URBAN FOREST
WORKING GROUP

DRAFT STRATEGY

Collated contributions from individual members of the Urban Forest Working Group

As amended

September 2017

Foreword

The Town of Bassendean's urban forest consists of all trees and vegetation located within the municipal boundary and comprises all the trees, irrespective of whether the trees are in parks, river foreshores, bushland areas, along road verges or within private ownership.

The Town 's Urban Forest Strategy will secure the urban forest as a sustainable asset, which further contributes to the liveability of the Town and quality of life for all its residents.

A thriving urban forest is seen as a desirable quality, supporting sustainable growth in population, property and industry and therefore the livelihoods, lifestyles and health of the entire community.

This strategic document provides a foundation for how Council will continue to enrich and enliven our neighbourhood character and amenity through the continued management of our most valuable assets, for current and future generations.

The Town of Bassendean Strategic Community Plan 2017-2027, sets out the following priorities for the natural and built environments:

Strategic Priority 2: **Natural Environment**		
Objectives What we need to achieve	**Strategies** How we're going to do it	**Measures of Success** How we will be judged
To display leadership in environmental sustainability	• Strengthen environmental sustainability practices and climate change mitigation. • Reduce waste through sustainable waste management practices. • Initiate and drive innovative Renewable Energy practices	• Waste reduction ratio to population • Carbon emissions ("Planet Footprint")
Protect our River, Bushland Reserves, and Biodiversity.	• Protect and restore our biodiversity and ecosystems. • Sustainability manage significant natural areas. • Partner with stakeholders to actively protect, rehabilitate and enhance access to the river.	• Community/Stakeholder Satisfaction Survey (River, Bushland and Reserves) • Biodiversity and Bush Condition (Keighery Scale of bush condition) measurement.
Ensure the Town's open space is attractive and inviting.	• Enhance and develop open spaces and natural areas to facilitate community use and connection. • Sustainably manage ground water, facilitate the conversion of drains to living streams.	• Community/Stakeholder Satisfaction Survey (Open Space and use of Open Space) • Increase in Public Open Space • Tree Canopy Area monitoring (Private and Public realms). • Water Quality entering the Swan River, analysed in accordance with the Australian Government National Health and Medical Research Council Guidelines.

Strategic Priority 3: **Built Environment**		
Objectives What we need to achieve	**Strategies** How we're going to do it	**Measures of Success** How we will be judged
Plan for an increased population and changing demographics	• Facilitate diverse housing and facility choices. • Implement sustainable design and development principles. • Plan for local neighbourhoods and their centres. • Ensure infrastructure is appropriate for service delivery.	• The number of new dwelling approvals granted by the Town against the *Perth and Peel@3.5 million* planning framework target for Bassendean (4,200 new dwellings by 2050). The level of community engagement and participation into Local Area Planning (Input into plans and policy development)
Enhance connectivity between places and people	• Protect and restore our biodiversity and ecosystems. • Sustainability manage significant natural areas. • Partner with stakeholders to actively protect, rehabilitate and enhance access to the river.	• Community/Stakeholder Satisfaction Survey (Roads, footpaths and c ycle paths). • Community/Stakeholder Satisfaction Survey (Access to public transport, both Town and within.
Enhance the Town's appearance	• Connect the Town through a safe and inviting waling and cycling network. • Advocate for improved and innovative transport access and solutions. • Enhance the liveability of local neighbourhoods. • Enhance road safety through design.	• Community/Stakeholder Satisfaction Survey (Heritage, amenity and appearance)

The management of our trees is a critical aspect of Council's function and with increasing urban density, and the loss of the traditional back yard, our community expectations and demands are increasing, with the management of these important assets is becoming more difficult and complex.

In 2010, the Western Australian Planning Commission adopted the Directions 2031 strategic planning document, which indicated the Perth metropolitan area would reach a population of 2.2 million by 2031. However, in 2015, the draft Perth and Peel @ 3.5 million suite of strategic land use planning document, was released for public comment which suggested the population would be reached a population of 3.5 million (under a medium growth scenario) by 2050. Given the projected increased urban density and climate change, these issues provide a clear opportunity to communicate the importance and benefits of urban forests in creating resilient, sustainable cities that provide healthy and enjoyable places for people to live and work.

The Institute for Sustainable Futures bench marked Western Australia's Urban Tree Canopy for 29 metropolitan local governments and published in 2014 the Town of Bassendean's tree canopy coverage was estimated at 15.7%, which includes all parks and reserves.

Whilst we do not have a full quantitative understanding of the environmental and financial benefits our trees have on the Perth metropolitan area, the Department of Planning, Western Australian Local Government Association report titled "the Urban Forest Perth & Peel Strategic Report, states, the major benefits of trees in urban areas are:

- Reduction of air pollution
- Reduction in volume of stormwater
- Mitigation of wind and noise
- Provision of habitat and support for biodiversity
- Reduction in UV exposure
- Air cooling through evapotranspiration
- Enhanced sense of place and identity
- Improved mental wellbeing
- Encouragement of outdoor activity
- Reduced demand for energy (lower GHG emissions)
- Increased property values

It is proposed that the Town's Urban Forest Strategy will transform and strengthen the Town's Street Tree Master Plan by building upon the present and the past plantings and provide a resilient, healthy and diverse tree canopy it will contribute to the health and wellbeing of our community, and to further improve the liveability of the built and natural environment.

Council has adopted a suite of policies to protect and manage all street trees and has the power in Local Planning Scheme No.10, to make Tree Preservation Orders on private land and, for the public realm; Council has established a Significant Tree Register and Amenity Tree Evaluation Policies for calculating the amenity value of our trees.

The focus on individual trees is associated with issues such as tree species selection, planting, establishment and maintenance through to maturity. Whilst not abandoning the recognition of the importance of individual trees, this strategy focuses on our populations of urban trees, or the urban forest.

Introduction & Definition

The urban forest can be defined as all trees and other vegetation within the municipality regardless of ownership or responsibility. The urban forest also includes those elements that support this vegetation: soil, water and the biosphere. A holistic approach to the Urban Forest considers the interrelationship between this “green infrastructure”, and the Town's “grey infrastructure”, and how they can interact for mutual benefit. A successful Urban Forest Strategy is one that recognises the importance of the role of the community as active participants in the development and nurturing of this forest.

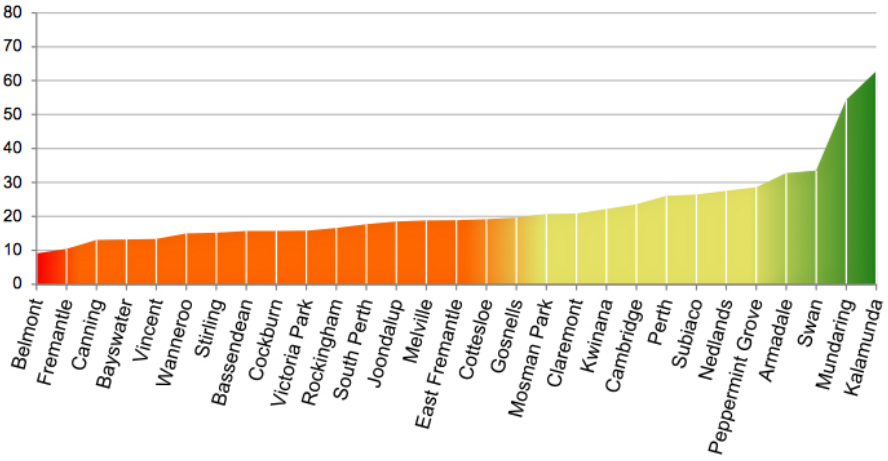
Urban Forest is a term that has recently become broadly understood in Perth WA. As the cumulative effects of urban canopy loss, due to increased development associated with infill development, impact on the liveability and biodiversity of our suburb, the realisation that urban greenery is a valuable asset has prompted concerned residents, designers and the Town to take a more proactive and strategic approach to its protection, maintenance and improvement.

Why do we need a strategy?

Urban infill is seen as more desirable than sprawl to accommodate an increasing population. Of course, what makes our urban areas liveable, healthy and appealing are the open green spaces and shady mature trees. These are at most risk from development. As the population density increases, there is a greater demand on our existing parks and public places. Cumulative loss of tree canopy is leading to Urban Heat Island Effect (UHIE), which can make summer temperatures inhospitable in some areas, and hinder establishing new greenery.

Predicted climate change will further exacerbate this. 'Business as usual' will see the Town of Bassendean's Urban Forest decline even further from the 15.7% measured in 2014 (see graph). The Urban Forest Strategy aims to reverse this decline through proactively improving the planning, policies, procedures and community engagement within the Town.

2014 Canopy Cover (%) for selected West Australian Local Government Areas



(Extract from Benchmarking Australia's Urban Tree Canopy: An i-Tree Assessment, prepared for Horticulture Australia Limited by the Institute for Sustainable Future, University of Technology Sydney)

Executive Summary

Executive Summary to be prepared once the draft strategy has been reviewed by UFWG/ Town's Asset Committee, at completion of draft strategy.

Background

Bassendean soil types, land form, biology and plants

Geology

Bassendean is located close to the Eastern edge of the Swan Coastal Plain and has given its name to the ancient, eroded beach sands known as the Bassendean Sands. Bassendean has a relatively flat topography, with very little separation between high and low points in the landscape.

Fact Box

1. 24.2 hectares of native vegetation remaining in the Town.

2. Covering 2.39% of the Town's area.

3. Owned by:

- *The State: 12 hectares*
- *The Town: 6 hectares*
- *About 3 hectares on private land.*

Soils

Bassendean soils originate from two sources and are shaped by the actions of wind and water. To the West and North, the soils were originally beach sands that have been gradually eroded by the wind. The Bassendean Sands are present West of Hardy Road and are characterised by highly leached quartz sands (more than 99.4% quartz), poor in organic matter and plant nutrients. Where the soils occur in the interdunal swales, soil nutrients are higher due to the presence of peat.

The soil pH for Bassendean sands is generally low and therefore acidic.

The river foreshore and low-lying riverine flat soils have been deposited through water action of the Swan River (alluvial). Two alluvial soils are present:

- The alluvial red earth terraces of the Swan Association, comprising loams, silts, silty sands and clays. These are present in the Ashfield Flats area and along most of the river foreshore for a distance of 100-300 metres from the riverbed. The soils of these riverine flats are richer in nutrients, but are also high in iron sulphides in some locations.

- The yellow duplex soils of the Guildford Soils can be seen around the Success Hill area. Present in the North-West corner of the Town is a small transition area between the Bassendean Sands and the Guildford Soil Formation where the sands overlie the alluvial clays and silts.

Soils with a high potential to become acid sulphate soils, occur in the interdunal swales, river foreshore or riverine flats, such as:

- Ashfield Flats Reserve and surrounding areas;
- Bindaring Park and surrounding areas;
- Industrial area between Railway Road and Collier Road;
- Between Collier Road, Grey Street, Broadway and Hanwell Way; and
- Success Hill Reserve.

The remainder of the Town of Bassendean is identified as being at low to moderate risk of developing acid sulphate soils.

Vegetation

1. The Bassendean Vegetation Complex – Central and South, occurred on the upland areas and where it still occurs, is typified by:
2. Banksia Low Open Woodland dominated by Candlestick Banksia (Banksia attenuate) and
3. Firewood Banksia (Banksia menziesii), with scattered Christmas tree (Nuytsia Vegetation 28 | Page floribunda), Pricklybark (Eucalyptus todtiana) and open shrubby understory, with Dryandra and Xanthorrhoea.
4. The Guildford Vegetation Complex – is found along the river north of Bindaring Park. In this location it occurs in lower lying areas and is typified by Open to Closed Forests and Woodlands of Flooded Gum (Eucalyptus rudis) and Freshwater Paperbark (Melaleuca rhaphiophylla).
5. The Southern River Vegetation Complex - occurs in transitional areas between the Bassendean Sands and the Guildford Formation. In upland areas the vegetation in similar to the Banksia woodland of the Bassendean Sands, and low-lying areas, is more similar to the Flooded Gum forests and woodlands of the Guildford Vegetation Complex.
6. The Swan Vegetation Complex – comprises fringing woodlands of Flooded Gum (Eucalyptus rudis) and Freshwater Paperbark (Meleuca rhaphiophylla) with localised occurrences of Swamp Sheoak (Casuarina obesa) and Saltwater Paperbark (Melaleuca cuticularis) in areas of higher salinity.

Due to the long history of development in Bassendean, most of the native vegetation has been cleared. The main threatening processes affecting native vegetation in Bassendean are fragmentation, erosion, disease, inappropriate fire regimes, and potential clearing for development, high nutrients, pollution and weed invasion.

Pre-European Vegetation Complexes in the Town of Bassendean, from Perth Biodiversity Project.

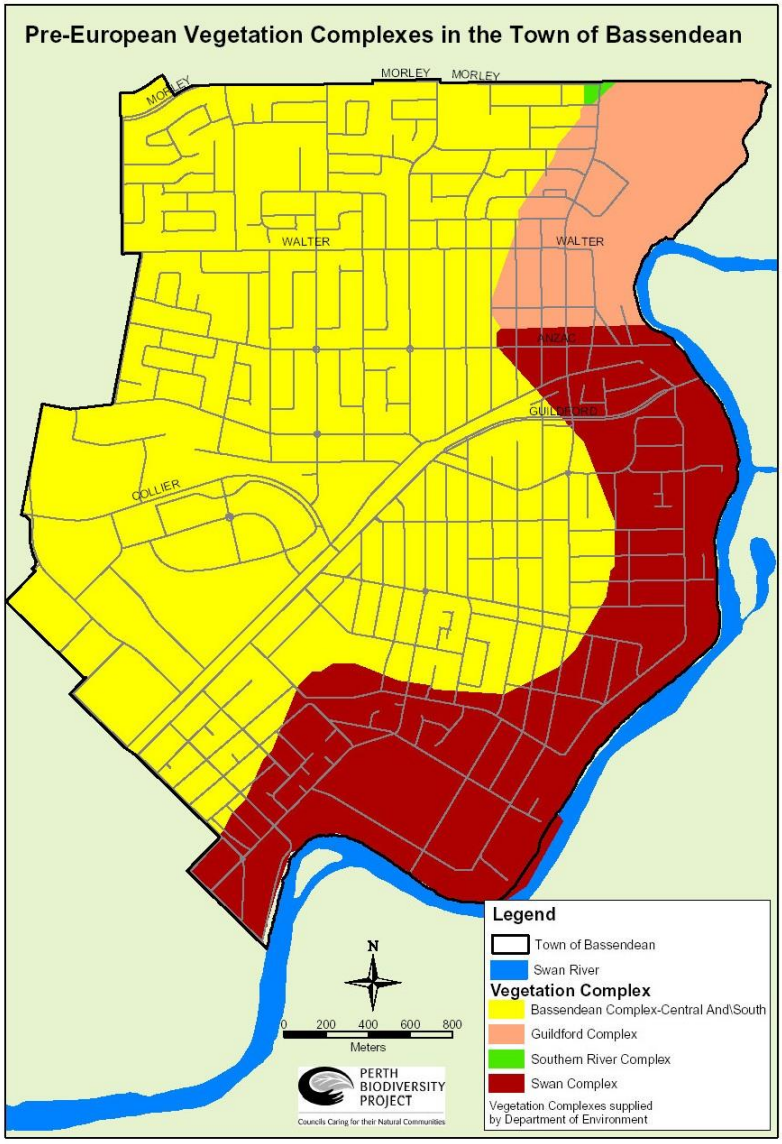
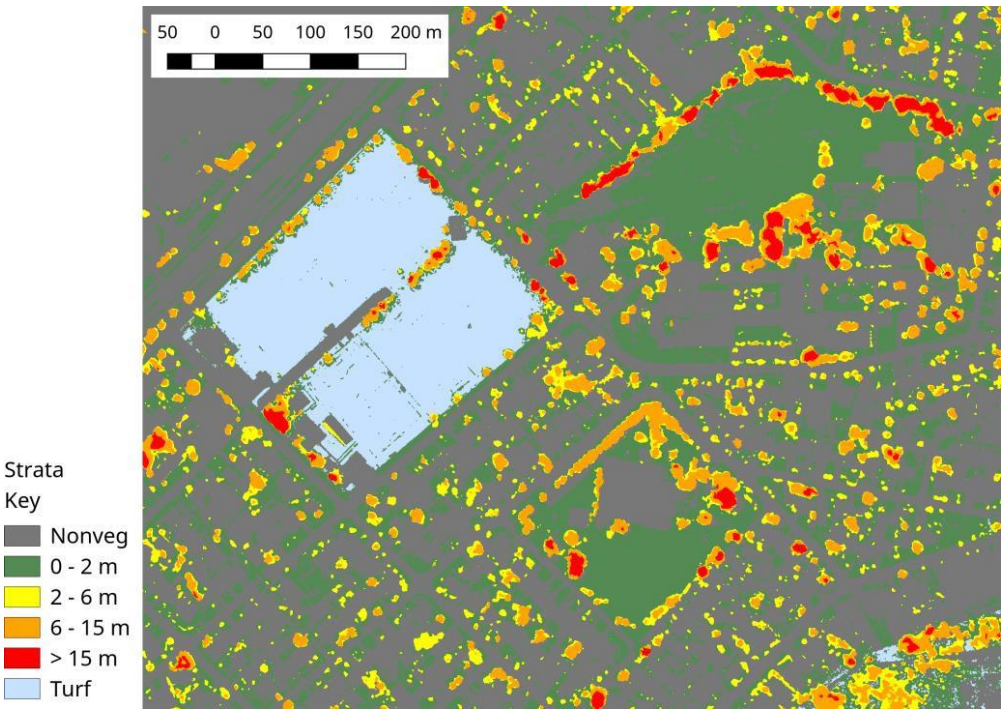


Image:from Town of Bassendean Environmental Management Plan 2014 – 2024 - Prepared by the Eastern Metropolitan Regional Council for the Town of Bassendean - EMRC – 147819. p.29

Table of height strata raster values and colours.

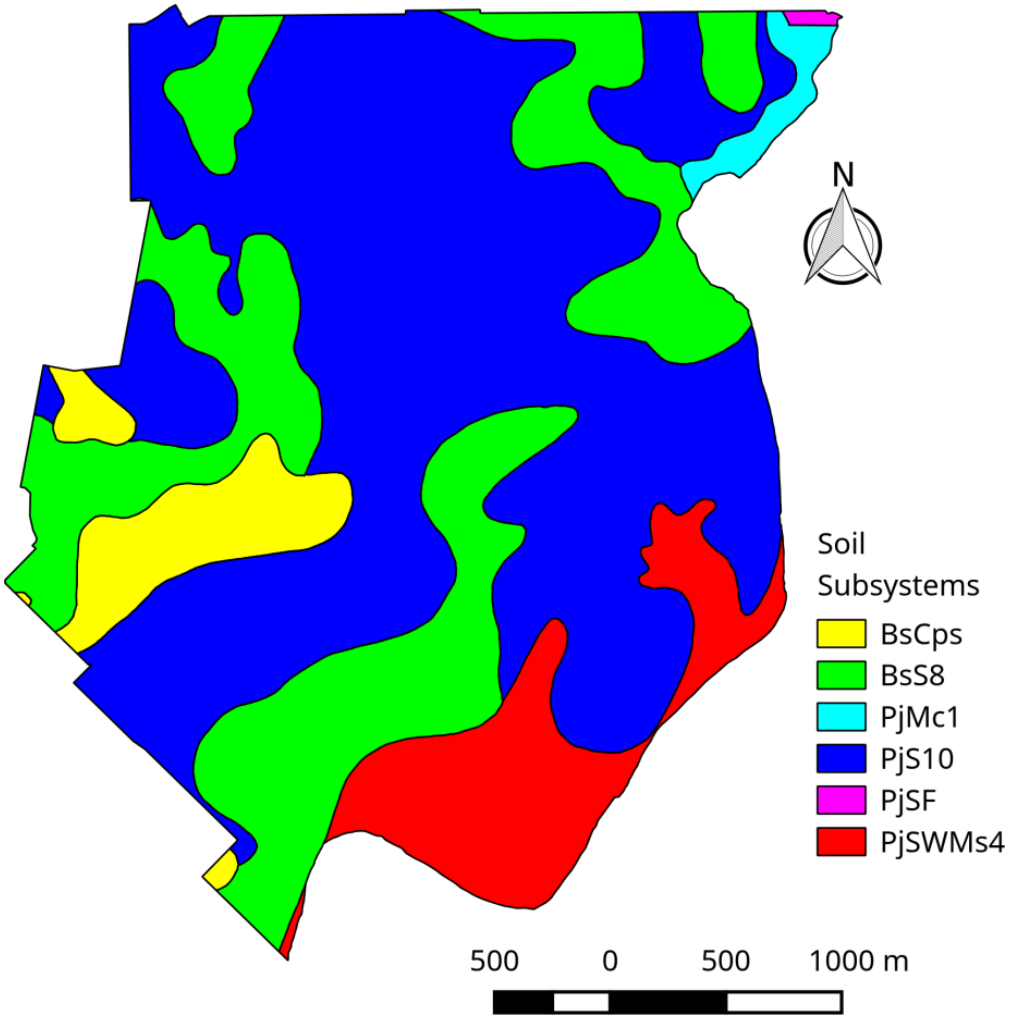
Value	Name	Colour
0	Nonveg	
1	0 – 2 m	
2	2 – 6 m	
3	6 – 15 m	
4	>15 m	
5	Turf	

From PAGE 3 Astron Environmental Services Pty Ltd., Aerial Vegetation Mapping Tree Canopy Analysis Urban Heat Island Mapping, January 2017, prepared for Town of Bassendean



From PAGE 3 Astron Environmental Services Pty Ltd., Aerial Vegetation Mapping Tree Canopy Analysis Urban Heat Island Mapping, January 2017, prepared for Town of Bassendean

Correlation of Soil Subsystems with Land Surface Temperature.



From page 19: Astron Environmental Services Pty Ltd., Aerial Vegetation Mapping Tree Canopy Analysis Urban Heat Island Mapping, January 2017, prepared for Town of Bassendean

Full descriptions of soil-sub-system codes, extracted from shape file "Soil_landscape_Subsystems_DAFWA_018_TOB.shp" supplied by the Town.

Code	Description
BsCps	peaty clay - dark grey and black, soft, variable organic content, some quartz sand in places, of lacustrine origin
BsS8	SAND - very light grey at surface, yellow at depth, fine to medium-grained, sub-rounded quartz, moderately well sorted of eolian origin
PjMc1	CLAYEY SILT - yellow brown to strong brown, blocky, mottled, soft, with variable clay content, dispersive in part, of alluvial origin
PjS10	SAND - as S8 as relatively thin veneer over sandy clay to clayey sand. Of eolian origin.
PjSF	Saline flats.
PjSWMs4	SANDY SILT - light yellow brown, blocky, mottled, some fine to medium-grained sand, soft when moist, variable clay content

From page 19: Astron Environmental Services Pty Ltd., Aerial Vegetation Mapping Tree Canopy Analysis Urban Heat Island Mapping, January 2017, prepared for Town of Bassendean.

Urban Forest Strategy Context

Urban Heat Island and Canopy Mapping (Astron Report - Bassendean 2017)

What is the Urban Heat Island Effect (UHIE) and why is it important?

UHIE is a phenomenon that occurs in urban and metropolitan areas as a result of human activity. Modification of land surfaces, removal of vegetation combined with some types of built form result in higher temperatures than are found in nearby natural areas. Waste heat from industry, motorised transport, air conditioning and energy use also contributes to UHIE. The urban / rural temperature difference is often more noticeable at night when thermal mass such as bricks, tiles, concrete and asphalt radiate absorbed heat back into the surroundings. Concrete can hold approximately 2,000 times as much heat as an equivalent volume of air.

UHIE is a phenomen on that occurs in urban and metropolitan areas as a result of human activity. Modification of land surfaces, removal of vegetation combined with some types of built form result in higher temperatures than are found in nearby natural areas. Waste heat from industry, motorised transport, air conditioning and energy use also contributes to UHIE. The urban / rural temperature difference is often more noticeable at night when thermal mass such as bricks, tiles, concrete and asphalt radiate absorbed heat back into the surroundings. Concrete can hold approx 2,000 times as much heat as an equivalent volume of air.

Healthy trees and vegetation reduce UHIE 2 ways:

- By shading surfaces, such as concrete, that would otherwise heat up in the sun.
- Via 'evapotranspiration'; a process by which plants absorb soil moisture via their root system which is then released through leaves, creating cooling. This also filters the water and air, while cooling surroundings.

UHIE is important because it directly effects our living environment, amenity and the health of people in urban areas. UHIE increases the severity of heat waves, often resulting in hospitalisation and sometimes even death of vulnerable people. Summer heatwave peak energy demands increase. UHIE also exacerbates air pollution.

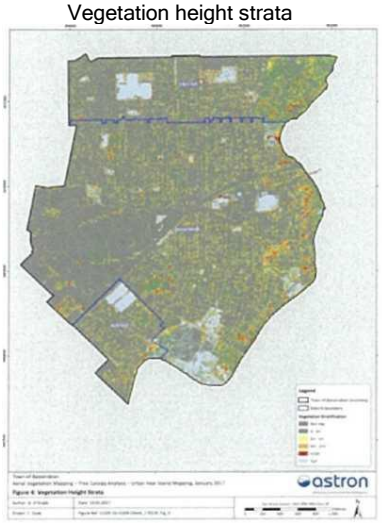
Research shows a correlation between high UHIE and higher concentrations of VOCs, carbon monoxide, nitrogen oxides, particulates and dangerous ground level ozone. In high rainfall events water quality is reduced as the water is warmer. Watercourses, wetlands and rivers can suffer from low oxygen, algal blooms and reduced biodiversity. UHIE also makes urban areas less hospitable to healthy plant life, hampering the establishment of new trees and landscapes.

A vital aim of the Urban Forest Strategy is to mitigate the Urban Heat Island Effect. Healthy trees can reduce surface temperatures by between 11 ~25C* It is important to consider placement of trees and vegetation within the urban context as trees which shade roads, buildings and other hard surfaces make a proportionally greater impact than those which do not. As larger trees provide considerably more benefit than smaller ones, retaining mature trees and avoiding unnecessary pruning is of benefit. Mature trees are vulnerable to infill developments:

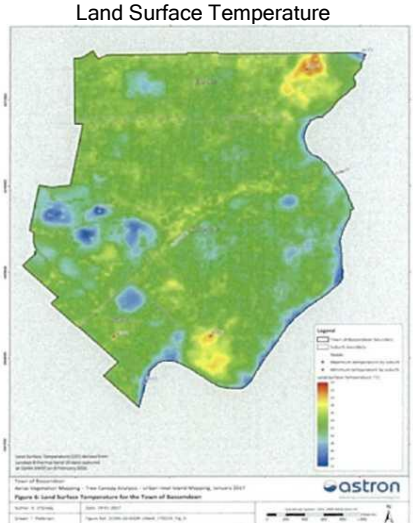
Canopy and Land Surface Temperature mapping

In 201 7 the Town of Bassendean engaged Astron to map the Town's Land use, canopy volume and Land Surface Temperature (LST). Four band aerial imagery was collected in 201 6 by Landsat at 1 0am on the hottest day in Feb 201 6. A 3D point cloud was created. This was combined with the aerial imagery to produce maps indicating tree canopy, shrubs, turf, irrigated turf, paving /asphalt and roofs. There was no distinction made between metal and tile roofs in the mapping however it is well understood that tile roofs have a higher thermal mass. Darker coloured surfaces absorb more heat than lighter ones, adding to the effect.

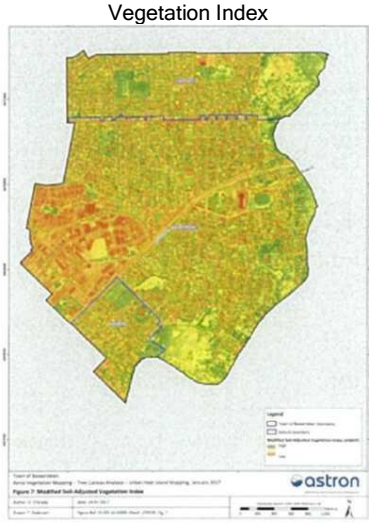
Vegetation height strata



Land Surface Temperature



Vegetation Index



Note: the complete report and mapping is available in the appendices of this document

The Findings:

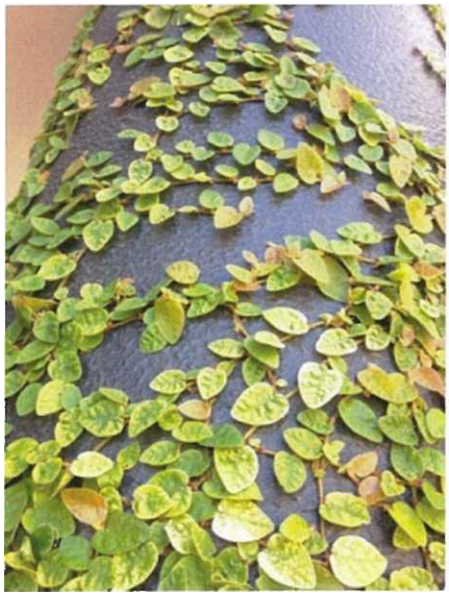
These layers of data were interpreted by Astron to provide a picture of the Town's canopy at that time, to identify correlations between canopy volume, health and Land Surface Temperature (LST) and to provide a baseline for future study. This was presented to the Urban Forest Working Group for consideration. On the day of data collection, 1 0:00am on a very hot summer day (46C max), surface temperatures ranged from 34C ~ 51C. depending on the height, volume and health of vegetation cover. As the data was collected in the morning, before most thermal mass had warmed up, it can be assumed that by late afternoon an even greater difference in temperature may have been recorded. Some data was confounded by metal roofing in the industrial area to the southwest of the Town and a misleading "cool" reading occurred there.

The study found a direct correlation between tall, healthy canopy volume and reduced LST. Also noticed, was that of all the surface treatments, until tree cover reaches between 6 and 1 5m in height, irrigated turf provides an equivalent or better UHIE mitigation; *"the observation that irrigation of turfed areas has a cooling effect may be moot, given the unlikely adoption of a policy to increase irrigation within the town; although, the data suggests that irrigated turf has a better cooling effect than tree cover below 6m in height"*

(Key Findings page 25 Astron report for Town of Bassendean 2017). Although the Town isn't likely to encourage increasing scheme or bore irrigation to improve turf and vegetation amenity, the harvesting of rainfall via Water Sensitive Urban Design (WSUD) and the sensible use of recycled water / grey water to parks, gardens and street verges to support soil and vegetation may provide opportunity to do this wisely. The "Drains to Living Streams" program can exploit existing watercourses and groundwater to enhance the urban forest and biodiversity.

"Take Home" messages:

- Large canopy volume mature trees are the most effective at reducing UHIE, in addition to the other amenity and habitat they provide, and are worth retaining where possible.
- Irrigated turf is very effective at reducing UHIE.
- Healthy, evapotranspiring vegetation is important and requires supporting soil and water to maintain vigour.
- Buildings with light colored metal roofs are preferable to dark coloured tile roofs.
- Design landscapes to minimise or shade hard surfaces.
- WSUD and water recycling can supply water in lieu of extra scheme or bore irrigation.
- Mature vegetation on private land is vulnerable to infill development, hence street verges and public places are becoming even more important for reducing UHIE.
- Vegetation supports and protects other vegetation - layers of turf/groundcover, understory and canopy can provide greater benefit than trees, turf or shrubs alone.
- Trees require a large soil volume to thrive. In limited space, think vertical for greenery: grow vines and creepers on walls, trellises or arbors to shade buildings.



Climbing fig, shopping centre Bassendean

Masonry wall shaded by vines

* https://www.epa.aov/heat-islands/using-trees-and-vegetation-reduce-heat-islands

- A Model of Urban Forest Sustainability, by JR Clark et al. (1997), was one of the formative works applying principles of sustainability to urban trees. 'The most significant outcome of a sustainable urban forest is to maintain a maximum level of net environmental, ecological, social and economic benefits overtime.'

- Urban forestry has yet to be well researched, implemented and evaluated in an Australian context. There is a reliance on research from the U.S., Europe and Asia to guide our thinking and programs. Whilst Australia, and particularly Western Australia, is some way behind in providing robust research and literature on the topic, Australian cities are by no means behind in current management and planning of urban trees and vegetation. We have been practicing the art and science of urban forestry for years through tree and park planning, arboriculture, horticulture and urban design.

- Urban forestry, as distinct from arboriculture and horticulture, considers the cumulative benefits of an entire tree population across a town or city. Looking holistically at the urban forest and its associated ecosystem services allows for consideration of the broader issues of climate change, urban heat island effects and population growth that can be influenced by, and that can affect, an urban forest.

- The Town of Bassendean is a metropolitan municipality, 10 kilometres north east of the Perth central business district (CBD) and approximately 20 kilometres from the coast. The Town covers an area of 10.4 square kilometres, maintains over 97 km of roads and has an estimated population of 15,923 (2013 - Australian Bureau of Statistics).

Figure 1 – Town of Bassendean location map

- The Town of Bassendean incorporates the suburbs of Bassendean, Eden Hill and Ashfield and is bounded by 7 kilometres of the Swan River frontage to the east, by the City of Swan to the north and east and by the City of Bayswater to the west.

- Directions 2031 Spatial Framework for Perth and Peel, the State Government's planning framework for the Perth Metropolitan Area, serves as the highest-level spatial framework and strategic plan. Its objective is to guide the planning and delivery of housing, infrastructure and services for the region. Its vision is "By 2031, Perth and Peel people will have created a world class liveable city: green, vibrant, more compact and accessible with a unique sense of place". In 2010, the Directions 2031 strategic plan projected the Perth metropolitan area would reach a population of 2.2 million by 2031. Then in 2015 a draft Perth and Peel @ 3.5 million suite of strategic land use planning documents projected, the population would be reached a population of 3.5 million (under a medium growth scenario) by 2050. In response to this, the Town of Bassendean recognises that the existing housing density will intensify, creating a more compact community.

- The Department of Planning report titled "Urban Forests of Perth and Peel 2014" states under "High risk – commercial, residential and industrial street blocks" that "Trees on private lots are at the greatest risk of development pressures because there is very limited protection for established trees under statutory policies. While residential extensions and redevelopments are a common cause of canopy loss, trees can be removed on private land at any time. It is likely that planning policies, schemes and structure plans that increase densities and allow for further subdivision will trigger increased development activity and subsequent tree canopy loss".

- In The Institute for Sustainable Futures; Bench Marking Australia's Urban Tree Canopy estimated in May 2014 the Town of Bassendean had 15.7% tree cover.

- The Town is located within a recognised global biodiversity hotspot, the Southwest Botanical Province, and although much of the area has been modified or developed for human use, there are still important biodiversity resources within the region, and a need to protect and conserve those resources and implement appropriate environmental management. As a result Council endorsed (OCM1 – 4/09/09) a Collective Biodiversity Strategy developed for the Town of Bassendean, the Cities of Bayswater and Belmont based on the Local Government Biodiversity Planning Guidelines (2004). The focus of the strategy is the protection and effective management of natural areas directly managed by the three local governments. The collective approach enables the consideration of ecological linkages within a broad landscape beyond municipal boundaries.

- The Town of Bassendean's Environmental Management Plan 2014 - 2024 (OCM – 18/03/14) provides for officers a strategic overview six key focus areas, being:
  - Governance and Communication
  - Land Use and Cultural Heritage
  - Atmosphere and Climate Change
  - Biodiversity
  - Waste Management
  - Water Conservation

- The Environmental Management Plan provided overarching strategic direction to numerous operational programs, which include but are not limited to, the following:
  - ACEr – Achieving Carbon Emissions Reduction Program
  - Local Climate Change Adaptation Action Plan
  - Natural Resource Management Plan
  - Schools Waste Reduction Program
  - Street Tree Master Plan and planting program
  - TravelSmart program
  - Volunteer Bushcare Program
  - Water Campaign
  - Water Conservation Plan (WCP) for Management of Groundwater
  - Water Quality Monitoring & Improvement program

- The Town of Bassendean's Local Planning Scheme No.10 does not currently provide a mechanism for contributions for the loss of tree canopy on development sites. The Town of Bassendean therefore, currently focuses on protecting verge trees by limiting the number of crossovers; ensuring setbacks are sufficient to protect trees, or imposes a developer contribution for the loss of street trees where no alternative access can be provided.

- Tree canopy cover is a key criterion by which we measure the urban forest's ability to produce benefits for the community and the environment. Increasing the extent of tree canopy throughout the municipality is vital for achieving the greatest environmental and public health benefits.

Historical Background

A Rich and Romantic Country

In March 1827 Captain James Stirling lead an expedition up the Swan River in two ship's long boats.

Sailing upriver from the Causeway, he noted that fish were in abundance and swans and ducks were numerous and able to be killed with ease.

At Ashfield, he described the last of the sandy hills on their left as that the water was brackish but no longer salt and 'the smoke from many fires was rising on different points of view'.

He records:

> *"There, peeping at us from behind trees, we discovered two boys; presently others appeared, and at last we saw a whole tribe of about thirty natives.' The warriors followed the boats and made threatening gestures, but when Stirling had a swan cast to them 'they testified the greatest delight at the present. This led to an interview which proceeded upon amicable terms. We gave them various articles of dress, a corporal's jacket, and three swans, and received in return all their spears and woomeras."*

Proceeding upstream, he recorded 'we continued to penetrate through a rich and romantic country' and observed many traces of natives and kangaroos. 'On the Flats, the Blue [Flooded] Gum Tree flourishes, but in a ratio of not more than 10 to the Acre, and they are generally unaccompanied by any other tree or shrub except a long leaved and beautiful species of Acacia."

As the river narrowed some of Stirling's party advanced along the banks and 'its open forest-like character afforded no impediment to the march, indeed generally the lowlands resemble fields of grain. ' By the time they reached Ellen's Brook, Stirling

was effusive in his description of the landscape writing it being ‘as beautiful as any thing of the kind I have ever witnessed.’

Two years later Stirling returned with soldiers and settlers and established the Swan River Colony.

What Stirling and the settlers did not appreciate was that Aboriginal people had an intimate knowledge of the land and had manicured the country using fire stick farming practices perfected over many thousands of years. The most fertile land was burnt regularly allowing kangaroos to flourish on the new grass shoots and hence there was plenty of food and no danger from bushfires. This fire knowledge was passed on from father to son. The ships artist Frederick Garling painted many scenes of the 1827 expedition and his works illustrate large tracts of open ground between bush refuges for animals. Stirling’s observation of not more than 10 trees per acre equates to one tree for every 400-500 square metres, which is the size of today’s average building lot.

Quotations above are from Stirling’s report to General Darling, Governor of NSW, of his journey of exploration through the Swan Valley – 10th to 16th March 1827 and found as Appendix A in On The Swan by Michael J Burke. i

Indigenous Background

To be referred BCAG for comment

Social Benefits

Trees have many environmental, economic and social benefits. The challenge identified in the Bassendean 2023 Community Strategic Plan, under the Town Planning & Built Environment, is to "foster enhanced public space and street appearance" by "planting of trees in streetscape in accordance with Street Tree Master Plan". Under the Environmental Sustainability and Adaption to Climate Change, the challenge it is to "maintain a healthy environment which supports a diverse range of flora and fauna" by "continuing to develop and maintain biodiversity corridors to provide breeding places and food sources for native flora and fauna".

This Urban Forest Strategy responds to the challenges by promoting a vision of the urban forest for the future and by setting out principles for the management of the urban forest within the Town of Bassendean.

State government planning documents such as the Liveable Neighbourhoods and the Urban Forest of Perth and Peel, detail the benefits urban forests provide, as being:

- Reduction in Air Pollution
- Control of storm water
- Mitigation of wind and noise
- Improves biodiversity
- Reduces Ultra Violet light exposure
- Reduces heat island effect and energy demand
- Enhances sense of place and wellbeing
- Increases property values
- Encourages outdoor activity

Urban warming, commonly referred to as the 'Urban Heat Island' Phenomenon (UHI) is a well-documented topic, and the magnitude of the UHI has been studied mostly in terms of the temperature difference between rural and urban locations. UHI is considered one of the major problems in the 21st century as a result of urbanization and industrialization of human civilization. With the rapid growth of the Perth

metropolitan area, changes to urban form have resulted in unintended environmental consequences such as increases in local ambient temperatures. Paved surfaces, buildings and other infrastructure have replaced pre-existing natural landscapes, and these hard surfaces absorb a greater amount of solar energy resulting in an increase of urban temperatures. They are also impervious, meaning that water drains away rapidly leaving little moisture in the ground layer, consequently reducing evapotranspirative cooling.

The UHI effects are particularly noticeable at night, when heat that is stored in the urban landscape is slowly released, increasing the temperature differential between urban and rural areas. Studies have found that UHI effect can add between 1°C to 6°C to ambient air temperature and is likely to be further exacerbated by climate change. The adverse effects of UHI includes the deterioration of living environment, increase in energy consumption, elevation in ground level ozone and even increase in mortality rates.

Perth population is projected to increase to between 3.5 million in the Perth-Peel region by 2031. In response to this, future development should restrict urban sprawl and create compact communities with housing and transportation choices near jobs, shops and schools. Many studies have reported and successfully applied measures on mitigating UHI with promising financial and environmental benefits.

On the East Coast of Australia, State and Local governments have worked together to create the 202020 vision. This vision is a mass collaboration of organisations working together to create 20% more green space in our urban areas by 2020. On the 5th November 2015, the Town signed up to http://202020vision.com.au/network/ with the aim of developing an urban forest strategy for Council consideration with the long term vision to increase tree canopy and mitigate the impact of UHI within Town of Bassendean.

A review of 5 International, 13 Australian articles concerning Urban Forests and 7 Urban Forest strategies, has been undertaken in order to guide the development of

the Town of Bassendean's Urban Forest Strategy and to identify potential management and operational improvement opportunities.

One of the measures to mitigate the Urban Heat Load is to increase the tree canopy which also improves carbon sequestration, filters air pollution, reduces the urban heat load, provides shade for pedestrians, increases walkability of neighbourhoods, makes our suburbs more attractive and increases the biodiversity for insects and birds

Therefore urban forests play a vital role in the health, social framework and economic sustainability and help build stronger communities.

Economic Benefits

Urban forest benefits that can be quantified in dollar terms span a range of industries and disciplines including health, engineering, planning, and sustainability, geology, and real estate industries. Bringing these together to form a solid economic business case for urban forests is a powerful tool for decision makers, as most infrastructure and design decisions are based on economic cost benefit analysis. Research findings have identified the following economic benefits of an urban forest:

1. **Reducing energy costs**: Major economic benefits come through Energy Efficient Design Principles such as shading buildings in summer, reducing the need for air conditioning, which in turn cut energy costs. Careful building design and strategically planted trees can easily achieve internal temperatures 5°C warmer in winter and 10°C degrees cooler in summer than in typical, poorly designed homes. Increasing tree cover by 10% – or strategically planting about three shade trees per building lot – has been estimated to save an estimated $50 to $90 per dwelling annually in heating and cooling costs.

2. **Increasing property values:** Trees in streets enhance neighbourhood aesthetics and, as a consequence, are proven to increase property values. A book published in 2012, titled “Landscape and Urban Planning”,, states that the effect of street trees on property value in Perth, Western Australia, differs depending on tree type and location and that it had been shown by a number of studies that urban trees are valued by the home owners (Abbott & Klaiber, 2010; Anderson & Cordell, 1988; Dombrow, Rodriguez, & Sirmans, 2000; Tyrväinen & Miettinen, 2000). The authors advised that trees are valued differently depending on whether they are located within the property boundary (private space), on the neighbouring property, or on the street verge adjacent to the property (public space). A tree on the street verge, but not on the property, increases the median property price of a house by about AU$16,889 (4.27%).

3. **Avoiding costs of infrastructure damage and renewal:** Urban forests that provide significant canopy coverage improve the lifespan of certain assets such as asphalt by shading them from harmful UV rays – potentially by 30%. Tree canopies and root systems also help to mitigate flood levels during extreme events and have the ability to lower stormwater flows into drainage infrastructure.

4. **Decreasing health costs:** The Department of Health published the "Health Promotion Strategic Framework 2012-2016 document to set out WA Health's strategic direction & priorities for the prevention of avoidable chronic diseases and injuries. The report indicates the following for the Town of Bassendean's Health Profile :

    - 36.3 % of Males and 23% of Females are overweight – not obese
    - 19 % of Males and 16.8% of Females are obese
    - 55% of persons have at least one of the four health risks factors
    - 3.6% of the population have type 2 diabetes

    The Australian Institute of Health and Welfare states that modifiable health risk factors are those over which individuals have some influence and which can be grouped into health-related behaviours, eg diet, exercise, smoking and alcohol consumption. Modifiable health risk factors are important targets for preventive health interventions. Research suggests that a healthy green city helps alleviate the burden on national health systems. While it is difficult to create a direct link and quantify dollar savings, it is likely that urban forests reduce health costs associated with sedentary behaviour, obesity and mental illness. A view of green space, including trees, can also encourage hospital patient recoveries, reducing the amount of time spent in hospital.

5. **Marketing the City:** Green spaces play a role in defining the culture and image of our Town. A better image makes a locality more competitive, thus expanding its political and economic influence. Tourism is of increasing importance to many Local Governments, and green space can help to promote tourism, as main attractions or – more commonly – as attractive 'settings' for various types of events

and activities that boost the local economy. For example the City of Melville each year has the Jacaranda festival.

6. **Storing and sequestering carbon:** During photosynthesis, trees convert carbon dioxide and water into sugar and oxygen and store carbon within their biomass. Urban trees therefore make an impact in absorbing carbon from the atmosphere. Tools such as i-Tree Eco (i-tree Eco Australia www.arboriculture.org.au/i-Tree-Australia) model air pollution reduction, greenhouse gas and carbon storage, and energy savings benefits.

Environmental Issues - Why we need an Urban Forest Strategy

---

15 June 17 Meeting Notes

- Why we Need a UFS
- A lot of material for this issue has already been researched by Nonie Jekabsons and is ready for compilation.
- Nonie Jekabsons to write and provide to ToB
- Previous notes moved to appendix

Community Engagement

People and our Urban Forest

The involvement of the local community in supporting the Urban Forest is critical to its long term survival and growth in the future.

The attitudes and values of the local community make up the social, cultural and political environment of the Town of Bassendean. Getting this environment right is essential for the sustainability of the Urban Forest, and there are a number of strategies that the town can employee to assist in this.

Increase community knowledge

- increase understanding of benefits of urban forest.
- increase understanding of urban forest needs.
- manage expectations

This can be done through a number of educational programs and by integrating education information into communications, an integrated approach to Displays, integrated education aspects to communications with local residences, communication and promotion material

Increase and identify community capacity

- request assistance - seek out local expertise
- mentor and identify community leaders
- work with young people
- work with existing volunteers and voluntary organisations
- Set up networks and links between different voluntary organisations.

Increase community engagement

- develop relationships, develop sense of ownership, shared responsibility,
- allow choice and flexibility
- set up systems that foster two way communication and conversation

Planting days, working groups, urban land care, verge transformation, adopt a street tree.

Our Future Urban Forest Strategy

Vision

The Town's Urban Forest Strategy will transform and strengthen the public and private realm tree canopy by building upon the present and the past plantings and provide a resilient, healthy and increased canopy diversity, which will contribute to the health and wellbeing of our community and further improve the liveability of the built and natural environment.

On the East Coast of Australia, State and Local governments have worked together to create the 202020 vision. This vision is a mass collaboration of organisations working together to create 20% more green space in our urban areas by 2020. On the 5th November 2015, the Town signed up to http://202020vision.com.au/network/ with the aim of developing an urban forest strategy for Council consideration with the long term vision to increase tree canopy and mitigate the impact of UHI within Town of Bassendean.

Objectives

1. **Educate and engage with the local community members, on the value of our urban forest asset, and how they can contribute to its growth and care.**
2. **Improve the quality, diversity and volume of tree canopy with the Town of Bassendean.**
3. **Build knowledge and capacity.**
4. **Strengthen the existing biodiversity corridors.**
5. **Implement Water Sensitive Urban Design.**

Objective 1:

Educate and engage with the local community members, on the value of our urban forest asset, and how they can contribute to its growth and care.

PHOTO: EMMA SLAVIN

Targets

- Urban forest workshops in Ashfield, Bassendean and Eden Hill
- Demonstration projects in Ashfield, Bassendean and Eden Hill

Actions

- Workshops
- Identify precincts (for community members to participate in planning)
- Establish and support volunteer network, with capacity building programs
- Engage local residents in the care of street trees and selection of species
- Support verge gardens
- Produce educational materials (e.g. species selection, tree maintenance, tree health, safety)
- Develop sites for nature-based play
- Develop community use areas within the urban forest (e.g. barbecues and seating)
- Liaise with local community groups
- Work with property owners, developers, designers and builders to improve retention of trees on private property.

Case studies

- Gary Blanch Reserve
- 

PHOTOGRAPHS: EMMA SLAVIN

Note: Despite that our aim is to increase the canopy, the losses in the private realm will exceed the capacity to compensate in the public realm.

Objective 2:

Improve the quality and quantity of tree canopy within the Town of Bassendean.

PHOTO: EMMA SLAVIN

Targets

- Increase tree canopy in the public realm by x%
- Increase tree canopy in the private realm by x%

Actions

- Strengthen the Town's Street Tree Master Plan and other relevant Town policies.
- Plant a forest corridor to demonstrate and investigate our urban forest (e.g. Ashfield Corridor)
- Identify successful species and individual trees and collect seed stock for propagation
- Investigate incentives to retain existing tree canopy
- Lobby the State Government to review the residential design codes to achieve…
- Adopt policies that support tree health (e.g. under-planting, soil health, reduce or stop use of pesticides, water harvesting.)
- Plant larger trees wherever possible (for shade and habitat etc.)
- Protect mature trees
- Identify locations for future landmark trees
- Identify gaps in canopy which provide planting opportunities
- Implement best practice tree establishment and maintenance
- Monitor new plantings in order to improve outcomes
- Investigate incentives to improve survival rate of new street trees

Case Studies

- Healthy Eucalyptus rudis at Sandy Beach Reserve – conditions that make them healthier than in other locations (e.g. number of trees, supporting fauna and soil biota; volunteer trees have more resilient root systems)

Objective 3:
Strengthen the existing biodiversity corridors

PHOTO: EMMA SLAVIN

Targets

- Document current situation

Actions

- Identify streets/sites to be planted as corridors between parks, reserves and the river.
- Identify specific locations for opportunities to plant larger/iconic trees, i.e. E marginate. C calophilla
- Establish living streams as biodiversity corridors
- Plant complementary understorey species
- Bindaring Park Management Plan
- Ashfield Flats Management Plan

Case Studies

- Bassendean Preservation Group Planting, Whitfield Street
- Baby tree 'stakeout' at Ashfield Flats, Bindaring Park

Objective 4:
Build knowledge and capacity

PHOTO: EMMA SLAVIN

Targets

- Staff to have completed relevant qualifications/attended workshops/conferences

Actions

- Staff training and networking
- Information sheets for residents
- Two way communication with residents and community
- Workshops for residents
- Website and social media
- Research

Case Studies

- Verge Transformation (One World Project 2016) https://www.facebook.com/actlocalbeglobalbassendean/

Jody Saxon (left), Emma Slavin and Jamie Dmden transforming a verge in Ashfield. Image: Eastern Reporter 1/8/17

- ArtsHouse Community Garden

PHOTO: EMMA SLAVIN

Objective 5:
Urban Sensitive Water Design

PHOTO: EMMA SLAVIN

Targets

- Reduce the amount of nitrogen entering into the river.
- Reduce the amount of phosphorus entering into the river.

Actions

- Identify opportunities to introduce or retrofit drainage to represent water sensitive urban design.
- Establish living streams
- Improve/implement integrated catchment management?

Case Studies

- Eric Singleton Bird Sanctuary

http://www.bushlandperth.org.au/bushland-treasures/north-of-the-river/227-eric-singleton-reserve

- SERCUL living streams projects (none so far in Bassendean – can use an example from elsewhere)

https://www.water.wa.gov.au/__data/assets/pdf_file/0015/1716/99300.pdf

Glossary

Community Sub-Group - Work in progress

Appendices

The following information was extracted from body of Town of Bassendean draft (February 2016) Urban Forest Strategy presented to Council for consideration and recommended by the Community Subgroup to be Appendices to this re-worked strategy:

1. Environmental Issues
2. Implications of Urban Consolidation
3. Verges
4. Street Tree Master Plan
5. Urban Forest
6. Tree Canopy Cover – Mapping
7. Improve Urban Forest Diversity
8. Our Future Urban Forest Strategy
9. Implementation Framework, Resourcing and Financials
10. Relevant Legislation
11. Supporting Policies, Plans Reports & Information

Additional appendices

Astron Mapping and Analysis - see separate pdf document

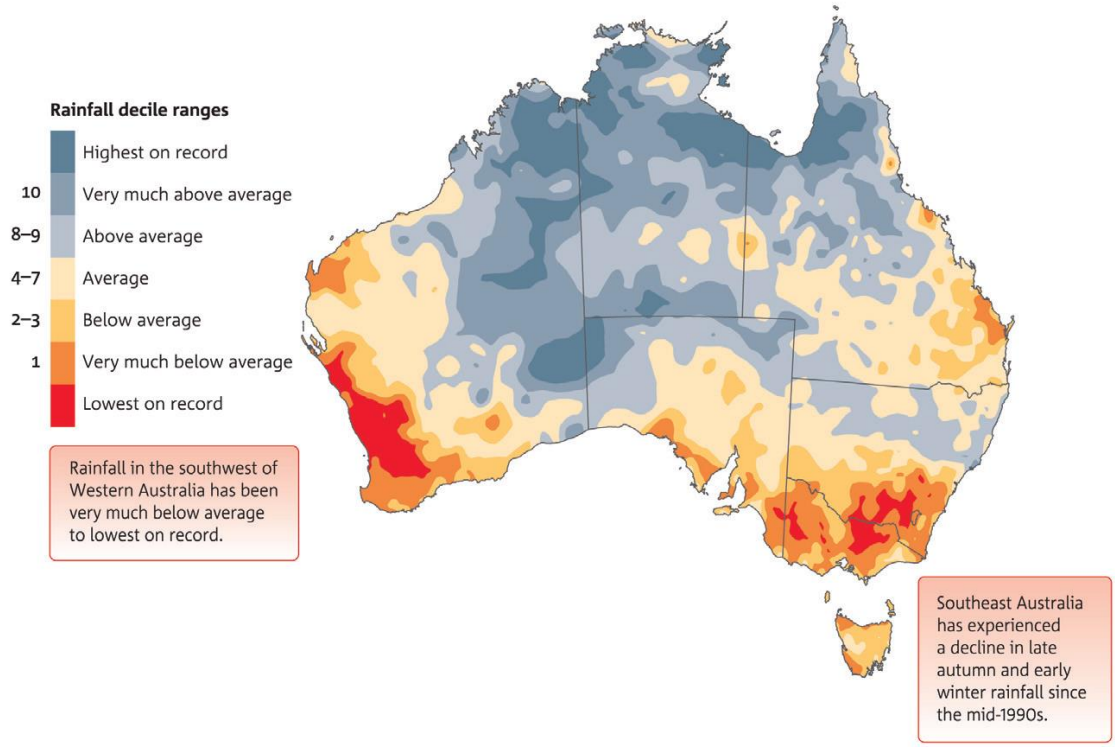
Draft Suggested Species List April 2017 - see separate pdf document

APPENDIX I - ENVIRONMENTAL ISSUES

The Western Australian Department of Water is responsible for planning and managing water for our future. To achieve this, in 2008 “Better Urban Water Management” (WAPC) process was developed to provide guidance on the implementation of State Planning Policy 2.9 Water Resources (Government of WA, 2006), which is a requirement of the State Water Strategy for Western Australia (Government of WA, 2003).

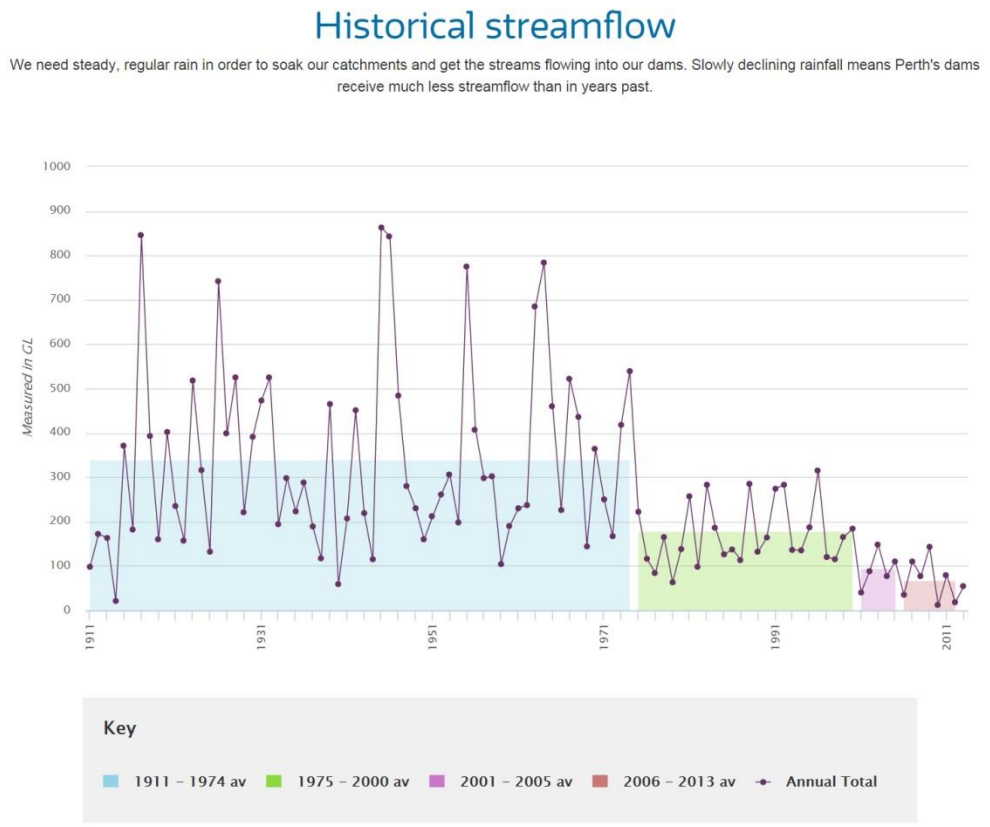
The CSIRO and the Bureau of Meteorology in 2015 released climate change projections for Australia in a publication titled “Thirsty Country: Climate Change and Drought” in Australia” that provide updated national and regional information and confirmed that most of the climatic changes observed over recent decades will continue into the future.

Whilst some parts of Australia are getting wetter, particularly the northwest of the continent, some of the most populous and agriculturally productive regions in the south are becoming drier (CSIRO and BoM 2014)

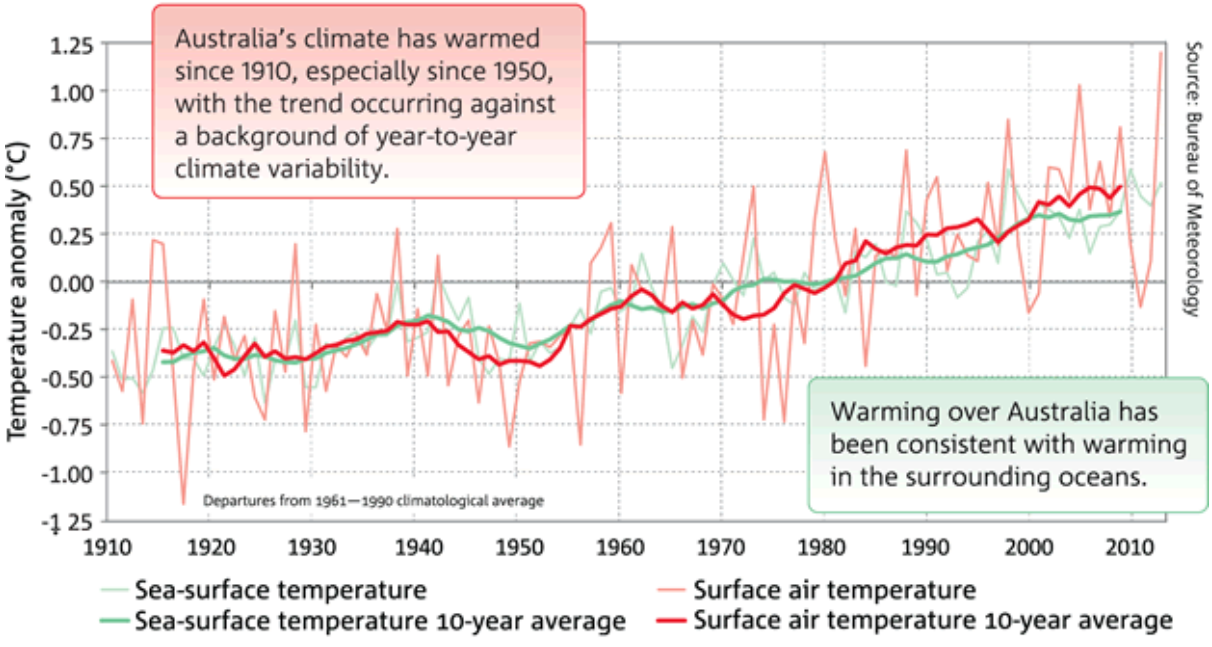


A long-term drying trend is particularly evident in the southwest and southeast of Australia, with rainfall deficiencies and declines in soil moisture indicative of dry conditions that have persisted in recent decades (CSIRO and BoM 2015).

Future drying trends in Australia are projected to be most pronounced over southwest Western Australia and the “Thirsty Country: Climate Change and Drought” report stated this could have significant implications for metropolitan Perth, which has already experienced a reduction of nearly 80% in total annual inflow into its dams since the mid-1970s.



State of the Climate 2014 report states that Australia's climate has warmed by 0.9°C since 1910, and the frequency of extreme weather has changed, with more extreme heat and fewer cool extremes.



In 2015, a study by Murdoch University Centre of Excellence for Climate Change research fellow Dr Niels Brouwers states that changes in climate are having a significant impact on forested ecosystems, causing increases in tree mortality rates, and decreases in tree growth and health.

The Federal Government's Department of Environment, Water, Heritage and Arts assessment of Australia's Terrestrial Biodiversity outline that higher temperature, elevated CO2 and changing rainfall patterns are a direct threat to the biodiversity of almost all ecosystems.

As a consequence, these environmental issues need to be taken into to consideration when maintaining the Town's existing trees or with plans to increase the Town's Urban Forest.

In addition, over the hot summer months Bassendean sands become water repellent due to the dehydration of an organic skin coating around the sand particles. Generally, with good winter rains this organic skin rehydrates to permit water filtration. However, with a drying climate, on occasions there has been insufficient rain over winter to hydrate the organic skin to allow the rain or applied additional water to filtrate into the deep into ground. As a result natural area land managers, including the Town of Bassendean, have increasingly found it difficult to achieve satisfactory plant establishment rates in our bush areas due to the reduced rainfall. In regards to the Town's new street tree plantings, they currently require up to 2-3 years of supplementary watering along with the regular applications of a wetting agent to improve water filtration over summer. Should rainfall continue to reduce, additional supplementary watering will need to be provided.

The Centre for Urban Greenery and Ecology in the USA published report titled Adapting Urban Forests to Climate Change which states "changes to the urban forest will have a number of important flow-on effects for management, urban ecosystems, and the urban public. With regard to management activities, these will include increased tree removal, pruning, and planting in response to damage, decline, and mortality. There will also be greater uncertainty about the outcomes of management actions in the urban forest". The article goes on to say that "recognising the importance of trait shifts as a result of this adaptation will allow managers to plan for a healthy urban forest that satisfies cultural and natural heritage needs".

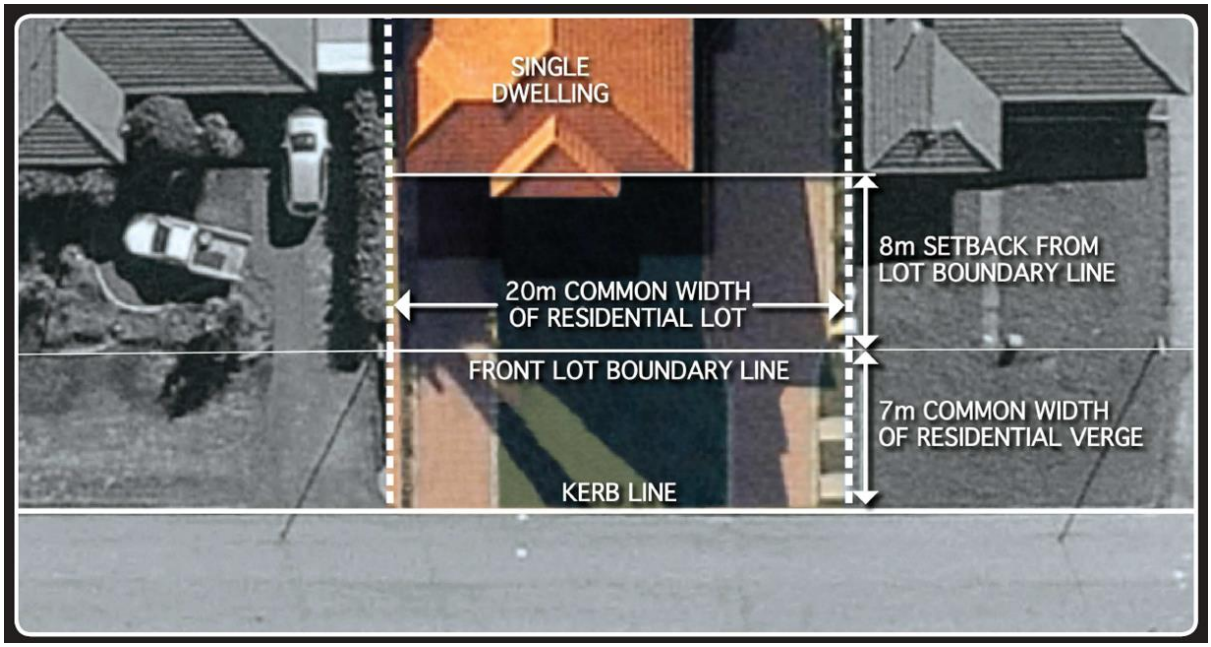
APPENDIX 2 - IMPLICATIONS OF URBAN CONSOLIDATION

The “Delivering Directions 2031 Report Card 2013” states the Town of Bassendean infill housing target of 2,430 dwellings by 2031.. Between 2011–2016 the report states the Town of Bassendean’s target is 700 new dwellings. The Town’s records indicate that between 2011 to February 2016, the Town has had a net increase of 503 new dwellings.

Typical R 20 Lot Prior to Urban Consolidation

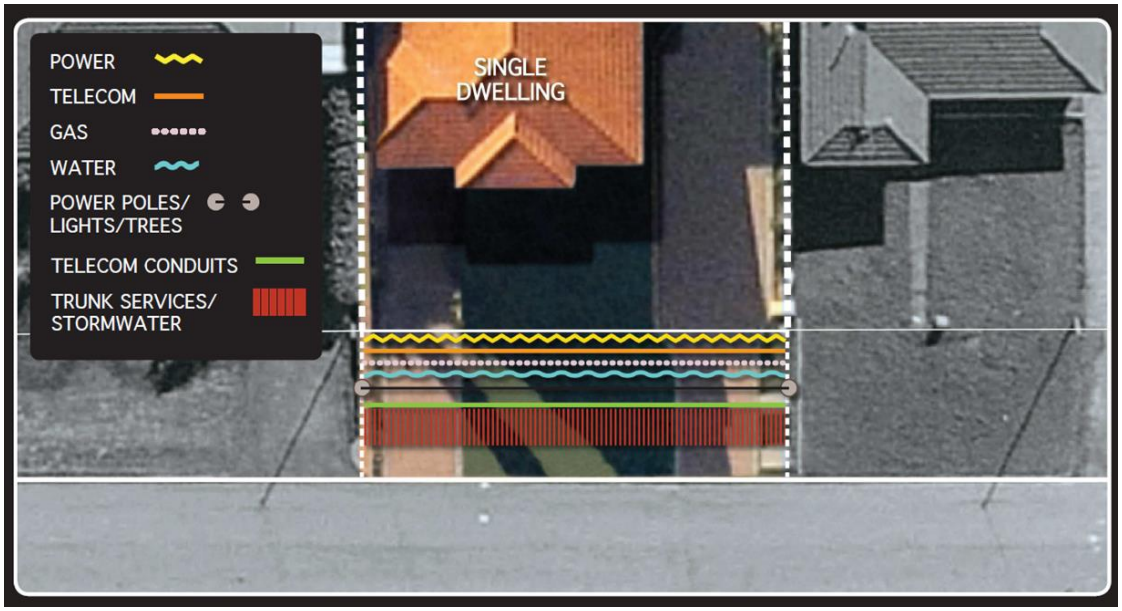
The Town of Bassendean’s Local Planning Scheme No. 10 outlines precincts within the municipality where lots can be consolidated. Typically, the adopted local planning strategy seeks to:

- increase the base coding to R25 for the majority of the scheme area
- apply densities of R100 within the 400 metre walkable catchment of Train stations
- apply densities of R60 within the 800 metre walkable catchment of the Train stations
- apply densities of R40 to selected areas currently coded R30.



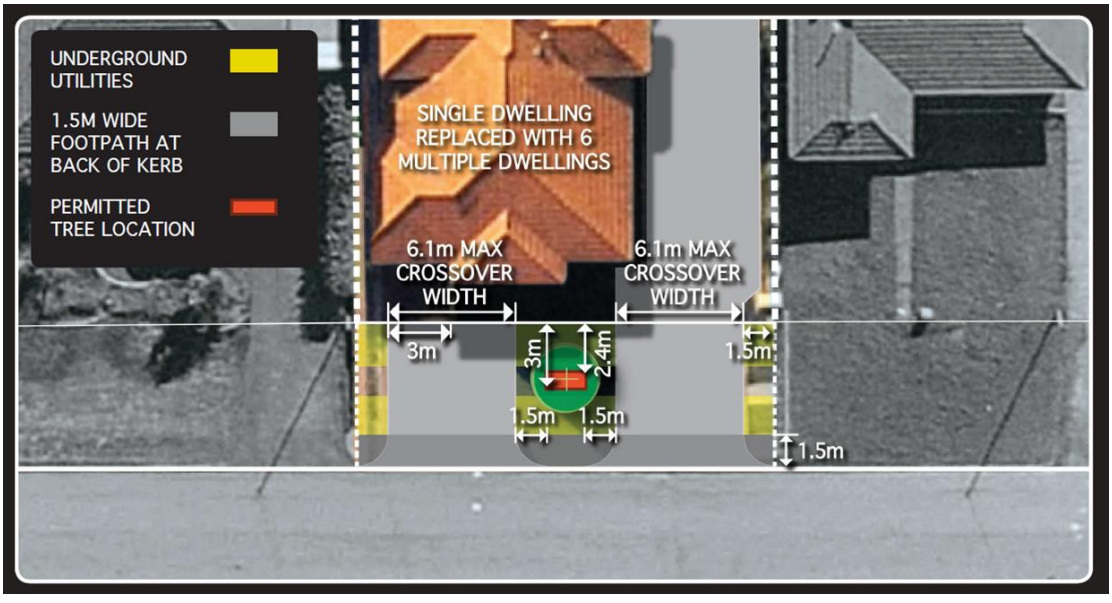
Typical Utility alignment in verge

The road verge is occupied by underground and overhead utilities on a predetermined set of alignments, upgrading these utilities to service urban consolidation will require repeated excavation and disturbance to the verge over time.



Crossover and Tree Planting Alignment

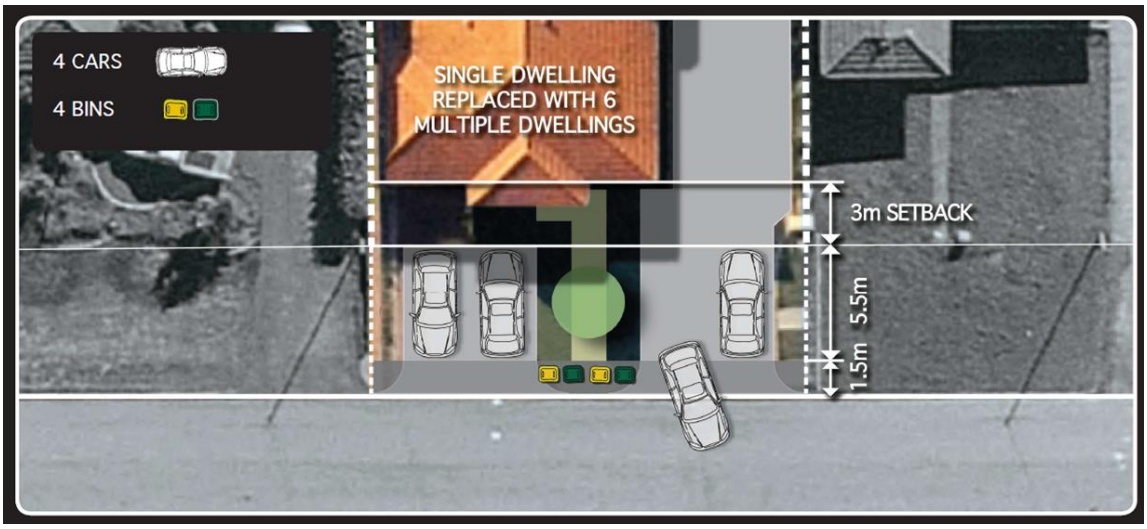
In addition to the areas reserved for underground and overhead utilities, the verge is also required to accommodate crossovers and street tree. As a result, the location where these can be located closely circumscribed.



Many of the Town's verges are below 7.metres

Theoretical Outcome of Rezoning

- Changes to the Residential Design Codes, has permitted an increased density of multiple dwellings on each lot with less provision of on-lot parking. This may lead to an increased demand for car parking on the road verge. The State Government has reduced parking in close proximity to public transport infrastructure – this issue applies beyond Multiple Dwellings
- A typical 800 square metre R20 Lot rezoned for R40 could be redeveloped with six multiple dwellings.
- The Town's crossover policy currently attempts to permit only one crossover per lot. However, additional crossovers within the streetscape may inadvertently be required as a consequence of a lot being sub-divided.
- Currently the Town of Bassendean provides two waste bins. Yellow-top recycling bin – fortnightly service and a Green-top rubbish bin – weekly service.



Potential Outcome of Rezoning & Western Australian Waste Strategy

- No space for 2-3 Bin system (general waste – weekly services, co-mingled recycling – fortnightly service and green organics waste – fortnightly service) without street or blocking parking bays.
- Conflict between neighbours over parking bay access likely.
- Refuse collection is estimated to take longer due to street parking.
- Degraded streetscape appearance due to increase in front boundary fencing, no street trees, ad-hoc paving materials and design on a lot-by-lot basis.
- Repeated repairs to verge paving will arise from need to upgrade utilities over time.
- Limited or no grass or tree canopy planting on either the house lot or the road verge – storm water implications.
- Dwellings in close proximity without shade will encourage close windows/use of air conditioning – increase residential CO2 output.
- Dwellings in close proximity, which do not provide sufficient tree canopy cover contribute to the Urban Heat Island Effect and therefore increase air conditioner usage which, in turn, increases our Carbon footprint, and increases cooling costs.

The Western Australian Waste Strategy sets out targets to move WA to a low-waste society. The strategy contains targets to divert municipal solid waste from landfill

The Waste Authority supports a three-bin system (general waste, co-mingled recycling and green waste), because it encourages source separation, which is important to maximising recovery.

The Town of Bassendean in conjunction with the EMRC have been investigating the 3 bin system.

Typical Existing R20 housing Block

Currently one dwelling per lot with large front and rear gardens and grassed verge with tree canopy.

Typical Housing Block, Post Urban Consolidation

- Increased Building footprints reduced permeable areas.
- More intensive (large) single residential housing developments, no permeable areas
- No trees or vegetation, poorly defined crossover locations. Difficult to determine where best to plant street trees.
- Parking conflicts between neighbours.
- High dependence on air conditioners due to built structure -restricted airflow, the urban heat island effect, no tree canopy shade.

Planning & Development Act 2005 (WA) & Local Planning Scheme No.10

The Western Australian Planning & Development Act 2005 provides for a system of land use planning and development in the State and for related purposes.

The Town of Bassendean's, Local Planning Scheme No.10 applies to the Scheme area which covers all of the local government district as shown on the Scheme Map – Appendix 2, however this scheme does not currently provide a mechanism for developers to off-set or contribute for the loss of tree canopy on development sites.

Discussions have been held with Planning Departments from other Western Australian Local Government Authorities concerning the Planning & Development Act 2005 (WA), and their respective Local Planning Schemes. Our investigations have confirmed that two important State Government operational policies: Liveable Neighbourhoods and Directions 2031 and Beyond, are currently eroding both the existing urban forest canopy and producing environments where a canopy cannot be established in the future.

With increased urban densities, the assumption that the tree canopy can be established on either the lot or the street is misguided unless developments are designed around trees.

The Town of Bassendean currently focuses on protecting verge trees by limiting the number of crossovers; ensuring setbacks are sufficient to protect trees, or imposes a developer contribution for the loss of street trees where no alternative access can be provided. Where a developer seeks concession on landscaping, Council may consider concessions to plant additional trees in parks.

Whilst Council can allocate funding to increase the number of trees planted within the public realm (e.g. verges and public open space), unless trees are retained on private property the Town will have no prospects of meeting any meaningful urban tree canopy. Therefore, it is critical that resources and funding be allocated to permit the Town to identify significant trees or groups of trees on private property and for Council to serve a notice in accordance with Planning Scheme No.10 Trees on Development Sites clause 1.8, which states the following:

Tree Preservation Orders

The Local Planning Scheme No. 10 gives Council the power to make tree preservation orders, having regard to a tree's aesthetic quality, historical association, rarity or other characteristics, which in the opinion of the local government, makes the tree worthy of preservation.

Any land owner or developer who allows a tree, the subject of a tree preservation order, to be cut or removed without the local government's consent, commits an offence under the Scheme and is liable for prosecution.

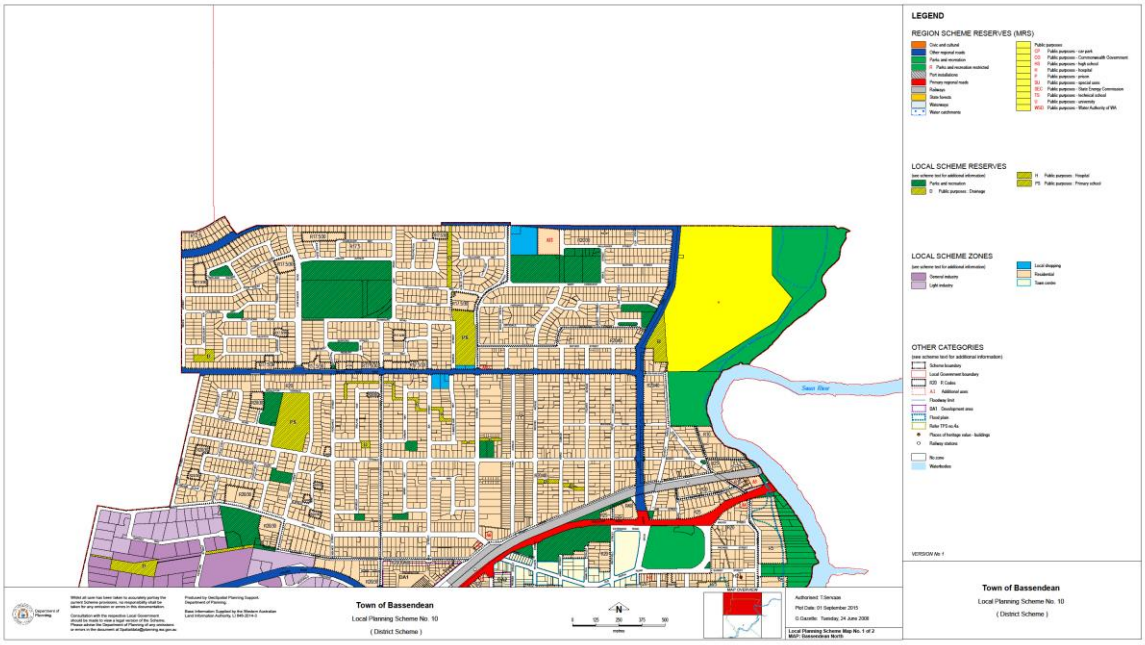
The Scheme also gives the power for Council to make a tree preservation order where there is a risk of imminent damage to a tree requiring an order to be made or amended as a matter of urgency, without consultation with the owner in advance.

To ensure Town of Bassendean's percentage of tree canopy has the capacity to increase, it is essential that Council investigates a mechanism through the Local Planning Scheme, to implement a regulatory tool that sets out the procedural framework governing the removal and the requirements to offset the loss of tree canopy. Should trees be retained, Tree Preservation Orders need to be applied and an arborist engaged to manage the pruning, alteration of soil levels close to trees and on-going management for the trees on private land. This is critical in order to protect trees and ensure the existing tree canopy is retained and to ensure the collective loss of trees across the Town is balanced by tree canopy replacements.

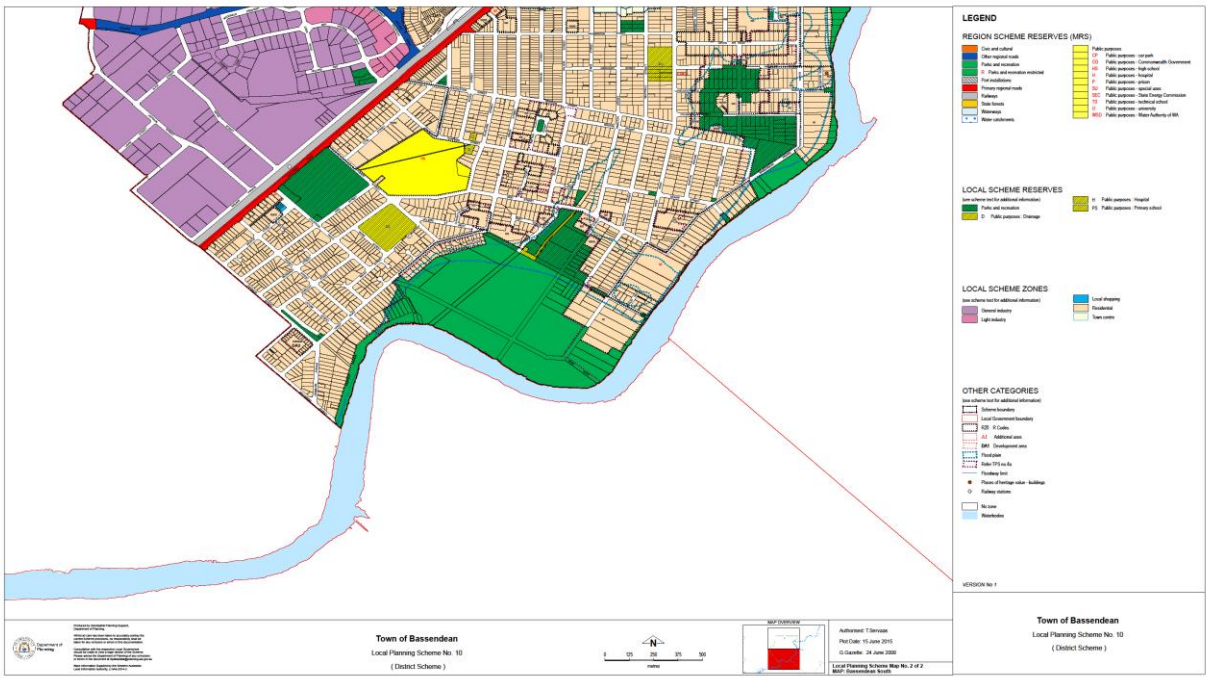
Developers, property owners and public authorities have certain obligations with respect to the protection of trees, and responsibilities for any damages or injury associated with the presence failure or growth of trees. Tree management in the urban environment is about balancing the various risks against the benefits that trees provide to ensure the best outcomes for the community as a whole and not just for developers.

Local Planning Scheme No. 10

North Map



South Map



APPENDIX 3 - VERGES

The portion of land between a property boundary and the carriageway or road is referred to as the verge. In accordance with Town of Bassendean's Activities on Thoroughfares and Trading in Thoroughfares and Public Places Local Law 2010, property owners or residents of land abutting the verge may install a permissible verge treatment.

The Town's Thoroughfares and Trading in Thoroughfares and Public Places Local Law 2010 states:

- Division 1 - General prohibitions : A person must not plant any plant except grass within 6m of an intersection
- Division 3 - Permissible Verge treatments:

(1) An owner or occupier of land, which abuts on a verge, may on that part of the verge directly in front of her or his land install a permissible verge treatment.

(2) The permissible verge treatments are:

(a) the planting and maintenance of a lawn;

(b) the planting and maintenance of a garden provided that:

(i) clear sight visibility is maintained at all times for a person using the abutting thoroughfare in the vicinity of an intersection or bend in the thoroughfare or using a driveway on land adjacent to the thoroughfare for access to or from the thoroughfare;

(ii) where there is no footpath, a pedestrian has safe and clear access of a minimum width of 2m along that part of the verge immediately adjacent to the kerb;

(iii) it does not include a wall or built structure; and

(iv) it is not of a thorny, poisonous or hazardous nature; or

(c) the installation of an acceptable material; or

(d) the installation of an acceptable material or other verge treatment in accordance with paragraph (c), and the planting and maintenance of either a lawn or a garden on the balance of the verge in accordance with paragraph (a) or (b).

Council determined the following acceptable materials, and other verge treatments, and the non-acceptable materials:

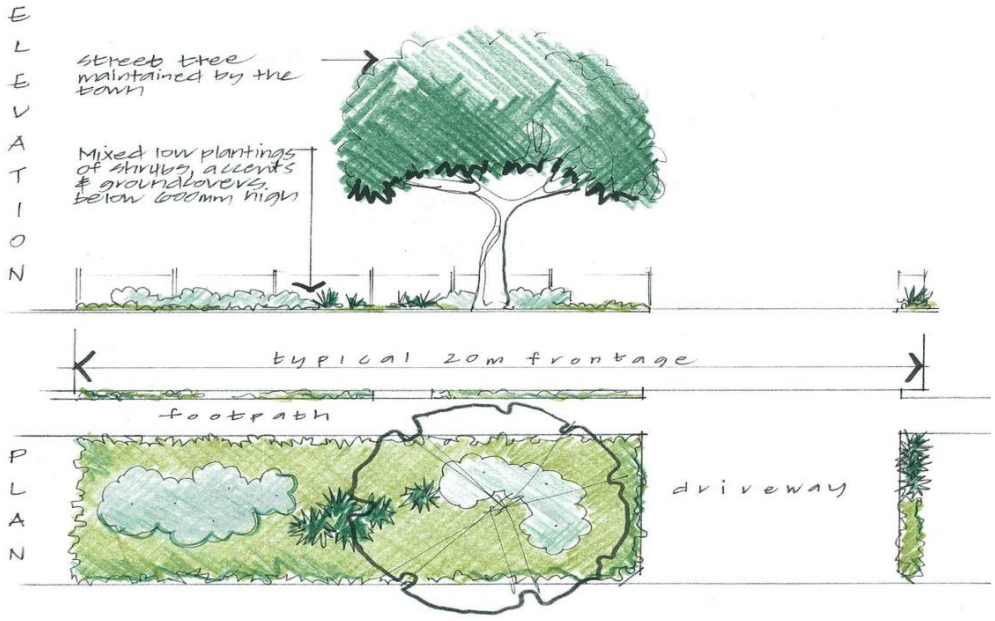
Acceptable materials	Conditional requirements
1. Composted mulch or chipper mulch material 2. Small format Permeable/ Porous Pavers 3. Irrigation system 4. Grass 5. Low growing ground cover plants	➢ Street Tree Protection policy requirements are applied to ensure the long-term health of the tree ➢ To protect the tree roots, all earth works under the tree drip line shall be performed using hand tools ➢ Verge pavers shall be at least 20 percent porous ➢ Storm water on verge shall be managed on site ➢ Verge pavers shall not be laid within 2 metres from base of existing tree trunk ➢ A minimum of 2 metre wide street tree planting bay (s) shall be provided for future street tree (s) ➢ No more than one third of the verge shall be paved excluding the crossover ➢ Mulch or paving once installed shall not be higher than the adjacent kerb line, footpath or crossover ➢ Paving shall tolerate limited vehicle traffic ➢ Below ground irrigation / pop up sprinklers

Examples of Non - Acceptable materials	Reason
1. Frangible objects such as mounds, rocks, sleepers, walls, and garden kerbs 2. Loose objects such as gravel or aggregate 3. In-situ concrete, concrete slabs, and bitumen 4. Artificial turf	➢ Frangible objects may be considered unsafe, cause damage or be used to cause damage ➢ Loose objects impact upon pedestrian safety ➢ Concrete & bitumen have poor water permeability and contribute to storm water flow ➢ Synthetic turf may reduce soil health and contribute to the urban heat island effect by absorbing sunlight and emitting heat

In regards to the landscaping of the verge, Town of Bassendean residents are encouraged to plant endemic (local native) low growing groundcovers and shrubs and informed when submitting an application, to ensure clear sight visibility for both pedestrians and vehicles be provided at all times. Where there is no footpath safe and clear, residents are advised to ensure access is provided for pedestrians.

The sketch landscape plan below is provided to assist the owner / occupier of the lot abutting a verge, and appreciate visually the verge planting requirements. In this plan, the plants have been arranged so that grass or a similar ground cover plant covers are placed at edges and low growing plant towards the middle of the verge area.

Below is an example of a verge landscaped plan**:**



Where street trees are growing under the overhead power lines, residents are advised that the Town's approved contractors will require appropriate machinery access to carry out street tree pruning operations.

APPENDIX 4 - STREET TREE MASTER PLAN

In developing the 2009 Street Tree Master Plan, Council took into consideration the mix of existing trees in each street that have been planted over a number of years, and the cultural or natural association of these trees to the area. Many of the trees planted in the 1970's, 1980's and 1990's were poorly selected and as a result, Council adopted the following tree selection criteria to guide the selection and development of the plan:

- "Boulevard" style streetscapes;
- Biodiversity Corridors;
- Historical, cultural or natural association;
- Form and scale;
- Impact on utility services;
- Drought tolerance;
- Performance record;
- Response to pruning;
- Planting tolerance in paved areas;
- Resistance to pest and diseases;
- Verge widths;
- Long lived; and
- Limb shear.

It is from the above criteria that the list of street trees suitable for the Town's streetscapes was prepared, and after extensive community consultation, Council adopted the 2009 Street Tree Master Plan. The 2009 Street Tree Master Plan links streetscapes to Public Open Space and natural areas by providing biodiversity corridors, which in the long term will create "Boulevard" style streetscapes.

In 2014, the Town sought community feedback on the current plan and in the 2015/2016 financial year allocated funding to review the Street Tree Master Plan. In early August 2015 a Street Tree Master Plan Review – Project Working Group considered the project brief and has been working towards the required actions. As part of this process, the Town signed up to Network http://202020vision.com.au/ with the aim of developing an Urban Forest Strategy proposal for Council consideration.

As part of Street Tree Master Plan review, the Town will increase species diversity by reviewing the street tree list. In addition, the Town will identify existing remnant endemic (local native) tree species and list for Council consideration their inclusion onto the Significant Tree register.

The revised Street Tree Master Plan, and the revised Tree Species Information (below), does not preclude the Town from considering other trees for streetscape features so long as the tree selection criteria is used in consultation with an Arborist for the specific location in order to minimise future expenditure on tree related issues due to inappropriate or high risk, high maintenance species being planted.

Please note that initially the Urban Forest Strategy with canopy targets for the public and private realm need to be resolved and then the Urban Forest Management Plan and revised Street Tree Master Plan can be prepared.

When Milestone 3 of the Urban Forest Strategy is completed, the revised Street Tree Master Plan and revised Street Information list will be added.

APPENDIX 5 - URBAN FOREST

State government planning documents such as the Liveable Neighbourhoods and the Urban Forest of Perth and Peel, detail the benefits urban forests provide, as being:

- Reduction in Air Pollution
- Harvest, control and filter storm water
- Mitigation of wind and noise
- Improves biodiversity
- Reduces Ultra Violet light exposure
- Reduces heat island effect and energy demand
- Enhances sense of place and wellbeing
- Increases property values
- Encourages outdoor activity, social interaction and mental health

Urban warming, commonly referred to as the 'Urban Heat Island' Phenomenon (UHI) is a well-documented topic, and the magnitude of the UHI has been studied, mostly in terms of the temperature difference between rural and urban locations. UHI is considered one of the major problems in the 21st century, as a result of urbanization and industrialization of human civilization. With the rapid growth of the Perth metropolitan area, changes to urban form have resulted in unintended environmental consequences such as increases in local ambient temperatures. Paved surfaces, buildings and other infrastructure have replaced pre-existing natural landscapes, and these hard surfaces absorb a greater amount of solar energy resulting in an increase of urban temperatures. They are also impervious, meaning that water drains away rapidly leaving little moisture in the ground layer, consequently reducing evapotranspirative cooling.

The UHI effects are particularly noticeable at night, when heat that is stored in the urban landscape is slowly released, increasing the temperature differential between urban and rural areas. Studies have found that UHI effect can add between 1°C to 6°C to ambient air temperature and is likely to be further exacerbated by climate change. The adverse effects of UHI includes the deterioration of living environment, increase in energy consumption, elevation in ground level ozone and even increase in mortality rates.

Perth population is projected to increase to 3.5 million in the Perth-Peel region by 2050. In response to this, the Western Australian Planning Commission strategic plans recommend future development should restrict urban sprawl and create compact communities with housing and transportation choices near jobs, shops and schools. Many studies have reported and successfully applied measures on mitigating UHI with promising financial and environmental benefits.

On the East Coast of Australia, State and Local governments have worked together to create the 202020 vision. This vision is a mass collaboration of organisations working together to create 20% more green space in our urban areas by 2020. On the 5th November 2015, the Town signed up to http://202020vision.com.au/network/ with the aim of developing an urban forest strategy for Council consideration with the long term vision to increase tree canopy and mitigate the impact of UHI within Town of Bassendean.

A review of 5 International, 13 Australian articles concerning Urban Forests and 7 Urban Forest strategies, has been undertaken in order to guide the development of the Town of Bassendean's Urban Forest Strategy and to identify potential management and operational improvement opportunities.

One of the measures to mitigate the Urban Heat Load is to increase the tree canopy, which also improves carbon sequestration, filters air pollution, reduces the urban heat load, provides shade for pedestrians, increases walkability of neighbourhoods, makes our suburbs more attractive and increases the biodiversity for insects and birds

Therefore, urban forests play a vital role in the health, social framework and economic sustainability and help build stronger communities.

APPENDIX 6 - TREE CANOPY COVER - MAPPING

A publication titled “Criteria and Indicators for Strategic Urban Forest Planning and Management” published by Arboriculture & Urban Forestry 2011. 37(3), states “All too often, urban forest management programs are driven by the need to increase urban forest canopy cover. Setting canopy cover goals has many implications, including the associated need for increased tree planting, watering and the long-term resources required to manage the expanding urban forest”.

The concept of using criteria and indicators as sustainable forest management tools originates from the 1994 meeting of the Working Group on Criteria and Indicators for the Conservation and Sustainable Management of Temperate and Boreal Forests in Geneva, Switzerland, as part of the Montréal Process. Since then, many sets of criteria and indicators of sustainable forest management have been developed around the world.

In 2002, American Forests (a branch of the United States Department of Agriculture - USDA) identified canopy cover targets by land use. They recommended the ideal canopy to maximise the benefits canopy provides (depending on climate and land use patterns). The recommended canopy cover is:

- 15% in central business district and industrial areas.
- 25% in urban residential and light commercial areas.
- 50% in suburban residential areas.

Canopy cover targets are now being developed by many Local Government Authorities throughout the world.

Direct comparisons cannot be made between different Local Governments existing canopy cover and their targets. Each municipality has different factors affecting their urban forest, with key differences being: existing canopy in public and private realm, planning and urban density, surrounding land use (central business district, residential, rural), climate (rainfall, temperature), soil types and maintenance budgets.

Therefore, the first step is to map or measure the existing canopy coverage in order to understand the extent of the municipality’s urban forest, as this data will then be used to guide our strategic directions –including setting canopy cover targets.

The Town of Bassendean’s tree canopy coverage is estimated at 15.7% which includes all private and public realm.

Apart for the 2006 Arborlogic Street Tree Audit data the Town obtained for the existing street trees, the other essential parameters of canopy mapping has not been undertaken in order to provide the base line data for all private and public realm existing tree species distribution, tree diversity, tree heights and other parameters in order to set specific canopy targets.

Information obtained from other Western Australian Local Governments tree canopy reports states that there has been substantial growth in its residential sector since the 1990’s and early 2000’s. This has resulted in a significant decline in canopy coverage in areas zoned “Residential”, attributed to urban infill and densification.

In order to complete this section of the report, it is suggested that Council allocate funds to undertake a GIS-based tree canopy study using aerial photography and LiDAR (light detection and ranging) data. The study will provided data on the height of the vegetation throughout the Town of Bassendean in four height categories (>20m, 10-20m, 5-10m and 3-5m) and a

percentage breakdown of canopy coverage within the streets, parks and private properties of each suburb. If required the study can provide an analysis of the Town's canopy cover in the commercial areas, Tonkin Park Industrial Area to assist in determining target canopy targets.

It is therefore recommended, that Council allocate funds to map the Town's private and public realm tree canopy in order to identify canopy cover targets by land use, which in turn permits the ongoing evaluation of success in implementing the urban forest strategy.

APPENDIX 7 - IMPROVE URBAN FOREST DIVERSITY

Urban forest diversity comes in two main forms: the plants' age and their species. Diversity is important as the urban forest is a living and natural asset; it has a lifespan, it provides sustenance, homes and other benefits to other living organisms and it is susceptible to pests and diseases.

The Town of Bassendean is committed to, and has developed numerous policies and plans such as the collective Biodiversity Strategy, which was used to develop 2009 Street Tree Master Plan, the numerous LPS No.10 Planning Policies need to be reviewed to ensure a diverse urban forest.

The Town's 2009 Street Tree Master Plan is currently under review and where necessary the plan will be transform and strengthen by building upon the present and the past plantings and provide a resilient, healthy and diverse tree canopy.

APPENDIX 8 - OUR FUTURE URBAN FOREST STRATEGY

Vision:

The Town's Urban Forest Strategy will transform and strengthen the public and private realm tree canopy by building upon the present and the past plantings and provide a resilient, healthy and increased diverse tree canopy. This will contribute to the health and wellbeing of our community and further improve the liveability of the built and natural environment.

Objectives:

The overall objective of developing an Urban Forest Strategy is as follows:

- Educate & Engage with the local community on the value of the urban forest asset and how they can contribute to its growth and care
- Strengthen the Town's Street Tree Master Plan;
- Improve the diversity, quality and quantity of tree canopy within the Town of Bassendean;
- Manage the conceptual shift from dealing with our trees on an individual basis, to managing the vegetation as a collective and integrated ecosystem;
- Contribute to the health and wellbeing of the increased population density.

The Town recognises its responsibility to maintain an asset that is dynamic and subject to increasing environmental changes in both built and natural environments. This Strategy embraces the opportunity to generate a new legacy for the Town of Bassendean and create a forest for future generations. This document sets out how to create an urban forest that will become diverse, robust and resilient in the face of current and future challenges. We know that climate change and increasing density and growth within our Town will place new pressures on our urban forest, but the targets set in this document will go a long way to meet those challenges

Goals:

- Investigate incentives to retain existing tree canopy
- Lobby the State Government in conjunction with other Local Government peak bodies, to review the Residential Design Codes to include genuine open space that can accommodate retention of trees on site or provision of new trees
- Strengthen the existing Biodiversity Corridors
- Increase tree canopy in the public realm by "x" %
- Minimise loss of tree canopy in private realm
- Apply water Sensitive Urban Design principals where opportunities arise and retrofit where possible.

Develop Community participation to implement the Urban Forest Strategy, through demonstration models and programsNote: Goals yet to be determined

Prior to Council determining the urban canopy goals, it is essential funding be allocated to map the Town's private and public realm tree canopy in order to identified canopy cover by land use, which in turn will determine the resources required to achieve the goals and will permit the Town measure the success of the urban forest strategy.

A MILESTONE APPROACH

To formalise the ongoing implementation of the Urban Forest Strategy, the Town intends to implement a five-milestone structure, similar to what has been used in the Town's Cities for Climate Protection (CCP) Program which assisted local governments to reduce their greenhouse gas emissions through a five milestone process.

The five milestones of the Urban Canopy Strategy are:

Milestone 1	• Develop a Urban Forest Strategy which includes total estimated tree canopy coverage in the private and public realm.
Milestone 2	• Purchase GIS -3D aerial laser photographic maps or similar to permit tree mapping • Undertake a GIS-based tree canopy study to provided data on the height of the vegetation throughout the Town of Bassendean in four height categories (>20m, 10-20m, 5-10m and 3-5m) and a percentage breakdown of canopy coverage within the streets, parks and private properties of each suburb. In addition, provide an analysis of the Town's canopy cover in the commercial areas, Tonkin Park Industrial Area to assist in determining target canopy targets • Review the Street Tree Audit data and estimate asset values • Identify endemic (local native) trees for inclusion to the Significant Tree register
Milestone 3	• Develop the Canopy Plan and an Urban Canopy Policy for Council consideration. • Finalise the revised Street Tree Master Plan • Amend the Urban Forest Strategy accordingly • Investigate a mechanism through the Local Planning Scheme to implement a regulatory tool, which sets out the procedural framework governing the removal and the requirements to offset the loss of tree canopy. • Consult with community/Council and formalise goals.
Milestone 4	• Allocate adequate resources and funding to commence implementation of the actions in order to achieve the strategy objectives and goals.
Milestone 5	• Review and evaluate progress towards the canopy target in regards to strategic objectives.

Milestone 5 will assist in identifying any gaps, or indicate areas of improvement towards the target. At Milestone 5, it may also be identified that the targets set at Milestone 2 and 3 require amendment to either further enhance the canopy coverage or maintain it. On completion of Milestone 5, the Town of Bassendean can revise the original Strategic Objectives in comparison to what has been achieved. This process ensures the Town is continually improving its management of the urban forest.

APPENDIX 9 - IMPLEMENTATION FRAMEWORK, RESOURCING AND FINANCIALS

The full implementation of the Strategy will require the development of a detailed Canopy Plan. The Plan will be a living document with continuous reporting and improvements to ensure that the Town is working towards.

Once the canopy plan is available, the Urban Forest Strategy will be refined to include the recommended goals and the respective implementation time-frames, human and financial resources, can be listed for Council considering.

APPENDIX 10 - RELEVANT LEGISLATION

Legislation	Summary
Planning & Development Act 2005 (WA)	An Act to provide for a system of land use planning and development in the State and for related purposes.
Environmental Protection Act 1986 (WA)	The Act is the key legislation for environmental management in the state and is the main method of considering the environmental impacts of major developments. The Act: ▪ established the Environmental Protection Authority (EPA) and its governance arrangements; ▪ allows for the development of environmental protection policies; ▪ outlines the environmental impact assessment process including: referral and assessment of proposals; ▪ establishes the state's environmental regulations including pollution and environmental harm offences, clearing of native vegetation, and prescribed premises, works approvals and licences; and ▪ provides for enforcement of regulations including legal proceedings.
Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth)	The Act provides a legal framework to protect and manage nationally and internationally significant flora, fauna, ecological communities and heritage places. The Australian Government Department of the Environment, Water, Heritage and the Arts administers the Act. The objectives of the Act are to: ▪ provide for the protection of the environment, especially matters of national environmental significance; ▪ conserve Australian biodiversity; ▪ provide a streamlined national environmental assessment and approvals process; ▪ enhance the protection and management of important natural and cultural places; ▪ control the international movement of plants and animals (wildlife), wildlife specimens and products made or derived from wildlife; and ▪ promote ecologically sustainable development through the conservation and ecologically sustainable use of natural resources.
Clean Energy Act 2011 (Commonwealth)	The Act provides a legal framework to encourage the use of clean energy, and for other purposes. The objects of the Act are as follows: a) to give effect to Australia's obligations under: (i) the Climate Change Convention; and (ii) the Kyoto Protocol; b) to support the development of an effective global response to climate change, consistent with Australia's national interest in ensuring that average global temperatures increase by not more than 2 degrees Celsius above pre-industrial levels; c) to: (i) take action directed towards meeting Australia's long-term target of reducing Australia's net greenhouse gas emissions to 80% below 2000 levels by 2050; and (ii) take that action in a flexible and cost-effective way; d) to put a price on greenhouse gas emissions in a way that: (i) encourages investment in clean energy; (ii) supports jobs and competitiveness in the economy; and (iii) supports Australia's economic growth while reducing pollution.

Legislation	Summary
Local Government Act 1995 (WA)	The Local Government Act 1995 is an act of the Western Australian Parliament, which lays down the responsibilities, powers and procedures of Local Government Bodies. Section 5.56.- Planning for the future, states: (1) A local government is to plan for the future of the district. (2) A local government is to ensure that plans made under subsection (1) are in accordance with any regulations made about planning for the future of the district.
Rights in Water and Irrigation Act 1914 (WA)	This Act provides the legislative basis for the planning, regulation, management, protection and allocation of water resources in Western Australia. The objectives of the legislation include providing for the management, sustainable use and development of water resources to meet the needs of current and future users, and for the protection of their ecosystems and the environment in which water resources are situated.
State Planning Policy 2.9 Water Resources (WA)	This policy is directly related to the overarching sector policy SPP 2 Environment and Natural Resources policy and provides clarification and additional guidance to planning decision-makers for consideration of water resources in land use planning.
Better Urban Water Management (WA)	Better Urban Water Management has been designed to facilitate better management of our urban water resources by ensuring an appropriate level of consideration is given to the total water cycle at each stage of the planning system. It also provides guidance on the implementation of State Planning Policy 2.9 Water Resources.
Planning Bulletin 92 Urban Water Management (WA)	This planning bulletin provides guidance on urban water management matters to be taken into account by the Western Australian Planning Commission (WAPC), local governments and applicants in considering planning proposals and applications for new residential, rural-residential, commercial and industrial areas.
Wildlife Conservation Act 1950 (WA)	The Act provides for the conservation and protection of all native flora and fauna. Under the Act, individual species of plants and animals are protected, with the level of protection varying depending on whether the species is rare or endangered. Flora and fauna that needs special protection because they are under identifiable threat of extinction, are rare, or otherwise in need of special protection are placed on the threatened species list.
Conservation and Land Management Act 1984 (WA)	The Act establishes a comprehensive set of legislative provisions dealing with state conservation and land management matters. It also provides for the vesting or reservation of land, particularly state forest or timber reserve, and the ability to enter into agreements with private landholders, state conservation and land management matters.
Contaminated Sites Act 2003 (State)	Imposes significant responsibilities on parties causing contamination, and on owners of contaminated land. Land owners, occupiers and polluters are required to report known or suspected contaminated sites to the Department of Environment Regulation (DER). Reported sites are then classified, in consultation with the Department of Health, based on the risks posed to the community and the environment and responsibility for clean-up is allocated.
Health Act 1911 (State)	This is the primary Act dealing with all matters relating to public health, including waste management, sanitary provisions, pest controls and environmental health and defines local government responsibilities.

Legislation	Summary
	Note a new Public Health Act is being developed for Western Australia to better protect and promote public health as well as prevent illness and injury.
Heritage of Western Australia Act 1990 (WA)	The Act provides for, and encourages, the conservation of places which have significance to the cultural heritage in the state and established the Heritage Council of Western Australia. The objectives of the Act are to: ▪ identify, conserve and where appropriate enhance those places within Western Australia which are of significance to the cultural heritage; and ▪ in relation to any area, to facilitate development that is in harmony with the cultural heritage values of that area; and ▪ to promote public awareness as to the cultural heritage, generally.
Native Title Act 1993 (Commonwealth)	The Act was enacted as a result of the decision made by the High Court of Australia in *Mabo v Queensland* (No.2) 1992. It: ▪ recognises and protects native title; ▪ provides that native title cannot be extinguished contrary to the Act; ▪ provides for agreement making - Indigenous Land Use Agreements (ILUAs); ▪ validated any past grants of freehold or leasehold interests that were thrown into doubt by the Mabo decision; and ▪ created a National Native Title Tribunal to administer claims to land by Aboriginal people.
Aboriginal Heritage Act 1972 (WA)	An Act to make provision for the preservation on behalf of the community of places and objects customarily used by or traditional to the original inhabitants of Australia or their descendants, or associated therewith, and for other purposes incidental thereto.
Electricity Act 1945 (WA)	An Act to make provision as to the examination and licensing of persons in respect of their competency to carry out works relating to electricity, and the examination, prohibition or approval of electrical appliances
Rights in Water & Irrigation Act 1914 (WA)	An Act relating to rights in water resources, to make provision for the regulation, management, use and protection of water resources, to provide for irrigation schemes, and for related purposes

APPENDIX 11 - SUPPORTING POLICIES, PLANS, REPORTS & INFORMATION

The development of the Urban Forest Strategy has been undertaken as cross-directorate collaboration, expanding across various internal service areas. This is primarily due to the compounding benefits a healthy urban forest returns and how it complements the work the Town of Bassendean already undertakes.

The Town of Bassendean webpage (http://www.bassendean.wa.gov.au/) includes a quick link to "Greening Bassendean", Council Policies, Plans, Reports and community information sheets which currently support this strategy:

Council Policies

Town planning & Built Environment

- Significant Tree Policy
- Verge Treatment and maintenance policy
- Street Tree Protect Policy
- Street Tree Removal, Pruning & replacement Policy
- Amenity Tree Evaluation Policy
- Dangerous Trees on Private Property Policy
- Local Planning Scheme No. 10 – Power to make Tree Preservation Orders
- Local Planning Policy No. 13 – Trees on Development Sites
- Local Planning Policy No. 18 – Landscaping with Local Plants

Environmental Sustainability and Adaptation to Climate Change

- Sustainable Bassendean Policy
- Natural Areas Management Policy
- Local Biodiversity Policy
- Landscaping with Local Plants Policy
- Foreshore Restoration Policy
- Water Sensitive Urban Design and Water Conservation Policy
- Nutrient and Irrigation Management Policy
- Wetlands Policy

Leadership and Governance

- Communication & Consultation, Community & Stakeholders
- Financial Sustainability Policy
- Risk Management Policy
-

Open Space Plans

- Street Tree Master Plan
- Street Tree Master Plan – Tree Species Information
- Collective Biodiversity Strategy
- Local Climate Adaptation Action Plan
- Environmental Management Plan
- Bush Weed Management Plan
- Water Conservation Plan for the Management of Groundwater in the TOB
- Play Spaces Implementation Plan
- Physical Activity Strategic Plan
- Optimizing Sporting & Cultural Activities
- Bassendean Bike Plan
-

Infrastructure Strategies & Reports

Asset Management Implementation Strategy
Recreational Asset Management Plan - Including (but not limited to) assets within areas such as:

- Parks reserves
- River Foreshore
- Native bushland and conservation areas
- Flood plains
- Medians and verges

Existing Street Tree Management Programs and Reports

- Adopt- A -Tree program
- Significant Tree - Register
- Significant Tree - Arborist reports
- Significant Tree - PiCUS Sonic Tomography Tests

Greening Bassendean - Information sheets:

- Adopt-a-Tree
- Building Material on Verge – Permit
- Bushfire Prevention – firebreaks, inspections, penalties, contacts
- Garden Bores – Restrictions, Penalties, Complaints
- Garden compost- How to Make, Use , Health Risks
- Garden (mixed green) Waste – verge collection dates
- Garden Verge Treatments'
- Garden – watering restrictions for households
- Graffiti Removal & management
- Grey Water – reuse of
- Mowing of Verges
- Mulch – availability of
- Rainwater tanks – general information
- Significant Tree – Identify, protect & manage
- Soak Wells – removal & decommissioning
- Street trees – Adopt –A Tree
- Street Tree – Planting, Pruning Removal
- Street Tree – Protection
- Street Tree – Significant
- Trees – Dangerous trees on private property
- Verge (Road Reserve) - Control and care of
- Verge – Disused materials on verge
- Verge maintenance - mowing
- Verge – permissible verge treatment

Additional Appendices

Astron Mapping and Analysis - see separate pdf document

Draft Suggested Species List April 2017 - see separate pdf document

Glossary

Work in progress

Biodiversity: a portmanteau of "biological diversity," generally refers to the variety and variability of life on Earth. According to the United Nations Environment Programme, *biodiversity* typically measures variation at the genetic, the species, and the ecosystem level. (https://en.wikipedia.org/wiki/Biodiversity*)*

Biosphere: the regions of the surface and atmosphere of the earth or another planet occupied by living organisms / an artificial structure enclosing a self-contained ecosystem or ecosystems.

By the most general biophysiological definition, the **biosphere** is the global ecological system integrating all living beings and their relationships, including their interaction with the elements of the lithosphere, geosphere, hydrosphere, and atmosphere. (*https://en.wikipedia.org/wiki/Biosphere*)

GHG emissions: GHG) is a gas in an atmosphere that absorbs and emits radiation within the thermal infrared range. This process is the fundamental cause of the greenhouse effect. The primary greenhouse gases in Earth's atmosphere are **water vapor**, **carbon dioxide**, **methane**, **nitrous oxide**, and **ozone**. (*https://en.wikipedia.org/wiki/Greenhouse_gas*)

Green Infrastructure : is a cost-effective, resilient approach to managing wet weather impacts that provides many community benefits. Sep 23, 2016 (www.epa.gov/green-infrastructure/what-green-infrastructure*)*

Liveability: The sum of the factors that add up to a community's quality of life—including the built and natural environments, economic prosperity, social stability and equity, educational opportunity, and cultural, entertainment and recreation possibilities. (http://livable.org/about-us/what-is-livability)

Soil Biota: Soil life, **soil biota**, **soil** fauna, or edaphon is a collective term that encompasses all organisms that spend a significant portion of their life cycle within a **soil** profile, or at the **soil**-litter interface. These organisms include earthworms, nematodes, protozoa, fungi, bacteria and different arthropods. (*https://en.wikipedia.org/wiki/Soil_biology*)

Urban Forest: is broadly defined as the collection of green spaces, trees and other vegetation that grows within an urban area, on both public and private land.

Urban Heat Island Effect: An **urban heat island** (UHI) is an **urban** area or metropolitan area that is significantly warmer than its surrounding rural areas due to human activities. ... The main cause of the **urban heat island effect** is from the modification of land surfaces. Waste **heat** generated by energy usage is a secondary contributor. (*https://en.wikipedia.org/wiki/Urban_heat_island) c*

Swan Coastal Plain: The **Swan Coastal Plain** in Western Australia is the geographic feature, which contains the Swan River as it travels west to the Indian Ocean. The coastal plain continues well beyond the boundaries of the Swan River and its tributaries, as a geological and biological zone, one of Western Australia's Interim Biogeographic Regionalisation for

Australia (IBRA) regions.[1][2] It is also one of the distinct physiographic provinces of the larger West Australian Shield division.

Topography: is the study of the shape and features of the surface of the Earth and other observable astronomical objects including planets, moons, and asteroids. The *topography* of an area could refer to the surface shapes and features themselves, or a description (especially their depiction in maps).(https://en.wikipedia.org/wiki/TopographyTopography*)*

Quartz

Interdunal swales

Alluvial

Swan Association

Yellow duplex soils

Vegetation --- names of plants ???

And so on …

REFERENCES

International

JR Clark and Nelda P. Matheny: A Model of Urban Forest Sustainability Application to Cities in the United States. Page 112-120

W. Andy Kenney, Philip J.E. van Wassenaer, and Alexander L. Satel; Arboriculture & Urban Forestry - Criteria and Indicators for Strategic Urban Forest Planning and Management 2011. 37: Page 108–117

David J. Nowak, Susan M. Stein, Paula B. Randler, Eric J. Greenfifi eld, Sara J. Comas, Mary A. Carr, and Ralph J. Alig; United States Department of Agriculture - Sustaining America's Urban Trees and Forests

Pacific Northwest Research Station (PNW) Calculating the Green in Green: What's an Urban Tree Worth; Issue 126

Jay S. Golden Sustainable Technologies Program, Consortium for the Study of Rapidly Urbanizing Regions, Arizona State University, Tempe, AZ, USA; The Built Environment Induced Urban Heat Island Effect in Rapidly Urbanizing Arid Regions – A Sustainable Urban Engineering Complexity

Australia

Western Australian Planning Commission – The Urban Forest of Perth & Peel statistical report. CSIRO 2009 Urban Monitor

Directions 2031 Spatial Framework for Perth and Peel, the State Government's planning framework for the Perth metropolitan area

Directions 2031 & Beyond -"Towards Perth & Peel 3.5 million - Urban Consolidation"; Central – Part 2

Institute for Sustainable Futures; Bench Marking Australia's Urban Tree Canopy May 2014

Department of Environment, Land, Water and Planning (Victoria), City of Melbourne- How to Grow an Urban Forest- A ten-step guide to help councils save money, time and share practical knowledge

Ram Pandita, Maksym Polyakovb, Sorada Tapsuwanc, Timothy Morand; Landscape and Urban Planning 110 (2013); The effect of street trees on property value in Perth, Western Australia; Page134– 142

Dr Jane Tarran; University of Technology Sydney; Improving Canberra's sustainability: why urban tree canopy and other vegetation matters

Dr Brent Jacobs; Institute for Sustainable Futures; Benchmarking Australia's Urban Tree Canopy: An i-Tree assessment

Vegetation and Management of Royal Park West, City of Melbourne, Victoria 1992

Helen Brown, Dianne Katscherian, May Carter, Jeff Spickett; Curtin University; Cool communities: Urban trees, climate and health

Department of Health (WA); Health Promotion Strategic Framework 2012-2106; WA Health's strategic direction & priorities for the prevention of avoidable chronic diseases and injuries

Water Corporation (Western Australia). Historical stream flow 1911-2011. Access at: http://www.watercorporation.com.au/water-supply-and-services/rainfall-and-dams/streamflow/streamflowhistorical.

Department of Environment, Water, Heritage and Arts - Assessment of Australia's Terrestrial Biodiversity 2008 Chapter 5 Threats to Australian biodiversity

Kendal-and-McDonnell-2014-Adapting-Urban-Forests-to-Climate-Change

City of Cockburn – Urban Consolidation considerations

City of Armadale (WA) - Urban Forest Strategy City of Belmont (WA) - Urban Forest Strategy City of Fremantle (WA) - 2020 Green Plan City of Vincent (WA) - Greening Plan	City of Burnside (SA)- Urban Tree Strategy City of Melbourne (VIC) - Urban Tree Strategy City of Sydney (NSW) – Urban Forest Strategy

References

Community Sub-Group - Work in progress

---

i Burke, M.J. (2XXX) 'On the Swan', PUBLISHER HERE Appendix A p.