





City of Wanneroo

LOCAL ENVIRONMENTAL STRATEGY

2019

Mayor's Message

The City of Wanneroo is proud to present the 2018/19 to 2023/24 Local Environmental Strategy.

The City is home to many unique and special natural environments, including 32km of coastline, wetlands, bushland and underground water resources, all of which are highly valued by the City and the community.

These areas need to be managed carefully and sensitively as we continue to experience the largest population growth in Western Australia.

The Local Environmental Strategy will provide important processes that enable the City to identify key concerns and improve the quality of natural and built environments in the local area over the next five years.

This Strategy has been developed through ongoing engagement with residents, community groups and other stakeholders.

It identifies six key themes to ensure all environmental elements are considered:

- Flora and Fauna – biodiversity and native vegetation
- Land and waste – contamination and management
- Community – sense of place and liveability
- Climate Change impacts
- Air and Energy – including air quality and energy reduction
- Water – including availability and quality

The result is a robust framework that will ensure balance between our wonderful natural environment and the emerging needs of our growing City.

Mayor Tracey Roberts JP

Figure 1: Location of the City of Wanneroo

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PART A – INTRODUCTION

1. Overview

1.1 Background

The City of Wanneroo is a large outer metropolitan council with an area of 684 square kilometres in the North-West of the Perth Metropolitan Region, a sub-region rich in environmental attributes, with notable natural assets and environmental values. Of the total area of the City, about a third is urban zoned, while the rest is a combination of rural, regional open space, national parks, state forest and conservation estate.

The City has many special environmental assets (a 32 km long coastline, nature reserves, wetlands and diverse bushland habitat, underground water resources, etc.) including good air quality, refreshing sea breezes allowing good urban 'ventilation'. These environmental qualities and assets are all highly valued by the Wanneroo community.

With a current population of approximately 200,000 due to grow to as much as 550,000 people by 2070, expansion of the urban footprint will be substantial. Much of this population growth can be accommodated within the existing and planned urban zone; nevertheless some growth will be accommodated in existing rural areas to be rezoned to urban land, such as East Wanneroo.

The challenge is that urban expansion will result in the removal of vegetation and encroach on various habitats and natural systems. The presence of more people and their activities (transport, recreation, work life, commerce and industry) will exert pressure on various natural resources. As some level of impact is inevitable, there is a need to guide and manage land use change so that adverse impacts are minimised, and opportunities for environmental conservation and enhancement are optimised. Ideally, good planning and urban management should aim to make these objectives complementary, rather than conflicting.

In order to ensure that the impact of urban development on environmental attributes is minimised, the City's planning should carefully consider its environmental attributes.

1.2 Purpose and Scope

This Local Environmental Strategy (LES) is an outline of the City's overall approach to protecting and managing the key environmental resources and values important to the City's future. As such, it aims to protect our highly-valued environmental attributes, including both those of the natural environment (e.g. bushland habitat, wildlife, wetlands and ocean beaches), and of the built environment (e.g. air quality, aesthetic values, heritage landscapes, etc.). It also provides a framework to help protect and improve the quality of the City's natural and built environment by identifying the threats to the City's key environmental assets and values, and the opportunities for their enhancement.

The LES is underpinned by a risk management approach to environmental planning, involving a rating of the key risks facing the natural and built environments. This enables the identification of high-level responses to address those issues and optimise opportunities to enhance the City's natural and built assets.

The Strategy will provide the City with direction on the approach to be undertaken over the next 5 years without prescribing detailed, specific actions that can often be difficult to implement when these are set out in a strategic document. This means that the LES establishes clear environmental management priorities and high level responses that will be further detailed and implemented through a more detailed LES Action Plan.

1.3 Process for LES Preparation

The LES has been prepared following a systematic process, as follows:

- identifying themes;
- establishing key topics;
- assessing issues;
- identifying opportunities; and
- determining responses.

As set out in **Figure 2** below, this process was informed by, and has had due regard to the priorities, outcomes and strategies set out in the City's *Strategic Community Plan 2017/18 – 2026/27*, particularly in relation to the aspirations of the community concerning environmental management.

Figure 2: Hierarchy for Strategic Environmental Planning

Six 'themes' and associated key focus areas have been identified in order to manage the risks facing the City's natural and built environment. The key themes along with their corresponding topics are presented in **Figure 3**. The themes are used to summarise the primary environmental factors affecting the City and that are important to the community.

Figure 3: The 6 Themes of the LES with corresponding Topics.

Themes	*Topics*
❖ Flora & Fauna	**Biodiversity of Flora and Fauna** **Native Vegetation**
❖ Land & Waste	**Waste Management** **Land Contamination**
❖ Community	**Sense of Place** **Liveability**
❖ Climate Change	**Climate Change Impacts**
❖ Air & Energy	**Air Quality** **Sustainable Energy**
❖ Water	**Water Availability** **Water Quality**

A breakdown of the issues and opportunities for each theme and focus area is provided in Section 2.2 below.

The key Topics and Issues were identified through a risk rating process in accordance with 'AS 5334-2013: Climate change adaptation for settlements and infrastructure – A risk based approach' to determine priorities in alleviating perceived risks. Identifying the causes and impacts of these issues and opportunities was necessary to formulate appropriate responses.

1.4 Strategic Framework

The Strategic Community Plan (SCP) 2017/18 – 2026/27 is a long-term, overarching document that presents the vision and aspirations for the future of the community, and sets out key strategies and action required to achieve these aspirations. The Plan provides a strong community mandate for protection of the natural and the built environment. The SCP, prepared with significant community input, makes clear the aspiration for ensuring a healthy and sustainable natural and built environment.

The SCP identifies the holistic nature of the natural and modified environment, and that liveability requires all these aspects of 'environment' to be considered. Accordingly, the LES focusses on both natural and modified environments, and not just the 'natural system' as usually set aside in reserves and regional open space. This approach includes biodiversity and conservation through to water, energy, transport, urban amenity and lifestyle opportunity. The SCP identifies environmental initiatives in the areas of resource management, enhanced environment, reduce/reuse and recycle waste, activated spaces, connected and accessible city and housing choice.

The SCP reinforces good environmental management as a vital Environment pillar, which is reflected in the Local Environmental Strategy. The SCP separates the Environment pillar into two distinct 'sub-pillars', the Natural Environment and Built Environment. Additionally, the SCP further identifies natural environment outcomes and built environment outcomes, together with strategies relating to each, as illustrated in **Tables 1 and 2**.

Accordingly, the LES provides a direct strategic link to the SCP through the Environmental pillar by providing more detailed direction on how the City will address its

key environmental issues. The LES essentially acts as an extension to the Environmental pillar and provides a direct response to the community's expectations through the six themes and then subsequently the responses. Figure 4 illustrates the connection between the Strategic Community Plan and the LES, and how the key issues and opportunities are linked to existing and future environmental initiatives run by the City.

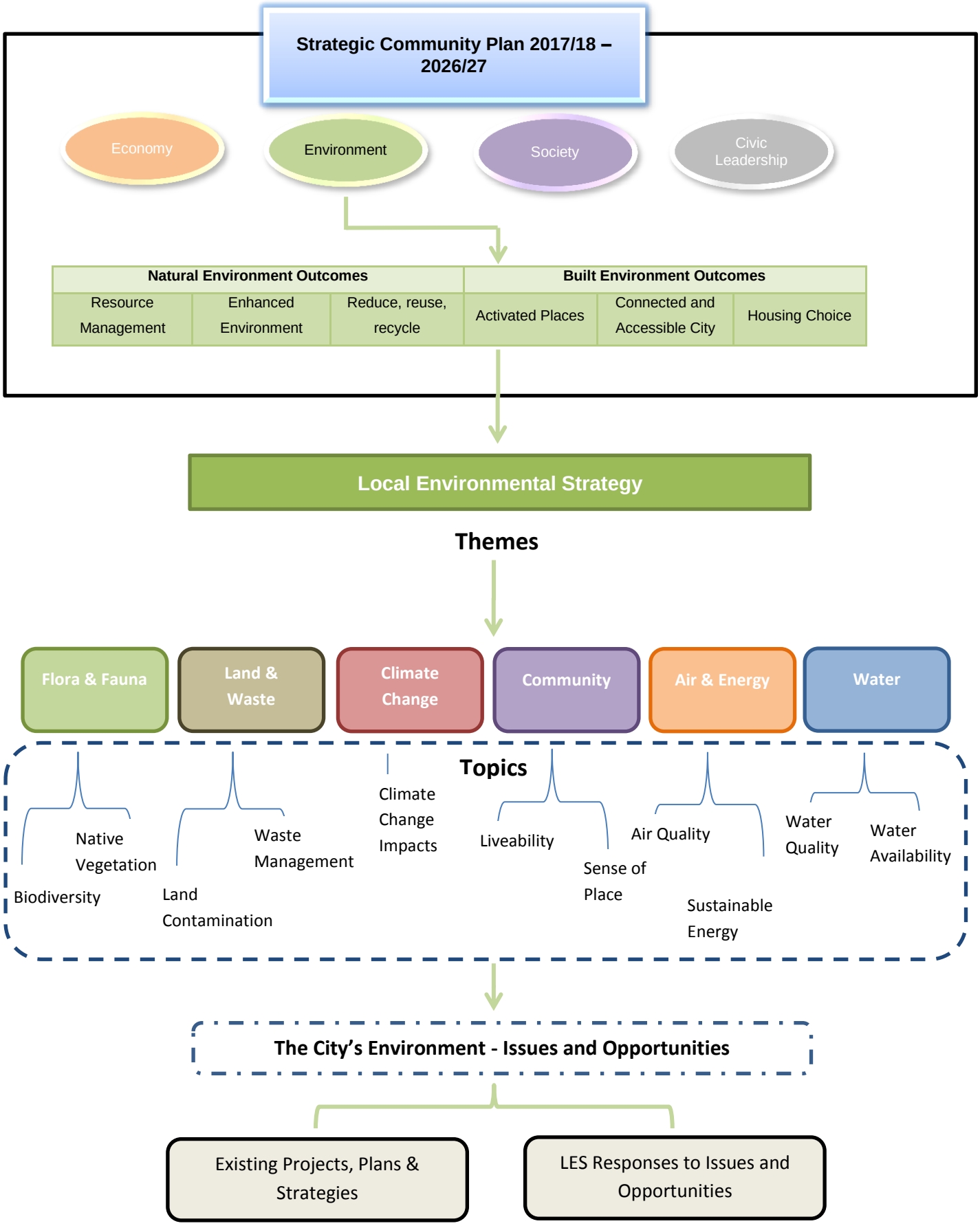
Table 1: Strategic Community Plan's Natural Environment Pillar Outcomes & Strategies

Outcome	Strategy
3.1 Resource Management	3.1.1 Minimise impacts of climate change
	3.1.2 Seek alternative ways to improve energy efficiency
	3.1.3 Proactively manage the scarcity of water through sustainable local water management strategies
3.2 Enhanced Environment	3.2.1 Maximise the environmental value of beaches, nature reserves and parks
	3.2.2 Collaborate with relevant State agencies with a focus on the enhancement of the natural environment
	3.2.3 Optimise retention of significant vegetation and habitat
3.3 Reduce, reuse, recycle waste	3.3.1 Treat waste as a resource
	3.3.2 Foster a partnership with community and industry to reduce waste
	3.3.3 Create and promote waste management solutions

Table 2: Strategic Community Plan's Built Environment Pillar Outcomes & Strategies

Outcome	Strategy
3.4 Activated Places	3.4.1 Create local area land use plans supporting our activated places
	3.4.2 Provide safe spaces, centres and facilities through our infrastructure management and designs for community benefit and recreation
	3.4.3 Enhance distinctive built form and spaces based on identity of areas
	3.4.4 Improve local amenity by retaining and complementing natural landscapes within the built environment
3.5 Connected and Accessible City	3.5.1 Deliver local transport infrastructure including roads, footpaths and cycle ways to improve accessibility
	3.5.2 Connect walking and cycling opportunities to key destinations and distinctive places
	3.5.3 Advocate for major integrated transport close to communities
3.6 Housing Choice	3.6.1 Facilitate housing diversity to reflect changing community needs

Figure 4: Strategic Alignment of the LES



2. The City's Environment

The City of Wanneroo covers a large area with a wide variety of landscapes; as such it is subject to a broad range of issues affecting the natural and built environments across the City. The following section provides an overview of the City's environmental assets and values. Key environmental topics and environmental values, and the relevant issues and opportunities are described in Section 2.2.

2.1 Current Situation

An important aspect of the City is its current urban form and its impact on the City's natural assets. The City features both extensive consolidated 'older' urban areas south of the Wanneroo town site to the suburbs of Girrawheen and Koondoola, and a fast growing urban corridor stretching along the coastline to the north. The latter is an extended urban residential corridor of dormitory residential suburbs supported by appropriate infrastructure, activity centres and services. Further to the east of this corridor and separated by extensive areas of conservation and regional open space are the 'heritage' rural zones of the City, and further to the east State Forest.

Distinctive characteristics of the coastal urban corridor are that development is occurring on several fronts at several locations according to the tenure and project timing of major land developers. There are still extensive areas yet to be planned for and developed and it is anticipated that significant future growth will be within the existing urban corridor, East Wanneroo, and infill development areas such as Girrawheen, Koondoola and Wanneroo.

Future growth and land use change will occur throughout large areas of the City, and it is expected that this will continue for a long time into the future. This land use change will always be in close proximity to various natural landscapes and environments, and will continuously impinge on and be influenced by key natural processes. This existing urban form and future urban development means that ongoing environmental management issues will need to be resolved.

Natural Environment

The City's key natural features include over 32km of coastline, a large extent of State Forest, substantial areas of natural vegetation in Crown reserves and on private land, productive soils, groundwater resources and surface wetlands, as well as significant deposits of basic raw materials such as limestone and sand. The key environmental features that make up the City of Wanneroo are described in detail below.

Landform & soils

The City features a range of distinctive geomorphic landforms that run in a north south direction roughly parallel to the coastline, each displaying different topography and soil characteristics. These landforms contribute to distinct landscapes, varied native vegetation types, and distinct 'sense of place'.

- The Quindalup Dunes – located adjacent to the coast across most of the City's length. These dunal soils are mainly young, infertile sandy soils lying over older Tamala Limestone. Soils of the Quindalup dunes are free draining, and easily eroded by wind.

- The Spearwood Dunes – located adjacent and further inland, are older than the Quindalup Dunes. Soils here tend to be more fertile, consisting of yellow to brown sands overlying limestone. Feature limestone ridges, with distinct native vegetation cover.

- The Bassendean Dunes – lie further to the east, are older again and feature deep soils with low fertility. The landform is fairly flat with low lying areas with occurrence of wetlands and damplands.

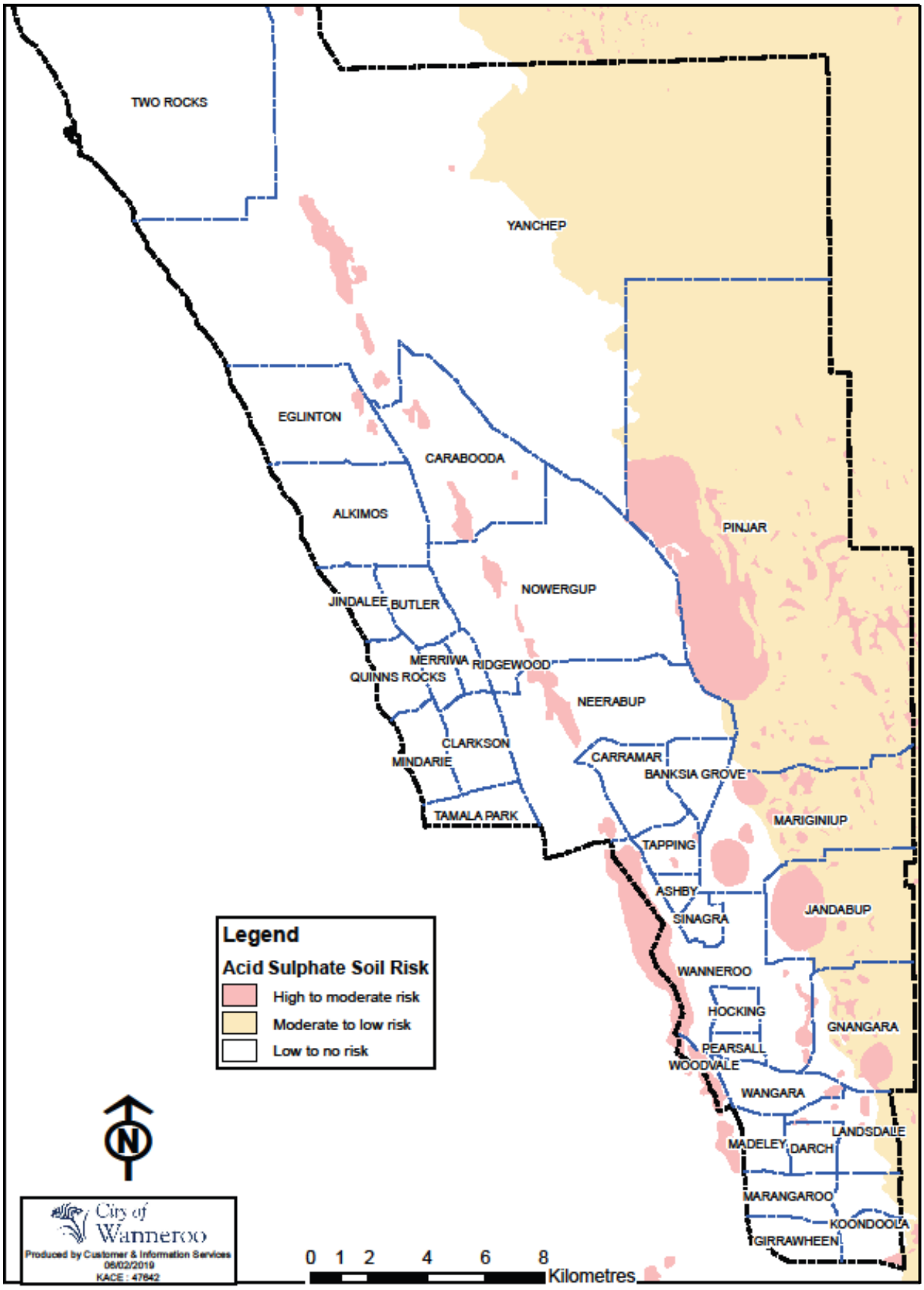
The City also features extensive acid sulphate soils due to the historically high water tables and surface water expressions such as wetlands and lakes. **Figure 5** illustrates the extent of these acid sulphate soils along with their relative associated risk levels. If disturbed and left unmanaged, they can present potential risks to groundwater and even human health.

Currently, the City manages acid sulphate soils through the planning and development process by ensuring that applicable conditions are applied to planning approval that aim to prevent mobilisation of acid sulphate in the groundwater. They are also managed in site specific projects

such as the Yellagonga Integrated Catchment Management Plan which aims to improve the quality of the Yellagonga wetlands.

The LES will aim to provide further guidance to landowners on the importance of acid sulphate soil management, and the importance of ensuring healthy soils and groundwater.

Figure 5: Acid Sulphate Soil Risk



Subterranean Fauna

Some of the caves in Wanneroo contain fauna that are specially adapted to living in the cave environment. These fauna are termed Troglobitic fauna. The most sensitive of these are stygofauna, which live in groundwater. Stygofauna include different types of crustaceans, and also worms, snails, insects, and other invertebrate groups. Most species spend their entire lives in groundwater and are not found in any other location (Jasinska, 1997). They are currently protected through specific management initiatives for cave systems occurring in conservation reserves.

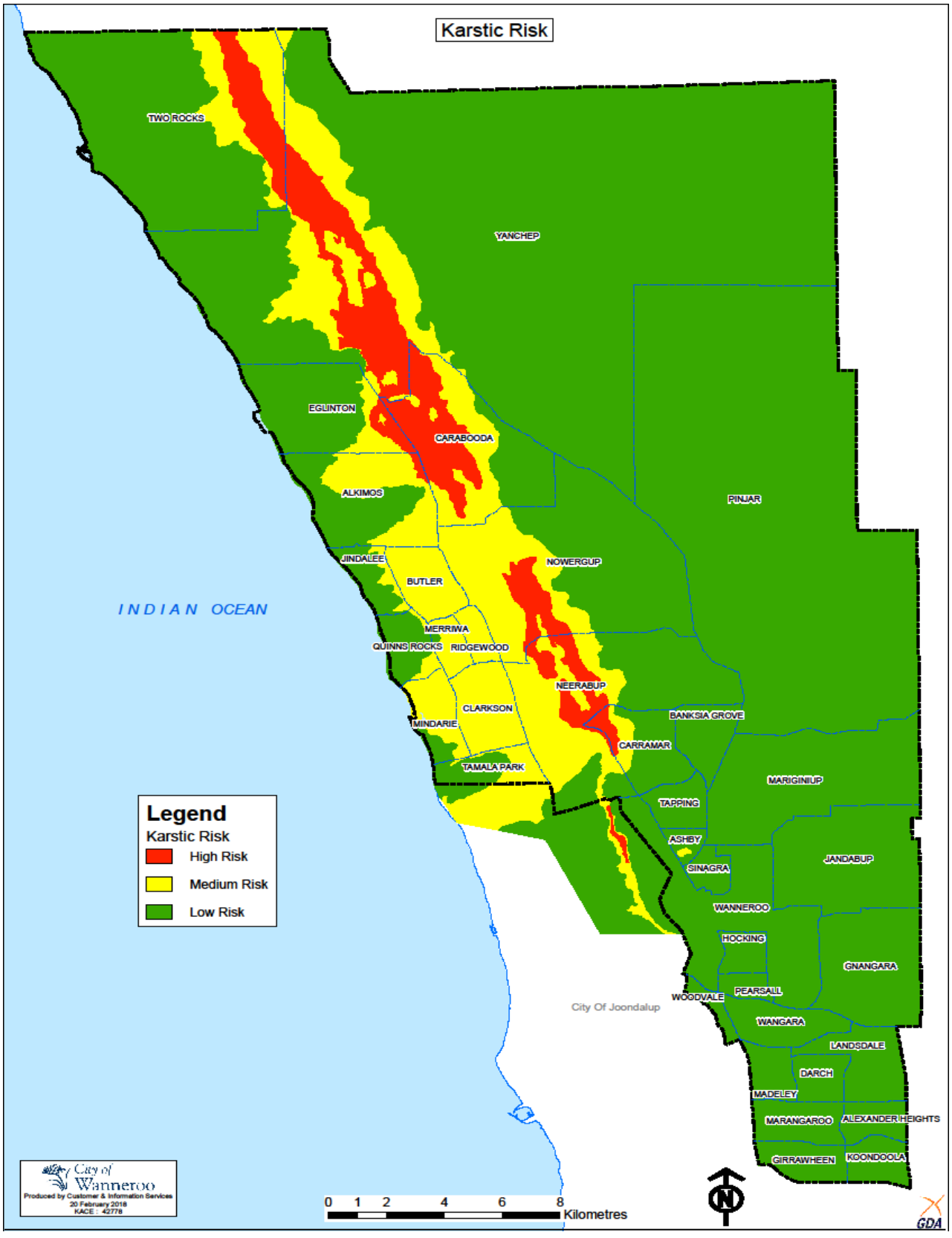
Karstic Features and Limestone Caves

In parts of the western Spearwood Dunes system, there is a high occurrence of karstic and cave features ranging significantly in size and extent, the most notable being the Crystal Cave system in Yanchep National Park. These are widespread features of the City found where there is Tamala limestone: a porous rock that can be slowly dissolved by weakly acidic groundwater or rainfall. This process, known as karst weathering, produces distinctive landform features such as sink holes, caves, dry valleys, tube structures and vaults (Geoscience Australia, 2003). **Figure 7** shows the extent of low, medium and high risk karstic features within the City of Wanneroo.

Karst features contribute to landform diversity and support biodiversity. The City's karst features are, however, at risk from urban development and in turn are a potential risk to specific developments. Development can damage karst features with conservation merit, and the inappropriate location of roads or buildings over cave and pinnacles presents a risk to public safety and integrity of built structures. Currently, the City provides guidance for planning proposals that might be affected by karst through its Local Planning Policy 4.13: Caves and Karstic Features.

Figure 6: A coastal karst formation in the City of Wanneroo. Credit: R Rabaro

Figure 7: Karst Risk in the City of Wanneroo



Flora and Fauna

The City is located within the South West Australia Global Biodiversity Hotspot, and contains a substantial area of important vegetation with local, regional, national and even international significance. The vegetation within the City includes species and communities that are only found in a restricted part of the southwest of the State. Some vegetation types are only found within the City, or represent the best remaining examples in the State (Trudgen, 1996). **Figure 9** shows what is remaining of the City's vegetation complexes.

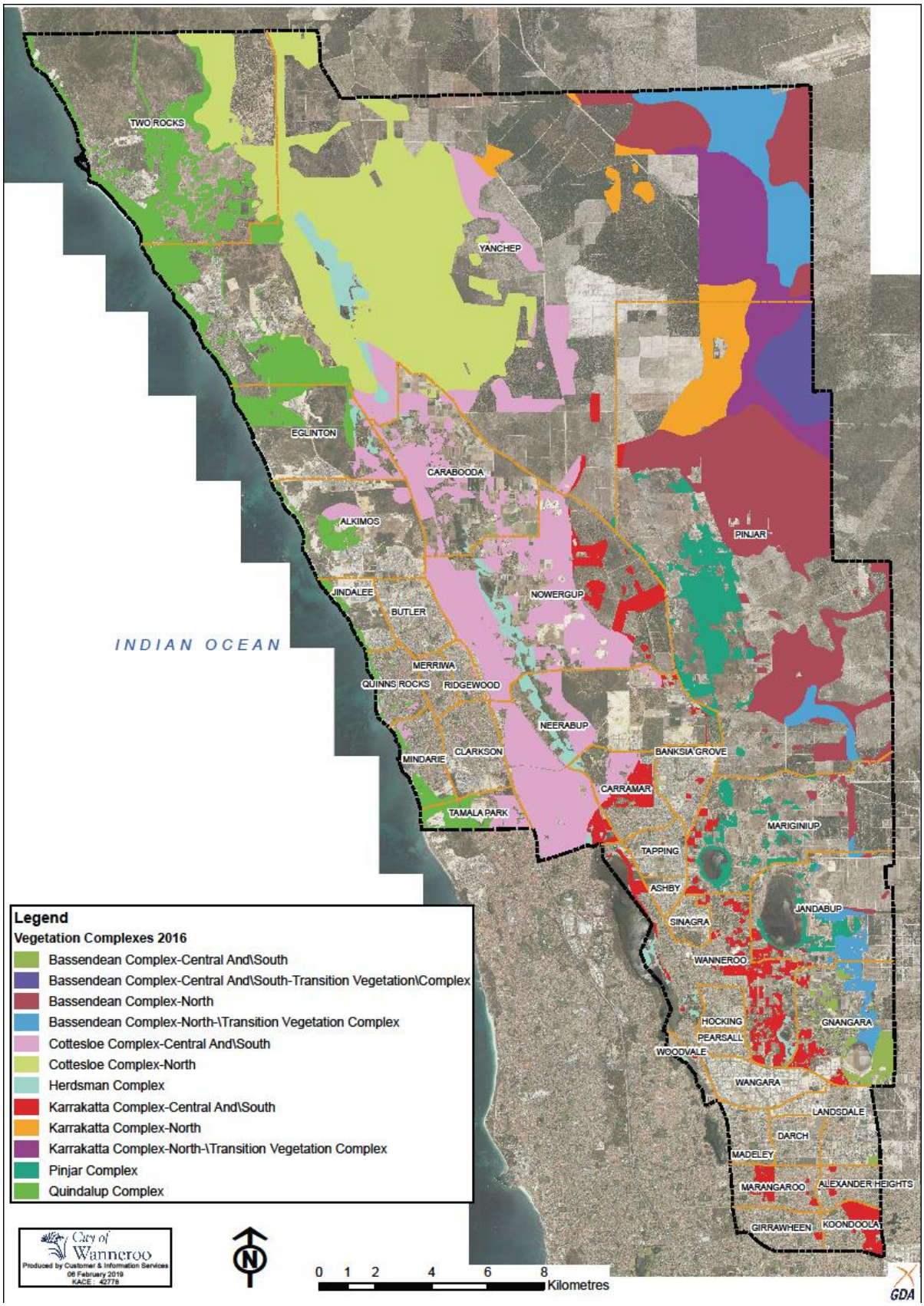
Of the 15 vegetation complexes on the Swan Coastal Plain, 11 occur in Wanneroo, highlighting the diversity of habitat that characterises the City's environment (WALGA, 2004). A number of these complexes are only found in Wanneroo, for example, the City contains the only occurrences of the Pinjar and Karrakatta North vegetation complexes in existence and the only occurrence of Karrakatta North Transition in the Perth Metropolitan Region. The City is also home to patches of federally significant vegetation communities such as the Banksia Woodlands which is currently listed under the EPBC Act as endangered, and the Tuart Woodlands which are currently undergoing assessment to be listed under the Act.

The retention of representative areas of native vegetation is currently provided for by extensive region open space, conservation reserves, local open space and national parks (Crown Reserves). Protection of these areas ensures that these biodiversity values are retained into the future.

It is important to retain and protect our biodiversity assets and the City aims to do so through projects such as the Local Biodiversity Plan. The City's Street Tree Policy, Local Planning Policy 4.8: Tree Preservation and Local Planning Policy 1.1: Conservation Reserves are just a few of the statutory mechanisms by which the City works to protect its biodiversity assets. Through the responses presented in the LES, the City has further opportunities to protect and enhance its native flora and fauna communities.

Figure 8: A pair of Rainbow Bee Eaters in Yellagonga Regional Park. Credit: G Tate.

Figure 9: Vegetation Complexes (current extent excluding approved development areas)



Groundwater

The depth of groundwater underlying the City varies across the landscape (**Figure 11**). The depth of the water table is fairly stable for three to four kilometres in from the coast, rising immediately east of the linear lake system. This is related to the contact between limestone and sand, through which water flows at different speeds (Bowman Bishaw Gorham, 1994).

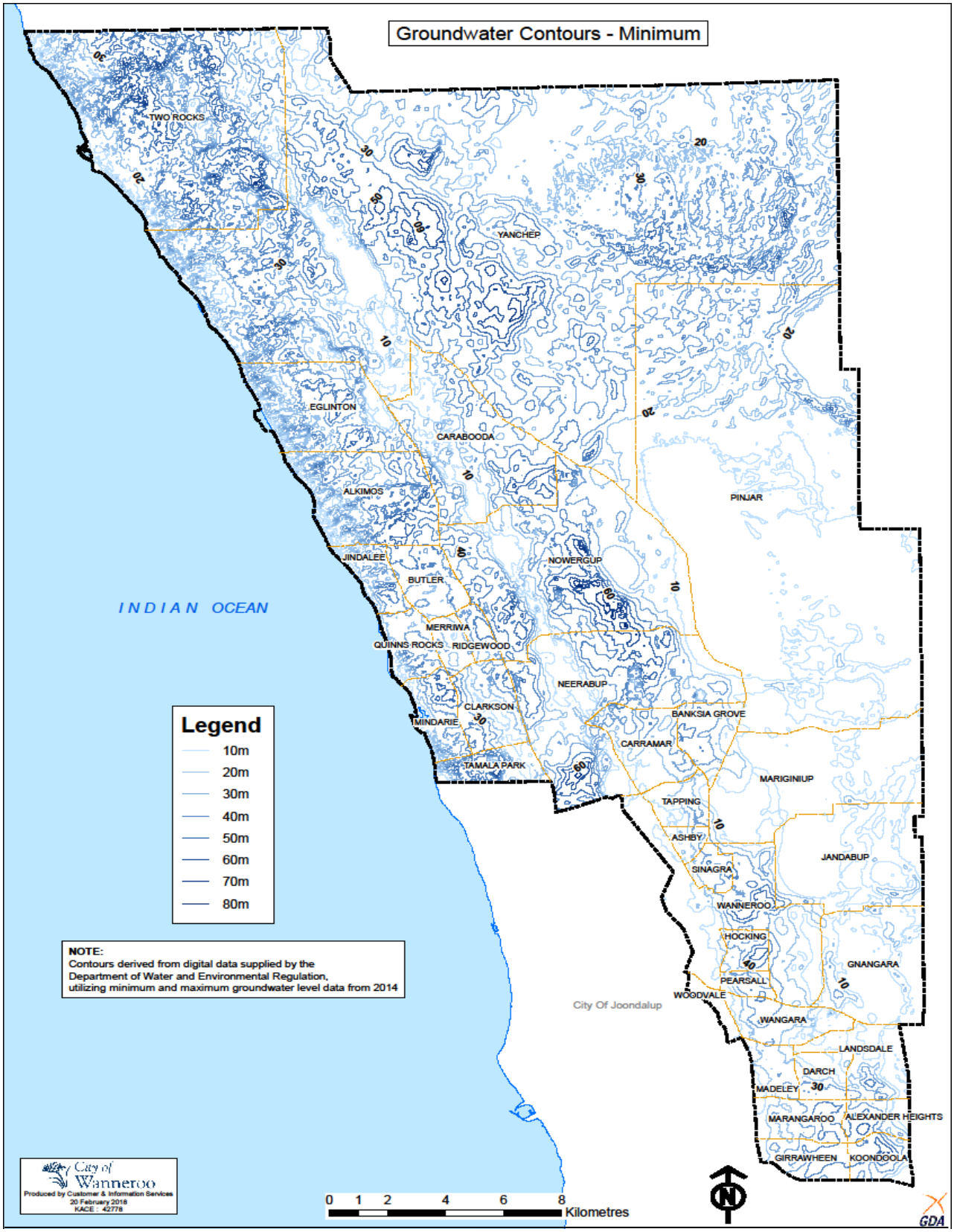
An important groundwater resource in the City is the Gnangara Mound, which is one of the main sources of public and private water supply in the metropolitan region and is protected by State Planning Policy. This good quality groundwater is generally unconfined, fresh and easily accessible, usually at depths of up to 50 metres below the surface (Water and Rivers Commission, 2004). The fundamental groundwater issues facing the City include:

- Groundwater levels and groundwater availability to a range of users and economic activities (e.g. horticulture, market gardening);
- Current over-allocation of groundwater;
- Ongoing protection of groundwater quality and protection from contamination; and
- Optimising beneficial recharge of treated waste water and surface-runoff to the groundwater body.

Through the Water Conservation Plan, the City aims to reduce its impact on the water table as a result of extraction for watering of parks. The LES looks to expand on the efficiency of groundwater protection through responses that focus on groundwater use, water sensitive urban design, and the City's water future as a whole. The LES will also look at how to maximise the use of water in its agricultural areas so that groundwater can be preserved and the City's important agricultural precincts can be preserved.

Figure 10: Pine trees are known to have a significant impact on groundwater levels in the City. Credit: B Ricetti.

Figure 11: Minimum Groundwater Contours



Surface Water - wetlands

A number of wetlands are situated throughout the City (**Figure 13**) where the ground surface in low-lying areas intersects with the seasonal groundwater table (Balla, 1994). The outcome is a range of wetland types, including a chain of linear lakes including Lake Joondalup, Goollelal, Nowergup, Neerabup and Carabooda, and a chain of circular lakes, including Lake Gnangara, Pinjar, Mariginiup and Jandabup. Wanneroo is also home to Kali Spring, a freshwater wetland along the coast of the City that also represents an important Aboriginal heritage site.

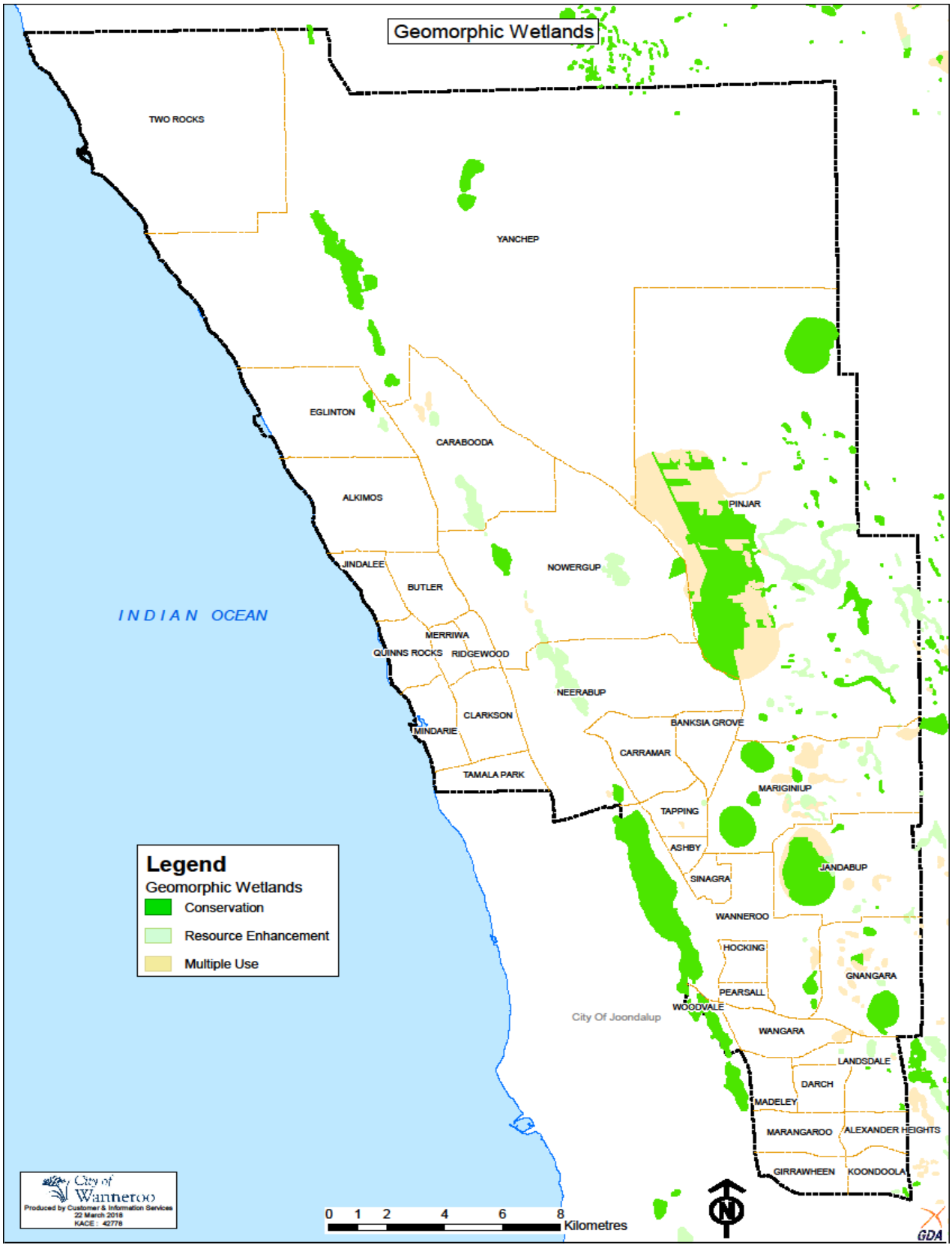
The City has a range of wetland ecosystems such as permanently inundated lakes, seasonally inundated swamps and seasonally waterlogged damplands. These wetlands provide important habitat for a diversity of fauna, including an extensive number of water bird species. The City's wetlands are divided into 3 management categories which denote their relative conservation values:

- Conservation category wetlands, which have a high level of ecological function and retention value. They must be retained in all development and subdivision proposals;
- Resource Enhancement wetlands, which are wetlands that may have been partially modified, but still support substantial ecological attributes. These must be retained in all development or subdivision proposals unless it can be demonstrated that little ecological value can be retained; and
- Multiple Use wetlands which contain few important ecological attributes. These are typically retained only as part of stormwater management where possible.

The City undertakes monitoring of some of its wetlands to ensure that they remain healthy. In addition, the City provides guidance on planning proposals that could have the potential to impact on wetlands through Local Planning Policy 4.1: Wetlands. The City looks to improve the quality of its wetlands through the implementation of the LES by pursuing innovative surface water improvement initiatives.

Figure 12: Lake Joondalup, Wanneroo. Credit: K Cook.

Figure 13: Geomorphic Wetlands



Coastline

The City's coast stretches 32 kilometres from Tamala Park in the south, to Two Rocks in the north. Wanneroo's coastal foreshore is relatively undeveloped, especially when compared to the coastline further south. The City's ocean coastline is an extraordinary natural asset for the City and has been an important stimulus to the urban growth of the coastal corridor.

The City's coast also contains important regional conservation values and extensive ecological linkages characterised by coastal limestone cliffs and coastal heathland vegetation. The coastline also represents sand dune formations occurring as beach ridges and a variety of dune types.

Virtually the entire coastal foreshore is contained in reserves for Parks and Recreation in the Metropolitan Region Scheme, and DPS2, as well as a majority being designated 'Bush Forever'. The extent of these reserves and coastal Bush Forever areas is shown in **Figure 15**, along with the projected 2120 vulnerability lines that have been determined through the City's Coastal Hazard Risk Management Adaptation Plan. It is important for the City to maintain a proactive approach to coastal adaptation in the face of rising sea levels, which represents a significant risk to the City in the future.

A majority of the overall coastal Parks and Recreation reserves are in public ownership; the exceptions being at the northern most part of the City's coastline where development has yet to occur.

Figure 14: Yanchep Lagoon. Credit: K Campbell.

Figure 15: Coastal Vulnerability

Built Environment

Historical Land Uses

The City of Wanneroo was first inhabited by indigenous Australians for approximately 35,000 years prior to British colonisation. Nyungar Aboriginal territory has been documented to have extended from Geraldton to Albany. Numerous Aboriginal heritage sites have been found within the City of Wanneroo and a significant number are protected under the Aboriginal Heritage Act 1972.

Following extensive and long lasting habitation by indigenous Australians, the City of Wanneroo was settled by market gardeners seeking out the potential of the extensive wetland system in the area for cultivation and available water supply. Later land uses in the City included limestone quarries and their associated limekilns. The Dongara to Fremantle stock route also ran through Wanneroo, using the lakes as watering holes along the way. Additionally, the coastline attracted fisherman to accessible points where small fishing communities established. These activities not only led to the City we know today, but also provided the foundation for the current mosaic of development and remnant natural vegetation cover. The township of Wanneroo established in the early part of the 20th century.

Current Land Uses

Over the last 50 years, this early land use pattern has evolved to a rapidly growing urban corridor nearest the coastline, with older residential suburbs of Girrawheen and Koondoola establishing during the 1970s. **Table 3** and **Figure 16** demonstrate the changes in urban and rural zoned land as the City's population increases over time.

The City is now one of the fastest growing in Australia, with extensive new urban areas being developed in the coastal corridor and east of Wanneroo Road. A characteristic of the City is therefore one of substantial land use transitions, including future changes in the adjacent rural zone(s) and former pine plantation State Forest 65 areas.

Another key characteristic of the City is an extremely dynamic and changing land use pattern. The current land uses within the City are illustrated in **Figure 17**.

Table 3: Changes in Urban and Rural land over time showing corresponding population growth.

Year	Urban Land (ha)	Rural Land (ha)	Population
2000	3,800[4]	19,800[4]	76,000[3]
2010	6,300[4]	17,300[4]	152,746[2]
2021	9,200[1]	14,400[4]	236,844[2]
2031	11,600[1]	12,400[5]	325,470[2]
2050	16,100[1]	7,900[4]	536,767[1]
Full development (approximately 2070)	18,100[1]	5,900[4]	614,500[1]

1 Figures derived from draft North West Sub-Regional Planning Framework

2 id. Consultants

3 Estimated from following year's census figures

4 Estimated by the City of Wanneroo Strategic Land Use Planning and Environment unit

5 Allows for 400 hectares of new urban land in South Pinjar State Forest (not rural land)

Figure 16: Urban and Rural land changes over time (with population growth).

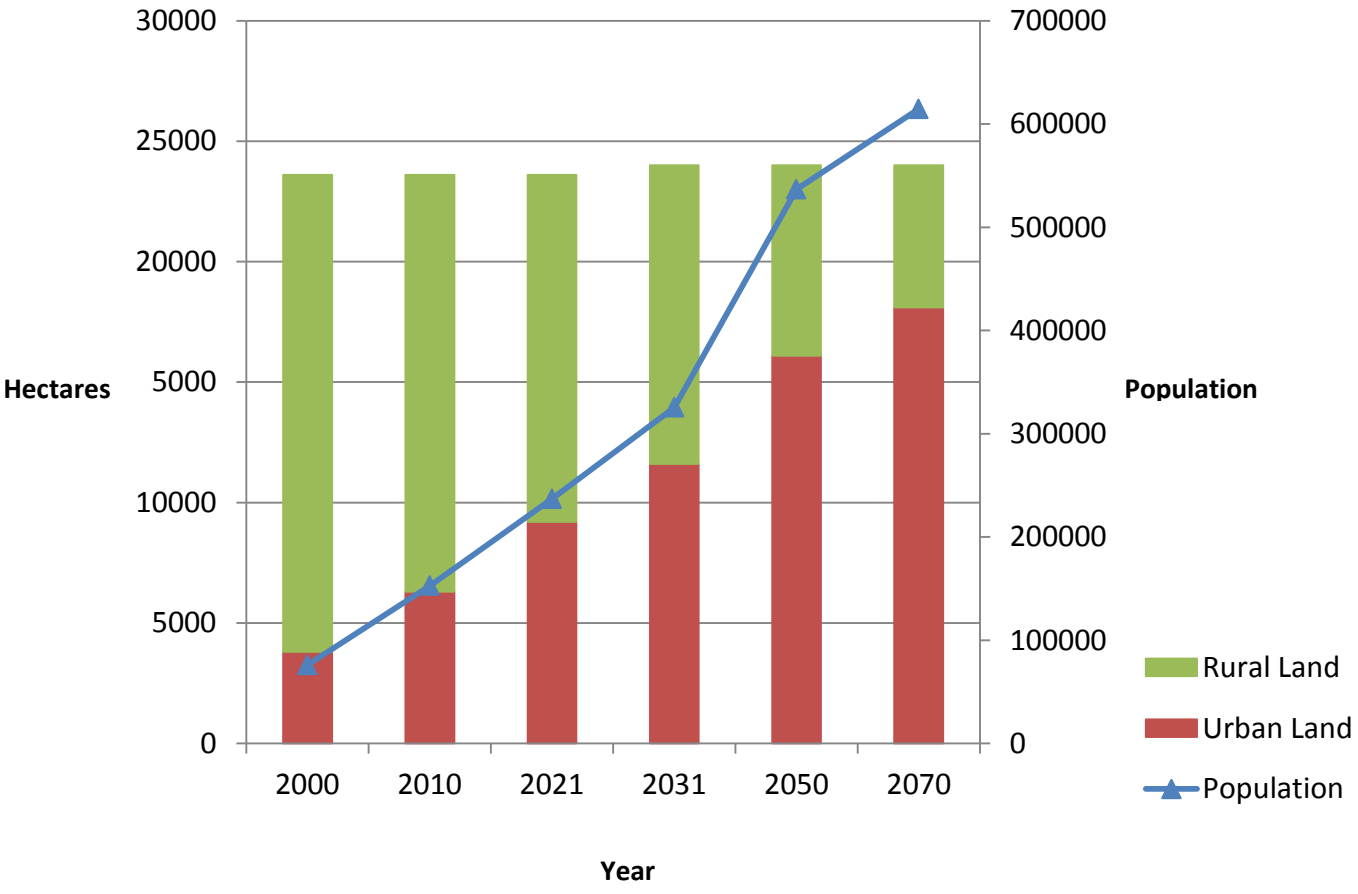
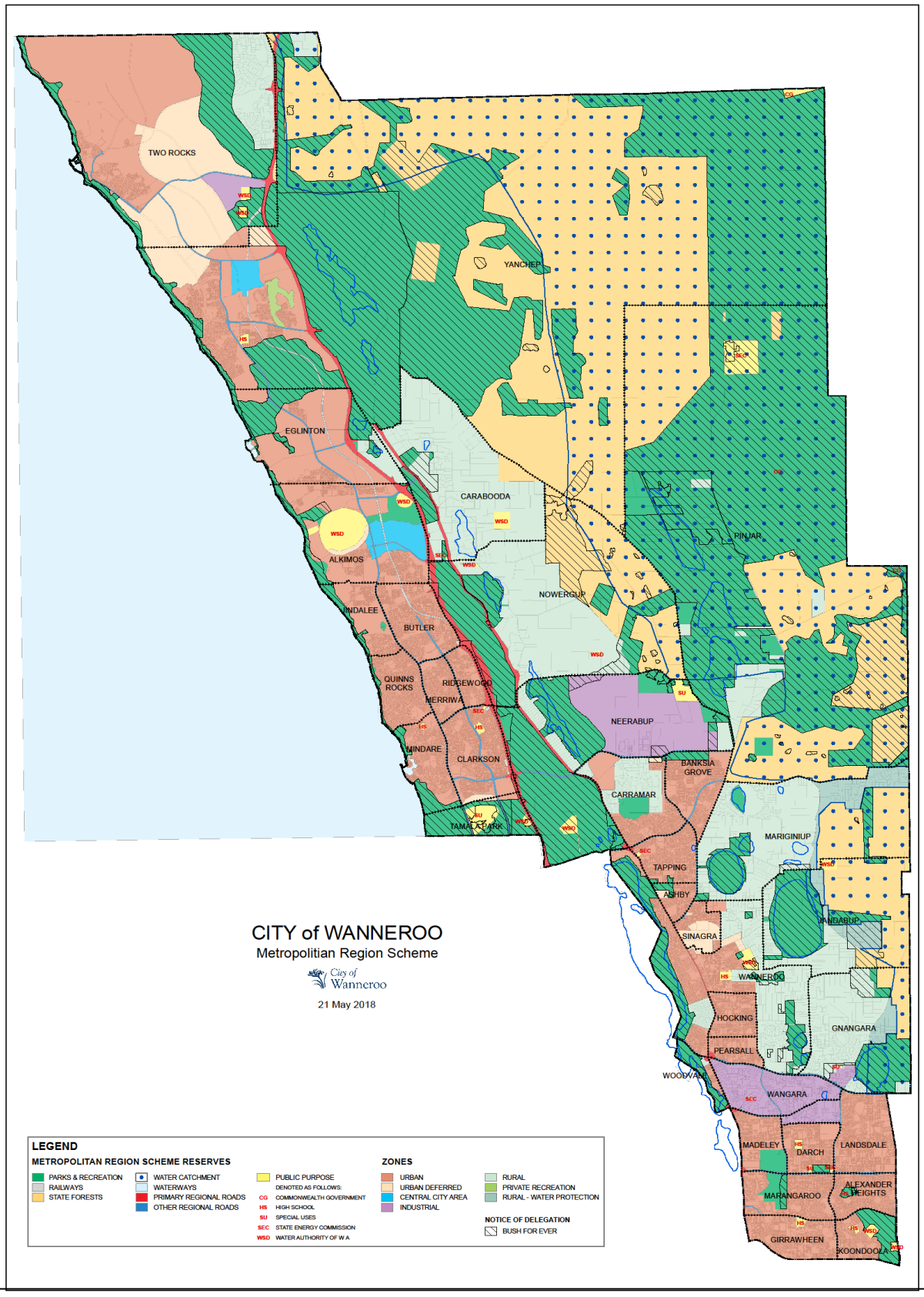


Figure 17: Current Land Uses in the City of Wanneroo



Built Form & Liveability

Development activities in the City to date have resulted in a diverse range of urban landscapes and built form outcomes. Beyond the broad land use types of residential, industrial, commercial (activity centres) and rural, the City is notable for the spatial pattern of evolving residential density, from larger lot (i.e. +700m^2) lower density residential areas in the older more established areas through to a more recent and far smaller lot sizes (i.e. +350m^2) in new subdivisions from Alexander Heights through to Mindarie and Butler, to portions of Yanchep.

The shift to higher density residential areas, particularly to cater for affordable housing, is creating a built form with increasing environmental issues, including:

- A reduction in amenity values;
- heat islands;
- insufficient street-tree canopy cover;
- diminishing private open space (i.e. gardens); and
- dominant roof-scapes.

In response to this, the LES will work towards providing green linkages through urban forestry, in order to encourage natural ventilation (e.g. breeze-ways), provide shade from harsh summer sunlight and radiant heat, and set aside remnant vegetation and native wildlife habitat.

Despite notable areas of high quality residential living (e.g. prime residential areas on the coastline, special rural subdivisions) there is increasing concern that the overall quality of the built environment in the City is at risk, or diminishing. This is a serious issue when combined with the realities of low local employment, long commutes to work, dense traffic and worsening congestion, and all the costs associated with these issues.

Some of the City's existing policies look to address some of these concerns such as Local Planning Policy 3.1: Local Housing Strategy and Local Planning Policy 4.20: Split Coded Areas, which look to regenerate some of the City's older areas by matching the housing types and locations with the needs of the community.

While the City provides generally appealing residential areas with appropriate housing, residential street design and subdivision layout and facilities, there is always room for improvement. The aesthetics of urban form, layout and quality of facilities are key contributors to 'liveability', and this is something that the LES aims to improve upon by proposing resposes that aim to improve the liveability of the City's built areas.

High Growth

The City is experiencing significant growth. Between 2001 and 2011 the population of the City grew from approximately 80,400 to 160,300 at an average of nearly 8,000 people per year. This has been the fastest growth of any local government in Western Australia, and represents about one fifth of all growth in the Perth-Peel region (ABS, 2011). **Figure 18** illustrates the extent of residential and industrial development per decade.

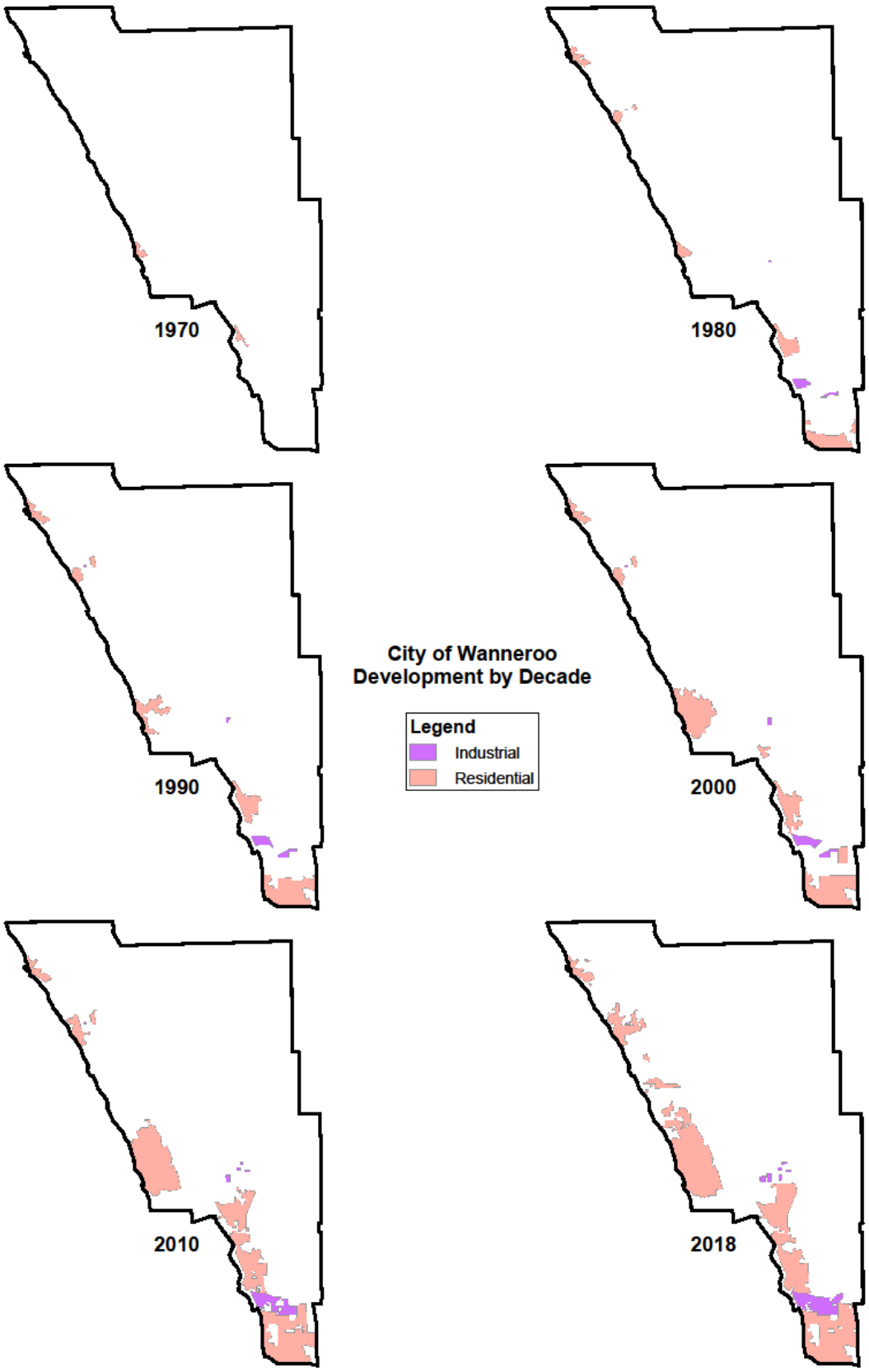
This population growth is expected to grow at more than 7,800 each year for the next two decades, resulting in more than a doubling of the population by 2036 (id Pty Ltd, 2013). This will make the City the most populated local government in the state within the next 10 years.

This high growth reality has enormous implications on many levels, and especially with respect to all aspects of environmental quality. Not only will natural systems (marine, surface and underground water, air quality and biological systems) all be exposed to various levels of potential impact, but so too will the maintenance of overall amenity and liveability.

Natural resources such as beaches, wetlands, and heritage landscapes are fixed assets in terms of their extent and availability. This means that with increased population of the scale envisaged these natural assets will in reality be a 'diminishing' resource, constantly facing increased levels of human use and intervention. Increasing demand for water, impacts on air quality, potential impact on groundwater quality, and protection and management of fertile soils will all be increasing concerns.

This Local Environmental Strategy seeks to address this reality.

Figure 18: Development by Decade



2.2 Issues and Opportunities

The following section outlines each of the Themes and their associated Topics. For each Topic, the corresponding issues and opportunities are presented.

Theme 1 – Flora & Fauna

There are a range of Issues and Opportunities that have potential to affect the quality of land in the City of Wanneroo. These include the changing physical characteristics of the natural and built environments, alterations in native vegetation cover over time, and impacts to biodiversity.

Native Vegetation

Issues:

There are large areas of remnant vegetation within the City of Wanneroo that are contained within land zoned for Urban Development which means that some of this will be formally protected through the creation of conservation reserves. The planning and development process provides a unique opportunity to retain and protect native vegetation within the designated urban growth corridor.

In this context, the prime issues are:

- Ensuring sufficient areas of representative natural vegetation are set aside in secure tenure(s) to ensure their protection in perpetuity.

- Ensuring sufficient mechanisms are in place for additional areas of natural vegetation to be securely set aside during the process of land use development and urban expansion, to add to the overall conservation estate ensuring adequate and sustainable natural vegetation cover in the City.

- Ensuring the protection of remnant native vegetation on private land within the City, and educating land owners on the benefits of retaining native vegetation on private property.

- Minimising the impacts of unlawful clearing through compliance and promoting the value of protecting native vegetation.

A further issue in the context of urban planning and residential subdivision design is the degree to which a significant amount of native vegetation can and should be re-introduced into the urban landscape. While this 'replacement' native vegetation is not a substitute for full ecosystem functions, it is nevertheless possible for reintroduced native plantings (high and mid canopy tree species particularly) to contribute significant environmental benefits to the City such as green linkages, functioning wildlife habitat, 'greening' of urban landscapes, micro-climate modification and reducing solar glare and radiant heat effects, which all contribute to liveability.

Opportunities:

A significant proportion of the overall City still retains natural vegetation cover. This is not surprising given the growth and development of the City has been relatively recent, and that historically the former Shire of Wanneroo was a heavily vegetated part of the region. This legacy exists today under various forms of tenure:

- First, extensive areas set aside in National Parks (e.g. Yanchep, Neerabup), crown land reserves, regional open space and various local open space categories (e.g. POS, conservation reserve) in the local planning scheme.

- Second, a considerable combined area of natural vegetation cover still occurs on privately owned land, in a range of different local planning scheme zones, including rural, urban and industrial, as well as a range of reservations including railways and public purposes.

Further, with an overall urban zoned land area of approximately 8000 hectares, there is an opportunity for substantial areas of land to be protected through the planning and development process. This includes protection of areas for inclusion into regional open space and bush forever, as well as retention of vegetation in smaller, local reserves and public open space.

Biodiversity

Issues:

Due to rapid population growth and an associated increase in urban development, particularly in the coastal corridor, the City will experience an increase in clearing of native vegetation. Over the past 5 years, the City has lost a sizeable land area (approximately 500 hectares) of the 'Quindalup' vegetation complex which is characteristic of the coastal area that has been designated and planned for urban development. The risk to the City is that it could lose representative vegetation complexes and fauna communities if their protection is not planned for in tandem with planning for development.

A key issue with respect to biodiversity is the sheer rate of land use change and urban development that is eroding the stock of natural resources (natural landscape features, native vegetation cover and fauna habitat), adversely affecting their supporting natural processes (e.g. maintenance of sub-surface groundwater flows, wetland water levels and water quality), which in turn impact on wildlife abundance and variability.

Opportunities:

The City has a significant range of both unmodified and partly modified ecosystems that contain significant levels of biodiversity, both individually and collectively. A significant portion of the City's biodiversity values are secured in State Forest and Crown reserves, local conservation reserves, and Regional Open Space. The tenure of these areas ensures the ongoing protection of natural environmental values including flora and fauna biodiversity. There are also, however, extensive areas of native vegetation and natural habitat on private land that are vulnerable to land use change.

In order to retain and promote biodiversity it is important to secure a range of habitats that provide a good representation of the vegetation complexes and fauna communities historically found within the City. The further protection of biodiversity is important for the ongoing survival of various flora and fauna species in the City, as well as to retain a sense of place based on the City's distinctive natural environment.

Theme 2 – Land & Waste

An increasing human population can lead to issues around waste generation and contamination of land, leading to increased health risks and decreased availability of land for waste disposal and other uses.

Waste Management

Issues:

As a result of an increasing human population, there is an associated increase in the amount of waste that is generated. Waste is generated by all sectors throughout the community, and it needs to be disposed of responsibly. The average City household disposes of 1.1 tonnes of waste through kerbside collected bins each year (CoW Strategic Waste Management Plan 2016).

As such, the availability of suitable land for the disposal of waste products is adversely affected. The diminishing availability of landfill in the Perth metropolitan area means that the City will need to seek alternative waste management and disposal methods in the future, with a view to reducing its environmental footprint.

There is also limited community understanding of how and where the City's waste is processed or disposed. This could be a contributing factor in the illegal dumping of rubbish in vacant land, verges, roadways, and bushland. Illegally dumped items, as well as general litter, are collected by the City in order to maintain amenity in public areas, and to protect the health of humans and the environment. This is done at a considerable cost to the City and as such, efforts should be made to reduce litter and illegal dumping across the City.

Opportunities:

A number of key opportunities present themselves when faced with the issues associated with excessive waste production. One of these opportunities involves considering waste as a resource that can be used by the community rather than something to dispose of. This is in line with modern industrial and commercial thinking that considers waste as a commodity of value.

Currently, the Mindarie Regional Council's Resource Recovery Facility uses waste as a resource by processing domestic waste into a soil enhancer. The majority of household waste, however, is

sent for landfill at Tamala Park, and so there is an opportunity to increase the volumes of waste being used as a resource.

The overall volume of waste going to landfill also needs to be reduced. This can be achieved by increasing recycling capabilities, and innovating in waste reuse and reduction. The City has an opportunity to reduce waste and to recover recyclable resources in line with the principles of a 'circular economy', which is a system that focuses on keeping material resources in use for as long as possible by reusing, recycling and repurposing items that would otherwise be placed into landfill.

In order to ensure that waste reuse and recycling initiatives are successful, the City will also need to investigate partnerships with wider industry and community groups to ensure that the community and industry is educated and kept up to date on waste management initiatives undertaken by the City. Community education would also likely assist in the reduction of illegal dumping and litter disposal in public areas.

The City's *Strategic Waste Management Plan 2016 – 2022* is well positioned to investigate the above opportunities around waste management and waste reduction and reuse, and it empowers the City to lead by example in the field of waste management.

Land Contamination

Issues:

Land can be contaminated through a variety of means, including but not limited to landfill, industrial activities, underground fuel storage, commercial activities, wastewater treatment plants, and naturally through acid sulphate soils.

Contaminated site identification and management has traditionally been the responsibility of individual landowners. This means that the responsibility lies with the City to manage and remediate its own contaminated sites; however, the City has a role in improving awareness for landowners of their own responsibilities within private property.

Soil and groundwater contamination is currently not effectively identified or managed across the City, which can potentially result in reputational damage, environmental harm, risk to human health and exposure to litigation/fines for the City and land owners. The City needs an effective

process around the identification and management of contaminated sites in order to reduce risks associated with not knowing their locations and not effectively managing and remediating land that is potentially contaminated.

Contaminated land can have detrimental effects on the quality of the natural and built environments, as well as adverse effects on human health if not managed and remediated. For these effects to be addressed and abated there needs to be a procedure in place for the identification, remediation, and ongoing management of contaminated land within the City.

Opportunities:

In Western Australia, contaminated sites are regulated by the Department of Water and Environmental Regulation (DoWER) through the *Contaminated Sites Act 2003* and the *Contaminated Sites Regulations 2006*. These allow the DoWER to identify and map confirmed contaminated sites through a data base. However, there is a risk that some contaminated sites remain unknown and therefore do not appear on the database. In addition to this gap, the City currently does not have a process to deal with the identification and remediation of its own contaminated sites.

This presents an opportunity for the City to develop its own database (including mapping) for contaminated sites that the City owns or manages, and to strategically consider how these sites can be remediated and what purposes the sites can be used for in the future.

The City also has a role to play in educating the community on the effects of contaminated sites on the natural environment and on human health, with the community likely benefitting from the City leading by example on the management and remediation of contaminated sites. Through the LES, the City can also investigate ways to better inform the community on the impacts of exposed acid sulphate soils, and what residents can do to prevent land contamination.

Theme 3 – Community

Impacts to the natural and built environments can either directly or indirectly result in negative impacts on the community. Such impacts can involve threats to liveability, sense of place and environmental health.

Sense of Place

Issues:

Sense of place can be a tenuous value, based on perception and influenced by many things. Tipping the balance from a positive sense of place to a negative sense of place (i.e. place-less-ness) is all too easy, particularly where rapid land use change is perceived as eradicating distinctiveness in the landscape replacing it with a pervasive mediocrity and uniformity deemed to be less than the landscape values it replaces.

This issue puts a great importance on the aesthetic and design quality of all developments and land use change. It is essential to strive to retain an original sense of place, or translate the essence or special values of places into the new urban form and developments. This involves respecting prominent or distinctive landscape elements (e.g. ridge-lines, topography, views and vistas, vegetation texture in the landscape), heritage sites and cultural icons that are valued by the community. However, additional to visual and physical artefacts it also involves traditional activities, such as trails or pathways, traditional sites for outings and picnics, lookouts and favourite meeting points, fishing and surfing locations, and market garden outlets for purchase of produce. These are all part of the lived environment, and wherever possible should be retained and integrated into the changing urban and non-urban landscapes so that cultural identity is preserved and enhanced.

Opportunities:

A sense of place refers to places that hold special meaning to the local or wider community. Places said to have a strong sense of place invariably have a strong identity and character that is deeply felt by local inhabitants and by many visitors. A distinctive sense of place is recognized to be an important attribute and asset of any location. It helps with positive 'place branding' of a local government and can be an important attractor to investors (investors and businesses), aspiring home buyers and visitors. Additionally, an exceptionally strong, positive sense of place can be the foundation of a thriving tourism industry, as many iconic locations around the world can attest to.

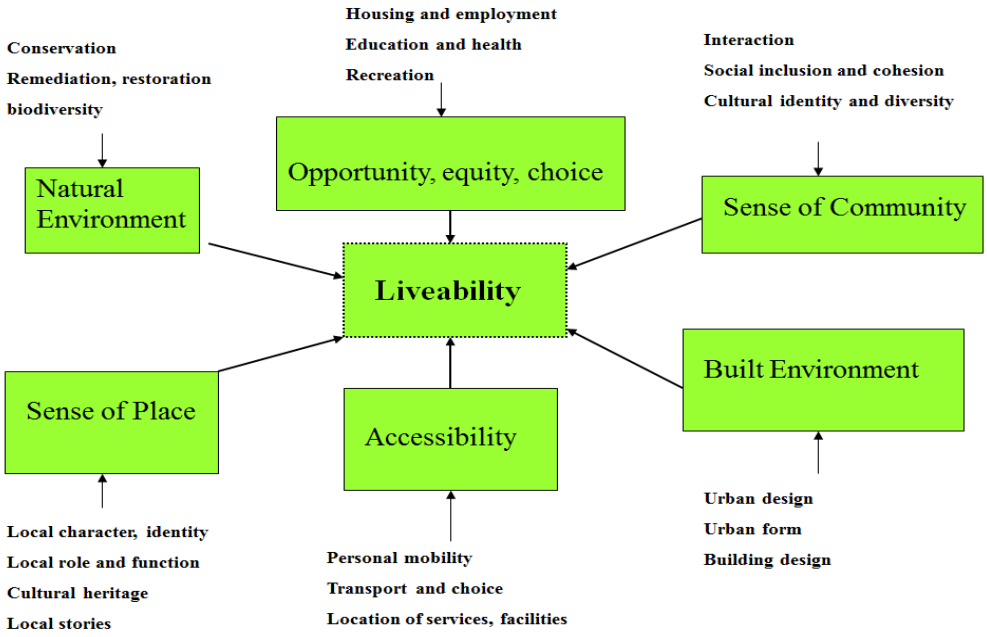
It is important for the City to capitalise on its exceptional natural attractions (beaches, wetlands, bushland, urban-scapes, and rural landscapes) and 'ocean frontage' setting to promote a strong sense of place.

Liveability

Issues:

Liveability is a diverse concept involving all factors that contribute to a positive 'way of living'. Liveability to most people means 'overall quality of life' with a particular focus on opportunities for recreation, employment, good health, education, as well as social and cultural equality. It also includes the availability of opportunity and supporting infrastructure for employment/jobs, and accessibility to all these important aspects of daily life.

Figure 19: Liveability Interactions with the Natural and Built Environments



At a practical level, a failure to achieve acceptable levels of 'liveability' can result from such things as urban development and poor street and residential design lacking in tree canopy so that summer sun results in excessive 'heat islands' and micro-climate conditions hazardous to the residents, particularly children and the elderly. It is essential that on the one hand the City promotes walkability (i.e. ped-sheds), functionality in streetscapes (i.e. streets performing multiple functions) and low energy transport options (i.e. cycle ways), but on the other installs pathways, cycle-ways, bus-stops with sufficient shade or weather protection.

Opportunities:

A sense of place is also part of liveability, but so too are the intactness of the natural environment and the qualities of the built environment such as urban design, urban form, architecture/ building design and providing access to public open space. Achieving a high standard of 'liveability' is an essential objective for the City, and a key aspect of both the Strategic Community Plan, and the Local Environmental Strategy.

Other important environmental contributors to liveability include the widespread occurrence of natural and non-urban landscapes, wildlife habitats and open spaces. These all provide essential 'relief' to the built environment. The community also values and obtains psychological relief from busy urban life-styles when reassured that nearby wildlife habitats and natural systems such as lakes, bushland, beaches and nearshore marine ecosystems are protected and managed.

The LES looks to promote liveability by providing a strategic response to improving walkability through improved urban design of new and existing residential areas. Public open space design and functionality can also be improved so that their integration with, and sense of ownership by the community is greatly improved to positively contribute to liveability of built areas.

Figure 20: Perry's Paddock, Yellagonga Regional Park. Credit: D. Win.

Theme 4 – Climate

Changing climate is a major issue that has the potential to adversely impact the natural, built, and human environments of the entire City. Impacts associated with climate change involve the potential loss of the City's natural and built assets through extreme weather and fire events. The risk levels of impacts associated with climate change are extremely high.

Climate Change Impacts

Issues:

It is known that the global climate change is projected to continue into the future, and as a result there will be an increase in extreme weather events, erosion of coastal areas, and changes to local climate. A projected increase in temperature of approximately 2.1°C by 2030 could potentially lead to impacts on human health, and reduced liveability in areas of the City, increased risk of bushfires, and loss of agricultural areas.

Opportunities:

There are two key approaches to climate change: climate change adaptation and climate change mitigation. The first is responding to climate change factors in order to minimise adverse outcomes and hence to manage risk. Examples include increasing development set-backs along the coast to address the risk of sea level rise and increased coastal erosion, and increasing water efficiency in the design and management of parks and public open space in response to declining rainfall.

The second is taking initiatives that contribute to the reduction of factors of climate change both directly such as energy reduction, reducing CO^2 emissions/carbon footprint, and indirectly such as instigating planning approaches to reduce transport needs and total vehicle movements per kilometre per year, and encouraging the construction of thermally efficient and reduced energy consumption in residential and commercial structures/buildings.

For the impacts of climate change to be further minimised, the City needs to ensure that it can adapt to the impacts of sea level rise, and ensure a resilient community that has the ability to prepare, react and respond to the impacts of extreme weather and fire events through the

completion of key projects. The City needs to ensure that the community are sufficiently equipped with accurate information so that informed decisions can be made by residents into the future.

Theme 5 – Air & Energy

Increasing human activity can adversely affect air quality, potentially leading to adverse health effects, reduced liveability, and changes to the natural environment. Increased emission of air pollutants, inefficient use of energy and resources, and heat islands can all contribute to reduced air quality in the natural and built environments

Air Quality

Issues:

There are a number of aspects to air quality relevant to this strategy. The first concerns the impact of emissions (gaseous pollutants) and particulate matter (i.e. dust) on air quality. These pollutants arise from a wide variety of activities, some of which are regulated under Part V of the Environmental Protection Act (e.g. Prescribed premises), but others of which arise from general physical conditions in the landscape and are affected by seasonal weather conditions (e.g. exposed ground surfaces and soils in hot windy summer conditions, generating dust, and airborne particulates from disturbance of contaminated soils such as peat fires), or by such factors as severe traffic congestion and lack of vegetation.

The second concerns what is broadly termed ‘ventilation’ (i.e. air movement). In urban areas this refers to effects of local topographic or landscape characteristics in conjunction with poor urban design, such that pockets of ‘poor air quality’ occur (e.g. ‘stale’ air from lack of ventilation/air movement; uncharacteristically ‘hot’ air due to prevalence of heat absorbing surfaces/thermal mass).

Over reliance on automobiles as well as the impacts of industrial land uses, raises the risk that air quality will be adversely affected with resultant impacts on human health. Poor development leading to an increased occurrence of heat islands in built areas can impact on liveability, amenity, and human health.

Opportunities:

One way for the City to protect air quality over time, is to ensure vegetation cover is protected in key areas wherever possible, and that developed areas contain sufficient tree canopy to clean (i.e. filter) the air and regulate microclimates. The City also needs to investigate sustainable transport options to counter the adverse air quality impacts of development, and consider a holistic approach to development of new areas in order to avoid the effects of heat islands. Community education can play a significant role here in spreading the message about the adverse effects of poor air quality. Through leading by example, the City can set a strong precedent for how air quality can be improved through effective building design and by providing and promoting sustainable transport options.

Sustainable Energy

Issues:

As one of the fastest growing Local Government Areas in Australia, the City is experiencing an increase over time in the use of natural resources in general, and in energy usage in particular, as new facilities are built and its operations are expanded to meet the demands of a growing population.

Taking energy as a key matter, the reliance on non-renewable energy (e.g. fossil fuels) at a State and Federal level raises significant sustainability issues, particularly due to increasing energy costs and increased impact to the natural environment. A steadily growing population also means that the City needs to encourage the wider community to consider alternative sources of energy and promote sustainability, in order to protect the way of life the City is known for.

Opportunities:

In order to ensure a sustainable future, there is a need to diversify energy resources utilised by the City and its community. The City recognises the need to take a lead by reducing its energy consumption, and assist the community in doing the same by providing guidance on energy efficient housing design and sustainable transport options. Water, dealt with below, is another key aspect of sustainability in the City.

The City also has an opportunity to investigate the viability of alternative, renewable energy resources in its own facilities, as well as to educate the community on the benefits of these in the residential setting.

Theme 6 – Water

This theme can be summarised by the potential threats to water quality and availability, primarily caused through over reliance on groundwater, expanding development, and urban water management practices.

Water Availability

Issues:

The Gnangara mound aquifer(s) underlies the City and is a highly valuable source of groundwater for public and private water supply, including both domestic consumption and commercial activities (e.g. horticulture/market gardening). Groundwater is also essential for the maintenance of various native vegetation and wetland systems.

Due to a downward trend in rainfall, a growing population and an increase in provision of facilities including areas of public open space which are heavily reliant on ground water, it is expected that over the next 10 years the demand for water in the City will increase significantly.

A higher demand for groundwater for public and private use will have a variety of effects including, but not limited to, increased costs for government, industry and residents, increased pressure on land uses such as agriculture that rely on groundwater, increased competition for remaining resources, and adverse impacts on wetland health and vegetation.

Opportunities:

Currently, there are ongoing reviews of State government policy direction on the Gnangara mound. The City needs to work with State government to develop a long term plan for the efficient use of groundwater. Alternative sources of water for public and private use also need to be investigated to ensure the water future of the City and its community.

Improvements in urban water resource management can contribute to reduction of waste water use, or water loss, and hence allow water resource allocation to high priority activities (e.g. food production, wetland replenishment, vegetated urban-scapes, etc.). The City also has an important role to play in leading by example and educating the community on efficient water use and promotion of water sensitive technologies and initiatives such as grey water systems, water wise gardens and stormwater collection and reuse.

Water Quality

Issues:

Increasing urbanisation is likely to have a detrimental effect on surface water catchments such as wetlands due to stormwater runoff and reducing groundwater levels. For example, Lake Joondalup has experienced environmental issues as a result of low water quality caused from runoff from incompatible adjacent land uses. Development of land also has the potential to disturb contaminated soils, including naturally occurring acid sulphate soils which can lead to surface water and groundwater contamination. Decreasing groundwater levels are also likely to have adverse impacts on the health of wetlands, leading to an increase in pest species such as midge and mosquitos, which can also lead to health impacts for the community.

Opportunities:

The City has a number of Conservation category wetlands, including a chain of linear lakes which include Lakes Joondalup, Neerabup, and Carabooda, and a chain of circular lakes including Lakes Gnangara, Pinjar, Mariginiup and Jandabup. Each of the City's lakes and wetlands is home to biodiverse ecosystems and environmental qualities that are valued by the community.
In order to ensure the health of the City's surface water catchments into the future, there needs to be constant review of the City's policy position on wetland retention and wetland buffer protection to avoid the impacts of development. The City also needs to ensure that water sensitive urban design principles are up to date and effective in nutrient and pollutant stripping. The City will also need to respond to any potential decrease in groundwater levels, and work proactively with State government to ensure the maintenance of groundwater into the future.

PART B – STRATEGIC APPROACH

3. Responses

Tables 4 to 9 below outline the existing and future strategic responses to the key issues and opportunities that have been identified under each Theme. Section 4 of the LES goes into further detail about how current work undertaken by the City fits into the responses, and how future initiatives will be translated into achievable and measurable actions for implementation.

Figure 21: Discovery Park, Banksia Grove. Credit: S Kaushal.

Table 4 – FLORA & FAUNA

Topic	Issues	Opportunities	City Response
Native Vegetation *(SCP Strategies – 3.2.1, 3.2.2, 3.4.4, 3.5.2)*	❖ Environmental impacts of planned development ❖ Unlawful vegetation removal	❖ Creation of Local Conservation Reserves through the planning process ❖ Emphasis on land zoning and reservation for the purpose of vegetation retention on private property	***Existing initiatives:*** - *Local Planning Policy 1.1: Conservation Reserves;* - *Local Planning Policy 4.8: Tree Preservation* - *Street Tree Policy and Verge Tree Planting Requests* - *Compliance administration with State and Federal legislation* ***Potential future initiatives:*** - *Investigate further protection and enhancement of native vegetation that integrates with forward planning and urban design, including improving the potential of the City's planning scheme to support increased vegetation retention and management on rural lands and in residential areas.* - *Response to outcomes of the Perth and Peel Region Green Growth Plan.*
Biodiversity *(SCP Strategies – 3.2.1, 3.2.3)*	❖ Potential loss of some vegetation complexes through development ❖ Loss of	❖ Further expansion of conservation estates in State Forest, Regional Open Space and Yanchep National Park	***Existing initiatives:*** - *Local Biodiversity Plan* - *Environmental Management Plan Guidelines, which provide guidance on vegetation and fauna protection through the*

	representative fauna communities	❖ Retention of high biodiversity through variety of vegetation complexes ❖ Protection of vegetation complexes unique to the City of Wanneroo	*development process* - *Local Planning Policy 4.1: Wetlands* - *Local Planning Policy 3.3: Fauna Management* ***Potential future initiatives:*** - *Investigate the establishment of a permanent, integrated POS based biodiversity network throughout the City that supports the establishment and protection of ecological linkages allowing the movement fauna.*

Table 5 – LAND & WASTE

Topic	Issues	Opportunities	City Response
Waste Management ***(SCP Strategies – 3.3.1, 3.3.2, 3.3.3)***	❖ Increased population leading to increased waste generation and a lack of available land fill area ❖ Illegal dumping of waste into vacant land and bushland	❖ Innovations in resource recovery, waste reduction and recycling ❖ Improvements in waste education and communication between the City and the community	***Existing Initiatives:*** - *Strategic Waste Management Plan* ***Potential future initiatives:*** - *Ensure the City's ongoing commitment to strategic waste management by measuring and utilising waste resources effectively and reduce waste to landfill by incorporating aspects of a circular economy into the way the City manages waste.*
Land Contamination ***(SCP Strategies – 3.2.1, 3.2.2)***	❖ Contaminated sites are not managed	❖ Improved reporting and mapping of	***Existing Initiatives:*** - *Enforcement of Unauthorised*

	in a coordinated manner across the City ❖ Potential health impacts from contaminated sites, including but not limited to generation of airborne particulates from disturbed contaminated (e.g. acid sulphate) soils.	contaminated land ❖ Remediation of contaminated sites so that land can be developed	*Discharge Regulations* - *Maintain register of the City's contaminated sites* ***Potential future initiatives:*** - *Maintain and improve a coordinated approach to contaminated sites management across the City that addresses identification and remediation of contaminated land.*

Table 6 – COMMUNITY

Topic	Issues	Opportunities	City Response
Sense of Place ***(SCP Strategies – 3.4.1, 3.4.2, 3.4.3, 3.4.4)***	❖ Loss of cultural identity through urbanisation ❖ Changing land uses	❖ Strengthening sense of place in urban and non-urban settings ❖ Enhancing landscapes and preserving land use diversity	***Existing Initiatives:*** - *The CoW Place Framework* - *Landscape Enhancement Zone in the City's District Planning Scheme No. 2* - *Local Planning Strategy (in preparation)* - *Local Heritage Survey* - *Local Planning Policy 4.13: Caves and Karstic Features* ***Potential future initiatives:*** - *Investigate and develop a landscape, urbanscape and heritage vision that takes account of planned future*

			growth and development of the City. - *Ensure the preservation of culturally and environmentally significant landscapes (e.g. Aboriginal and European heritage).*
Liveability ***(SCP Strategies – 3.4.1, 3.4.4, 3.5.2)***	❖ Increasing urban development ❖ Poor functionality in streetscapes, activity centres and community facilities (i.e. open space) – for pedestrian, cycling and localised human movement	❖ Promoting recreation and social interaction through planning and design ❖ Increased lifestyle options based on appropriate urban and civic design ❖ Providing access to public open space, local natural areas and regional resources for recreation and leisure (e.g. ocean beaches, major parks etc.)	***Existing Initiatives:*** - *Local Planning Policy 4.3: Public Open Space* - *Draft Local Planning Policy 4.10: Streetscapes* - *Adherence to guidance set out in 'Liveable Neighbourhoods'* ***Potential future initiatives:*** - *Activate parks, nature reserves, public/ civic space and streets in the City.* - *Seek to maximise the functionality and integration of open space resources with the built urban environment.* - *Investigate and implement ways to improve walkability within residential areas.*

Table 7 – CLIMATE

Topic	Issues	Opportunities	City Response
Climate Change Impacts *(SCP Strategies – 3.1.1, 3.2.2)*	❖ Increasing occurrence of extreme weather events ❖ Increasing occurrence of community health impacts as a result of a warming climate	❖ Promoting a positive approach to climate change response ❖ Pursuing a proactive approach to coastal management	***Existing Initiatives:*** - *Climate Change Adaptation and Mitigation Strategy* - *Coastal Hazard Risk Management Adaptation Plan* ***Potential future initiatives:*** - *Ensure that the City maintains a proactive approach to climate change mitigation imperatives.* - *Investigate options for ongoing adaptation and response to climate change into the future.* - *Investigate ways to improve community preparedness and ability to respond to climate change events.*

Figure 22: Low water levels in Lake Joondalup as a result of a changing climate. Credit: B Ward.

Table 8 – AIR AND ENERGY

Topic	Issues	Opportunities	City Response
Air Quality ***(SCP Strategies – 3.2.3, 3.4.2, 3.4.4, 3.5.1, 3.5.2, 3.5.3)***	❖ Increasing incidence of heat islands ❖ Continued reliance on cars	❖ Increasing canopy cover through tree retention and street tree planting ❖ Improving sustainable transport options	***Existing Initiatives:*** - *Transport Strategy (under preparation)* - *Local Planning Strategy* - *Draft Local Planning Policy 4.10: Streetscapes* ***Potential future initiatives:*** - *Identify sustainable transport options and initiatives throughout the City and reduce/ mitigate transport related impacts on the human environment.* - *Enhance the urban environment by integrating tree canopy into the urban form and incorporating breezeways and linear POS into streets to establish a sustainable urban forest.* - *Continue to explore all initiatives to help reduce traffic congestion and road transport volumes.* - *Investigate the development of planning mechanisms to facilitate increased tree canopy in new developments.*
Sustainable Energy ***(SCP Strategies – 3.1.2, 3.2.2)***	❖ Increasing energy usage with a growing population ❖ Continued reliance	❖ Reducing energy consumption through new initiatives	***Existing Initiatives:*** - *Energy Reduction Plan* ***Potential future initiatives:*** - *Identify priority opportunities for*

	on fossil fuels		*energy reduction and efficiency in community facilities, and investigate use of alternative, renewable energy resources.* - *Lead by example with ongoing identification of innovative technologies for potential application within the City (e.g. micro-grids, battery technology, and solar farms).* - *Identify approaches to inform the community on the benefits of new and improved technologies for reducing energy use.* - *Investigate the development of planning mechanisms to promote energy efficiency and renewable energy technologies in new developments.*

Table 9 – WATER

Topic	Issues	Opportunities	City Response
Water Availability ***(SCP Strategies – 3.1.3, 3.2.2, 3.4.4)***	❖ Increasing demand for groundwater ❖ Decreasing rainfall ❖ Lack of guidance from State government on future water resourcing	❖ Protection and management of the Gnangara mound through innovative science and technology ❖ Conservation of water through environmental initiatives ❖ Optimising the overall water balance through informed land use changes	***Existing Initiatives:*** - *CoW Water Conservation Plan* - *Local Planning Policy 4.4: Urban Water Management* ***Potential future initiatives:*** - *Effectively plan for the City's water future by maximising water use efficiency and improving water sensitive urban design applications.* - *Continue to identify potential*

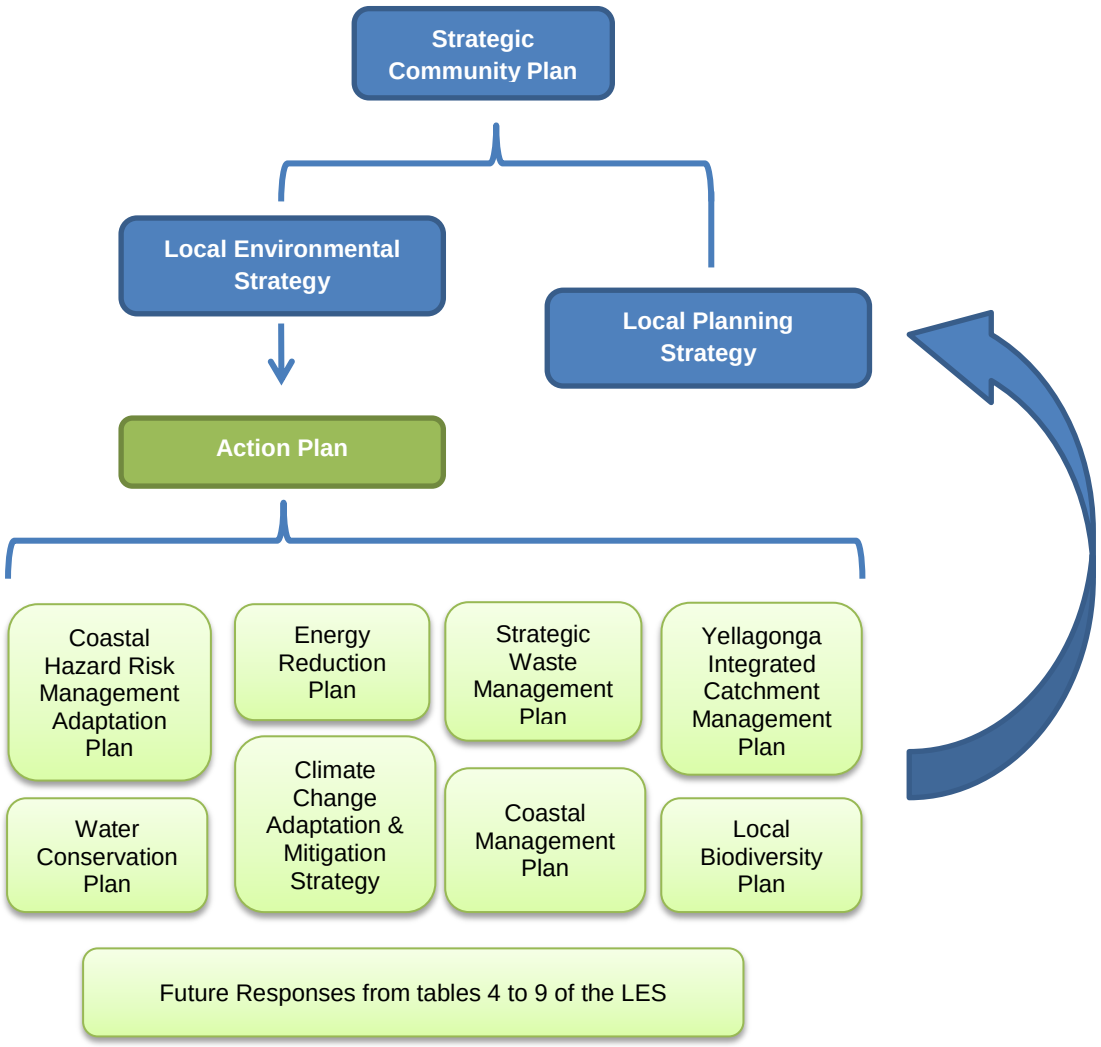
			new water sources for the Wanneroo agricultural area and Rural zone. - *Investigate the development of planning mechanisms to promote water efficiency, water capture and reuse technologies, and alternative water sources in new developments.*
Water Quality ***(SCP Strategies – 3.1.3, 3.2.1)***	❖ Pollution of surface water (i.e. wetlands) and groundwater from stormwater runoff and land contamination (e.g. acid sulphate soils). ❖ Increasing occurrence of incompatible adjacent land uses	❖ Enhancement of conservation category wetlands ❖ Implementation of water sensitive urban design principles ❖ Applying new technologies to prevent/ minimise impacts on groundwater quality in urban settings.	***Existing Initiatives:*** - *Yellagonga Integrated Catchment Management Plan 2015 – 19* - *Local Planning Policy 4.1: Wetlands* - *Continued compliance administration with State Government groundwater protection legislation* ***Potential future initiatives:*** - *Continue to investigate groundwater and surface water quality improvement initiatives across the City (e.g. improving water use efficiency, retrofitting stormwater infrastructure, soil improvement, and investigating domestic stormwater technologies).*

4. Implementation

4.1 Structure of Environmental Planning Framework

The LES sets the strategic direction for a range of existing and future initiatives and operational projects. **Figure 23** illustrates how the LES leads to the implementation of environmental plans, strategies, and projects within the City and how they feed information back into the Local Planning Strategy. While **Figure 23** only shows major strategic projects following on from the LES, there will be a range of other measures such as policies, processes and procedures that will be implemented to address the key issues and opportunities identified in the LES through the Action Plan.

Figure 23: Strategic framework for the LES and related Plans and Strategies



4.2 Implementation, Monitoring and Review

The LES will be implemented and monitored through a comprehensive Action Plan which will ensure that:

- Existing and future responses to issues and opportunities align with community expectations as they are set out in the City's SCP;
- Individual actions address each of the responses presented in **Tables 4 to 9** in Section 3 above, and include indicative timeframes and service unit responsibilities for carrying out each action;
- Actions adequately address the issues and opportunities set out in the LES and stay relevant to the key environmental topics across the City;
- Key risks identified through the preparation of the LES are incorporated into the City's Strategic and Corporate Risk Registers so that the implementation of the LES can align with and inform the City's Risk Mitigation Strategies (See **Figure 24** below); and
- There is continual improvement of City responses to issues and opportunities by including actions into the City's Corporate Business Plan, and managing individual actions through the City's project management framework.

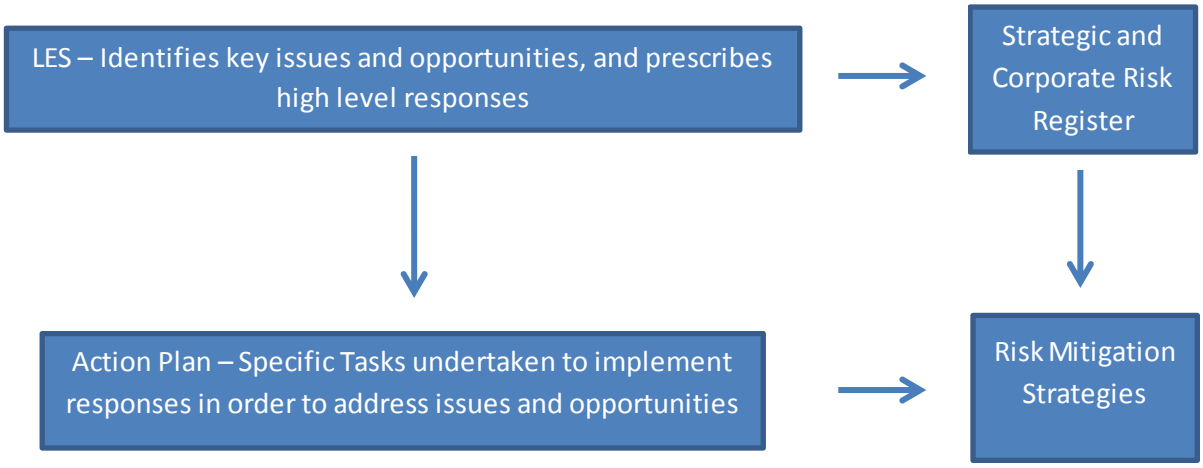
The purpose of the Action Plan will be to implement the LES and to keep track of the City's progress in regards to addressing key issues and opportunities identified through **Tables 4 to 9**. The Action Plan will be a living document that will ensure that the LES remains an up-to-date and aligned with the community's expectations as reflected in the Strategic Community Plan.

Individual actions that will be included in the Action Plan will include the following:

- Creation of new strategies and plans;
- Drafting new local planning policies;
- Operational work, procedures and processes; and
- Assessment of management plans and planning applications.

The risks identified through the LES and incorporated into the City's risk registers will be continually monitored at a corporate level in order to ensure that the City continues to address the key issues and opportunities identified in the LES.

Figure 24: Incorporation of LES responses into corporate risk mitigation.



The progress of the implementation of the LES will be monitored and evaluated through the Action Plan to ensure alignment with the Strategic Community Plan, and adjustments will be made where necessary to ensure the actions of the LES reflects the key environmental issues and opportunities. The LES will be comprehensively reviewed in response to changes in community expectations as reflected in the Strategic Community Plan; or if environmental issues and opportunities demand a comprehensive review of the LES, with the strategic and corporate risk registers will be updated accordingly.

Figure 25: Perry's Cottage, Yellagonga Regional Park. Credit: A Dabrowski.

PART C – APPENDICES

Appendix 1 – Glossary of Terms

ABS – Australian Bureau of Statistics

CHRMAP – Coastal Hazard Risk Management and Adaptation Plan

CoW – City of Wanneroo

DA – Development Application

DoWER – Department of Water and Environment Regulation

DPS 2 – District Planning Scheme No. 2

EAC – Environmental Advisory Committee

EMP – Environmental Management Plan

LES – Local Environmental Strategy

LPS – Local Planning Strategy

MRS – Metropolitan Region Scheme

SCP – Strategic Community Plan

POS – Public Open Space

WALGA – Western Australian Local Government Association

WAPC – Western Australian Planning Commission

Appendix 2 - References

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Appendix 3 – Key Stakeholders

Partnerships with key stakeholders, including local government organisations, state and federal government, and community groups, are important to successfully implement strategic environmental management.

The key stakeholders listed in **Table 10** are those who have a shared interest in the management of the natural and built environments.

Table 10: List of Key Stakeholders

City of Wanneroo community members	Department of the Environment and Energy
Mindarie Regional Council	Department of Water and Environmental Regulation
Environmental Advisory Committee	Department of Biodiversity Conservation and Attractions
Other Local Government Organisations	Department of Planning, Lands and Heritage
Community Groups	Western Australian Local Government Association
Residents Associations	City of Joondalup
City of Stirling	City of Swan

Partnerships with individuals and organisations, as above, can help the City in its strategic and on-ground initiatives to improve the natural and built environments.

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