



URBAN HEAT REPORT

NORTH APPIN PRECINCT

Prepared for Ingham Property Group
June 2023

EXECUTIVE SUMMARY

This report has been prepared on behalf of Ingham Property Group (**the proponent**) to provide an assessment of the heat impacts associated with the rezoning of the land located at 345 Appin Road, Appin (**the Site**) which forms part of the North Appin Precinct in the Greater Macarthur Growth Area.

The Site comprises approximately 301 hectares of land and the Draft Structure Plan is envisioned to deliver approximately 3,000 new dwellings. The Planning Proposal builds on the NSW Government's vision and aspirations for the Greater Macarthur Growth Area as a region which delivers housing and employment opportunities in a sub-regional environment. In line with the NSW Government's vision, a diverse range of housing typologies will be planned, targeted for and delivered to meet the residential market demands in south-west Sydney.

In addition, the site will integrate the delivery of a high amenity environment, focused on the principles of achieving a distribution of open space, community facilities, retail and other related non-residential land uses that directly correlate with the needs of the incoming population, but also responsive to the constraints and opportunities of the site. It will promote pedestrian walkability and connectivity to public places and spaces across the precinct, and fundamentally build on the green and blue grid objectives.

CONTENTS

Introduction	4
Site Context	5
Strategic Context	11
Indicative Structure Plan	16
Landscape Strategy	19
Potential Measures to Address Urban Heat	27
Recommendations	31
Conclusion	32

Urbis staff responsible for this report were:

Director	Jon Mills
Associate Director	Richard Barry
Consultant	Patrick Jones

© Urbis Pty Ltd
ABN 50 105 256 228
All Rights Reserved. No material may be reproduced without prior permission.
You must read the important disclaimer appearing within the body of this report.

Urbis acknowledges the important contribution that Aboriginal and Torres Strait Islander people make in creating a strong and vibrant Australian society. We acknowledge, in each of our offices, the Traditional Owners on whose land we stand.

1. INTRODUCTION

Urban Heat is an increasingly problematic issue in the urban areas of Sydney and Australia. With the increasing temperatures from climate change, it will only continue to have a greater impact. Planning for urban heat is and will become an increasing priority for development in NSW.

Western Sydney is heating up twice as fast as the eastern parts of the city and experiencing six times the number of days over 35 degrees (WSROC, 2021). Identifying measures and priorities to mitigate urban heat will be especially relevant to the Western Sydney growth areas as these parts of the city are greatly overrepresented when it comes to negative urban heat effects.

The Wollondilly Shire Local Government Area (LGA) is one of the fastest growing local government areas in Australia, with its population set to double by 2041 (Wollondilly Shire Council, 2020). With this growth there are challenges to overcome, and opportunities to be realised, to ensure the creation of a liveable place for people in the years to come.

This Urban Heat Report has been prepared by Urbis Pty Ltd (**Urbis**) on behalf of Ingham Property Group (**the Proponent**) to address the urban heat issues that may arise through the proposed amendments to the *State Environmental Planning Policy (Precincts – Western Parkland City) 2021* to facilitate the redevelopment of the site located at 345 Appin Road, Appin (**the Site**) located in the Greater Macarthur Growth Area (**GMGA**).

VISION STATEMENT

The North Appin (Part) Precinct (the Precinct) celebrates and acknowledges its natural environment through the conservation of vegetation, waterways, and riparian corridors. The precinct will provide open space opportunities which connect the Precinct with the broader green and blue grid, whilst maintaining its ties to First Nations cultural history. The Precinct will create a sustainable place which reduces the potential Urban Heat Island effect (**UHI effect**), promotes resilience to climate change, and encourages an active, healthy and engaged community.

THE AIMS OF THE URBAN HEAT REPORT

As part of planning for new urban areas, Urbis has developed this report in line with best practice Urban Heat mitigation policies and strategies. The best-practice examples have been reviewed in order to:

- Understand the impacts that new development will have on the physical environment and its communities in relation to Urban Heat Island.
- Ensure that precinct design further explores the distribution of ambient and surface temperatures whilst, seeking to minimise these to assist in improved thermal comfort.
- Assess the cooling potential of the nominated mitigation strategies and demonstrate how they can be implemented from a precinct level.
- Assist DPE in providing qualitative and quantitative data that better supports and validates these strategies when addressing urban heat.
- Recommend measures to reduce the impacts of Urban Heat, and providing further updates during development and a follow up report post development addressing whether these strategies were successful or could be enhanced.

This report seeks to specifically respond to these requirements, establishing a framework for future urban development.

2. SITE CONTEXT

2.1 PLANNING BACKGROUND

Current Planning Proposal

A Draft Planning Proposal was lodged with the Department of Planning and Environment (DPE) in December 2022 seeking to rezone the Site at 345 Appin Road, Appin.

The objectives and intended outcomes of the Planning Proposal will be facilitated through amendments to the *State Environmental Planning Policy (Precincts - Western Parkland City) 2021 (Precincts SEPP)* and associated land use mapping provisions.

The indicative proposed SEPP amendment includes:

- Precincts SEPP:
 - Rezoning the land to part:
 - UD Urban Development
 - SP2 Infrastructure
 - C2 Environmental Conservation

Urban Heat Report

DPE has requested the preparation of an Urban Heat Report which demonstrates how the Planning Proposal, Draft Structure Plan, and Urban Design Report have considered measures to mitigate the effects of Urban Heat. DPE requested that the report also address the relevant actions and priorities nominated by relevant strategic planning policies.

The structure and recommendations have been prepared with consideration of the Sustainability Policy 2030 prepared by Wollondilly Shire Council and the WSROC Urban Heat Planning Toolkit.

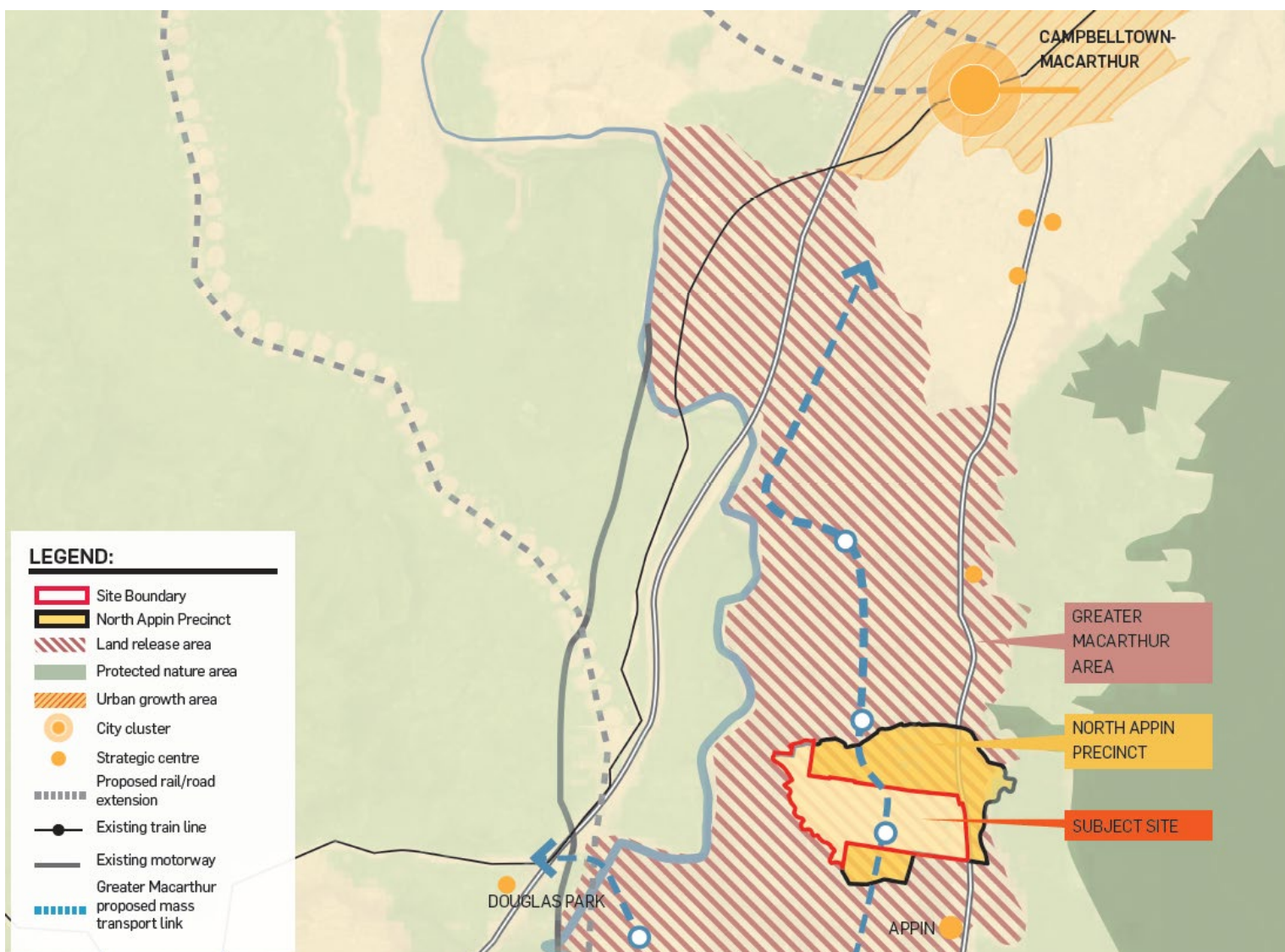


Figure 1 Greater Macarthur Growth Area and surrounding context

2.2 SITE DESCRIPTION

The Site

The subject Site is situated 14km south of the Campbelltown-Macarthur metropolitan centre, within the North Appin Precinct, of the Greater Macarthur Growth Area. The Site comprises an approximate area of 301 hectares. The majority of the Site is located within the Wollondilly LGA, and a small north-western portion is located within the Campbelltown LGA.

The Precinct shares the following borders:

- East: The Site borders Appin Road to the east, with a frontage of over 1km.
- West: The Site is bound by Ousedale Creek to the west which flows in a north-westerly direction into the Nepean River
- North: The Site borders rural and agricultural land to the north, beyond which is land currently subject to the Gilead Stage 2
- South: The Site borders the Macarthur Motorcycle club and the remainder of Ousedale Creek to the south.

Landform Characteristics

The Site has an undulating terraced landform with relatively level areas along the eastern edge with an elevation of 228m at the east and 108m at the west. The Site contains a central north-south ridgeline, with land falling steeply to the west and a prominent east-west spur that also falls to the west

The Site has a few ridgelines which transverse across the Site. The tallest and longest ridgeline on the Site transverses from the north to the south, with the Ousedale Creek and its tributaries embedding multiple depression corridors at the western portion of the Site.

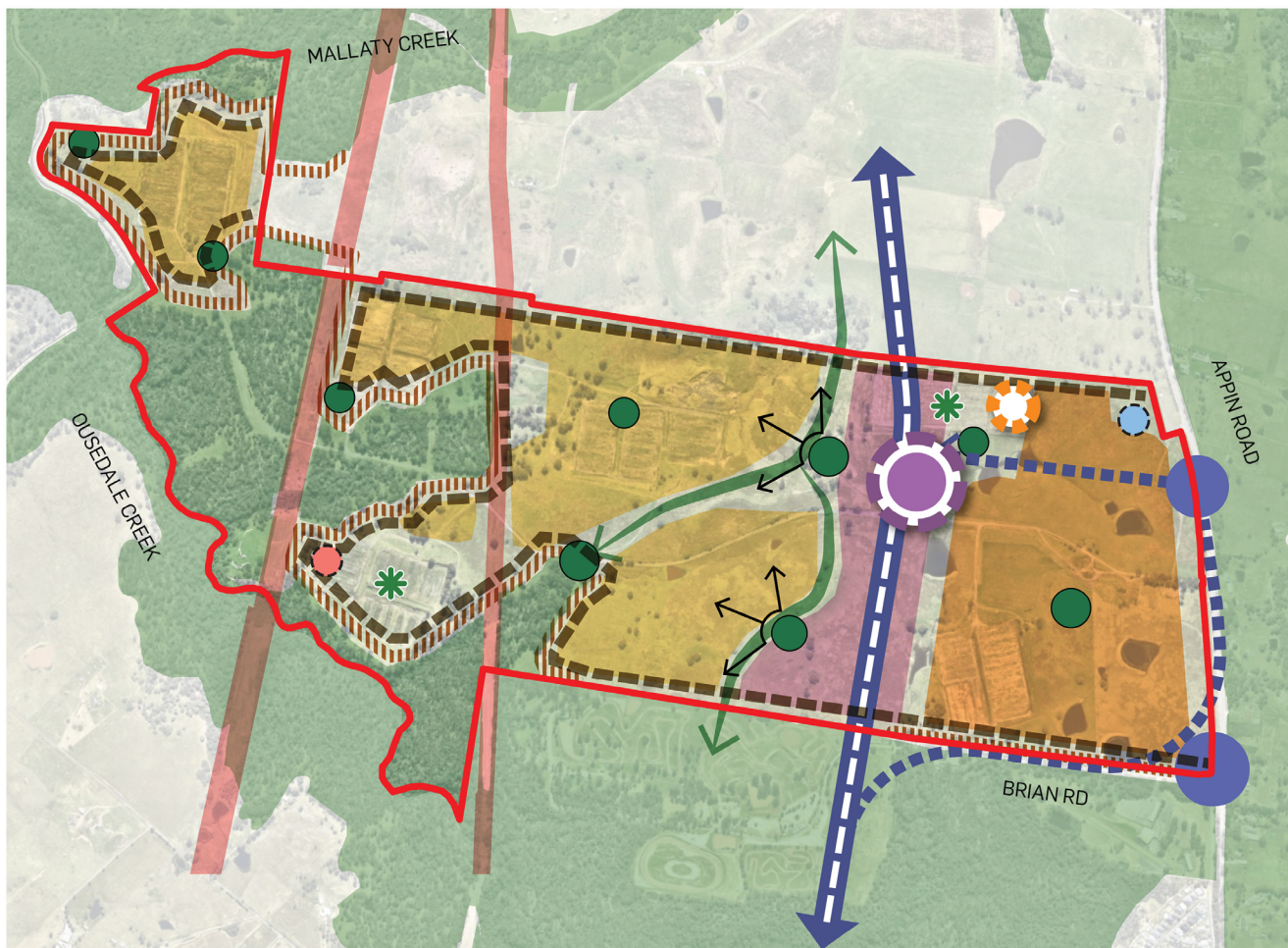
All of the ridgelines fall in a westerly direction, creating the Ousedale Creek corridor on the western boundary of the Site.

Road Infrastructure

The main access to the Site is via Appin Road, which runs in a north-south direction on the eastern boundary of the Site. It connects to the Appin town centre to the south and the Campbelltown-Macarthur region to the north before joining the Hume Hwy which provides access to Parramatta and the Sydney CBD. Appin Road is currently the only available main access road.

There is an existing sealed access road that runs east-west through the Site, connecting Appin Road to the north-western corner of the Site. Brian Road runs east-west along the southern site boundary (immediately south of the subject site).

The Greater Macarthur 2040 Structure Plan identifies an indicative north-south transit corridor connecting Campbelltown-Macarthur, Gilead, Appin and Douglas Park.



Opportunities and Constraints

SITE CONSTRAINTS

Easement

- The site is bisected by easement corridors. These easement corridors impose land use restriction on the subject site.

Bushfire - Asset Protection Zone (APZ)

- The site contains bushfire-prone land, with the need for APZs to be established accordingly.

Existing Contour Lines

- The site's topography generally falls from the east to the west at a central north-south ridgeline. The location of roads and design of development parcels will need to respond sensitively to this topography.

Existing Vegetation Corridor

- The vegetation corridor wraps around the site and is mostly identified by CPCP for conservation.

SITE OPPORTUNITIES

Movement

Transport Corridor

- The Greater Macarthur 2040 proposes a north-south running Transport Corridor that potentially accommodates public transport, walking, driving and active transport.

Appin Road Site Access

Two site access points are proposed off Appin Road.

- The southern access point utilises the existing Brian Road corridor and it will be widened to accommodate the increasing population within the region. It is an alternative alignment than that indicated in the GMGA Structure Plan. It more closely follows the ridge line, and results in regular-shaped development parcels.
- The northern access road is proposed to avoid dependency on the northern landowner to provide access from Appin road into the subject site.

Place

Local Centre

- A local centre is proposed at the heart of the subject site along the Transport Corridor to service future community. The centre will provide mix of services including: retail, health services, community facilities etc.

Green Connections

- There are opportunities to provide green corridors that links to the wider vegetated corridor and facilitate wildlife movements.

Local Parks

- Locate a variety of open spaces at high points and in places most accessible by the community (400m).

Views

- Frame view lines to and from the local ridge lines, which is a part of Locality's identity.

Infrastructure

School

- Opportunity to locate a new primary school in proximity to the local centre.

Sporting Fields

- Co-locate a sporting field next to the primary school. The balance of sporting fields can be located on existing flat land adjacent to bushfire prone vegetation as a buffer to future development.

Perimeter Roads

- Perimeter roads are required to address bushfire risks and provide opportunities for co-locating active transport routes and water management.

Reservoir

- A water reservoir is required at the site's high point at Appin Road.

Zone Substation

- A zone substation is required and should be located in proximity to the existing electricity transmission line.

Developable Areas

Higher density

- Opportunities for higher densities along the Transport Corridor and around the Local Centre as they have the optimal access to services.

Medium density

- The lands between the Transport Corridor and Appin Road are suitable for medium density development given proximity to the Transport Corridor, Local Centre and Appin Road.

Lower density

- The lands to the west are most suited to lower density development, particularly in areas of steep topography and adjacent to conservation vegetation.

Figure 2 Opportunities and Constraints Map

2.2 PHYSICAL CONDITIONS

Climate

The Camden Airport Automatic Weather Station (AWS) is located approximately 17 kilometres north-west of the Site. Data has been collected by the Bureau of Meteorology at the weather station and is referenced below to indicate climatic conditions for the Site.

Temperature averages and extremes

January is the warmest month on average at Camden Airport AWS (mean maximum temperature of 30.4°C), and July is the coldest month (mean maximum temperature of 17.6°C). In comparison, Sydney – Observatory Hill in the Eastern City has a mean maximum temperature of 26°C in January, representing an average 4°C cooler than the Western City.

At Camden Airport AWS, the highest temperature ever recorded at the site was 46.4°C on January 18 2013, compared to the highest temperature ever recorded of 45.8°C at Observatory Hill, on the same day. Seasonally, mean maximum temperatures reach 30.4°C in summer with a decile 9 of 37.9°C.

Annually, an average of 14.7 days are recorded at Camden Airport AWS where the temperature exceeds 35°C. In comparison, an average of only 3.2 days over 35°C were recorded at the Sydney – Observatory Hill weather station. http://www.bom.gov.au/climate/averages/tables/cw_066062_All.shtml

Wind Speeds

Mean wind speeds at Camden Airport AWS are relatively consistent throughout the year, ranging from approximately 5.4 to 9.3 km/hr. The strongest wind gust ever recorded at the site was 114.8 km/hr on 25 September 2020, from a south-westerly direction

The predominant wind direction in all seasons is south-westerly.

Humidity

Relative humidity is defined as the amount of moisture in the air expressed as a percentage of the amount of moisture present if the air was saturated at that temperature.

Generally, humidity at Camden Airport AWS is higher at 9.00am than 3.00pm.

June is the most humid month on average with a mean 9.00am relative humidity of 74% which lowers to 49% by 3.00pm.

In summer, an average humidity of approximately 75% is reached at 9.00am which reduces down to 49% at 3.00pm. Report prepared for IPG

28/06/2023

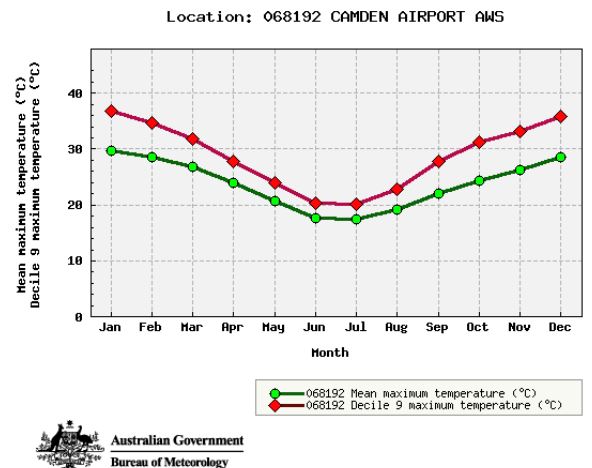


Figure 4 Camden AWS Maximum Temperature

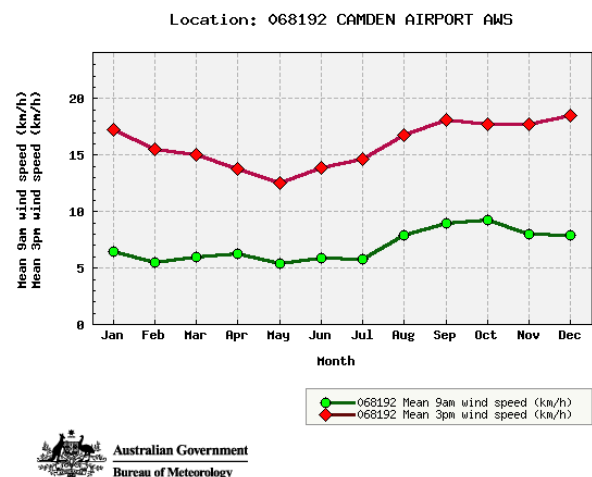


Figure 5 Camden AWS Wind Speeds

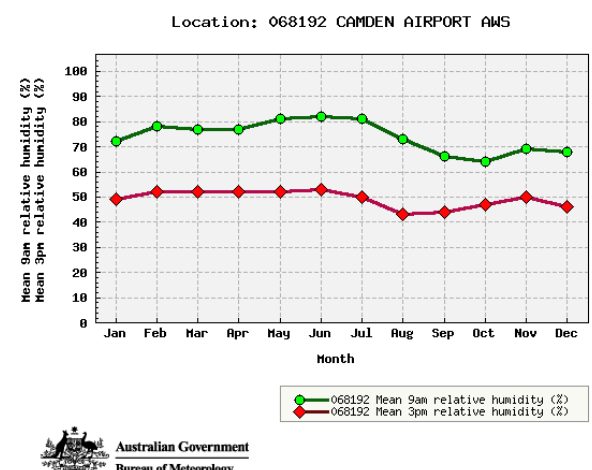


Figure 6 Camden AWS Relative Humidity

3. STRATEGIC CONTEXT

3.1 STATE WIDE STRATEGIC DOCUMENTS

GREATER SYDNEY REGION PLAN: A METROPOLIS OF THREE CITIES

The Greater Sydney Region Plan (**Region Plan**) is a strategy prepared by the Greater Sydney Commission (GSC), now the Greater Cities Commission (GCC), for managing growth and change to guide integrated land use planning and infrastructure delivery for Greater Sydney to 2056. The Region Plan is built on a vision of three cities where most residents live within 30 minutes of their jobs, education and health facilities, services and great places. The vision brings new thinking to land use and transport patterns to boost Greater Sydney's liveability, productivity and sustainability by spreading the benefits of growth.

The Greater Macarthur Growth Area is an area identified for anticipated growth and acceleration of housing growth resulting from the development of new communities. The Region Plan also identifies that development within the land release areas is set to provide significant capacity 'into the long and medium term'. Further, the Region Plan is set to enhance regional connectivity through north-south transport corridors between Wollongong and Greater Sydney which will 'significantly influence land use opportunities in Appin and its relationship to Wollongong'.

The Urban Heat Report aims to support the achievement of **Strategy 38.1** of the Region Plan which is to mitigate the urban heat island effect and reduce vulnerability to extreme heat.

GREATER SYDNEY DISTRICT PLANS: WESTERN CITY DISTRICT PLAN

Five District Plans were also prepared by the GSC as guides for implementing the Region Plan at a District level. Each plan is structured around priorities in relation to infrastructure and collaboration, liveability, productivity, sustainability and implementation. The Site is located within the Western City District.

The Wollondilly Local Government Area (LGA) is expected to receive the second greatest increase in older population in the Western District, and strong population growth across all age groups.

This Urban Heat Report aims to respond to the following priorities of the Western City District Plan:

- **Priority W15**
Increasing urban tree canopy cover and delivering Green Grid connections
- **Priority W18**
Delivering high quality open space
- **Priority W20**
Adapting to the impacts of urban and natural hazards and climate change

THE SIX CITIES REGION DISCUSSION PAPER

The Six Cities Region Discussion Paper (**Discussion Paper**) was prepared by the Greater Cities Commission (GCC) to stimulate discussion about the most suitable approaches to planning the Six Cities Region. The Discussion Paper is built on a vision of six cities where access to jobs, education and health facilities, services and great places is balanced equitably across the six cities. Ultimately, the vision brings new thinking to land use and transport patterns whereby people and goods can be moved across the region in 90 minutes, jobs are located within 30 minutes by public transport from great homes and all of an individual's daily needs are met within a 15-minute walk.

A key component of the Discussion Paper is the delivery of a fast rail network which will connect the Greater-Macarthur region with the six cities, as well as Canberra, and the Southern Tablelands.

Chapter 6 of the Discussion Paper also identifies the minimisation of urban heat through increasing tree canopy cover and Water Sensitive Urban Design (WSUD) as integral component of creating climate-resilient green cities and places. Particularly, the Discussion Paper identifies the use of recycled water, including recycled stormwater, as essential to mitigating urban heat through reducing reliance on rainfall, and drinking water supplies. To realise the above urban heat mitigation strategies, the Six Cities Region Plan and subservient District Plans will develop tree canopy investment strategies and set place-based targets for canopy cover and consider recycled water infrastructure.

GREENER PLACES DESIGN GUIDE

In November 2017, the GANSW released the Draft Greener Places Design Guide, the NSW Government's policy for green infrastructure in NSW. The guide presents a collection of priorities, four (4) principles and four (4) outcomes to guide design and planning in the delivery of green infrastructure in NSW, with a focus on open space for recreation, urban tree canopy and bushland and waterways. Fundamentally, the policies seek to respond to the following NSW challenges:

- Health
- Climate resilience
- Rapidly growing population
- Changing lifestyle and demographics
- Infrastructure and urban renewal
- Biodiversity loss

Built upon the principles of integration, connectivity, multifunctionality and participation the draft Guide seeks to achieve the following outcomes:

1. Conservation of the natural environment
2. Increased access to open space
3. Improved connectivity to promote active living
4. Increase urban greening to ameliorate climate extremes

The draft Guide provides recommendations for planning new development in greenfield sites to maximise opportunities for well-located and accessible parks and public open spaces that provide for a diverse range of recreational activities. The desired outcome for greenfield areas is to base public open space around natural systems, which support connectivity, active transport and a diversity of settings which enhance the local character. Additionally, such practice offers opportunities for improved water-sensitive urban design and habitat conservation, ultimately creating a stronger blue and green grid.

3.2 WOLLONDILLY COUNCIL STRATEGIC DOCUMENTS

WOLLONDILLY LOCAL STRATEGIC PLANNING STATEMENT

The *Wollondilly Local Strategic Planning Statement (LSPS)* was endorsed by the Greater Sydney Commission in March 2020. The LSPS identifies the vision for land use planning over the next 20 years.

The overall vision for Wollondilly is underpinned by four key themes: infrastructure and collaboration, liveability, productivity and sustainability. These mirror the priorities of the Region Plan and District Plan and are critical to how Wollondilly will grow and evolve. The proposed Urban Heat Report aims to respond to the following priorities of the LSPS:

- **Planning Priority 2**
Embracing innovation to enhance livable, connected and sustainable communities
- **Planning Priority 15**
Delivering an urban tree canopy
- **Planning Priority 18**
Living with climate impacts and contributing to the broader resilience of Greater Sydney

WOLLONDILLY LOCAL HOUSING STRATEGY

The Wollondilly Local Housing Strategy (**LHS**) was endorsed by Wollondilly Council in March 2021 and was prepared in response to the region, district and local planning policy objectives to establish an evidence-based plan for housing in the Wollondilly LGA over the next 20 years.

Over the next 20 years, the LGA is forecasted to experience significant housing growth with a forecast demand for an additional 31,300 dwellings by 2041.

The North Appin (Part) Precinct is identified as having the potential to deliver 3,000 additional new homes, from 2027. The site is identified in the North Appin (Part) Precinct of the Greater Macarthur Growth Area which includes growing and evolving land release precincts. Housing within this precinct will comprise of low and medium density housing

This Urban Heat Report aims to respond to the following priorities and actions of the LHS:

- | | |
|--|---|
| <ul style="list-style-type: none">• Priority 4
Build sustainable and resilient communities that protect and celebrate our environment | <ul style="list-style-type: none">• Action 4.3
Work with the NSW Department of Planning and Environment to integrate a focus on sustainable communities in the planning of Wilton and Greater Macarthur Growth Areas |
|--|---|

WOLLONDILLY COUNCIL URBAN TREE CANOPY PLAN AND LANDSCAPE STRATEGY

The Wollondilly Council Urban Tree Canopy and Landscape Strategy has been prepared to indicate the steps that Council could undertake to protect, maintain and enhance a healthy and diverse urban tree canopy. The Urban Tree Canopy Plan sets ambitious targets for the tree canopy cover in urban areas that are in-line with the NSW Department of Planning and Environments targets. The Council targets are as follows:

- 40% mature canopy cover target in new developments
- Less than 10% single species planting in a single development
- 95% tree survival rate 12 months after planting.

This Urban Heat Report aims to respond to a range of actions and priorities which seek to embed sustainability into urban planning and design and create sustainable and resilient urban environments:

- **Create – Strategic planting of more trees to meet Wollondilly’s urban canopy targets**
 - Review and revise relevant provisions in the LEP/DCP and other local planning instruments to support canopy targets.
 - Review WSUD development controls in DCP to retain water in the landscape to support new trees
 - Developing guidelines for planning proposals to deliver greater canopy outcomes to enhance liveability, biodiversity and reduce urban heat
 - Encourage developers to incentivise the establishment of canopy trees by homeowners in privately owned landscape areas (e.g. trees need to be planted as identified within approved plans prior to the issuance of an occupancy certificate)
 - Work with DPE, and developers to create an effective urban canopy in release areas.
 - Develop tree management plans and master plans for key parks and streetscapes and ensure new park master plans include a mature canopy diagram to demonstrate canopy targets are being met.
- **Manage – Protect and Maintain a Diverse, Healthy, Connected and Resilient Urban Canopy**
 - Identify priority areas for targeted canopy protection. (e.g. new urban release areas, biodiversity connectivity areas and habitat, and heat spots and heat vulnerable areas)
 - Adopt innovative WSUD, and water recycling technologies to passively irrigate trees
 - Advocate to DPE the need to review existing and developing planning policies and strategies within the Growth Areas that provide positive outcomes for tree canopy at a localised scale.
 - Prioritise the retention of tree species with long lifespans and healthy large trees that provide or will grow to provide effective shade, amenity and habitat
- **Bushfire Management – Plan and Manage Canopy in Bushfire Prone Areas to not increase Bushfire Risk**
 - Undertake a bush fire risk assessment for precincts in or adjoining bushfire prone areas before planning to embellish public spaces with trees
 - Do not increase vegetation canopy on or near bush fire prone areas beyond the Planning for Bushfire Protection Guidelines 2019.
 - Consult with the NSW RFS and emergency management professionals in the planning process for tree canopy embellishment
 - Develop a list of suitable fire-retardant plants and landscaping guidelines (verified by an ecologist and fire expert) that are place specific
- **Community – Collaborate with and educate our community**
 - Provide guidance for private landowners, builders and developers on retaining and protecting existing trees, including for complying development and when designing site access to protect street trees

WOLLONDILLY SUSTAINABILITY POLICY

Wollondilly Shire Council recently adopted their new 'Sustainability Policy' on the 4th of April 2023. The Policy outlines the values and sustainability principles to be applied in all governance decision making processes and operations.

Whilst the policy is intended to apply to Council's business operations, it provides important insights into Council's appetite for sustainable development which is responsive to Urban Heat.

The relevant implementation measures which this Urban Heat report intends to respond to are as follows:

- **3.3.1** Incorporation of environmentally, socially and economically sustainable design that improves quality of life for current and future generations and maintains and improves the health of the natural environment
- **3.3.2** Increase the use of sustainable materials, methods and equipment in development approvals
- **3.3.3** Increasing sustainable and safe transport options including shared pathways and public transport

SUSTAINABLE BUILDINGS SEPP

The *State Environmental Planning Policy (Sustainable Buildings) 2022*, also known as the 'Sustainable Buildings SEPP', aims to simplify and coordinate the way that sustainable buildings are planned and designed. The Sustainable Buildings SEPP (**SB SEPP**) was first notified on 29 August 2022 and will come into force on 1 October 2023 and does not contain any transitional arrangements, meaning that the provisions of the SEPP will immediately apply in full-force.

The SB SEPP will improve the existing standards for residential buildings under BASIX and non-regulatory frameworks such as NABERS. For the first time in the NSW planning system, it will introduce sustainability measures for non-residential buildings.

As such, the provisions of the SB SEPP, including 7-star NatHERS and revised heating and cooling caps for residential development, will require consideration during any subservient Development Application.

4. DRAFT STRUCTURE PLAN

Urbis has prepared a Draft Structure Plan (Draft SP) for the site, illustrated in **Figure 7**, which has informed the planning provisions proposed under the SEPP amendment.

The Draft SP has been shaped by a comprehensive site analysis, key connecting with Country principles and identification of the site opportunities and constraints (see **Figure 2**), ensuring the appropriate and considered use of land. The Draft SP is framed around the significant investment and opportunities realised from the Greater Macarthur 2040 Strategy.

The primary objective of the redevelopment of the site is to deliver compatible land uses within its unique natural ecological setting. The arrangement of land uses has been situated to celebrate the natural site assets and mitigate the site challenges, including taking advantage of local views, providing activation along riparian corridors and areas of vegetation, and consideration of areas with high cultural value.

The distribution of land uses across the site takes advantage of the large scale of the site whilst also ensuring an efficient and sensitive development of the landholding. The development strategy varies across the site depending on the local context, with the residential areas promoting a walkable and highly amenable residential community.

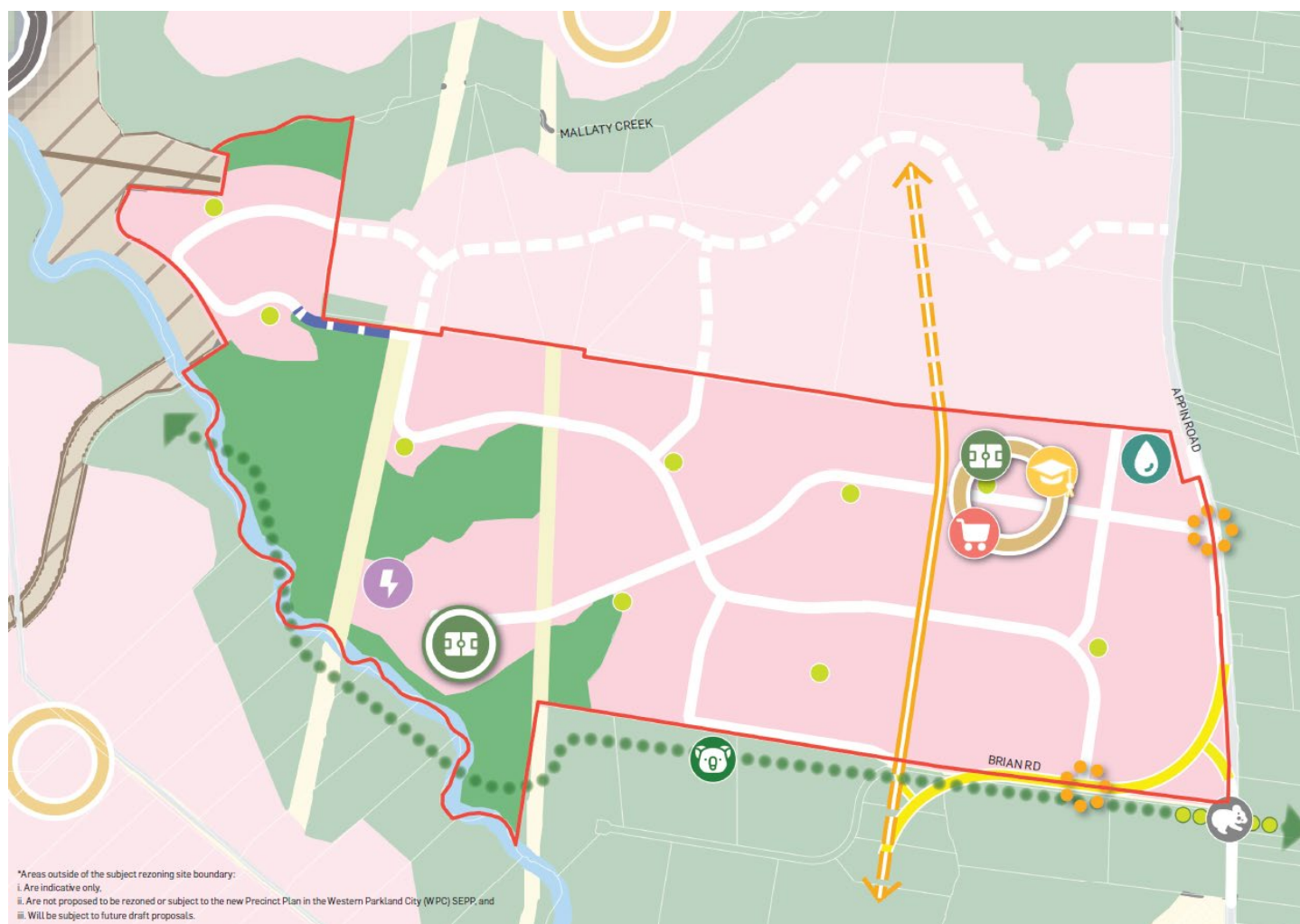


Figure 7 Indicative Structure Plan

LEGEND	
	Site Boundary
	Urban Development Land
	Proposed Local Centre
	Proposed Primary School
	Proposed Retail Centre
	Sports Field
	Active Recreation Cluster
	Local Parks
	Zone Substation
	Reservoir
	Greater Macarthur Transit Corridor
	Key Roads
	East-west Connection
	Indicative Future Roads
	Site Access Points
	Excluded Land (Potential co-location with recreation uses)
	Environmental Conservation Land (CPCP)
	Ousedale Creek Koala Corridor
	Fauna (Koala) Underpass
	Heritage Item - Upper Canal
	Potential Access Road

4.1 LANDSCAPE STRATEGY

In collaboration with the Draft Structure Plan, Urbis has also prepared a Draft Landscape Strategy, illustrated in **Figure 8** overleaf.

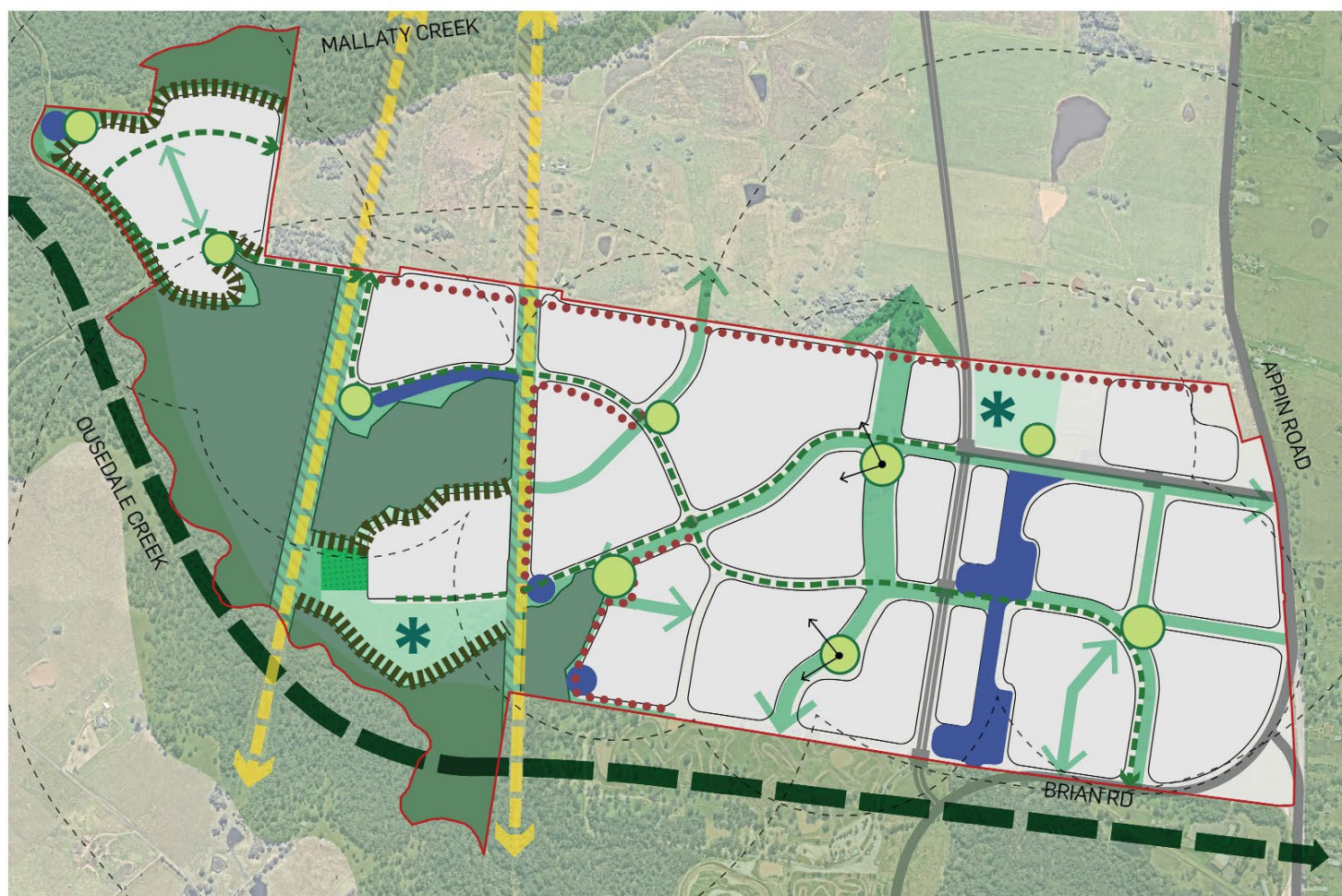
With consideration to the overall landscape character and open space demand identified in the, Social Infrastructure Assessment, a draft Landscape Strategy has been designed for the precinct which celebrates and responds to the existing site topography, protects environmental qualities and koala corridors, and promotes active lifestyles.

The Social Infrastructure Assessment, in line with DPE requirements, has identified a standard 2.83ha of open space per 1,000 people, which includes 1.37ha of active open space per 1,000 people. In effect, the Planning Proposal indicatively includes 25.47ha of open space, which includes 12.33ha of active open space, leaving approximately 52% as passive open space across an extensive network of connected open space that conserves and reflects the landscape character and biodiversity of the precinct.

Overall, the landscape strategy indicatively comprises of:

- 13.14ha of passive open space.
- 12.33ha of active open space/playing fields.
- A green network which provides additional green spaces and tree canopy cover

The Draft Landscape Strategy does not specify targets for urban tree canopy cover, but will guide the next design phase to utilise design measures that can achieve a minimum 40% tree canopy.



Landscape Strategy

PUBLIC OPEN SPACE

Public parks, facilities, urban and street spaces will be well designed, scaled and located to respond to the community's needs and expectations.

Sporting fields



Two sporting fields are proposed, one co-located with the primary school and the other to the south-west at the interface with CPCP land. They are connected by a series of linear open spaces and exist within a considered landscape setting. Facilities should not be single use, and the usage is maximised throughout the year.

Green Connection



The site will be equipped with green connections among open spaces and key destinations offering active transport, walking and shading to the residents, subject to further investigation.

Local Parks



Local parks provided across the site. They provide gathering and recreation spaces for the community.

Bushland



Access to CPCP bushland is provided via series of linear open space connections and perimeter roads.

TREE CANOPY

Street trees provide shading and effectively mitigate the urban heat island.

The Structure Plan is capable of delivering effective tree canopy coverage via street trees together with trees in yards and setback zones. Provisions for tree canopy coverage will be addressed in a future site specific DCP.

TOPOGRAPHY

The development is carefully designed to enhance and leverage the existing topography.

View Points and Outlooks



Local vantage points within the open spaces function as view points and provide outlooks to connect the people to the land

Stormwater Detention Basins



Stormwater basins are proposed across the site. Where possible, human connection to these spaces should be allowed in the form of boardwalks, lookouts etc. Water Sensitive Urban Design will be consolidated into the design of these basins.

NATURAL ENVIRONMENT

The existing natural environment is respected and protected as much as possible. New open spaces will be framed around existing significant trees clusters and creek tributaries. This also includes the protection of koala movement corridors.

Open Space



Approximately 56 ha of existing vegetated lands identified by CPCP will be retained and protected.

Asset Protection Zone



Buffer landscapes should not be devoid of vegetation, and RFS standards for asset protection zones make significant allowances for canopy trees in particular. Buffer areas may be utilised as productive landscape spaces so long as they not capable of carrying bushfire. In practise, this will often result in a parklike setting with scattered canopy trees, almost no shrub layer and ground cover that can be maintained to low heights. The buffers can also contain roads, recreational, drainage and services infrastructure and should form a multipurpose space.

An assessment of bushfire risk has been undertaken by Blackash and indicative bushland-urban interface areas are illustrated in following pages.

Bushfire Emergency Access / Egress



A perimeter road is introduced along the northern boundary and retained bushland as a potential bushfire hazard mitigation method.

Ousedale Creek Koala Movement Corridor



The Koala corridor will be retained by the conservation of CPCP lands. Appropriate buffers are to be established surrounding these zones to increase the protection and maximise the opportunity for success of community growth.

Easements



The two easement corridors could be used as pollinator and wildlife corridors. Dense low level planting should be utilised where trees are limited. Integration of walking paths and activity nodes should be considered. Activities that are not ideal adjacent to residential development such as skate parks, bike tracks etc would be suitable in easement landscapes. Easements may be utilised for productive low level landscapes.

PRIVATE OPEN SPACE

Private open space provisions to be addressed in a future site specific DCP.

Figure 8 Landscape Strategy

4.2 PLACE STRATEGY

Alongside the Draft Landscape Strategy, Urbis has prepared a Draft Place Strategy which further outlines the indicative provision of community gathering and green spaces, illustrated in **Figure 10**. The Draft SP, Draft Landscape Strategy, and the Draft Place Strategy collectively offer generous green spaces and street trees that provide shade and reduce the urban heat island effect.

The Draft Place Strategy is underpinned by the principles of accessibility and walkability. To ensure that individuals have access to green spaces, all Local Parks are within a 5–10 minute walk of residential development.



PUBLIC DOMAIN The Structure Plan envisages an active, safe, accessible and inclusive public domain comprising active main streets, community facilities and open spaces that provide for a range of recreational activities. Community Gathering Spaces - Local Park - Local Centre - Sporting fields The Structure Plan proposes a number of local parks plus two sporting fields across the site. The parks are located to all the residents are within a 5-10 minute walk from home. A community centre is to be incorporated in the new local centre. These facilities provide places for people to interact and gather.	HERITAGE AND CULTURE The Structure Plan will not impact any heritage item within or in the vicinity of the subject site. WaterNSW Upper Canal There are no heritage items within the site area. However, WaterNSW Upper Canal, which runs just outside of the western site boundary is recognised to have significant heritage value. The Structure Plan provides an opportunity to connect the residents to the canal via the preserved CPCP land. This provides both cultural and recreational value to the community. COMFORT AND SAFETY Residents will have access to places that are safe and high-quality. Activation and passive-surveillance are provided across the precinct, and streets offer ample and safe space for pedestrians, cyclists and drivers. Green Spaces The Structure Plan offers generous green spaces and street trees that provide for shade and reduce urban heat island effect.	LOCAL POPULATION Support population growth by delivering approximately 3,000 new homes to the North Appin Precinct. LOCAL ECONOMY Housing, amenities, infrastructure and services are proposed to support the growing community and boost local economy. Local Centre A local centre is proposed at the heart of the neighbourhood along the new Transport Corridor. It to accommodate various functions including retail, health, and services and also create employment opportunities for the community. Greater Macarthur 2040 Transport Corridor This corridor provides public transport, active transport and pedestrian connection to/from other regional key destinations, and it is a key enabling infrastructure to unlock further development potential of the site.
--	---	---

Figure 9 Place Strategy
Report prepared for IPG

28/06/2023

4.3 ANTICIPATED TREE CANOPY

Based on the indicative distribution of uses as outlined in the Draft SP, Draft Landscape Strategy, and the Draft Place Strategy prepared by Urbis, it is anticipated the Draft SP is capable of achieving approximately **44.2% tree canopy coverage**.

This indicative tree canopy coverage will be reassessed during the detailed design phase with consideration of recommended urban heat mitigation design initiatives from this report.

Use	Indicative Area (HA)	Tree Canopy Assumption	Indicative Tree Canopy (HA)
Residential	120.03	19.28%*	19.93
Local Centre	2.36	20%	0.47
Educational Establishment	2.36	40%	0.94
Roads	66.85	50%	33.42
Substation	1.19	5%	0.05
Reservoir	0.95	0%	0
Employment Land	2.36	20%	0.4
Active Open Space	12.33	20%	3.63
Passive Open Space	13.14	60%	1.00
Easements	11.55	0%	0
Other park (non creditable)	2.02	80%	1.61
Drainage basins/ Riparian corridors	9.79	70%	2.93
CPCP land	55.83	100%	55.83
Total Precinct Area	300.76	44.2%	133.1

**assumption is based on an aggregation of low and medium density residential*

ASSUMPTIONS

Residential Land

To anticipate the potential tree canopy and permeability of residential development within the precinct, an assessment has been undertaken of the relevant provisions of the Greenfield Housing Code incorporated in *State Environmental Planning Policy (Exempt and Complying Development Codes) 2008* for residential dwellings as this is the likely planning pathway for the redevelopment of the site.

Lot Size	Lot area	Maximum GFA	Minimum Open Space
Attached -Semi detached / Rear (150 – 350sqm)	200m ² –250m ²	78% of lot area	44sqm to 55sqm
	>250m ² –300m ²	75% of lot area	62.5sqm to 75sqm
	>300m ² –350m ²	235m ²	65sqm to 115sqm
Detached (350 – 450sqm)	>350m ² –450m ²	25% of lot area + 150m ²	112.5sqm to 187.5sqm
Detached Large (450 – 600sqm)	>450m ² –560m ²	290m ²	160sqm to 270sqm
	>560m ² –600m ²	25% of lot area + 150m ²	270sqm to 300sqm

Based on minimum open space and the inclusion of driveways/pathways etc, an assumption of 20% tree canopy has been used as a minimum for low density residential land and 15% tree canopy for medium density land. This assumption ensures that the Precinct is not relying on private development to maintain tree canopy within the Precinct, with reliance focused on the public domain, streetscape and public parks.

ASSUMPTIONS

Educational Establishment

Schools Infrastructure NSW have prepared *Guidelines for School Site Selection and Development* (October 2020) which identifies metrics which are used by the State government in identifying school sizes and capacity. The urban design guidelines for site selection require 10sqm of open space per student based on maximum school enrolments for new schools.

The current Social Infrastructure Assessment prepared by Urbis anticipates the future educational establishment will have a demand of approximately 1,003 primary school aged students, requiring 2ha at a minimum. Based on the above metrics, approximately 50% of the identified school site (0.75ha) will be used as open space. To allow for pathways and other outdoor facilities, an assumption of 40% tree canopy is assumed for the school site.

Local Centre and Employment Land

The Draft Structure Plan and Urban Design Report identify the location of the proposed Local Centre on the future transit corridor in the centre of the Site. At this stage, the area of open and green space to be provided in the Local Centre have not been determined.

Based on the above, an assumption of 20% tree canopy has been used for the Local Centre. However, it should be noted that this assumption is based on the minimum potential scenario, and it is recommended that tree canopy cover of 30-35% would be feasible and provide significant urban heat reduction.

Roads

An indicative road network has been prepared by Urbis as part of the Draft Structure Plan for the Site. The standard road sections have not been determined at this Planning Proposal stage. Street trees located in road reserves can provide a significant contribution to the overall tree canopy in a precinct and mitigate the urban heat effects by providing shade over road surfaces and increase comfort for walkability. It is recommended that a minimum tree canopy of 50% for roads should be designed to facilitate a minimum average of 40% tree canopy across the precinct.

Playing Fields

While trees will not be located within playing fields, it is anticipated some tree coverage will be provided surrounding playing fields to provide shelter for spectators and the like. As such, an assumption of 20% is anticipated for playing fields.

Drainage Basins/ Riparian Corridors

The Draft Structure Plan proposes a water management system that is integrated with the open space network. Indicatively, there are seven (7) basins proposed across the Precinct, with five (5) integrated with the riparian corridor. Given the high level of integration with the open space and riparian network, a 70% rate of tree canopy has been associated with drainage basins and retained vegetation in riparian corridors for the Precinct.



Figure 11 Indicative design for Sporting Fields

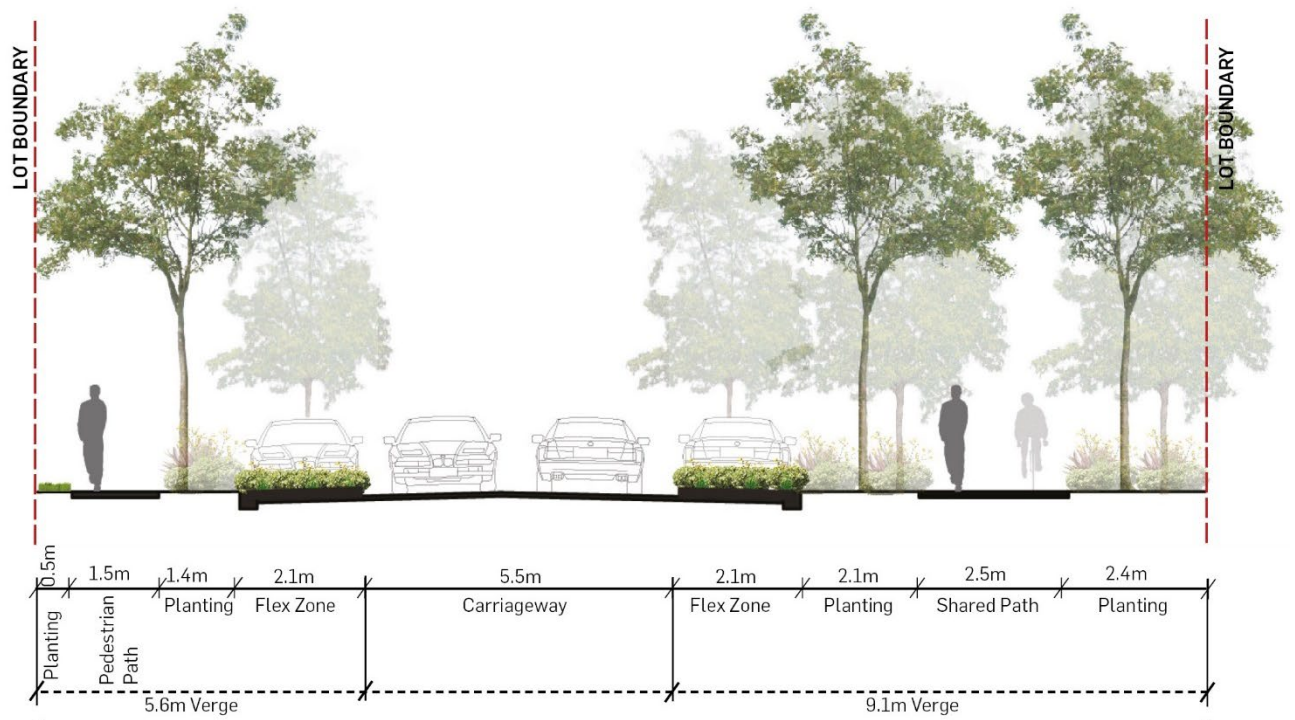


Figure 12 Example of a recommended typical street section (20.2 metres wide) with flex zones for parking and planting

5. POTENTIAL MEASURES TO ADDRESS URBAN HEAT

Local planning provisions are important mechanisms to influence built environment outcomes, and improved controls have the potential to reduce the impacts of urban heat. But this is also a new and complex space.

To inform the recommendations provided in this report, Urbis refers to the WSROC Urban Heat Planning Toolkit and Cool Suburbs tool to identify best-practice approaches which can be implemented into the overall design of the Site.

COOL SUBURBS TOOL

The Cool Suburbs Tool (CST) is a voluntary, industry-based performance (ratings) tool prepared by WSROC in 2022 for place-based heat resilience. The CST has been designed for use by both developers and government, with the goal of supporting improved heat-mitigation outcomes. Whilst Wollondilly Shire Council is not included within the WSROC organisation, the potential measures to address urban heat are based on the CST due to it being recognised as best practice in the industry.

The CST is intended to inform and guide planning and development decisions by providing a synthesis of urban heat science in an easy-to-use platform.

The CST's objectives include:

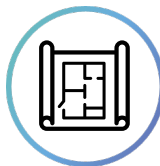
- Setting out a broad range of measures (represented by credits in the CST) that guide improved place-based urban heat resilience.
- Identifying specific measures that should be considered at different stages of the development process; supporting the Tool's use in early stages of planning and design.
- Scoring (via a rating system) the urban heat resilience of a range of developments from precinct to lot scale.
- Providing guidance for the assessment of urban heat resilience in existing, transforming, and new suburbs.

The following measures to address urban heat have been based on the design elements outlined in the Cool Suburbs Toolkit.

5.1 GREEN INFRASTRUCTURE

		Performance Measure	Recommendation
Green Cover 	Greater green cover such as tree canopy and vegetation has shown to have a major impact on urban heat by increasing evapotranspiration and shading adjacent surfaces.	▪ Increase the amount of green cover including green spaces/parks and mature trees ▪ Retain existing trees where possible ▪ Increase tree canopy within the public domain ▪ Hardscaping elements are shaded by overhanging vegetation	The current Draft SP has incorporated a range of green open spaces Additional controls regarding the retention of existing trees are recommended.
Permeable and cooling surfaces 	Roads and non-permeable surfaces have been identified as major heat sources in urban areas.	▪ Incorporate cool and permeable paving rather than impervious heat absorbing surfaces ▪ Consider the use of light-colored road surfaces to reduce the ambient road temperature	Measures are recommended to encourage permeable and cool paving.
Water Sensitive Urban Design 	Urban heat mitigation starts with retaining water in the landscape.	▪ Incorporate green infrastructure such as passive irrigation systems, stormwater wetlands and rain gardens which provide a high level of water retention	Incorporate WSUD methods into the Site.
Heat Resilient Social Infrastructure 	Residents vulnerable to extreme heat include the elderly, people living with disability or chronic illnesses, and young children who do not have access to air conditioning.	▪ Provide a network of Council and community-run venues and associated services to support residents during a significant heatwave event such as heat refuges, covered bus shelters, as well as water bubblers and water play	The Final Structure Plan, Landscape Strategy and Place Strategy are recommended to consider heat resilient social infrastructure
Evaporative Cooling 	Evaporative cooling measures have been identified as integral to reducing ambient temperatures in urban areas.	▪ Implement evaporative cooling measures in key 'cool zones' including active evaporative cooling features such as misting fans and water fountains. ▪ Provide vegetation with sufficient water in hot weather, so that evapotranspiration can work to reduce heat	Encourage water retention – e.g. passively watered street trees. Ensure the provision of evaporative cooling measures in public spaces.

5.2 DESIGN MEASURES

		Performance Measure	Recommendation
Roof colour and surfaces 	The concentration of many houses with dark roof colours not only contributes to increased urban heat but they can also increase the temperature inside the individual houses.	▪ Roof colour selected for new developments should avoid dark colours in order to not attract and store heat ▪ Implementing vegetated areas on the roof of buildings to increase biodiversity and reduce urban heat	Introduce controls relating to building design and materials. Introduce minimum requirements for green roof coverage and landscaped elements on top of non-residential buildings.
Solar Control Systems (Shading) 	Outdoor shading is useful in reducing both ambient air temperature and surface temperature.	▪ Outdoor shading structures at parks and outdoor recreational facilities should be used where tree canopy cannot provide cover. ▪ Utilise large civic-scaled trees over numerous small trees to maximise canopy cover and habitat resources	Ensure shading is encouraged. Encourage the use of larger tree species over numerous smaller trees
Orientation 	Prevailing winds and sun direction/exposure should be considered when developing building designs and street orientation.	▪ Encourage building and open-space design which takes advantage of prevailing winds, natural ventilation, and solar access	Introduce controls relating to building design, materiality and orientation
Thermally Safe Housing 	Achieving cool homes is an essential element in mitigating the impacts of urban heat. Houses are a refuge during extreme weather, therefore houses must be able to maintain safe temperatures without the need for air-conditioning or heating (passive thermal performance).	▪ Encourage building design which takes advantage of prevailing winds, natural ventilation, and solar access	While BASIX, and the SB SEPP from 1 October 2023, will prevail for all residential and non-residential development, additional controls relating to building design and materials should also be encouraged.

5.3 LOW CARBON PRECINCTS

Reducing energy use in building



Building more energy efficient housing and buildings is imperative for mitigating the effects of urban heat on the population. This also important for thermally safe housing

Performance Measure

- Incorporate maximum efficiency appliances
- Minimal glazing on the eastern and western access to minimise summer heat entry
- High thermal mass materials used on the inside of buildings to absorb winter solar gain and stabilise internal temperature
- High insulation value to roof and walls to minimise uncontrolled heat loss/gain

Recommendation

Introduce controls relating to building design and materials for non-residential development.

Increasing renewable electricity generation



Reducing our reliance on fossils fuels is imperative if we want to reduce the effects of climate change.

- Incorporate on-site renewable energy systems and battery storage
- Minimum standards for solar panel installation. i.e. mandating minimum area to include solar panels on building rooftops

Introduce controls relating to on-site renewable energy generation and storage.

Reducing transport emissions



Transport contributes to a significant amount of carbon emissions in Australia. It also contributes to air pollution levels, especially in urban areas

- Encourage active and public transport use
- Encourage EV vehicle usage through introducing EV charging on and off-street
- Minimum requirement for 25% of off-street on-site parking supply is for shared, pooled, or common use parking.

The Draft SP, Landscape Strategy and Place Strategy have been designed to provide a walkable community. Ensure that public facilities can be used during high heat events.

6. RECOMMENDATIONS

The UHI effect is a pressing issue for new developments in South-Western Sydney and will continue to increase unless suitable mitigation measures are incorporated into new developments. Wollondilly Shire Council, NSW Department of Planning and Environment, and the Greater Cities Commission have identified urban heat as a significant area of concern and encourage the development of strategies which reduce the UHI effect.

The *Wollondilly Local Strategic Planning Statement* and *Local Housing Strategy* also include priorities to ensure future development within Appin addresses urban heat:

- Delivering an urban tree canopy;
- Contributing to the broader resilience of Greater Sydney;
- Maximise connectivity and accessibility to riparian corridors; and
- Build sustainable and resilient communities that protect and celebrate our environment.

To achieve effective urban environment and building design responses to urban heat and the urban heat island effect, the following recommendations are suggested:

- **Incorporate urban design measures into the Final Structure Plan to mitigate urban heat, as recommended in Section 5.**
- **Introduce local provisions that will facilitate urban heat mitigation into detailed design outcomes that are to be considered during development assessment.**
- **Include measures in the site-specific DCP that address urban heat, with a particular focus on the street network and public domain.**
- **Introduce additional controls in site-specific DCP that promote circular design outcomes, use of innovative materials during construction to mitigate urban heat effects from roads and buildings, construction of sustainable and resilient buildings through building design and material choice, and measures to reduce the consumption of resources.**

7. CONCLUSION

This Urban Heat Report has been prepared to support the rezoning of the land at 345 Appin Road, Appin within the Greater Macarthur Growth Area, part of the North Appin Precinct. The site is identified as a strategic location for urban development.

This report has assessed the current Planning Proposal package to identify how the current Draft Structure Plan has addressed the effects of urban heat and to recommend measures which should be considered during the next phases of design and development.

Having considered all relevant matters, the proposal represents a sound outcome that fulfils the vision to develop the Site into a high-quality master planned community in South-Western Sydney that can be suitably designed to mitigate urban heat island effects.

