



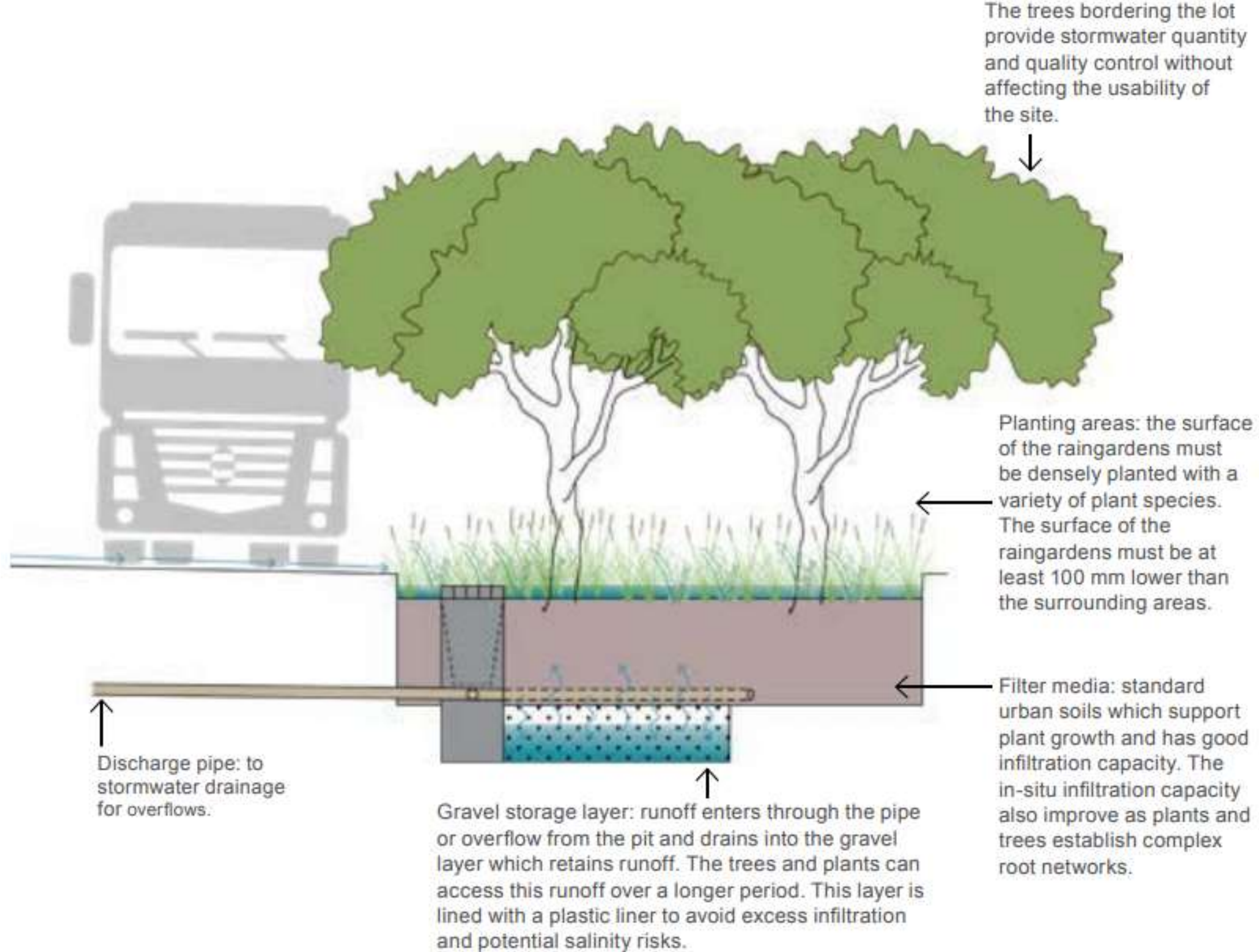
Sydney
WATER

Turning Runoff into Resilience

Integrating Passively Irrigated Street Trees (PIST) in Urban Planning

Shreyaa Sundararaghavan | Graduate Environmental Scientist

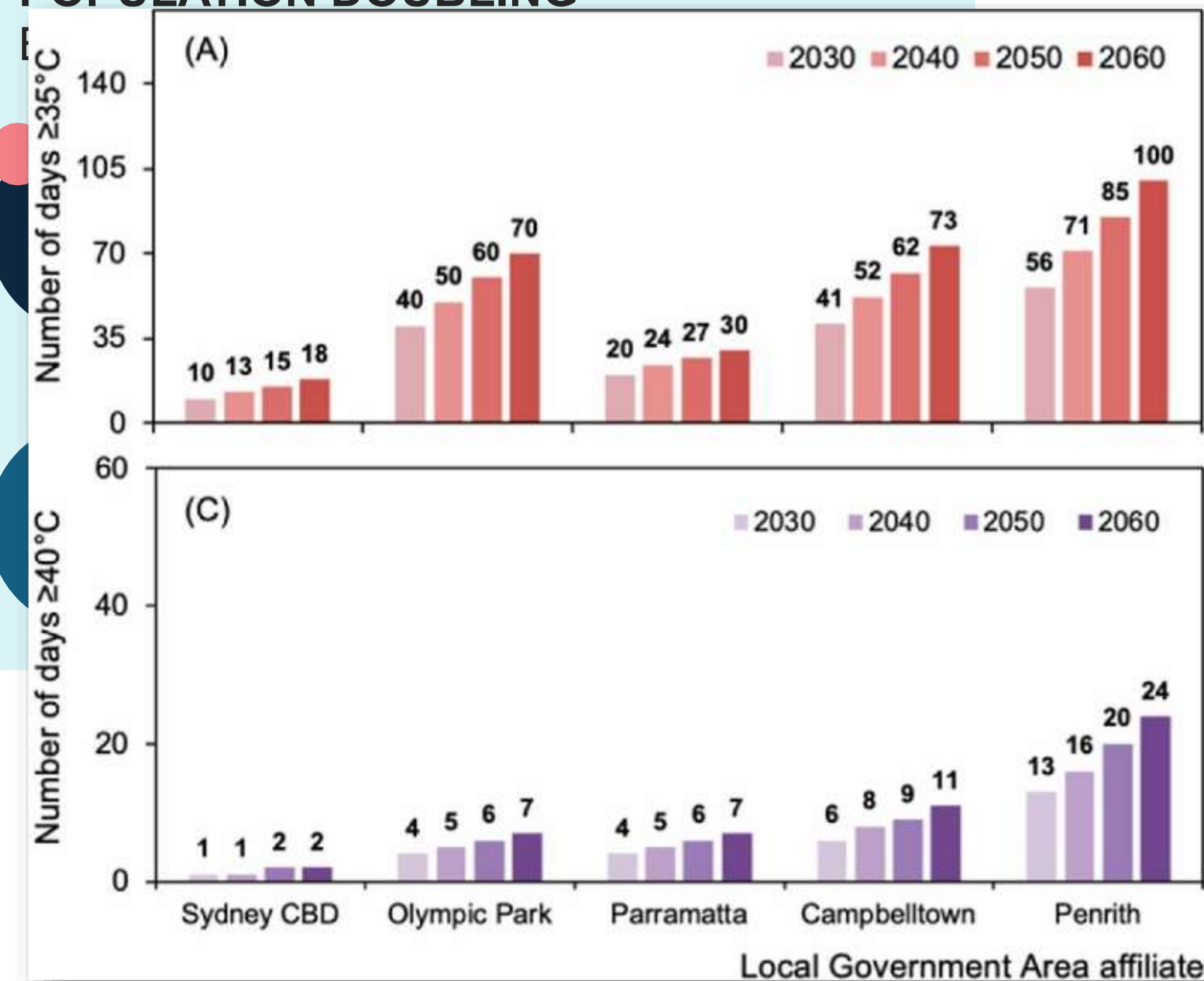




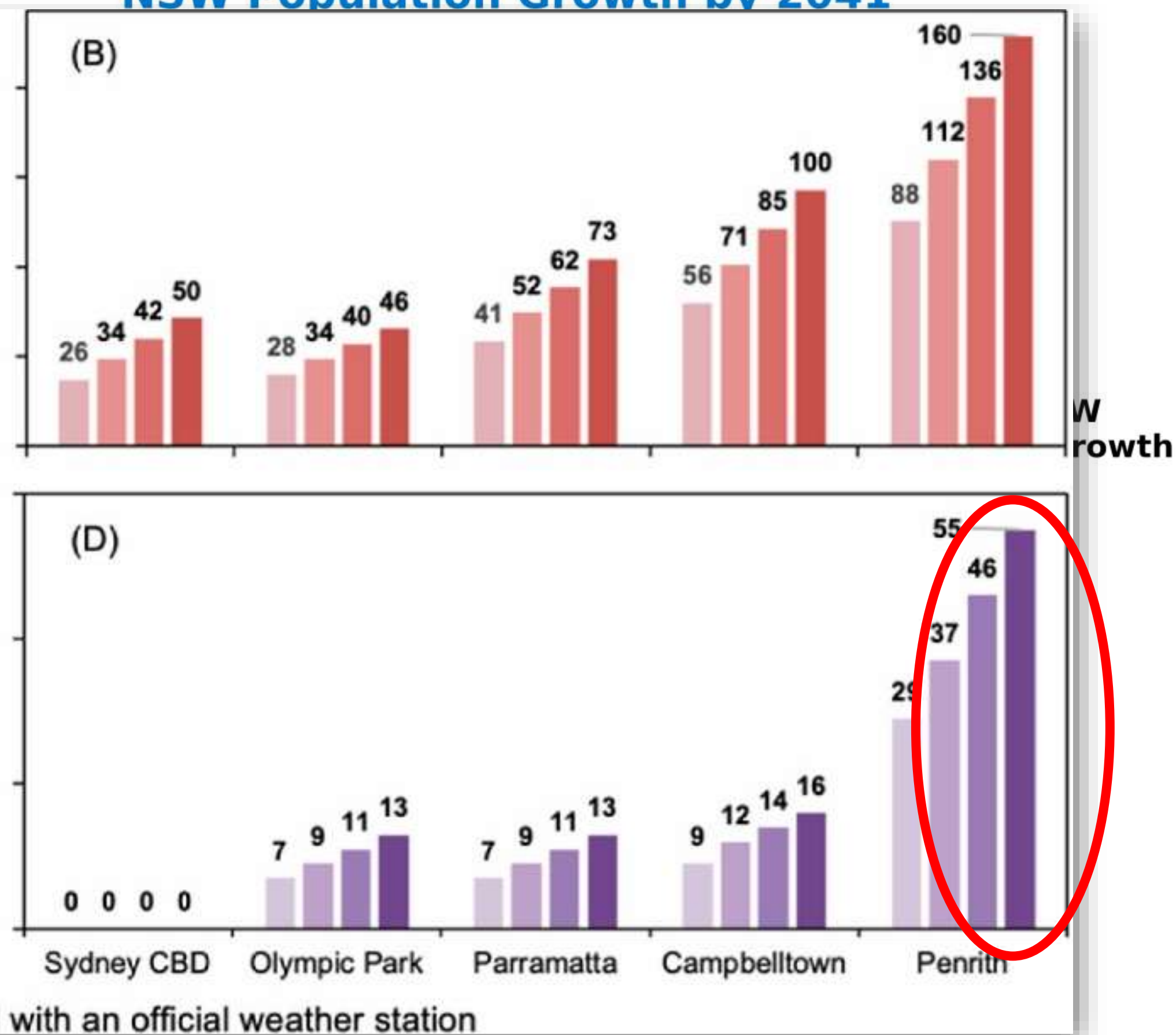
Wianamatta Street Tree – employment areas

Western Sydney: Urban Heat Island Central

POPULATION DOUBLING



NSW Population Growth by 2041



Liveability in Western Sydney

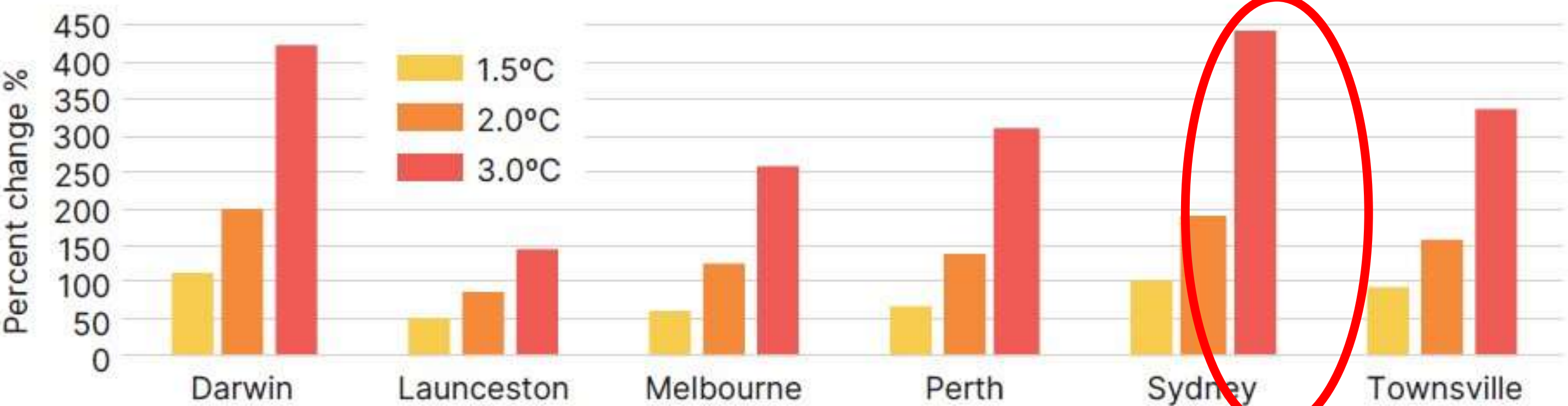
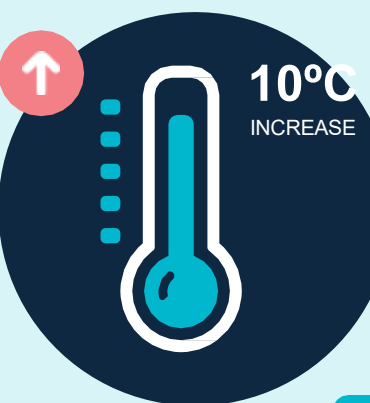


Figure 4: Examples of the projected increase in heat-related mortality for different global warming levels compared to the current period.

National Climate Risk Assessment, 2025

**LIVEABILITY
RATING**

10% LOWER
THAN THE EAST



**UP TO
10 DEGREES
HOTTER
THAN
EASTERN
SYDNEY**





BLIGH
TANNER



GREY INFRASTRUCTURE



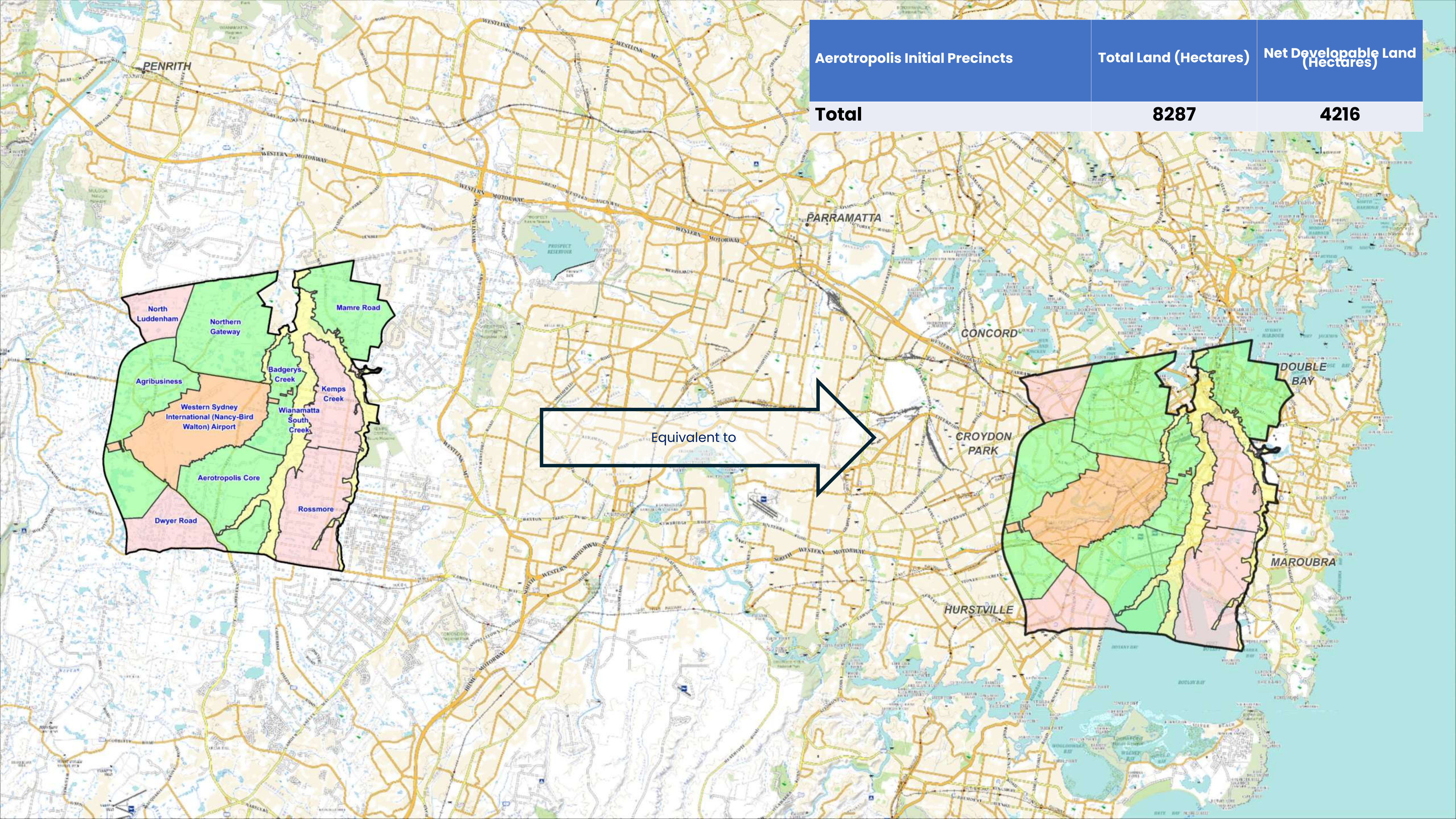
GREEN INFRASTRUCTURE



BLUE INFRASTRUCTURE



BLUE-GREEN INFRASTRUCTURE



Aerotropolis Initial Precincts

Total Land (Hectares)

Net Developable Land (Hectares)

Total

8287

4216

Equivalent to





26 Jun 2024 at 9:43:47 AM
33° 42' 44" S, 150° 56' 57" E
20–28 Raymond Ct.
Kellyville NSW 2155
Australia
3m x 15m bank erosion



four bridge
A Hezlett Road
dney
696607 +150 949871
Jan 2021 at 9:41:23 am



t Road
7,+150.949778
at 1:30:52 pm



Current Practice

In new greenfield developments, up to one in three street trees are dying within the first three years.

Attrition rates likely due to poor planting methods and maintenance regimes.

Council spending approx \$1 million of landscaping budget on removing dead trees per annum.

Conclusion: current practice is not working and will not be effective in achieving canopy targets.

Initial concept design

Simple, efficient, cost-effective

Simple drop pit to capture and direct stormwater from road

Gravel wicking bed to hold and store runoff

Natural soil for tree growth

Colocation of services to maximise space for trees

Maximise perviousness - permeable pavements for footpaths and parking



**Stormwater
Authority**

Councils

**State
gov/planning
authorities**

Utility

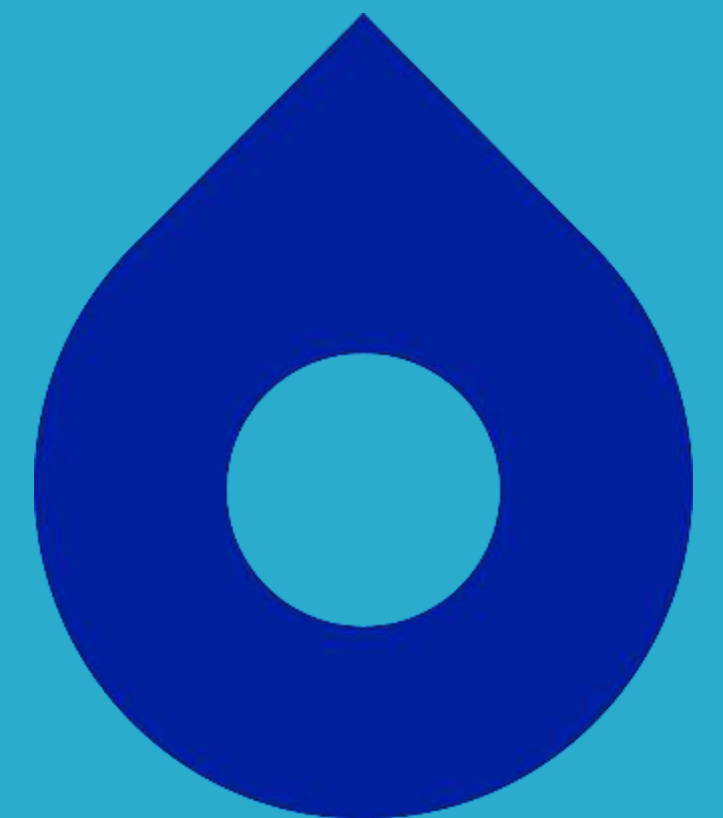
**Waterways/
Environment**

**Industry/
Developers**

Community

**Roads/
Transport
Authority**

Sydney
WATER



CBA with Charles Sturt University

1. Conventional street trees – standard infrastructure, irrigation only during establishment.
2. Mixed conventional and bioretention trees – passive irrigation throughout their lifetime.
3. Wianamatta hybrid design – trench and bioretention, capturing stormwater in situ.
4. Wianamatta trench-only design – full volume retention, no offsite infrastructure.

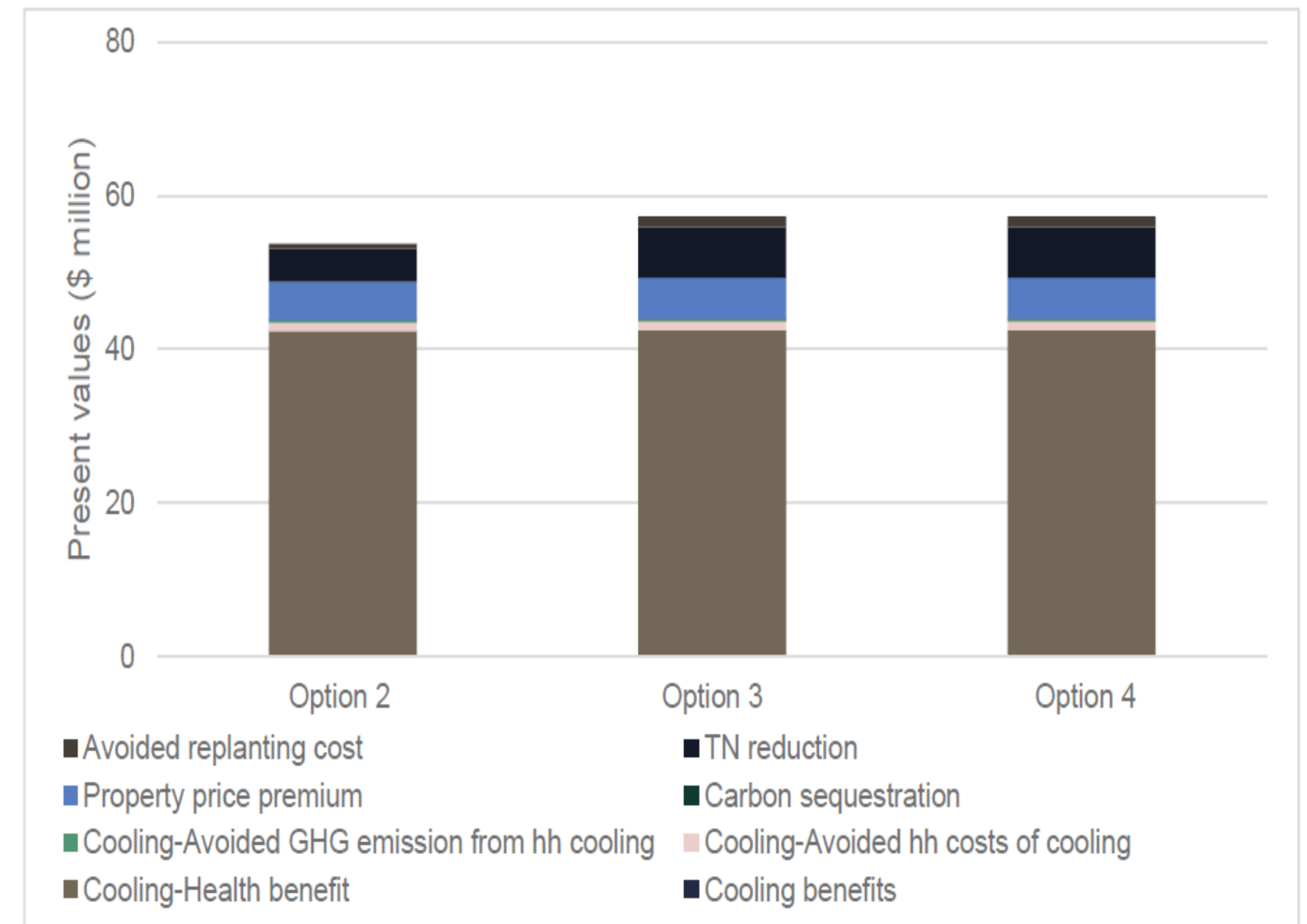


Figure 3. Share of benefits for each of the project options

Project Name
Mamre and Aero Street Trees

Location (City):
User Defined

Evaporation Data
Monthly

Input Required?

Yes

Add Climate Data

Step 4 - Tree Characteristics:

Water Use Category
Medium

Crop Factors
Default

User Defined Crop Factor
Min 0.3
Max 0.8

Crop Factor Behaviour
D

Tree Type
Native

Canopy Diameter (m)
8

Root Growth Constrained?
Y

Root Diameter (m)
5

Root Depth (m)
0.8

Default
Crop Factor
Min:0.3
Max:0.8

Small tree: 5m
Medium tree: 8m
Large tree: 16m

Root Vol = 35% of canopy dia

Do not change root DIA

Step 2 - Runoff Characteristics:

Catchment Type Catchment (m2) Initial Losses (mm)

		User Defined
Tree	21.1	5
Road	40.5	2
Footpath	23.8	2
Other (Impervious)	0.0	1
Total	85.5	

Step 3 - Soil Characteristics

Type 1 Soil Cross-Section (mm)
1000

Type 2 Soil Soil depth (mm)
Sandy Loam 800

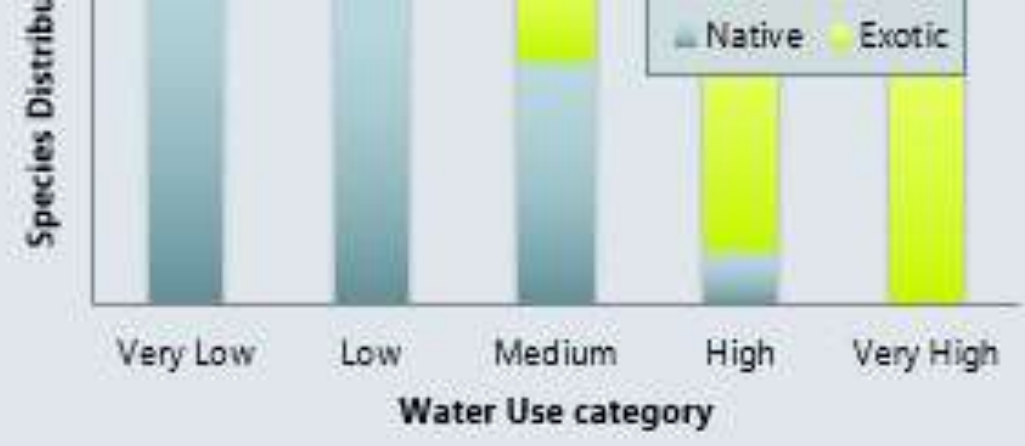
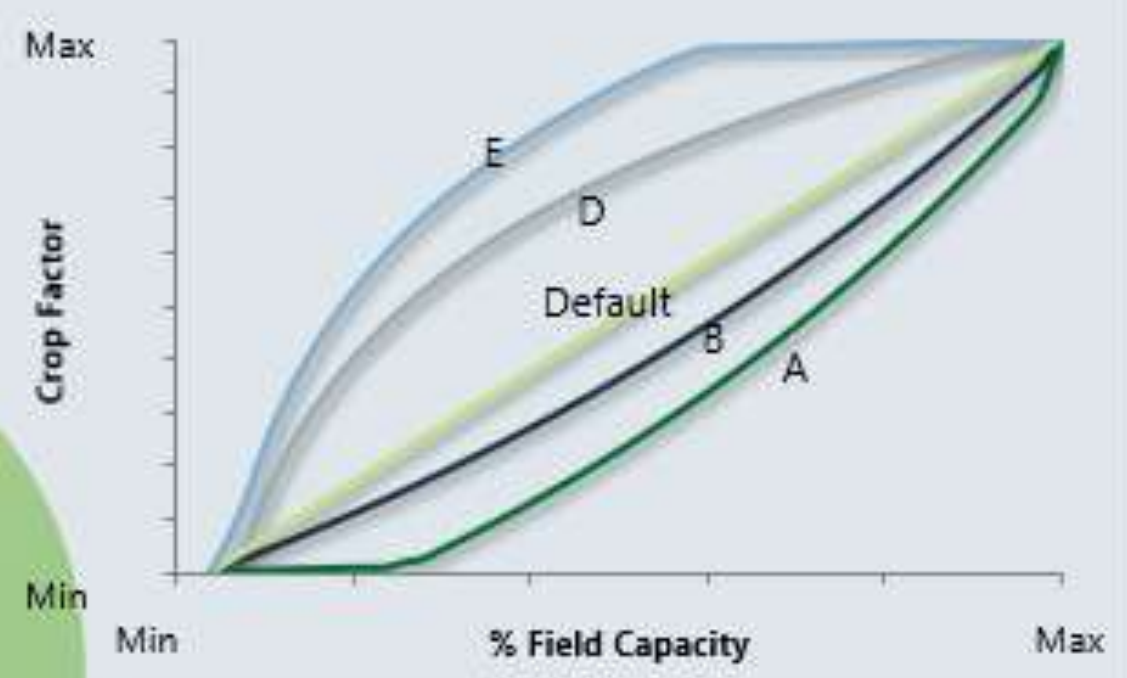


Chart 2 - Crop Factor Behaviour with Varying Soil Moisture



Soil Properties:

User Defined?	Default	No
Field Capacity (mm)	121.2	
% of volume	15%	
Wilting Point (mm)	17.2	
% of volume	2%	

Step 5 - Watering Requirements:

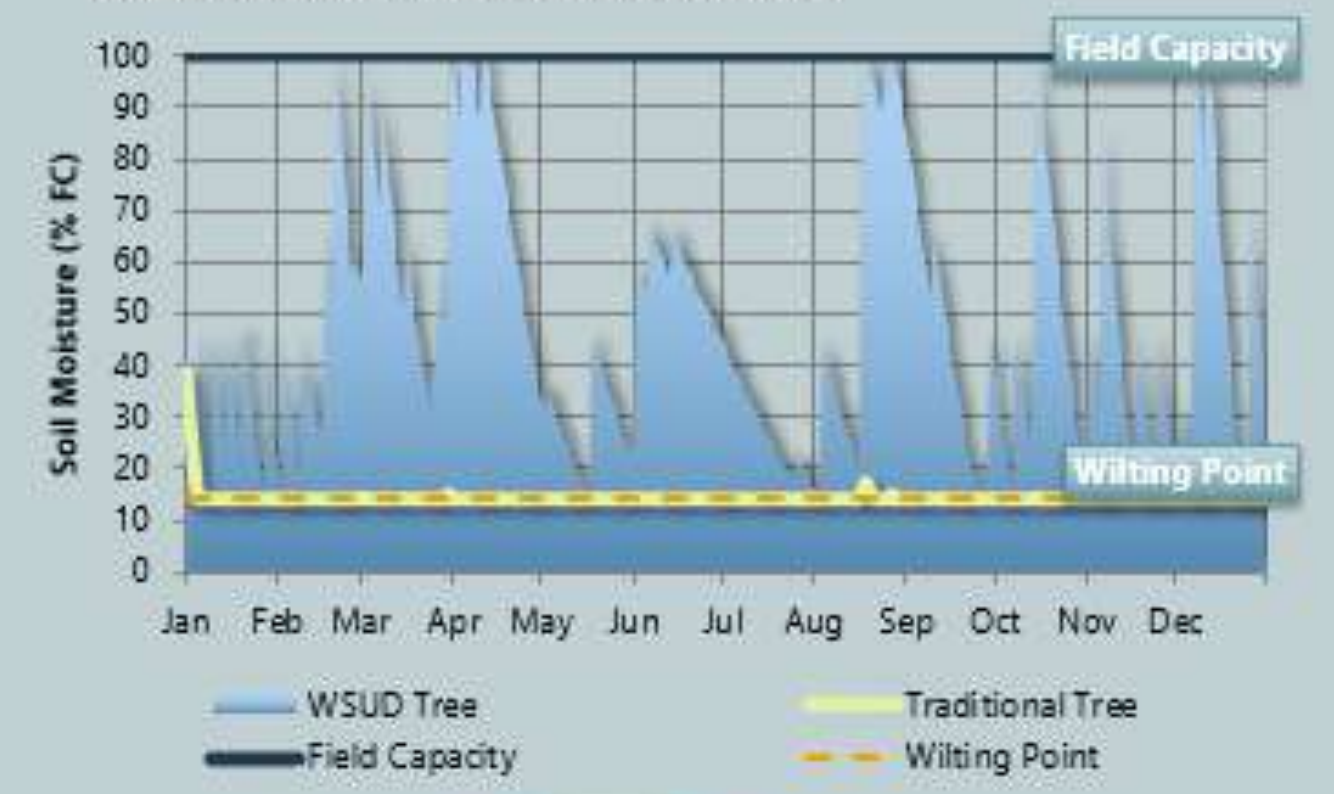
Allow Irrigation (only when MC < WP)? Yes
Application Rate (L/wk) 800

Start Date (average yr)	1/01/2014
Mean daily rainfall (mm)	1.90
Annual Rainfall (mm)	693
Mean Daily Evap (mm)	3.67
Annual Evap (mm)	1,342

Water Balance Stats

	WSUD Tree	Traditional Tree
Total Runoff Inflow (m3)	38.5	1.0
Total ET Demand (m3)	37.6	20.8
Total Irrigation Water (m3)	11.2	0
Spill Volume	13.1	
Water balance (m3)	-12.5	
Number of Wilting/Irrigation Days	14	0
MARV % reduction	66%	
MARV (ML/Ha/annum)	1.54	
No. of days tree pit spills per annum	15	
No. of days of impervious surface runoff per annum	58	

Results Graph 1 - With Urban Catchment





Project team

Group	Role
Sydney Water	Project design and management, procurement, and subject matter expertise.
UNSW	Research design, monitoring, and execution.
City Green	Street tree design options
Wave Consulting	Detail design for tree pits
Campbelltown Council	Potential field trial partner



Developers

Council

Project activities

A scenic view of a park with a stream, trees, and people. The stream flows through the foreground, surrounded by tall grasses and reeds. In the background, there are large trees and a paved path where several people are walking. The sky is blue with some birds flying.

Development of six detailed street tree cell designs

Installation of the designs at five locations in Western Sydney.

Monitoring and analysis of street tree performance

Determine community sentiment

The creation of Best Practice Guidelines for street tree installation in high density areas in Western Sydney

Why we need PIST

Community health benefits

Reduce and improve run-off

Reduce temperature

Climate Resilient



Thank you!

Sydney
WATER

