

DRAFT

City of Wanneroo

**Climate Change Adaptation and
Mitigation Strategy**

2016-2020



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EXECUTIVE SUMMARY

City of Wanneroo Strategic Community Plan 2013/14 to 2023/24 aspires to achieve "a sustainable natural, built and healthy environment". In response to this community vision, an action within the City of Wanneroo Corporate Business Plan has been the preparation of this report, the Climate Change Adaptation and Mitigation Strategy (CCAMS).

The purpose of the CCAMS is to identify areas where the City of Wanneroo and the community it represents are exposed to climate change and provide risk management adaptation measures to reduce the risk.

In Western Australia, the CSIRO predicts climate change to result in hotter days and nights; reduced rainfall in the southern region, but more intense rain periods; more extreme weather conditions such as long periods of drought and severe storms; more bushfires; and rising sea levels¹. It is expected that the City of Wanneroo will be affected by these impacts.

This report looks specifically at adaptation; the ways the City of Wanneroo can adapt to, and be prepared for the unavoidable impacts of climate change as they arise. The report outlines the adaptive actions that are required to be implemented across the City and the required timeframes needed for successful implementation.

The City's Risk Management Framework has been used to identify effective management measures for the risks associated with climate change. The Risk Management Framework will assist in the implementation of the CCAMS adaptation actions and will allow for efficient allocation of resources addressing issues of utmost importance.

1. Background

The City of Wanneroo recognises and acknowledges the risk that climate change presents to its local residents and the wider global community. To date, the City has made significant progress in terms of reducing its impact on climate change through a number of key initiatives.

The City's Local Environment Plan 2009-14 promoted a focus on reducing greenhouse gas emissions. This vision was realised with the inception of the Sustainability Investment Fund Reserve (SIF) in 2010. The fund has been particularly successful in reducing energy and greenhouse gas emissions. The role of the SIF is to fund initiatives aimed at reducing the City's environmental footprint and reducing the City's energy bills. Utility cost savings accrued by SIF projects are redirected back into the fund for future use.

The City has funded large scale solar panel systems at high energy usage sites that had been identified as having ideal conditions for solar panel investment. These include the Civic Centre, Aquamation, Kingsway Sporting Complex and Clarkson Library. This has ensured the City is less reliant on coal fired electricity and has provided a public demonstration of Council's commitment to the environment - achieving environmental outcomes in a financially viable way.

In more recent times, the City has diversified its investment in the future by installing a voltage optimisation system at Aquamation. This electrical energy saving device is further cutting the City's energy usage by ensuring less energy is wasted within the facility. The new equipment is expected to have a short financial pay-back period of less than two years.

The City of Wanneroo made a very public commitment to sustainability in 2011, jointly sponsoring the design and build of the award winning EcoVision display homes. The two homes showcased best practice affordable and sustainable design options including water conservation, greywater recycling, photovoltaics, healthy home principles and universal design. The homes were open to the public for 12 months and took out numerous awards including the National Greensmart Award for the Sustainable Townhouse/ Villa category.

Looking towards the future, the planned Civic Centre extension project has a high level of sustainable inclusions. These include passive solar design orientation, solar panels, energy efficient lighting and sunshades (reducing the need for air conditioning). All of these features will ensure less reliance on coal fired electricity. The running costs will be lower and the comfort of occupants will be maximised for the life of the building.

In addition, the table below outlines some current measures by the City to address impacts of climate change:

Risk	Current Actions	Related Impact
Increasing temperature	<ul style="list-style-type: none"> • Implementation of Local Emergency Management and Recovery Plans • Annual bushfire awareness community day • Annual review of current emergency management risks within the City • Quarterly local Emergency Management Committee meetings with all relevant agencies; and • Fire Protection Officers employed by the City. 	Increased potential for bushfires
Increasing temperature	<ul style="list-style-type: none"> • Annual trees planning programs implemented at various sites around the City including wetlands, bushlands, foreshore and parks/reserves. • Preparation of Streetscape improvement policy • Review of Significant Tree Policy 	Increase in surface temperature
Reducing rainfall	<ul style="list-style-type: none"> • Implementation of Hydrozoning program involving the staged replacement of irrigation systems in parks and reserves, to ensure water is used more effectively throughout parks. • Preparation and implementation of a Water Conservation Plan • Preparation and implementation of North West Corridor Water Supply Strategy (with Department of Water) 	Reduced water availability for park areas
Extreme weather events	<ul style="list-style-type: none"> • Photographic monitoring following extreme storm events at Quinns Beach, Two Rocks and Yanchep Lagoon to monitor coastal erosion. 	More intense storms
Sea Level rise	<ul style="list-style-type: none"> • Photographic monitoring and survey of beach levels twice yearly at Quinns Beach, Two Rocks and Yanchep Lagoon to monitor long term coastal erosion. • Preparation of Coastal Assets Policy 	Storm surges and flooding

In addition to the above the City intends to prepare an Energy Reduction Plan (see Action 1.9) that will look to reduce the City's energy use and encourage the City's community to reduce their greenhouse gas emissions.

Through consultation with its residents, the City had identified the need to have a stronger vision around responding to climate change. This conversation, which is an ongoing one, led to the creation of this strategy.

1.1. Purpose

As a local government, the City of Wanneroo, on behalf of the local community, shares a responsibility for the management of risks to public assets (including the natural environment). This involves service delivery and creating an institutional and regulatory environment that promotes and supports private adaptation to climate change.

Professor Palutikof Director of the National Climate Change Adaptation Research Facility states: *“the scientific evidence points strongly that there will be unavoidable climate change even though our mitigation efforts can reduce some impacts. As Australia’s climate changes in increasingly significant ways over the coming decades we need to be sure that we are ready (2013).”*

Scientists have been encouraging risk management and adaptation strategies, along with promoting the reduction in greenhouse gas emissions, so that we are prepared for climate change². As local governments are at the forefront in dealing with the impacts of climate change, innovative planning is essential.

Figure 2 below highlights the relationship between the City's Strategic Community Plan 2013/14 – 2022/23 and the Corporate Business Plan 2014-2018 that have identified the need for this Climate Change Adaptation and Mitigation Strategy.

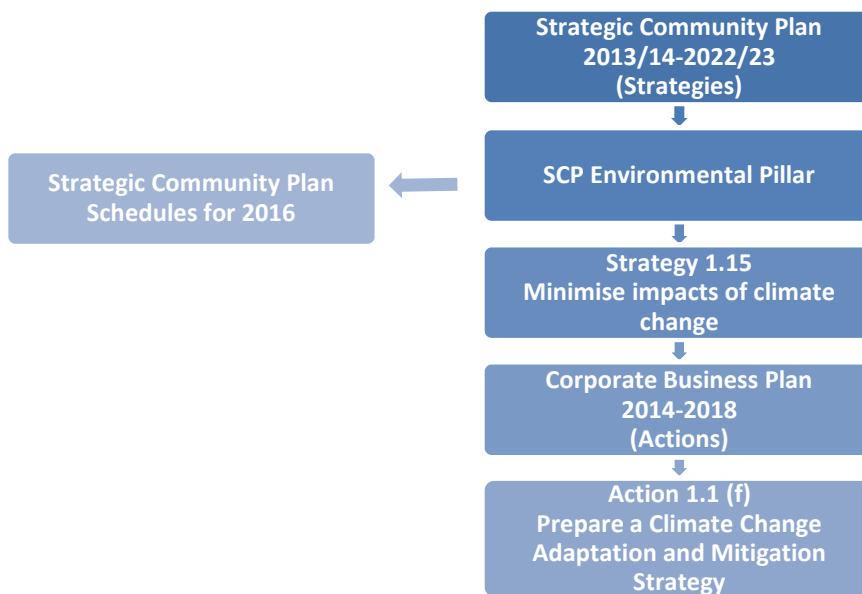


Figure 1 - City of Wanneroo Climate Change Adaptation and Mitigation Strategy strategic alignment.

Adaptation to climate change means taking actions to adjust to changes in the climate that are already underway such as temperature increases, reduced rainfall and extreme weather events and to plan and prepare for the risk of bigger changes in the future, and resulting impacts such as sea level rise.

The Intergovernmental Panel on Climate Change (IPCC) defines climate adaptation as: *"an adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities (2011)."*

The City of Wanneroo's main priority is to adapt to the impacts of climate change that are predicted to be of large scale and inevitable with or without the City reducing its contribution to greenhouse emissions.

The CSIRO defines mitigation as actions that aim to reduce the amount of climate change, typically by limiting the future increases in concentrations of greenhouse gases in the atmosphere³. Accordingly, the City of Wanneroo has a social responsibility to take further steps to reduce its contribution of greenhouse gases that are causing these changes in the climate.

By implementing adaption actions to reduce climate change impacts, the City will also indirectly reduce its overall contribution to greenhouse gas emissions, resulting in mitigation. For instance, an adaptive action to cope with a hotter climate, such as planting trees around a Council building, may also reduce the need for air-conditioning use to ensure comfort to the building's occupants. Consequently, the reduced energy consumption leads to a reduction in greenhouse gases. This scenario is outlined in Figure 3 below.

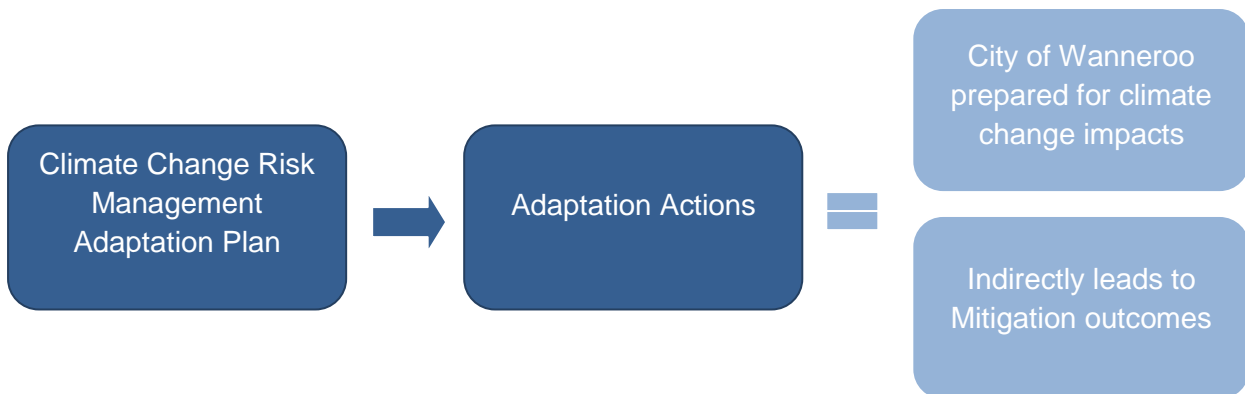


Figure 2 CCAMS outcomes.

1.2. Climate Change

Over the last 100 years, the globe has warmed by approximately 0.75°C. Major contributors to this warming are human activities, including the burning of fossil fuels that have released large quantities of greenhouse gases in the atmosphere⁴. These gases become trapped within the lower atmosphere increasing the temperature of the global climate. Glaciers are melting, sea levels are rising, rainfall patterns are changing and extreme weather events, while becoming less frequent, are becoming more intense⁵.

Over the past 50 years in Australia there has been an increase in heatwaves, less rain, less frosts, increase in droughts, and a slight rise in sea level. Many of the Australian population have seen these changes in their daily lives, through effects such as higher fresh food prices and water restrictions⁶.

The following diagram outlines the expected climate change impacts in Western Australia.

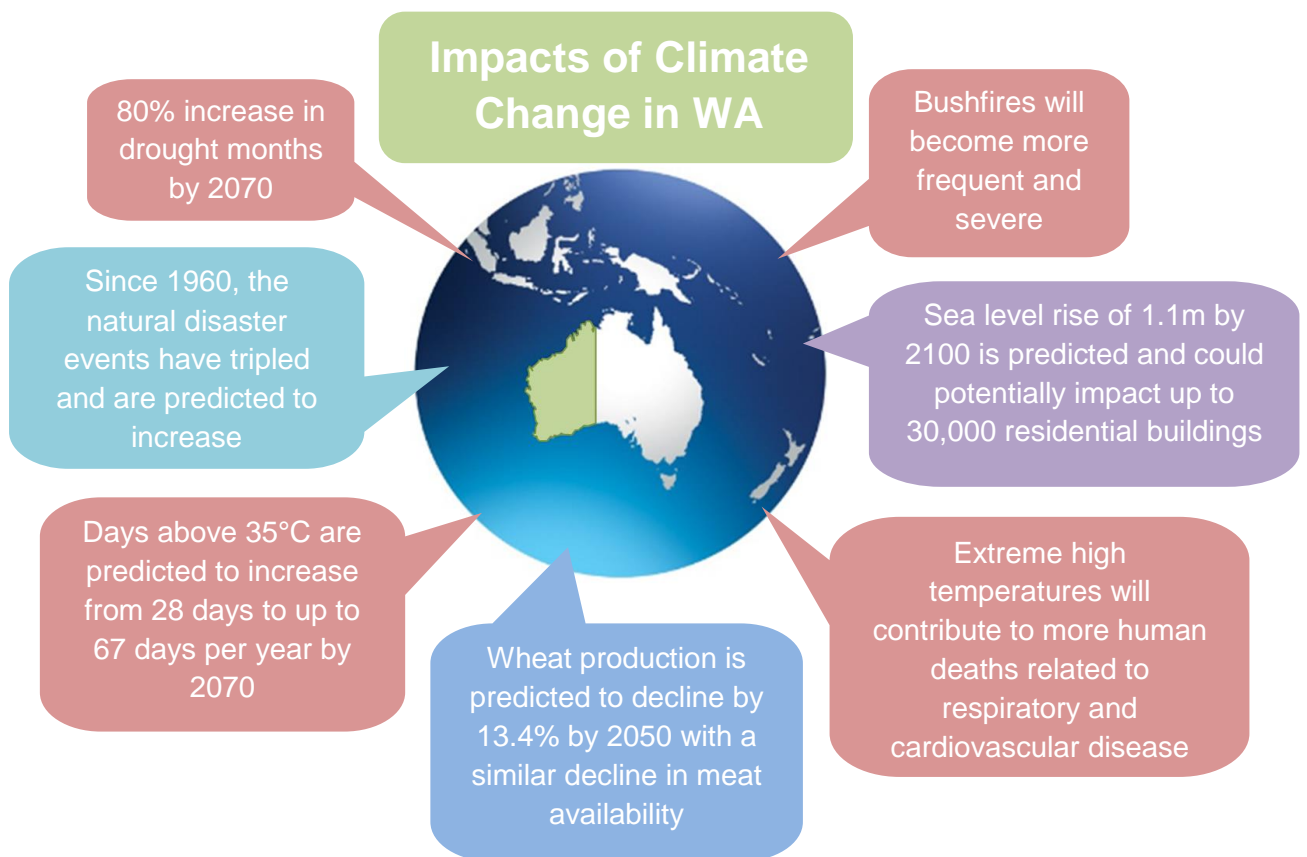


Figure 3 Impacts of Climate Change in WA (Sourced from World Health Organisation⁷ and Department of Environment⁸).

1.3. City of Wanneroo and Climate Change

The City of Wanneroo will experience numerous impacts resulting from the changing climate. This section details the changes in temperature, rainfall, extreme weather and sea level and outlines how these changes may impact the City of Wanneroo.

Temperature

Wanneroo's average temperature has increased since 1910 in line with the Perth average and is predicted to continue rising. Perth's temperature has increased by 1.0 to 1.5°C during 1910 to 2013⁹. The average temperature is predicted to increase between 0.5 to 2.1°C by 2030. If greenhouse gas emissions continue to grow at rates consistent with past trends, warming is projected to be in the range of 1.0 to 6.0°C by 2070¹⁰. There will also be weaker westerly winds and a reduction in their associated cooling effect. These trends are expected to continue until 2050⁹.

The following impacts and consequences are predicted to affect the City of Wanneroo both in the immediate and long term future as a result from the predicted increase in temperature:

Impacts	Consequences
Increased risk of bushfires. ¹¹	<ul style="list-style-type: none"> • Increase in home evacuations to recovery centres; • Access blockage on major arterial roads and train lines; • Death of people unable to evacuate; • Disruption to the biodiversity cycle resulting in biodiversity loss; • Increase in weed invasion; • Impact upon water quality; • Damage to council facilities and property; • Damage to street lighting; and • Loss of power.
Impacts upon human health ¹² .	<ul style="list-style-type: none"> • Rise in food poisoning cases; • Increase in mosquito borne diseases; and • A rise in heat stress and mental health issues particularly on vulnerable groups such as elderly and children, which will result in increased pressure on medical facilities¹³.
An increase in surface temperature ¹⁴ .	<ul style="list-style-type: none"> • Potential air conditioner malfunction due to overuse; • Financial stress (cost of transport and cooling); and • Impacts on transport systems (buckling of rail lines and road wear and tear).
Damage to agricultural crops ¹⁵ .	<ul style="list-style-type: none"> • Increase in food costs and an overall reduction in productivity that will see changes in the agricultural industry; and • Subsequent impacts on land use, economy and employment¹⁶.

Table 1 Increased temperature impacts and consequences.

Rainfall

Autumn and winter seasonal rainfall throughout the Perth Metropolitan area, including the City of Wanneroo, has declined by 20 per cent over the past 60 years. This drying trend has intensified over the last 10 years¹⁷. The City of Wanneroo could experience a further 20 per cent reduction (from present) in rainfall by 2050 and a further 30 per cent reduction by the end-of-century¹⁸.

Decreasing rainfall is contributing to the reduction of ground water levels held in the Gnangara water mound. This is reflected in related wetlands, including Lake Joondalup and Loch McNess (Yanchep National Park), with lowering water levels, exposed acid sulphate soils, water quality deterioration and negative ecological impacts.¹⁹ The following table presents the impacts and consequences that are predicted to affect the City of Wanneroo:

Impacts	Consequences
Reduced water availability for park areas ²⁰ .	<ul style="list-style-type: none"> • Reduced turf quality of playing fields and park closures affecting community health and lifestyle.
Increasing cost to deliver services ²¹ .	<ul style="list-style-type: none"> • As water supply reduces the price is likely to increase.

Table 2 Reduction of rainfall impacts and consequences.

Extreme Weather

Drought-months (months without rainfall) are predicted to increase by 40 per cent by 2030 and 80 per cent by 2070²². This will consequently increase the number of fire-weather risk days²³.

During the period of 1958 to 2011, hot spells have become more frequent (increasing from an average 6 events to 8 events per year) however the average duration of each hot spell has declined (from 2 days to 1.5 days)²⁴.

A decrease in deep troughs has caused an increase in large scale weather systems²⁵. In addition, CSIRO has predicted an increase in the intensity of storm events causing more flash flooding and an increase in wind speed, damaging infrastructure and telecommunications²⁶. Impacts and consequences are:

Impacts	Consequences
More intense storms. ²⁷	<ul style="list-style-type: none"> • Damage to vegetation causing hazards for people and animals (for example falling tree branches); and • Road closure.
Increase in storm surge. ²⁸	<ul style="list-style-type: none"> • Beach erosion; and • Damage to coastal facilities, property and structures.
Unexpected extreme weather. ²⁹	<ul style="list-style-type: none"> • High costs due to damaged infrastructure and buildings; and • Increased risks to human safety.

Table 3 Extreme weather impacts and consequences.

Sea Level

The latest IPCC report modelling suggests a 0.5 to 1.0 meter sea level rise by 2100 compared to 1990 levels³⁰.

The City of Wanneroo's coastline extends 39 kilometres from Tamala Park to Two Rocks and is characterised by recreational boat jetties, coastal limestone cliffs, coastal heathland vegetation and relic sand dune formations (the Quindalup dune system) occurring as beach ridges.

The City of Wanneroo will be impacted by sea levels rising in the following ways:

Impacts	Consequences
Storm surges and flooding. ³¹	<ul style="list-style-type: none"> • Erosion and inundation of dune systems;³² • Damage and loss of coastal structures including recreational facilities, jetties and harbours (including the damage and loss of boats and ships); • Damage to residential and commercial buildings, facilities and parks resulting in devaluation of private properties and litigation; • Effects on unconfined aquifers and contamination of bores; and • Impacts on infrastructure including leakage to septic tanks and sewer systems, causing instability of swimming pools, tanks and other subsurface structures that are not anchored.

Table 4 Sea Level Rise Impacts and consequences.

Conclusion

In summary, the City of Wanneroo has a challenge ahead to ensure its assets and the community are prepared for the potential impacts of climate change. Effective adaptation planning is needed to reduce the expected impacts, consequences and risks associated with climate change.



Figure 5. Climate Change: Crops Wanneroo (Wes Cooper), Loch McNess Dried up (Steve Copsy) and Mental Health (WA Government).

2. Risk Identification Process and Workshops

A series of workshops and meetings were held at the City of Wanneroo to undertake a risk assessment on the impact climate change poses to the City and to prepare adaptation actions to enable the City to respond to these consequences and reduce the overall risk of climate change.

2.1. Risk Assessment Approach

The first workshop required attendees to examine the level of climate change risk for the City in the areas of temperature, rainfall, extreme weather events and sea level rise. Table 5 illustrates the outcomes of the risk identification workshop. The risk rating refers to the current risk to the City and would cover a period of 5 years and would need to be reassessed after this time. Appendix 1 provides information regarding the City's Risk Management methodology used in this process.

FACTORS	CONSEQUENCE	LIKELIHOOD	RISK RATING
Temperature	Minor	Almost certain	High
Rainfall	Minor	Likely	High
Extreme Weather Events	Moderate	Unlikely	Moderate
Sea Level Rise	Minor	Moderate	Moderate

Table 5 City of Wanneroo Risk Assessment Levels.

2.2. Action Identification Process

At the second and final workshop, participants were asked to identify actions that could be taken to alleviate the major climate change risks to the City of Wanneroo. Policies that may be updated to address these risks were also identified, along with further correspondence sought to confirm which service unit was responsible for each action and the timeframe required. Section 3 summarises the outcomes of both workshops.

3. Risk Management and Adaptation Actions

1. TEMPERATURE		RISK RATING: High	
<p>Temperature increase of 2.1°C by 2030</p> <p><i>Increased potential for bushfires, impacts on public health, increased stress on biodiversity, increased surface temperature, damage to agriculture, impacts to transportation systems and financial costs³³.</i></p>			
ACTIONS	RESPONSIBILITY	RELATED IMPACT	TIME-FRAME
1.1 Prepare and implement a street tree planting program that identifies priority areas for implementation and targets the planting of a minimum number of additional trees.	Infrastructure Park Maintenance	Impacts upon human health	3-5 years
1.2 Prepare shade policy that includes tree planting and shade sails for community facilities and parks.	Community Development (policy)	Impacts upon human health	3-5 years
1.2.1 Implement prioritised program of works.	Infrastructure Capital Works (part 2)		
1.3 Investigate preparation of a local planning policy and/or guidelines for developers to improve energy efficiency performance of the City of Wanneroo's built form.	Planning	Increase in surface temperature	3-5 years
1.4 Implement a Mosquito Monitoring Program and public education campaign to reduce the potential increase of mosquitos and educate the public regarding mosquitos in the home.	Environmental Health	Impacts upon human health	1-2 years
1.5 Create decision support tool to guide investment decisions in sustainable technology in alignment to the City's long term financial plan.	Infrastructure Building Projects & Finance (modelling tool)	Increase in surface temperature	3-5 years
1.6 Investigate the use of alternative pathway and road materials: <ul style="list-style-type: none"> • That are durable within high temperatures; • Are of a lighter colour to reduce the urban heat island effect; and 	Asset Management	Increase in surface temperature	3-5 years

ACTIONS	RESPONSIBILITY	RELATED IMPACT	TIME-FRAME
<ul style="list-style-type: none"> • That allow for infiltration i.e. permeable paving. 			
<p>1.7 Conduct an independent energy audit of the top 20 energy use sites within the City of Wanneroo in order to identify areas for energy efficiency improvements (including air-conditioning systems.)</p> <p>1.7.1 The identified improvements to be gradually implemented through a prioritised program of works.</p>	Strategic Asset Management	Increase in surface temperature	3-5 years
<p>1.8 Work with research institutions and local agricultural sector to support local business in considering the impact of climate change on food production.</p>	Economic Development	Increase in surface temperature	3-5 years
<p>1.9 Prepare and implement an Energy Reduction Plan to reduce the City's energy use and encourage our community to reduce their greenhouse gas emissions</p>	City Growth	Increase in surface temperature	1-2 years

2. RAINFALL**RISK RATING:
High****20% reduction in rainfall by 2050*****Reduced water availability for watering park areas affecting the community and lifestyle, reduced water availability for natural wetlands affecting the natural environment and an increase in costs to deliver services³⁴.***

ACTIONS	RESPONSIBILITY	RELATED IMPACT	TIME-FRAME
2.1 Investigate best practice technology for irrigation delivery. 2.1.1 Review irrigation practices based on this investigation.	Assets - Parks Maintenance	Reduced water availability for park areas	3 - 5 years
2.2. In streetscapes review, assess the standards and specifications on the amount of permeable surfaces within the city to maximise rainwater capture including surfaces around street trees and vegetation.	Strategic Asset Management	Reduced water availability for park areas	3-5 years
2.3 Complete a comprehensive assessment of water usage within City buildings and identify key areas for savings.	Strategic Asset Management	Increasing cost to deliver services	3-5 years
2.4 Review and update the City's Water Conservation Plan including specific reference to best practice irrigation.	Parks Maintenance	Increasing cost to deliver services	3-5 years
2.5 Investigate opportunities for water reuse and recycling including stormwater.	Parks Maintenance	Reduced water availability for park areas	3-5 years
2.6 Advocate to the Department of Water to properly consider wetland protection in its preparation of the Gngangara Groundwater Allocation Policy.	City Growth	Reduced water availability for park areas	3-5 years
2.7 Advocate to the State Government to prepare final Gngangara Sustainability Strategy to compliment the strategic assessment for the Perth Peel region.	City Growth	Reduced water availability for park areas	3-5 years

3. EXTREME WEATHER EVENTS

RISK RATING:
Moderate

Increased wind speed, flooding and hail.

This will cause damage to infrastructure, telecommunications and the natural and built environment³⁵.

ACTIONS	RESPONSIBILITY	RELATED IMPACT	TIME-FRAME
3.2 As the need for specific maintenance arises, apply for State Government funding through the Department of Transport Coastal Adaptation and Protection Grant Program. In addition to:	Infrastructure and Coastal Maintenance	More intense storms	3-5 years
<ul style="list-style-type: none"> Implement a coastal monitoring and storm response program for the City's coastline and associated assets. 	Infrastructure and Coastal Maintenance	Increase in storm surge	3-5 years
<ul style="list-style-type: none"> Maintenance of beaches (beach nourishment) and coastal structures (such as repositioning of rock, importing of additional rock, repairs to beach access points) to be undertaken as required. 	Infrastructure and Coastal Maintenance	Increase in storm surge	3-5 years
3.3 Review the City's insurance policies to ensure they adequately treat climate change risks.	Risk and Business Improvement	More intense storms	1 year
3.4 Review our stormwater design standards adequacy for proposed new stormwater systems. 3.4.1 Conduct a risk assessment on current (older) stormwater systems.	Strategic Asset Management	More intense storms	3-5 years

4. SEA LEVEL RISE

**RISK RATING:
Moderate**

1 metre sea level rise predicted by 2100 compared to 1990 levels.

This will potentially cause inundation of infrastructure in low lying areas, loss of recreational facilities, litigation, increase in community concern, contamination of aquifer, damage to coastal structures and beach erosion³⁶.

ACTIONS	RESPONSIBILITY	RELATED IMPACT	TIME-FRAME
<p>4.1 Engage consultants to complete and implement the findings of a Coastal Hazard Risk Management and Adaptation Plan (CHRMAP) that will identify areas at risk of sea level rise over the following two parts:</p> <ul style="list-style-type: none"> • Part 1- Coastal Vulnerability Assessment and Hazard Mapping; and • Part 2- Hazard Risk Assessment and Adaptation Planning. 	City Growth	Storm surges and flooding	1 Year
<p>4.2 Investigate incorporating salt resistant materials and technologies in upgrades of existing and proposed development of Council owned buildings located in coastal areas subject to direct sea breeze and coastal erosion.</p>	Infrastructure Building Projects	Storm surges and flooding	3-5 Years

3. Implementation

In order for the City of Wanneroo to adapt to the predicted impacts of climate change, a cross-directorate approach is required. City of Wanneroo service units are required to implement the actions identified in the Risk Management and Adaptation Actions tables by the required timeframe. In addition to this, close co-operation with relevant state and federal government departments is essential for achieving desired outcomes.

The City of Wanneroo has a comprehensive risk management process. The actions identified in section 3, as part of the risk management process, will form part of the City's Risk Registers. The Risk Registers categorise the risks and identify which actions are to be carried out by the responsible service unit and by when. The adaptation actions will form part of each service unit's plans as part of the integrated planning process.

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1. Appendix 1

CITY OF WANNEROO RISK MANAGEMENT METHODOLOGY

RISK RATING TABLE

CONSEQUENCE	Catastrophic	High	Extreme	Extreme	Extreme	Extreme
	Major	High	High	Extreme	Extreme	Extreme
	Moderate	Moderate	Moderate	High	High	Extreme
	Minor	Low	Low	Moderate	High	High
	Low	Low	Low	Low	Moderate	High
		Rare	Unlikely	Moderate	Likely	Almost Certain
LIKELIHOOD						

RISK ACCEPTANCE / REPORTING CRITERIA

Risk Rating	Criteria for Acceptance	Responsibility	Monitoring	Reporting
Low	Risk acceptable with Management Systems Effectiveness rating above Unsatisfactory	Operational Leader (OL)	Annual risk review by OL	Annually to Manager
Moderate	Risk acceptable with Satisfactory Management Systems Effectiveness rating OR Newly Introduced or Some Weaknesses and treatment plan	Manager	Quarterly risk review by Manager	Quarterly to EMT. Six monthly to Audit Committee / Council
High	Risk acceptable with Satisfactory Management Systems Effectiveness rating and treatment plan	Director / CEO	Quarterly risk review by Director / CEO	Quarterly to Audit Committee / Council
Extreme	Risk acceptable with Satisfactory Management Systems Effectiveness rating and treatment plan	CEO / Council	Monthly by CEO	Quarterly to Audit Committee/ Council

NOTE 1: The above table relates to Operational and Compliance risks as all Governance and Strategic risks will be reported to Council quarterly.