

Creating a Cool Kingston



APRIL 2020

URBAN
COOLING
STRATEGY



City of
KINGSTON

Acknowledgment of Country



"We acknowledge that this strategy was prepared and conducted activities on the traditional lands of the Kulin Nations. We pay our respects to their elders past, present and emerging as they are the original carers and keepers of the sacred environmental knowledge of this land."

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Summary

Background and purpose

Extreme heat and heat waves have a major impact on the health and wellbeing of the community and more broadly the productivity of the economy.

As cities grow and populations increase, the way that heat accumulates across the Municipality changes. This is a result of changes in the amount of green space compared with hard impervious surfaces. Where the vegetation is retained during development and cool materials are used, temperatures can be maintained. However, where surfaces are replaced with materials that accumulate heat, the landscape can become hotter.

Urban heat islands were identified in the City of Kingston using thermal imagery from satellites. Heat islands occur where there is a greater proportion of bitumen, dark roofs, dry grass and bare ground (e.g. Moorabbin Airport). In contrast, cool islands feature irrigated grass, wetlands, water bodies and trees (e.g. golf courses).

What is an urban heat island?
An urban heat island is a part of a city or town where heat has accumulated, causing temperatures to rise above a regional average

Urban heat islands could become more widespread as a result of climate change and increased urbanisation. Modelling of the impact of climate change suggests that the area of heat islands in the municipality could significantly expand.

This Urban Cooling Strategy presents the City of Kingston's vision for Creating a Cool Kingston. It is underpinned by significant technical analysis (see the Technical Background Report for more information) and consultation across Council and with the community.

Creating a Cool Kingston

City of Kingston's vision is a municipality with no urban heat islands. It is a community that actively manages the impacts of urban heat on people and the environment through decisions that encourage urban cooling.

To achieve this vision, Council will develop strategies and actions based on the following principles:

- Target hotspots where the most vulnerable community members live, work and travel;
- Lead and innovate in the adoption of evidence based, new practices;
- Work collaboratively with the public and private sector;
- Integrate 'cooling' into decision making across Council;
- Advocate for policy change;
- Monitor and evaluate; and
- Maximise the social, environmental and economic benefits of actions, now and into the future.

The range of strategies that assist with managing urban heat and Creating a Cool Kingston are relevant to multiple functions within Council, and also require working with the broader community, government agencies and business. Council's five Strategic Directions in this Urban Cooling Strategy outline the actions we will deliver in the next one to three years, the medium term outcomes (4-9 years), which will contribute to achieving longer-term goals (10+ years).

The five Strategic Directions under which actions have been developed are:



1. Urban greening

Urban greening describes vegetation in the urban landscape, such as trees, shrubs, irrigated turf, green walls and green roofs. Collectively, these greening elements help to cool the landscape.

Our goal 1:

Increase vegetation cover across Kingston, including tree canopy.

2. Planning and building

Planning and building decisions drive the structure and function of cities. As cities grow, they are shaped by the way suburbs are planned, and commercial and residential buildings are designed and constructed.

Our goal 2:

Incorporate urban heat mitigation principles and elements in planning and building decisions.

3. Cool Council buildings and assets

Building and construction materials absorb and retain heat in different ways and therefore material selection significantly contributes to the occurrence of heat islands.

Our goal 3:

Adopt the use of cool materials in Council buildings and assets.

4. Emergency and health response

Planning, preparing, responding and recovering from periods of extreme heat are essential aspects of emergency response. Additionally, as the significance of the impact of extreme heat on human health has become better understood, so too has its focus within health services sectors.

Our goal 4:

Support community members who are vulnerable to heat to develop the skills, knowledge and support networks to reduce the impacts of extreme heat.

5. Education, engagement & partnerships

Council can contribute to urban cooling by raising both staff and community awareness about the drivers and impacts of urban heat, engaging with developers and businesses, and building partnerships with different levels of government. This Strategic Direction underpins the actions undertaken in all of the Strategic Directions.

Our goal 5:

Improve staff, community and stakeholders' understanding of the impact of extreme heat and how they can make decisions that mitigate the impacts of heat through greening, cool materials and behaviours.



Implementation program

Council will develop an implementation plan that is reviewed annually, informed by the principles identified in this Strategy, building on the previous year's activities.

An internal staff working group with representatives from key functional areas will oversee implementation of the Strategy.

1. Why do we need an Urban Cooling Strategy?

1.1. BACKGROUND

Metropolitan Melbourne’s population increases steadily each year. To support this growing population new developments and infrastructure such as roads are being constructed at an ever-increasing rate. This is resulting in the continued transition of green open space to hard impervious surfaces.

The loss of green space and the construction of hard surfaces that absorb and retain heat increases the temperature in cities. While small areas of hard surfaces can create localised hot spots at the scale of a few metres, large areas of heat can accumulate in “heat islands” at the block or neighbourhood scale. Living and working in these heat islands exposes people to much greater temperatures, which creates health and productivity risks for the community and economy.

Heat islands could become more widespread and intense in the future if development is done in a way that removes green open space or uses building and construction materials that absorb heat. Furthermore, climate change, which has already impacted Melbourne and will see temperatures continue to rise over the coming decades, is exacerbating the impact of extreme heat on urban areas.

While heat islands exist in every capital city in Australia, actions can be taken to mitigate or even eliminate them. Councils are in an ideal position to influence the mitigation of heat islands given their roles in influencing development and planning as well as managing features of the natural landscape such as parks, sporting fields and streetscapes.

1.2. PURPOSE

This Urban Cooling Strategy presents the City of Kingston’s vision for creating a cooler city. It recognises existing programs already being undertaken in the municipality and highlights areas where a ‘cooling lens’ can be applied to our work. It has been developed to ensure that the health and wellbeing of the community, and productivity of the economy, can be maintained as urbanisation, population growth and climate change combine to exacerbate urban heat.

The Strategy:

- Describes the local and policy context relevant to creating a cool city;
- Summaries key background, technical analysis that identifies the location and drivers of urban heat and cooling now and in the future;
- Presents a vision, guiding principles, high level strategic-directions, goals, outcomes and actions;
- Introduces governance mechanisms and how creating a Cool Kingston can be monitored and evaluated in the future.

Importantly, this Strategy has been developed to provide direction for tangible actions that Council can undertake directly, as well as where Council can work with and influence others, and identify avenues for further investigation.

1.3. HOW HAS THIS STRATEGY BEEN DEVELOPED?

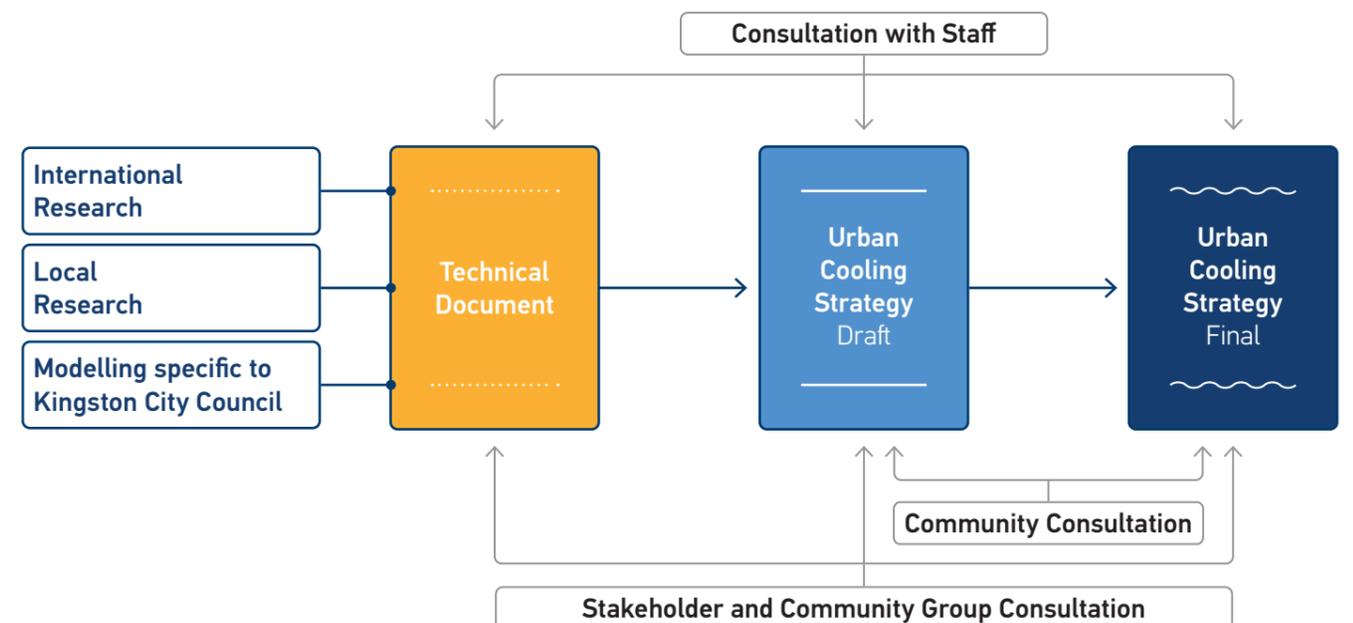
A Technical Report was prepared to inform development of this Strategy. It analysed international and local research, and modelling of localised data and conditions to describe the location of urban heat islands across the City of Kingston, what their drivers are, the location of urban heat islands in relation to vulnerable members of the community, and how urban heat islands could change in the future.

This technical research and modelling informed two workshops with Council staff from across the organisation. The workshops identified and prioritised actions required to create a Cool Kingston.

Briefings were held with several community groups, including the Access and Equity Committee, and the Public Space and Environment Advisory Committee to further inform the development of the Strategy.

The draft Strategy was provided to the community for consultation over November and December 2019 via Council’s consultation website: Your Kingston, Your Say. Notifications were placed in Leader Newspapers, Kingston Your City, The Voice, Kingston community e-newsletters, social media posts and direct emails through Council committees. We received nearly 120 responses which have helped to further shape the final Urban Cooling Strategy.

Figure 1. Preparation of the Urban Cooling Strategy



2. Context

2.1. LOCAL CONTEXT

The City of Kingston, located 20 km south of Melbourne, is 90 square kilometres in size and incorporates 13 km of coastline and a broad mix of residential suburbs, commercial areas and industrial zones. Residents in Kingston have access to a range of open space assets on public land such as wetlands, waterways, beaches, natural resource areas, parks, playgrounds, sporting grounds and shared paths. There are also significant areas of open space on private land, most notably golf courses and market gardens in our Green Wedge.

Kingston is the tenth largest municipality in Melbourne and continues to grow. The population was approximately 157,000 in 2016, which is an increase of about 20,000 people over the past decade. The population is expected to continue to rise in the decades ahead, with the 2036 population projected to be about 190,000 people, which includes an additional 10,000 seniors. This will require an increase of between 14,000 and 18,000 dwellings¹.

Some major features of the municipality include Moorabbin Airport, Braeside Park, Edithvale Wetlands, Southland Shopping Centre, Moorabbin Oval, and the large Braeside Industrial Area. The Patterson River and Mordialloc Creek both run through the City.

2.2. POLICY CONTEXT

The City of Kingston Council Plan 2017 – 2021 sets out a vision for:

A diverse, dynamic community where we all share a sustainable, safe, attractive environment and a thriving economy.

The Council Plan features five goals:

1. Our well-planned, liveable city supported by infrastructure to meet future needs
2. Our sustainable green environment with accessible open spaces
3. Our connected, inclusive, healthy and learning community
4. Our free-moving safe, prosperous and dynamic city
5. Our well-governed and responsive organisation.

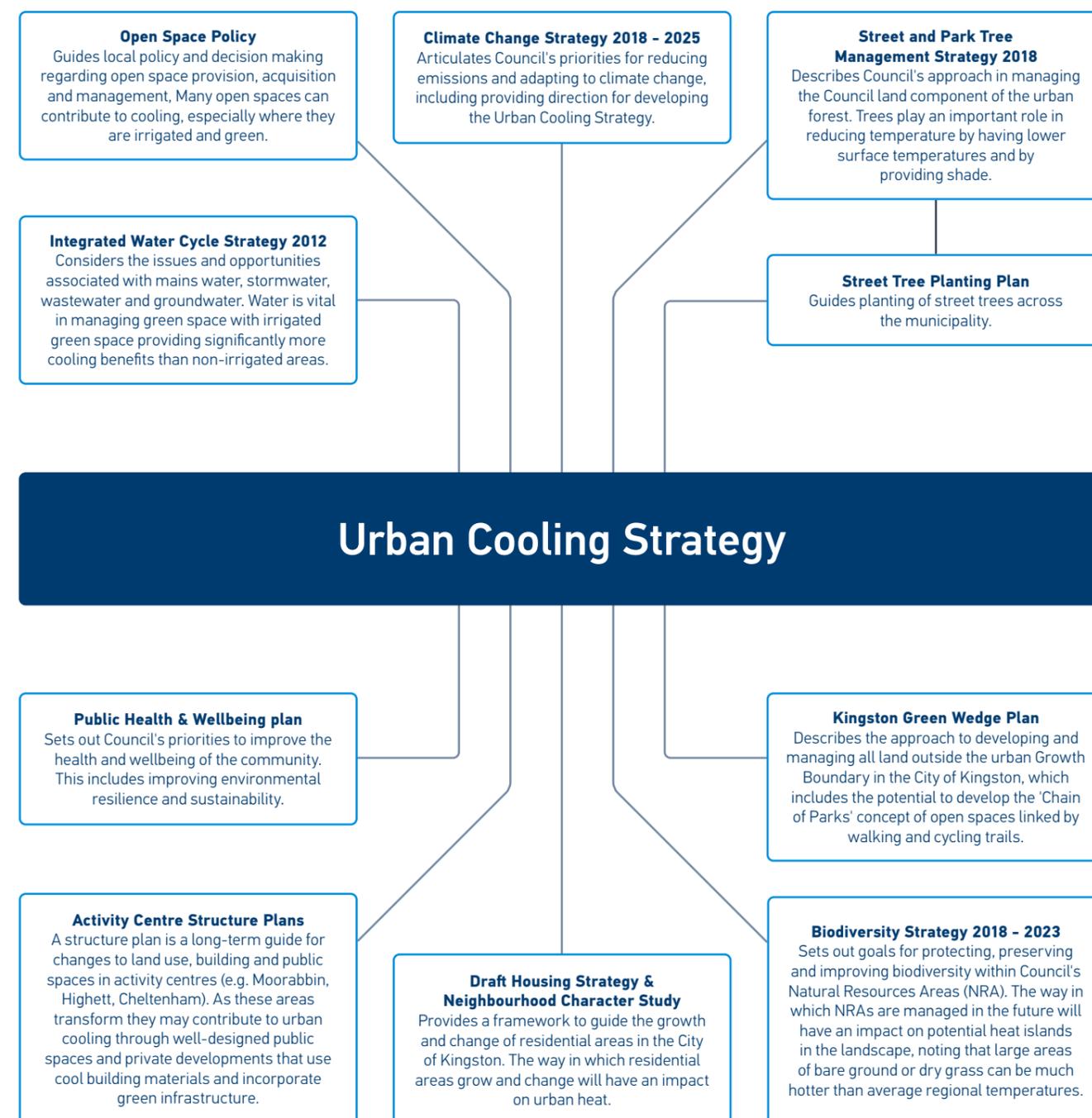
Urban cooling is central to achieving the majority of these goals, playing an important role in creating a liveable city, with a sustainable green environment that supports a healthy and prosperous community.

The development of this Strategy was undertaken in the context of a range of other key Council strategic planning documents. The relationship between these documents and this Urban Cooling Strategy is described in Figure 2. This strategy also interacts with the Kingston Planning Scheme and policy documents such as Kingston's Community Buildings Environmentally Sustainable Design (ESD) Policy. Through the actions identified in this Strategy, urban cooling is likely to influence how actions are implemented in many other strategic planning and policy documents.

At a State and Metropolitan Melbourne level this Strategy complements:

- The Victorian Government's Plan Melbourne 2017 – 2050;
- Victoria's Climate Change Adaptation Plan 2017-2020 and
- Resilient Cities' Living Melbourne: Our Metropolitan Urban Forest Strategy.

Figure 2. Relationship between the Urban Cooling Strategy and other Council strategies, plans and policies.



3. Why is urban heat important?

What is the difference between extreme heat and an urban heat island?

Extreme heat can affect all parts of a city and is normally measured as a period of prolonged high air temperature. An urban heat island on the other hand is a part of a city where heat has accumulated, causing temperatures to rise above a regional average (Figure 3). The experience of extreme heat is greatest in urban heat islands.

In Victoria, extreme heat is defined as an average temperature equal to or exceeding defined heat-health thresholds, which for the City of Kingston, is 30°C². Periods of extreme heat lasting several days are referred to as “heat waves” and cause more illnesses and deaths each year than any other natural hazard³. Illnesses range from mild to life-threatening, and include heat oedema (fluid retention), heat cramps, and heat stroke⁴. In addition, exposure to extreme heat can exacerbate existing chronic illnesses that account for a high proportion of excess deaths during extreme heat events^{5,6}.

Extreme heat also impacts productivity, especially affecting people working outdoors by contributing to lower performance and reduced working hours. It also creates issues for the operation and maintenance of essential services infrastructure such as water, energy, telecommunications and transport infrastructure.

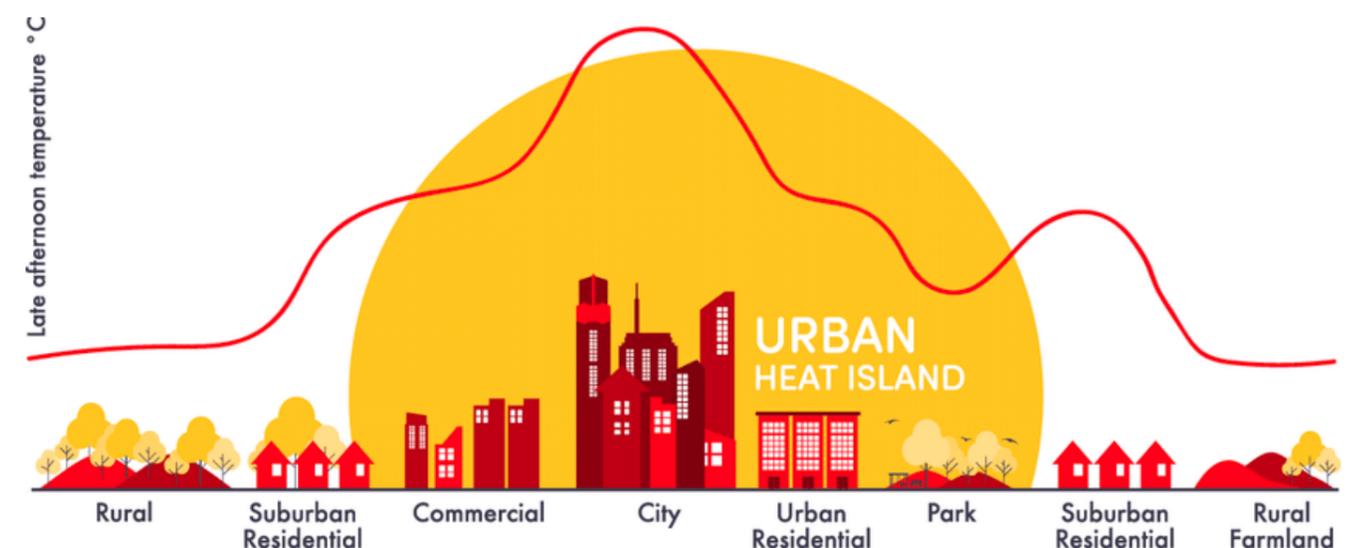
While extreme heat and heat waves relate to trends in temperatures over time, the urban heat island describes trends in average temperatures over space, specifically describing the average higher ambient air temperatures

in urban areas compared to surrounding rural areas⁷. The urban heat island effect is critical for human health and well-being because it exacerbates increases in extreme heat, making urban populations more vulnerable to heat-related impacts.

Reducing the impacts of extreme heat and urban heat island effects requires an understanding of how heat varies across a city so that cooling can be prioritised to local hot spots (measured at the scale of a couple of metres) and/or heat islands (measured at the scale of hundreds of metres). Measuring urban heat is generally done in three ways: (1) land surface temperature; (2) air temperature; and (3) thermal comfort.

While land surface temperature and air temperature are different, cooling high land surface temperatures as a way to mitigate urban heat island effects is considered to be an appropriate strategy⁸. For the analysis that informed the identification of heat islands in Kingston, only land surface temperature, measured through thermal imagery from the Landsat 8 satellite platform was used.

Figure 3.
Urban heat island location in the landscape.



Source: Western Sydney Regional Organisation of Councils⁹.

4. How is urban heat impacting Kingston?

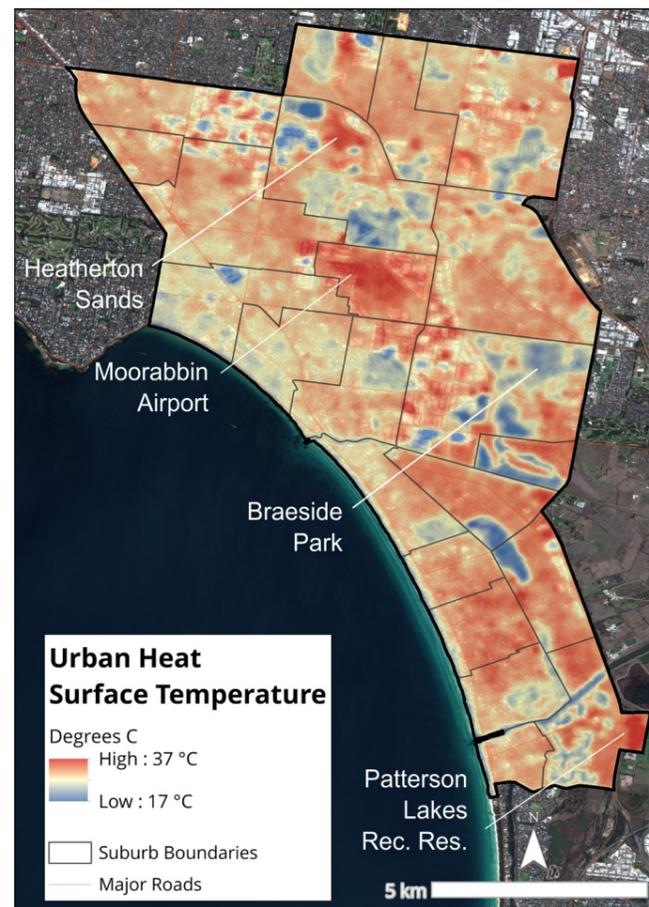
4.1. WHAT OUR COMMUNITY TOLD US

Our community told us that extreme heat and heat waves impact them in numerous ways. It can adversely affect their sleep, as well as their mental and physical wellbeing. Extreme heat and long periods of hot weather can stop community members from exercising and doing many of their normal daily activities like shopping, walking the dog and work. It also impacts how they get around – with many people choosing to drive rather than walk, or to alter their commute to work.

4.2. WHERE ARE THE HEAT ISLANDS?

The location of heat in Kingston was determined by analysing the surface temperature over the landscape during the summer of 2018/19^A. This analysis is represented in Figure 4 and provides a snapshot of where heat builds up in Kingston on a typical warm summer day.

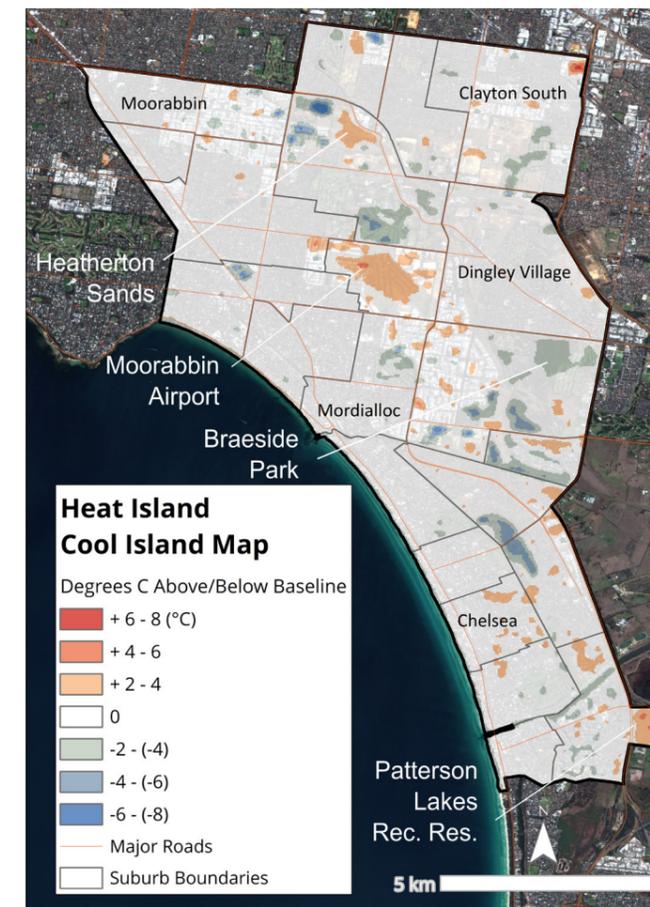
Figure 4. Land surface temperatures averaged from two warm days during the 2018/19 summer season (27/12/2018 – 37.1° and 28/01/2019 – 33.2°). High temperatures are red areas and low temperatures are blue areas, with yellow indicating average temperatures for the entire council area.



A) Landsat 8 images were analysed from 27 December 2018 and 28 January 2019, days during which air temperatures reached 37.1 and 33.2 °C, respectively (BOM Moorabbin Airport).

While small areas of hard surfaces can create localised hot spots at the scale of a few metres, large areas of heat can accumulate in “heat islands” at the block or neighbourhood scale.

Figure 5. Heat and cool island map showing where temperatures are more than 2°C warmer or cooler than the regional average.



To understand where accumulated heat can lead to problems, an urban heat island map was produced by calculating the degrees above or below a reference baseline temperature, calculated as the average land surface temperature of all non-water surfaces in Kingston and the adjacent councils (Figure 5). This results in a relative temperature map showing how many degrees warmer or cooler one area is compared with the baseline temperature. All areas more than 2°C above the baseline are identified as an urban heat island. The heat island area, proportion and relative surface temperature are summarised in the Technical Background Report.

Hot spots and heat islands were found throughout the City of Kingston, including:

- Moorabbin Airport: surface temperatures upwards of 34.5 °C, which is more than 4 °C above the temperature threshold for an extreme heat island;
- Patterson Lakes: heat islands recorded in residential areas to the immediate west of Old Wells Road and in the Patterson Lakes Recreation Reserve;
- Various locations across Chelsea Heights; and
- Heatherton Sands: an old sand mine located in the suburb of Heatherton.

Despite the presence of hot spots and heat islands, cool areas also exist in the City of Kingston.

Examples identified in the analysis include:

- Golf courses such as Capital, Commonwealth, Kingston Heath, Rosedale, Spring Valley and Woodlands;
- Edithvale-Seafood Wetlands and parks and reserves such as Braeside Park, Karkarook Park and Mordialloc Creek; and
- Areas within industrial parks with lighter coloured roofs, such as Braeside and Moorabbin.

4.3. WHO IS AT RISK FROM HEAT ISLANDS?

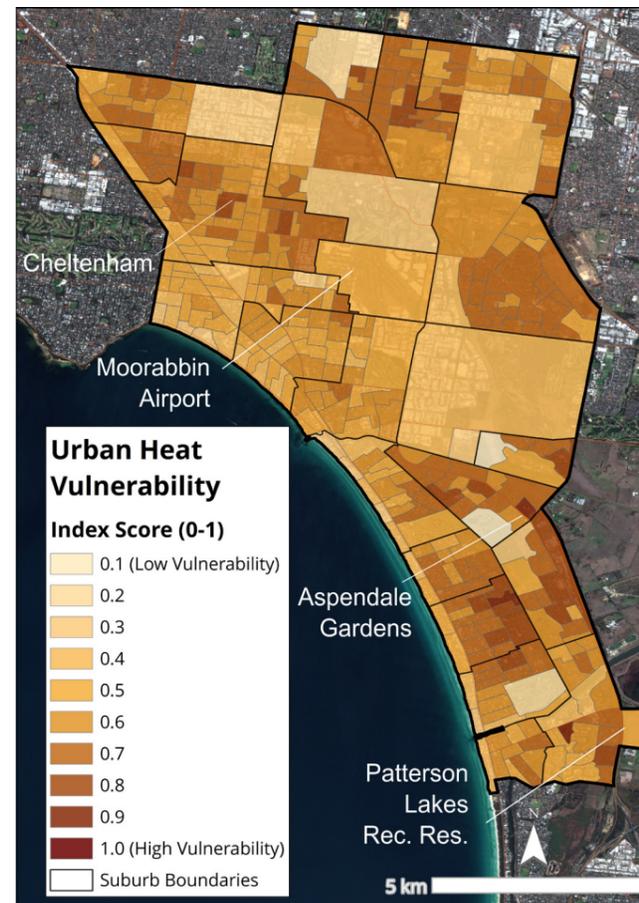
The technical analysis that underpins this Strategy used statistical information about heat vulnerable groups identified as being most relevant for Kingston. These groups were babies and young children under 4 years of age, seniors over 65 years, culturally and linguistically diverse (CALD) households^B, single person households over 65 years, and people living with a disability. This social vulnerability information was combined with the heat exposure data to develop an urban heat island vulnerability map (Figure 6)

The results of the analysis suggest that residential areas such as Aspendale Gardens, Cheltenham, Clayton South and Patterson Lakes have the highest urban heat island vulnerability within the City of Kingston i.e. vulnerable members of the community occurring in areas exposed to urban heat.

Some of the most vulnerable areas in Kingston have large, predominantly senior populations combined with the extreme heat in these locations.

The biggest impact of urban heat islands is when they occur in areas where people vulnerable to heat either live, work or travel through.

Figure 6. Urban heat vulnerability for suburbs (boundaries shown) and SA1^C units (shaded areas) for the City of Kingston.



B) CALD households are where a non-English language is the primary language spoken at home
C) Statistical Area Level 1 - geographical areas built from whole mesh blocks (geographic unit).



4.4. WHAT INFLUENCES HEAT ISLANDS?

4.4.1. Impact of surface materials

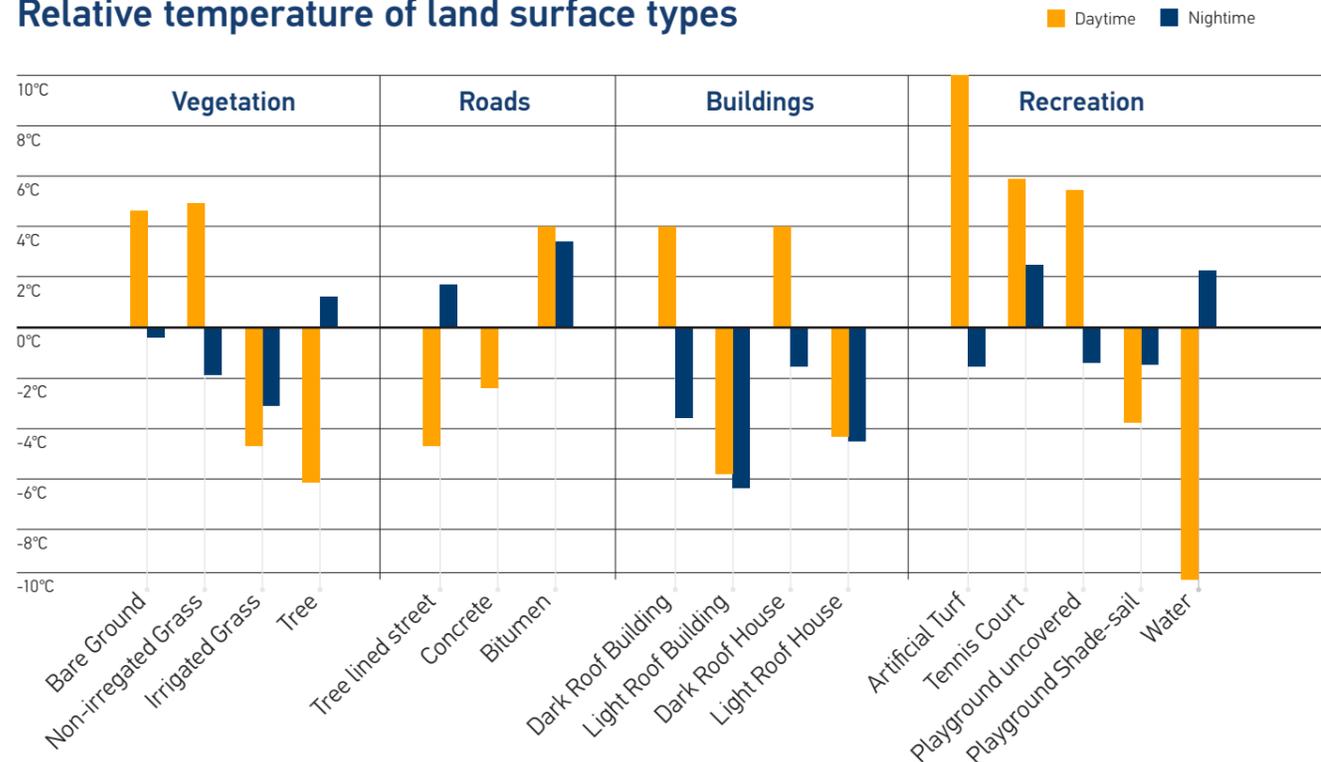
Hot spots and heat islands are driven primarily by the type of materials covering the land surface. The resolution of satellite imagery used for this analysis was too coarse to identify these fine-scale relationships, however, analyses conducted for the Eastern and Northern Adelaide region of Councils (Figure 7) is relevant for Kingston. These analyses show that:

- Surfaces that are cool during both the day and night include:
 - light roofed buildings (commercial and residential);
 - irrigated grass; and
 - shade sails;

- Surfaces that are cool during the day and can retain heat at night include:
 - open water bodies;
 - trees; and
 - tree-shaded streets;
- Surfaces that are warm during the day and cool at night include:
 - artificial turf;
 - uncovered playgrounds;
 - non-irrigated grass;
 - bare ground; and
 - dark roofed buildings (commercial and residential);
- Bitumen is warm during the day and night.

Figure 7. Relationship between surface temperature and land surface type based on thermal data collected during the day and night in Eastern and Northern Adelaide during the summer of 2017/18¹⁰.

Relative temperature of land surface types

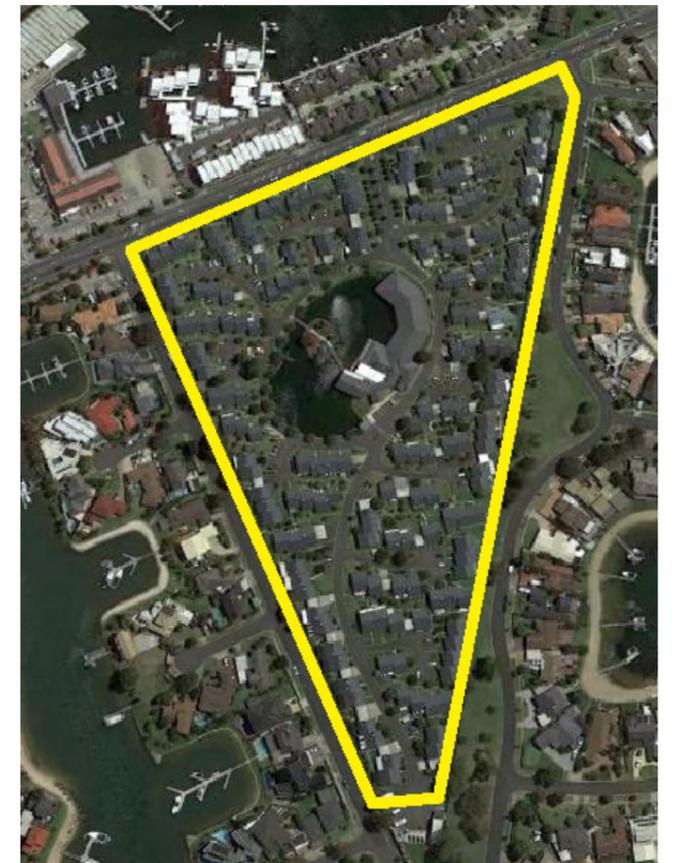


Using these land surface relationships, the patterns of urban heating and cooling in the City of Kingston can be explained, such as:

- Moorabbin Airport is a strong heat island because of the combination of hard surfaces like bitumen and concrete combined with large open areas of bare ground or grass that dries off during summer;
- Patterson Lakes Recreation Reserve is a heat island due to the large areas of non-irrigated grass;
- The impact of dark roofs and small blocks is illustrated in Patterson Village (Figure 8), which at an SA1¹⁰ level has very high heat exposure;
- Golf courses and recreational parks are cooler than the regional average temperature because turf is regularly irrigated; and
- Suburbs such as Braeside, Waterways, and Aspendale Gardens have more varied thermal landscapes with small heat islands (driven by dense residential areas with dark roofed buildings) intermixed with cool islands (created by large expanses of green areas, water, and light-coloured roofs).

Warming in a suburb can be moderated by large areas of green space, or proximity to the coast and the cooling effect of onshore winds, such as in Mentone and Parkdale.

Figure 8. This image presents a notable hot area in the landscape, showing dark roofed buildings and small-medium sized blocks with the total impervious area taking up a large proportion of the block.



D) Statistical Area Level 1 - geographical areas built from whole mesh blocks (geographic unit).

4.4. WHAT INFLUENCES HEAT ISLANDS?

4.4.2. Trees and green spaces

Management of trees, vegetation and water throughout the City can help to offset the most negative impacts of urban heat by breaking up large expanses of drivers of heat and by providing localised cool spots that residents can visit for relief.

Trees are known to have significant cooling effects, as well as providing a range of additional benefits to people and the environment.

Resilient Melbourne and The Nature Conservancy's Living Melbourne Strategy provides a snapshot of the metropolitan tree cover for 2016-2017¹¹. This is complemented by 2018 vegetation analysis undertaken by the Department of Environment, Land, Water and Planning¹². Together these analyses suggest that the tree canopy cover in Kingston greater than 3 m in height is 9.7 and 8.9 % respectively, which is below the average for Metropolitan Melbourne of 15.4% (Figure 9).

Within the municipality, leafier suburbs tend to be cooler than suburbs with a lower proportion of canopy cover (Figure 10). While the amount of canopy and green spaces within a City are important, so too is the placement of these spaces, if urban heat is to be adequately mitigated across the City as a whole.

City of Kingston has numerous golf courses across the municipality that contribute to both the urban forest and retaining water in the landscape. They deliver valuable ecological services for the municipality and provide an important role in localised cooling in the municipality, as shown in Figure 5.

Figure 9.
Combined tree cover and urban heat map.
Tree cover represents trees >3m.

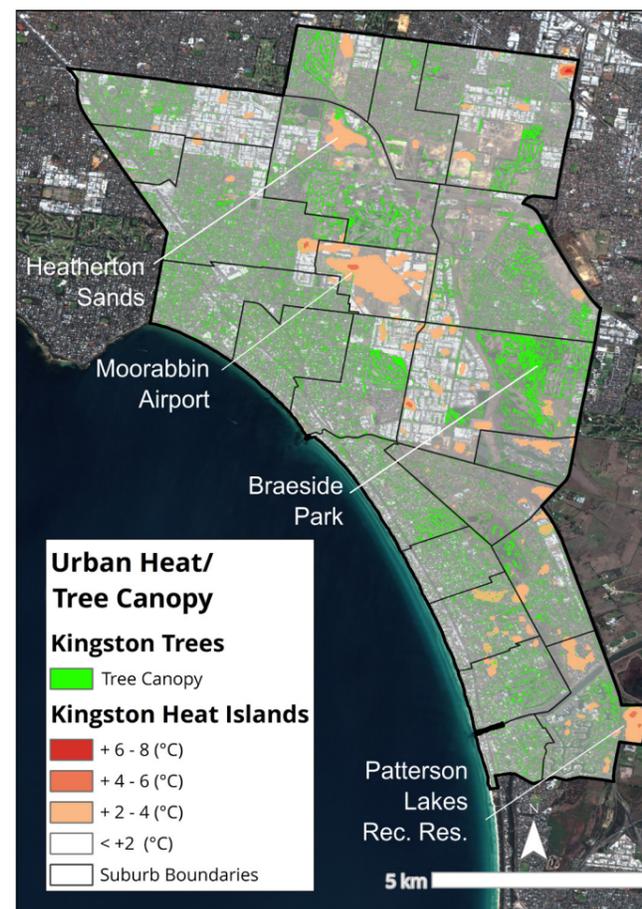
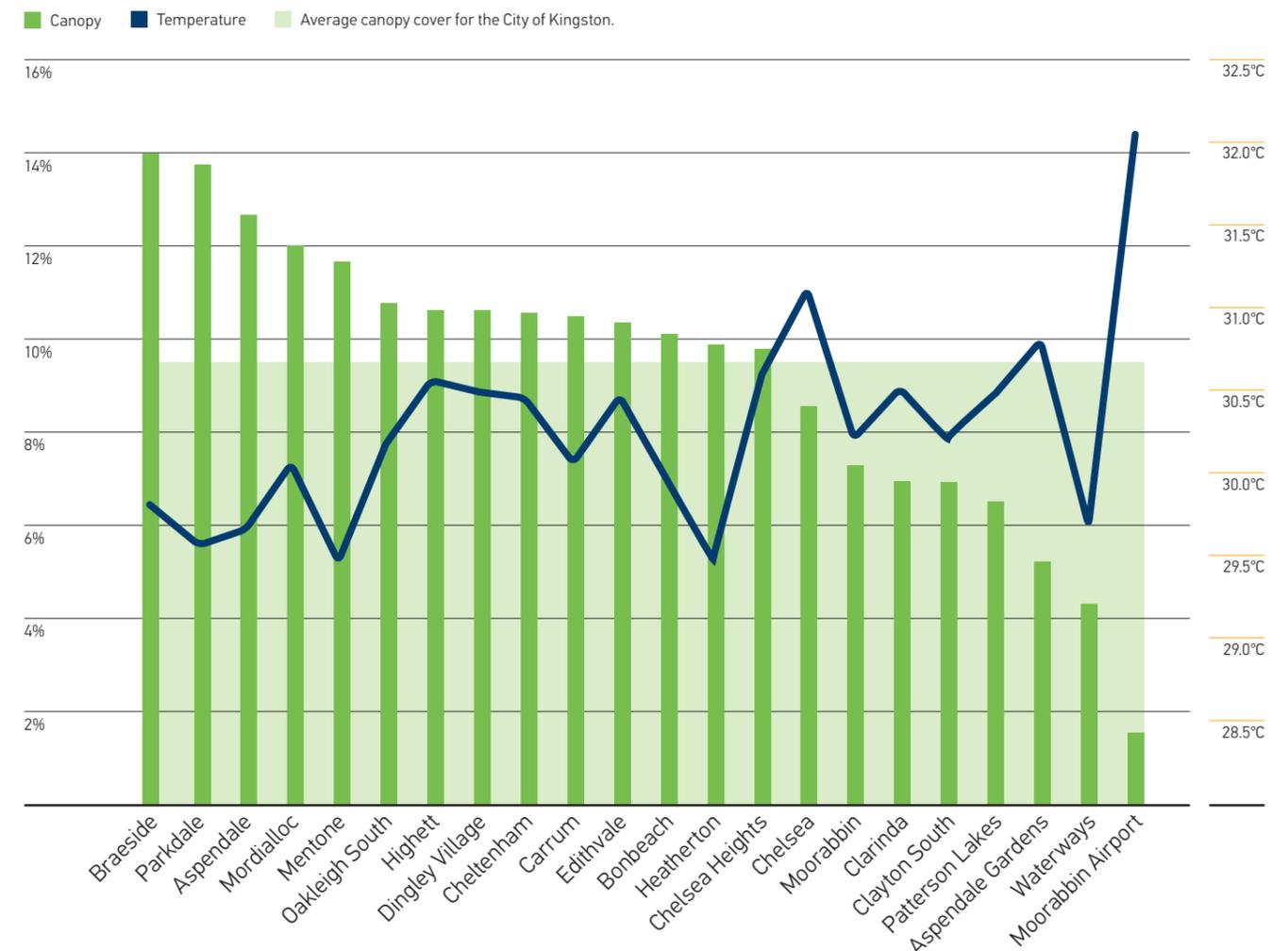


Figure 10.
Percentage canopy cover for different suburbs versus average surface temperature for each suburb.

Suburb canopy cover vs temperature



4.4. WHAT INFLUENCES HEAT ISLANDS?

4.4.3. Water and the landscape

Water is vital to cooling the municipality, particularly through irrigation of green spaces. Areas that remain green and irrigated during warmer months over late spring, summer and early autumn, will contribute to cool spots. However, if such areas become dry either as dry grass or bare ground, they could become heat islands, further exacerbating the effects of extreme heat. This reinforces the need to consider ways to actively maintain green open spaces and consider alternate water sources across the municipality. Council's Integrated Water Cycle Strategy outlines how Kingston will improve water efficiency, and increase the use of alternate water sources (such as recycled water and stormwater) for irrigation and other appropriate purposes.

4.4.4. Heat production by people's activities

Heat produced by activities such as driving combustion engine cars and using split system air conditioners can contribute to warming the air temperature where these activities are concentrated. Air pollution from emissions of particulates from engines and industrial processes further contributes to trapping heat in the urban environment. Council's Climate Change Strategy commits to support our community to reduce emissions by 20% by 2025, which helps to address heat from human activities.

Water is vital to cooling the municipality, particularly through irrigation of green spaces.



5. How might hotspots change in the future?

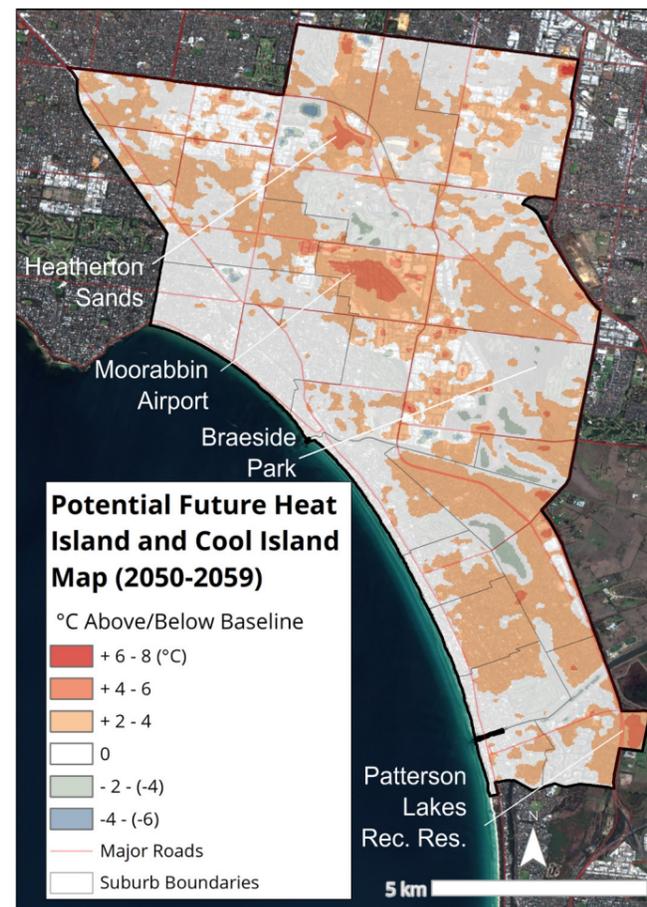
5.1. IMPACT OF CLIMATE CHANGE

Climate change has already impacted Australia, with average temperatures having increased in Melbourne by 1.2 to 1.4°C since 1950. Future climate change will result in hotter and drier conditions in Melbourne and more extreme heat days and heat waves¹³.

To understand future urban heat, climate data prepared for Victoria by the CSIRO¹⁴ was applied to Kingston^E. By mid-century the data suggests land surface temperatures are likely to increase by a further 1.3 – 1.65°C with the stronger warming occurring in the north-eastern suburbs. Using this data, potential future climate heat islands were calculated against current baseline temperatures (Figure 11).

Using this approach for Kingston, the severe heat islands become larger and more intense in the future, and most suburbs see a large expansion of heat islands. In this future, all cool islands are constrained to water bodies, and areas with concentrated trees and light-coloured roofs. Further information about potential heat island distribution in the future is provided in the Technical Background report.

Figure 11. Possible future heat islands showing how increased surface temperatures will create expanded heat islands compared to current baseline temperatures.



5.2. IMPACT OF DEVELOPMENT

Development-driven changes in Kingston’s land cover have the potential to both increase and decrease the amount of heat retained in the urban landscape. Expansion of cooling surfaces such as trees, irrigated grass, and light surfaces will reduce the heat island effect while expansion of warming surfaces such as bitumen, bare ground, and dark surfaces will exacerbate the effect.

The CRC for Water Sensitive Cities Scenario Tool can be used to model the impact of future land surface types and development approaches on land surface temperature. The Scenario Tool was used to assess whether development that incorporates urban cooling principles has the potential to cool current day hotspots. This showed that for a current industrial site in Kingston which has high surface temperatures, future development with medium density dwellings could result in a cooling benefit, due in part to the increase in green cover. Further analysis showed that increasing the number of trees, irrigating grass and using cool road surface treatments could all contribute to cooling the landscape.

The Scenario Tool was also used to better understand the impact of subdividing existing larger house blocks into two dwellings, with hard surfaces covering the majority of the block. This shows that infill of this type could increase warming and the development of heat islands, however, this could also be offset by incorporating trees on each land parcel, irrigated grass and using cool road surface treatments.

5.3. FUTURE AREAS OF HEAT VULNERABILITY

As climate change occurs over the next 30 years heat exposure will continue to cause greater impacts for individual and community wellbeing, causing additional heat-related illness and death, especially for the most vulnerable people in the community such as older people, babies and young children, people living with disabilities and chronic disease. To understand where growth in vulnerable members of the community is likely to occur, and what types of heat environments future residents are likely to encounter, ABS census data was combined with temperature projections to identify future urban heat island vulnerability. A detailed description of this approach is provided in the Technical Background Report.

Warming is expected to be more pronounced in Kingston’s northern suburbs.

Within these warming suburbs, areas with the highest population and higher social vulnerability are the areas that have the highest urban heat island vulnerability by mid-century.

E) The Australian Community Climate and Earth-System Simulator (ACCESS) model was used which is a reference model in the Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report (AR5).



Bonbeach Reserve playground

6. Creating a Cool Kingston

6.1. VISION AND PRINCIPLES

Kingston City Council is committed to creating a Cool Kingston. This will require direct action delivered by Council, as well as action by our community and stakeholders, where Council can provide guidance and perhaps influence.

The Kingston community do many things to cool their environment including planting canopy trees and maintaining gardens watered with rainwater tanks, building verandahs on the west side of homes if applicable, or even just closing external shades and internal blinds and curtains on very hot days. On a more personal level, community members are aware they need to keep hydrated in hot weather, to wear clothes that protect them from the heat, and to reschedule outdoor activities so they don't occur in the hottest time of the day.

The following sections set out the vision for a Cool Kingston, the principles that will guide our cooling work, and the Strategic Directions for our actions.

The vision for the City of Kingston is: **A municipality with no urban heat islands. It is a community that actively manages the impacts of urban heat on people and the environment through decisions that encourage urban cooling.**

To achieve this vision, Council will develop strategies and actions based on the following principles:

- Target hotspots first – On-ground actions will prioritise known hotspots, especially where they occur in close proximity to where vulnerable members of the community live, work or recreate;
- Lead and innovate in the adoption of evidence-based, new practices – By working with universities, R&D organisations and product developers;
- Work collaboratively – Work with the community, business sector and other areas of government to raise awareness about the impacts of urban heat and improve knowledge and skills for how this can be managed;
- Integrate 'cooling' into decisions – Ensure that urban cooling is considered in decision making across Council, noting its relevance to a broad range of functional areas;
- Advocate for policy change – Where required action is beyond the control of Council, advocate for change by working with State and Federal Government;
- Monitor and evaluate – Conduct ongoing monitoring and periodic reviews to reassess changes over time, and the effectiveness of our actions;
- Maximise the social, environmental and economic benefits of actions, now and into the future.

6.2. STRATEGIC DIRECTIONS

Kingston has identified five strategic directions to guide our work to actively manage urban heat and create a Cool Kingston. They cross multiple functions within Council, and also require working with the Kingston community, local businesses and government agencies.

The strategic directions articulate actions to be delivered in the short term (1-3 years) and the outcomes we wish to achieve in the medium term (4-9 years), which will ultimately contribute to goals that will be achieved during a timeframe of greater than 10 years.

Not all outcomes can be directly delivered by Council. As such, outcomes are noted with “(C)” where the outcomes are under the direct control of Council, and “(I)” where Council can influence but does not directly control the outcome.

6.2.1.

Strategic direction 1: Urban greening

Urban greening, or what is also referred to as green infrastructure, describes ways that plants can be incorporated into the urban landscape, such as trees, shrubs, irrigated turf, green walls and green roofs.

Collectively, these greening elements help to cool the landscape. To ensure the greatest cooling benefit from green cover, an ongoing, consistent source of water is important, especially for grass in passive recreation reserves and parks.

The City of Kingston has a variety of green cover, such as parks and sporting grounds on public land, large areas of irrigated grass on golf courses, street verges vegetated with trees, shrubs and grass, and private backyards with the full range of green cover. Recent mapping undertaken by the Department of Environment, Land, Water and Planning as part of the Cooling and Greening Melbourne project indicates that Kingston currently has 8.9% of its land area covered by tree canopy and 29.3% covered by all types of vegetation combined¹⁵.

Aside from cooling benefits, plants can also deliver a broad range of other benefits such as:

- Improving air quality through trees absorbing pollutants;
- Providing wildlife habitat and resources such as flowers, fruit, and insects for a range of native wildlife species;
- Reducing and improving stormwater runoff by intercepting rainfall;
- Improving mental health and wellbeing;
- Creating a sense of place;
- Improving youth development and health;
- Increasing property values; and
- Improving commercial activity such as in treed shopping precincts.

Existing Council actions

Urban greening aligns with a range of other Council strategies, including the Biodiversity Strategy, Climate Change Strategy, Integrated Water Cycle Strategy, Kingston Green Wedge Plan, Open Space Strategy and the Street & Park Tree Management Strategy. Council is also working collaboratively to deliver actions in Living Melbourne: Our Metropolitan Urban Forest.

Key actions already being delivered:

- A comprehensive street tree planting plan is being developed, incorporating additional tree planting in line with the Street & Park Tree Management Strategy;
- Distribution of two free plants to residents to encourage private planting;
- Site inspections of private developments are being undertaken to ensure compliance with endorsed landscape plans, focusing on retention and planting of canopy trees.

Urban Greening goal and outcomes

Our goal 1:

Increase vegetation cover across Kingston, including tree canopy.

Increasing green cover and tree canopy aligns with the objectives of the Living Melbourne Strategy, which proposes ambitious regional tree canopy cover targets of between 20 and 30 per cent and with Council's Street and Park Tree Management Strategy which proposes to increase canopy cover in the municipality to 30%.

Key actions in the short term

(delivered over the next 1-3 years), Council will:

- Trial green infrastructure on at least one Council building (C);
- Identify where green infrastructure has changed over time and research the drivers of change (C);
- Develop Kingston preferred species list and planting guidelines for a hotter, drier climate to cool the municipality and enhance biodiversity, ideally using indigenous or native species (C);
- Identify public areas (in addition to streets) for shading priority (C, I).

Medium-term outcomes

(to be achieved in 4-9 years)

- Kingston's urban forest and green infrastructure will be managed in an integrated way across both public and private land (C);
- Green infrastructure will feature along major road corridors through working with VicRoads (C, I);
- Kingston will have increased access to alternative water supplies to support greening, such as recycled water distribution pipeline networks and stormwater capture and reuse (C, I);
- Increased rates of adoption of innovative greening solutions on private land such as rooftop gardens and green walls in apartments and commercial buildings (I); and
- Plants used for urban greening on public and private land are selected for greater suitability to a warmer and drier climate, ideally indigenous or native plants (C, I).
- All new developments will be compliant with endorsed landscape plans (I, C).

Did you know?

Building rooftops cover almost 20% of the urban surfaces in Australian cities, and nearly 50% in medium-density residential areas. Conventional roof surfaces can reach a surface temperature of 50-90°C on a typical hot summer day¹⁶



6.2. STRATEGIC DIRECTIONS

6.2.2.

Strategic direction 2: Planning and building

Planning and building decisions drive the structure and function of cities. As cities grow, they are shaped by the way in which suburbs are planned, and commercial, residential and industrial buildings are designed and constructed.

Planning and building decisions influence urban cooling in a range of ways. For example, infill developments can promote maintenance of green space and tree cover and use materials that absorb less heat, which combined contribute to cooling. Also, decisions about the size of blocks in new developments and the width of road verges can have a significant impact on maintaining a cool city by ensuring that backyards are sufficient to support green cover and streets have the ability to plant medium to large sized street trees.

Existing Council actions

Planning and building aligns with a range of Council strategies, including the draft Housing Strategy & Neighbourhood Character Study, Kingston Green Wedge Plan, the Open Space Strategy and the Kingston Planning Scheme.

Key actions already being delivered:

- Economic analysis of the cost implications of integrating 'cooling' elements into planning and building decisions.

Planning and building goal and outcomes

Our goal 2:
Incorporate urban heat mitigation principles and elements in planning and building decisions.

Key actions in the short term

(delivered over the next 1 – 3 years), Council will:

- Research drivers for materials' choice in residential, commercial & industrial sectors (C);
- Engage with the development industry on cooling issues and opportunities (C);
- Develop resources and processes to guide cooling inclusions in planning (C);
- Investigate development of an industrial area planning policy that incorporates cooling elements (C);
- Identify opportunities to integrate cooling in large-scale development projects (C, I).
- Incorporate urban heat considerations into the Planning Scheme (C).

Medium-term outcomes

(to be achieved in 4 – 9 years)

- Increased community adoption of roof colour and materials that support urban cooling (C, I);
- Structure plans for activity centres will embed details for water sensitive urban design, urban greening and cooling (C).

6.2. STRATEGIC DIRECTIONS

6.2.3.

Strategic direction 3: Cool Council buildings and assets

Building and construction materials absorb and retain heat in different ways. Their temperature is influenced by their reflectivity (albedo), conductivity (heat moving into the surface), and capacity (storing heat). A cool surface material will typically have a combination of one or more of high reflectivity, low conductivity and low heat capacity.

Material selection is a key driver of heat islands and therefore an important consideration for Council's own buildings and assets. For example, asphalt roads and play courts absorb heat during the day and then retain it during the night, contributing to heat islands under both day and night conditions. Dark coloured roofs can also significantly increase the amount of heat retained in the landscape, especially during the day.

Existing Council actions

Using cool materials is relevant to Council's Community Buildings policies, Asset Management Plans and Open Space Strategy.

Cool Council buildings and assets goal and outcomes

Our goal 3:
Adopt the use of cool materials in Council buildings and assets.

Key actions in the short term

(delivered over the next 1 – 3 years), Council will:

- Trial cool materials (such as light roof colour, lighter coloured road treatments and permeable paving) in Council buildings, roads and pavements (C);
- Advocate for peak agencies to embrace cooler temperature playing surface technologies (C);
- Include cool material specifications in Council Buildings ESD policy; and
- Embed cool material specifications in procurement processes (C).

Medium-term outcomes

(to be achieved in 4 – 9 years)

- Increased incorporation of design elements and materials into Council buildings to mitigate urban heat (C);
- Increased shade provided close to Council facilities and service providers (C).

The use of cool building materials can be especially important where the type of development means that green cover is not an easy option.

Examples of cool materials include

- Lighter coloured road treatments
- Low temperature (high emissivity) paving
- Permeable paving
- More reflective roof surfaces.

6.2.4.

Strategic direction 4: Emergency and health response

Planning, preparing for, responding to and recovering from periods of extreme heat are essential aspects of emergency response.

Additionally, Council plays a significant role in working with the community to maintain overall health and well-being by providing a range of facilities and services, especially to people recognised as being vulnerable to heat, such as the very young (< 4 years of age) and seniors (> 65 years).

Existing Council actions

Emergency and health response aligns with a range of Council strategies and plans, including the Community Health and Wellbeing Strategy, Climate Change Strategy, and the Municipal Emergency Management Plan.

Key actions already being delivered:

- Extreme weather planning is implemented for Access Care clients, including heat planning.

Emergency and health response goal and outcomes

Our goal 4:

Support community members who are vulnerable to heat to develop the skills, knowledge and support networks to reduce the impacts of extreme heat.

Key actions in the short term

(delivered over the next 1 – 3 years), Council will:

- Revise Council's Heatwave Strategy (C);
- Incorporate heat health and wellbeing impacts into the next Kingston Health and Wellbeing Plan (C);
- Incorporate capacity building for heat resilience into existing Council health response programs (C);
- Research real time changes in heat across the municipality, and its impact on service provision (C).

Medium-term outcomes

(to be achieved in 4 – 9 years)

- Community members vulnerable to heat will have increased social networks to help build resilience (C, I); and
- Staff working with vulnerable members of the community will have increased knowledge and skills to reduce the impact of extreme heat on the health of community members vulnerable to heat (C, I).

Council can contribute to urban cooling by raising community awareness about the drivers and impacts of urban heat...

6.2. STRATEGIC DIRECTIONS

6.2.5.

Strategic direction 5: Education, engagement and partnerships

Our community and the business sector have experience with living through hot summers, but the drivers of urban heat and strategies for cooling at a street through to city scale are not equally well known. Furthermore, essential services and transport infrastructure can be designed and constructed by utilities or state government agencies without sufficient consideration of local scale cooling objectives.

Council can contribute to urban cooling by raising community awareness about the drivers and impacts of urban heat, engaging with developers and businesses, and building partnerships with different levels of government.

Education, engagement and developing partnerships underpins the actions undertaken in all the Strategic Directions.

Existing Council actions

Council actively engages with infrastructure developers and stakeholders in the municipality to improve liveability outcomes for our Community.

Key actions already being delivered:

- Engagement with the Level Crossing Removal Project (LXRP) around cooling and shading outcomes for the projects delivered in Kingston
- Engagement with precinct developers to consider cooling outcomes (through vegetation, water, materials use and siting of buildings).

Education, engagement and partnerships goal and outcomes

Our goal 5:
Improve staff, community and stakeholders' understanding of the impact of extreme heat and how they can make decisions that mitigate the impacts of heat through greening, cool materials and behaviours.

Key actions in the short term

(delivered over the next 1 – 3 years), Council will:

- Develop and deliver staff education that is relevant to different functional areas (C);
- Develop & deliver community education to improve understanding of the value of trees (C,I);
- Develop & deliver community education to improve understanding of drivers of urban heat, and ways to reduce risk (targeted to different demographics) (C, I);
- Continue to engage with major infrastructure projects to ensure mitigation of urban heat (C, I); and
- Explore cool material research partnership opportunities.

Medium-term outcomes

(to be achieved in 4 – 9 years)

- Greater understanding and promotion of the benefits of cool materials (C, I);
- Local communities value street, park and private trees more highly (C, I);
- Better understanding of the drivers of urban heat and ways to reduce their heat risk by the Kingston community (C, I); and
- Greater engagement with the private sector to support cooling of large industrial sites (C, I).



7. Implementation program

7.1. PRIORITY ACTIONS AND PRINCIPLES

The five strategic directions provide focus for implementing actions to deliver the medium-term outcomes that ultimately contribute to meeting the goals and broader vision for this Strategy.

Council will develop an Implementation Program that will be reviewed annually, informed by the principles identified in Section 6, building on the previous year's activities. This will identify actions, timelines and responsibilities for different actions.

For successful implementation of this Strategy, internal governance arrangements will address resourcing and resolve shared and contested responsibilities.

7.2. GOVERNANCE

For successful implementation of this Strategy, internal governance arrangements will address resourcing and resolve shared and contested responsibilities. An internal staff Urban Cooling Working Group with representatives from key functional areas will oversee implementation of the Strategy, which will identify priority actions on a year to year basis, agree to responsibilities and ensure coordination of activities across teams. The Urban Cooling Working Group will be guided by the Principles identified in this Strategy.

The functional areas represented on the staff Working Group include:

- Environmental Planning
- City Development
- Compliance and Amenity
- Community Buildings
- Parks and Recreation
- City Strategy
- Social Development

7.3. MONITORING, EVALUATION AND LEARNING

Monitoring and evaluation are critical for adaptively managing project implementation and for determining the success of the strategies and actions. A Monitoring, Evaluation and Learning (MEL) plan will be developed which will outline the review framework for this strategy. The MEL plan will specify:

- Key evaluation questions to guide the assessment of the Strategy;
- Indicators, source of data and frequency of measurement;
- Responsibility for measuring and reporting against the Urban Cooling Strategy; and
- Review timeline for the Strategy.

8. Glossary

Extreme heat

An average temperature equal to or exceeding defined heat-health thresholds, which for the City of Kingston is 30°C. The average is calculated from the maximum daytime temperature and the minimum night time temperature².

Green roof

A roof of a building covered or partially covered with vegetation, planted in specially designed growing medium laid over a waterproofing membrane.

Green wall

A vertical wall intentionally covered with vegetation.

Heat waves

Periods of extreme heat lasting for several days.

Impervious surfaces

Surfaces covered by water-resistant materials, such as asphalt, concrete, roofs.

Urban forest

Trees and other vegetation - and the soil and water that support them.

Urban greening

Trees, shrubs, irrigated turf, green walls and green roofs. Sometimes called green infrastructure.

Urban heat island

A part of a city or town where heat has accumulated, causing temperatures to rise above a regional average.

9. References

1. Currie & Brown 2018, draft Kingston Housing Strategy and Neighbourhood Character Study. Prepared for the City of Kingston.
2. Victorian Government Department of Health 2011, Heatwave Plan for Victoria.
3. Coates, L. 1996, NDR96 Conference of Natural Disaster Reduction. Gold Coast, Australia
4. Coris, E.E., Ramirez, A.M. and Van Durme, D.J. 34, 2004, Heat illness in athletes. Sports Medicine, pp. 9-16.
5. Michelozzi, P. 2005, The impact of the summer 2003 heat waves on mortality in four Italian cities. Eurosurveillance, Vol. 10, pp. 161-165.
6. Rooney, C, et al. 1998, Excess mortality in England and Wales, and in Greater London, during the 1995 heatwave. Journal of Epidemiology and Community Health, Vol. 52, pp. 482-486.
7. United States Environmental Protection Agency 2012, Heat island effect.
8. Norton, B A, et al. 2015, Planning for cooler cities: A framework to prioritise green infrastructure to mitigate high temperatures in urban landscapes. Landscape and Urban Planning, Vol. 134, pp. 127-138.
9. Western Sydney Regional Organisation of Councils 2018, Turn Down the Heat Strategy and Action Plan.
10. Seed Consulting Services, EnDev Geographic and Monash University 2018, Collaborative Heat Mapping for Eastern and Northern Adelaide Report. Prepared for the City of Unley on behalf of the Eastern Region Alliance of Councils and the City of Salisbury.
11. The Nature Conservancy and Resilient Melbourne 2019, Living Melbourne: Our Metropolitan Urban Forest. Melbourne : The Nature Conservancy and Resilient Melbourne.
12. Victorian Government Department of Environment, Land, Water and Planning. Cooling and Greening Melbourne Interactive Map. [Online] <http://mapshare.maps.vic.gov.au/coolinggreening>
13. Department of Environment, Land, Water & Planning 2019, How climate change will affect the Greater Melbourne region and how you can be climate-ready. 19 July 2019.
14. CSIRO 2019, CCAM Climate Downscaling Data for Victoria 2019. 1 May 2019.
15. Victorian Government Department of Environment, Land, Water and Planning. Cooling and Greening Melbourne Interactive Map. [Online] <http://mapshare.maps.vic.gov.au/coolinggreening>.
16. Osmond, P and Sharifi, E. 2017, Guide to Urban Cooling Strategies. Low Carbon Living CRC.

