



# Climate Change Action Plan

2011-2020







## For Further Information

**Visit** [www.darwin.nt.gov.au](http://www.darwin.nt.gov.au)

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## Acknowledgements

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## Disclaimer

The information in this document has been gathered from the most current data available at the time of writing.

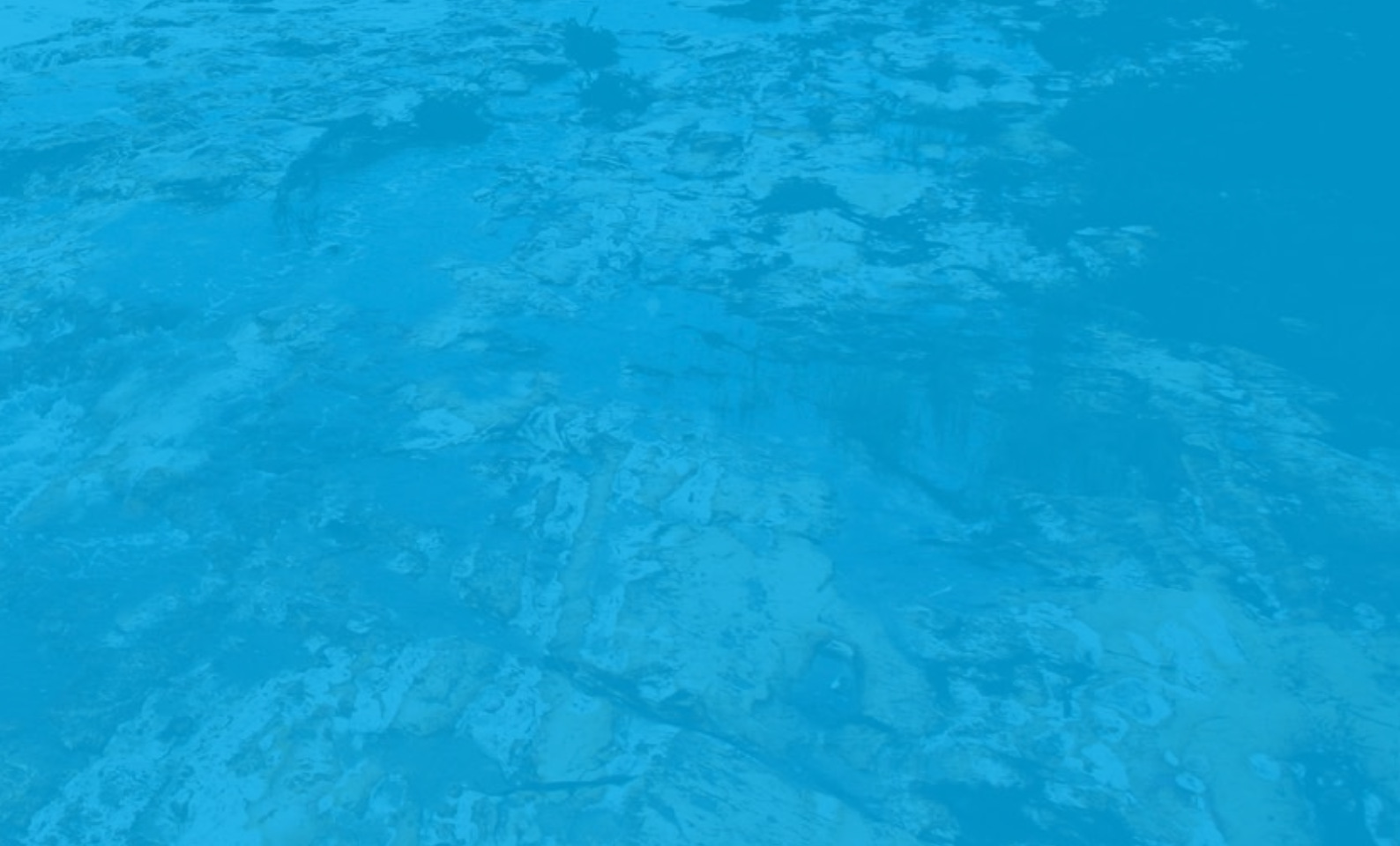
All figures and diagrams have been sourced from various government and climate change research organisations documents, especially from those listed under *References* at the back of this document and through their websites.

The *Climate Change Action Plan 2011–2020* should be read in the setting of being ‘a living document’. As such the Plan will be reviewed every three years and appropriated amendments made.

Further, anticipated additional contemporary information which will be released over the forthcoming years by governments and research organisations will be considered alongside the current information provided throughout the term of the *Climate Change Action Plan 2011–2020*.







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# Foreword

Darwin is a thriving tropical city with a population of 77,290 and bordered on three sides by a harbour three times the size of Sydney Harbour. The City encompasses a total land area of about 112 square kilometres, including many types of parkland and reserves, and several beaches. The original inhabitants of the Darwin area were the Larrakia (Larrakeyah) Aboriginal people. Darwin City Council is one of four Darwin coastal managers, the others being the Australian Government (Department of Defence), the Northern Territory Government and the Larrakia Nation.

As the Northern Territory's capital city, Darwin is a vibrant destination renowned for its tropical climate as well as being Australia's gateway to world class nature and cultural experiences. A city of shady parks and gardens, with a range of restaurants, new apartments and tourist venues including the Wharf Precinct, Cullen Bay and the Darwin Convention Centre at the waterfront, Darwin is an increasingly popular place to live and visit. East Point Reserve, just a few minutes drive from the city centre, is a favourite spot for sunset picnics and home to a colony of Agile wallabies. Darwin has excellent walking and bicycle paths along the foreshore and through the parks and suburbs.

Although Council is limited in its powers and ability to control town planning or urban development, the Council actively advocates on behalf of the community and focuses its attention on matters

it can control. The challenge for the Council is to balance the sometimes competing interests and needs of the community with the available resources and capacity to deliver on those interest and needs.

Climate change is occurring and is relevant to a wide range of local government functions, thus become a high profile issue for Darwin City Council.

Council is taking leadership by addressing mitigation and adaptation focusing on infrastructure and general business, by embarking on organisational and community behaviour change, by working in partnership with the Australian and Northern Territory Governments, environmental organisations, scientific and tertiary institutions, indigenous and community interests, by sharing knowledge and advice, and embarking on joint projects with partners including the Larrakia people.

This Action Plan provides a framework for Darwin City Council to implement a suite of actions over the next 10 years to reduce greenhouse gas emissions and tackle the issue of climate change for Council's operations and to support community goals.



GRAEME SAWYER  
LORD MAYOR



# Executive Summary

Darwin City Council (Council) through its *Evolving Darwin Strategic Directions: Towards 2020 and Beyond*, provides a vision of enhancing Darwin's unique lifestyle and tropical feel with a strong focus on the environment and sustainability, for residents and visitors alike.

Increasingly, jurisdictions are seeing human induced climate change as one of the most significant and controversial global environmental issues facing local, regional and global communities.

Climate change is relevant to a wide range of local government functions, and has become a high profile issue for Council.

Council acknowledges and respects the importance of addressing climate change and environmental priorities in a way that is not only beneficial for the organisation and community but also for the land and water managed by adjoining Local Governments, the Australian and Northern Territory Governments, and the Larrakia people. Council also accepts responsibility to provide a strong response locally in order that Australia can meet national and international environmental obligations.

Infrastructure represents a major investment for Council and so it is important to ensure that it is designed and constructed to accommodate the predicted effects of climate change. The additional expense of making new infrastructure and buildings more resilient to climate change is costly, but to not do so has the potential to be even more so. Coastal storm surges and subsequent flooding to urban facilities, along with the degradation and failure of materials requires recognition of likely climate change, its impacts and the appropriate adaptation measures which need to occur now.

Adaptation to climate change is a relatively new policy challenge. It is important of Council to encourage sustainable development for the future growth and strategic planning of Darwin. Council is

meeting the challenge by taking into consideration a range of infrastructure and cost-effective energy savings initiatives to reduce our contribution to global greenhouse gas emissions.

Council is well placed to do this and by taking positive steps to reduce its carbon foot print, Council is in a position to lead and influence the community to reduce their greenhouse gas emissions through the way it conducts its own activities.

By taking leadership and responsibility towards reducing its local contribution to a global problem Council will be on the path to creating an inspirational workplace and City.

Council recognises that delaying action to address climate change will increase the environmental and societal consequences as well as the costs. Strong leadership at all levels is needed.

Council is committed to meeting the challenge. We owe this to future generations.

At the Council Meeting on 28 September 2010 the *Climate Change Policy* was adopted. The *Climate Change Action Plan 2011-2020* underpins this policy.

## i. Policy Summary

Council is committed to finding practical and effective ways to address climate change concerns within the municipality.

This will include managing climate change risks to natural and human systems and the built environment within the municipality using a combination of sustainable adaptation and mitigations measures.

Council will ensure that its objectives of the climate change policy are incorporated into strategic planning and decision making processes and operations of Council.



Preparing Australian communities for the unavoidable impacts of climate change is a national priority of local government.



## ii. Policy Objectives

- To provide effective and strong leadership to the region to respond to climate change and build a sustainable region.
- To develop and implement strategies designed to manage climate change risks to natural and human systems and the built environment within the municipality using a combination of sustainable adaptation and mitigation measures.
- To provide Council and the public with objective information that will assist in understanding the problem, alternatives, opportunities and/or solutions.
- To review climate change risks and impacts (for example, sea level rise, carbon footprint, temperature rises, a higher frequency of severe cyclones) as further research information becomes available.
- To comply with applicable legal requirements and implement any relevant Australian and Northern Territory Government policies, guidelines and/or directives.

## iii. Background

Preparing Australian communities for the unavoidable impacts of climate change is a national priority of local government.

Climate variability occurs naturally<sup>i</sup> however the overwhelming weight of contemporary science indicates that anthropogenic (human induced) climate change is accelerating at an increasing rate with the first decade of 2000-2010 being the hottest on record.

Increased climate variations are expected to result in adverse economic, social and environmental outcomes unless otherwise addressed.

Local government activities likely to be directly impacted by climate change such as sea level and water table rises and storm surges include planning for future developments and road infrastructure. There will also be impacts on natural resources, health and building regulations and community infrastructure and services.

Council has been active on the issue of climate change since 2004 when it joined the Cities for Climate Protection (CCP™) Program.

Council's *Climate Change Policy* provides the opportunity to promote Council's roles and responsibilities for adaptation to the impacts of climate change and identify priorities for mitigation through collaborative action across the three tiers of governments and the whole of community.

## iv. Policy Statement

Council recognises that meeting the challenges of climate change requires a partnership between government, business and the community as a whole.

Council is committed to delivering a range of mitigation and adaptation measures to meet the adverse impacts of climate change for the organisation, for the community and for environment sustainability.

Council will provide leadership on and demonstration of actions that can be undertaken to reduce greenhouse gas emissions. Council can work to increase awareness and advocate action to abate emissions and adapt to the impacts of global warming.

Council acknowledges and respects the importance of addressing climate change and environmental priorities within its sphere of influence in a way that is beneficial to the organisation, the Darwin community, the biodiversity of the region and Australia.

Council will incorporate climate change priorities in decisions about land use, infrastructure design, power and fuel usage, location and management of parks and reserves and water management.

Council recognises that this approach to climate change should be flexible and able to adapt to the changing political and legislative environment.

## v. Implementation and delegation

The Chief Executive Officer will lead a whole of Council approach to climate change which will include management participation from all areas of Council.

## vi. Evaluation and review

On-going evaluation of the progress of mitigation and adaptation strategic outcomes will be undertaken by the Climate Change and Environment section of Council.

The Climate Change and Environment Advisory Committee will continue to provide advice to Council on climate change risks and impacts (for example, sea level rise, carbon footprint, temperature rises, a higher frequency of severe cyclones) as further research information becomes available.





## Section 1 – Climate Change Policy Structures

Actions to address climate change are being undertaken at global, international, regional and local levels. With the purpose of proving a prospective on the role that Darwin City Council (Council) can play in contributing to climate change management a snapshot of the major evolving structures and policies for climate change is considered useful.

After reviewing a wealth of information, the following international, national and Northern Territory significant events have been taken into account in the development of Council's *Climate Change Action Plan 2011-2020*.



## 1.1 Global Architecture – The Convention and the Kyoto Protocol

The driver for management of climate change at the global level is the United Nations Framework Convention on Climate Change (UNFCCC), an international treaty formulated in 1992. The prime goal of UNFCCC is to manage atmospheric greenhouse gas concentrations at a level that will 'prevent dangerous human interference with the climate system'. Currently 195 countries (referred to as parties) have ratified UNFCCC.

In 1997 the Kyoto Protocol was added to the UNFCCC. The Protocol embeds the principle that countries have 'common but differentiated responsibilities'. The Protocol recognises developed countries, compared to developing countries, have traditionally been the major source of anthropogenic emissions of greenhouse gas (GHG) emissions to atmosphere.

The major feature of the Kyoto Protocol is that it sets legally binding targets for 37 industrialised countries and the European community for reducing GHG emissions. These amount to an average of 5% against 1990 levels over the five-year period 2008-2012. Australia's target under the Kyoto Protocol is to limit GHG emissions to 8% above the 1990 level.

A key component of the Kyoto Protocol is that countries are able to use 'market based mechanisms' covering mitigation actions in developed and developing countries to meet their emission reduction commitments. Currently 193 countries, including Australia but with notable exception of USA, have ratified the Kyoto Protocol.

The major distinction between the Protocol and the Convention is that while the Convention encouraged industrialised countries to stabilize GHG emissions, the Protocol commits them to do so.

The work of developing, implementing and monitoring the progress on the UNFCCC and the Kyoto Protocol is directed by annual meetings of

countries, called Conference of Parties (COPs), who have ratified the Treaties. For example the meeting of countries in Copenhagen in December 2009 was COP 15, the 15th meeting of countries who have ratified the UNFCCC.

Outcomes from recent COPs have focussed on progressing high road climate policy. Outcome of COP 13 (held in Bali, Indonesia in December 2007) saw agreement on a comprehensive process to implement a shared vision for long term cooperation, up to and after 2012, by developed and developing countries to reach an agreed and adopted (binding) decision at COP 15 scheduled for Copenhagen, Denmark, in December 2009. The shared vision was to be constructed consistent with principle of 'common but differentiated responsibilities and respective capabilities, and taking into account social and economic conditions'.

The outcome of COP 15 was the non-binding Copenhagen Accord. The Accord 'agreed that deep cuts in global emissions are required according to science and as documented in Intergovernmental Panel on Climate Change (IPCC) 4th Assessment Report with a view to reducing global emissions so as to hold the increase in global temperature below 2 degrees C'. Consistent with the Accord, developed countries (referred to as Annex 1 countries) committed to implementing quantified economy wide emission targets for 2020.

The outcome of the most recent COP (COP 16 held in Cancun, Mexico, December 2010) was to affirm the intent of the Copenhagen Accord, and agreement to establish a large (US \$100B by 2020) 'Green Carbon Fund', as well as the new Climate Technology Centre and Network.

Processes and programs to implement global structures to manage GHG emissions are a works in progress. COP 17 is scheduled for Durban, South Africa in December 2011 (for more information visit <http://unfccc.int/2860.php>).

## 1.2 Australian Government Response to Climate Change

Australia's climate change policy is evolving, consistent with processes detailed in UNFCCC and the Kyoto Protocol supplemented further by other initiatives such as the Carbon Farming Initiative. Australia's evolving policy for climate change will in all likelihood settle on a mixture of regulatory requirements and incentive programs to offset carbon emissions. For the regulatory component current Australian Government policy calls for the interim carbon price on GHG emissions from nominated industries transferring into a cap and trade system to manage mandated GHG emission target. The Carbon Pollution Reduction Scheme developed by the Australian Government in 2009 continues to provide frameworks for GHG management.

The Australian Government commissioned Professor Ross Garnaut AO to examine the impacts of climate change on the Australian economy, resulting in the *The Garnaut Climate Change Review* which recommended medium to long-term policies and frameworks to improve the prospects for sustainable prosperity.

A series of papers addressing developments across a range of subjects including climate change science and impacts, emissions trends, carbon pricing,

technology, land and the energy sector, were developed and released in the lead up of the 2010 update of *The Garnaut Climate Change Review*. The updated *Garnaut Climate Change Review* was then presented to the Australian Government on 31 May 2011 (for more information visit <http://www.garnautreview.org.au>).

The Australian Government released *Australia's Emissions Projections, 2010* in February 2011 and has reiterated its intention to introduce a carbon price in Australia to reduce emission and meet the 2020 target it made to the Kyoto Protocol target of limiting emissions.

Australia releases official projections of its GHG emissions annually. The previous projections were released as part of *Australia's Fifth National Communication on Climate Change*, a report under the United Nations Framework Convention on Climate Change (referred to as the 2009 projections).

This document is considered to be the Australian Government's most contemporary key document in relation to Australia's response to the Kyoto protocol target and for the Australian economy and communities.





### 1.3 Northern Territory Government Response to Climate Change

*Northern Territory Climate Action Policy* (2009) has an aspirational goal of 60% carbon emissions reduction by 2050, compared to 2007 emissions. This document has nine key elements which provide the focus for collaborative action including:

1. Government leadership on climate change.
2. A focus on green energy.
3. Land management.
4. Building green cities and towns.
5. Rethinking waste.
6. Expanding green business and industry.
7. Developing a green workforce.
8. Promoting green communities.
9. Living with change.

Further, under the Northern Territory Government headline actions, coastal wetlands at risk from rising sea levels, are noted to be given specific interventions aimed to reduce salt water intrusion, protect fishing and biodiversity.

Developed by the Northern Territory Government, *Territory 2030 - Strategic Plan 2009* is a road map for the future setting priorities to guide Government's efforts over the next two decades. It contains 128 targets linked to six key priorities: education, society, economic sustainability, health and wellbeing, the environment, and knowledge, creativity and innovation.

### 1.4 Local Government Response to Climate Change

#### 1.4.1 Australian Local Government Association (ALGA)

The ALGA adopted the *Climate Change ALGA Position Paper and Discussion Document* which discusses local government's place in addressing climate change as well as identifying areas for action and next steps. ALGA identifies the following:

- At the local level, local government will need to prepare for climate change and at the very least develop the capacity to protect its own assets and adapt to localised conditions.
- Local government has an important role in providing leadership and education to assist citizens and businesses to understand and accept their responsibilities to address climate change.

- Local service delivery needs to be improved in partnership with governments and the private sector.

#### 1.4.2 Local Government Association of the Northern Territory (LGANT)

LGANT has been working with councils to undertake climate change risk assessments for their municipality or shire with the following three project aims:

1. Undertake a risk assessment at the community level.
2. Initiate a community awareness program.
3. Develop an action plan for climate change adaptation.

#### 1.4.3 Darwin City Council

*Evolving Darwin – A dynamic, different and diverse city* provides strategic direction for Council to 2020 and beyond. It outlines a series of goals and associated outcomes including:

- 2.1.4 Provide a clean and liveable municipality.
- 2.2.3 Manage and improve the pathway and cycleway network and encourage safe cycling and walking.
- 4.1.1 Develop and implement a climate change policy and strategies for reducing of carbon emissions.
- 4.2.1 Develop and implement a water efficiency plan.
- 4.3.1 Lobby for, provide and develop contemporary waste management practices.
- 4.4.2 Enhance water quality, ecological systems and biodiversity in Council.

The *Climate Change Action Plan 2011-2020* follows on from the *Environmental Management Plan 2005-06* which addressed a range of environmental priorities for Council and Community.

The *Climate Change Action Plan 2011-2020* is to inform Council activities for the next ten years regarding corporate and community activities.

Council has a Climate Change and Environment Advisory Committee which consists of external experts who provide input and advice to Council on a 'needs be' basis.

The development of a new \$50,000 Climate Change and Environment Community Grant Program for 2011 has further strengthened Council's commitment to reducing the community's environmental footprint.

## Section 2 – Climate Change Overview

‘Climate Change’ is the changing of long-term weather patterns. Whilst Darwin will still have alternating Wet and Dry seasons, it is possible that the Wet will have more rain, and the Dry will become hotter.

The climate has often changed in the past. In fact, we are living today in a period of time when the Earth’s climate alternates between cool and warm, when sheets of ice kilometres-high push across the continents over thousands of years, and then recede.





## 2.1 What is Climate Change?

The Intergovernmental Panel on Climate Change (IPCC) defines the phenomena of climate change as 'a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods'.<sup>ii</sup>

'Climate' is a statistical description of weather conditions and their variations, including both averages and extremes in a given area. Darwin has a tropical climate with pronounced Wet and Dry seasons, with most rain falling between December and March, and warm rainless days from May to September.

'Climate Change' is the changing of long-term weather patterns. Whilst Darwin will still have alternating Wet and Dry seasons, it is possible that the Wet will have more rain, and the Dry will become hotter.

The climate has often changed in the past. In fact, we are living today in a period of time when the Earth's climate alternates between cool and warm, when sheets of ice kilometres-high push across the continents over thousands of years, and then recede.

Ice sheets last covered the continents (known as a 'glacial period') about fifteen thousand years ago, and until recently were expected to do so again. Parts of the ice sheets still remain today, as seen in Antarctica and Greenland.

Figure 2.1 shows what the world may have looked like at the peak of the last glacial maximum, when the ice cap surrounding the North Pole had expanded to cover much of Europe and North America.

There are many theories about the causes of historical climate change. When considering current climate change, the most relevant contributor is that of GHG. The theory is that in the past, a slight increase in the average global temperature from any particular trigger lead to a slight increase in the emission of GHG, which lead to a further increase in temperature and a further increase in emissions. What is unique about current climate change is that human civilisation is acting as a 'climate change trigger' producing vast amounts of GHG in only a few centuries.

### 2.1.1 Mitigation

Climate change mitigation focuses on reducing the amount of GHG we emit into the atmosphere. This action will help to avoid future impacts of climate change beyond what is already projected.

### 2.1.2 Adaptation

Climate change adaptation addresses the changes already projected to occur. Adaptation increases our ability to cope with a changing climate including variability and extreme weather events.

Figure 2.1: The world at the peak of the last glacial maximum



Source: Intergovernmental Panel on Climate Change <http://www.ipcc.ch/>.

## 2.2 What are Greenhouse Gases?

There are several gases which create a greenhouse effect. The most important include water vapour, carbon dioxide, methane and ozone. The major anthropogenic (human induced) GHG is carbon dioxide (CO<sub>2</sub>), mostly produced through the burning of fossil fuels. However, 'carbon emissions' is the colloquial term used to describe all anthropogenic GHG, not just CO<sub>2</sub>.

Some gases cause a greater warming effect than others, so for simplicity and ease of comparison, GHG are converted into an equivalent of carbon dioxide known as CO<sub>2</sub>-e. For example, methane (CH<sub>4</sub>) has a warming effect 25 times that of carbon dioxide equivalent, so

1 tonne of CH<sub>4</sub> = 25 tonnes of CO<sub>2</sub>-e<sup>1</sup>

Over the past 750,000 years, atmospheric CO<sub>2</sub>-e levels have remained between 180 and 280 parts per million.<sup>iii</sup> The difference of 100 parts per million of CO<sub>2</sub>-e correlates with drastic changes to the

Earth's climate. Since industrialisation, humans have burned enough fossil fuels to increase the level of CO<sub>2</sub>-e to 391 parts per million of carbon dioxide in the atmosphere, a rise above natural levels that the world has not seen for several million years.

### 2.2.1 What do Greenhouse Gases actually do?

Each GHG has a different global warming, or heat trapping, potential. The global warming potential of each of the major GHG, as well as the key source of the gases, is shown in Table 2.1.

Sunlight shines onto the Earth's surface, where it is absorbed and then radiates back into the atmosphere as heat. In the atmosphere GHG trap some of this heat and the rest escapes into space, a process commonly known as the 'Greenhouse Effect' (see Figure 2.2). Scientists have calculated that if it were not for these gases, Earth might be 40°C cooler.<sup>iv</sup> However, increasing the amount of GHG leads to increased trapping of heat, which is known as 'Global Warming'.

Table 2.1: Key Sources of Greenhouse Gas Emissions

Greenhouse Gas	Source	Greenhouse Warming Potential*
Carbon dioxide	Burning of fossil fuels	1.0
	Land clearing	
	Cement manufacture	
Methane	Waste decomposition without air (e.g. when waste is buried in landfill)	25
	Coal-bed methane from coal mining	
	Leakage of natural gas	
	Grass digestion by grazing animals	
	Burning of biomass fuels	
Nitrous oxide	Soil, nitrogen fertiliser decomposition	298
	Burning of petroleum products	
Chlorofluorocarbons (CFCs)	Leakage from refrigeration and air-conditioning systems	4750 - 14400
	Aluminium smelting	

\*100-Year Greenhouse warming potential (GWP) (per kilogram of gas) in terms of kg CO<sub>2</sub>-e.

Source: adapted from Intergovernmental Panel on Climate Change (2007) Working Group I Contribution to the Fourth Assessment Report, *Climate change 2007—the physical science basis Chapter 2 Changes in atmospheric constituents and in radiative forcing*.

<sup>1</sup> Comparing gases in this way refers to the 'Global warming potential' of each gas. This depends on both the warming effect of the gas, and its longevity in the atmosphere. The standard potential is set upon the warming potential over 100 years, with CO<sub>2</sub> having the value 1.

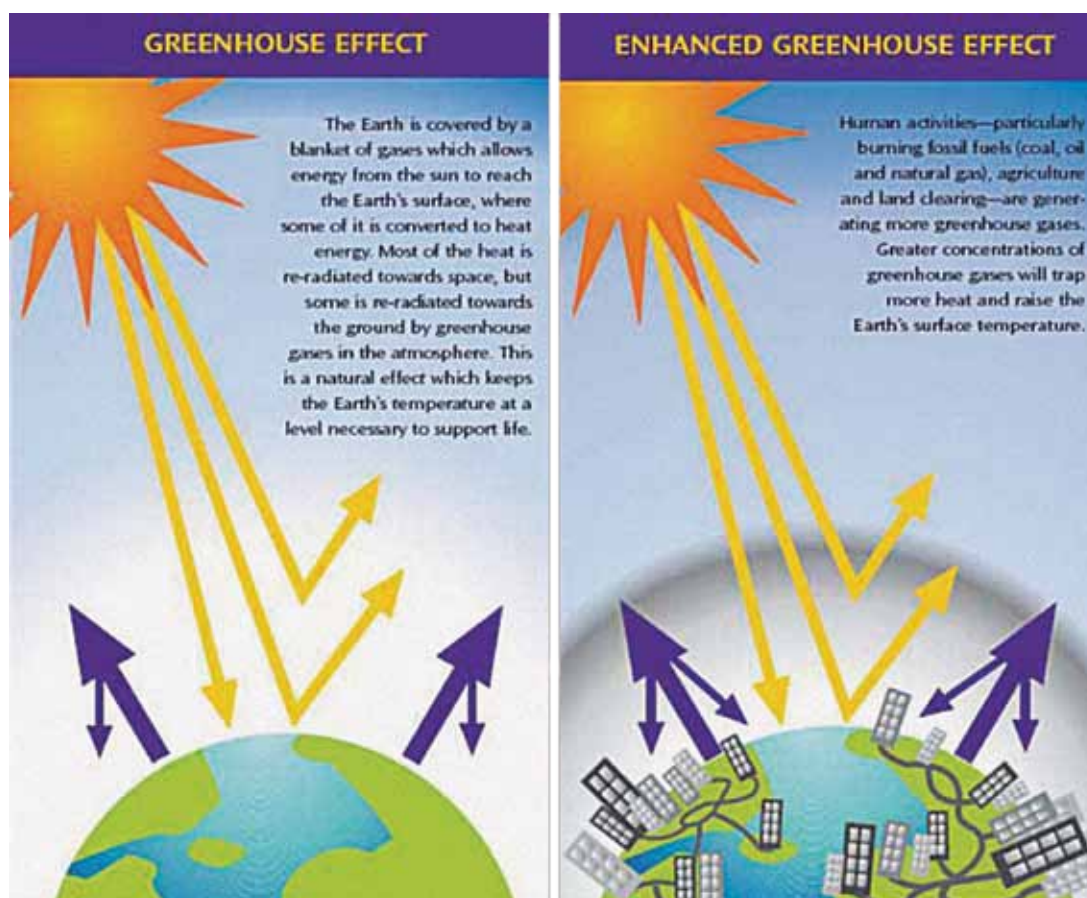


### 2.2.2 How does Global Warming change the Climate?

Current theory suggests the level of GHG in the atmosphere is actually a delicate balance, so that the Earth could get very cold when GHG are removed and very warm when gases are added. To understand just how delicate this balance is, current climate change is being caused by GHG trapping an increase of less than 0.5% of the Sun's energy.<sup>2 v</sup>

The global climate is very dependant upon temperature. Small changes in temperature can change ocean currents, wind patterns, and the size of the ice caps. This can fundamentally change the normal weather to patterns never seen before by humans.

Figure 2.2: A simplified diagram of the Greenhouse Effect



Source: Australian Greenhouse Office <http://www.climatechange.gov.au/>.

<sup>2</sup> Radiation from the Sun is 343 watts per square metre ( $\text{W/m}^2$ ). The increase in radioactive forcing from anthropogenic sources is about  $1.6 \text{ W/m}^2$ , or 0.46%.

## 2.3 Australia's Historical Climate Changes

Australia's climate has changed a great deal over the last twenty two thousand years, before stabilising about five thousand years ago.

The temperature was about 6°C cooler twenty two thousand years ago, so cold that much of the Earth's water was frozen into the massive ice sheets that covered much of Europe and North America. This meant that the sea level was about 135 metres lower than today.

Australia and New Guinea were joined by a land bridge, and the coastline of what became Australia was several hundred kilometres closer to Timor. As can be seen in Figure 2.3, the Gulf of Carpentaria was an inland lake.

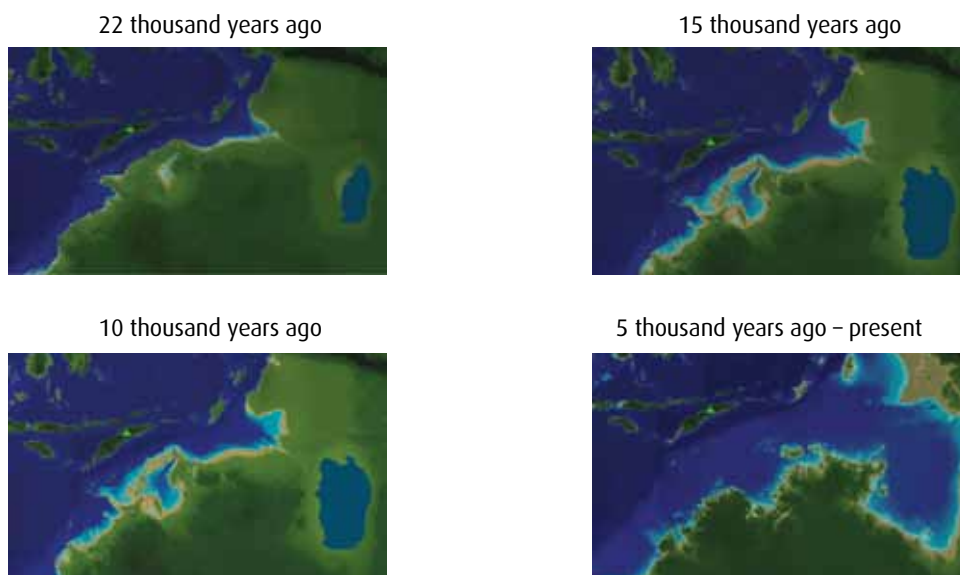
As the temperature began to rise, the vast polar ice caps and sheets around the globe melted,

and the sea level rose until it reached the present level where it has remained steady for about five thousand years.

All of these changes occurred because of a temperature rise of 6°C. It is very likely there will be significant warming through the 21st century and beyond. Current science models estimate a further 2°C to 7°C rise by 2100.

Reduction of GHG emissions could significantly reduce long-term warming. In Australia, the average surface temperature has increased by about 0.7°C since 1960 with some areas having warmed faster and some showing relatively little warming. The warming has caused an Australia-wide average increase in the frequency of extremely hot days and a decrease in the frequency of cold days.

Figure 2.3: Australia and New Guinea joined by a land bridge



Source: Collier, M. *The Sahul Time Project*, Monash University <http://sahultime.monash.edu.au/>.

## 2.4 Australia's Emissions

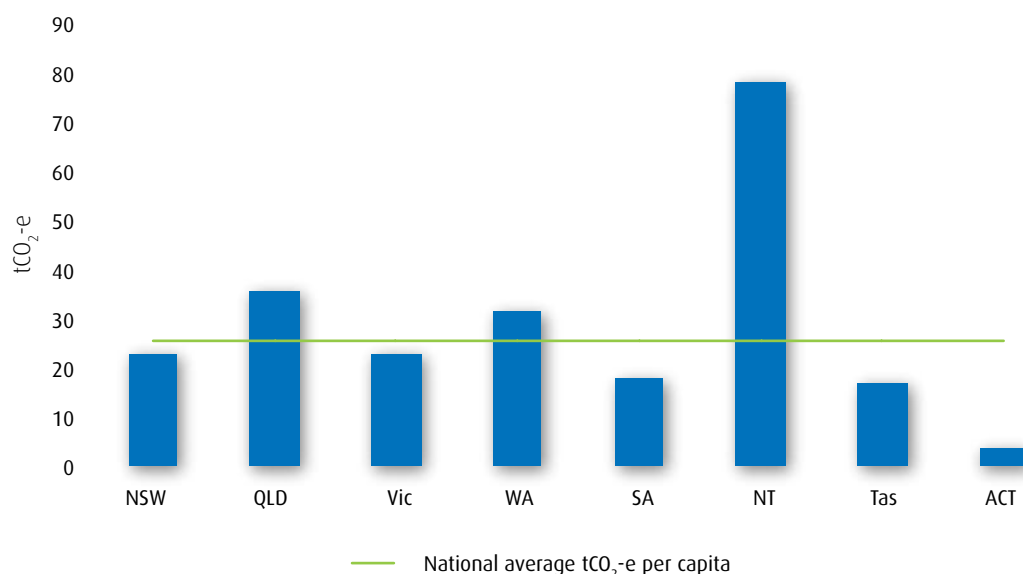
Australia produced about 549 million tonnes of measured GHG in 2009<sup>vi</sup>, about 25 tonnes per person. This is approximately 2% of total global emissions, or six times the global average per person.<sup>3</sup>

The Northern Territory produces 17 million tonnes of GHG per year<sup>vii</sup>, about 79 tonnes per person. Whilst this is approximately 3% of Australia's total GHG emissions<sup>viii</sup>, it equates to three times the Australian average per person, and nineteen times the global average per person as Figure 2.4 demonstrates.

<sup>3</sup> Global emissions are approximately 29,000 Mt of CO<sub>2</sub>-e per year. The world's population is estimated to be about 6.8 billion people.



Figure 2.4: Tonnes of CO<sub>2</sub>-e per capita by State and Territory



Source: adapted from Australian Government (2011) *Australia's National Greenhouse Gas Accounts - State and Territory Greenhouse Gas Inventories 2009*, and Australian Bureau of Statistics *Australian Demographic statistics*.

## 2.5 Northern Territory's Emissions

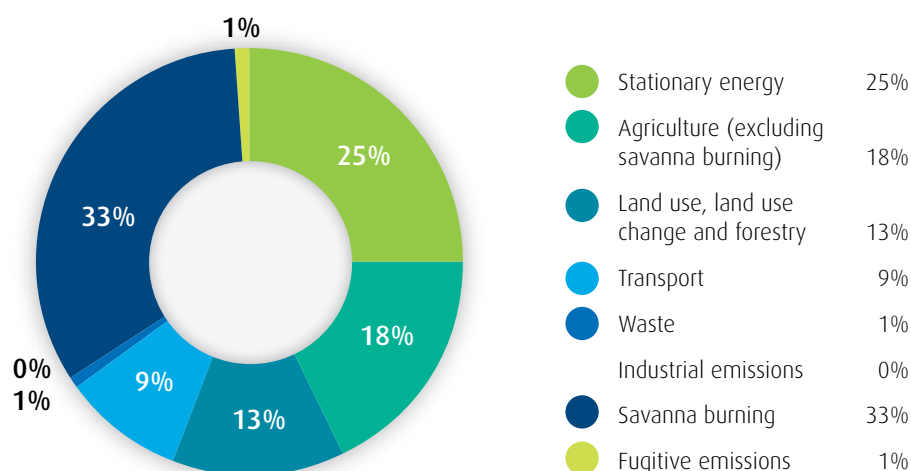
In December 2009 the Northern Territory Government (NTG) released its *Northern Territory Climate Change Policy*. Figure 2.5 demonstrates the breakdown of GHG emissions in the Northern Territory.

The Northern Territory's emissions profile is unique because of the:

- Vast geographical area of the Northern Territory and its low population density.
- Territory's climate, which gives rise to a high use of air-conditioning.

- Presence of some major emissions-intensive industries in the Territory, particularly the mining sector.
- High rate of savanna burning, which accounts for over a third, and in some years up to a half, of the Territory's total emissions. Without savanna burning, our emissions profile is similar to that of other parts of Australia, with stationary energy (i.e. electricity generation) being the largest source.

Figure 2.5: Northern Territory's greenhouse gas emissions



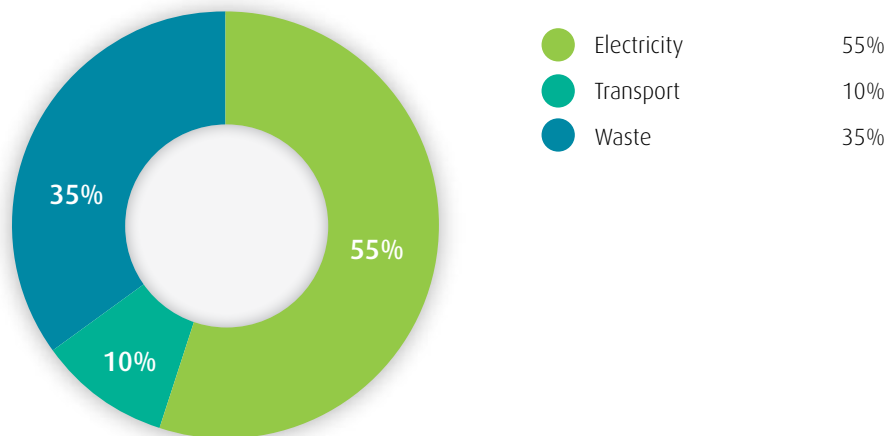
Source: Department of Chief Minister (2009) *Northern Territory Climate Change Policy 2009*, Darwin.

## 2.6 Darwin City Council's Emissions

Council's emissions are produced in three key sectors: stationary energy (electricity), transport (petrol/diesel) and waste (landfill). Regular Greenhouse Gas Inventories are undertaken externally for Council. Figure 2.6 demonstrates the breakdown of Council's emissions. Electricity creates 55% of Council's

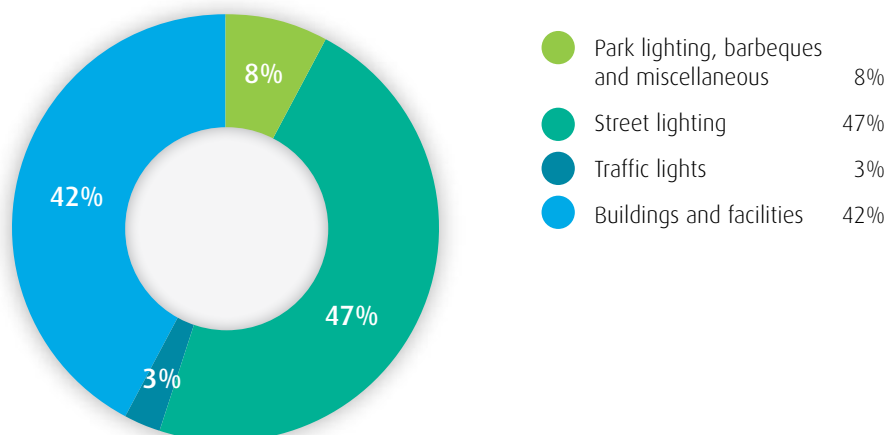
emissions, of which just under half is from street lighting. Figure 2.7 provides a further breakdown of electricity related emissions. Fuels such as petrol and diesel account for about 10% of Council's emissions, the majority from diesel. 35% of Council's emissions come from waste, such as office paper and garden material.

Figure 2.6 Council's Emissions in 2009 <sup>4</sup>



Source: adapted from RG Consulting (2010) Greenhouse Gas Emission Inventory 2010 Darwin City Council Report no. D-001-10, Darwin.

Figure 2.7 Council's Electricity emissions breakdown 2009



Source: adapted from RG Consulting (2010) Greenhouse Gas Emission Inventory 2010 Darwin City Council Report no. D-001-10, Darwin.

<sup>4</sup> Note: as landfill emissions have historically been reported as emissions generated by the community, the waste figure has been extrapolated using 2001 percentages.



Energy audits undertaken by Council for the 2009 period show that Council's corporate emissions were in the vicinity of 10,881 tonnes of CO<sub>2</sub>-e for the period. This is a 5% increase when compared to 10,358 CO<sub>2</sub>-e calculated for the 2007 period. This increase can be attributed to new infrastructure (street lighting, parks and community centre) associated with the new suburb of Lyons coming on line and an increase in service to accommodate for population growth.

Data provided to Council through its involvement with the CCP™ program calculated that, by implementing reductions identified in the *Greenhouse Action Plan 2001-2010* Council's corporate emissions would be in the vicinity of about 11,536 tonnes of CO<sub>2</sub>-e per annum by 2010. This figure relates to Council's operations only.

The first renewable energy project in tropical Australia, the Darwin Renewable Energy Facility, located at the Shoal Bay Waste Disposal Site, is a partnership between Darwin City Council and LMS Generation Pty Ltd. The facility generates approximately 9,000 megawatt hours of base-load renewable electricity each year using gas collected from the site. Gas generated from the breakdown

of organic waste is captured from the site via a network of below ground wells and interconnecting pipe work. The gas is converted to electricity which is exported into the electricity network, and on sold by Power and Water Corporation.

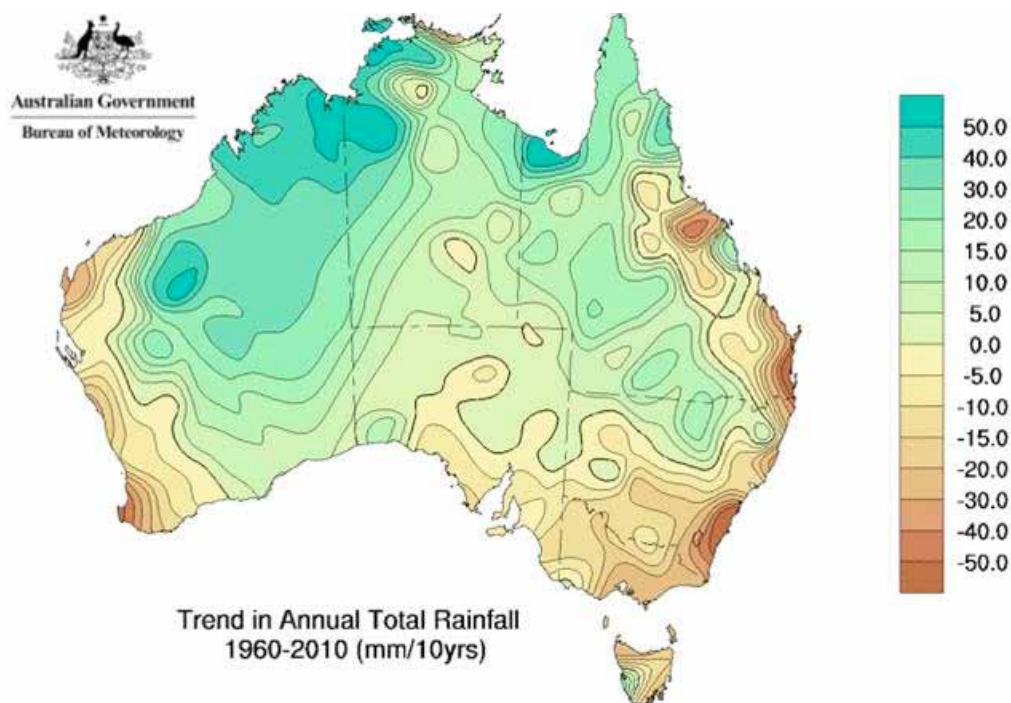
This facility has generated over 52,000 megawatt hours of renewable energy since it was commissioned in August 2005. The combustion of landfill gas to generate this base-load electricity, which is typically 50% methane, equates to the abatement of over 40,000 tonnes of carbon dioxide equivalent greenhouse gas emissions each year. The facility produces enough electricity to power approximately 1,800 homes each year.<sup>ix</sup>

## 2.7 Rainfall and Sea Level Impacts

### 2.7.1 Rainfall

Rainfall for Australia as a whole has been relatively stable (see Figure 2.8); however the geographical distribution has changed significantly in the last 50 years.<sup>x xi</sup> Annual rainfall for Darwin has steadily increased by 50-60 millimetres per decade. Predictions for the next several decades are unclear, however percentiles are often used to provide estimates of future activity.

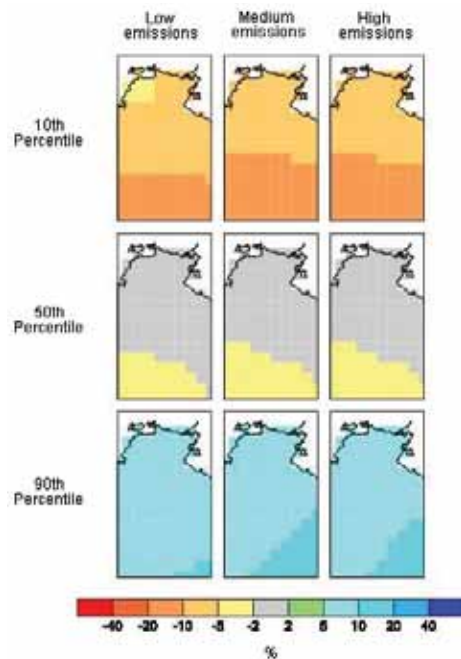
Figure 2.8: Trend in annual rainfall 1960-2010



Source: Bureau of Meteorology <http://www.bom.gov.au/>.

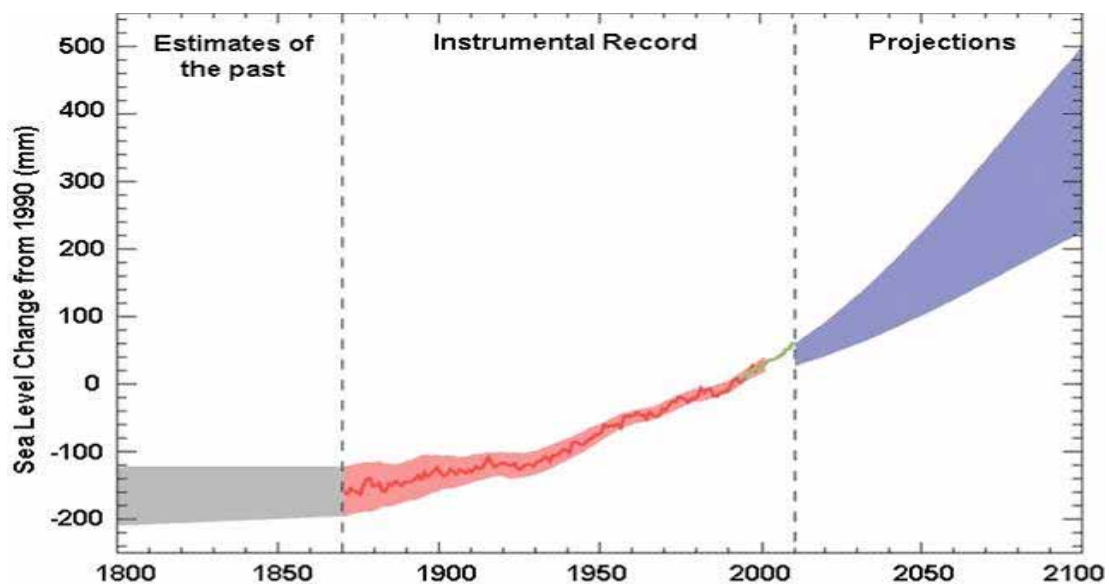
The 50th percentile is often used as the 'best estimate' of the future, which suggests little change in annual total rainfall. The 10th and 90th percentiles are 'outlier' scenarios. The greater the difference between the 10th and 90th percentiles, the higher the overall uncertainty in the projections. Figure 2.9 demonstrates rainfall percentile climate prediction where the 'High Emissions' scenario is considered 'business as usual', and aligns well with current GHG emissions globally. <sup>xii</sup>

Figure 2.9: Rainfall Climate prediction for 2030



Source: Climate Change in Australia  
<http://www.climatechangeinaustralia.gov.au/ntrain1.php>.

Figure 2.10: Sea Level change projection



Source: Intergovernmental Panel on Climate Change (2010) Fourth Assessment Report <http://www.ipcc.ch/>.

## 2.7.2 Sea Level

The *Fourth Assessment Report of the IPCC – 2007* states that sea levels have remained fairly constant for the last five thousand years, yet began to rise over the last century at an increasing rate as a result of climate change. The rise is caused predominantly by thermal expansion (water expands as it warms), and the loss of land-based ice due to increased melting. <sup>xiii</sup>

From a global perspective, Figure 2.10 demonstrates actual and estimated sea level rise from 1800 to 2100. The red section shows the recorded sea level, which became more accurate within the 20th century. The green line represents the introduction of accurate satellite mapping. The blue section represents the upper and lower limits for the sea level which were predicted in the 1990s. <sup>xiv</sup> The sea has risen about 20 centimetres over the last century, and in 2010, is currently tracking above the highest predictions made twenty years ago.

The projected sea level for Darwin is an 80 centimetre increase between 1990 and 2100, at the current rise of 7.2 millimetres per year. <sup>xv</sup> This projection does not include contributions from ice sheet melting, which could substantially increase the upper limit of sea level rise to several metres. <sup>xvi</sup>



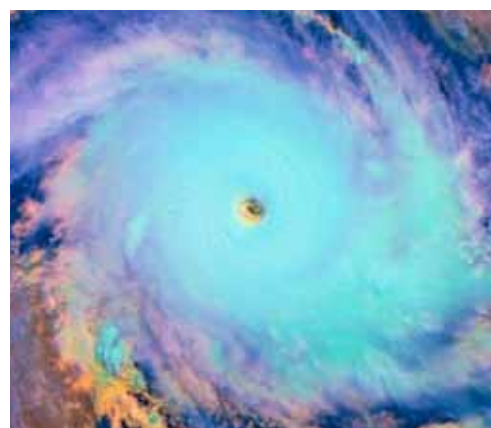
## 2.8 Severe Weather Events

### 2.8.1 Cyclones

Tropical storms are not predicted to be more frequent, but instead potentially more severe (Category 3–5), with larger peak wind speeds and heavier rain. Currently Darwin's building planning and emergency systems are prepared to deal with a Category 4 cyclone. (Cyclone 4 is quoted for Building/Planning and Category 5 for Emergency systems).

Future Australian cyclones are likely to continue to form in the Top End and projections show the potential is for them to move further south, thus continuing the trend over the last half-century.

Figure 2.11: Tropical Cyclone Monica 2006



Source: Bureau of Meteorology <http://www.bom.gov.au/>.

### 2.8.2 Storm Surges

The combination of more powerful cyclones with rising oceans poses a potential risk of severe storm surges, as much of Darwin is located only a few metres above sea level. As Figure 2.12 demonstrates, a storm surge occurs when the winds of a cyclone causes water to pile up against the coast. Unusually large waves then develop, which sweep inshore like a giant bulldozer. Storm surges are most dangerous when occurring at high tide. Worldwide, the majority

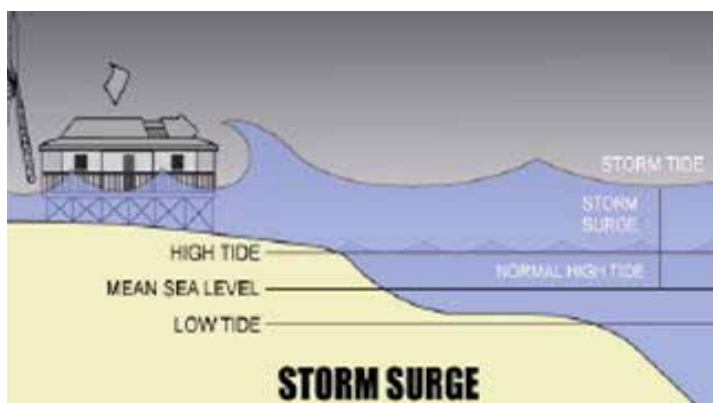
of deaths associated with cyclones are as a result of storm surges. <sup>xvii</sup>

The Northern Territory Government released an updated version of its *Darwin Area Storm Surge Inundation for 2100* in August 2011 which identifies primary (100 year average recurrence interval) and secondary (1,000 year average recurrence interval) storm surge. <sup>xviii</sup>



Figure 2.12: Storm Surge

Source: Hunter, J (2010)  
Presentation to Darwin City Council.

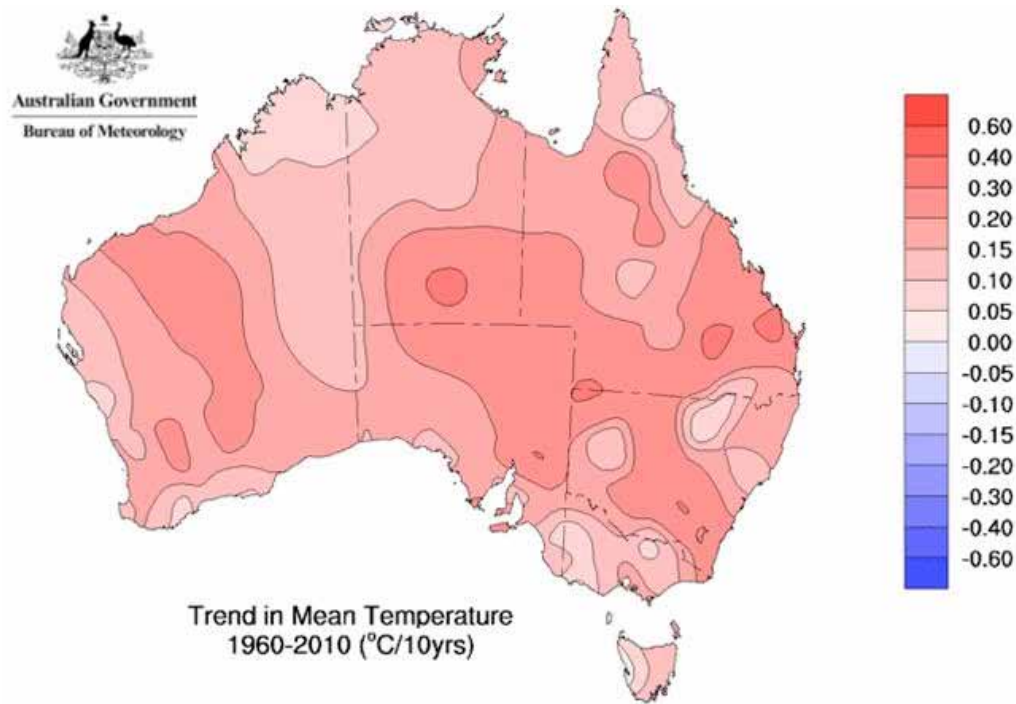


## 2.9 Temperature Increases

Since 1960 the average temperature in Darwin has increased by about 0.5-0.7°C (see Figure 2.13). 2000 to 2010 was Australia's warmest decade on record.

Since 1910, the average minimum temperature recorded at Darwin Airport has increased by approximately 2.5°C. <sup>xix, xx</sup>

Figure 2.13: Trend Mean Temperature 1960-2010



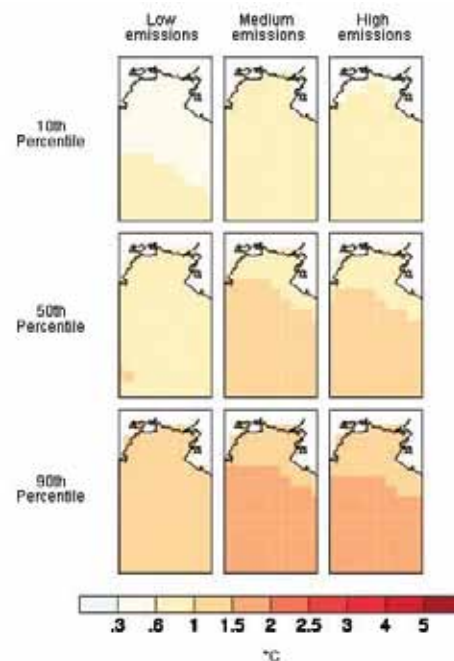
Source: Bureau of Meteorology <http://www.bom.gov.au/>.

The average annual number of days with a maximum temperature above 35°C has increased from 7.9 days during the 1941-1970 period, to 13.1 days during the 1981-2010 period, and under the best case scenarios will be 28 days by 2030, and 49 days by 2070.

Figure 2.14 outlines temperature predictions for 2030. Temperature is predicted to increase further by between 0.6°C to 1.5°C by 2030. There is a high level of confidence that warming will continue into the future, since all scenarios show warming. The current best estimate (50th Percentile, High Emissions) is for warming of 0.6°C to 1.0°C by 2030.

The worst-case scenario suggests possible warming of between 1.0°C and 1.5°C by 2030. <sup>xxi</sup> Under this scenario there could potentially be 308 days above 35°C annually by the year 2070.

Figure 2.14: Temperature Prediction for 2030



Source: Climate Change in Australia  
<http://www.climatechangeinaustralia.gov.au/nttemp1.php>.



## 2.10 Coastal Erosion

Council commissioned a report on coastal erosion in 2008, *Coastal Erosion Issues in the East Point and Nightcliff of Darwin* (for more information visit <http://www.darwin.nt.gov.au/aboutcouncil>).

Coastal erosion is an ongoing issue under current weather patterns, and is predicted to increase during future intense storm events.

Coast lines in Darwin have eroded at an average of 30 centimetres per year over the last three decades,<sup>xxii</sup> consistent with the estimation that erodible coasts will recede one metre for every centimetre rise in sea level.<sup>xxiii</sup> However, as the sea level is rising at an increasing rate, there will be an increased rate of erosion.

Higher sea levels will also result in more frequent flooding above a given level. Unless such changes are taken into account, design criteria for existing coastal structures will progressively become outdated.<sup>xxiv</sup>

Coastal infrastructure is of particular concern as much of Australia's population and infrastructure is in the coastal zone, increasing vulnerability to climate change. Council assets are vulnerable to inundation from sea level rise and extreme sea level events. Erosion and inundation threats are a critical issue for Council, the community and the Northern Territory Government.

Figure 2.15: Erosion at Nightcliff



Source: Jones, G., Baban, S. and Pathirana, S. (2008) *Coastal Erosion Issues in the East Point and Nightcliff areas in Darwin*. Southern Cross University, Lismore.

## 2.11 Biodiversity

The interaction of climate change with existing stresses – such as land clearing, fire, invasive pest plants and animal species, water quality – all add further levels of complexity especially in the low lying wetlands throughout the top end including the world heritage listed Kakadu National Park which is intrinsically linked with Darwin in terms of iconic biodiversity in the region and the tourism links for the Top End Capital City.

Kakadu is of very low elevation (0.2 to 1.2 metres above sea level), and as such is at severe risk of being inundated with sea water (see Figure 2.16). 72% of the freshwater habitat is vulnerable to a 30 centimetre sea level rise, which is predicted to occur by the year 2050. This would promote the growth of salt-tolerant systems such as mudflats and mangroves at the expense of freshwater wetland species.<sup>xxv</sup>

Climate change poses an increased risk to the remaining natural ecosystems in Darwin.<sup>xxvi</sup> For example, East Point Reserve will come under increasing threat from the sea level.<sup>xxvii</sup>

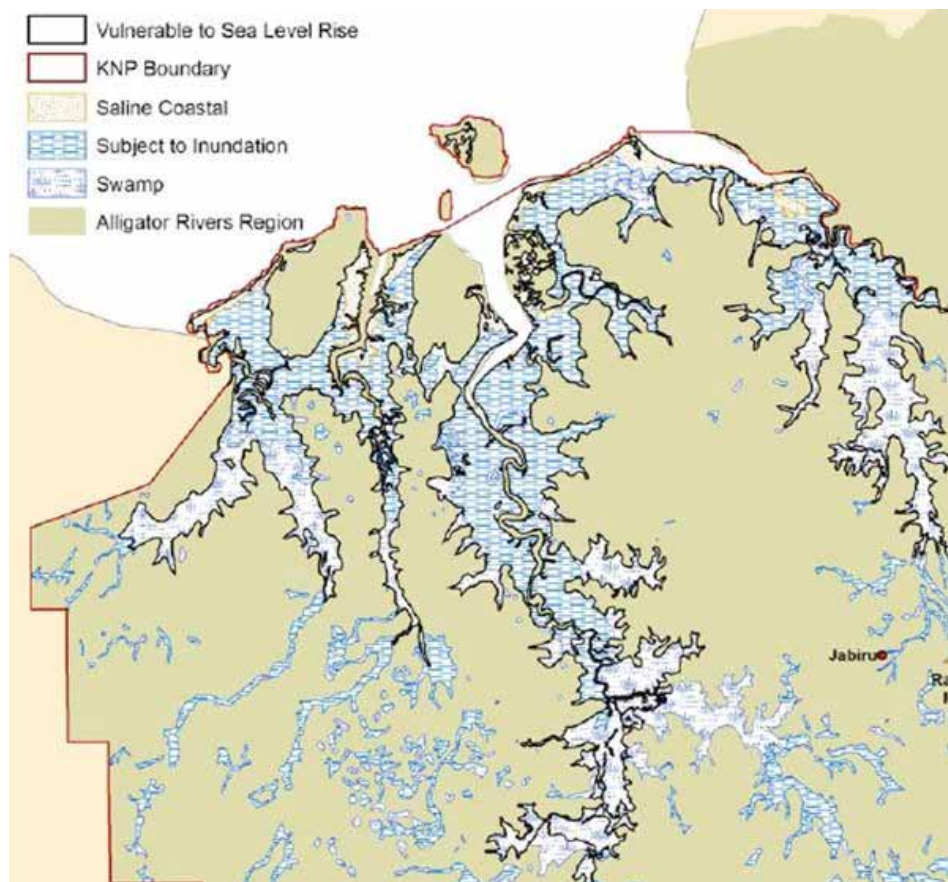
Darwin emerged as Australia's Most Sustainable City in the Australian Conservation Foundation's Sustainable Cities Index in 2010. Biodiversity is considered a core assessment element in liveability and sustainability indexes, scoring highly in the area of biodiversity, with Darwin considered to have a pristine environment when scored alongside other capital cities.<sup>xxviii</sup>

However, attention to careful on-going protection of Darwin's biodiversity is critical, particularly as increased demands for land clearing, new developments and increased infrastructure are sought to meet the fast growing City.

The climate change vulnerability of a new or existing infrastructure assets relies on a combination of responses to the retention of vegetation when addressing structural and physical changes.

Protection measures and increased plantings are key contemporary responses which international and national local governments are considering in order to enhance biodiversity.

Figure 2.16: Vulnerable areas of Kakadu National Park to sea level rise



Source: Bayliss, B., Brennan, K., Eliot, I., Finlayson, C.M., Hall, R., House, T., Pidgeon, R., Walden, D. and Waterman, P. (1997) *Vulnerability assessment of predicted climate change and sea level rise in the Alligator Rivers Region, Northern Territory Australia*. Supervising Scientist Canberra.



## 2.12 Climate Change and its effects on Darwin

Darwin has already been affected by climate change as a result of more extreme weather events. However, the available data for future climate change effects on Darwin is limited. The predicted effects are severe, although they remain potential rather than actual risks and include:

- Potential for rainfall, particularly increased extreme rainfall events.
- A rising sea level.
- A greater proportion of severe cyclones.
- Increased risk of storm surges.
- Increased daily temperature maximums.
- Continued coastal erosion.
- Continued loss of and risk to biodiversity.
- Risk of a contaminated water supply.

Other possible effects which may impact Darwin include:

- An increase in displaced people with the potential for people to move to Darwin as the sea level rises and inundates communities situated along low lying coastal areas.

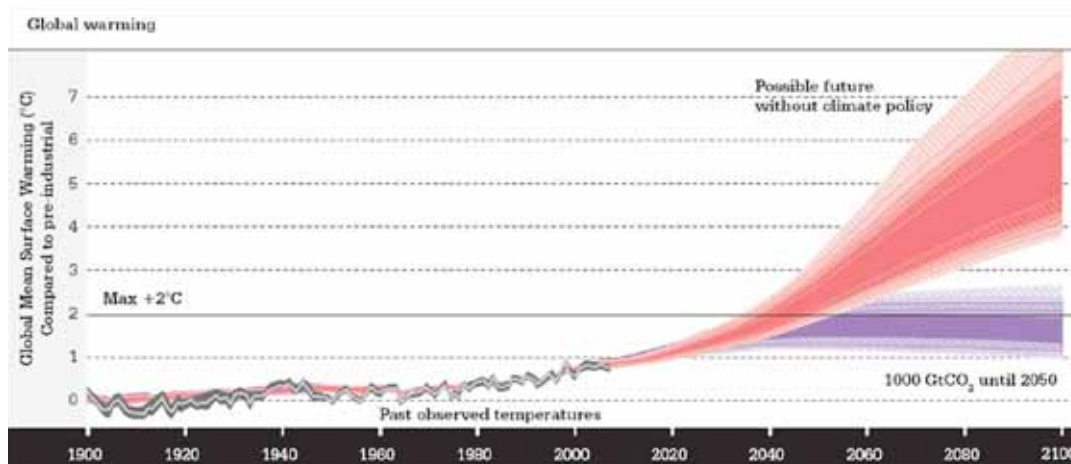
- An extension of the jellyfish season due to higher water temperatures.
- Increase in riparian and aquatic weeds and algal blooms which will impact on water quality.
- Saltwater intrusion into fresh water aquifers in some areas.
- Health impacts including the potential spread of disease.

## 2.13 Summary of Climate Change effects

Darwin faces significant challenges to its built and natural environment if the current predictions are borne out. It will be difficult to adapt to these changes. Economic studies have clearly demonstrated that the global cost of adapting to climate change is many times more than the cost of moving to a carbon-free global economy.<sup>5</sup>

Figure 2.17 demonstrates predicted surface temperatures in two scenarios – the pink as a business as usual basis versus a scenario where emissions are capped for 50 years (between 2000-2050) at 1 trillion tonnes.

Figure 2.17: Median projections and uncertainties of global – mean surface air temperature based on two emissions scenarios.



Source: Climate Commissioner (2011) *The Critical Decade – Climate science, risks and responses*, Climate Commission, Canberra.

<sup>5</sup> See The Stern Review on the Economics of Climate Change - [www.hm-treasury.gov.uk/sternreview\\_index.htm](http://www.hm-treasury.gov.uk/sternreview_index.htm), or *The Garnaut Review* - [www.garnautreview.org.au](http://www.garnautreview.org.au)



## Section 3 - Climate Change Action Plan 2011-2020

Darwin City Council (Council) is committed to the challenge of reducing its climate change footprint through the development of this *Climate Change Action Plan 2011-2020* which aims to develop and strengthen partnerships as well as reducing greenhouse gas (GHG) emissions to meet mitigation and adaptation actions.



## 3.1 Implementation

Darwin City Council is committed to the challenge of reducing its climate change footprint through the development of this *Climate Change Action Plan 2011-2020* which aims to develop and strengthen partnerships as well as reducing GHG emissions to meet mitigation and adaptation actions.

Sections 4 and 5 identify actions and performance indicators. A range of infrastructural and behaviour change initiatives will subsequently be developed and implemented in order to ensure the outcomes and performance indicators are met. These 'on ground' initiatives will also help to provide a basis for informing targets.

Darwin City Council developed its *Climate Change Action Plan 2011-2020* with advice from Council's Climate Change and Environment Advisory Committee, taking into consideration its earlier document called *Climate Change and Environmental Action Plan 2009-2012*.

The *Climate Change Action Plan 2011-2020 Plan* provides context for Council's Climate Change Policy and was endorsed at the Second Ordinary General Council Meeting on 25 October 2011.

## 3.2 Benefits

The following list of benefits will result from the implementation of the *Climate Change Action Plan 2011-2020*.

### 3.2.1 Economic

- Energy efficiency initiatives will reduce the financial costs associated with Council's energy usage.
- Leading by example and assisting the community by providing information and guidance for actions that can reduce community and personal energy consumption and therefore lead to financial savings.
- The implementation of measures within the plan may have flow on benefits for the local economy through the development of new markets in areas such as renewable energy and the creation of local job opportunities.

### 3.2.2 Social

- The improvement of public health through improved local air quality.
- The implementation of the plan will require the development of partnerships with the commercial, residential and industrial sectors of the community. This can act to improve community relations and foster a greater sense of community.
- The community will see Council as a leader in addressing climate change by taking positive action to reduce its emissions.

### 3.2.3 Environmental

- The implementation will reduce Council's environmental footprint, and in doing so provide a means of mitigating and adapting to the predicted effects of climate change.
- It is expected implementation will also play a role in the improvement of local air quality, reduction in waste to landfill as well as reducing pressure on water and energy reserves.
- Efficient resource use is central to the plan and is a core environmental imperative.

## 3.3 Commitment

### 3.3.1 Resourcing

The budget requirements and priorities contained in the plan will be assessed on an annual basis. Council will investigate the use of realised savings, resulting from the energy efficiency initiatives, to be reinvested to fund additional programs and actions.

### 3.3.2 Reporting

The *Climate Change Action Plan 2011-2020* should be seen as an opportunity for Council to attend to mitigation and adaptation activities to reduce its impact on climate change. It should be noted that the Action Plan is seen as a living document.

The Action Plan may require modification from time to time to reflect new science and initiatives as well as budget constraints. Council will report on the progress, amendments and any new initiatives for the plan through its annual report.

The Action Plan has been included in Council's central business plan and reporting system (Interplan®).

All actions within the Action Plan have been incorporated into individual departmental business plans for completion.

Monitoring of the Action Plan and reporting against each of these actions will occur each month per Council's internal performance reporting process.





## Section 4 – Corporate Actions

Develop strategies for Council to reduce its carbon footprint.



## 4.1 Climate Change

Action		Performance Indicator	Time Frame	Responsibility	Outcome
Mitigation					
C1	Develop strategies for Council to reduce its carbon footprint.	C1.1 Number of strategies adopted and targets met.	Ongoing	Office of the Chief Executive	Council adopted strategies and targets for carbon emission reductions.
Adaptation					
C2	Develop a best appropriate practice planting strategy to address erosion control and habitat conservation and restoration.	C2.1 Best appropriate practice strategy developed C2.2 Development of suitable species list	2011/12	Infrastructure	Erosion on Council land is reduced. Native habitats are conserved and maintained. High levels of biodiversity are maintained. Increased vegetation on Council assets act as urban carbon sinks.
C3	Advocate for the provision of coastal sea surge buffer zones.	C3.1 Number of advocacy activities undertaken	Ongoing	Office of the Chief Executive	NT planning schemes incorporate updated storm surge zones. Impacts of sea level rise and storm surge on new infrastructure are minimised. Sustainable planning outcomes for coastal areas within the municipality are increased.
C4	Provide input into development proposals in relation to energy efficiency and climate change impacts.	C4.1 Number of energy efficient clauses inserted into development proposals	Ongoing	Office of the Chief Executive	New developments and infrastructure take energy efficiency and climate change impacts into consideration.
		C4.2 Number of new developments and infrastructure with greater resilience to the impacts of climate change	2011/12	Infrastructure	
C5	Develop strategic partnerships for climate change initiatives.	C5.1 Strategic partnerships developed	Ongoing	Office of the Chief Executive	Information is shared and disseminated between partners. General knowledge of climate change initiatives across internal and external stakeholders is increased.

## 4.2 Water

Action		Performance Indicator	Time Frame	Responsibility	Outcome
<b>Mitigation</b>					
W1	Develop a Water Efficiency Action Plan for Council open space assets.	W1.1 Water Efficiency Action Plan developed W1.2 Actions to reduce water consumption are identified	2011/12	Infrastructure	Total potable water used in Council's open space assets is reduced. Council has a greater understanding of its water usage.
W2	Continue the installation of water saving equipment in Council facilities.	W2.1 Installation of water saving equipment in Council facilities W2.2 Number and type of projects implemented	Ongoing	Infrastructure	Total water use across Council facilities is reduced.
W3	Monitor and report on Council water usage.	W3.1 Annual water usage report	2011/12	Infrastructure	Potable water usage across Council activities is reduced.
<b>Adaptation</b>					
W4	Provide effective responses to Darwin Harbour Integrated Monitoring and Research Program.	W4.1 Participation in the development and implementation of a Darwin Harbour Water Quality Protection Plan	Ongoing	Office of the Chief Executive	Understanding of the Darwin Harbour and its natural processes, condition and variability is increased. Land-water interface in Darwin Harbour is protected.
W5	Incorporate principles of Water Sensitive Urban Design in Council Subdivisions and Development Guidelines.	W5.1 Water Sensitive Urban design incorporated into guidelines W5.2 Promotion of Water Sensitive Urban Design for Darwin subdivisions	2011/12	Infrastructure	Subdivisions and developments incorporate water sensitive urban design.
W6	Incorporate strategies for landscaping, utilising water conservation principles and appropriate plant species in public open spaces and road verges.	W6.1 Number of strategies implemented	2015/16	Infrastructure	Potable water used in Council's open space assets is reduced.



### 4.3 Land

Action		Performance Indicator	Time Frame	Responsibility	Outcome
Mitigation					
L1	Develop a strategy to maintain and enhance the urban forest.	L1.1 Strategy developed L1.2 Strategy implemented	2011/12	Infrastructure	Native habitats created in urban areas are increased where appropriate.
Adaptation					
L2	Develop and implement a Coastal Erosion Management plan for Council owned land.	L2.1 Development of a Coastal Erosion Management plan for the municipality L2.2 Implementation of Coastal Erosion Management Plan	2011/12	Infrastructure	Council has an increased understanding of erosion processes and effects of sea level rise in Darwin coastal areas.  Erosion on Council land is managed.
L3	Take into account coastal erosion, sea surge and flooding in all new infrastructure and development projects.	L3.1 New infrastructure and development projects constructed taking into consideration the future effects of sea level rise and storm surge zones	2011/12	Infrastructure	Infrastructure developed with resilience to the impacts of climate change.

### 4.4 Air Quality

Action		Performance Indicator	Time Frame	Responsibility	Outcome
Adaptation					
A1	Lobby for external scientific approaches to improve and monitor air quality.	A1.1 Number of lobbying activities undertaken.	Ongoing	Office of the Chief Executive	Council has an increased understanding of air quality issues. Air quality is monitored.



## 4.5 Biodiversity

Action		Performance Indicator	Time Frame	Responsibility	Outcome
Mitigation					
B1	Increase native endemic vegetation to ensure conservation of existing communities.	B1.1 Number of areas of conserved habitat for biodiversity	2011/12	Infrastructure	Native habitats are conserved and maintained.  Contiguous habitat corridors are increased.  High levels of biodiversity are maintained.
Adaptation					
B2	Advocate for biodiversity and habitat monitoring by external organisations.	B2.1 Number of advocacy activities undertaken	Ongoing	Office of the Chief Executive	Native habitat areas are monitored.  Priority biodiversity conservation areas are identified, and then established.
B3	Continue to revegetate East Point Recreation Reserve.	B3.1 Number of revegetation activities undertaken	Ongoing	Infrastructure	Native endemic habitat at East Point is increased.

## 4.6 Recycling and Waste

Action	Performance Indicator	Time Frame	Responsibility	Outcome
Mitigation				
R1	Review and enhance Council's kerbside waste minimisation strategy.	R1.1 Review of strategy undertaken R1.2 Volume of waste sent to landfill per capita R1.3 Recycling rates per capita	2013/15  Infrastructure	Council's Kerbside Waste Minimisation Strategy is reviewed.  Volume of waste sent to landfill per capita is reduced.  Recycling rates per capita are increased.  Life of Shoal Bay landfill is extended.
R2	Advocate and promote a greater range of economical recyclable products to be included within Council's recycling service.	R2.1 Number of advocacy and promotional opportunities undertaken	2017  Infrastructure	Inclusion of greater range of economical recyclable products in new kerbside collection contract 2017.  Volume of waste sent to landfill per capita is reduced.  Recycling rates per capita are increased.  Community satisfaction with Council's recycling service is increased.

Action	Performance Indicator	Time Frame	Responsibility	Outcome	
Mitigation					
R3	Continue to promote Council's Policy Position on Container Deposit Legislation.	R3.1 Number of promotional activities undertaken	2011/12	Infrastructure	Container Deposit Legislation introduced and promoted.
R4	Develop a Green Purchasing Policy for Council.	R4.1 Development of a Green Purchasing Policy R4.2 Percentage of green products and services purchased	2012/13	Corporate Services	Increased number of green products and services purchased. Council's influence on the supply chain through education and support for sustainable low emission industries is increased.
R5	Develop an internal waste policy with actions to encourage staff to reduce their waste production while at work.	R5.1 Internal waste policy developed	2011/12	Office of the Chief Executive	Volume of waste sent to landfill per full time equivalent is reduced. Recycling rates per full time equivalent are increased. Paper consumption rate per full time equivalent is reduced.
R6	Monitor and report on Council's waste production.	R6.1 Waste reporting including recycling rates	2012/13	Office of the Chief Executive	Volume of waste sent to landfill per full time equivalent is reduced. Recycling rates per full time equivalent are increased. Paper consumption rate per full time equivalent is reduced.
R7	Encourage all areas of Council, community, markets and other events to implement environmentally preferable packaging.	R7.1 Ratio of community events using environmentally preferable packaging	2011/12	Corporate Services	Council's influence on the supply chain through education and support for sustainable low emission industries is increased.
Adaptation					
R8	Promote the minimisation of plastic bag use and packaging internally.	R8.1 Volume of plastic bags and packaging sent to landfill per full time equivalent	Ongoing	Office of the Chief Executive	Volume of plastic bag and packaging waste sent to landfill per full time equivalent is reduced.



## 4.7 Energy

Action	Performance Indicator	Time Frame	Responsibility	Outcome	
Mitigation					
E1	Undertake programmed energy audits on Council's major energy consuming facilities every three years.	E1.1 Energy Audits completed E1.2 Continual benchmarking of progress E1.3 Identified areas in Council's operations where cost effective energy reductions can be made	Ongoing (every three years)	Office of the Chief Executive	Council's energy consumption is reduced.
E2	Conduct Greenhouse Gas Inventories every three years.	E2.1 Regular Greenhouse Gas Inventories undertaken E2.2 Regularly address Council's compliance with emissions trading scheme	Ongoing	Office of the Chief Executive	Council has increased understanding of its greenhouse gas production and related impacts.
E3	Apply ecologically sustainable development (ESD) design principles and energy efficiency criteria for new and refurbished council facilities.	E3.1 Ratio of new and refurbished Council buildings with ESD design principles applied	Ongoing	Infrastructure	ESD principles applied across new and refurbished Council facilities. Council's energy consumption is reduced.
E4	Investigate feasibility of renewable generated power for use within Council's facilities and parks.	E4.1 Feasibility studies undertaken	Ongoing	Infrastructure	Projects which utilise renewable generated power are implemented.
E5	Lobby Power and Water Corporation to provide local accredited GreenPower.	E5.1 Number of lobbying activities undertaken.	Ongoing	Office of the Chief Executive	Power and Water supply local accredited GreenPower. Opportunity for Council to purchase local accredited GreenPower is available.
E6	Encourage energy efficient features in new public lighting design.	E6.1 Ratio of energy efficient features implemented versus actual projects	2011/12	Infrastructure	Council's public lighting efficiency is increased.

Action		Performance Indicator	Time Frame	Responsibility	Outcome
Mitigation					
E7	Develop a Green Computer Policy.	E7.1 Development of a Green Computer Policy	2013/14	Corporate Services	Council's energy consumption is reduced.  Paper consumption rate per full time equivalent is reduced.
E8	Develop a Green Fleet policy to minimise GHG emissions including investigating the use of electric vehicles/scooters for Darwin central business district usage.	E8.1 Development of a Green Fleet Policy  E8.2 Investigation into electric vehicles/ scooters undertaken	2013/14	Corporate Services	Council's travel related greenhouse gas emissions are reduced.  Electric vehicles or scooters are considered for city usage.  Percentage of lower emissions vehicles in Council's fleet increased.
E9	Promote the benefits of car-pooling, biking, walking and public transport use to staff.	E9.1 Number of promotional activities undertaken	Ongoing	Office of the Chief Executive	Staff travelling to work by environmentally preferable travel methods is increased.  Staff participation in Ride To Work day is increased.
E10	Allocate staff priority parking spaces for car-poolers.	E10.1 Set-up of priority car spaces	2013/15	Corporate Services	Staff car-pooling is increased.
E11	Monitor and report Council's energy usage and emissions.	E11.1 Annual energy reporting	2011/12	Office of the Chief Executive	Council's energy consumption and emissions production are reduced.
Adaptation					
E12	Promote energy conservation and concept of sustainable living to all staff.	E12.1 Number of promotional activities undertaken	Ongoing	Office of the Chief Executive	Council's energy consumption is reduced.  The number of homes with ESD principles applied within the municipality is increased.



## Section 5 – Community Actions

Provide information and tools to assist reduction of energy consumption within the community.





## 5.1 Climate Change

Action		Performance Indicator	Time Frame	Responsibility	Outcome
<b>Mitigation</b>					
CMC1	Develop public education displays for libraries and public events around climate change issues.	CMC1.1 Number of public displays and events participated in	Ongoing	Office of the Chief Executive	Community awareness of climate change issues and associated challenges is increased.
<b>Adaptation</b>					
CMC2	Provide information and tools to assist reduction of energy consumption within the community.	CMC2.1 Number of programs and products delivered	Ongoing	Office of the Chief Executive	Community has an increased understanding of energy consumption and how it relates to their actions.
CMC3	Work with and support, community based sustainability events.	CMC3.1 Number of public displays and events participated	Ongoing	Office of the Chief Executive	Community awareness of climate change issues and associated challenges is increased.
CMC4	Provide climate change and environment grant funding.	CMC4.1 Number of successful applicants to grants CMC4.2 Estimated reduction of greenhouse gas emissions due to grants	Ongoing	Office of the Chief Executive	Climate change and environment related community projects and programs are undertaken. Community awareness of climate change issues and associated challenges is increased.



## 5.2 Water

Action		Performance Indicator	Time Frame	Responsibility	Outcome
Mitigation					
CMW1	Build partnerships with external agencies to provide community education campaigns for reduced water usage.	CMW1.1 Number of partnerships developed	Ongoing	Office of the Chief Executive	Community education campaigns are integrated through partnerships.
		CMW1.2 Number of combined education campaigns undertaken			

## 5.3 Land

Action		Performance Indicator	Time Frame	Responsibility	Outcome
Mitigation					
CML1	Advocate for urban intensification along public transport corridors, high density and urban design, incorporating universal design principles including 'Aging-in-Place' independent living principles.	CML1.1 Number of submissions made for efficient urban design projects	Ongoing	Office of the Chief Executive	Carbon dioxide is reduced and energy efficiencies are increased within the municipality.

## 5.4 Biodiversity

Action		Performance Indicator	Time Frame	Responsibility	Outcome
Mitigation					
CMB1	Work with a variety of government and non government organisations to promote benefits of community tree planting days.	CMB1.1 Number of public displays and events participated in annually  CMB1.2 Number of revegetation programs completed annually  CMB1.3 Number of Council contracts	Ongoing	Office of the Chief Executive	Revegetation projects undertaken on Council land are increased.
Adaptation					
CMB2	Promote the protection of areas of high conservation values in the Darwin municipality.	CMB2.1 Number of promotions undertaken	Ongoing	Office of the Chief Executive	Refuge areas for threatened species are increased.  High conservation value areas are increased within the municipality.

## 5.5 Recycling and Waste

Action		Performance Indicator	Time Frame	Responsibility	Outcome
Mitigation					
CMR1	Promote recycling and resource recovery at community events including markets and use promotional activities to assist in educating residents in reduction of waste generated from households.	CMR1.1 Number of promotions undertaken	2011/12	Office of the Chief Executive	Community has a greater understanding of recycling and resource recovery.  Volume of waste sent to landfill per capita is reduced.  Recycling rates per capita are increased.  Resource recovery rates are increased.
Adaptation					
CMR2	Provide prominent recycling information on recycling receptacles.	CMR2.1 Provision of information on recycling receptacles	Ongoing	Infrastructure	Contamination of recyclables is reduced.  Volume of waste sent to landfill per capita is reduced.
CMR3	Continue to provide contemporary community education for waste and recycling.	CMR3.1 Number of promotional activities undertaken	Ongoing	Infrastructure	Volume of waste sent to landfill per capita is reduced.  Recycling rates per capita are increased.
CMR4	Support the minimisation of single use plastic bags within the community.	CMR4.1 Volume of plastic bags consumed within the community	Ongoing	Office of the Chief Executive	Plastic bag litter is reduced within the community.  Volume of single use plastic bag consumed is decreased.



## 5.6 Energy

Action		Performance Indicator		Time Frame	Responsibility	Outcome
Mitigation						
CME1	Promote energy efficient building design suitable for the tropical climate of Darwin in partnership with other organisations.	CME1.1	Number of promotions undertaken	Ongoing	Office of the Chief Executive	New buildings and retrofits using ABGR, NABERS and NatHERS principles are increased.  Community awareness of opportunities and benefits of energy efficient design is increased.
CME2	Advocate to relevant authorities the potential for reward schemes or incentives for residents who implement measurable power conservation initiatives.	CME2.1	Number of advocacy opportunities undertaken	Ongoing	Office of the Chief Executive	Resident uptake of reward schemes and incentives is increased.
CME3	Promote emission reduction strategies, cool housing designs, Energy Star rated appliance information and grid connected solar panels.	CME3.1	Number of promotional activities undertaken	Ongoing	Office of the Chief Executive	Uptake of emission reduction strategies and cool housing design is increased.  Community has a greater understanding of the connections between every day actions and energy consumption.
CME4	Participate in programs encouraging efficient energy usage in households.	CME4.1	Number of public displays and events participated in	Ongoing	Office of the Chief Executive	Community has a greater understanding of the connections between every day actions and energy consumption.  Uptake of programs encouraging reduced household energy consumption is increased.

Action		Performance Indicator	Time Frame	Responsibility	Outcome
Mitigation					
CME5	Advocate to relevant authorities energy-efficient design standards and codes for commercial and industrial premises.	CME5.1 Number of advocacy opportunities undertaken	Ongoing	Office of the Chief Executive	Inclusion of energy efficient design within building codes and standards both locally and nationally.
CME6	Promote the benefits of car-pooling, biking, walking and public transport use in the community.	CME6.1 Number of promotional activities undertaken	Ongoing	Office of the Chief Executive	Community has a greater understanding of green travel benefits. Increased uptake of green travel methods.
CME7	Lobby for sustainable public transport systems.	CME7.1 Number of lobbying activities undertaken	Ongoing	Office of the Chief Executive	Government investigates and implements sustainable public transport systems where feasible.
CME8	Advocate the introduction of 'Park and Ride' Hubs.	CME8.1 Number of advocacy opportunities undertaken	Ongoing	Office of the Chief Executive	Introduction and uptake of 'Park and Ride' hubs.





## Section 6 – Abbreviations, Glossary and References





## 6.1 Abbreviations

<b>ABGR</b> –	Australian Building Greenhouse Rating	<b>ICLEI</b> –	International Council for Local Environmental Initiatives
<b>ABS</b> –	Australian Bureau of Statistics	<b>IPCC</b> –	Intergovernmental Panel on Climate Change
<b>ABARE</b> –	Australian Bureau of Agriculture Research Economics	<b>LED</b> –	Light Emitting Diode
<b>AGO</b> –	Australian Greenhouse Office	<b>LPG</b> –	Liquid Petroleum Gas
<b>CCP™</b> –	Cities for Climate Protection™	<b>IPCC</b> –	Intergovernmental Panel on Climate Change
<b>BOM</b> –	Bureau of Meteorology	<b>CH<sub>4</sub></b> –	Methane
<b>CO<sub>2</sub></b> –	Carbon Dioxide	<b>Mt</b> –	Million tonnes
<b>CO<sub>2</sub>-e</b> –	Carbon Dioxide Equivalent	<b>NABERS</b> –	National Australian Built Energy rating System
<b>CFC</b> –	Chlorofluorocarbon	<b>NatHERS</b> –	Nationwide House Energy Rating Scheme
<b>CSIRO</b> –	Commonwealth Scientific and Industrial Research Organisation	<b>NGGI</b> –	National Greenhouse Gas Inventory
<b>DCC</b> –	Darwin City Council	<b>NGRS</b> –	National Greenhouse Response Strategy
<b>ESD</b> –	Ecologically Sustainable Development	<b>NGS</b> –	National Greenhouse Strategy
<b>FCCC</b> –	The United Nations Framework Convention on Climate Change	<b>N<sub>2</sub>O</b> –	Nitrous Oxide
<b>FTE</b> –	Full Time Equivalent	<b>NT</b> –	Northern Territory
<b>GHG</b> –	Greenhouse Gas Emissions	<b>NPI</b> –	National Pollution Index
<b>GWP</b> –	Greenhouse Warming Potential	<b>O<sub>2</sub></b> –	Ozone
<b>Ha</b> –	Hectare	<b>WMO</b> –	World Meteorological Organisation
<b>HWS</b> –	Hot Water System	<b>UNEP</b> –	United Nations Environment Program

## 6.2 Glossary

<b>Abatement</b>	Reducing the degree or intensity of, or eliminating greenhouse gas emissions.
<b>Anthropogenic</b>	Resulting from or produced by human activities, in particular, factors that affect the atmosphere due to the burning of fossil fuels, deforestation and other land use change.
<b>Brown fields/development</b>	This relates to previously developed land which is available for re-use.
<b>CO<sub>2</sub></b>	Carbon dioxide is a colourless, odourless gas that occurs naturally and is also emitted by fossil fuel combustion and land clearing.
<b>CFCs</b>	Chlorofluorocarbons are greenhouse gases used for refrigeration, aerosol propellants and other purposes. These gases bind with ozone molecules in the Earth's atmosphere and deplete the ozone layer.
<b>Carbon sequestration</b>	Carbon sequestration is defined by the IPCC as the process through which carbon is absorbed by biomass such as trees, soils and crops.
<b>Carbon sink</b>	Ecosystems, notably forest and oceans which remove carbon from the atmosphere by absorbing and storing it, thereby offsetting carbon dioxide emissions, are referred to as carbon sinks.
<b>Climate</b>	Climate is defined by the WMO as 30 years of weather including temperature, precipitation and wind.
<b>Climate change</b>	This refers to the statistically significant variation in the average state of climate over a minimum 30 year period for an extended period
<b>Climate variability</b>	In comparison to climate change, climate variability describes a range of weather conditions which, averaged together, describe the 'climate' of a region. In some parts of the world, or in any region for certain time periods or parts of the year, this variability can be weak, i.e. there is not much difference in the conditions within that time period. However, in other places or time periods, conditions can swing across a large range, from freezing to very warm, or from very wet to very dry, thereby exhibiting strong variability.
<b>FTE</b>	Full Time Equivalent relates to the number of equivalent full time staff which work in an organisation. For example, 2 x part time staff = 1 x full time equivalent.
<b>Greenfields development</b>	This refers to undeveloped agricultural, native vegetation or landscape designed land being developed for large projects such as housing, factories, airports, etc.
<b>GWP</b>	Greenhouse Warming Potential is an index describing characteristics of greenhouse gases that represents the combined effect of the differing times these gases remain in the atmosphere and their relative effectiveness in absorbing outgoing infrared radiation.
<b>IPCC</b>	Intergovernmental Panel on Climate Change was set up in 1988 by the WMO and UNEP to advise governments on the latest science of climate change, its impacts and the possible adaptation and mitigation activities.
<b>Methane</b>	Methane is a greenhouse gas produced through processes including decomposition of landfill waste in the absence of oxygen; animal digestion; and production of gas and oil.

<b>Mitigation</b>	Mitigation of global warming refers to actions taken to reduce the greenhouse gas emissions in order to minimize their effects on global climate change. Instead of trying to adapt to global warming, mitigation refers to the prevention and control of the products and actions that cause climate change.
<b>NGGI</b>	National Greenhouse Gas Inventory provides annual reports on Australia's greenhouse gas emissions as part of commitments under the UNFCCC. It is based on international guidelines established by the IPCC and reports on human – induced greenhouse gas emissions in six sectors – energy, industrial processes, solvent and other product use, agriculture, land use changes and forestry and waste.
<b>N<sub>2</sub>O</b>	Nitrous Oxide is a greenhouse gas mainly produced by industrial processes, fertiliser use and other agricultural activities, including land clearing and biomass burning.
<b>Per capita</b>	Relates to a measurement of per person.
<b>Reforestation</b>	It is the direct human-induced conversion of non-forested land to forested land through planting, seeding and /or promotion of natural seed sources
<b>Sequestration</b>	The removal of greenhouse gases from the atmosphere by vegetation or technological measures.
<b>Sector</b>	Emissions by sector can be made up of multiple emissions sources.



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