

Melbourne heatwave 2009



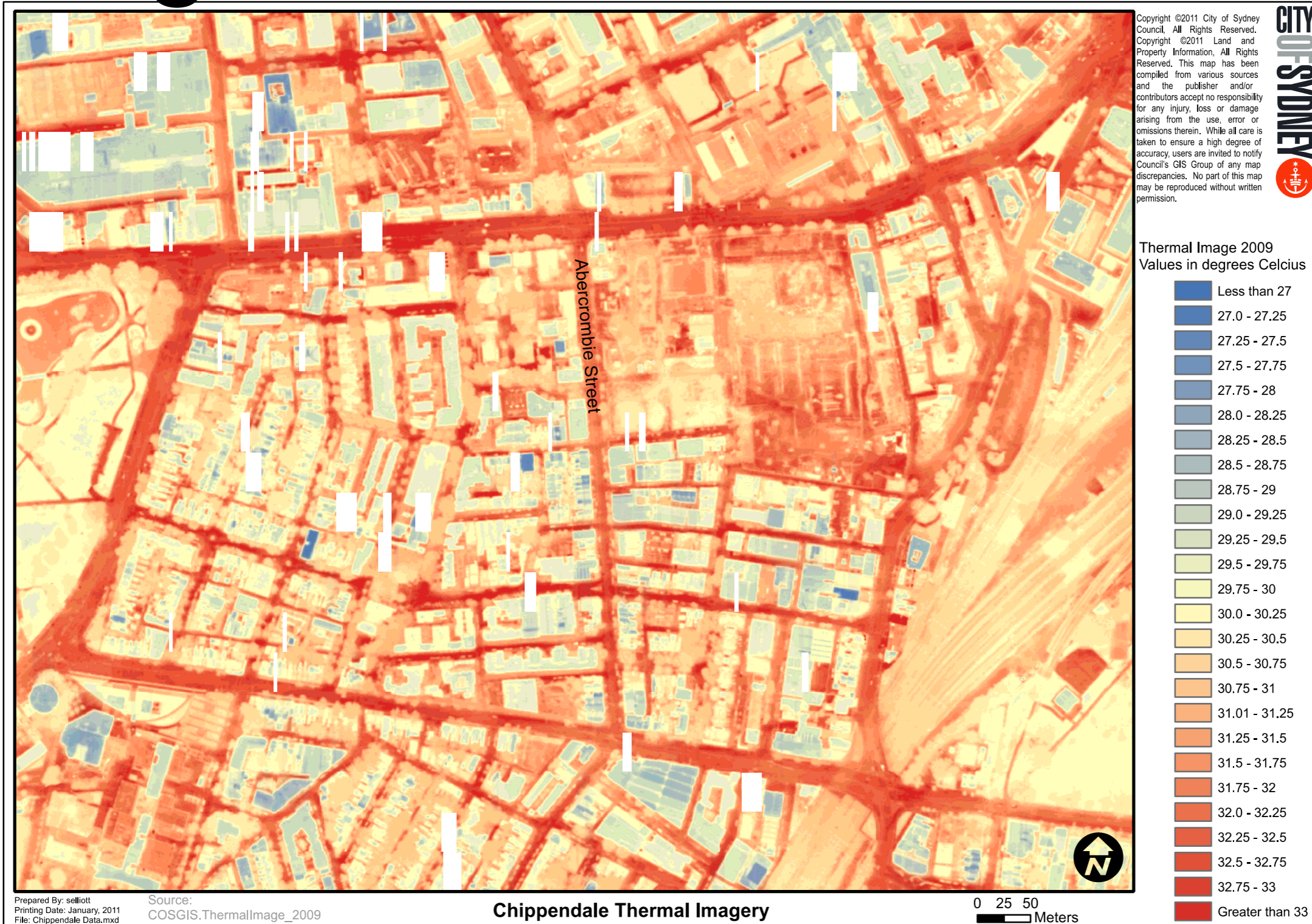
Bicycle tyres and wheels melted by Melbourne heatwave

How to cool cities by 2 degrees by 2020

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Or, cities stay hotter by 4 – 8 degrees . . . Get hotter . . .



**From forest to farm to black road, black roofs,
little or no trees. City plans, road design,
sustainability checklists and red tape ignore
city heat, and make cities hotter.**

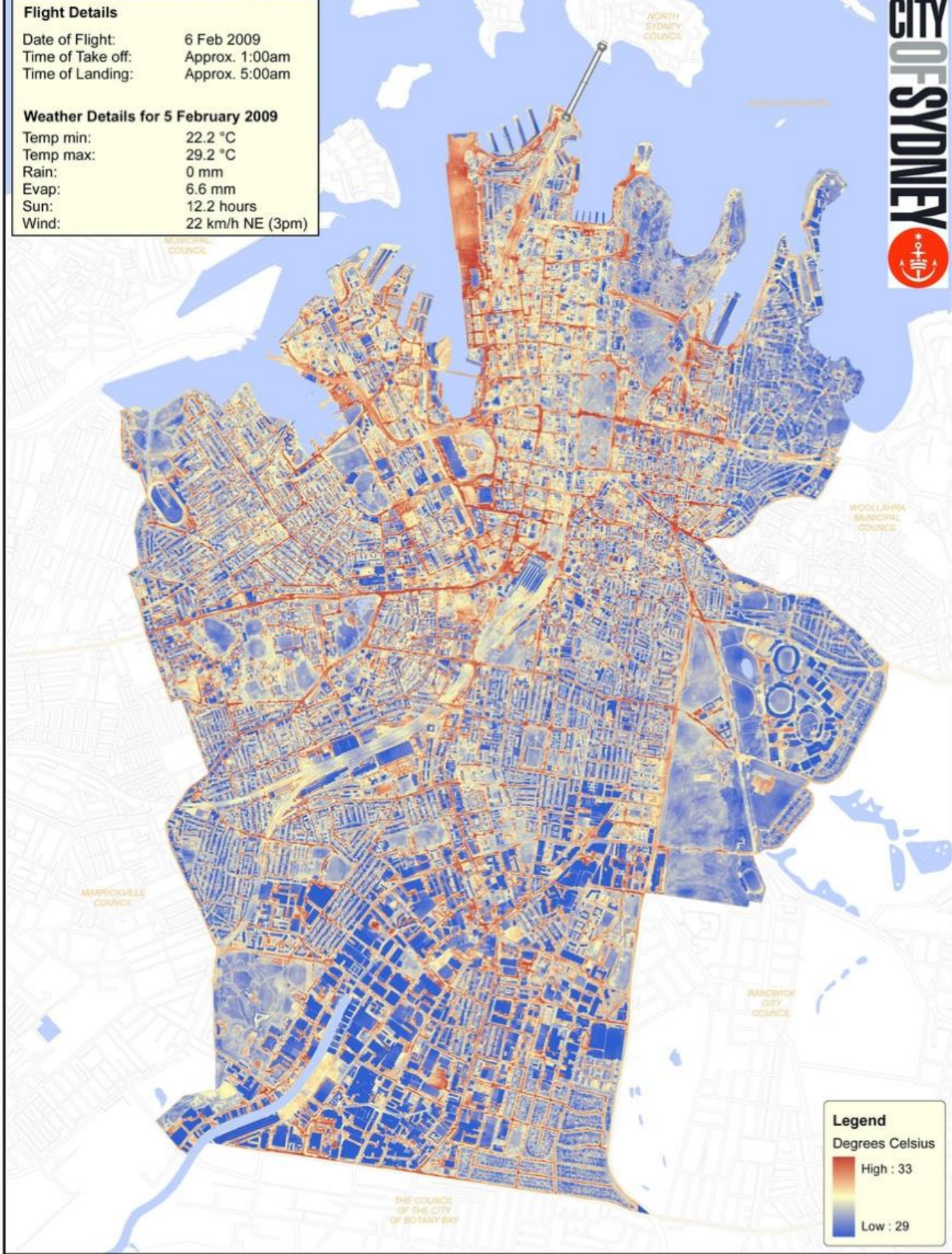
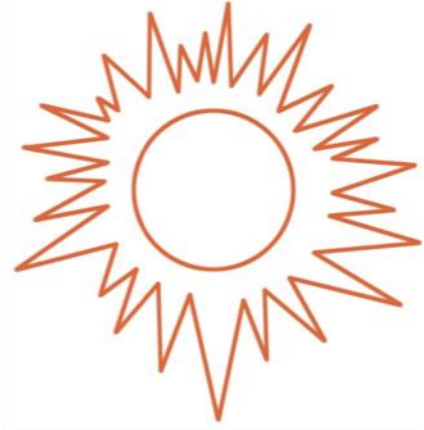


**In the 2002 European heat wave when
34,000 people died in four months
London was 9 degrees hotter than the
surrounding countryside**

23/06/2006

Flight Details
 Date of Flight: 6 Feb 2009
 Time of Take off: Approx. 1:00am
 Time of Landing: Approx. 5:00am

Weather Details for 5 February 2009
 Temp min: 22.2 °C
 Temp max: 29.2 °C
 Rain: 0 mm
 Evap: 6.6 mm
 Sun: 12.2 hours
 Wind: 22 km/h NE (3pm)



13 Governments have created red hot radiator roads heating our cities:

Road-makers, utilities in the streets, councils

What the sun sees & does to cities:

- Black roads > 33 degrees
- Private land < 29

Thermal Imagery



Prepared By: sozdemir
 Printing Date: November 13, 2009
 File: Thermalimagery.mxd

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- Rain
- Residence
- Phone
- Gas
- Plants

- 6 - Road
- 7 - Water
- 8 - Sewer
- 9 - Storm

- 10 - Streetlight
- 11 - Electricity
- 12 - Sun
- 13 - Business

Problems

No heat goals in city plans, road design guidelines, codes, green checklists

+

No responsibility, no incentives = hot cities.

Going up:

- city temperatures
- air con and energy use
- premature human deaths
- energy, food and water bills
- air and water pollution
- business operating costs
- travel times and costs

Solutions

How? Plans, codes, checklists, road designs, employment performance contracts have common goal to cut city summer temperatures by 2 degrees by 2020

How? Cool materials, colours for roads, roofs, walls

How? Grow trees, plants, pop up median strips, urban farms on roads, walls and roofs. Turn food waste into compost to grow trees, plants to cool our cities; no food waste to landfill.

How? Financial, and red tape incentives.

Benefits: Cool cities, lower energy, water and food bills; healthier humans and enriching, biodiverse cities.



**What's a cool road look like?
Productive trees and pale roads cool cit**

FRESH ASPHALT

Reflectivity: 5%

Temperature: 123°F

AGED ASPHALT

Reflectivity: 10%

Temperature: 115°F

PROTOTYPE

ASHPHALT COATING

Reflectivity: 50%

Temperature: 90°F



Case Study: Myrtle St, Chippendale



Cost to Council of trial
\$75k; less with volume

Cooling Effect:

Temp (°C)	Ave Temp in Sun	Ave Temp in Shade	Ave Difference Shade and Ambient
DARK	46.4	25.0	-5.4
LIGHT	45.7	22.8	-6.3
DIFFERENC E	-0.7	-2.3	0.9

Access to data [here](#), or
as [CSV](#)

Sydney Ccl road engineers, staff supportive; have initiated other pale pavements



STREET COOLERS



www.streetcoolers.com.au
streetcoolers@gmail.com

Shading and Vegetation



Buckland St,
Chippendale
in Oct 2016

Shading and vegetation cools our streets more than pale roads

We found that surface level temperatures in the shade were on average **9°C cooler** than those in the sun.

Buckland St has the darkest pavement, but the coolest ambient summer temperatures while Myrtle St had the highest.

Why?

Shading! Buckland had 64% tree cover compared with Myrtle St at just 6%.



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Effect of Shade

Video taken in November 2016, on Albermarle St, Newtown. Ambient Temperature was only 22 degrees.

The difference?

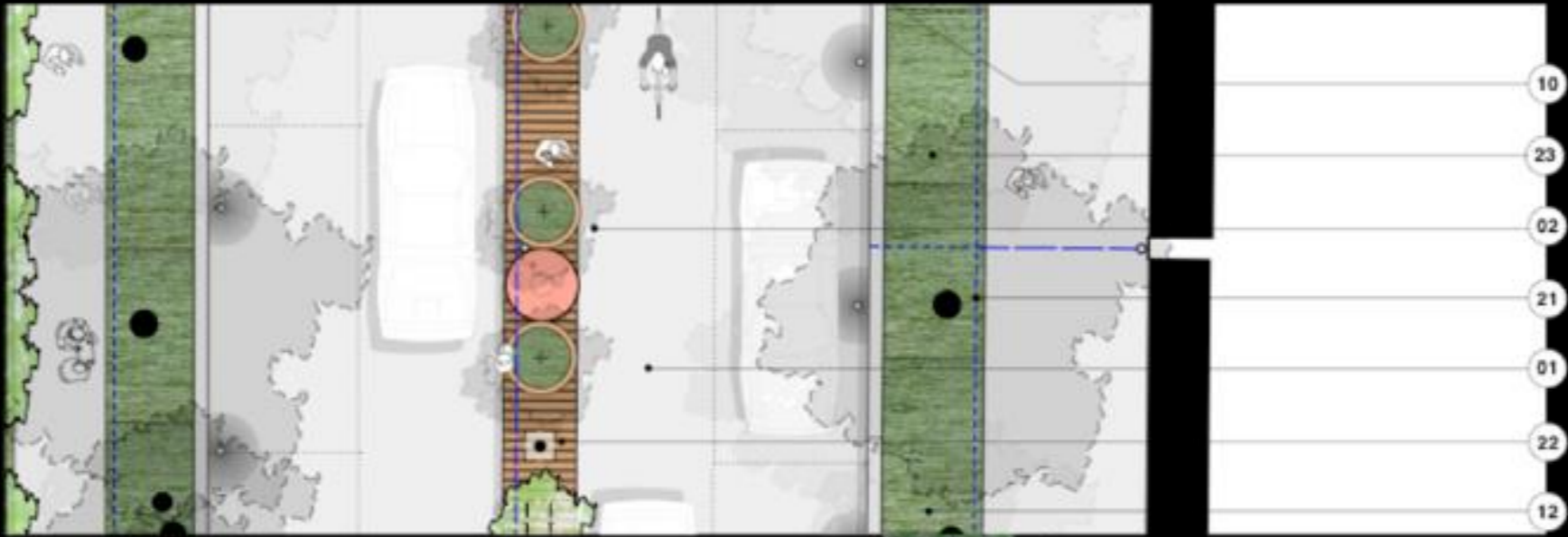
Over **18 degrees cooler** in the shade of a street tree, when compared to direct sun on the road



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SE SE SE SE SE SE SE



**500 billion litres of rain from Sydney's roofs, roads and parks to the ocean, harbour each year
+ over 2 billion litres of sewage a day.**

Whales, fish, humans swim & breath through it.

Rate rebates, stormwater fee exemptions can stop the pollution, use the water to grow trees, plants.



**Sydney Council dredging sludge
from Lake Northam 21 Feb 2017
due to failing water, park design**



**Plastic, rubbish, low tide,
Canada Bay 21 Feb 17**

**Simple, low cost
solutions for
householders to cool
their houses and
streets**



Pick a rosemary stem; use the leaves in cooking; keep the stem to dry then use the stem as Shish kabob skewers to add flavour



Come gardening with us

Sustainable Chippendale

A Sustainable Suburb In the Making
CHIPPENDALE, SYDNEY, NSW AUSTRALIA



Chippendale residents and Sustainable Chippendale chose and planted these plants provided by Sydney City Council. All the plants are edible.

A six year old laying a leaky drainage pipe, Shepherd st, Chippendale, Dec 16.

Not one consultant around.



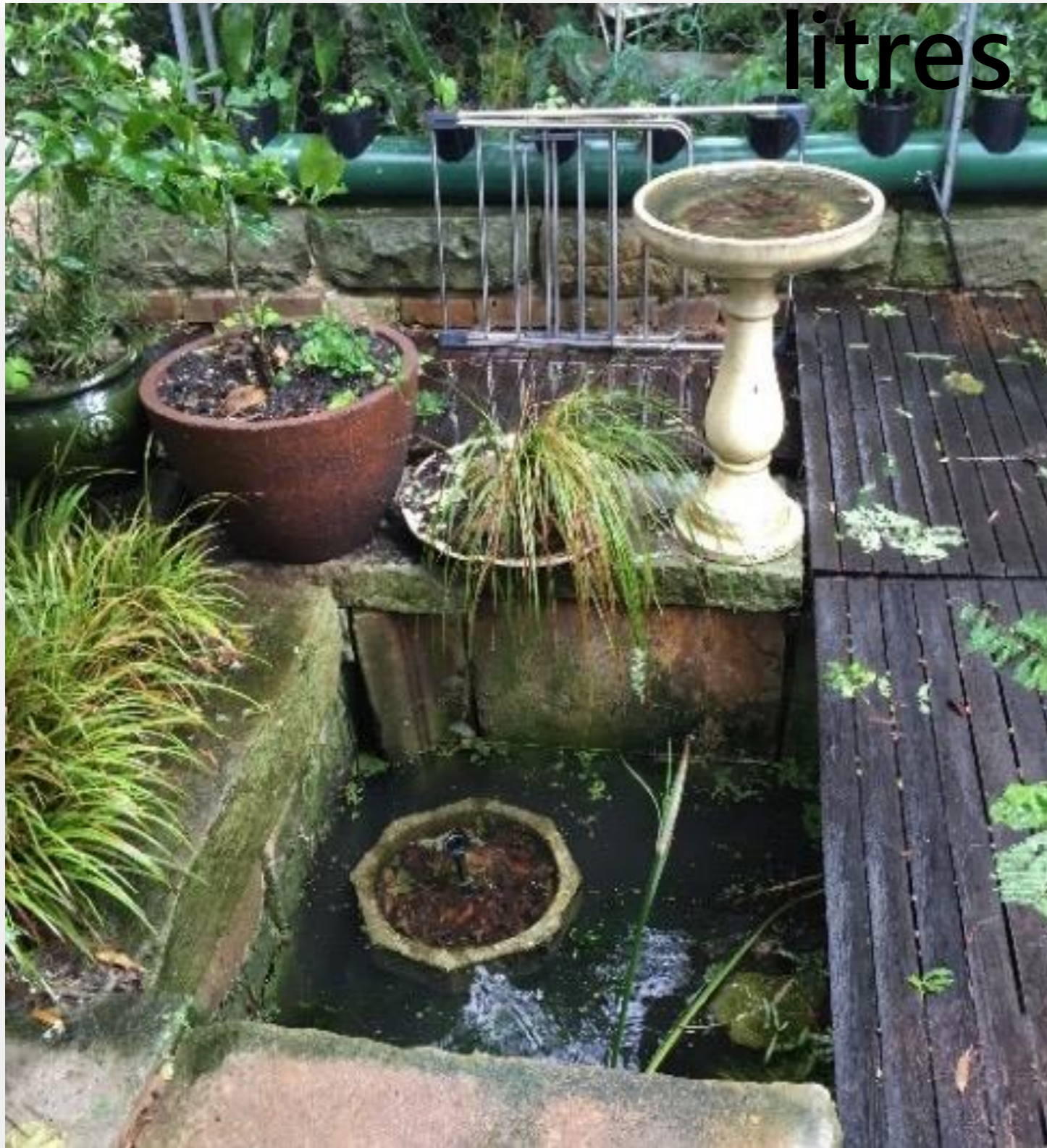


**A chilli plant
there, March,
2017**

**Sustainable
Chippendale is
discussing
incentives with
Council,
Sydney Water**

No stormwater, sewage left Sydney's Sustainable House in 20 years = 2 m

litres



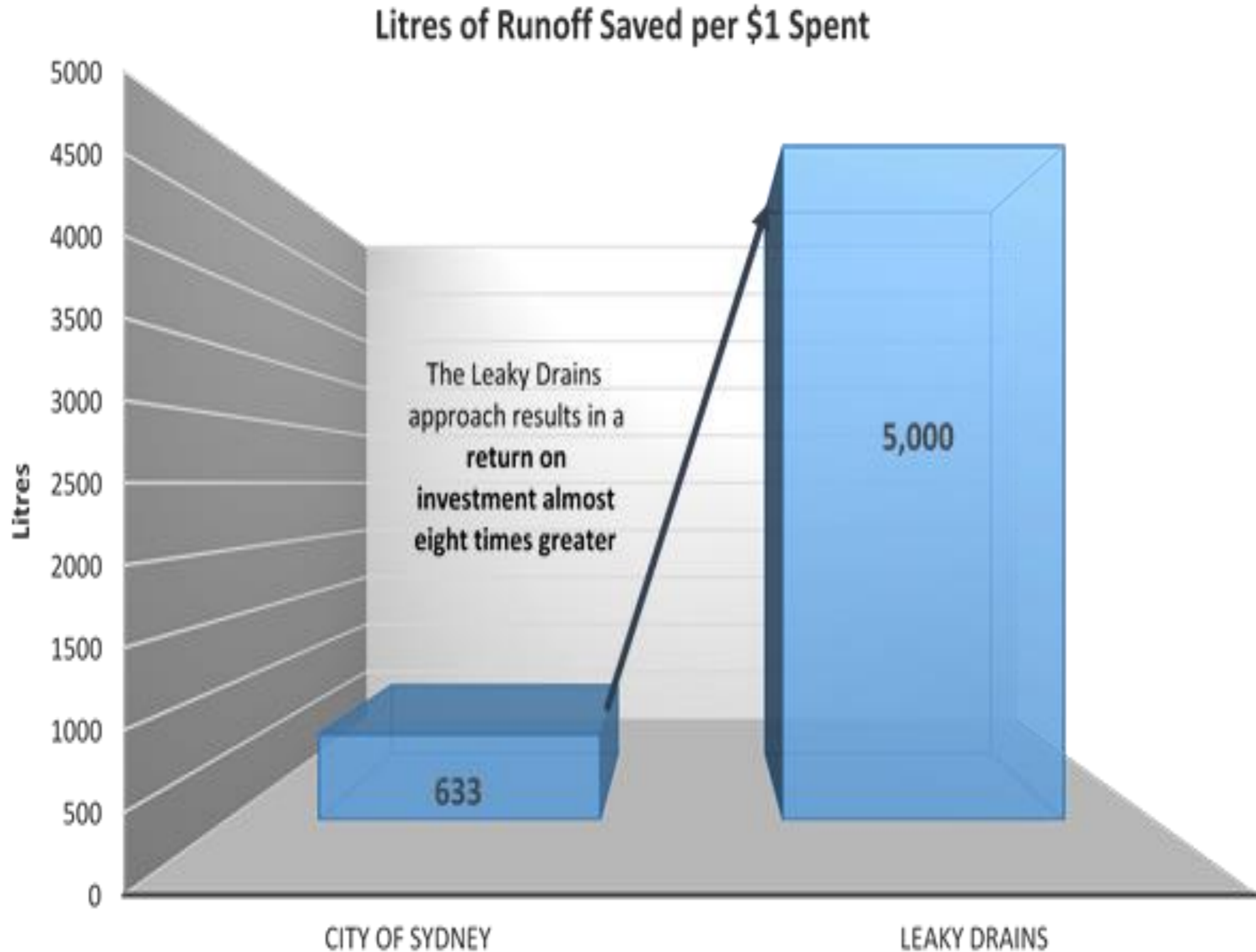
But:

- Sydney Water charges me a stormwater fee; I refuse to pay it
- Sydney Council charges me a stormwater levy; I refuse to pay it.



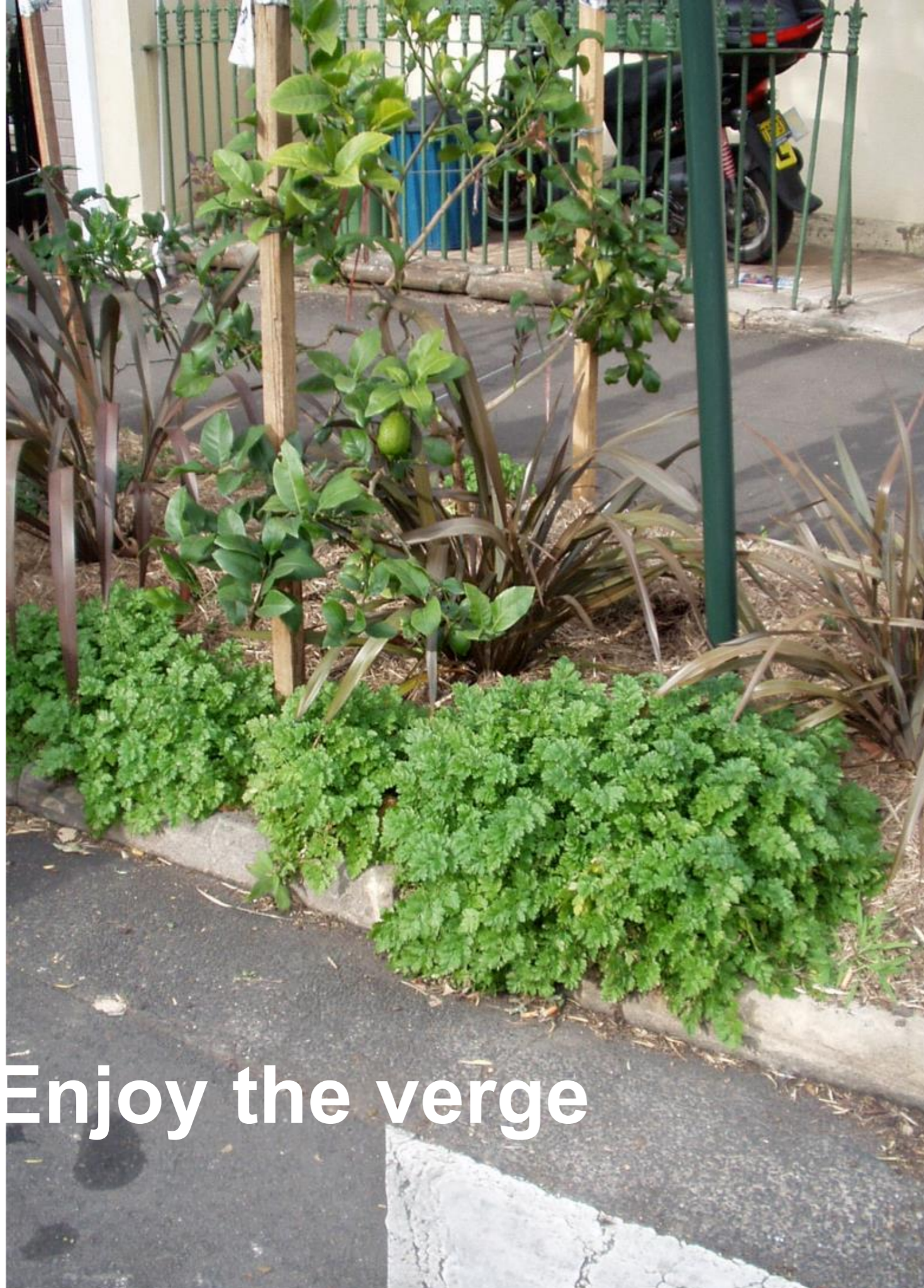
Watering street trees with rainwater using a [leaky drain](#)

COST SAVINGS WITH LEAKY DRAINS





Plant the verge



Enjoy the verge

Drainage trial





PETER NICOL RUSSELL BUILDING

ecoPOPs

Mini ecoPOPs at Sydney Uni



**A productive,
cool fence**



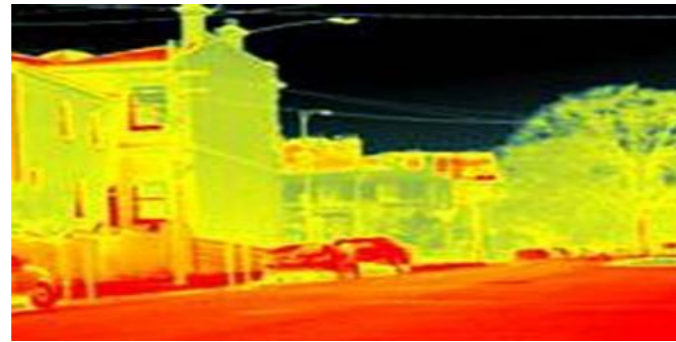
**Coffee grounds at
café quilia**



**Coffee grounds going
on orange trees**

Two ways to cool your street

Streetgardens and ecoPOPs



Business as usual



Streetgardens

ecoPOPs

<p>How it works</p>	<p>Cities replace vegetation with dark, built surfaces which get very hot and do not absorb rainfall. This is the main cause of Urban Heat Islands.</p>	<p>Grow trees, plant gardens and harvest rainwater on your street. Streetgardens and ecoPOPs bring vegetation, increased tree canopies and rainwater collection to an otherwise unshaded, hot, and wasteful street.</p>
<p>Cooling streets</p>	<p>Average air temperatures of a city with 1 million people or more can be 1 to 3°C warmer than its rural surroundings. In the evening, the difference can be as high as 12°C.</p>	<p>Research shows that a 10% increase in urban green space can cool surface temperatures by up to 4°C. Shade trees can reduce surface temperatures by up to 19°C. Streetgardens and ecoPOPs cool streets by increasing shade.</p>
<p>Cutting energy use</p>	<p>Urban Heat Islands increase electricity demand, especially on summer afternoons when offices and homes are running cooling systems, lights, and appliances.</p>	<p>Studies show that every 1°C temperature reduction means around 5% energy savings through reduced cooling load. This amounts to significant savings in your fridge and aircon bills.</p>
<p>Managing stormwater</p>	<p>21.6 BILLION LITRES of stormwater pollute Sydney's harbours every year because city roads and verges are impermeable.</p>	<p>Streetgardens divert street runoff into a patch of soil on the curb to irrigate trees and plants. ecoPOPs can collect up to 2,000L of rainfall and use it to water the built-in gardens and trees.</p>

Two incentives

- Rate rebates for farmers, city folk who go off-grid
- Fast track, deemed to comply approvals for low heat, low bills projects

Bathurst Burr: Mobbs' magnum opus on sustainable councils and development

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Kylie Ahern installed a "drain garden" (designed by Michael Mobbs) into the front verge of her house at her own expense but received no rebates on storm water or rates charges

Why incentives?

- Low bills: Energy and water bills - less than \$300 a year for a four person household
- Cooler streets cool cities, cut energy use, increase electricity grid efficiency, cut human and biodiversity mortality rates; [data](#), [examples](#)
- Quickest way to cut climate pollution is to cool cities via incentives for building owners who invest on their land and adjacent street.

Facts for change

- **A 10% increase in urban green space can cool surface temperatures by up to 4 degrees C**
- **Shade trees can reduce surface temperatures by up to 19 degrees C.**
- **For every 1 degree C temperature reduction there is around 5% energy savings through reduced cooling loads. Fridge and aircon use and bills drop significantly.**

Rate rebates, stormwater exemption

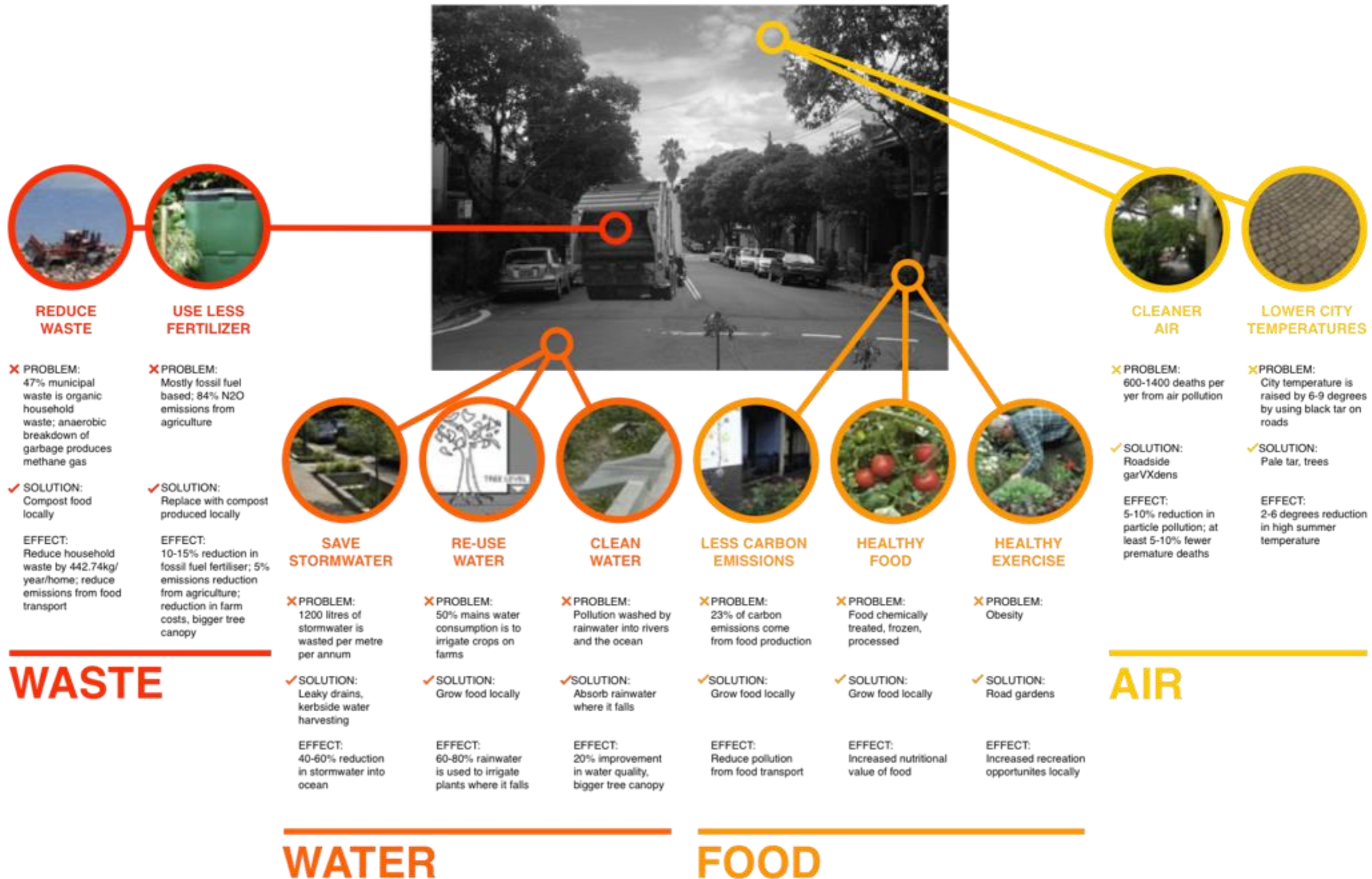
A rate rebate to participating households of ~ \$120 a year for so long as they maintain the trees, irrigation and put compost from food waste on them can be revenue neutral for councils, water and road agencies.

Cost estimates

Drain gardens and pop up gardens can catch, store and absorb from 2,000 to 29,000 litres of water a year to grow trees, plants and canopy.

Adding five to 20 trees + 5 to 20 leaky drains & stormwater bypasses to a treeless city block of about 40 houses at a one-off cost to property owners between a total of \$500 to \$15,000 will cut energy bills for air con and refrigeration at each house from between \$150 to \$2000 a year.

Opportunities for a Sustainable Street



What “NO’ does by 2050?

Experts:



The average amplitude of UHIE in Australia will be **5 degrees**, with a high penalty of **23%** increase in energy user per degree (Santamouris, 2016)



Additional **2.7 Billion people** worldwide that require many additional resources (UN, 2015)



800% Increase in energy use worldwide, leaving many people in energy poverty (Santamouris, 2016)



Statistically significant increase in number and duration of heat waves, resulting in an exponential increase in **mortality** rate above 37.7°C, especially children and elderly (Loughnan, 2010)

Me: . . . This by 2025

Data is essential for solutions



Button Temperature Loggers



*Sap Flow Meter Tool and
Dendrometer*



Soil Moisture Meter



Automatic Weather Station



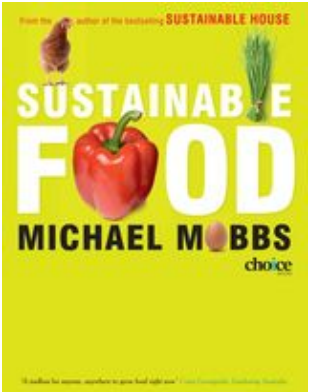
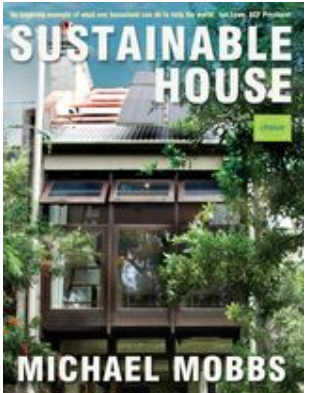
Aeroqual for Air Quality



Net Radiometer

Monitoring of street temperatures, house energy use Eg www.solaranalytics.com, tree canopy and height

Tour Fact Sheet – Sydney’s Sustainable House and Chippendale Road Gardens

Sydney’s Sustainable House	Chippendale Road Gardens	Your project	Books
<p>If four people live there, each year it saves:</p> <ul style="list-style-type: none"> • over \$3,000 a year – only \$300 a year for energy and water bills • 4 tonnes of coal from being burnt • 8 tonnes of greenhouse gases from polluting Earth • 100,000 litres sewage polluting the ocean • 100,000 litres stormwater polluting Sydney Harbour • Leaves 100,000 litres water in dam 	<p>Over 1,000 fruit trees, herbs and plants both native and introduced are in Chippendale road gardens:</p> <ul style="list-style-type: none"> • Midgenberry • Lemon grass • Lilli pilli • Bush lemon • Lemon Myrtle Tea Tree • Paw paw • Fejoia • Native raspberry • Rosemary • Tahitian lime • Caffre lime • Macadamia • Comfrey, parsley, nasturtiums 	<p>What will you choose for your project?</p>	<p>Facts, examples, how to go green, drawings, photos:</p>  <ul style="list-style-type: none"> • Sustainable Food by Michael Mobbs
<p>Same as any other house to live in because:</p> <ul style="list-style-type: none"> • Use same electrical appliances as any house • The water and energy appliances use less energy and water because they are efficient • No special training or qualifications required • Can buy and use same plumbing, electrical equipment at any hardware shop in Australia • No batteries – electricity is mains quality as back up is from the mains power lines 	<ul style="list-style-type: none"> • For less than \$300 using leaky drains which we built ourselves we residents and businesses keep over 4 million litres of stormwater from roofs to irrigate road verge gardens. • Cool roads here cool cities anywhere. • Residents, businesses and Sydney City Council are working together to make Chippendale Sustainable – see: www.sustainablechippendale.com 		 <ul style="list-style-type: none"> • Sustainable House by Michael Mobbs <p>Books may be purchased on the tour</p>