

**Limerick City and County
Council**

**Climate Change Adaptation
Strategy 2019-2024**

PRELIMINARY DRAFT



Comhairle Cathrach
& Contae **Luimnigh**

Limerick City
& County Council

**Limerick City and County
Council
Physical Development
Directorate (Version 1.6 -
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CHAPTER 1

Introduction

1.0 Climate Change in Ireland

A recent report commissioned by Environmental Protection Agency finds that evidence of climate change in Ireland is "clearer and more compelling" than had been the case previously with rising temperatures, increased rainfall and continuing rises in sea level recorded.

The lead author Dr Margaret Desmond of the report - *A Summary of the State of Knowledge on Climate Change Impacts for Ireland*, - says projections indicated that changes would continue, but that there was "uncertainty" as to how they would affect Ireland.

"The evidence that Ireland is being impacted by global climate change is now clearer and more compelling and the projections of future climate change across all scenarios suggest that changes will continue, but uncertainties on details of these for countries such as Ireland remain large. Uncertainties also exist with respect to the effectiveness of global actions to address climate change."

Some key findings of the report include:

- Average temperatures have increased by 0.8C since 1900
- and are expected to rise by between 1C to 1.6C by mid-century. The highest increases will be in the east. All seasons are warmer than the 1961-1990 average and are expected to be "significantly warmer" by 2050. Table 1.1 shows that the ten warmest years have occurred in the last twenty years.
- Average annual rainfall rose 5% - or 60mm - between 1981 and 2010, with the highest increases in the west. Drier summer conditions are likely.
- The number of storms will increase and they will be more intense. Winter flooding has increased between 1954-2008. Between 350-600sq km of coastal areas and floodplains are also vulnerable to sea flooding;
- Sea level continues to rise, up 3.5cm per decade since the early 1990s compared with 1-2cm per decade before 1990. Increases of up to 60cm are forecast, which will amplify storm surges and wave erosion on coastlines.

This is one of many reports that outline more winter rain, higher temperatures and more frequent, turbulent storms. In the context of Limerick, this has resulted in increased storm events, higher risk of flooding and last year (2018) a prolonged drought. This resulted in disruptions to water supply and over the last five years flood events which have affect both City and County. These will be considered in more detail in Chapter 3, where examples of weather and climate events will be examined with a view to assessing future climate risk and responses in County Limerick.

Rank	Year	Anomaly °C
1	2016	0.94
2	2015	0.90
3	2017	0.84
4	2014	0.74
5	2010	0.70
6	2013	0.66
7	2005	0.65
8	2009	0.64
9	1998	0.63
10	2012	0.62

Table 1.1 Top Ten Warmest Years (1880-2017)

Source: National Ocean and Atmospheric Administration (2018)

1.2 The Adaptation Strategy

This is a climate adaptation strategy. This means that it concentrates on dealing with the **effects** of climate change such as flooding, storms or increased temperatures. Mitigation on the other hand deals with the **causes** of climate change. This might include measures to reduce emissions of greenhouse gases.

This Climate Change Adaptation Strategy is the first of its type for Limerick City and County and is a high-level document designed to mainstream the issue of climate change in local authority plans, policies and operations.

Adaptation and Mitigation are opposite sides of the same coin and LCCC has begun the process of implementing mitigation actions. Section 4.4 has details of mitigation actions.

1.3 Policy Background to the Strategy

1.3.1 At EU level, a white paper on adapting to climate change was published in 2009. Following this, an EU Climate Adaptation Strategy was published in April 2013. It has three main objectives:

- **Promoting action by Member States** - the Commission has been encouraging all Member States to adopt comprehensive adaptation strategies, and provides funding to support member states build up their adaptation capacities and take action.
- **'Climate-proofing' action at EU level** – the Commission has promoted the integration of climate adaptation into EU policies - in key vulnerable sectors such as agriculture, fisheries and its cohesion policy - to help to ensure that Europe's infrastructure is made more resilient. Economic and social cohesion – as defined in the 1986 Single European Act – is about 'reducing disparities between the various regions'. In the case of climate adaptation it means the integration of climate adaptation into all EU activities.
- **Better-informed decision-making** – the Commission is attempting to address gaps in knowledge about adaptation and has developed a European climate adaptation platform (Climate-ADAPT) as a 'one-stop shop' for adaptation information in Europe.

1.3.2 At national level, the National Policy Position on Climate Action and Low Carbon

Development (2014) sets out the national objective of achieving a transition to a low carbon economy. This was given legislative effect by the Climate Action and Low Carbon Act 2015. The Act provided for the development of a National Adaptation Framework (NAF), which was published in December 2017. The NAF requires sectoral and local adaptation strategies.

1.3.3 The NAF identifies 12 key sectors in seven Government departments, where Adaptation Strategies have to be prepared. Table 1.2 below indicates the different sectors.

Sector	Parent Department
Seafood	Department of Agriculture, Food and the Marine
Agriculture	Department of Agriculture, Food and the Marine
Forestry	Department of Agriculture, Food and the Marine
Biodiversity	Department of Culture, Heritage and the Gaeltacht
Built and Archaeological Heritage	Department of Culture, Heritage and the Gaeltacht
Transport Infrastructure	Department of Transport, Tourism and Sport
Electricity and Gas Networks	Department of Communications, Climate Action and Environment
Communications networks	Department of Communications, Climate Action and Environment
Flood Risk Management	Office of Public Works
Water Quality	Department of Housing, Planning and Local Government
Water Services Infrastructure	Department of Housing, Planning and Local Government
Health	Department of Health

Table 1.2: Sectoral Adaptation Strategies – Sectors and Parent Departments.

Source: DCCAE December 2018, p. 8.

1.3.4 Each local authority is required to develop a Climate Adaptation Strategy for the period 2019-2024. This strategy is the response of Limerick City and County Council to the requirement.

Local strategies will “be used to inform development plans and other statutory plans and policies of the Local Authority.” (Department of Communications, Climate Action and Environment 2018, p.7)

The statutory deadline for the submission of all local and sectoral adaptation strategies to Government is 30th September, 2019.

1.4 Methodology:

The structure and content of this Adaptation Strategy follows closely the recommendations contained in the Local Authority Adaptation Strategy Development Guidelines (DCCAE, 2018) in particular Table 1.2 on page 16 of that document.

The first step of the process was to establish an in-house cross-Directorate Adaptation Team. This Team comprised of representatives of differing sections of the Local Authority, provided background information on aspects such as housing, roads, emergency services and essential infrastructure within the city and county. They also contributed information on climate events as they affected their respective areas of responsibility. This was then used in developing the baseline assessment (see Chapter 3) which provides an overview of climate hazards as they apply to Limerick. The advice and contribution of this team was crucial in helping to prepare the draft Adaptation Strategy. This fed into the identification of specific risks as they relate to the operational areas of the Local Authority.

Following on from this the consequences and risks of such events were assessed, in terms of service responses and disruptions. An important step in the preparation of the Adaptation Strategy then followed with the identification, assessment and prioritisation of Adaptation Actions.

The final step in the preparation of the draft Adaptation Strategy is the Implementation, Monitoring and Evaluation Chapter, which describes measures put in place to implement the Adaptation Strategy and to monitor the results of its actions.

It should be noted that this draft has been prepared concurrently with the preparation of adaptation strategies of the other sectors (See Table 1.2 above). It is likely that some contents of some or all of the sectoral strategies may affect the content of future drafts of this document. The Council will have regard to the actions contained in the sectoral strategies and will work with the other agencies in implementing relevant adaptation actions that fall within the remit of the Local Authority.

CHAPTER 2

Regional and Local Context

2.1 Regional Context:

For the purposes of preparing the Climate Change Adaptation Strategies, the country has been divided into four regions. Limerick lies within the Atlantic Seaboard South Region. This is based on regions which face similar risks from climate change and includes the Local Authority areas of Cork County, Cork City, Kerry and Clare. All of these Councils face similar risks from sea level rise, coastal flooding, storms, ground water flooding and rural pluvial flooding.

A Climate Action Regional Office (CARO) supports each region and in each region, one local authority has the role of lead authority. In the case of the Atlantic Seaboard South region, Cork County Council fulfils this role. The function of the CARO is to assist and coordinate the preparation of county level adaptation strategies. The support of the CARO in the preparation of this Strategy is gratefully acknowledged.

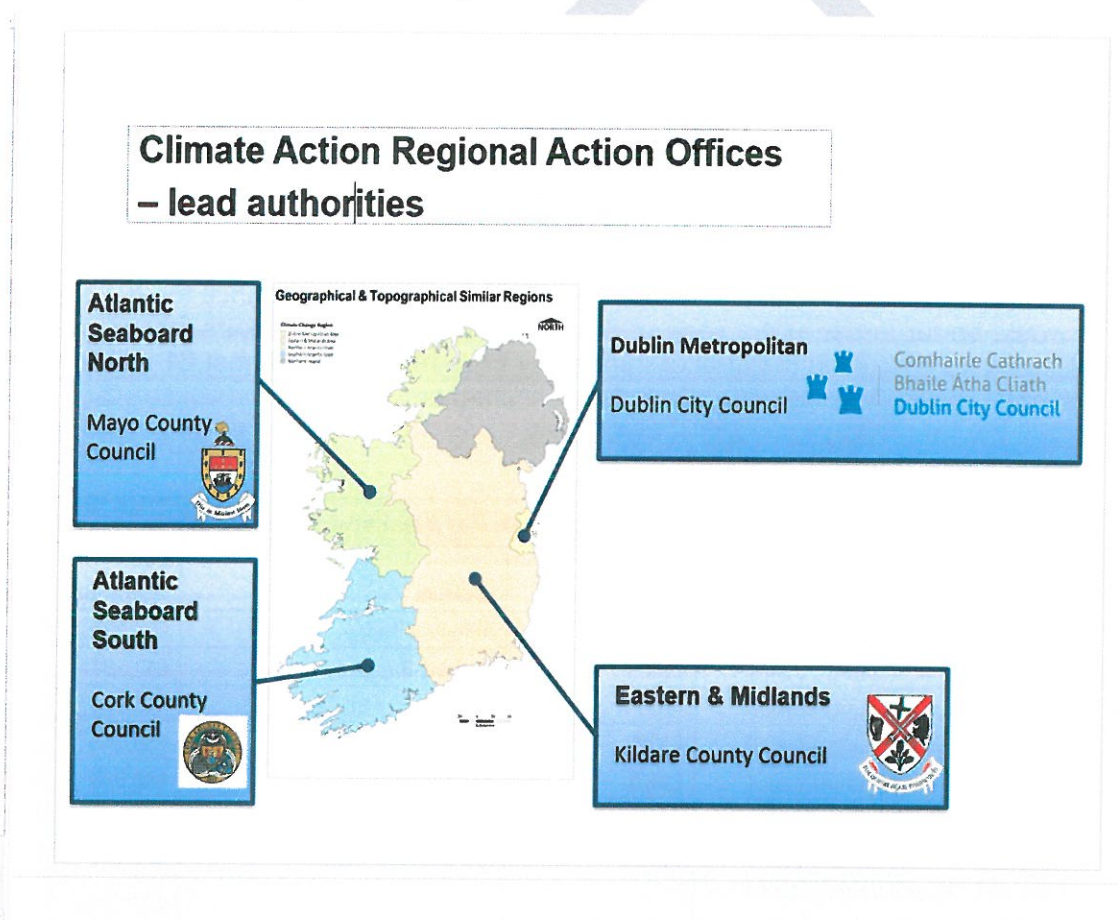


Figure 1: Showing the Climate Action Regional Offices and the differing climate planning regions.

2.2 Limerick Context:

Limerick City and County Council serves a population of 194,899, based on Census 2016 figures (Census 2016), and has a geographical area of 2,790 sq.km. Limerick City is the largest urban area in the Midwest and serves as the economic driver of the region. The Limerick County Development Plan 2010-2016 (as extended) identifies 80 other settlements including towns and

villages in the county. The Limerick City Development Plan 2010-2016 (as extended) is the current planning policy document covering Limerick City.

The River Shannon and its estuary forms the northern boundary of the County. The estuary extends from Limerick towards the sea and is almost 100km in length (Shannon Integrated Framework Plan sifp.ie, accessed 27th November 2018) Limerick is mainly drained by the catchments of the Rivers Shannon, Maigue and Feale. The two latter rivers flow northwards and drain into the Shannon estuary. The ESB operates the country's largest hydro-power scheme on the River Shannon at Ardnacrusha in Clare, a short distance upstream of Limerick City (ESB 2017).

Limerick City and County Council manages approximately 5,200 public housing units (LCCC 2018). The Council owns a range of municipal buildings, whose functions encompass the full range of local government activity and vary from Area Offices and Libraries to Civic Amenity Sites to those offering leisure facilities.

The National Road network, which is managed by Transport Infrastructure Ireland (TII), has a total length of 5,306km, of which 192.5km are in the Council's administrative area (TII, 2018). Limerick City and County Council has responsibility for the regional and local roads in its administrative area. Some of these are designated as strategic regional roads, as they also play an important part in the transport infrastructure of the county.

Bridges are an important part of the transport infrastructure and in 2014, it was estimated that up to 250 bridges would need repairs and improvements (LCCC). Some of this damage has been caused by flood events and increased flows where scouring had undermined bridge supports and caused damage to bridge structures. Indeed bridges were badly damaged on the Limerick/Tipperary border in 2014 due to high rainfall and resulting increased flows. It is likely that this will become a bigger issue because of increased rainfall following from climate change.

Tables 2.1 and 2.2 below show the normal allocation for bridge maintenance for 2018 and 2019, but this would be far larger in the case of damage and emergency repairs following a climate event. Repairs to bridges in the east of the county in 2014 came to almost €1 million following a flood event. This is considered in more detail in Chapter 4.

2018 Bridge Rehabilitation Works on Regional and Local Roads			
Local Authority	Road Number	Location	LA Allocation
Limerick City and County Council	L1131	Abington Bridge	€92,483
Limerick City and County Council	L1303	Ardrine Bridge	€42,584
Limerick City and County Council	R523	Athea Upper Bridge	€48,070
Limerick City and County Council	R512	Ballycampion Bridge	€59,043
Limerick City and County Council	L1401	Thorpe's Bridge	€48,593
Limerick City and County Council	R513	Newtown Bridge	€63,223
Limerick City and County Council	L6150	Ballingarry Bridge	€73,150
Limerick City and County Council Total			€427,144

Table 2.1 Funding allocations for bridges 2018.

Source: DTTAS 2018.

2019 Bridge Rehabilitation Works on Regional and Local Roads			
Local Authority	Road Number	Location	LA Allocation
Limerick City and County Council	L1131	Abbington Bridge	€45,000
Limerick City and County Council	L6150	Ballingarry	€85,000
Limerick City and County Council	R521	Shanagolden Village Culvert	€30,000
Limerick City and County Council	L1222	Ballylin	€35,000
Limerick City and County Council	R525	Derrylusk Bridge	€30,000
Limerick City and County Council	R857	Thomond Bridge, Limerick City	€102,000
Limerick City and County Council	L8504	Ballyhaukish Bridge	€10,000
Limerick City and County Council	LP1122	Annagh Bridge	€20,000
Limerick City and County Council	R516	Tullovin Bridge	€35,000
Limerick City and County Council	L1324	Meenheala Bridge, Abbeyfeale	€25,000
Limerick City and County Council	R463 & R857	Matthew Bridge , Sarsfield Bridge , Athlunkard Bridge	€10,000
Limerick City and County Council Total			€427,000

Table 2.2 Funding allocations for bridges 2019.

Source: DTTAS 2019.

CHAPTER 3

Adaptation Baseline Assessment (Climate Hazards) and Climate Risk Identification

3.0 Introduction:

In order to understand the issues posed by future climate hazards we must first consider past extreme weather events. Consideration includes the type of weather event, its severity and the resultant service disruption. The range of weather events should also be considered particularly in view of the climate region within which Limerick is located and the climate risks which our region faces (See Section 2.1 above). The type of weather events will form the basis for adaptation actions that are set out in Table 4.2 later in this document. It is not possible to record all weather events but a sufficient number have been documented in the section that follows to show the range of climate events that we have faced and may potentially face. These will inform appropriate adaptation measures. It should be noted, that new risks arising from compound events such as combined wind, tidal and fluvial events might also add to future risks.

A review of extreme weather events in the strategy area over the period 1945 to 2018 has been undertaken using published Met Éireann data. This is not a complete listing but is intended to give an idea of the type of extreme weather events with which Limerick City and County Council has dealt with in the past and may have to deal with in future years. They are listed in Table 3.1 below.

Extreme Weather Event	Date of Occurrence	Location
Coastal flooding	January-February 2014 October 2017 and January 2018 November 2004, February 2014, February 2015, December 2015	Foynes Askeaton Limerick City
Coastal storm	January 1945 February 2015 October 2017	Limerick City, Foynes and Estuary area generally
Extreme heat	Summer 1976: prolonged drought Summer 1995: warmest weather since 1955 Summer 2006: warmest weather since 1995 Summer 2018: warmest for 42 years, prolonged drought	County-wide
Extreme rainfall	August 2008	Newcastle West

	December 2015 March 2018	Limerick City Limerick City
Fluvial (River) flooding	November 2009 July 2014 March 2018	Castleconnell Doon Limerick
Freezing conditions	January-March 1947 January 1963 January-February 2009 November 2010	County-wide.
Groundwater flooding.	January 2018	Portnard, Cappamore
Heavy Snowfall	January 1982	County-wide
Pluvial (Rainfall) flooding	August 2008 June 2018	Newcastle West Bruff
Storm force winds/ windstorms	January 1945 137km/hour winds August 1986 Hurricane Charley February 1988 Storm force winds October 2017: Hurricane Ophelia February 2015 Storm Darwin	County-wide

Table 3.1 Extreme Weather Events in Limerick 1945-2018

Source: Met Éireann


The main category of extreme weather events reported has been flooding (coastal, fluvial and pluvial events), with fluvial being the most common. This is followed by windstorms and coastal storms. The effects of tides have often exacerbated the effects of coastal flooding events. This leads to what is referred to as compound events (DCCA 2018, p. 23), where there is a combination of climate events. Another example of this occurred Newcastle West in 2008, where a severe pluvial (rainfall) event led to both pluvial and fluvial flooding.

3.1 Identifying Climate Risk:


In identifying climate risk, it is important to realise that risk is based on projections and therefore requires regular updating. The main climate related risks are outlined below and the following is an account of possible effects on “key operational areas of the Local Authority” (DCCA, 2018, p. 16). In terms of assessing how such events affect operational areas of the Council, some examples are included.


3.2 Climate Variables and Climate Risk:

Based on available sources, observed and projected changes in seven climate variables have been investigated. They are summarised below, with future climate risks identified:


	3.2.1 Hydrology
Observed	<p>The analysis of river flows is complex and subject to large variability and as a result, it is difficult to identify impacts of climate change. For Ireland during the period 1954 to 2008, summer mean flows were dominated by decreasing trends, while for winter there is a tendency for increases in mean flows. This is associated with rainfall events and aspects of future rainfall patterns such as drier summers could have effects on summer base-flows of rivers in Limerick and recharge of aquifers. This has implications for the provision of drinking water and this was an issue in the south east of the county in 2018. Following the summer drought, full supplies were only restored in January 2019.</p>
Projected	<p>Changes in temperature and precipitation will affect hydrological response. Due to the uncertainties associated with projected changes in precipitation, projected changes in hydrological response remain subject to a high level of uncertainty. The response of individual catchments will be determined by individual catchment characteristics (e.g. groundwater versus surface water dominated catchments and land uses within the catchments). For example, summer reductions for groundwater-dominated catchments are not as severe as those projected for surface water dominated catchments (Gray, 2016). Using runoff impact models, an indication of increasing seasonality in hydrological regimes is evident with increases in winter and spring stream flow likely and a decrease in summer flow. A 20% increase in the amount of water flowing during winters through rivers is expected for the majority of catchments by mid-late century, while for summer periods, decreases of over 40% (those with little groundwater storage in particular) have been simulated for the end of the century (Murphy and Charlton 2007, Steele-Dunne et al 2014). Projected increases in winter flows, coupled with likely increases in extreme precipitation events, are likely to lead to an increased flood risk. However, catchment response time will be important in determining the changing nature of extremes, and catchments with fast response times are likely to be most at risk. In a Limerick context, rivers such as the Allaughan is regarded as a catchment with a fast response time. The Shannon is slower in response, but would have greater effects due to its size and the fact that it flows through or near larger population centres such as Limerick City and its environs.</p>
Summary of Change	<p>Increasing seasonality in hydrological regimes is expected with decreased summer and increased winter flows likely.</p> <p>Flood risk will increase due to a combination of higher river flows and increases in extreme precipitation events.</p> <p>What has been referred to as “compound events” are likely to play a greater role. One example of this is high tides coupled with fluvial and pluvial events especially in the lower reaches of the Shannon estuary. This would have specific effects in settlements such as Askeaton and Limerick City.</p>
Climate Risks Identified	<p>Groundwater flooding, which is the emergence of groundwater at the surface away from river channels and watercourses, under conditions where the 'normal' ranges of groundwater level and flow are exceeded. As stated elsewhere, this is likely to be exacerbated in areas along the estuary where ground water is subject to tidal influence. This is an issue in areas such as Adare. It has also occurred in other areas of the county such as Cappamore in 2018. This is likely to become an increasing phenomenon especially in areas where water tables are close to the surface.</p> <p>Pluvial, or surface-water flooding, which results from rainfall-generated overland flow,</p>


	<p>which may occur during or immediately after intense rainfall events and before the runoff enters a watercourse or drainage system.</p> <p>Fluvial or river flooding, which occurs when excessive rainfall causes a river to exceed its capacity. This has happened in Newcastle West with the River Arra in 2008 and with the River Mulkear in Annacotty and the River Shannon in Castleconnell in 2009.</p>
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	3.2.2 Rainfall.
Observed	Throughout Ireland, annual average rainfall amounts have increased, by roughly 5 %, relative to the 1961-1990 baseline period with this increase observed across all seasons. However, spatially, rainfall intensity and amounts vary with no clear direction of change yet apparent. Severe rainfall events have had significant local effects such as occurred during the Newcastle West flooding of August 2008.
Projected	Precipitation projections are less certain than those for temperature are, and when examined on an individual basis, climate models indicate differing temporal and spatial patterns. This is part of the reason for the different CARO regions that are shown in Figure 1. The projections do indicate increased seasonality, with wetter winters and drier summers likely (McGrath et al 2005, Sweeney et al 2003, Nolan et al 2013, Nolan 2015). For spatial variations, there is a level of disagreement between individual climate models, and as a result, spatial details are not deemed reliable (Nolan 2015). As global temperatures increase, the hydrological cycle is expected to become more intense and will result in more extreme precipitation events. For Ireland, projected changes in the frequency of very wet days (>20mm of precipitation) indicate a marked increase for winter of approximately 20%.
Summary of Change	Increasing seasonality in precipitation can be expected with drier summers likely. An increase in the occurrence and magnitude of extreme rainfall events is also likely.
Climate risks Identified	Groundwater flooding Pluvial flooding Fluvial flooding

	3.2.3 Sea Level Rise.
Observed	Observations indicate that sea level around Ireland has risen by approximately 3.5cm a decade since the early 1990s, which means an increase of up to 70cm between 1990 and 2015.
Projected	The trend is likely to accelerate over the coming years with projected increases of 55-60cm by the end of the century. With 40% of the population living within 5km of the coast, Ireland is particularly vulnerable. In a Limerick context, this will have implications for the city and settlements like Askeaton and Foynes. Increased storm surges and higher tides will also have to be considered.
Summary of Change	Sea levels are expected to increase for all Irish coastal areas. Nationally the overall trend is towards rising sea levels; however, there will be regional variations. (Marine Institute 2009).

Climate Risks Identified	<p>Coastal flooding, which occurs when normally dry, low-lying land is flooded by seawater.</p> <p>Coastal erosion, which is the process of wearing away material from the coastline due to imbalance in the supply and export of material from a certain section. It takes place in the form of scouring at the foot of cliffs or sand dunes and results in coastline retreat. The “predicted changes in North Atlantic storminess as part of climate warming are likely to cause Ireland’s coastal wetlands and other soft-sedimentary systems to be among the first in Europe to respond to storm-led sea level rise” (Devoy 2008). The Shannon estuary with its mudflats would be vulnerable in this regard. Coastal infrastructure has been affected; repairs have to be made to the sea defence wall along the N69 route in 2016.</p>
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	3.2.4 Sea Temperature
Observed	<p>Records “of sea surface temperature from around Ireland show a mean warming trend below the global average between 1850 and 2008 of 0.3°C. However, the speed at which warming has occurred since 1994 (0.6°C per decade) is unprecedented in all of the 150 year observational period, with the warmest years on record being 2005, 2006 and 2007. Approximately half of the present increase in Irish sea surface temperatures can be accounted for by the present warm phase of the Atlantic Multi-decadal Oscillation, with the North Atlantic Oscillation and East Atlantic Pattern playing smaller roles. However, the remaining increase has been attributed to an underlying global warming trend” (Marine Institute 2009). This warming is evident in Irish waters throughout the year and is particularly strong in the southeast of Ireland.</p>
Projected	<p>In line with global changes, the seas around Ireland are projected to continue warming over the coming decades. This is in line with the natural cycle but is expected to show a greater increase than has been the case, However, due to a limited number of climate model projections, projected changes remain uncertain. The Marine Institute (2009) does indicate a “mean warming trend”.</p>
Summary of Change	<p>In line with global trends, the seas around Ireland are expected to continue warming.</p>
Climate Risks Identified	<p>Coastal flooding e.g. Foynes</p> <p>Coastal erosion e.g. vulnerability of coastal infrastructure e.g. N69 route national road</p> <p>Effects on marine bio-diversity</p>

	3.2.5 Surface Air Temperature
Observed	<p>Observations indicate an increase in the surface temperature for Ireland of 0.8°C since 1900. In addition, the number of warm days has increased while the number of frost days has decreased. A heat wave was a feature of the summer of 2018. This is defined as when the daily maximum temperature of more than five consecutive days exceeds the average maximum by 5°C.</p>
Projected	<p>Mean air temperatures are expected to increase everywhere and for all seasons relative to the present. With increasing air temperatures, an increase in the intensity</p>

	and duration of heat waves is expected, with a coincident decrease in the occurrence of frost days likely (McGrath et al 2005). It is considered that the summer and autumn season will experience the greatest seasonal increases. One source (Dunne et al 2009, p.v.) anticipate likely increases of between 3- 4 degrees Celsius. See Figure 3.1 below.
Summary of Change	Surface air temperatures are expected to increase everywhere compared to the present An increase in the intensity and duration of heat waves is expected
Climate Risk Identified	Heat waves. These may lead to severe drought and violent thunderstorms that impact upon human health, physical infrastructure, and river water levels, and may cause forest fires. Freezing conditions: fewer frost days and milder nighttime temperatures are expected. One benefit might be a longer growing season, which might suit agricultural production.

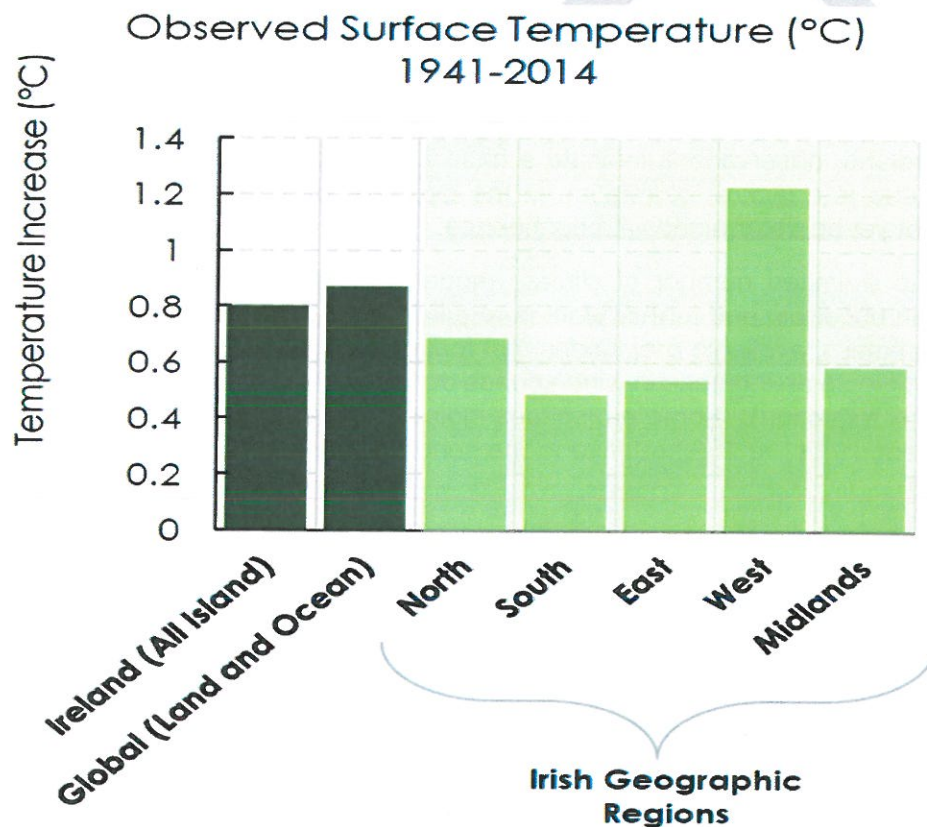




Figure 3.1: Temperature increase over the period 1941 to 2014. For the south it is 0.5 degrees Celsius. Source: O Dwyer B and Alexander P (2016) Essential Climate Information Ireland.

	3.2.6 Waves and Surges
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Observed	Analysis of satellite data for the period 1988 to 2002 shows a general increase in wave height in the northeast Atlantic.
Projected	Projections indicate an increase in the occurrence of coastal storms and surges in spring and winter for all areas of the Irish coast with the exception of the southwest. Modelling results indicate an increase in the frequency of storm surge events, with increases in surge heights between 50 and 100cm in the northwest (Marine Institute 2009). It is likely that "extreme wave heights" will increase in all regions (Dunne et al 2009).
Summary of Change	The magnitude and intensity of storm wave heights are expected to increase for spring and winter.
Climate Risks Identified	Coastal flooding Coastal erosion Effects on marine bio-diversity

	3.2.7 Wind Speed and Storms
Observed	For Ireland, observations indicate a high degree of yearly variability in wind speeds and, due to a lack of correlation in the available data, analysis of long term trends cannot yet be determined with confidence.
Projected	Due to a limited number of climate model projections for wind speed, predictions remain uncertain and further work is required to increase confidence in their outputs. Nonetheless, available projections that focus on wind speeds at a reference height of 60m indicate an increase in wind speeds during winter and a decrease during summer (3-15% reduction). Some projections indicate an overall decrease in wind power for the period 2041 to 2060 relative to the period 1981 to 2000. (O Dwyer and Alexander 2016).
Summary of Change	Projections indicate a decrease in wind speeds for summer and increases for winter. An increase in the intensity of extreme windstorms is expected.
Climate Risks Identified	Windstorms or high winds, that are defined as a having a wind speed greater than 50 km/h, which equates to a Force 7 (28–33 knots) on the Beaufort wind force scale. This could result in storm damage to structures.

3.3 Climate Change Risk Prioritisation.

In order to respond to future climate risks,

it is necessary to assess the degree of risk from different climate events based on their frequency, severity, duration and possible effects. In the previous section climate variables and risks have been examined to give a broad idea of the risks that Limerick is likely to face. Many major climate events are caused by compound events with different causes interacting. This makes prediction of climate events difficult and it is considered that in a Limerick context any predictions should be based on past events with due regard for changing environmental conditions.

Future climate risk can be calculated by combining the projection confidence (i.e. the level of confidence attributable to projections of change in the climatic variable) with the future impact consequence (i.e. the estimated future level of service disruption caused- see table 4.1). A

notional scale is developed for each parameter as shown in matrix format in Table 3.2, and the future climate risk is calculated using the equation:

$$\text{Future climate risk} = \text{Projection Confidence} \times \text{Future Impact Consequences}$$

		PROJECTION CONFIDENCE				
		LOW	LOW/MED.	MEDIUM	MED./HIGH	HIGH
FUTURE CONSEQUENCE	NEGLIGIBLE 1	1	1	1	1	2
	MINOR 2	1	1	2	2	3
	MODERATE 3	2	2	3	3	4
	MAJOR 4	3	3	4	4	5
	CRITICAL 5	4	4	5	5	5

Table 3.2 Climate Risk Matrix

Calculation of the future climate risk for each variable allows the ranking and prioritisation of risks as shown in Table 3.4. The future risk priorities are given scale values with the following definitions:

Projection Confidence Ranking	Future Consequence	Definition
5	Critical	Must not be accepted as part of routine (unadapted) operational procedures; urgent attention at the most senior level required; adaptation measures that function to diminish risk must be proposed and acted on immediately.
4	Major	May be accepted as a part of routine operations only where adaptation measures have been identified and are immediately feasible, monitoring/early warning of the risk is routine and the nature of risk is well understood; senior management must be informed of the status and evolution of the risk over time.
3	Moderate	May remain part of routine operations, but a schedule for future adaptation should be in place, with a thorough investigation of any lead time and/or required precedent steps prior to adaptation measures becoming feasible having been conducted.
2	Minor	Likely to remain part of routine operations; should be assigned a monitoring and observation protocol; existing controls are sufficient and no further action will be required unless significant change occurs
1	Negligible	No further action will be required in the short term unless significant change occurs in the climate variable or receiving environment in question.

Table 3.3 Future Climate Risk Definitions

Table 3.4 below sets out the prioritization of future climate change risk for County Limerick, based on an analysis of projection confidence and future impact consequence. Some of the priorities such as the identification of the vulnerability of the mudflats in the estuary to disturbance from sea level rise are an important factor for Limerick and Clare.

Future Climate Risk	Projection Confidence	Future Consequence	Future risk priorities
Fluvial Flooding	4	5	5
Heat Waves	4	4	4
Coastal Flooding	4	4	4
Pluvial Flooding	3	3	3
Wind Storms	4	4	4
Groundwater Flooding	2	3	2
Coastal Erosion	4*	3	3
Freezing Conditions	2	3	2

Note: * The estuary with its mudflats is particularly vulnerable- see page 17 above.

Table 3.4: Prioritisation of future climate change risks for County Limerick.

CHAPTER 4

Local Authority Adaptation Objectives

4.0 Introduction:

Adaptation actions are a natural follow on from the climate risks identified in the last chapter. At the outset, it must be pointed out that the Local Authority has considerable experience in dealing with such events. This experience and the procedures that are in place form a useful foundation on which to base adaptation actions. Limerick City and County Council has a severe weather assessment team in accordance with the requirements of the National Framework for Emergency Management. This works closely with the National Emergency Coordination group. The staff of this team ensures that the Council responds appropriately to severe weather events. It directs operation such as gritting, work teams, Fire Services and Civil Defence.

4.1 Some Implications to Consider:

There have been direct effects on Local Authority operations in responding to past climate events. These extend throughout the Council and have implications for personnel at all levels engaged in responses, consequences for service provision and budgetary consequences. For those engaged directly in emergency responses there are the issues of staff rotation and welfare, the provision and renewal of appropriate equipment and continued re-deployment of staff as the situation evolves.

On a less immediate level, climate events and climate change taken as whole leads to a need for new training and expertise amongst staff. There may also be a need for new equipment or the replacement of older equipment. It should be remembered that Council teams work closely with other agencies in responding to climate events. In storm events the loss of power can have effects on Council services and cooperation with the Electricity Supply Board is essential in such situations. The Water Services Section has reported that loss of power in past climate events has led to cessation of operations in Waste Water Treatment Plants. This has obvious human health implications and emphasises the importance of the integration of our Adaptation Strategy with relevant parts of Irish Water's Adaptation Strategy and that of the Electric Ireland.

Reponses to climate events do, of course, lead to re-deployment of staff and resources from other Council services, which might lead to service provision being suspended in other areas for the duration of the event and for a period shortly afterwards. The other obvious effects would be on budgets, as local authorities frequently incur expenditure in responding to severe weather events. In 2009 for instance a claim for €108,300 was lodged to central government following a flood event in Castleconnell. In 2014, damage to bridges and roads in the east of the county led to direct repair costs of €470,000 with additional costs including professional and design fees bringing the total to almost €1 million. In 2014, costs of €2,382,690 were incurred in responding to flood events in both city and county. Table 4.1 outlines the costs of responding to climate events over a five-year period.

Year	Number of Severe Weather Events.	Cost €
2014	Nine (9)	2,382,690.54
2015	Seven (7)	780,683.07
2016	Twelve (12)	5,239,405.20
2017	Eight (8)	423,579.92
2018	Eight (8)	634,836.81
	Total Cost €	9,461,195.54.

Table 4.1 Climate Event Costings 2014-2018.

Source: Physical Development Directorate March 2019.

4.2 Limerick City and County Council – Structure and Directorates

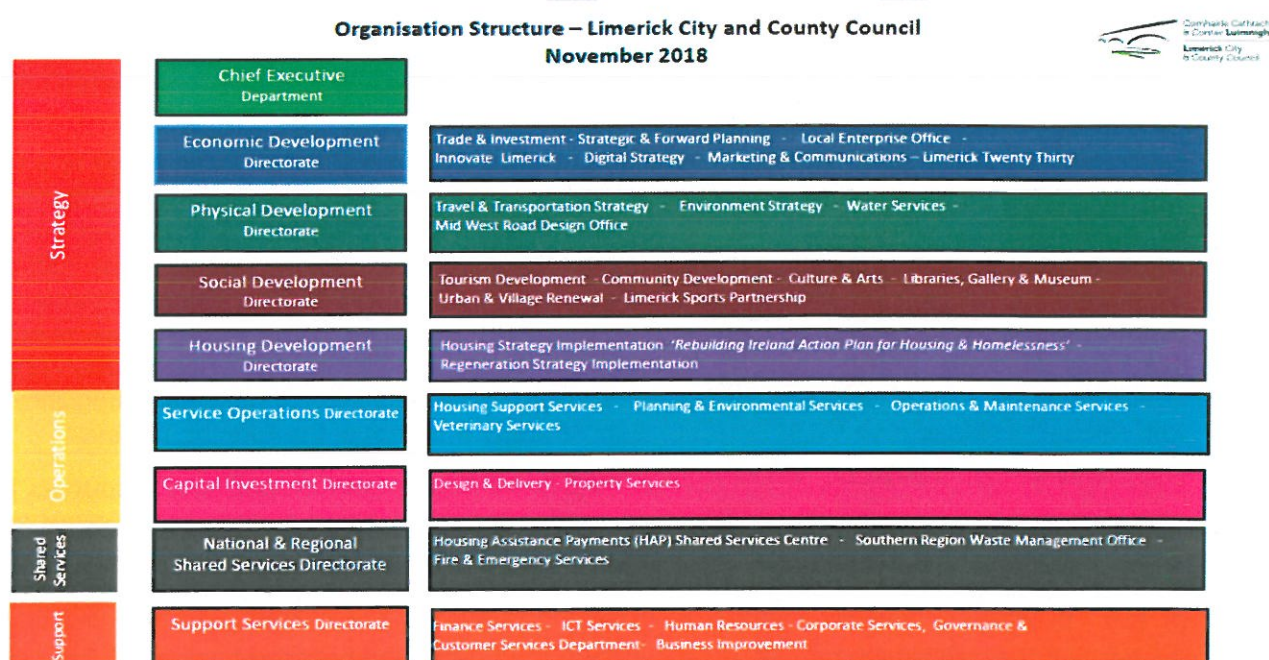


Figure 4.1 – Limerick City and County Council Organisational Structure

Figure 4.1 above sets out the current organisational structure of Limerick City and County Council. All of these will respond through different climate events through a series of adaptation actions.

Some of the climate adaptation actions may be the responsibility of two or more directorates. Where this is the case, it is indicated in Table 4.2 below.

4.3 Climate Change Objectives

The *National Policy Position on Climate Action and Low Carbon Development (2014)* and the *Climate Action and Low Carbon Development Act 2015* establishes the fundamental national

objective of achieving transition to a competitive, low carbon, climate-resilient and environmentally sustainable economy by 2050" (DCCA, 2019). This forms the basis for objectives that follow. The overriding objective for Limerick City and County Council in the preparation of the Climate Change Adaptation Strategy 2019-2024 is **to mainstream climate adaptation in all the functions and activities of the local authority.**

Following on from the main objective there are, in table 4.2 below, a series of climate adaptation themes. Under each theme, there are a number of objectives, each with a number of linked actions. There are six themes in total listed below:

1. Extreme Weather Event Response
2. Land Use and Planning
3. Infrastructure, Built Environment and Service Provision
4. Environment
5. Economic Development Activities
6. Emerging Issues

There are three timeframes associated with the actions, short term within three years, medium term, three to five years and long term, five to ten years.

Table 4.2 Adaptation Themes, Objectives and Actions

Theme 1 - Extreme Weather Event Response							
Objective 1: To ensure most efficient response to climate risk and climate events by Limerick City and County Council							
Lead Directorate	Associate Directorates	Climate Change Risks	Impact of Climate Change Risks	Action Number	Adaptation Actions	Timescale	Budget
Emergency Services	Service Operations Directorate	Fluvial flooding; Heat waves; Coastal flooding; Pluvial flooding; Wind storms; Groundwater flooding; Coastal erosion; Freezing conditions	Threat to safety or health of population Damage to property and/or infrastructure.	1.1	Prepare a standard response document, to ensure data from extreme weather events are documented and that responses are recorded to ensure adequate local and countywide responses to extreme weather events. This data will help to inform future operational procedures.	Short term	No
Emergency Services/ Service Operations Directorate		Flooding	Major social and/or economic impact	1.2	Review flood response plan to ensure that lessons learned are incorporated for future responses.	Short term	Yes
Service Operations Directorate		Fluvial flooding; Heat waves; Coastal flooding; Pluvial flooding; Wind storms; Groundwater flooding; Coastal flooding;	Damage to property and/or infrastructure	1.3	Review and collate information on existing early warning systems (e.g. flood early warning systems, coastal surge system, tides and up to date weather forecast etc.) to better predict future events.	Short term	No

		erosion; Freezing conditions							
Service Operations Directorate		Fluvial flooding; Heat waves; Coastal flooding; Pluvial flooding; Wind storms; Groundwater flooding; Coastal erosion; Freezing conditions			1.4	Investigate redeployment of early warning systems e.g. Shannon flood warning sensor may need to be further upstream to provide adequate warning to Limerick City.	Short term	No	
Objective 2: To ensure that responses to climate events are properly informed and evolve over time to respond to changing circumstances									
Property Services		As above Fluvial flooding; Heat waves; Coastal flooding; Pluvial flooding; Wind storms; Groundwater flooding; Coastal erosion; Freezing conditions	Interruption of Council service.		2.1	Support the provision of alternative power supply (generators) and battery storage for offices to ensure continuity of all communications and necessary services	Ongoing through plan period	Partially funded	
Emergency Services	All Other Directorates	Fluvial flooding; Heat waves; Coastal flooding; Pluvial flooding; Wind storms; Groundwater flooding; Coastal erosion; Freezing conditions	Interruption of Council service.		2.2	Ensure that Business Continuity Plan is developed in such a way that all possible impacts of Climate Change are considered.	Short term	Yes	

Theme 2 - Land Use And Planning

Objective 3: To ensure that the risk and impact of flooding is adequately integrated into Planning Policy

Lead Directorate	Associated Directorates	Climate Change Risks	Impact of Climate Change Risks	Objective and Action Number	Adaptation Actions	Timescale	Budget
Economic Directorate	Physical Development Directorate Service Operations Directorate	Fluvial flooding; Heat waves; Coastal flooding; Pluvial flooding; Wind storms; Groundwater flooding; Coastal erosion; Freezing conditions	Damage to infrastructure, properties and businesses.	3.1	Map current and available climate change projections to identify areas that may be susceptible to identified climate change risks. Take into account different climate risks (S 3.2) with suitable allowance for climate change built in. See action 7 below.	Short term	No
All Strategic Directorates	All Other Directorates	Fluvial flooding; Heat waves; Coastal flooding; Pluvial flooding; Wind storms; Groundwater flooding; Coastal erosion; Freezing	Damage to infrastructure, properties and businesses	3.2	Review flood risk management policies to ensure they are effective in preventing inappropriate development in areas that are or may be at risk of flooding, and update as appropriate.	Short term	Yes

Physical Development Directorate	Economic Development Directorate	conditions Flooding	Flooding	3.3	Prepare Flood Risk Assessment for the Metropolitan area and vulnerable zoned settlements in the County to inform Development Plan policy.	Short term	Significant funding required.
Objective 4: To ensure integration of climate adaptation and mitigation into Land Use and Planning Policy							
Economic Development Directorate	All Other Directorates	Flooding	Flooding	4.1	Integrate Climate Change Adaptation Planning into all plans, strategies and policies prepared by the Council, including Development Plans, Local Area Plans, Masterplans, Transportation Plans, Tourism and Economic Plans.	Short term	Yes
Physical Development Directorate	Service Operations Directorate Economic Directorate	As above	Overloading of drainage infrastructure, in particular those associated with storm water and clean water diversion	4.2	Update policy content to ensure that drainage design standards and guidelines that are being employed are the most technically up to date and have suitable allowances for climate change. Provide training and guidance on sustainable urban drainage techniques.	On-going	Yes
Objective 5: To incorporate climate proofing of infrastructure into Planning Policy							
Economic Directorate	Physical Development Directorate	As above	Damage to ESB/Irish Water/Communic	5.1	Ensure that Development Plan policies take account of climate proofing for infrastructure such as	Short term.	Yes

Economic Development	Cooperate with ESB Networks, Irish Water			ations Infrastructure				electricity, communications and water services.	
	Strategic and Forward Planning	As above.		Damage to ESB/Irish Water/Communications Infrastructure	5.2			Encourage cooperation between utility and service providers to ensure their networks are resilient to the impacts of climate change	Short term.
									No

Theme 3 - Infrastructure, Built Environment And Service Provision

Objective 6: To increase the climate resilience of Limerick City and County Council building and housing stock where appropriate

Lead Directorates	Associated Directorates	Climate Change Risks	Impact of Climate Change Risks	Action Number	Adaptation Actions	Timescale	Budget
Property Services	Limerick 2030 Innovate Limerick	Heat waves, windstorms and flooding. Freezing conditions.	Damage to Council building stock	6.1	Prepare an inventory of Council building stock; assess climate resilience of current buildings stock, with a view to determining appropriate works.	Short term	No
Service Operations Directorate (Housing Maintenance)		Heat waves, windstorms and flooding. Freezing conditions.	Damage to Council housing stock	6.2	Prepare an inventory of Council housing; assess climate resilience of current housing stock.	Short term	No
Service Operations Directorate (Housing Maintenance)				6.3	Compile a single database of housing stock with information on their condition and BER ratings.	Short term	No
Service Operations Directorate.	Housing Development Directorate	Heat Waves, Freezing conditions	Overheating and occupant discomfort in Council building stock due to extreme temperatures.	6.4	Ensure that new build are designed with climate change in mind. Consider a programme of retrofitting housing stock. Ensure that retrofit is carbon neutral where possible.	Long term	No

Objective 7: To increase resilience of infrastructure to climate change

Service Operations Directorate		Fluvial flooding; Heat waves; Coastal flooding; Pluvial flooding; Wind storms; Groundwater flooding; Coastal erosion; Freezing conditions	Damage and disruption to road network due to impacts of climate change risks.	7.1	Using road and bridge and city quay wall maintenance data and reports from area engineers, identify areas at most risk from climate events. This will identify vulnerable stretches of road network and associated structures such as bridges. Prioritize these areas for remedial works.	Medium term	Yes
Physical Development Directorate	Capital Investment Directorate	Fluvial and Coastal flooding and Pluvial Flooding or any combination of these.	Damage to infrastructure and property and disruption to daily life.	7.2	Support and assist OPW in delivery of flood relief schemes and defences.	Short term	No
Housing Development Directorate	Service Operations Directorate (Housing Maintenance)	Heat waves.	Hotter, sunnier summers	7.3	Support design measures to take account of increased sunlight when designing Council housing stock to ensure alternative energy sources such as solar paneling or photo-voltaic panels are considered in the building design.	Short term	No

Theme 4 - Environment

Objective 8: To work with other agencies, where feasible, to foster a broad response to climate change

Lead Directorates	Associated Directorates	Climate Change Risks	Impact of Climate Change Risks	Action Number	Adaptation Actions	Timescale	Budget
Physical Development Directorate	All Other Directorates	Fluvial flooding; Heat waves; Coastal flooding; Pluvial flooding; Wind storms; Groundwater flooding; Coastal erosion; Freezing conditions	Impact on bio-diversity	8.1	The local authority will have due regard to the content of the Sectoral Climate Adaptation Strategies where relevant to local authority functions.	Medium term	No

Objective 9: To encourage the adoption of green solutions to climate change

Physical Development Directorate	Economic Development Directorate	All of the above.	Impact on bio-diversity.	9.1	Encourage the adoption of Neighbourhood Scheme and Native Woodland Scheme in suitable locations.	Short term	No
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Physical Development Directorate	Economic Development Directorate			9.2	Encourage the implementation of ecosystem and catchment based approaches to protect against impacts of climate change. Green infrastructure is to be an integral part of this approach.	Short term	No
Physical Development Directorate	Economic Development Directorate	Fluvial flooding; Heat waves; Coastal flooding; Pluvial flooding Groundwater flooding; Coastal erosion	Declining water quality is a consequence of climate change. Water temperatures will generally rise in streams, lakes, and reservoirs as air temperature rises. This tends to lead to lower levels of dissolved oxygen in water, hence more stress on the aquatic life that relies on oxygen.	9.3	Update policy content in relation to River Basin Management Plans in Council policy documents. Work with local communities and LAWCO, where possible to achieve better water quality in selected rivers.	Short term	No
Economic Development Directorate	Social Development Directorate	Fluvial flooding; Heat waves; Coastal flooding; Pluvial flooding; Wind storms; Groundwater flooding; Coastal erosion; Freezing	Impact on built and cultural heritage.	9.4	Prepare an inventory of Council owned cultural and built heritage sites.	Short term	Yes

		conditions							
All Strategic Directorates		As above			9.5	Assess Vulnerability of cultural and built heritage sites, including graveyards to Climate Change.	Medium term	No	
Economic Development	All Other Directorates				9.6	Liaise with in-house Heritage and Culture team to work on heritage adaptation issues.	Short term	No	
Economic Development	Physical Development	All of the above	Impact on bio-diversity		9.7	Prepare green infrastructure content for the Development Plan.	Short term	Yes	
Economic Development Directorate	Physical Development Directorate		Impact on bio-diversity		9.8	Prepare invasive species policy content for Development Plans and Development Management.	Short term	Yes	
Physical Development Directorate			Impact on bio-diversity		9.9	Promote adequate invasive species control protocols on all Local Authority projects and works.	Medium term	No	
Physical Development Directorate	All Other Directorates		Impact on bio-diversity		9.10	Support, where possible, control measures for invasive species.	Medium term	No	

Theme 5 - Economic Development Activities

Objective 10: To incorporate climate change concerns into Limerick's economic sector, where feasible

Lead Directorates	Associated Directorates	Climate Change Risks	Impact of Climate Change Risks	Action Number	Adaptation Actions	Timescale	Budget
Marketing and Communication Unit	Economic Development Directorate Social Policy Directorate Physical Development Directorate	Fluvial flooding; Heat waves; Coastal flooding; Pluvial flooding; Wind storms; Groundwater flooding; Coastal erosion; Freezing conditions	Disruption to business and industry due to impacts of climate change	10.1	Identify best possible means of communicating with the private sector and the public on information relating to severe weather events.	Short term	Yes
Marketing and Communication Unit	All Other Directorates	As above	Disruption to business and industry due to impacts of climate change	10.2	Implement these communications links as required	Short term	Yes

Objective 11: To identify and promote economic opportunities arising from climate change and adaptation

Economic Development Directorate/LEO	Social Development Directorate	All of the above	Potential opportunities to work with the private sector to	11.1	Liaise with other agencies such as the IDA, Bord Bia, Bord Failte, or others to identify new products or services that might result from climate change. Conversely, some	Medium term	No
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Service Operations Directorate/Emergency Services	Major Emergency Management Team Human Resources Health and Safety	All of the above	Increased pressure on first line responders to climate change events.	12.2	Liaise with Fire Service and outdoor work teams regarding the type and frequency of climate change events ranging from wild fires to flooding. Assess their requirement in terms of equipment, training welfare and staff allocation and make appropriate recommendations and resource allocations.	Short term	Partially funded
Physical Development Directorate.	All Other Directorates	All of the above	It may not be possible to adequately predict future effects of climate change	12.3	Ensure continuation of support for the Climate Adaptation Team following publication of the Climate Adaptation Strategy, to monitor and continue to assess climate change issues as they arise. It will also feed into future climate strategies and projects. Emphasise the need for buy in at all levels of the Council in relation to Climate Adaptation.	Ongoing	Partially funded
Objective 13: Work with other Local Authorities and Agencies to ensure a regional response to Climate Change							
Social Development Directorate	LCDC	All of the above	Raising awareness and expertise in local communities in relation to climate adaptation	13.1	Work with local communities in relation to publicising climate change adaptation and working them through events and training courses in relation to improving community adaptability in Limerick City and County.	Short term	Partially funded

Physical Development Directorate	Economic Development	All of the above	Regional and estuary wide effects.	13.2	Work with neighboring Local Authorities to develop regional wide adaptation responses to climate change, as appropriate.	Short term	No
Climate Adaptation Team	Service Operations Directorate and other relevant directorates.	All of the above.	Regional and estuary wide effects.	13.3	Work with all regional and sectoral bodies with which the Council has an association to ensure - in the context of climate adaptation - consistency of approach and to identify the impact on Council services of the climate adaptation strategies of other bodies/sectors.	Short term	Partially funded
All Directorates				13.4	LCCC will work with neighbouring local authorities and statutory bodies, on a regional basis, through structures such as the Shannon Integrated Framework Plan and other fora, to develop estuary-wide and regional adaptation and mitigation responses to climate change.	Short term	Partially funded.

4.4 Mitigation Actions Already In Place

As noted above the Council has experience in responding to climate events and already has many procedures in place. In many situations, it will simply be case of continuing with or adapting existing programmes - such as the road and bridge maintenance programme - which have served well to date.

These include proposals for the changeout of the existing Council Public Lighting stock to energy efficient lighting. LCCC currently has approximately 23,000 public lights across the city and county. In conjunction with the Road Management Office (RMO), Clare County Council, Kerry County Council, Cork County and Waterford City and County Council, Limerick City and County Council has agreed to enter into a regional contract for the replacement of public lighting to energy efficient lighting. This contract will be managed by Cork County Council as lead authority and is due to go to tender later this year. A contractor is expected to be appointed in Q1 2020 and it is anticipated that the contract would be completed 2 years from the date of contract signing. €10m will be invested by LCCC into this project. With respect to any new LCCC infrastructure projects and also developments carried out through planning applications, energy efficient lighting in accordance with a LCCC specification has been put in place for the last couple of years. Public lighting (PL) proposals for all developments are assessed by Central Services PL staff.

Limerick City and County Council has also undertaken the development of both urban and rural greenways. While the rural green ways are also regarded as a tourist amenity, the creation of urban greenways, particularly in the east of the city and between the University and the city centre has lead to a comprehensive network of cycling and pedestrian networks, which not only promotes sustainable urban transport but contributes to quality of life.

Limerick City and County Council is tendering for an electric car for the Mayoral office, and is considering the procurement of electric vehicles.

The Council offices in Dooradoyle have had photovoltaic panels in place since 2008 and these have continue to make contribution to the energy demands of the buildings. At certain times these supply 15% of the buildings energy requirements.

The Council has also worked with local communities in terms of advising them on the retrofitting of renewable technologies to buildings such as community centres.

Table 4.3 Some examples of Adaptation Measures in place.

Adaptation Action Categories	Early Stage Adaptation Measures
Existing initiatives.	<p>Major Emergency Plan and Severe Weather Plans in place.</p> <p>A number of early warning systems and working groups are in place, for example:</p> <ul style="list-style-type: none"> • Flood Early Warning systems in place for Limerick, see action 3(b) Table 2. • OPW Irish Coastal Protection Strategy Study Phase IV (December 2013) • Shannon Flood Risk State Agency Coordination Working group in place. • IceCast Road Weather Information System in place for National Roads. <p>2010 -2016 (as extended) County Development Plan (CDP) references climate change (section 7.4.4) and the need to update the Limerick Clare Energy Agency Climate Change Strategy and Energy balance.</p> <p>Staff member appointed specifically to assess flood risk and to assess and prepare Council flood works.</p> <p>Climate Adaptation Plan being prepared. Adaptation Team set up as part of the preparation of the Climate Adaptation Plan. The Adaptation Team will continue to meet after the preparation of the Adaptation Strategy and will help inform the preparation of any subsequent Mitigation Plans.</p> <p>See also mitigation actions mentioned in S4.4 above.</p>
Investigate, review and prepare guidance.	<p>Physical Development to prepare briefing on SUDS.</p> <p>LCEA to update 2006 energy balance.</p> <p>Climate Adaptation content being prepared for Local Area Plans.</p>
Prepare inventories and undertake vulnerability assessments of assets	<p>Property Section has details of Council owned properties.</p> <p>Service Operations Directorate has records of Regional and Local road bridges, including rated condition and damage type.</p> <p>Water Services has details of WWTPs and potable water supplies.</p>
Identify opportunities	<p>Local Enterprise Office and Economic Development directorate has expertise in project/product development with business and industry.</p>
Raise awareness	<p>Marketing and Communications Unit would be ideally placed to raise awareness of these issues.</p> <p>It could also be incorporated into forward planning first issues documents for plan preparation e.g. Local Area Plans and Development Plans.</p>

Further develop relationships	Important relationships include: <ul style="list-style-type: none">• stakeholders such as An Garda Siochana, HSE, Irish Water, SEAI, EPA, ESB, OPW, NPWS. DHPLG, DCCAIE DTTAS TII, NTA• 3rd level instructions with research interests in climate change.
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CHAPTER 5

Implementation, Monitoring and Evaluation.

This strategy has implications for the functions and operations of Limerick City and County Council, which makes it important that the Climate Adaptation Team brings together representatives from all key functional areas with various technical, operational and management expertise who can successfully carry out the necessary tasks and implement the actions contained within strategy. Climate Adaptation and its related mitigation actions will continue to evolve and it is for this reason that the Climate Adaptation Team will continue to function following the preparation of the adaptation strategy. It will meet quarterly.

The tasks of the team are as follows:

- Prioritise actions within the short, medium and long term delivery timeframes,
- Develop an approach and initiate implementation of the actions,
- Liaise with other stakeholders and sectors, both locally and regionally, where required for the implementation of actions,
- Monitor and evaluate implementation of the actions and,
- Report on Progress to the relevant SPCs and subsequently to full Council.
- Respond to changing adaptation and mitigation requirement and ensure that Council policies and procedures are updated accordingly.

The assistance of the Atlantic Region South Climate Adaptation Regional Office will continue to be sought and is gratefully acknowledged with their help in the process to date. Limerick City and County Council will continue to work with the CARO throughout the lifetime of this strategy. This will include submitting progress reports to the CARO if required.

1: Prioritise Actions

An essential task is to prioritise adaptation actions for delivery within the short, medium and long term timelines as defined in the strategy document. Actions are to be assigned timeframes for implementation and assigned to relevant section of the Council.

2: Develop an approach and initiate implementation

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

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

- Timeframe that measures will be implemented,
- Identify risks to the implementation of actions.

Many of the above have been mentioned previously in the document but these are likely to be further developed as the plan progresses and experience of climate adaptation grows within Limerick City and County Council.

3: Liaise with other Stakeholders/Sectors

As mentioned in Table 4.2 and throughout the Adaptation Strategy, the Local Authority will be required, as considered necessary, to liaise with other key stakeholders to provide for the delivery of actions. By the same token, the sectors, as identified in the National Adaptation Framework, will engage and liaise with Local Authorities in the delivery of sectoral adaptation actions stemming from their respective adaptation plans.

4: Monitor and evaluate implementation

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

The climate adaptation team will use results from the monitoring and evaluating program to:

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

This means that adaptation actions will be informed by latest climate change data and projections. As a result, monitoring, and evaluation can help improve the efficiency and effectiveness of adaptation efforts in the Council.

Part of the monitoring will of course be the monitoring of climate events themselves, which will inform future adaptation and mitigation policies. One suggested template for monitoring such events is shown below:

Table 5.1 Monitoring Climate Events & Impacts

Table below sets out the identified climatic events, the methods of monitoring the events and impacts

Future Climate Risk	Indicator	Measurement	Frequency of Measurement	Data Source	Impact
Fluvial Flooding	Flooding events River Levels River Volume Flow	Number Meter M3 / second	As occurs Day/Week/Month Day/Week/Month	Own Data OPW	Increase demand on emergency services, Loss of land for agriculture, Contamination of Drinking water.
Heat Waves	Ambient Air Temperature	Deg. Celsius	Day/Week/Month	Met Eireann	Demand on Potable Water Damage to Road Surfaces Demand on emergency services
Coastal Flooding					
Pluvial Flooding					
Wind Storms					
Groundwater Flooding					
Coastal Erosion					
Freezing Conditions					

5: Report on progress

The Climate Adaptation Team will develop and agree appropriate timeframes and mechanisms to report on the progress of the practical implementation of actions of this strategy to Local Authority Management, relevant Special Policy Committees and to Council as appropriate.

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

The progress report should provide for, inter alia:

- Progress achieved on actions to that point (including key indicators as established)
- Extent to which actions have built new relationships with key stakeholders, agencies, communities and identified new or emerging opportunities.

- Identification of funding streams used
- Encouraged positive community engagement
- Reports on the outcomes of efforts to change behaviour

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

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

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

The National Adaptation Steering Committee, chaired by the DCCAE maintains a role to ensure a coordinated and coherent approach to implementing actions under the NAF. This steering committee with representation from Local Authorities and the CAROs has a role in promoting cross sectoral coordination.

The High Level Climate Action Steering Committee, chaired by the Minister for Communications, Climate Action and Environment has a role in monitoring progress by sectors and local authorities in delivering on climate change adaptation actions.

Under Section 13 of the Climate Action and Low Carbon Development Act 2015, the Advisory Council has a role, at the request of the Minister, in conducting periodic reviews of the implementation of the National Adaptation Framework and sectoral adaptation plans and to report on its findings and recommendations.

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