PART B: Site planning controls

Section B6 Urban heat

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1.0 Introduction

Urban heat refers to the higher temperatures experienced in urban areas. Little vegetation or evaporation, and increased impermeable vertical and horizonal surfaces cause urban areas to be warmer than surrounding rural and natural areas. This is further exacerbated in inland areas that can be up to 5% warmer than coastal areas.

Changes in land-use patterns influence micro-climates. This is especially true for the areas where increased horizontal impermeable surfaces such as concrete and asphalt can absorb solar radiation and reduce heat reflectivity. Similarly, increased hard vertical surfaces such as building facades and roofs can reflect heat to surrounds and to the city below. Increased prevalence of air conditioning system outlets on the sides of buildings further increases temperatures and exacerbates UHI micro-climates.

Along with regional climate influences, the degree of micro-climate fluctuation is dependent on a range of factors including green space and urban forest coverage. Green infrastructure can play a key role in mitigating the urban heat island effect to create cooler spaces, reduce demand for electricity, insulate buildings, support water absorption and control air movement. Green infrastructure has myriad benefits for ecosystems, soil, air, and water health, community health and wellbeing, and the economy.

The urban forest comprises trees, shrubs, plants, and other vegetation in the city on public and private land. The urban forest includes vegetation in and along streets, parks, gardens, activity centres, waterways, wetlands, coastal areas, car parks community gardens, and green built fabric such as green walls and roofs. There are other requirements in DCP 2023 relevant to meeting urban heat objectives. These are in relation to landscape areas (including deep soil areas), trees (including tree protection, compensatory trees and requirements for new trees and water sensitive urban design.

The National Construction Code and State policies regulate key aspects of building design.

Homes that adopt passive design minimise their impact on their surrounding environment by reducing energy requirements in heating and cooling and by minimising their contribution to the external environment through excess heat loss/ heat production generated by mechanical cooling systems (the exhaust from an air-conditioner unit).

High passive thermal performance of buildings with reduced reliance on air conditioning to maintain comfortable and safe indoor conditions is the desired outcome for all buildings.

2.0 Application

This section applies to all development.

For development involving heritage items or heritage conservation areas identified under *Newcastle Local Environmental Plan 2012* (LEP 2012), a merit assessment will be required to ensure the outcomes sought are balanced with heritage conservation outcomes.

3.0 Related sections

The following sections will also apply to development:

- C3 Vegetation preservation and care
- C4 Stormwater
- C12 Open Space and landscaping

4.0 Objectives

1. Design built form, including public and private open spaces, with measures that reduce the impact of high to extreme heat stress days on residents, workers and visitors.
2. Reduce and mitigate the contribution of built development to urban heat, through passive design and nature-based solutions.
3. Mitigate urban heat to facilitate a high level of comfort throughout the year, with improved outcomes on hot days and the summer period.
4. Encourage landscaping and shading that supports urban heat resilience.

5.0 Definitions

A word or expression has the same meaning as it has in the LEP 2012, unless otherwise defined. Other words and expressions include:

- **Albedo -** is the fraction of solar radiation reflected from a material's surface.
- **Green infrastructure** – is the network of green spaces including built fabric and urban forest. It supports sustainable communities and is strategically planned, designed and managed to support a good quality of life in the urban environment.
- **Heat rejection unit** – is a mechanical cooling unit or system that rejects excess heat when the cooling unit or system heat load is reached.
- **Hot days** - Defined by the Climate Council as days between 30°C and 35°C.
- **Maximum external solar reflectance** – is the maximum allowable percentage of solar reflectance for the external face of a Reflective Surface. The percentage of solar reflectance is to be measured at a normal angle of incidence.
- **Non-reflective surfaces** – are those surfaces that diffusely reflect light and heat and have surfaces that have specular normal reflection of less than 5%.
- **Reflective surface ratio (RSR)** – is the ratio of reflective to non-reflective external surface on any given facade. Reflective surfaces are those surfaces that directly reflect light and heat and have surfaces that have specular normal reflection of greater than 5% and includes, but is not limited to, glazing, glass faced spandrel panel, some metal finishes and high gloss finishes.
  Note – RSR is to be expressed as a percentage between 1 and 100.
- **Reflective surfaces** – are those surfaces that directly reflect light and heat and have surfaces that have specular normal reflection of greater than 5% and includes glazing, glass faced spandrel panel, some metal finishes and high gloss finishes.
- **Solar access** – is the ability of a building to continue to receive direct sunlight without obstruction from other buildings or impediments, not including trees.

- **Solar reflectance index (SRI)** – is a composite measure of a materials ability to reflect solar radiation (solar reflectance) and emit heat which has been absorbed by the material. For example, standard black paint has a SRI value of 5 and a standard white paint has a SRI value of 100.

- **Thermal comfort** - The condition of mind that expresses satisfaction with the thermal environment; i.e. the conditions in which a person feels neither too cold nor too warm.

- **Urban heat** - A general term that refers to high temperatures in urban areas that pose a risk to our communities and infrastructure.

- **Urban heat island effect** - is the tendency of cities to be much warmer than their rural counterparts. Urban surfaces such as roads and roofs absorb, hold, and re-radiate heat; raising the temperature in our urban areas. Human activities such as traffic, industry, and electricity usage also generate heat that adds to the urban heat island effect.

- **Wintergardens** – are balconies that have an additional layer of operable glass, that can be readily enclosed and does not compromise access to daylight.

6.0 Application requirements

Development category	Application requirements	Explanatory notes
All development with an estimated development cost over $1,000,000 within the Newcastle city centre, Wickham, Renewal corridors and Local centres excluding heritage items and contributory buildings in heritage conservation areas, single dwellings, dual occupancies, secondary dwellings and multi-dwelling housing including ancillary development. Refer to 7.0 Cool facades.	A reflectivity modelling report. Further details are provided in **sub-section 7.0** on cool facades.	A report is required to qualify the extent of reflected solar heat radiation. The modelling is to consider all aspects that influence the amount of solar heat reflected at any point in time particularly from vertical surfaces.
Development with a reflective surface ratio (RSR) >30% on vertical facade of street walls. If no street wall, the first 12 metres of facade as measured from the ground level.	Shadow diagrams as part of a reflectivity modelling report are to be submitted with the development application (DA) quantifying the extent of shading at 10am, 11.30am, 1pm, 2.30pm and 4pm on 21 December for each relevant facade. Where it is demonstrated that the RSR is less than 30%, shadow diagrams for 21 December are not required to be submitted with the DA.	In addition to a reflectively model, shadow diagrams are required to consider reducing impacts of urban heat experienced on high to extreme heat stress days. Additional shadow diagrams may be required to demonstrate existing and proposed overshadowing for June 21 at hourly intervals between 9:00am and 3:00pm. See Part D.

7.0 Cool facades within the Newcastle city centre, Wickham, Renewal Corridors and Local Centres

Objectives

1. Reduce the contribution of development to urban heat reflected from facades in the Newcastle city centre, Wickham, Renewal corridors and Local centres
2. Minimise the reflection of solar heat downward from the building facade into private open space and/or the public domain.

Controls (C)	Acceptable solutions (AS)	Explanatory notes
These controls apply to the Newcastle city centre, Wickham, Renewal corridors and Local centres. They do not apply to heritage items and contributory buildings in heritage conservation areas, single dwellings, dual occupancies, secondary dwellings and multi-dwelling housing including ancillary development. C-1.The extent of the vertical facade of street walls or first 12 metres of facade as measured from the ground plane that comprise reflective surfaces must demonstrate a minimum percentage of shading as defined in **Table B6.01.** **Table B6.01: Minimum percentage shading for the street wall or first 12 metres of facade as measured from the ground plane of a building** **Reflective surface ratio (RSR)** | **<30%** | **30%-70%** | **>=70%** Minimum percentage shading (%) | 0 | (1.5RSR)-45 | 75 C-2.Calculation of RSR for each relevant facade must also be submitted with the DA. C-3.Shadows from existing buildings, structures and vegetation are not considered in the calculations. Refer to **Table B6.02** for sun angles corresponding to shading reference times. C-4.Non-reflective surfaces on vertical facades are excluded from the calculations.	AS-1.Shading may be provided by: a. external feature shading with non-reflective surfaces reducing solar radiation reaching the facade and amount reflected back away from ground or absorbed converted by air b. intrinsic features of the building form such as reveals and returns c. shading from vegetation such as green walls that is consistent with the controls in section 8.0.	Reflective surfaces - are surfaces that directly reflect light and heat. For the purpose of this section they are defined as those surfaces that have specular normal reflection of greater than 5% and include glazing, glass faced spandrel panel, some metal finishes and high gloss finishes. Minimum percentage shading - Calculations will be on 21 December on the east facing facade at 10am, northeast and southeast facing facade at 11.30am, north facing facade at 1pm, northwest and southwest facing facade at 2.30pm and the west facing face at 4pm (as shown in Figure B6.01). Refer to Section E1 Built and Landscape Heritage.

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Table B6.02: Shading sun angles		
Orientation of façade	Time	Sun angles
East ± 22.5°	10:00 AEDT	Sun elevation: 51° Sun Azimuth: 86°
Northeast/Southeast ± 22.5°	11:30 AEDT	Sun elevation: 69° Sun Azimuth: 66°
North ± 22.5°	13:00 AEDT	Sun elevation: 80° Sun Azimuth: 352°
Northwest/Southwest ± 22.5°	14:30 AEDT	Sun elevation: 67° Sun Azimuth: 290°
West ± 22.5°	16:00 AEDT	Sun elevation: 48° Sun Azimuth: 272°

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<td>C-5.Where it is demonstrated that shading cannot be achieved in accordance with the above controls, a maximum external solar reflectance as indicated in Table B6.03 is acceptable with greater emphasis on cooling of outdoor spaces.

Table B6.03: Maximum solar reflectance of Reflective Surfaces			
Reflective surface ratio (RSR)	**<30%**	**30%-70%**	**>=70%**
Minimum percentage shading (%)	No max.	62.5-0.75RSR	10

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<td>AS-1.Development takes all reasonable steps to reduce external solar reflectance downward from the building facade into private open space and/or the public domain.

AS-2.Exceed landscaped and deep soil area requirements in C12 Open Space and landscaping. This includes retention of established trees and/or planting of large and medium size trees to reduce urban heat.</td>
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<td>C-6.Where multiple reflective surfaces or convex geometry of reflective surfaces introduce the risk of focusing on solar reflections into public spaces a building must not exceed 1,000W/m^2 in the public domain at any time.</td>
<td>AS-1.A reflectivity modelling report to qualify the extent of reflected solar heat radiation.</td>
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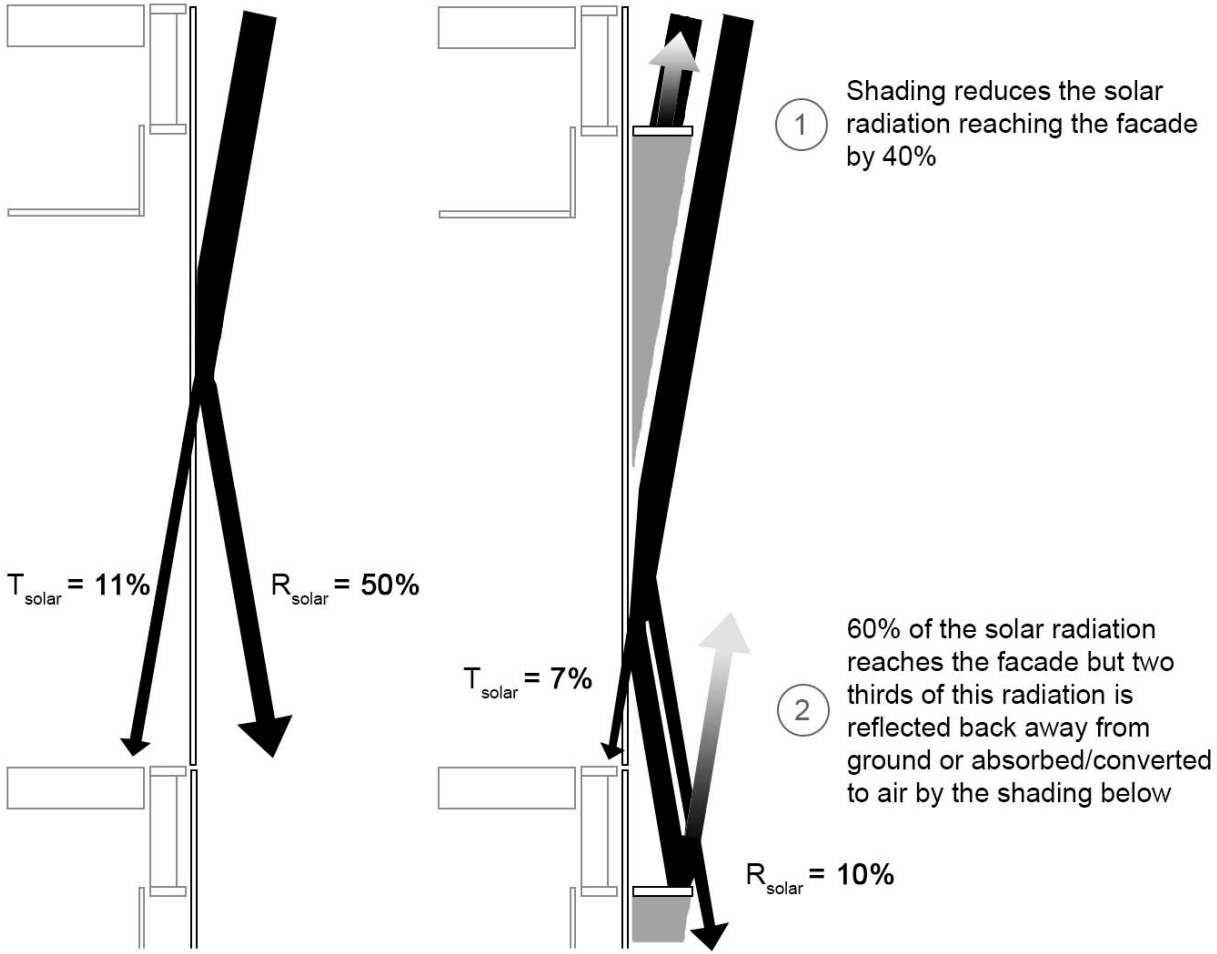

Figure B6.01: How shading reduces solar reflectance. Image courtesy of WSROC Urban Heat Planning Toolkit, 2021

8.0 Cool outdoor spaces

Objectives

1. Create cool outdoor spaces in public and private domain
2. Prioritise cooling of areas with high activity

Controls (C)	Acceptable solutions (AS)	Explanatory notes
C-1.Shade paved surfaces and walls where possible, also considering solar access in the cooler months.	AS-1.Existing mature trees to be retained in position or transplanted where practicable AS-2.Tree species should consider the suitability of the species AS-3.Placement of new trees should also consider their ability to channel breezes if applicable AS-4.Deciduous trees should be used where sunlight is desirable in winter; evergreen trees should be used where year-round shade is preferable. AS-5.Trees should be positioned to provide shade to hard surfaces during the hottest times of the day, particularly pedestrian pathways. AS-6.Where site constraints do not allow for the planting of trees, other shade solutions such as vegetation covered pergolas and light-coloured artificial shade structures should be considered.	
C-2.Consider cool or permeable paving.	AS-1.Use cool paving, with high albedo (high solar reflectance) and/or high thermal emittance (which releases heat quickly). AS-2.Use permeable paving, either to promote deep soil infiltration or with near-surface water storage.	

9.0 Cool homes - Passive design measures to reduce urban heat

Objectives

1. Buildings minimise mechanical cooling and heating demand indoors and heat absorbance through orientation, the design of roofs, facades, walls and window treatments, materials and finishes.
2. Encourage developments to incorporate green infrastructure, water and cool materials to reduce urban heat.

Controls (C)	Acceptable solutions (AS)	Explanatory notes
C-1.Development uses passive design measures to reduce reliance on energy for cooling (and heating).	AS-1.Orientate buildings to take advantage of prevailing winds, natural ventilation, and solar access. AS-2.Provide western and northern facades with adjustable external shading devices to shield the building from hot summer sun, while allowing direct sunlight in winter. AS-3.Low heat conductive materials, appropriate insulation, wider eaves on northern and western facades are used to reduce passive internal heating of the building. AS-4.Light coloured materials for walls/vertical surfaces, but preferably only where heat can be absorbed by surrounding vegetation. AS-5.Vegetated or high reflective surfaces and high emittance materials for roofing to generate lower temperatures (at night) compared to dark roofing material.	A DA is to include evidence to demonstrate how urban heat management will be addressed. All DAs are to incorporate passive design measures to reduce reliance on mechanical cooling and heating. For residential buildings, thermal performance and energy efficiency standards are set within BASIX. Because a large proportion of buildings' energy use is linked to heating and cooling, improved building design for thermal performance (e.g. insulation, natural ventilation, appropriate level of glazing) could play an important role. Therefore, all new dwellings are encouraged to include passive design measures to minimise urban heat and support thermal comfort. Heritage places can play a key role in climate adaptation and mitigation. The retention and adaptive re-use of heritage buildings can help minimise a site's carbon footprint and curtail climate change by limiting the loss of embodied energy associated with demolition and the manufacture, transport, and installation of construction materials. It often takes fewer resources, and generates less waste, to adapt an existing structure than to construct a new one.

10.0 Cool outdoor spaces - Heat emitted from HVAC systems

Objectives

1. Reduce the impact of heat emitted from heating, ventilation and cooling systems from contributing to urban heat.
2. Avoid or minimise the impact from heating, ventilation and cooling systems on user comfort in private/communal open spaces onto surrounding properties, and in the public domain.

Controls (C)	Acceptable solutions (AS)	Explanatory notes
C-1.Heat rejection units are not to be located on a street wall frontage for all development.		
C-2.Heat rejection units do not reject heat onto public and private outdoor recreation spaces, windows of adjoining properties and hard surfaces that may retain heat including paths, balconies and courtyards.		Where it cannot be demonstrated that heat rejection cannot be achieved without venting into these spaces, this area must be excluded from any calculation of private and communal open space.
C-3.Residential apartments within a mixed-use development or residential flat building, and non-residential development must incorporate efficient heating, ventilation and cooling systems (HVAC) which reject heat from a centralised source.	AS-1.The location of centralised heat rejection for buildings is from the roof. AS-2.For residential apartments within a mixed-use development or residential flat building with more than eight residential storeys, and where it can be demonstrated that a rooftop location is not practical, the centralised heat rejection can be in dedicated on-floor plant rooms sufficiently sized to provide efficient heat rejection and suitably screened to reduce visual and noise impacts.	
C-4.Where a mixed-use development or residential flat building proposes wintergardens as the primary private open space, no heat rejection source from heating, ventilation and cooling systems are permitted in the wintergarden.		Where it cannot be demonstrated that heat rejection cannot be achieved without venting into these spaces, this area must be excluded from any calculation of private and communal open space.