City of Kwinana

Climate Change Plan
2021-2026

Contents

Executive Summary

Science has demonstrated that our climate is already experiencing changes, and these changes will continue to increase in intensity, severity and impact. In the future, Kwinana and the surrounding greater Perth region will experience higher average temperatures, increased frequency of hot days and heatwaves, lower rainfall, increased frequency and severity of extreme weather events, increased fire prone conditions and sea levels will continue to rise.

Long term feedback has clearly and consistently demonstrated that sustainability, environment and climate change response is of high importance to the Kwinana community. In addition, it is crucial that the City of Kwinana (the City) undertake ongoing mitigation and adaptation action to protect public health, assets and the local environment in the face of current and future climate change impacts. This Climate Change Plan 2021-2026 (the Plan) defines how the City intends to continue our work in climate change mitigation, and how we will anticipate and respond to the changing climate. It follows on from the achievements of the previous Climate Change Mitigation and Adaptation Plan 2015-2020 and will direct future actions in a prioritised, coordinated and best practice manner.

The Plan sets the following overarching mitigation and adaptation goals:

- Reduce carbon dioxide equivalent emissions generated by the City's operations by 5% per capita by 2025
- Identify and ensure that the increasing impacts of climate change are considered and addressed through the City's strategic framework and operations
- Support the community to better understand, prepare for and adapt to the impacts of climate change

There are a total of 41 actions outlined in the Plan that are aimed at achieving the goals and organisational objectives. These actions have been grouped into the following key categories:

- Energy generation and efficiency
- Vehicles
- Monitoring and review
- Trees and green cover
- Sustainability and environmental education
- Policy development and review
- Development and construction
- Coastal impacts
- Water sustainability
- Community and staff health
- Urban heat

The effects and local impacts of climate change will continue to worsen over time, and there will be an associated escalation of financial risks if the City takes a business-as-usual approach. Allowing climate change impact-related issues that appear insignificant now to continue and develop, may cause them to become financially unaffordable to address later on. Key actions to address this include the development of an Energy Sustainability Plan, the review of asset deterioration rates and the monitoring of human resourcing demands resulting from climate change impacts.

Any changes to budgeted future expenditure identified as necessary to the sustainability of the City's operations or assets will be appropriately justified and proposed through the City's Long Term Financial Plan process. All direct actions outlined in this Plan are considered achievable within the City's existing budgets and, as such, there are no direct financial implications resulting from the implementation of this Plan.

1. Introduction

1.1 BACKGROUND

Australia's climate is on average 1.4 ± 0.24°C warmer now than when national temperature records first began in 1910. In the southwest of Australia, annual rainfall has declined by approximately 16% since 1970, with the largest reduction in rainfall of 20% occurring between May and July (Bureau of Meteorology, 2020). It has become increasingly clear that greenhouse gas emissions caused by human activity have been the primary driver of the unprecedented and accelerating speed of changes to the Earth's climate since the Industrial Revolution (IPCC, 2014).

We can now say with certainty that the effects on the Earth's climate caused by anthropogenic greenhouse gas emissions will continue to intensify over time. In Perth this is experienced as increasing temperatures, reductions in winter rainfall, sea level rise and ocean warming and acidification (Bureau of Meteorology, 2020). These changes will have significant impacts on the future of City of Kwinana operations and its community.

At the same time, the Australian community are becoming increasingly aware of and concerned with the effects of climate change. 80% of Australians now believe that we are already experiencing impacts from climate change, and 71% think that Australia should be a world leader in identifying solutions to climate change (The Australia Institute, 2020).

1.2 PURPOSE

The Rio Declaration on Environment and Development, of which Australia is a signatory, states

"In order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation" (United Nations, 1992).

As a developed country, Australia has the capacity to take decisive action to assist with mitigating climate change through reducing our reliance on activities that generate significant greenhouse emissions, and instead implementing solutions that are less greenhouse emissions intensive.

Negative impacts caused by climate change are already occurring, and are increasing in severity as we head into the future. Continuing with a business-as-usual approach in terms of corporate greenhouse emissions, strategies and operations, is not a viable option as the financial cost of climate change related impacts will escalate over time. The City of Kwinana will need to take proactive steps to adapt to these changes, to ensure continuity of current service levels across all of its operations. The City will also need to be prepared to be able to respond to climate-related incidents such as significant weather events and bushfires as they arise. Addressing impacts before they become unwieldy is therefore a prudent option.

Local Governments exist to serve the local community, and are in an ideal position to lead all parts of the community in making the transition towards a lower greenhouse emissions future. The City of Kwinana understands that we have a responsibility to lower our own corporate greenhouse gas emissions and adapt our operations, as well as support our local residents and businesses to be able to make achievable changes to lower their emissions and adapt to the effects of a changing climate.

The City of Kwinana population is the second fastest growing Local Government area within Western Australia. Using the Western Australia Tomorrow forecasts, the City's population is predicted to grow as follows: 2021 – 49,700 to 54,640; 2026 – 61,700 to 68,360; and 2031 – 71,610 to 78,630. The general trend demonstrates a population in the order of 85,000 within 15 years (Department of Lands, Planning and Heritage, 2020). The City of Kwinana will need to ensure that our services and community facilities continue to remain able to adequately serve the needs of this rapidly growing resident population and that we maintain resilience in the face of a changing climate.

The City of Kwinana is also the most disadvantaged population in the Perth Metropolitan Area, and one of the most disadvantaged populations in the State. The City's Socio-Economic Indexes for Areas score is 972, with older suburbs being substantially lower. The level of disadvantage in the Kwinana community not only limits the community's capacity to adapt to impacts driven by a changing climate, but also requires the City's limited resources to be applied to key programs that are intended to support and build the community. In terms of unemployment, from 2006 to 2016 the rate in Kwinana grew from 5.8% to 10.8%, which was well above the all of WA unemployment rate of 7.8%. By June 2020, the unemployment rate increased to 11.3% (.id Community, 2020). The City will need to consider how some residents may require increasing access to City-run facilities and programs to seek advice and support to assist them to adapt to the impacts of climate change.

This Climate Change Plan defines how the City views climate change, its effects and the risks that climate change associated impacts may have on the City's corporate operations as well as on our community. The City will identify and organise relevant data to benchmark its current position and use this information to inform its long term planning and budget requirements in the context of climate change mitigation and adaptation.

The Plan contains a set of implementation actions, grouped into three categories:

- Mitigation actions will assist with the reduction of the City's corporate greenhouse gas emissions.
- Adaptation actions will assist the City and its community to anticipate and adapt to the progressive impacts of climate change.
- Actions addressing both mitigation and adaptation are listed in their own category.

Many of the actions proposed in this Plan that reduce the emission of greenhouse gases or adapt to a changing climate do not only address these specific challenges, but also provide additional benefits to our community. Examples include:

- Reducing our reliance on fossil fuel generated electricity and transport results in a reduction in pollutants released into our atmosphere, and cleaner air.
- Expanding our tree canopy cover in public open space and streetscapes not only mitigates against urban heat, but also improves the amenity of areas, encourages the use of these spaces by the community, and makes active transport (walking or cycling) more appealing. A more active lifestyle is associated with many potential physical and mental health benefits.
- Investing in energy efficiency retrofits and renewable power generation systems such as rooftop solar reduces ongoing electricity costs for City facilities.

1.3 INTERNATIONAL, NATIONAL, STATE AND LOCAL CONTEXT

Australia formally ratified the Paris Agreement, a legally binding international treaty on climate change, on 10 November 2016. As part of this agreement, Australia committed to "implement an economy-wide target to reduce greenhouse gas emissions by 26 to 28 per cent below 2005 levels by 2030" (Australian Government, 2015).

The Australian Government has developed a variety of approaches that will contribute towards a reduction in overall national emissions. They have recognised that there needs to be significant investment in new and emerging technologies for Australia to be able to work towards its emissions reductions targets while maintaining a strong, competitive economy. The Technology Investment Roadmap: First Low Emissions Technology Statement identifies five priority technologies with expected emissions reductions for further research and development, while offering the potential to either provide energy at a comparable price to that from high-emissions sources, or to create negative emissions outcomes or offsets:

- Clean hydrogen
- Energy storage
- Low carbon materials (steel and aluminium)
- Carbon capture and storage
- Soil carbon
(Commonwealth of Australia, 2020).

The Australian Government has also introduced a Climate Solutions Package that includes:

- A Climate Solutions Fund to incentivise corporate investment in emissions reductions.
- The provision of support to promote energy efficiency in homes, businesses and community organisations.
- The development of a national strategy that will assist in the development of electric vehicle infrastructure.
- Further investment in hydroelectric projects.
(Australian Government Department of Industry, Science, Energy and Resources, 2021).

The Government of Western Australia has set a target of net zero emissions for Western Australia by 2050 (Department of Water and Environmental Regulation, 2020). The City of Kwinana recognises that this ambitious goal will only be possible if all sectors contribute towards a reduction in greenhouse emissions.

Local Governments exist at the interface between government and community, and many Local Governments around Australia are leading the way with their response to climate change. However, of a total 139 local governments in Western Australia, only one third have publicly available climate change adaptation planning documents. The City of Kwinana is one of those Councils, with its previous Climate Change Mitigation and Adaptation Plan 2015-2020 being recognised as one of the best in Western Australia (Climate Planning, 2020). This Plan will continue to build on the City's progress and achievements to date and the City will continue to investigate opportunities and funding that align with Commonwealth and State Government programs that support climate change mitigation and adaptation activities.

1.4 STRATEGIC CONTEXT

The City of Kwinana Strategic Community Plan 2021-2031 has been developed in consultation with the local community and this is the overarching document that guides the City's priorities. Outcomes and objectives directly relevant to this Climate Change Plan are as follows:

Our Outcomes	Our Strategic Objectives
1. A naturally beautiful environment that is enhanced and protected	1.1 Retain and improve our streetscapes and open spaces, preserving the trees and greenery that makes Kwinana unique
	1.2 Maintain and enhance our beautiful, natural environment through sustainable protection and conservation
3. Infrastructure and services that are sustainable and contribute to health and wellbeing	3.1 Develop quality, financially-sustainable infrastructure and services designed to improve the health and wellbeing of the community

The following City of Kwinana strategic documents influence or are influenced by this Climate Change Plan. Note that this list is not exhaustive, as the impacts of climate change would affect all of the City's operations and services to some degree. The actions set within this Plan will help to inform future reviews of these documents.

- Strategic Community Plan 2021-2031
- Corporate Business Plan 2021-2026
- Long Term Financial Plan
- Climate Change Policy
- Sustainable Water Management Plan 2018-2023
- Green Building Policy
- Risk Management Policy
- Local Planning Strategy 2021-2036
- Local Planning Policy 1 – Landscape Feature and Tree Retention
- Bike and Walk Plan 2018
- Public Health Plan 2019-2023
- Integrated Strategic Mosquito and Midge Management Plan
- Fleet Procurement Policy
- Asset Management Policy
- Building Asset Management Plan 2020-2021
- Stormwater Drainage Asset Management Plan 2020-2021
- Public Lighting Asset Management Plan 2020-2021
- Roads and Transport Asset Management Plan 2020
- Parks and Reserves Asset Management Plan 2020
- Landscape Development Guidelines 2020
- Irrigation Development Guidelines 2019
- Streetscape Upgrade Strategy 2019-2029
- Street Trees and Verge Treatments Policy
- Environmental Education Strategy 2019-2024
- Bushfire Risk Management Plan
- Kwinana Local Emergency Management Arrangements
- Waste Plan 2021-2025

1.5 CLIMATE CHANGE IN KWINANA

Climate change projections for the future depend on the rate of greenhouse gas emissions over time. Therefore there are several different climate change scenarios, dependent on whether the world continues with a business-as-usual approach, or if actions are taken to reduce greenhouse gas emissions. The Intergovernmental Panel on Climate Change (IPCC), the leading international body on climate change, developed four representative scenarios based on projected atmospheric concentrations of carbon dioxide called the Representative Concentration Pathways (RCPs):

- RCP 2.6 represents a future where stringent mitigation actions have been taken on a global scale.
- RCP 4.5 represents a situation where some mitigation actions have been made.
- Pathways between RCP 6.0 and 8.5 represent an outcome following no additional efforts to limit emissions. In effect, these represent business-as-usual or 'baseline scenarios'.
(Intergovernmental Panel on Climate Change, 2014).

The following climate change projections relate to our local region, the south-west of Western Australia:

Rainfall

- By 2030, winter rainfall is likely to decrease by up to 15% under all RCP scenarios.
- By 2090, winter rainfall is likely to decrease by up to 30% under RCP 4.5, or 45% under RCP 8.5.
- The length of periods of drought are likely to increase under all RCP scenarios.

Temperature

- By 2030, average temperatures are likely to increase by 0.5-1.2°C above those experienced between 1986-2005 under all RCP scenarios.
- By 2090, average temperatures are likely to increase by 1.1-2.1°C under RCP 4.5 and 2.6-4.2°C under RCP 8.5
- Extreme temperatures are likely to increase in line with the increases in average temperature, with a significant rise in maximum temperature experienced on hot days, as well as an increased frequency of hot days and heat waves.

Fire weather

- Climate change will contribute toward the worsening of fire weather into the future, the severity of which will be dependent on overall temperature increases and decreases in rainfall.

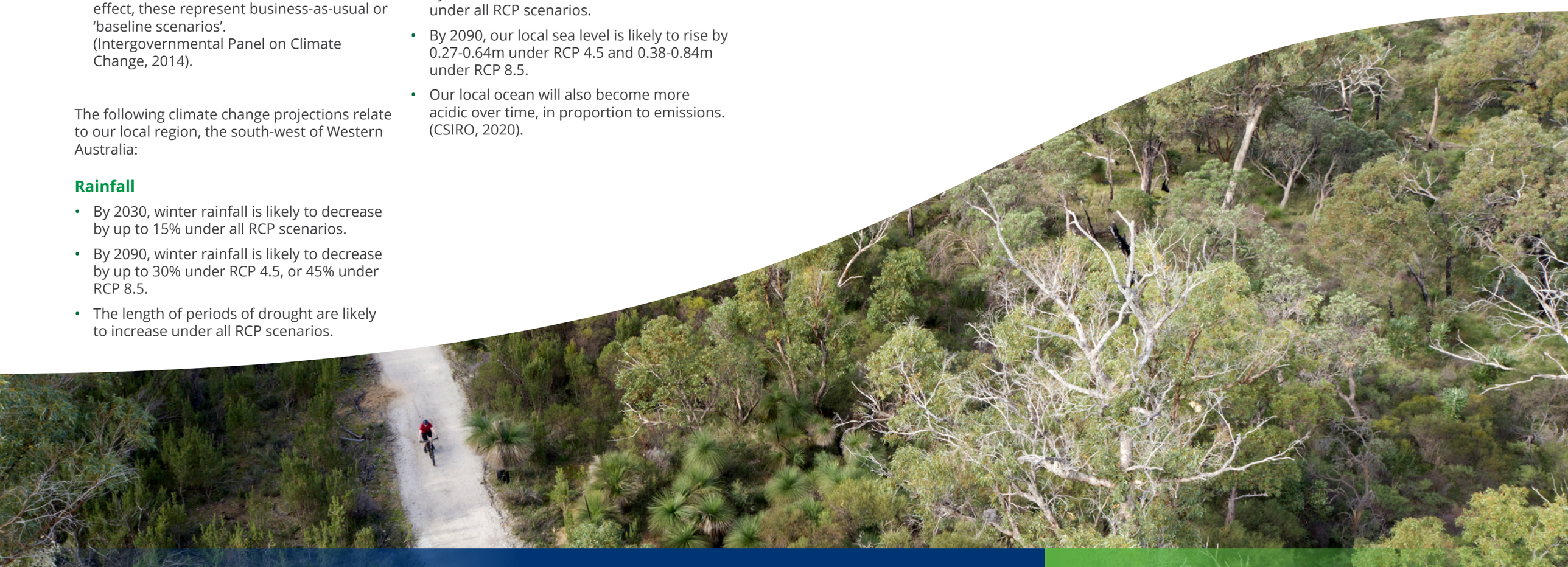
Sea level rise

- By 2030, our local sea level is likely to rise by 0.07-0.18m above the 1986-2005 level under all RCP scenarios.
- By 2090, our local sea level is likely to rise by 0.27-0.64m under RCP 4.5 and 0.38-0.84m under RCP 8.5.
- Our local ocean will also become more acidic over time, in proportion to emissions. (CSIRO, 2020).

1.6 CLIMATE CHANGE EFFECTS, IMPACTS AND RISKS

Effects of climate change are being experienced on a worldwide scale. These include an increased frequency and severity of extreme weather events, rising sea levels due to glacial melting and water expansion, and varying temperatures and precipitation rates, with specific effects dependent on an area's geographical location. The City of Kwinana is experiencing the following escalating climate change effects and their localised impacts:

Climate Change Effect	Localised Impacts
Temperature change	Increased number and severity of hot days and heat waves
	Increased evaporation from public open space areas, sports fields and parks
	Increased number of high fire risk days and potential for severe bushfires
Reduced rainfall	Drier vegetation and landscapes
	Reductions in groundwater recharge rates
	Reduction in water availability for properties reliant on rainwater tanks as their domestic water source
Rising sea level	Increased erosion and inundation of coastal areas
Extreme weather events	Localised flooding
	Severe wind events



The above localised climate change impacts have the potential to affect the City of Kwinana's operations and community in a variety of ways. Major potential risk categories to the City of Kwinana's operations and community associated with these localised impacts of climate change include the following:

Damage or accelerated ageing of City and community infrastructure

- An increase in the number of hot days and heat waves will potentially accelerate the rate of ageing of City owned or managed assets.
- An increase in the frequency of extreme weather events, with associated damaging wind speeds and localised flooding, may cause unanticipated damage to both City and community infrastructure.
- Reduced rainfall and water availability will lead to drier vegetation, with potential damage, increased prevalence of disease and fatalities of vegetation across public open space areas and streetscapes. Combined with increased average temperatures throughout the year and an increase in the number of hot days and heatwaves further exacerbating these effects, we will likely experience a decrease in the quality and amenity of vegetation over time.
- An increase in the number of fire risk days may lead to more frequent and/or severe bushfires, potentially damaging properties, buildings and other infrastructure.

Public and City staff health and safety

- An increase in the number of hot days and heat waves will elevate the risk of staff and residents experiencing heat stress-related effects and illness. The groups most vulnerable to this are outdoor workers, very young and elderly people, and residents (usually from lower socio-economic groups) who do not have mechanical cooling in their homes. Of those who do have access to mechanical cooling, some are financially unable to pay for the power needed to run it. During heat waves, sleep can be severely affected for people who do not have access to adequate mechanical cooling. This can affect their ability to function safely and effectively during the day, leading to potential injury and losses in productivity.
- An increase in the frequency of extreme weather events could expose City outdoor workers and local residents to the risk of potential harm or fatalities associated with damaging wind or localised flooding.
- An increase in the number of fire risk days may lead to more frequent and/or severe bushfires. These have the potential to significantly impact staff, local residents and businesses. People may need to be evacuated, and there could be injuries, illness or fatalities among those affected. There is also the potential for increased stress and mental illness among people in the community who have been affected by bushfire.
- Increased average temperatures combined with rainfall events can produce conditions that increase the risk of mosquito-borne viruses. In Western Australia, these include Ross River virus, Barmah Forest virus and Murray Valley encephalitis (Weeramanthri, 2020). Ross River Virus has recently been detected in mosquitoes sampled from the area of The Spectacles. This may indicate that changes in our local climate are already having an effect on mosquito species that are able to carry this virus.

Water availability and cost

- Reductions in rainfall over time have reduced the recharge of local groundwater aquifers, and groundwater reserves are diminishing. The City holds groundwater licences with the Department of Water and Environmental Regulation (DWER), enabling access to groundwater reserves for irrigating our public open spaces and streetscapes. There is no additional groundwater available in our local groundwater allocation area for the City to increase its licensed allocation, despite the continual expansion of the City's network of public open space areas associated with new residential developments.
- There is also the possibility in the future that DWER may reduce the City's licensed allocation in order to preserve local groundwater resources. Therefore the City will need to be as efficient as possible with its groundwater use, and this may mean a prioritisation ranking of irrigated areas to identify those where irrigation rates can be further reduced or eliminated.
- Our rapidly growing local population will have a corresponding increase in demand on the Water Corporation-supplied scheme water system. Perth's rainfall has decreased significantly and will continue to decrease over time, and Water Corporation sources a large proportion of its water from energy intensive desalination plants. It is important that the City understands the need to educate and support our local residents and businesses to be as efficient as possible with their water use, to ensure we have an adequate supply of water into the future, as well as minimise the cost and greenhouse emissions associated with our scheme water supply.
- More frequent and severe bushfires will increase the demand for water needed to extinguish them. Local fire brigades source firefighting water from tanks fed by groundwater bores located at their fire stations. Larger fires can also require water to be taken from locally accessible water bodies that are suitable for the Department of Fire and Emergency Services aerial fleet to access. Section 44 of the Bush Fires Act 1954 grants the power to bush fire control officers and brigade officers to take water from any source apart from school or domestic water tanks for the purposes of fighting fires. This could potentially result in a lack of water at the properties and areas where this water is taken from, impacting on human activity and the health of ecosystems that rely on those water bodies.

Vegetation health and biodiversity

- Reduced rainfall and water availability combined with increased average temperatures throughout the year and an increase in the number of hot days and heatwaves will lead to drier, more stressed vegetation. This is likely to affect all City managed areas of vegetation, including natural reserves, parks and streetscapes. There will likely be a decrease in the quality and amenity of vegetation, plus an associated potential loss in local biodiversity over time, as species will not have enough time to adapt to a climate that is becoming hotter and drier at an unprecedented rate.
- As stated above, reductions in rainfall over time may result in the need for a prioritisation ranking of irrigated areas to identify those where irrigation rates can be further reduced or eliminated.
- An increase in the number of fire risk days may lead to more frequent and/or severe bushfires. Depending on the severity of a fire, it could lead to a loss of biodiversity among plant species that are not able to recover.

Resource usage and cost

- An increase in the number of hot days and heat waves will increase the need for mechanical cooling. This will generate additional costs associated with energy use to cool City owned facilities and City vehicles. There is also the potential that some City residents who are financially or otherwise unable to use mechanical cooling at home may access City facilities (such as the library, aquatic centre or community centres) more often to escape the heat.
- Energy use costs will increase for residents who choose to use mechanical cooling in their homes during hot weather.
- More frequent and severe bushfires or storm events may require additional mobilisation of City resources and staff. Resources will also be required to be allocated toward community support during the recovery period following major bushfire or weather incidents. This may impact increasingly on the City's business-as-usual operations and will need to be considered during future bushfire and emergency planning processes.

2. Progress to Date

The previous Climate Change Mitigation and Adaptation Plan 2015-2020 set a climate change mitigation emissions reduction target to:

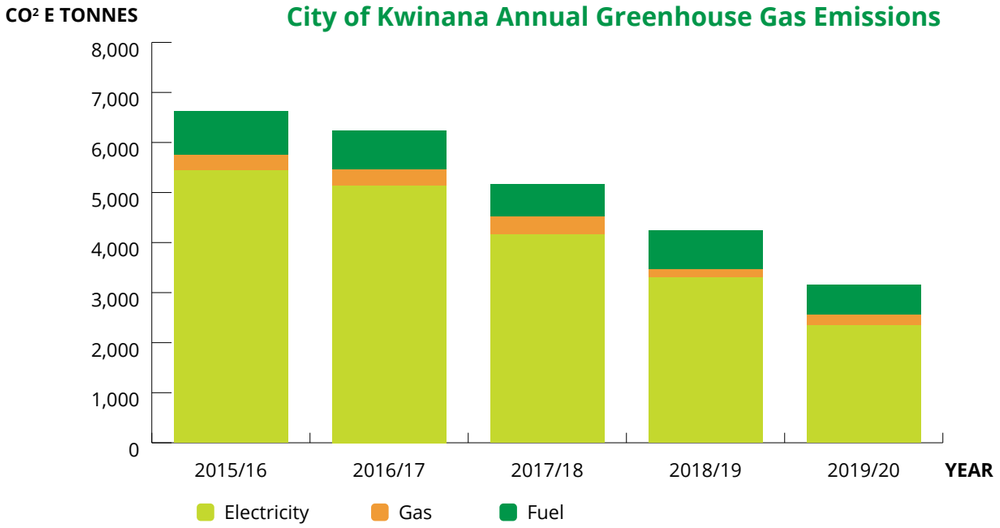
Reduce carbon dioxide equivalent emissions from our own facilities by 10% per capita of resident population below 2009-2010 levels by 2020.

In 2009-2010, annual City of Kwinana corporate greenhouse gas emissions were 4,527 tCO2-e (tonnes of carbon dioxide equivalent greenhouse gas emissions). In 2019-2020, the total was 3,161 $tCO2^{-e}$. This represents a 30.2% reduction in annual corporate greenhouse gas emissions from the baseline year. This higher than expected overall reduction in the City's emissions was the result of a combination of the mitigation actions that the City implemented, along with a decreasing emissions factor by our electricity provider Western Power.

Over time, the relative proportion of Western Power's electricity generation powered by the combustion of fossil fuels has been decreasing, and there is now a greater mix of energy sources, including renewable sourced energy. This lower emissions factor feeds into the process that the City uses to calculate our own operational emissions, and has influenced our emissions total. The year 2019-2020 generated the lowest emissions out of the ten preceding years, and the temporary close down of City facilities associated with its COVID-19 response resulted in even lower emissions for that particular year.

The City has completed a number of actions since the previous *Climate Change Mitigation and Adaptation Plan 2015-2020* was reviewed in 2018. These include:

- Installation of solar photovoltaic systems onto John Wellard Community Centre (30kW), Fiona Harris Pavilion (10kW) and Wellard Pavilion (10kW).
- Continued street tree infill programs in the Kwinana Industrial Area and Bertram. Street trees were also planted that had been requested by residents and any street trees that had required removal were replaced. A total of 1,381 street trees were planted under these programs between 2016 and 2020.
- Completed an Australian Standards (AS/NZS 3598.1:2014) Level 3 energy audit and solar feasibility study at the Kwinana Recquatic. Two recommendations from the audit have been actioned:
  - Installation of occupancy sensors in the group fitness rooms that switch lights off when the rooms are not in use.
  - A localised control panel for the basketball stadium lighting, enabling users of the area to control the lights has also been installed. This represents a significant improvement, as the stadium lights had previously been kept on for the entire day each day the centre was operating.



- A seven-week sustainable living course run annually. Between 2015 and 2020, a total of 110 people completed the course. Feedback has consistently been very positive, with most participants making tangible and lasting changes to their lifestyle to improve sustainability.
- Continued to participate in the Cockburn Sound Coastal Vulnerability Project.
- Participated and reported to the Cities Power Partnership, a collective of local governments working to mitigate climate change.
- Continued to participate in the Switch Your Thinking sustainability and greenhouse emissions reduction initiative for local governments by hosting sustainability education workshops for the community and engaging in other education opportunities for sustainability officers in local government.
- Calculated an annual greenhouse gas (carbon dioxide equivalent) emissions inventory. Each year, the City collates its total electricity, gas and vehicle fuel consumption data. This data is used to calculate the amount of greenhouse gas emissions generated.

Other work that the City has completed with climate change-related benefits includes:

- The planting of around 70,000 local endemic species as part of the City's revegetation programs between 2016 and 2020. The City was recognised as a Local Government leader for having increased its green cover by 6% while experiencing the highest level of population growth in its climate category (Greener Spaces, Better Places, 2020). This is an encouraging sign that the City's revegetation and street tree expansion programs are having a demonstrated impact.
- Finalisation of the Landscape Development Guidelines 2020, which indicates a preference for local native species in landscaping within new developments.
- Completion of the updated Irrigation Development Guidelines 2019, specifying the efficient use of water in the irrigation of public open space areas. The City has also been progressively replacing older irrigation systems with more efficient systems. Of the City's 80 irrigation systems, 67 are now centralised control compatible, to enable more effective control over water application at different sites.
- The City installed an additional three data loggers on scheme water meters to add to its logger network on selected high water using facilities and parks. Leaks and water use anomalies have been identified using this network, that otherwise may have gone unnoticed until the end of the relevant billing period.

3. Mitigation

Greenhouse gas emissions generated by human activity have been proven to be the main contributor toward our rapidly changing climate (Bureau of Meteorology, 2020). In the context of this Plan:

Climate change mitigation refers to actions taken to reduce the direct or indirect generation of greenhouse emissions.

The City of Kwinana aims to minimise its greenhouse gas emissions as much as practicable. This will be achieved through a number of approaches, including:

- Increasing the energy efficiency of City facilities and public lighting.
- Installing renewable energy generation systems on facilities where an acceptable payback period can be demonstrated and budget is available.
- Investigating how the City can increase the efficiency of its vehicle fleet.
- Investigating the feasibility of acquiring electricity from energy providers that use renewable energy sources.

The City's greenhouse emissions in 2019-2020 were 30.2% lower than in 2009-2010. This reduction was achieved through the accumulated effects of the actions implemented from the previous Climate Change Mitigation and Adaptation Plan 2015-2020 in combination with a decreasing emissions factor by our electricity provider, Western Power. Completed actions so far resulted in cost-effective significant emissions reduction outcomes, and further work in this area will likely have a relatively higher financial cost and/or result in relatively smaller reductions.

During the life of Climate Change Plan 2021-2026, the emissions reduction target will be more modest as the City's main focus will be on improving its capture and reporting of data relevant to its energy use and generation, as well as developing methodology to reliably represent its greenhouse gas emissions and carbon sequestration balance. Once the City has established a structured system of data collection, analysis and reporting to monitor its progress, this will enable accurate planning of its pathway towards a zero net emissions future.

The City has been a member of the Cities Power Partnership since 2018. This is a collective of Australian councils who are all working to mitigate climate change. The City committed to seven pledges associated with renewable energy, energy efficiency and community education that help guide our climate change mitigation work, and report on these pledges annually. It is also a good platform for the City to learn from the great work of other councils.

The City's overarching climate change mitigation goal will be to achieve the following greenhouse gas emissions target during the life of this Climate Change Plan 2021–2026:

To reduce carbon dioxide equivalent emissions generated by our own operations by 5% per capita of resident population below 2019-2020 levels by 2024-2025.

The City will also work to offset its greenhouse emissions through the continuation and expansion of its tree planting and revegetation programs. The City's abovementioned recognition for achieving an overall increase in green cover despite rapid population growth represents an opportunity to further motivate our corporate programs and community to continue to green our local area. As identified through community consultation during the development of the City's Strategic Community Plan 2021-2031, our community highly values our local natural areas and green spaces, and this will help to drive further planting works. Actions within this Plan and the City's Local Planning Strategy will better formalise the City's work on expanding and protecting our network of urban trees and natural areas.

4. Adaptation

The climate is changing at an unprecedented and accelerating rate (IPCC, 2014). Not only do we need to take action to mitigate against further greenhouse emissions, but the City and its community must also prepare for and adapt to its effects to ensure we can maintain a good quality of life for everyone. Impacts caused by our changing climate will continue to increase, and will require us to remain adaptable in how we approach potential and current issues that arise. This will allow us to remain financially sustainable into the future. In the context of this Plan:

Climate change adaptation refers to any decisions and actions taken either in anticipation of or in response to the impacts of climate change.

Major adaptations to climate change have already been made in the Perth Metropolitan area by the scheme water supplier, Water Corporation. Water Corporation has had to diversify its water sources due to changes in rainfall over time. During the 1980s, 65% of Perth's water came from storage dams linked to surface water catchments. Due to the reductions in annual rainfall, alongside an increase in average temperatures over time that increased evaporation rates, dams now only supply 15% of Perth's scheme water, with the largest source now being from climate-independent desalination using sea water (Water Corporation, 2020).

The City of Kwinana's overarching climate change adaptation goals are:

To identify and ensure that the increasing impacts of climate change are considered and addressed through the City's strategic framework and operations, and

To support the community to better understand the impacts of climate change and to prepare for and adapt to them.

5. Implementation Plan

This section outlines actions that the City will take to continue to reduce its greenhouse gas emissions and to prepare for and adapt to local climate change-related impacts.

Climate change mitigation actions contribute toward a reduction in overall global emissions. This means that any emissions reductions achieved by the City of Kwinana will contribute towards how climate change progresses into the future, and all of its associated effects. It is for this reason that individual climate change effects and impacts are not listed in the Mitigation Actions section.

5.1 MITIGATION ACTIONS

Action Number	Action type	Action	Responsible position/ team	New/ Existing/ Amended Action	Timeframe for completion	Budget	Risk categories addressed	Measure of success
Energy Generation and Efficiency								
1	Strategy	Develop an Energy Sustainability Plan to prioritise and direct capital works that increase efficiency and renewable energy generation. Each proposed project will involve a business case analysis.	Sustainability Officer	New	2021-2022	Determined by works plan	Resource usage and cost	Original Plan developed and reviewed annually.
2	Capital works	Install solar panels onto Council buildings as per the approved Energy Sustainability Plan. Appropriate facilities will be determined by historical electricity consumption patterns.	Sustainability Officer	Amended	Ongoing	Dependent on facilities chosen, majority funded through Revolving Energy Fund. Refer to Energy Sustainability Plan	Resource usage and cost	Installation of systems completed as planned in Energy Sustainability Plan.
3	Capital works	Implement energy efficiency retrofit works to Council facilities as per the approved Energy Sustainability Plan. Appropriate facilities will be determined by analysing previous energy consumption.	Sustainability Officer, Manager Asset Management Services	New	Ongoing	Refer to Energy Sustainability Plan	Resource usage and cost	Implementation of energy efficiency projects as planned in Energy Sustainability Plan.
4	Investigation	Investigate viability of participation in a WALGA developed Green Power Purchase Agreement. Commit to participation if cost-beneficial.	Sustainability Officer, Contracts Officer, Manager Asset Management Services	New	2021-2022	Budget to match or be cheaper than electricity tariffs currently paid	Resource usage and cost	Green Power Purchase Agreement entered into if it matches current electricity tariffs paid.
5	Capital works	LED sports lighting to be considered for oval lighting renewal or new installations.	Asset Management Services	Existing	Ongoing	Captured in capital works/ asset renewal budget	Resource usage and cost	All new/replaced sports lighting is energy efficient.
6	Investigation	Conduct an Australian Standards Level 3 Energy Audit at Darius Wells Library and Resource Centre.	Sustainability Officer	Existing	2021-2022	$10,000 (in budget)	Resource usage and cost	Energy audit completed and actions selected for inclusion in LTFP.
7	Investigation	Optimise the existing real time energy monitoring at the Darius Wells Library and Resource Centre to provide data that can be used to refine HVAC system settings and inform other energy efficiency work throughout the facility.	Sustainability Officer, Coordinator Facility Maintenance	Existing	2021-2022	$1,000 (in budget)	Resource usage and cost	Real time energy monitoring system suits our data collection requirements.
8	Investigation	Prepare a costed project proposal to undertake a pilot retrofit of a selected number of Western Power-owned streetlights to LED to reduce energy cost and emissions. This would be used to inform future revisions of the Public Lighting Asset Management Plan and operating expenditure.	Technical Officer Civil Infrastructure Assets, Engineering Services	Amended	2022-2023	Captured in asset renewal budget	Resource usage and cost	Business case completed for retrofitting selected streetlights to LED.
Vehicles								
9	Investigation	Investigate setting maximum emission thresholds for fleet vehicles and potential for plug in hybrid electric vehicles (PHEV) or electric vehicles (EV), to inform amendment of the Fleet Procurement Policy.	Human Resources (Policy owner), City Operations Technical Services (Policy implementation)	Amended	2022-2023	Staff time	Resource usage and cost	All new fleet vehicles are within specified emission threshold, once established.
10	Investigation	Investigate feasibility of electric vehicle charging stations within the City of Kwinana.	Manager Economic Development, Sustainability Officer, Manager Asset Management Services, Manager Engineering Services, Planning Services	New	2025-2026	Staff time	Resource usage and cost	Investigation completed.

Action Number	Action type	Action	Responsible position/ team	New/ Existing/ Amended Action	Timeframe for completion	Budget	Risk categories addressed	Measure of success
Monitoring and Review								
11	Participation	Continue to participate in the Cities Power Partnership (CPP). The City committed to seven pledges as part of joining the CPP in 2018, and has already implemented a number of actions.	Sustainability Officer	Existing	Annually	Staff time	Resource usage and cost	Reporting completed annually on the City's seven pledges.
12	Participation	Consult with relevant stakeholders annually to monitor progress on actions and amend action planning as necessary.	Sustainability Officer, various officers	Amended	Ongoing	Staff time	Resource usage and cost	Consultation undertaken annually.
13	Investigation	Identify approved methodology that can be used to calculate the carbon offsets achieved by the City's tree planting and revegetation programs. Also investigate the potential for all vegetation within City managed parks and reserves to be included as carbon sequestration assets.	Sustainability Officer	Amended	2022-2023	Staff time	City and community infrastructure, Vegetation health and biodiversity	Appropriate methodology selected and annual calculation of carbon offsets has commenced.

5.2 ACTIONS ADDRESSING BOTH MITIGATION AND ADAPTATION

Action Number	Action type	Action	Responsible position/ team	New/ Existing/ Amended Action	Timeframe for completion	Budget	Relevant climate change effect(s)	Relevant localised climate change consequences addressed	Risk categories addressed	Measure of success
Trees and green cover										
14	Strategy	Develop and adopt an Urban Forest Plan that will outline how the City will preserve, expand and manage its urban forest.	Senior Environmental Planner, Landscape Architects, Coordinator Technical Operations	Existing	2021-2022	Staff time	Temperature change, reduced rainfall	Increased number and severity of hot days and heatwaves, increased evaporation from POS areas, sports fields and parks, drier vegetation and landscapes	Vegetation health and biodiversity	Urban Forest Plan adopted by Council.
15	Strategy	Develop a centralised database of all City planted and removed street trees. The database is to be updated following any works, to track planting and mortality numbers and inform future planting programs.	Coordinator Technical Operations, Landscape Architects	New	2021-2022	Staff time	Temperature change, reduced rainfall	Increased number and severity of hot days and heatwaves, increased evaporation from POS areas, sports fields and parks, drier vegetation and landscapes	Vegetation health and biodiversity	Database of street tree plantings developed and utilised.
16	Strategy	Develop and maintain a centralised Tree Asset Database, including digital spatial data on all City managed trees. Data from the above action (15) will form a component of this.	Coordinator Technical Operations, Landscape Architects, Asset Management services	Amended	2024-2025	Dependent on approximate number of trees and specific data needing capture.	Temperature change, reduced rainfall	Increased number and severity of hot days and heatwaves, increased evaporation from POS areas, sports fields and parks, drier vegetation and landscapes	Vegetation health and biodiversity	Tree Asset Database developed.
17	Strategy	Develop and implement processes that ensure protection of City managed trees through relevant Local Laws, Policy and statutory means.	Essential Services, Governance Services, Sustainability Officer, City Operations, Engineering Services, Planning Services	New	2022-2023	Staff time	Temperature change, reduced rainfall	Increased number and severity of hot days and heatwaves, increased evaporation from POS areas, sports fields and parks, drier vegetation and landscapes	City and community infrastructure, Vegetation health and biodiversity	Statutory framework in place to enforce protection of City managed trees.
18	Education	Develop a Street Tree Education Program to use in conjunction with Living Green and the annual street tree planting program to encourage residents to value and care for their street trees.	Sustainability Officer, Landscape Architects, City Operations, Marketing and Communications	Amended	2021-2022	Staff time	Temperature change, reduced rainfall	Increased number and severity of hot days and heatwaves, drier vegetation and landscapes	Vegetation health and biodiversity, Public and City staff health and safety	Street Tree Education Program material in use.
19	Capital works	Continue street tree infill planting programs throughout the City as set in annual works plans.	Coordinator Parks, Landscape Architects	Existing	Annually	Refer to relevant works plans	Temperature change, reduced rainfall	Increased number and severity of hot days and heatwaves, increased evaporation from POS areas, sports fields and parks, drier vegetation and landscapes	Vegetation health and biodiversity	Street tree infill programs completed as planned.

Action Number	Action type	Action	Responsible position/ team	New/ Existing/ Amended Action	Timeframe for completion	Budget	Relevant climate change effect(s)	Relevant localised climate change consequences addressed	Risk categories addressed	Measure of success
Sustainability and Environmental Education										
20	Education	Continue to deliver an annual seven week sustainable living course.	Sustainability Officer	Existing	Annually	$7500/year (in budget)	Temperature change, reduced rainfall	Increased number and severity of hot days and heatwaves, drier vegetation and landscapes, reductions in groundwater recharge rates	Public and City staff health and safety, Resource usage and cost, Water availability and cost, Vegetation health and biodiversity	Course delivered annually.
21	Education	Identify and collate environmental, sustainability and waste education resources, tools and services into an integrated package that the City can offer to schools, local businesses, community groups and sporting groups. This will form a component of the review and update of the Environmental Education Strategy.	Sustainability Officer, Bushcare Officer, Waste Education Officer, Marketing and Communications	Existing	Ongoing	Staff time	Temperature change, reduced rainfall	Increased number and severity of hot days and heatwaves, drier vegetation and landscapes, reductions in groundwater recharge rates	Resource usage and cost	Environmental, sustainability and waste education package developed. Relevant groups have been offered these resources.
22	Participation	Continue to utilise the Switch Your Thinking program: run three community workshops per annum and promote the Rewards for Residents scheme.	Sustainability Officer	Existing	Ongoing	$5000/year (in budget)	Temperature change, reduced rainfall	Increased number and severity of hot days and heatwaves, drier vegetation and landscapes	Resource usage and cost	Community workshops delivered annually, promotion of Rewards for Residents undertaken.
23	Educate	Develop and implement an annual communications plan that promotes the City's climate change-related work and achievements with our community and stakeholders.	Sustainability Officer, Marketing and Communications team	New	Ongoing	Staff time	Temperature change, reduced rainfall, rising sea level, extreme weather events	Increased number and severity of hot days and heat waves, increased evaporation from public open space areas, sports fields and parks, increased number of high fire risk days and potential for severe bushfires, drier vegetation and landscapes, reductions in groundwater recharge rates, increased erosion and inundation of coastal areas, localised flooding, severe wind events	All categories indirectly	Climate change work and achievements communicated to our community at least twice a year.
Policy Development and Review										
24	Strategy	Update the Climate Change Policy to align with the updated Climate Change Plan. Include the development of a Revolving Energy Fund Framework to formalise the allocation and use of funds saved through the implementation of renewable energy generation and energy efficiency projects.	Sustainability Officer, Manager Finance, Governance Services	New	2021-2022	Staff time	Temperature change, reduced rainfall, rising sea level, extreme weather events	Increased number and severity of hot days and heat waves, increased evaporation from public open space areas, sports fields and parks, increased number of high fire risk days and potential for severe bushfires, drier vegetation and landscapes, reductions in groundwater recharge rates, increased erosion and inundation of coastal areas, localised flooding, severe wind events	All risk categories	Updated Climate Change Policy adopted by Council.
25	Strategy	Update the Green Building Policy to be able to accommodate regular improvements in available technologies and efficiency levels. This may involve the development of a related set of guidelines referring to technologies and efficiency standards available at the time of planning new building projects or renovations.	Sustainability Officer, Technical Officer – Building Infrastructure Assets, Manager Asset Management Services	New	2023-2024	Staff time	Temperature change, reduced rainfall	Increased number and severity of hot days and heatwaves	Resource usage and cost, Water availability and cost.	Green Building Policy updated to accommodate regular improvements in available technologies and efficiency levels.

Action Number	Action type	Action	Responsible position/ team	New/ Existing/ Amended Action	Timeframe for completion	Budget	Relevant climate change effect(s)	Relevant localised climate change consequences addressed	Risk categories addressed	Measure of success
Development and Construction										
26	Investigation	Investigate opportunities to encourage applicants to include sustainability related initiatives in their developments via the planning approvals process. Also consider opportunities to better retain endemic native vegetation within development sites.	Sustainability Officer, Planning Services	New	2022-2023	Staff time	Temperature change, reduced rainfall	Increased number and severity of hot days and heatwaves, drier vegetation and landscapes	Resource usage and cost	Sustainability related development provisions identified and considered for inclusion in Structure Planning, subdivision design, Local Development Plans and/or Development Applications.
27	Investigation	Investigate opportunities to encourage applicants to include sustainability related initiatives in private construction projects via the building approvals process.	Sustainability Officer, Building Services	New	2022-2023	Staff time	Temperature change, reduced rainfall	Increased number and severity of hot days and heatwaves, drier vegetation and landscapes	Resource usage and cost	Enforcement of any sustainability provisions set in Local Development Plans.
Monitoring and Review										
28	Investigation	Align with and report to the specific UN Sustainability Development Goals (United Nations, 2015) that the City of Kwinana has identified as relevant to the City's operations in the Strategic Community Plan 2021-2031. These goals are: Goal 1 – No Poverty (indirect influence) Goal 2 – Zero Hunger (indirect influence) Goal 3 – Good Health and Well-being (direct influence) Goal 5 – Gender Equality (direct influence) Goal 8 – Decent Work and Economic Growth (direct influence) Goal 9 – Industry, Innovation and Infrastructure (direct influence) Goal 10 – Reduced Inequality (direct and indirect influence) Goal 11 – Sustainable Cities and Communities (direct influence) Goal 12 – Responsible Consumption and Production (direct and indirect) Goal 13 – Climate Action (direct and indirect influence) Goal 14 – Life Below Water (indirect influence) Goal 15 – Life on Land (direct and indirect) Goal 16 – Peace and Justice Strong Institutions (direct and indirect) Goal 17 – Partnerships to achieve the Goal (direct and indirect influence)	Sustainability Officer	New	2022-2023, Ongoing	Staff time	Temperature change, reduced rainfall, rising sea level, extreme weather events	Increased number and severity of hot days and heat waves, increased evaporation from public open space areas, sports fields and parks, increased number of high fire risk days and potential for severe bushfires, drier vegetation and landscapes, reductions in groundwater recharge rates, increased erosion and inundation of coastal areas, localised flooding, severe wind events	Resource usage and cost, Water availability and cost, Vegetation health and biodiversity	Reporting of relevant actions from this Plan against the City's selected UN Sustainability Goals completed annually.

5.3 ADAPTATION ACTIONS

Action Number	Action type	Action	Responsible position/ team	New/ Existing/ Amended Action	Timeframe for completion	Budget	Relevant Climate Change effect(s)	Relevant localised climate change consequences addressed	Risk categories addressed	Measure of success
Coastal Impacts										
29	Strategy	Develop a Sea Level Rise Policy incorporating the projections completed as part of the Cockburn Sound Coastal Alliance project.	Senior Environmental Planner, Coastal and Marine Program Manager	Existing	2022-2023	Staff time	Rising sea level, extreme weather events	Increased erosion and inundation of coastal areas, localised flooding, severe wind events	City and community infrastructure, Public and City staff health and safety	Sea Level Rise Policy adopted by Council.
30	Participation	Continue to participate in the Cockburn Sound Coastal Vulnerability Project.	Coastal and Marine Program Manager	Existing	Ongoing	Staff time	Rising sea level, extreme weather events	Increased erosion and inundation of coastal areas, localised flooding, severe wind events	City and community infrastructure	City staff attending meetings and contributing toward Cockburn Sound Coastal Vulnerability Project.
Sustainability and Environmental Education										
31	Education	Investigate options for including the community in citizen science and education initiatives to raise awareness of the effects of climate change locally and connect community members with activities that assist in adapting to the effects of climate change.	Sustainability Officer, Community Engagement team	New	2023-2024	Staff time, grants/ industry sponsorship	Temperature change, reduced rainfall, rising sea level, extreme weather events	Increased number and severity of hot days and heat waves, drier vegetation and landscapes, increased erosion and inundation of coastal areas, localised flooding, severe wind events	City and community infrastructure	Community education initiatives identified and planned for implementation.
Water Sustainability										
32	Participation	Retain Gold Waterwise Council endorsement to promote corporate water efficiency. Aim to achieve Platinum Waterwise Council status.	Sustainability Officer	New	Gold Annually – Platinum 2025-2026	Staff time	Temperature change, reduced rainfall	Increased number and severity of hot days and heat waves, increased evaporation from public open space areas, sports fields and parks, drier vegetation and landscapes	Water availability and cost, Resource usage and cost, Vegetation health and biodiversity	Gold Waterwise Council endorsement maintained. Platinum endorsement achieved.
33	Participation	Attain and retain Gold Waterwise Aquatic Centre endorsement. Aim to achieve Platinum endorsement.	Recquatic Centre Operations Supervisor	New	Gold Annually – Platinum 2025-2026	Staff time plus any proposed capital works	Temperature change, reduced rainfall	Increased number and severity of hot days and heat waves	Water availability and cost, Resource usage and cost	Recquatic Gold Waterwise Aquatic Centre endorsement maintained and Platinum endorsement achieved.
34	Investigation	Investigate further opportunities to hydrozone parks and/or replace traditional plants with waterwise/endemic species.	Coordinator Parks, Technical Officer Parks Operations, Technical Officer Public Open Space Infrastructure Assets, Landscape Architects	New	Ongoing / 2025-2026	Staff time plus any proposed retrofit works	Temperature change, reduced rainfall	Increased number and severity of hot days and heat waves, increased evaporation from public open space areas, sports fields and parks, drier vegetation and landscapes, reductions in groundwater recharge rates	Water availability and cost, Resource usage and cost, Vegetation health and biodiversity	All parks are hydrozoned where possible and plants are Waterwise and/ or appropriate for their location.
35	Investigation	Investigate opportunities for expanding Water Sensitive Urban Design (WSUD) components throughout the City's stormwater drainage infrastructure at time of asset renewal.	Coordinator Engineering Design, Manager Asset Management, Coordinator Infrastructure Operations	New	2024-2025	Asset renewal budget	Temperature change, reduced rainfall, rising sea level, extreme weather events	Drier vegetation and landscapes, reductions in groundwater recharge rates, increased erosion and inundation of coastal areas, localised flooding	City and community infrastructure, Vegetation health and biodiversity, Water availability and cost	WSUD is considered at the time of asset renewal/ replacement for drainage assets.

Action Number	Action type	Action	Responsible position/ team	New/ Existing/ Amended Action	Timeframe for completion	Budget	Relevant Climate Change effect(s)	Relevant localised climate change consequences addressed	Risk categories addressed	Measure of success
Community and Staff Health										
36	Strategy	Review and update Public Health Plan to consider the increasing effects of climate change on vulnerable members of our community, and how to ensure appropriate support.	Manager Environment and Health, Manager Community Engagement	New	2022-2023	Staff time	Temperature change, reduced rainfall, extreme weather events	Increased number and severity of hot days and heat waves, increased number of high fire risk days and potential for severe bushfires, localised flooding, severe wind events	Public and City staff health and safety, Vegetation health and biodiversity	Updated Public Health Plan adopted by Council.
37	Strategy	Review and update risk assessments and adapt relevant working environment procedures for any City staff who undertake work outside of temperature controlled environments to minimise the risk of heat related illness or injury.	Health, Safety and Injury Management Advisor	New	2021-2022	Staff time	Temperature change	Increased number and severity of hot days and heat waves	Public and City staff health and safety	Risk assessments reviewed and updated to include provisions to mitigate against the effects of heat on employees.
Urban Heat										
38	Strategy	Develop a Shade Policy to respond to increasing temperatures and investigate opportunities for the City to increase the amount of shade throughout public areas consistent with the Urban Forest Strategy and Landscape Development Guidelines. This may involve a combination of tree planting and shade infrastructure.	Sustainability Officer, Planning Services, Landscape Architects, Coordinator Parks, Asset Management, Coordinator Technical Operations	New	2024-2025	Staff time plus any proposed capital works	Temperature change, reduced rainfall	Increased number and severity of hot days and heat waves, increased evaporation from public open space areas	Vegetation health and biodiversity	Shade Policy adopted and shade available at all POS areas.
39	Investigate	Investigate the possibility of developing a 'heat refuge' program, where specific air-conditioned buildings around the City of Kwinana could be made accessible to vulnerable community members on hot days for those who otherwise do not have access to a cooled environment.	Library and Community Resource Centre Manager, Manager Community Engagement	New	2025-2026	Staff time, potential cost of extended opening hours for some community centres	Temperature change	Increased number and severity of hot days and heat waves	Public and City staff health and safety	Heat refuge program developed.

Action Number	Action type	Action	Responsible position/ team	New/ Existing/ Amended Action	Timeframe for completion	Budget	Relevant Climate Change effect(s)	Relevant localised climate change consequences addressed	Risk categories addressed	Measure of success
Monitoring and Review										
40	Strategy	Investigate and develop a centralised system for recording City resources utilised in response to climate change related events (such as storm and bushfire events). This system will be used to enable monitoring of the ongoing impact that these events have on the financial cost of the diversion of staff and other resources. This data will be used to better inform ongoing resource planning. Information collected may also demonstrate a need for additional preventative works to mitigate against escalating impacts from these events.	Sustainability Officer	New	2025-2026	Staff time	Temperature change, reduced rainfall, extreme weather events	Increased number and severity of hot days and heat waves, increased evaporation from public open space areas, sports fields and parks, increased number of high fire risk days and potential for severe bushfires, drier vegetation and landscapes, increased erosion and inundation of coastal areas, localised flooding, severe wind events	Resource usage and cost, Water usage and cost, Public and City staff health and safety	System for monitoring resource usage has been developed and data is being collected.
41	Strategy	Asset management and renewal processes consider the potential acceleration of expected ageing of infrastructure due to the effects of climate change.	Manager Asset Management Services	New	Next review of Asset Management Plans	Asset renewal budget	Temperature change, reduced rainfall, rising sea level, extreme weather events	Increased number and severity of hot days and heat waves, increased evaporation from public open space areas, sports fields and parks, increased number of high fire risk days and potential for severe bushfires, drier vegetation and landscapes, increased erosion and inundation of coastal areas, localised flooding, severe wind events	City and community infrastructure, Resource usage and cost, Water usage and cost	Asset Management Plan anticipates accelerated infrastructure ageing due to climate change impacts.

6. Financial Implications

Energy efficiency and renewable energy technologies are rapidly evolving. Research and investment in these areas is being driven by the increasing cost of non-renewable sourced energy, a push to reduce greenhouse emissions and public sentiment. Advances in these technologies has led to them becoming more affordable, and this will further assist the City in transitioning its infrastructure and operations to a low emissions future.

The effects and relevant local impacts of climate change will continue to worsen over time, and there will be an associated escalation of financial risks if the City takes a business-as-usual approach in terms of its strategic position and operations. Allowing climate change impact-related issues that appear insignificant now to continue and develop, may cause them to become financially unaffordable to address later on. It makes economic and environmental sense for the City to undertake reasonable adaptive steps now to enable an acceptable standard of operations and services to continue, sustainably, into the future.

The City of Kwinana has a total replacement value of around $160M in building assets, $57M in stormwater drainage assets, $380M in roads and transport assets, $5.7M in public lighting, $40M in depreciable and $44M in non-depreciable assets in its parks and reserves. Climate change related increases in temperature and the frequency of extreme storm events over time will likely affect the rate of ageing of these infrastructure items and facilities. Asset management planning and budgeting will need to consider the potential for renewal work timeframes to become progressively shorter over time.

As an action within this Plan, an Energy Sustainability Plan will be developed to guide the timing and budget requirements for relevant energy-related works. Proposed works will be considered in terms of priority, financial implications, projected energy and cost savings and the subsequent payback period for return on investment. Necessary capital and operating expenditure that has not already been budgeted for will be identified and proposed for funding through the Long Term Financial Plan process.

There is also an action within this Plan to develop a more formal framework for the existing Revolving Energy Fund. The intent will be to establish a clearer process for the calculation of energy costs saved with the implementation of energy efficiency and renewable energy works. Clearer criteria will also be developed for the prioritisation of future energy efficiency and renewable energy projects to be funded with the savings resulting from the Revolving Energy Fund program.

7. Monitoring and Review

There are a variety of actions specified within the Implementation Plan, each assigned to specific positions or teams. The progress of each action will be reviewed annually against its relevant measure of success and considered in the context of the priorities of the organisation and community at the time. In addition, during the mid-life Climate Change Plan review in 2023-2024, actions may be modified, added to or removed where appropriate in response to changing priorities, technologies, opportunities and challenges.

The City's greenhouse emissions data is calculated annually, and this data will be used to demonstrate how the City is tracking toward its new corporate emissions reduction target. This target will be reviewed at the time of the mid-life Plan review to ensure it remains realistic and achievable within the life of the Plan.

Once the Revolving Energy Fund framework is developed, this will be used to calculate any financial savings through reductions in energy consumption at locations where energy efficiency or renewable energy generation works have been implemented. These calculated savings will be allocated to fund additional energy efficiency or generation works.

The City of Kwinana will continue to monitor for any changes in government regulations or standards that apply to energy use, efficiency or generation that may affect our adaptation actions or corporate operations, and respond accordingly.

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