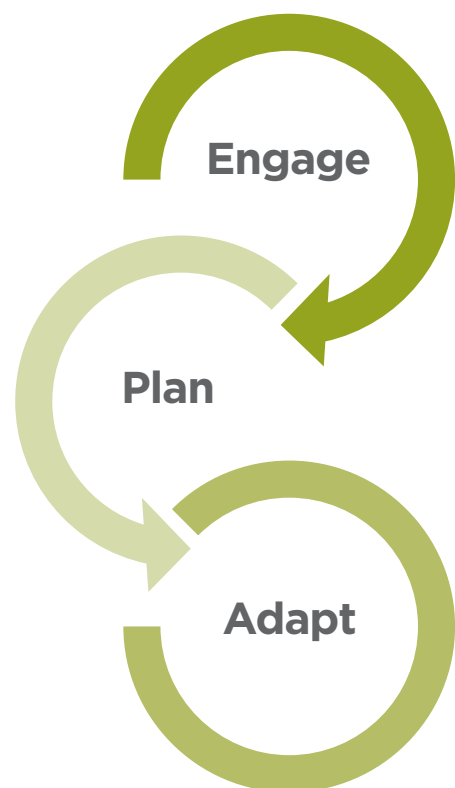
STEP 4: GOALS, OBJECTIVES & ACTIONS

STEP 5: IMPLEMENTATION

OBJECTIVES TO MEETING THE ADAPTATION GOALS

The four Goals are high-level long-term statements, while the Objectives define strategies or implementation steps to attain the identified Goals. The Objectives are common across all four Goals and set out the steps to implementing the Strategy.

Objectives



Engage

Improve education, awareness-raising and capacity on climate change, adaptation (and mitigation), impact reduction and early warning across the Local Authority departments, businesses, communities and individuals.

Plan

Integrate climate change measures into policies, strategies and planning, as well as the identification of areas at risk to inform planning and decision-making.

Adapt

Strengthen resilience and adaptive capacity and develop and implement co-ordinated responses to climate risk where needed.

ADAPTATION ACTIONS

The Goals and Objectives of the Adaptation Strategy provide an overarching framework for climate adaptation planning in Donegal.

The next step calls for the development of specific Actions under each of the Goals and Objectives of this current 5-year Strategy, that collectively will begin the journey to a Climate Ready Donegal.

The Actions have been divided across the 4 Goals, with an additional category added for governance of the Adaptation Strategy.

Action Timeframes

The Adaptation Actions will be implemented in the Short (5 years or less), Medium (greater than 5 and less than 10 year) and Long term (greater than 10 years).

Many of the early Actions are centred around awareness, training, and updating policies, procedures and plans to take account of climate projections and impacts.

For those measures for implementation in the medium and long terms some Actions have been identified to gather data and build a better understanding of impacts in the short term.



ADAPTATION ACTIONS



ACTION PLAN: GOVERNANCE & SUPPORT

This is the County's first Climate Adaptation Strategy to provide a framework for dealing with the impacts of climate change in Donegal, but is just the start of a process to ensure Donegal becomes a climate resilient County. The Governance & Support Structure proposed will allow for monitoring and implementation of the Adaptation Strategy

No	Objective	Actions	Lead LA Dept/ Team	Budgeted		Relevant Partners	Action Timeframe	Policies and Legislation
				Yes	No			
1		Climate Adaptation Steering Group Establish a dedicated Climate Adaptation Steering Group to ensure that the Goals, Objectives and Actions of the Donegal Climate Change Adaptation Strategy are achieved and ensure it's successful implementation.	Senior Management Team	✓		CARO, Sectors named in the NAF, Government Departments, EU Funds	Short	
	Engage / Plan / Adapt	1. Climate Adaptation Steering Group will manage and oversee the delivery of the Adaptation Actions and the mainstreaming of Climate Adaptation into all relevant plans, programmes, strategies and policies of Donegal County Council.		✓				
	Engage / Plan / Adapt	2. Develop an Implementation Plan for Adaptation Actions and monitor and report on progress.		✓				
	Engage / Plan / Adapt	3. Facilitate potential partnerships and identify funding sources to progress relevant climate adaptation projects.		✓				
2	Engage / Plan / Adapt	Corporate Plan Include the objective of being Climate Ready as a Strategic Goal of the Corporate Plan and prepare an annual progress report on the implementation of the Strategy.	Senior Management Team	✓		CARO	Short	Corporate Plan, Annual Report
3	Engage / Plan / Adapt	Sectoral Adaptation Plans Build and strengthen partnerships and promote cross-sectoral communication and cooperation in the implementation of Local Authority and Sectoral Adaptation Plans by forming a North West Climate Action Forum.	Steering Group		✓	All Sectors, CARO, relevant Northern Ireland Councils	Short	National Adaptation Framework, Sectoral Adaptation Plans
4	Engage / Plan	Mapping & Identification of Vulnerable Areas Support relevant national and regional agencies to develop an evidence database on projected changes and the impacts of weather events. This will aid mapping and identification of areas at risk and inform risk assessments, contingency planning, adaptation planning and decision-making.	Water & Environment Directorate		✓	CARO, Climate Ireland, EPA	Short	
5	Engage	Risk Assessments, Risk Register & Remedial Action List 1. Continue to review winter maintenance programmes, flooding programmes and annual maintenance programmes to consider the potential hazards, impacts and consequences of climate change and extreme weather events on their function and conditions.	Roads and Transportation Directorate		✓	Dept of Transport, Tourism & Sport, TII	Short	Winter Maintenance Programme, Annual Road Maintenance Programme, Design Manual for Urban Roads and Streets, NRA Design Manuals for Roads
	Plan / Adapt	2. Continue to integrate these programmes into the decision making processes for the road infrastructure programmes; design, planning and maintenance.					Short - Medium	

ACTION PLAN: GOVERNANCE & SUPPORT

No	Objective	Actions	Lead LA Dept/ Team	Budgeted		Relevant Partners	Action Timeframe	Policies and Legislation
				Yes	No			
5	Engage	3. Support the national and regional agencies to develop a risk assessment of the potential impacts of climate change on waste management facilities to identify sites and processes most affected by climate change, and formulate appropriate action plans to address the potential impacts.	Water & Environment Directorate			Regional Waste Management Office, Waste Regulator, Waste Operators, Academia, EPA	Short - Medium	Waste Framework Directive, Waste Act, EPA Licences, Regional Waste Management Plans
	Engage/Plan	4. Support the Connaught/Ulster Regional Waste Management Office, waste regulators and waste companies to build a shared understanding of the potential impacts of climate change on waste management policies and practices, and identify adaptation actions for waste management processes; engineering, operational, investment etc.						
6	Engage	<p>Communication of Implications of Climate Change on Natural and Cultural Assets</p> <p>1. Work with national and regional agencies to develop a climate risk register of cultural and heritage sites/assets/collections to include a consideration of flood risk and sea level rise, high temperatures, extreme wind and precipitation events and increased tourism.</p>	Housing, Corporate & Cultural Services Directorates		✓	Department of Culture, Heritage & the Gaeltacht, National Parks & Wildlife, The Heritage Council, OPW, communities, Municipal Districts, CARO, DCHG, Fáilte Ireland, private landowners, PPN, OPW, LEADER	Short	Heritage Act, National Heritage Plan, Tourism Strategy, Heritage Ireland 2030, National Biodiversity Action Plan, National Monuments Act, Planning & Development Acts, Wildlife Acts & EU Directives
	Plan/Adapt	2. Support national and regional agencies to monitor the effects of climate change on cultural and heritage sites/assets/collections to inform adaptation policy and management, and support and facilitate the appropriate maintenance and repair programmes.			✓		Short - Medium	
7	Engage / Plan	<p>Support to Local Climate Action</p> <p>Support communities (e.g. Tidy Town Committees and PPN) to develop community based adaptation plans.</p>	Water & Environment Directorate, Community Development and Planning Services Directorate		✓	CARO, Dept of Communication, Climate Action & Environment, LCDC, PPN	Short	

ACTION PLAN: GOAL 1 – CRITICAL INFRASTRUCTURE & BUILDINGS

Goal 1: Increase the Resilience of Critical Infrastructure & Buildings to Climate Change by Planning and Implementing Appropriate Adaptation Measures

Land use planning & development control plays a central role in preparing Donegal for a changing climate. Effective local planning and measures to protect existing infrastructure is essential to minimise future vulnerability and improve resilience to the impacts of climate change.

No	Objective	Actions	Lead LA Dept/ Team	Budgeted		Relevant Partners	Action Timeframe	Policies and Legislation
				Yes	No			
1		County & Local Area Development Plans Continue to integrate climate change and the Climate Change Adaptation Strategy into the County and Local Area Development Plans, and apply planning policies to reduce the vulnerability of County Donegal to the impacts of climate change	Community Development & Planning Service Directorate, all relevant directorates			Dept of Housing, Planning & Local Government, Northern & Western Regional Assembly		County Development Plan, Local Area Plans, Regional Spatial & Economic Strategy, Planning Acts
	Engage	1. Continue to promote quality climate resilience through sustainable design and construction 2. Promote climate adaptation through supporting national initiatives which embrace green buildings 3. Promote low carbon neighbourhoods through high quality green (e.g. woodlands, parks, playing fields, natural habitats) and blue (e.g. rivers, ponds, lakes, coastal areas) infrastructure.		✓			Short	
	Plan	4. Support national reviews of design requirements of Sustainable Urban Drainage Systems (SUDs) and consider their inclusion in future reviews of the County and Local Area Development Plans. 5. Ensure new developments are considered in the context of best practice as it relates to flood risk management. 6. Continue to conserve and enhance open space assets and their connections to the wider network of natural habitats e.g. establish the value of natural flood plains as part of the County's approach to flood risk management. 7. Develop sustainable land use planning policies which facilitates transportation efficiency, economic returns on transport investment, minimisation of environmental impacts and a general shift towards the use of low carbon public transportation throughout the county.		✓			Short	
2		Flooding & New Developments Future infrastructure and buildings to be planned and built in consideration of future flood risk projections				OPW, CARO, Marine Institute, Met Éireann, Communities, Municipal Districts		County & Local Area Development Plans, Flood Planning Guidelines, OPW Flood Maps
	Engage	1. Support the OPW in the periodic development of Preliminary Flood Risk Assessments, flood hazard mapping and flood management plans.	Roads and Transportation Directorate	✓				

ACTION PLAN: GOAL 1 – CRITICAL INFRASTRUCTURE & BUILDINGS

No	Objective	Actions	Lead LA Dept/ Team	Budgeted		Relevant Partners	Action Timeframe	Policies and Legislation
				Yes	No			
2	Plan	2. Support the development of Flood Risk Assessments where these are required to inform planning decisions for new infrastructure and buildings in line with Flood Risk Management guidelines.	Community Development & Planning Service Directorate and all directorates developing infrastructure, projects, etc.	✓		OPW, CARO, Marine Institute, Met Éireann, Communities, Municipal Districts		County & Local Area Development Plans, Flood Planning Guidelines, OPW Flood Maps
		3. Ensure Strategic Flood Risk Assessments are conducted for future reviews of the County Development Plan and Local Area Plans	Community Development & Planning Service Directorate	✓				
	Adapt	4. Consider new developments take into account the potential future impacts of climate change in their designs in line with Flood risk management Guidelines.	Community Development & Planning Service Directorate, Roads and Transportation Directorate	✓				
3		Infrastructure Risk Register Support national and regional initiatives which identify key infrastructure and the built environment which are vulnerable to the likely impacts of climate change and use this to inform adaptation policy.	Climate Adaptation Steering Group, All Directorates developing/ maintaining infrastructure			Municipal Districts, Climate Ireland, CARO, Statutory Authorities	Short	Flood Planning Guidelines, Flood Emergency Response Plan
	Engage	1. Support national and regional agencies to develop a register of critical equipment, systems and assets at risk from existing extreme weather events and projected climate change.		✓				
	Plan	2. Continue to extend existing monitoring plans which inspect the integrity of key infrastructure, particularly elements at risk from extreme weather events e.g. bridge inspection programmes. Support national and regional agencies as appropriate, e.g. OPW flood defences		✓				
	Adapt	3. Develop necessary maintenance/upgrade programme to address climate risk of key infrastructure identified above e.g. continue to progress prioritised bridge strengthening programmes			✓			
		4. Identify backup and contingency plans for extreme weather events that have the potential to impact critical infrastructure, the failure of which would have major consequences and/or a cascading effect on other services e.g. identify alternatives for prioritised routes		✓				

ACTION PLAN: GOAL 1 – CRITICAL INFRASTRUCTURE & BUILDINGS

No	Objective	Actions	Lead LA Dept/ Team	Budgeted		Relevant Partners	Action Timeframe	Policies and Legislation
				Yes	No			
4		Data Capture of Impacts of Extreme Weather Events	Climate Adaptation Steering Group			Government Departments/ Agencies, Academia, CARO, PPN	Short	Emergency Flood Response Plan, Corporate Plan
	Engage	1. Support national, regional and local research to collate and document the impacts of extreme weather events in Donegal, including areas and infrastructure impacted, people/ communities affected, resources deployed during and after an extreme event, cost of repairs/replacement of infrastructure, increased maintenance costs and impact on service delivery			✓			
	Plan	2. Capture the impact of climate change on critical infrastructure and buildings through GIS mapping to help identify hazards and vulnerable areas to allow for future adaptation planning			✓			
	Plan/Adapt	3. Support national and regional agencies to develop a reporting and information sharing system that allows for the assessment of the impacts of climate change and supports an economic evaluation of adaptation projects in the future.			✓			
5		Promote Opportunities through Green Infrastructure	Climate Adaptation Steering Group		✓	All Directorates, CARO, Academia, SEAI, PPN	Short	
	Plan	2. Identify opportunities to increase the climate resilience of infrastructure and the built environment through greening measures in new developments and retrofit of existing developments through the use of natural features (e.g. street trees, green roofs, rain gardens) and other materials (e.g. permeable paving).			✓			
6	Engage / Plan / Adapt	Road Design & Maintenance Standards Work with national and regional agencies to develop guidance on maintenance and design standards that address future climate change projections that impact on road structures and materials.	Roads and Transportation Directorate	✓		Department of Transport, Tourism & Sport, TII	Short	Winter Maintenance Programme, Annual Road Maintenance Programme, Design Manual for Urban Roads and Streets, NRA Design Manuals for Roads

ACTION PLAN: GOAL 1 – CRITICAL INFRASTRUCTURE & BUILDINGS

No	Objective	Actions	Lead LA Dept/ Team	Budgeted		Relevant Partners	Action Timeframe	Policies and Legislation	
				Yes	No				
7		Integrated Coastal Zone Management	Water & Environment Directorate			DHPLG, DAFM, DCHG, DCCAIE, Academia, Marine Institute, DTTAS, EPA, OPW, GSI		Marine Spatial Plan, OPW Irish Coastal Protection Strategy Study, Research Projects	
	Engage	1. Engage stakeholders to identify how Donegal can adapt to accommodate a dynamic and changing coast and live with increased coastal flood and erosion risk.		✓					Short
	Engage/ Plan/ Adapt	2. Support national and regional research to support the development of Guidance and Policies to enhance and develop protective habitats of coastal ecosystems (e.g. dunes and wetlands) to protect critical infrastructure and assets from damaging storm surges.		✓					Short / Medium
	Plan/Adapt	3. Work with national and regional agencies to develop Coastal Zone Management Plans so that new developments take account of future risk from coastal erosion, storm surges and sea level rise. Such plans should identify at-risk coastal erosion zones and, where appropriate, actions to manage climate risk and build resilience to climate change.	✓		Short / Medium				
8		Increase the Resilience of Housing & Building Stock	Housing, Corporate and Cultural Services Directorate and Municipal Districts			Dept of Housing, Planning & Local Government, Tenants, SEAI	Short	Tenant Handbook, Building Regulations, Winter Ready Awareness	
	Engage	1. Support national and regional initiatives to increase awareness of private house owners and Council housing tenants of potential impacts on housing from climate change and how best to avoid or reduce impacts of severe weather events.			✓				Short
	Engage/ Plan	2. Support national and regional initiatives which will identify historic, derelict and /or dangerous buildings that may cause a risk to public safety during extreme weather events, and which will identify appropriate mitigation actions.			✓	HSA, private landowners	Short		
9	Engage	Planning for Resilient Energy Networks	Climate Adaptation Steering Group	✓		Energy Network Companies	Short		
		1. Encourage and enhance cooperation and communication with energy and service providers to ensure that energy infrastructure and services are resilient to the impacts of climate change.							

ACTION PLAN: GOAL 2 - NATURAL & CULTURAL HERITAGE

Goal 2: Increase the Resilience of our Natural & Cultural Capital to Climate Change by Planning and Implementing Appropriate Adaption Measures

Climate change will affect the natural and cultural environment through temperature rise, extreme weather events and sea level rise. However, the natural environment, greenspaces and green infrastructure also have an essential role in offsetting some of the predicted impacts of climate change.

No	Objective	Actions	Lead LA Dept/ Team	Budgeted		Relevant Partners	Action Timeframe	Policies and Legislation
				Yes	No			
1		<p>Build Awareness of Nature Based Adaptation Solutions Support national, regional and local initiatives to promote nature based solutions as potential low cost win-win climate change adaptation and mitigation solutions to:</p> <p>a) Mitigate the effect of extreme weather events - reduce the impact of heavy rain and floods, improve the effectiveness of SUDs, improve air quality, and help reduce the urban heat effect through tree planting</p> <p>b) Help nature to adapt to climate change by strengthening habitat networks,</p> <p>c) Reduce habitat fragmentation and provide opportunities for non-invasive species to migrate</p> <p>d) Promote the restoration of natural processes as a means of increasing resilience.</p> <p>e) Research and map areas considered beneficial local carbon offset measures for carbon sequestration.</p>	Water & Environment Directorate			Housing, Corporate and Cultural Services Directorate, EPA, NPWS, National Biodiversity Data Centre, Academia, Department of Culture, Heritage and the Gaeltacht, Arts Office, The Heritage Council, Municipal Districts, Community Office, PPN		Our life Insurance, Our Natural Capital: an EU Biodiversity Strategy to 2020, National Biodiversity Action Plan, European Communities (Birds and Natural Habitats) Regulations 2011, Heritage Ireland 2030, County & Local Area Development Plans
	Engage	1. Support national, regional and local awareness campaigns to highlight the role of the natural environment and its' positive contribution to Climate Action.		✓			Short	
		2. Support national, regional and local initiatives to encourage the use of information boards at tourism and amenity sites, at natural landscape locations, cultural heritage sites and other appropriate locations to increase awareness of the benefits of the natural and cultural environment and its role in Climate Action.		✓			Short	
		3. Support the use of the Arts Programme to raise awareness of climate action.	Housing, Corporate and Cultural Services Directorate	✓			Short	
		4. Continue to promote policies and measures to help nature to adapt to climate change by strengthening habitat networks, reducing habitat fragmentation and providing opportunities for species to migrate, e.g. green corridors connecting different habitats.	Community Development & Planning Service Directorate	✓		Water & Environment Directorate, EPA, NPWS, CARO, private landowners, Department of Culture, Heritage and the Gaeltacht	Short	National Biodiversity Action Plan, County & Local Area Development Plans
		5. Support initiatives to increase the awareness of the value of natural capital, (e.g. benefits of parks, woodlands in urban areas) and Ecosystem Based Adaptation (e.g. benefits or wetlands in flood mitigation).	Housing, Corporate & Cultural Services Directorate		✓		Short-Medium	
2	Engage / Plan	<p>Biodiversity Management Plans Review the Donegal Biodiversity Action Plan having regard to the National Biodiversity Action Plan and likely climate changes.</p>	Senior Management Team		✓	Climate Adaptation Steering Group, EPA, NPWS, National Biodiversity Data Centre, Academia, Department of Culture, Heritage and the Gaeltacht, The Heritage Council	Short	Our life Insurance, Our Natural Capital: an EU Biodiversity Strategy to 2020, National Biodiversity Action Plan, European Communities (Birds and Natural Habitats) Regulations 2011

ACTION PLAN: GOAL 2 - NATURAL & CULTURAL HERITAGE

No	Objective	Actions	Lead LA Dept/ Team	Budgeted		Relevant Partners	Action Timeframe	Policies and Legislation
				Yes	No			
3	Engage / Plan	Support Biodiversity through Natural Pollination Consider the All Ireland Pollinator Plan to explore how Donegal County Council can support a diversity of plant species to increase food sources and habitats for pollinators.	All Directorates	✓		EPA, NPWS, National Biodiversity Data Centre, Academia, Department of Culture, Heritage and the Gaeltacht, Community Office, The Heritage Council, PPN	Short	National Biodiversity Action Plan, All-Ireland Pollinator Plan, County & Local Area Development Plans
4	Engage / Plan	Invasive Species Management Support national and regional initiatives relating to policy development for management of Invasive Species to ensure that invasive species whose spread is linked with climate change are identified and appropriate management techniques for their control are developed.	Water & Environment Directorate		✓	All Directorates, National Biodiversity Data Centre, EPA, NPWS, Invasive Species Ireland, private landowners	Short	EU biodiversity strategy to 2020, National Biodiversity Action Plan
5	Engage / Plan	Peatland Management Plan Support national and regional initiatives to implement measures from the National Peatlands Strategy in partnership with key stakeholders.	Senior Management		✓	Water & Environment Directorate, EPA, NPWS, Academia, Irish Peatland	Short - Medium	National Peatlands Strategy (draft), EU Biodiversity Strategy to 2020, National Biodiversity Action Plan
6	Engage / Plan / Adapt	Species Spatial Responses Support national and regional initiatives to reduce the barrier effects of roads, disused railways and technical objects to facilitate species spatial responses to climate change	All Directorates developing/ maintaining infrastructure		✓	TII, OPW, DCCAE (IFI), NWPS	Short	Habitats Directive, National Biodiversity Action Plan
7	Engage	Impacts of Cultural & Heritage losses on Tourism 1. Support national and regional initiatives to explore the consequences of climate change impacts on heritage, cultural and amenity sites and the potential for loss of tourism resources.	Economic Development, Emergency Services and Information Systems Directorate - Tourism		✓	DCHG, Fáilte Ireland	Short - Medium	
	Plan	2. Support national and regional initiatives relating to cost-benefit analysis of adaptation investment for key tourism sites at high risk from climate change.			✓		Short - Medium	
8	Plan/Adapt	Improved Management Plans for Heritage Support national and regional initiatives to integrate climate change adaptation into the protection, conservation, promotion and maintenance of key heritage sites.	All Directorates	✓		DCHG, Municipal Districts, Private landowners, Heritage Council, interested community groups	Short	Heritage Act, National Heritage Plan
9	Engage / Plan / Adapt	Enhancement & Restoration of Natural Systems Support national and regional agencies to enhance and restore natural systems to increase resilience to climate change, e.g. protection of bogs, native woodlands, river and lakes.	Water & Environment Directorate and Housing, Corporate & Cultural Services Directorate		✓	DCHG, DAFM, MI, BIM, OPW, DCCAE (IFI), Bord na Mona, Coillte, eNGOs, Local communities and private landowners	Short	



ACTION PLAN: GOAL 3 – WATER RESOURCES & FLOOD RISK MANAGEMENT

Goal 3: Increase the Resilience of Water Resources & Flood Risk Management to Climate Change by Planning and Implementing Appropriate Measures

Climate change will affect the Water Resources and Water Quality and a changing precipitation pattern with more extreme rainfall and sea level rise will lead to increased incidence and impacts from fluvial, pluvial and coastal flooding. Understanding and managing these risks will be critical to developing a Climate Ready Donegal

No	Objective	Actions	Budgeted		MCC Lead Dept/Team	Relevant Partners	Action Timeframe	Policies and Legislation
			Yes	No				
1	Engage / Plan / Adapt	Flood Protection Schemes Work with the OPW and other organisations to identify and support the development of Major and Minor Flood Protection and Flood Proofing Schemes in Donegal.		✓	Water & Environment Directorate, Roads and Transportations Directorate	OPW, CARO, Academia, Marine Institute, Met Éireann, EPA, Climate Ireland, Department of Agriculture	Short	CFRAM Flood Risk Management Plans, OPW Minor Flood Mitigation Works & Coastal Protection Scheme
2		Register of Hard & Soft Flood Protection Infrastructure			Water & Environment Directorate, Roads and Transportations Directorate, Housing, Corporate and Cultural Services Directorate	OPW, Tidy Towns, Coillte, private landowners		CFRAM Flood Risk Management Plans, OPW Minor Flood Mitigation Works & Coastal Protection Scheme
	Engage	1. Support national and regional agencies to develop a register of existing hard and soft flood protection infrastructure around the county.	✓				Short	
	Plan	2. Continue to extend existing monitoring plans which inspect the integrity of key flood protection infrastructure. Support national and regional agencies as appropriate, e.g. OPW flood defences		✓			Short - Medium	
	Adapt	3. Develop necessary maintenance/upgrade programme to address climate risk of key flood protection infrastructure identified above. Support national and regional agencies as appropriate, e.g. OPW flood defences		✓			Short - Medium	
3	Engage	Natural Flood Management Projects 1. Support national, regional and local initiatives to explore opportunities for natural flood management or other enhancement projects arising from the flood risk assessments.		✓	Water & Environment Directorate, Roads and Transportations Directorate	OPW, Dept of Culture, Heritage & the Gaeltacht, Municipal Districts, Department of Agriculture	Short	County and Local Area Development Plans, CFRAM Flood Risk Management Plans, Planning, Culture & Heritage (National Tree Planting Week)
	Engage / Plan / Adapt	2. Support national, regional and local initiatives to promote increased tree and vegetation cover that could reduce stormwater runoff, protect against erosion, and moderate surface and air temperatures.		✓			Short	
	Engage	3. Support national, regional and local initiatives to promote land management opportunities for water attenuation.		✓			Short	
4	Engage / Plan	Flood Buffer Zones Support national, regional and local initiatives that encourage protective measures to manage ecosystems, e.g. buffer zones along rivers, lakes, reservoirs and coasts for flood control and water quality management.		✓	Water & Environment Directorate, Community Development & Planning Service Directorate, Roads and Transportations Directorate	OPW, CARO, Academia, EPA, NPWS, Department of Agriculture	Short - Medium	CFRAM Flood Risk Management Plans, National Biodiversity Action Plan, Habitats Directive
5	Engage / Plan	Watercourse Maintenance Works Liaise with the OPW and CARO in the development of multi-annual maintenance programmes for watercourses and coastlines where such works would substantially reduce flood risk.		✓	Water & Environment Directorate, Roads and Transportations Directorate	Municipal Districts, OPW, NPWS, private landowners, IFA	Short	CFRAM Flood Risk Management Plans

ACTION PLAN: GOAL 3 – WATER RESOURCES & FLOOD RISK MANAGEMENT

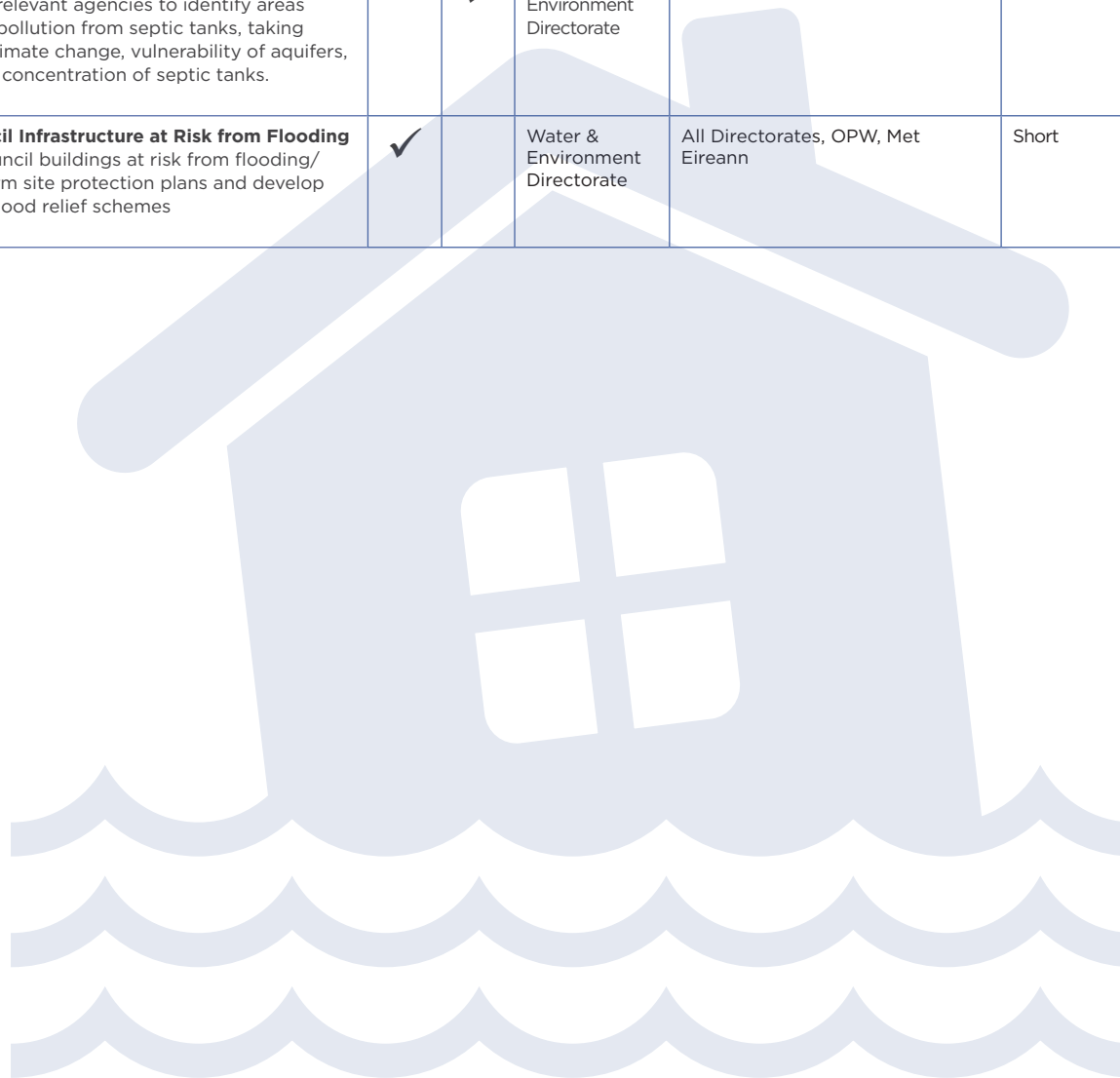
	Objective	Actions	Budgeted		MCC Lead Dept/Team	Relevant Partners	Action Timeframe	Policies and Legislation
			Yes	No				
6	Engage / Plan / Adapt	<p>Protection of Floodplains and Wetlands Work with national and regional agencies to protect the County's floodplains, wetlands and coastal areas that flood as green infrastructure for storage and conveyance of floodwater and protection of biodiversity and wildlife habitats.</p>		✓	Water & Environment Directorate, Community Development & Planning Service Directorate, Roads and Transportations Directorate	Municipal Districts, OPW, NPWS, private landowners, IFA	Short	County and Local Area Development Plans, CFRAM Flood Risk Management Plans, National Biodiversity Action Plan
7	Engage / Plan / Adapt	<p>Surcharging Combined Sewers Work with Irish Water to identify combined sewers that are at risk of surcharging during extreme rainfall events, and develop suitable solutions.</p>		✓	Water & Environment Directorate	Irish Water, Municipal Districts	Short - Medium	
8		<p>Green Infrastructure to Reduce Urban Flooding</p>		✓	Water & Environment Directorate, Community Development & Planning Service Directorate, Roads and Transportations Directorate	Planning, Flood Management, Infrastructure Departments, LAWCO, private landowners, Municipal Districts	Short - Medium	Sustainable Drainage Systems, County & Local Area Development Plans
	Engage	1. Work with national and regional agencies to identify and develop locations for green infrastructure to reduce runoff and stormwater flows that may otherwise exceed system capacity, e.g. rain gardens, green roofs, vegetation or pervious materials instead of impervious surfaces.		✓				
		2. Support national and regional agencies to identify and develop mechanisms to promote de-paving of front gardens, school grounds, etc and introduce permeable surfaces, where appropriate.		✓				
		3. Work with national and regional agencies to promote the provision of green roof technology for new public buildings and commercial and industrial buildings, where appropriate. This action will assist in flood alleviation, insulation and improved biodiversity.	✓				Short	
9	Engage	<p>Surface Water Management Plans 1. Identify and map areas prone to surface water and groundwater flood risk.</p>			Roads and Transportation Directorate	Municipal Districts, Road Design, OPW, Irish Water, GSI, LAWCO, private landowners	Short	Sustainable Drainage Systems, County & Local Area Development Plans, CFRAM Flood Risk Management Plans, National Biodiversity Action Plan
	Plan	2. Work with national and regional agencies to develop Surface Water Management Plans to manage surface water flood risks in the areas identified.						
	Adapt	3. Work with national and regional agencies to prioritise and implement Surface Water Management Plans/Projects on a risk basis.						

ACTION PLAN: GOAL 3 – WATER RESOURCES & FLOOD RISK MANAGEMENT

No	Objective	Actions	Budgeted		MCC Lead Dept/ Team	Relevant Partners	Action Timeframe	Policies and Legislation
			Yes	No				
10	Engage/ Plan	Areas Isolated by Flooding Work with national and regional initiatives to identify areas susceptible to isolation as a consequence of flooding and establish measures to reduce the risk and preparedness to respond.	✓		Roads and transportation Directorate	Fire Service, Municipal Districts, Road Design, OPW,	Short	Flood Emergency Response Plan
11	Engage	Flood Risk Training Work with national and regional agencies to identify and address knowledge gaps in Flood Risk Management and Flood Risk Assessments.	✓		Roads and Transportation Directorate, Economic Development, Emergency Services and Information Systems	Fire Service, CARO, OPW, NTG, Marine Institute, Academia	Short	CFRAM Flood Risk Management Plans, Flood Planning Guidelines
12	Engage	Research Coastal Erosion & Sea Level Rise Work with national and regional agencies to identify research areas and case studies, and improve awareness of current and future coastal change along the Donegal coast.	✓		Water & Environment Directorate	CARO, OPW, Marine Institute, Academia	Short	CFRAM Flood Risk Management Plans, Flood Planning Guidelines, Marine Spatial Plan, County & Local Area Development Plans, RSES
13		Protection of Public Water Supplies			Water & Environment Directorate	Irish Water, LAWCO, private landowners, IFA ,EPA	Short	Drinking Water Regulations, Water Framework Directive
	Engage	1. Support Irish Water to identify public drinking water sources vulnerable to climate change and develop source protection, or alternative sources, in order to maintain water quantity and quality levels.	✓					
	Engage	2. Work with Irish Water to identify impacts of power outages of varying durations on Water and Wastewater Scheme operations, and identify critical and vulnerable receptors.	✓					
	Plan/ Adapt	3. Support Irish Water to develop, conserve and upgrade water supply systems to ensure that County Donegal has an adequate supply of water to address climate change impacts.	✓					
14	Engage / Plan / Adapt	Protection of Private Group Water Supplies Work with and support private Group Water Schemes and national agencies to identify drinking water sources vulnerable to climate change and develop source protection, or alternative sources, in order to maintain water quantity and quality levels.	✓		Water & Environment Directorate	Irish Water, Private GWS, GWS Federation, EPA, LAWCO	Short	Drinking Water Regulations, Water Framework Directive
15	Adapt	Internal Water Conservation, Energy and Waste Management Continue to develop and implement water conservation, energy management, and waste management programmes in all Donegal County Council office buildings.	✓		Housing, Corporate and Cultural Services Directorate	Water & Environment Directorate, Irish Water, SEAI	Short	SDG Implementation Plan,
16	Engage	Water Quality Monitoring Continue to work with relevant agencies to monitor surface water conditions during/after extreme weather events to build an understanding of conditions and the factors that alter water quality, and to identify mitigating actions.	✓		Water & Environment Directorate	LAWCO, EPA, IW, OPW (Hydrometric Data)	Short	Water Framework Directive

ACTION PLAN: GOAL 3 – WATER RESOURCES & FLOOD RISK MANAGEMENT

No	Objective	Actions	Budgeted		MCC Lead Dept/ Team	Relevant Partners	Action Timeframe	Policies and Legislation
			Yes	No				
17	Engage/ Plan	Septic Tanks & Ground Water Vulnerability Continue to work with relevant agencies to identify areas at risk of groundwater pollution from septic tanks, taking account of projected climate change, vulnerability of aquifers, groundwater table and concentration of septic tanks.		✓	Water & Environment Directorate	EPA, GSI	Short	
18	Engage/ Plan	Identification of Council Infrastructure at Risk from Flooding Identify and assess Council buildings at risk from flooding/ extreme rainfall to inform site protection plans and develop low-cost minor works flood relief schemes	✓		Water & Environment Directorate	All Directorates, OPW, Met Eireann	Short	CFRAM Flood Risk Management Plans, OPW Flood Maps, Sectoral Adaptation Plans



ACTION PLAN: GOAL 4 – COMMUNITY SERVICES

Goal 4: Increase Resilience of Community Services to Climate Change by Planning & Implementing Appropriate Adaptation Action, and Promote Opportunities

Donegal County Council deliver vital local services that are central to the quality of life for the people, and are a key provider of economic and social development in the county. We must lead the way on Climate Adaptation through Engaging, Planning and Adapting or services, enable communities to reduce exposure to climate risks and to capture new opportunities.

No	Objective	Actions	Lead Dept/ Team	Budgeted		Relevant Partners	Action Timeframe	Policies and Legislation
				Yes	No			
1	Plan	Business Continuity Plan Consolidate existing response plans (e.g. Emergency Flood Response Plan, Winter Readiness Plan, management of Gorse Fires) into a Business Continuity Plan to identify and address the impacts associated with extreme weather events on services provided by Donegal County Council.	Climate Adaptation Steering Group	✓		Senior Management, CARO	Short	Corporate Plan
2	Engage / Plan	Service Delivery Programme Support the integration of Climate Adaptation into the Council's Service Delivery Programme and include in relevant Team Development Plans and Personal Development Plans.	Climate Adaptation Steering Group	✓		Senior Management	Short	Corporate Plan, PMDS
3	Engage	Climate Change Awareness		Climate Adaptation Steering Group		PPN, LCDC, CARO, Department of Communication, Climate Action and Environment, EPA, Climate Ireland, Academia, NTG, Donegal Education Centre, Education and Training Board	Short	National Adaptation Framework, National Mitigation Plan
		1. Internal Awareness Training Support the rollout of national, regional and local Climate Change and Adaptation Training Programs in Donegal County Council.			✓			
		2. Community Awareness Campaign Support national and regional agencies to roll out Climate Change Public Awareness Programmes through an inclusive stakeholder consultation process.			✓			
		3. Support national and regional agencies to roll out educational projects in schools and through community events as opportunities to disseminate climate change information to the public.	✓					
		4. Develop Training Programmes Support national and regional agencies to develop further tailored awareness training programmes for specific sectors and communities.		✓				
4	Engage	Community Resilience Plans 1. Support national and regional agencies to work with communities vulnerable to climate change and extreme weather events.	Climate Adaptation Steering Group	✓		PPN, Municipal Districts, LCDC, CARO, Department of Communication, Climate Action and Environment, EPA, Climate Ireland	Short	Emergency Response Framework, Major Emergency Response Plan, Flood Response Plan
	Plan/ Adapt	2. Support national and regional agencies to develop Community Resilience Plans.			✓			

ACTION PLAN: GOAL 4 – COMMUNITY SERVICES

No	Objective	Actions	Lead Dept/ Team	Budgeted		Relevant Partners	Action Timeframe	Policies and Legislation
				Yes	No			
5		Knowledge Sharing						
	Engage	<p>1. Support national and regional agencies to promote climate adaptation by providing support and knowledge sharing to local businesses and organisations.</p> <p>2. Support CARO to collate and showcase successes and best practice on adaptation and mitigation, and provide support to those looking to take independent adaptation action.</p>	Climate Adaptation Steering Group	✓		CARO, SEAI, Academia, IBEC, Chamber of Commerce, Local Enterprise Office	Short	
6		Community Toolkits & Climate Leaders						
	Engage	<p>1. Support national, regional and local efforts to identify individuals and communities to be champions for climate adaptation and sustainable living.</p> <p>2. Support national, regional and local efforts to develop Climate Adaptation Community Toolkits.</p>	Community Development & Planning Service Directorate		✓	PPN, LCDC, CARO, SEAI, Department of Communication, Climate Action and Environment, EPA, Climate Ireland, Academia, The Heritage Council	Short - Medium	SEAI - Sustainable Energy Community National Dialogue on Climate Change
7	Plan	Festivals & Events Support national, regional and local initiatives to integrate climate change considerations at the planning and development stage for festivals/ events.	All Directorates	✓		Met Éireann, CARO, PPN, LCDC, Community Groups, Tourism Agencies, Arts Council	Short	
8		Project Funding						
	Plan / Adapt	<p>1. Support national and regional initiatives to include Climate Change considerations as a criteria for assessment of projects subject to public funding.</p> <p>2. Support national and regional initiatives to promote funding streams for local and community climate action projects, e.g. funding for Tidy Towns groups.</p>	All Directorates Community Development & Planning Service Directorate	✓	✓	CARO, SEAI, Department of Communication, Climate Action and Environment, EPA, Climate Ireland, NWR, PPN, LCDC, LEADER	Short	Green Public Procurement Rural Development Fund, Climate Action Fund, EU Funding Streams
9	Plan	Emergency Response Plans	Major Emergency Management	✓		HSE, An Garda Síochana, Met Éireann, Municipal Districts, Housing, Corporate and Cultural Services Directorate	Short	Emergency Response Framework, Major Emergency Response Plan, Flood Response Plan, Framework for Major Emergency Management, A Guide to Community Resilience, A Guide to working with the Voluntary Emergency Service
		1. Continue to integrate climate change and the Climate Change Adaptation Strategy into the Donegal Major Emergency Response Plan.						
		2. Continue to integrate climate change and the Climate Change Adaptation Strategy into the Donegal Flood Emergency Response Plan.		✓				

ACTION PLAN: GOAL 4 – COMMUNITY SERVICES

No	Objective	Actions	Lead Dept/ Team	Budgeted		Relevant Partners	Action Timeframe	Policies and Legislation
				Yes	No			
10	Plan	Health & Safety Plans Continue to integrate climate change and the Climate Change Adaptation Strategy into the Councils' Health & Safety Statements and Risk Assessments.	All Directorates	✓		HSA	Short	Corporate Health & Safety Statement
11	Plan	Capturing Costs of Extreme Weather Events Work with national and regional agencies to develop templates to capture the financial aspects of extreme weather events.	Finance	✓		All Directorates, CARO	Short	
12	Engage	Promoting Opportunities & Supporting Business	Local Enterprise Office			CARO, SEAI, Department of Communication, Climate Action and Environment, , EPA, Climate Ireland, NWRA, LEADER, IDA, Enterprise Ireland, IBEC, Chamber of Commerce, Science Foundation Ireland	Short	
		1. Support national and regional agencies to promote funding streams for the active implementation of climate adaptation actions that will contribute both environmentally and economically to Donegal.		✓				
		2. Support national and regional initiatives that encourage and nurture new business ideas, technologies and opportunities in advancing Climate Adaptation and Climate Mitigation actions.		✓				
		3. Support national and regional agencies to develop Climate Change Awareness Programmes for business and start-ups and promote business supports and funding options to businesses seeking to become more resilient to climate change.		✓				
		4. Support national and regional initiatives that encourage and promote projects that will grow the Circular and Bio-economy.		✓				
13	Engage / Plan	Communication of Implications of Climate Change on Natural and Cultural Assets	Climate Adaptation Steering Group			CARO, LCDC, PPN, The Heritage Council	Short	
		1. Support national and regional initiatives to communicate the implications of climate change on Donegal's natural and cultural assets, through websites, social media and public information.						
		2. Support national and regional agencies to work with relevant bodies with responsibility for the management of water courses affected by climate change e.g., Inland Fisheries Ireland and Loughs Agency.						
14	Engage	Building Community Resilience to Flooding Support national and regional agencies to build resilience to flooding within communities vulnerable to climate change and extreme weather events.	Community Development & Planning Service Directorate	✓		Fire Service, HSE, An Garda Síochana, Municipal Districts, OPW, LCDC, PPN, Voluntary Emergency Services	Short	Flood Emergency Response Plan, Donegal Local Economic & Community Plans, Framework for Major Emergency Management. A Guide to Community Resilience. A Guide to working with the Voluntary Emergency Services.

STEP 5: IMPLEMENTATION

STEP 1: PREPARING THE GROUND

STEP 2: BASELINE ASSESSMENT

STEP 3: FUTURE CLIMATE RISKS

STEP 4: GOALS, OBJECTIVES & ACTIONS

STEP 5: IMPLEMENTATION

IMPLEMENTATION, MONITORING & REPORTING

The preparation of this Climate Adaptation Strategy is the start of an iterative process that will deliver a wide range of actions and measures to adapt County Donegal to the impacts of climate change. The Strategy is the start of an in-depth, long-term process to ensure Donegal evolves to be a Climate Ready county.

Our adaption journey is a flexible process and subject to regular reviews in terms of the appropriateness of projects, policies and programmes, as well as climate projections.

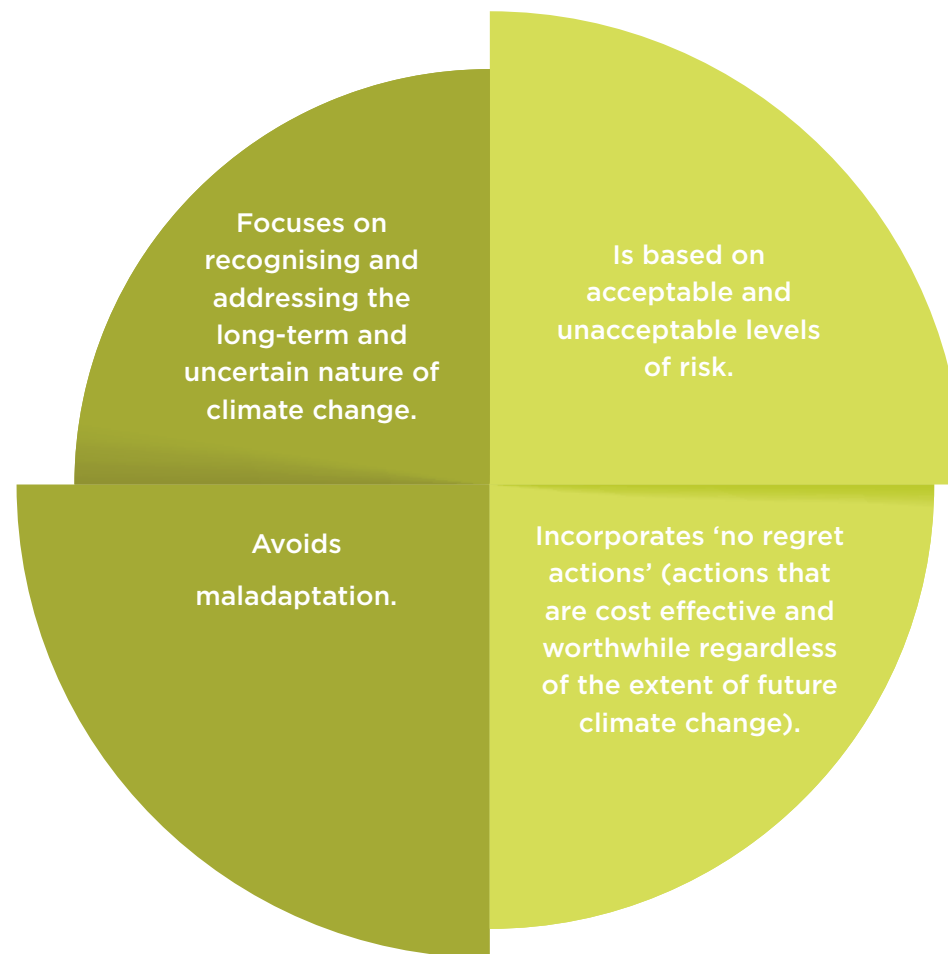
To ensure the integration of climate adaptation actions listed in this strategy, it is imperative that all strategic documents including the County Development Plan, Corporate Plan, Annual Service Delivery Plans, Operational Policies and Procedures be reviewed.

CORPORATE PLAN

Donegal County Council is a vibrant, progressive and responsive organisation working for the people of Donegal, whether at home or abroad, to develop sustainable, inclusive and prosperous communities.

The Plan presents a broad framework for action for Donegal County Council in terms of driving enterprise and growth, in supporting economic development & job creation and enabling the delivery of quality services and supports.

The Corporate Plan will be reviewed considering the Goals, Objectives and Actions of the Climate Adaptation Strategy and progress on implementation of the Strategy will form part of the Chief Executive's annual progress report to the Council.



CLIMATE ADAPTATION STEERING GROUP

To ensure that the Actions in the Strategy are delivered a dedicated Climate Adaptation Steering Group will be established to take forward the governance of adaptation in the county.

The Steering Group will be chaired by a Director of Services and be made up of the Head of each Department assigned with Adaptation Actions. The Climate Action Regional Office (CARO) will also be represented in the Group.

The Steering Group's role is to oversee the development and implementation of the Adaptation Actions. It will work with the CARO and encourage and facilitate partnership with other stakeholders to ensure efficient and effective delivery of the adaptation actions.

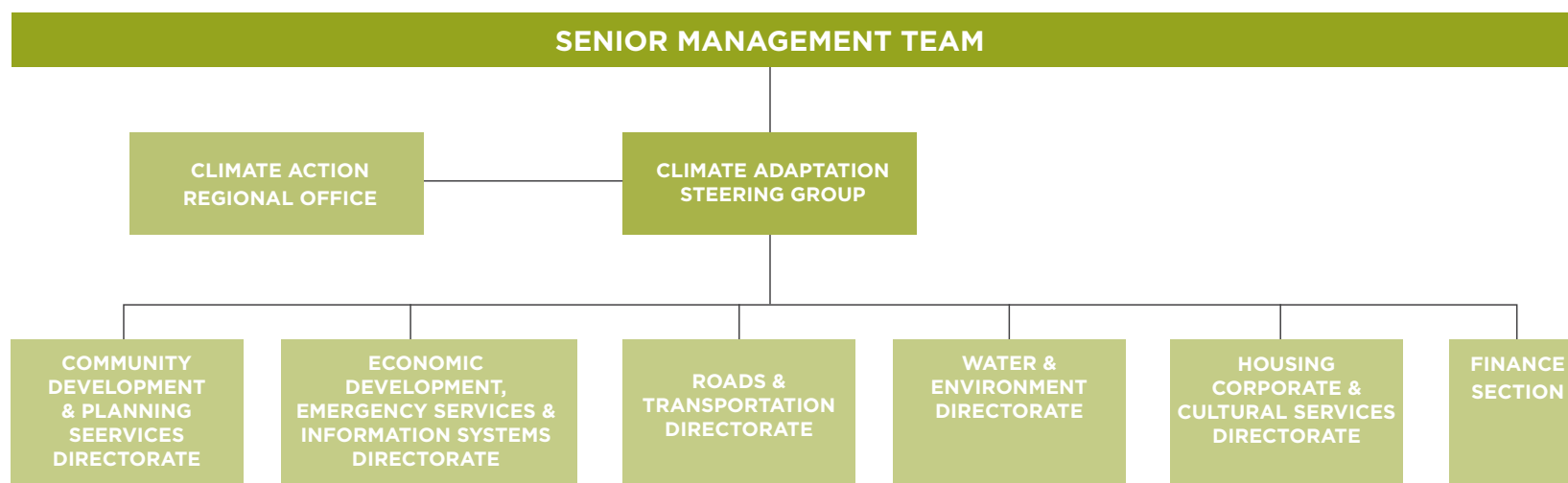
As well as providing a governance structure for adaptation in the county, the Steering Group will also ensure evidence is built up and kept updated on how the climate in Donegal is changing, and what the potential impacts of this will be. This will serve to aid mapping and identification of areas at risk, and to inform risk assessments, contingency planning and decision making.

It is also crucial that the Steering Group communicate and raise awareness of climate change and the effects this will have on the county. This will enable the sharing of best practice, help build partnerships and inform, engage and empower all sectors of the county. The Steering Group will meet quarterly and report on progress annually.

Action Implementation Plans

To assist in the delivery and progress around each of the Adaptation Actions listed in the Strategy, each action will require an 'Action Implementation Plan' to be prepared by the lead Department and submitted to the Climate Adaptation Steering Group for review.

The first Implementation Plan will be prepared within 3 months of adoption of the Strategy. Subsequent Plans will be prepared in July of each year to allow for associated budget submissions.



MONITORING

The Adaptation Strategy will be monitored to keep a record of progress made in implementing specific adaptation actions in relation to their objectives and inputs, including financial resources.

Monitoring will be undertaken with the help of indicators which may evolve over time as the adaptation process matures and is mainstreamed. Indicators will provide a basis for 'before' and 'after' analysis and describe the positive and negative, anticipated and unanticipated, intended and unintended effects of adaptation actions.

Adaptation indicators will

- Monitor the implementation of adaptation policies, measures and actions.
- Target, justify and monitor funding for adaptation programmes.
- Mainstream adaptation through links between sectors(e.g. infrastructure and the built environment) and related indicators (e.g. climate change impact indicators).
- Communicate adaptation to policy and decision-makers, and other stakeholders.
- Compare adaptation achievements across sectors, regions and countries.
- Inform and report climate change adaptation progress to central government.

Evaluation of the Adaptation Strategy will be a systematic and objective process to determine the effectiveness of adaptation actions. Given the complexity and long-term nature of climate change it is essential that adaptation is designed as a continuous and flexible process and subjected to periodic review, both in terms of the validity of the underlying scientific assumptions and the appropriateness of projects, policies and programmes. Lessons learned and good practices identified during the monitoring and evaluation of ongoing and completed projects, policies and programmes should inform future actions, creating an iterative and evolutionary adaptation process.



REPORTING

As part of the Implementation Plans each lead Department will prepare an annual Progress Report for their assigned Actions. These will inform an Annual Progress Report on the Climate Adaptation Strategy itself, with reviews on good practices identified during the implementation of actions plans, policies and programmes.

The review of the Adaptation Strategy will be a systematic and objective process to determine the effectiveness of the adaptation actions with items such as appropriateness of allocated timeframes, financial, social and environmental effects of actions.

In general, the following measures will provide insight into the progress of the Climate Adaptation Strategy:

- The development of Action Implementation Plans and indicators for the Climate Adaptation Strategy to show active progress.
- The extent to which climate change considerations are increasingly incorporated into high level policies, plans and practical programmes in priority impact areas.
- Growing evidence that implemented adaptation strategies are increasing resilience to extreme weather events.
- Growing evidence of engagement between the Council and its partners, communities, non-governmental organisations and other levels of government on addressing climate change issues.
- Level of technical capacity increases across the county to assess and respond to the risks of climate change.
- Level of public, staff and stakeholder awareness about climate change and its impacts increases as well as support for actions to protect against climate change



The annual reports will be submitted to the Climate Action Regional Office to support the integration of actions and increase resilience to climate change across local governance, economic and community sectors.

COMMUNICATING

Stakeholder participation is stipulated under the National Adaptation Framework, principally to;

- Promote the integration of a range of knowledge and values in adaptation.
- Build support for the adaptation process through embedding it in local interests and concerns.
- Ensure that adaptation processes at the local scale are aligned with similar processes that are under way in neighbouring authorities and relevant sectors.

The Action Implementation Plans will therefore include a structured and substantive programme for the engagement of stakeholders from the elected members, within the local authority, the local community, relevant non-governmental organisations and state sector bodies, and particularly those who will be expected to play a role in the implementation of Actions of the Adaptation Strategy.

It will also be important that completed local adaptation strategies align with sectoral plans being completed under the NAF. For the purposes of the NAF, 12 key 'sectors' under the remit of seven Government Ministers have been identified which must prepare adaptation plans of their own. These adaptation processes will carry several critical implications for adaptation planning at local authority level (and vice versa). To ensure that any necessary sectoral input is obtained as efficiently as possible coordination between sectoral and local scale adaptation efforts will be facilitated via each CARO.



MITIGATION

Some level of adaptation will be required to reduce the effects of a changing climate already 'locked in' by past and current emissions and this strategy focuses on the adaptation actions which will be implemented by Donegal County Council. We recognise that to build climate resilience and reduce global warming both Adaptation and Mitigation measures are required.

Climate change mitigation and adaptation are not mutually exclusive but are key partners in any strategy to respond to climate change. Mitigation is required to reduce climate risks in the 21st century and beyond, increase prospects for effective adaptation, reduce the costs and challenges of mitigation in the longer term and contribute to climate-resilient pathways for sustainable development.

Sir David Attenborough speaking from the "People's Chair at COP24 said:

"Right now, we are facing a man-made disaster of global scale. Our greatest threat in thousands of years. Climate change. If we don't take action, the collapse of our civilizations and the extinction of much of the natural world is on the horizon."

The UN Intergovernmental Panel on Climate Change (IPCC) '1.5-degree report' shows it's not too late to reduce the worst effects of global warming – and confirms prompt actions now will minimise the economic costs.



Mitigation actions also bring a host of co-benefits that are desirable, even without the decarbonisation imperative. Broadly speaking, mitigation should improve energy efficiency and security, stimulate innovation and the creation of new industries and markets. Other positive impacts include improvement in human health because of less air pollution and increased activity. Whilst climate change is the biggest global health threat of the 21st Century, action to combat it is likely to be the greatest global health opportunity of the 21st Century.

MITIGATION

National Targets for Reduction in GHG Emissions

The EU's Effort Sharing Decision (Decision No 406/2009/EC) sets targets for the non-Emissions Trading Scheme sector for EU Members States including Ireland for 2020.

Ireland is required to deliver a 20% reduction in non-ETS greenhouse gas emissions by 2020 (relative to 2005 levels). The non-ETS sectors cover those that are outside the EU Emissions Trading Scheme and includes Agriculture, Transport, Residential, Commercial, Waste and non-Energy Intensive Industry.

Ireland's National Policy position is to reduce CO2 emissions in 2050 by 80% on 1990 levels across the Energy generation, Built environment and Transport sectors, with a climate neutrality goal in the agriculture and land-use sector.

Ireland's greenhouse gas emissions increased by 3.6% or 2.1 million tonnes of carbon dioxide equivalent, from 59.4 million tonnes of carbon dioxide equivalent in 2015 to 61.5 million tonnes of carbon dioxide equivalent in 2016.

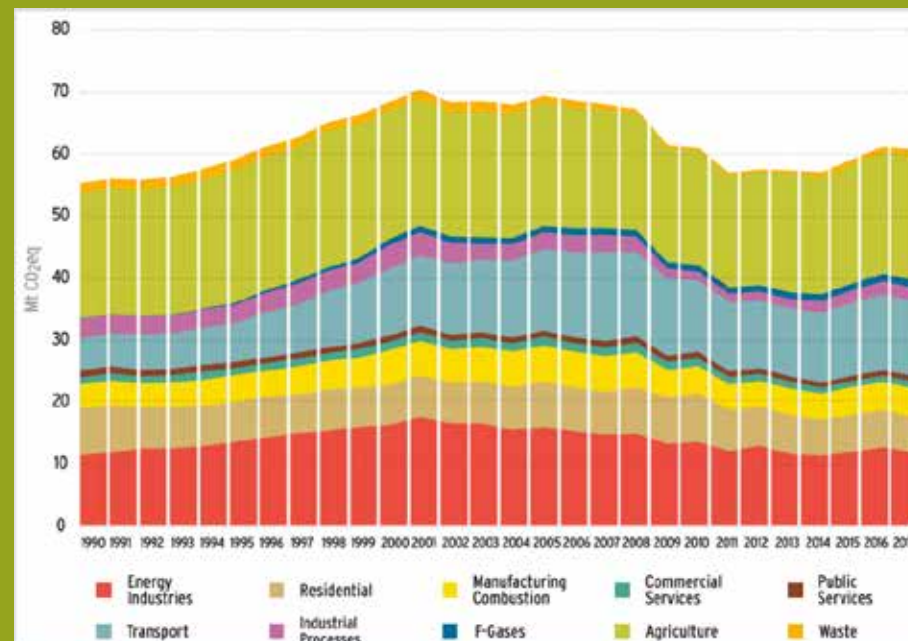
National Picture

Irish greenhouse gas emissions are rising rather than falling. Instead of achieving the required reduction of 1 million tonnes per year in carbon dioxide emissions, consistent with the National Policy Position, Ireland is currently increasing emissions at a rate of 2 million tonnes per year.

The EPA report on 'Ireland's Provisional Greenhouse Gas Emissions 1990-2017' shows that emissions for Transport, Energy Industries and Residential sectors decreased, however, emissions in the Agriculture, Commercial and Public Services sectors are heading in the wrong direction.

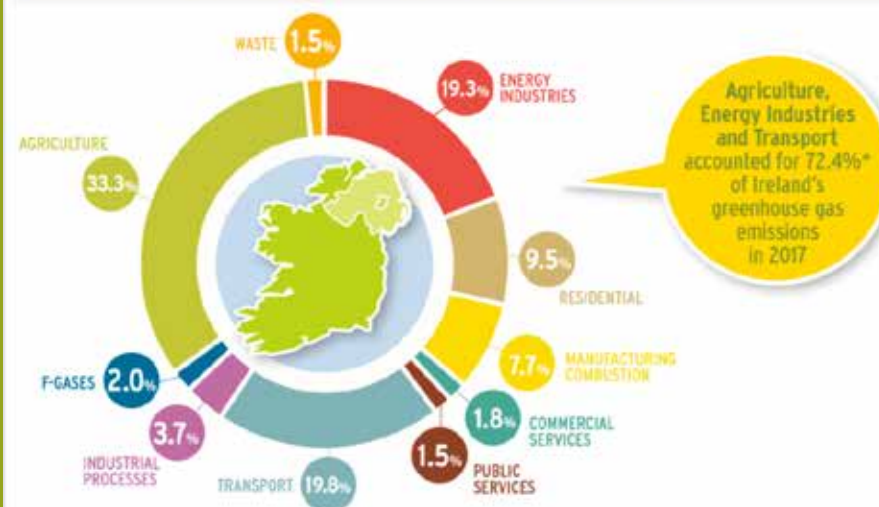
Projected emissions in the 'With Additional Measures' scenario indicate that Ireland remains off-target to achieving a 20% reduction on 2005 levels by 2020.

Greenhouse gas emissions from the Residential sector decreased in 2017 by 5.0% or 0.30 Mt CO2eq due to a milder winter



EPA: Ireland's Provisional Greenhouse Gas Emissions, 1990-2017

SOURCES OF GREENHOUSE GASES



MITIGATION

Mitigation in Donegal County Council

When a national target of improving our energy efficiency by 20% by 2020 was set in 2009, the public sector was given an even higher target of 33%. At the end of 2015, the sector was using 21% less energy than it had in 2009, resulting in avoided costs of €619m and emissions savings of 548,000 tonnes over that period.

Donegal County Council has achieved Energy Efficiency improvements of 21.1% by the end of 2018.

We are involved in a number of actions and projects that will increase efficiency and reduce greenhouse gas emissions such as the Public Lighting Plan, participating in SEAI Better Energy Community programmes, the development of greenways, switching to renewable energy supplies and increasing energy efficiency via ISO50001 certification for energy management.

ISO50001 Accreditation

Donegal County Council successfully obtained ISO50001 accreditation for its Energy Management System in October 2016. This has allowed the Council to realise energy savings in a number of its Significant Energy Users in the last few years. Examples of these over the period 2016 to 2018 include:

- a reduction in electricity consumption in our 3 main Cultural Services Buildings of almost 8%;
- a reduction of 15.5 % in electricity consumption in our main office accommodation at County House and the 5 Public Services Centres;
- a reduction in the average thermal energy consumption from 595kWh/HDD (Heating Degree Day) to 530 kWh/HDD
- the retrofitting of in excess of 4100 Public Lights to LED to date





‘North West Greenway Network Project’

In December 2016 Derry and Strabane District Council, Donegal County Council, the Department for Infrastructure (NI) and Sustrans were awarded €14.8 million funding from the EU’s INTERREG VA programme, to construct 46.5kms of cross-border greenway. Match-funding has been provided by the Department for Infrastructure in Northern Ireland and the Department of Transport, Tourism and Sport in Ireland. These routes link Derry to Buncrana via Bridgend; Muff to Derry via Culmore; and Lifford to Strabane. Once completed, this will result in a greenway network of approximately 126.5km in the North West, of which 76.5km will be classified as high quality greenway.

Project Vision and Objectives

‘To develop a cross border network of greenways that link people with places locally, regionally and nationally – bringing social, economic and environmental well-being to all’

- To construct 46.5kms of greenway and cycling/walking routes
- Encourage a minimum of 500 people to cycle or walk to school, work or college by 2022
- Reduce carbon dioxide emissions entering our atmosphere by over 300 carbon tonnes per annum by 2023
- Encourage more people to walk and cycle as part of their daily routine
- Invest in the wider economic and social infrastructure in the North West Region

APPENDICES

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DONEGAL COUNTY COUNCIL
Climate Adaptation Strategy
September 2019