ESD Concept Design Report

Taree Police Station

ESD SERVICES

JHA

CONSULTING ENGINEERS

DOCUMENT CONTROL SHEET

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1. EXECUTIVE SUMMARY

This Ecologically Sustainable Design (ESD) Concept Design Report identifies the key ESD initiatives that could be included for the proposed Taree Police Station located on Albert Street, Taree NSW 2430. This report investigates the high level ESD opportunities applicable at concept design stage. This report identifies a number of sustainability opportunities available that would provide on-going energy & water savings as well as provide a healthier and more productive environment for future occupants.

Opportunities are grouped into the following ESD categories:

Climate Specific Opportunities

A comprehensive assessment of the site's climate is conducted to determine temperature patterns, precipitation, wind, solar paths and humidity. High level recommendations for glazing, wall insulation and shading are included within the report. A NCC Section J report using JV3 verification method is recommended to optimise the thermal specifications of the building fabrics.

Indoor Environmental Quality, Health & Wellbeing

The report strongly recommends the use of low VOC paints, coatings, adhesives, sealants, flooring, and composite wood products that are used indoors.

The report also suggests that due to the climate zone and use of the building, the urban heat island effect should be a primary concern. Efforts to mitigate this phenomenon result in cost savings for indoor climate control, increased occupant comfort, and is an overall contribution to social responsibility and environmental stewardship. Strategies addressed include the use of reflective roofing materials, and both natural and man-made shade structures.

Energy

The energy performance of the building services will impact on the building's ability to achieve a 4.5 star NABERS rating.

Options covered to reduce the electricity load include the use of solar preheat for domestic hot water, heat recovery air conditioning, photovoltaic panels, LED lighting and specialised controls, and meter monitoring. The section concludes that solar preheat, LED lighting and controls, and a metering and energy management strategy are the most viable strategies applicable to this project.

Water

The report strongly encourages the use of fixtures such as taps, showers, water closets and urinals that have high star ratings through the Australian government's Water Efficiency Labelling Scheme (WELS). Such fixtures do not require increased initial costs and generate savings during the operational phase of the project. The use of 4 Star WELS-rated Taps, Water Closets and Urinals will be considered. The use of 3 Star WELS-rated showers will also be considered.

As project phasing progresses, the above existing options can be explored in more detail. In addition, new options can be addressed during the appropriate stage when more information is available, such as interior fit-out.

2. INTRODUCTION

JHA has been engaged to provide ESD consultancy service for the proposed Taree Police Station located on Albert Street, Taree NSW 2430. JHA is a member of the Green Building Council of Australia and has accreditation in:

- National House Energy Rating Scheme (NatHERS) / Association of Building Sustainability Assessors (ABSA) – ABSA Accreditation;
- Green Building Council Australia (GBCA) – Green Star Accredited Professional;
- National Australian Built Environment Rating System (NABERS) – NABERS Accreditation; and
- Commercial Building Disclosure (CBD) Program – CBD Accreditation.

This Ecologically Sustainable Design (ESD) Concept Design Report identifies the key ESD initiatives that could be included in the proposed new police station. The Police Station is committed to maintaining a focus on sustainability throughout the phases of design, construction and operation/occupancy.

The report is a holistic and dynamic document which provides an assessment of applicable ESD strategies that all stakeholders can review JHA's considerations and provide feedback for further discussion and review.

The report identifies a number of sustainability opportunities available that would provide on-going energy & water savings as well as provide a healthier and more productive environment for future occupants.

Out of the vast array of ESD initiatives that currently exist, the report identifies the ESD initiatives applicable at concept design stage. In addition, the report acknowledges that this stage of the project is the best time to review these strategies by respective disciplines to investigate feasibility, applicability and cost information over the lifecycle of the project.

The report was also undertaken to identify opportunities for architects in order to deliver a low energy architectural solution. The report aims to aid in environmental decision making for architectural design by exploring climate responsive design strategies.

3. PROJECT INFORMATION

The proposed development consists of a new two storey building. The subject site for the proposed development is located at 83 Albert Street, Taree NSW 2430.

Figure 1 – Site Location

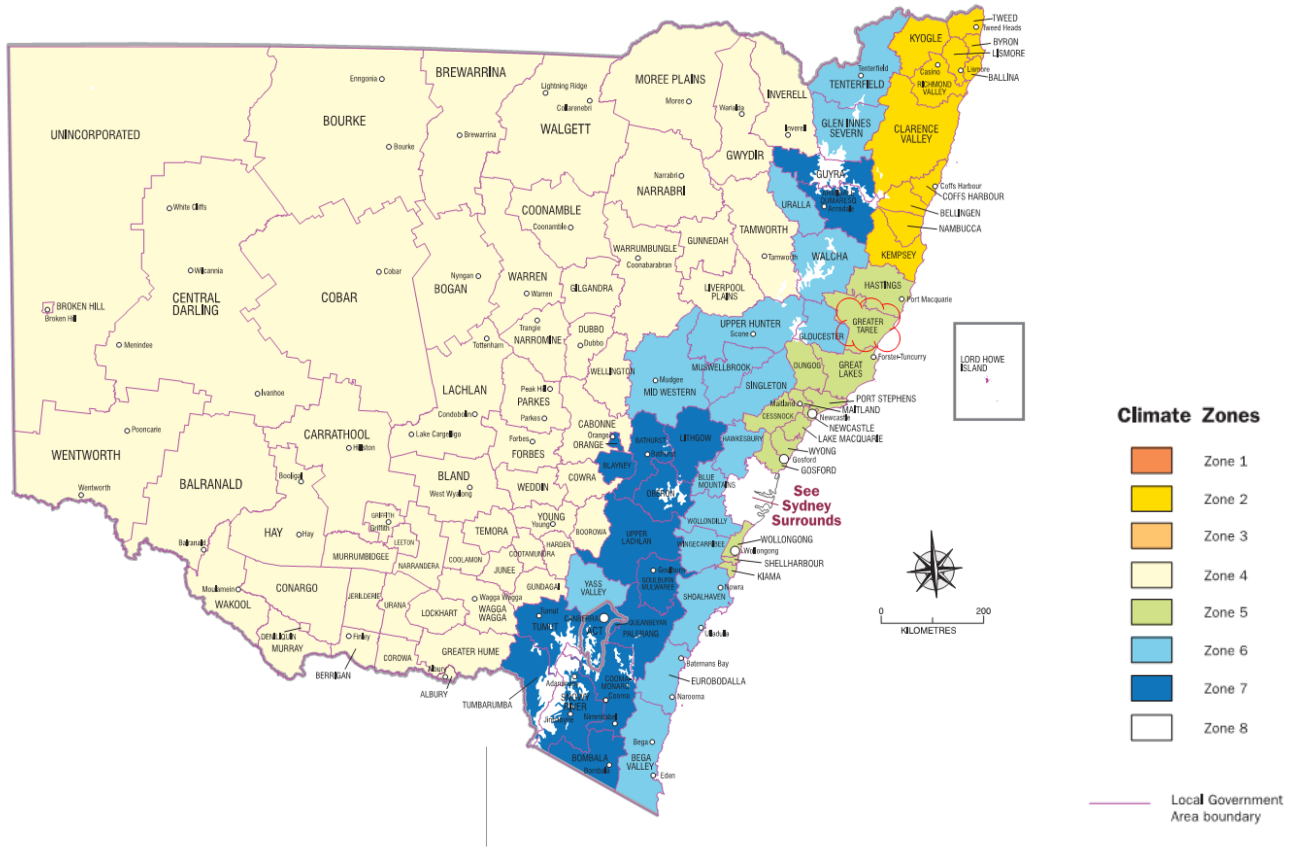
4. CLIMATE SPECIFIC OPPORTUNITIES

4.1 SITE AND CLIMATE

Taree is a town on the Mid North Coast, New South Wales, Australia and is the centre of a significant agricultural district. It is 16 km from the Tasman Sea coast, and 317 km north of Sydney. Taree can be reached by train via the North Coast Railway, and by the Pacific Highway.

4.1.1 BCA CLIMATE ZONE

The site is located within Climate Zone 5 as defined by the National Construction Code (NCC / BCA).



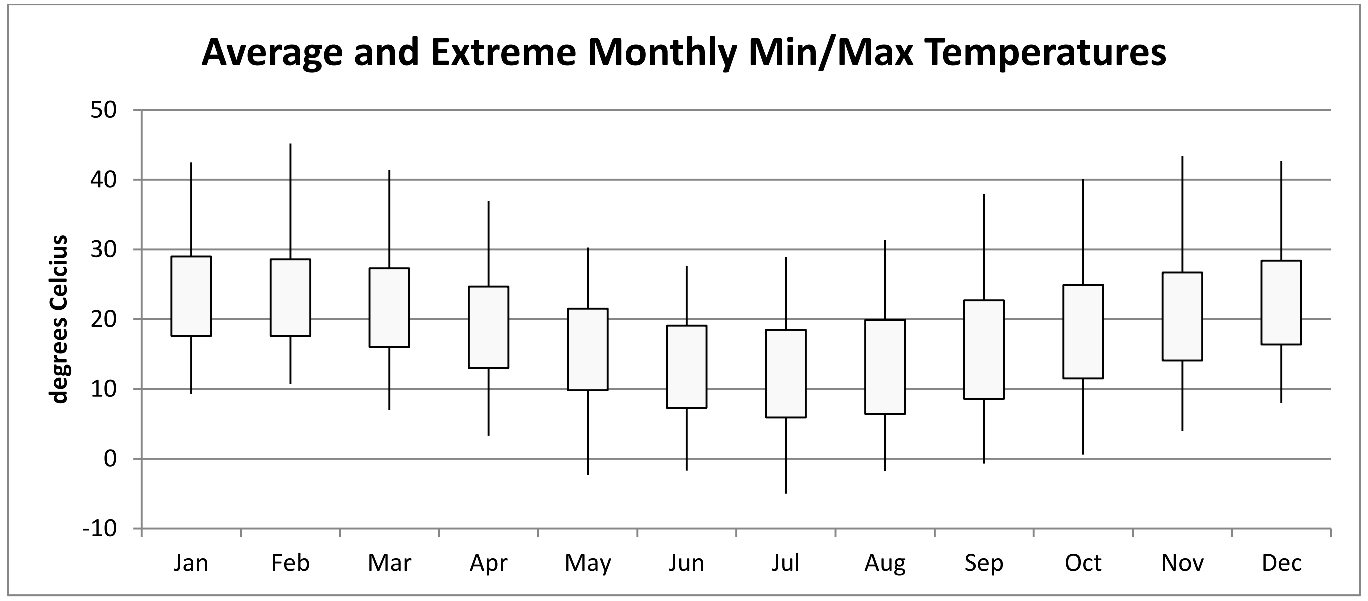
BCA Climate Zones for Sydney Urban Zones

This climate zone is described as a warm temperature zone.

4.1.2 CLIMATE ANALYSIS

Climatic analysis of a location allows feasibility assessment for the passive design strategies. A detailed assessment of the Bureau of Meteorology's long term Climate and Weather data for Taree is conducted to derive effective design strategies for proposed site.

Monthly Min/Max Temperatures

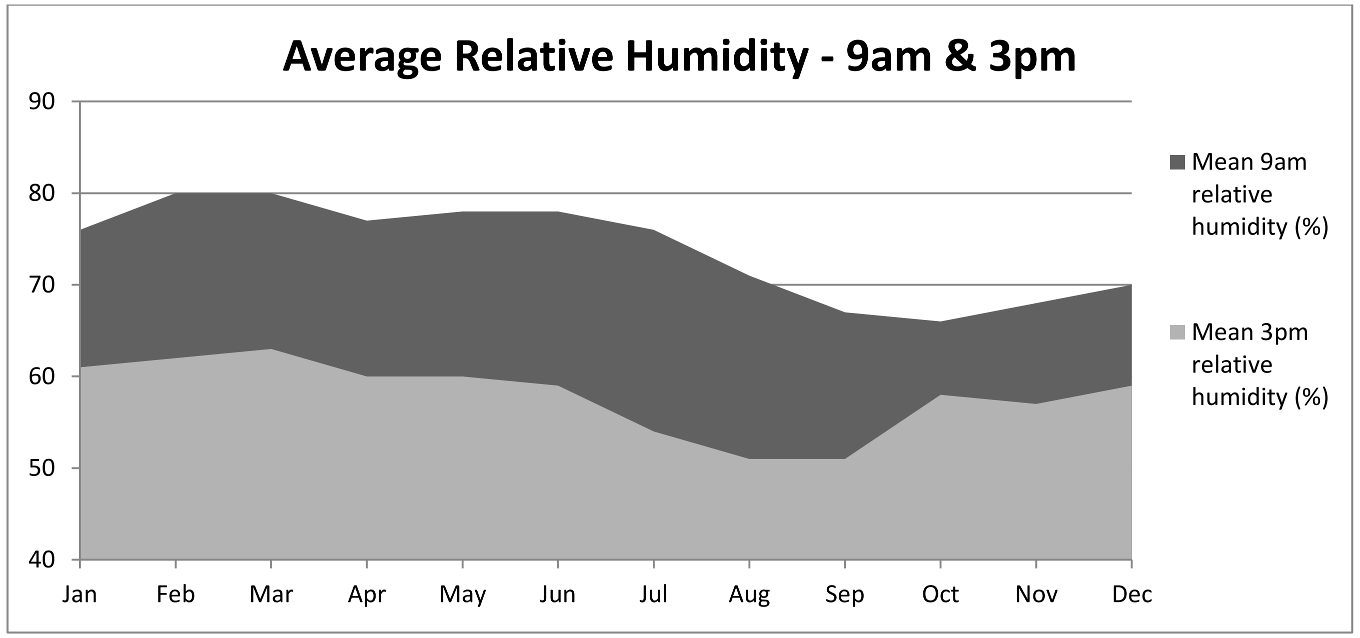


Average and Extreme Monthly Min/Max Temperatures

Key characteristics include high diurnal (day/night) temperature range, four distinct seasons with summer and winter temperatures that can exceed human comfort range; spring and autumn temperatures are generally within comfort range.

The average maximum temperature in the hottest months is around 28-29°C. The average minimum temperature in the coolest months is around 6-7°C. Typically, for this development type, internal loads are enough to demand cooling for a larger part of the year, although some heating may be required during the coolest part of the year.

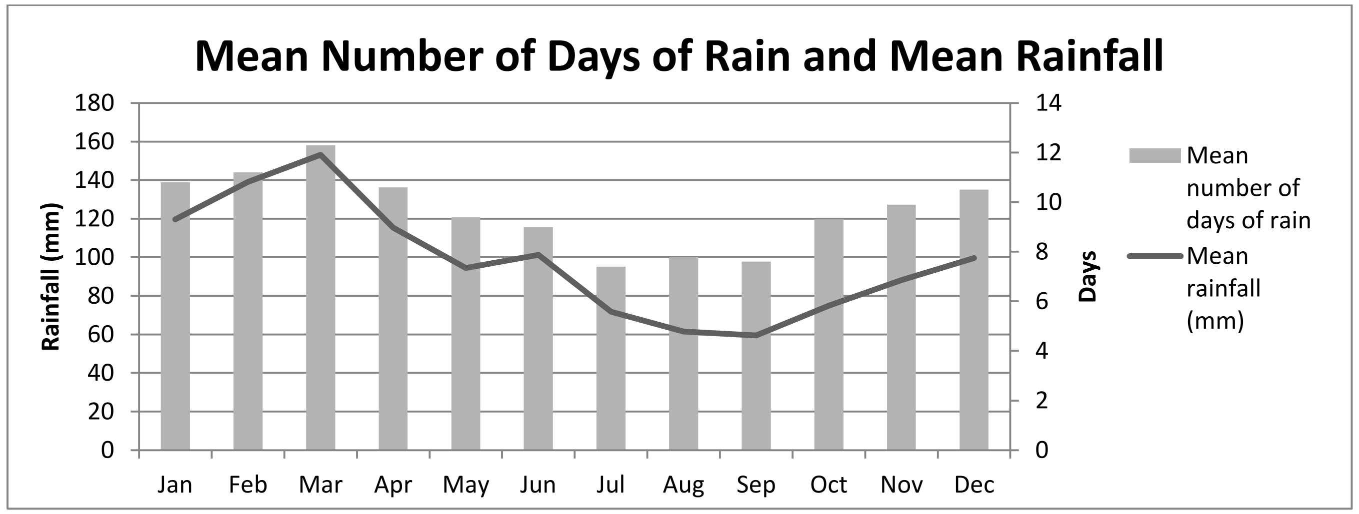
Relative Humidity



Relative Humidity in the Morning and Afternoon

The average relative humidity in the morning being 74% and in the afternoon being 58%. In general, this is above the ideal indoor humidity level, which is typically between 30 to 50%.

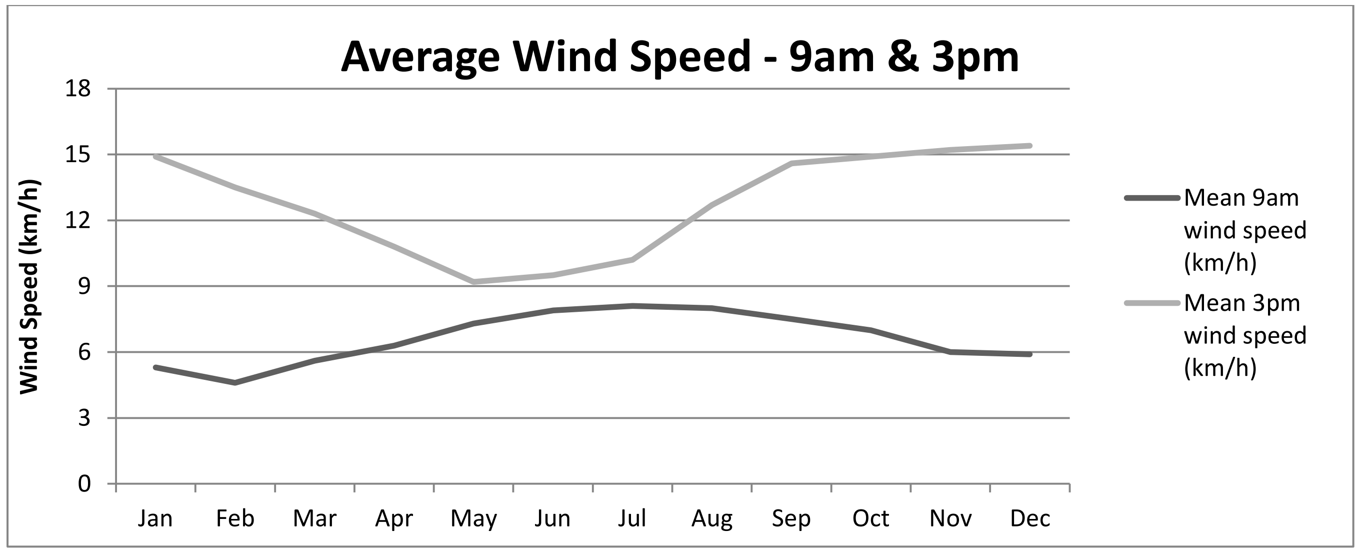
Rainfall and Rain Days



Average monthly rainfall and rainfall days

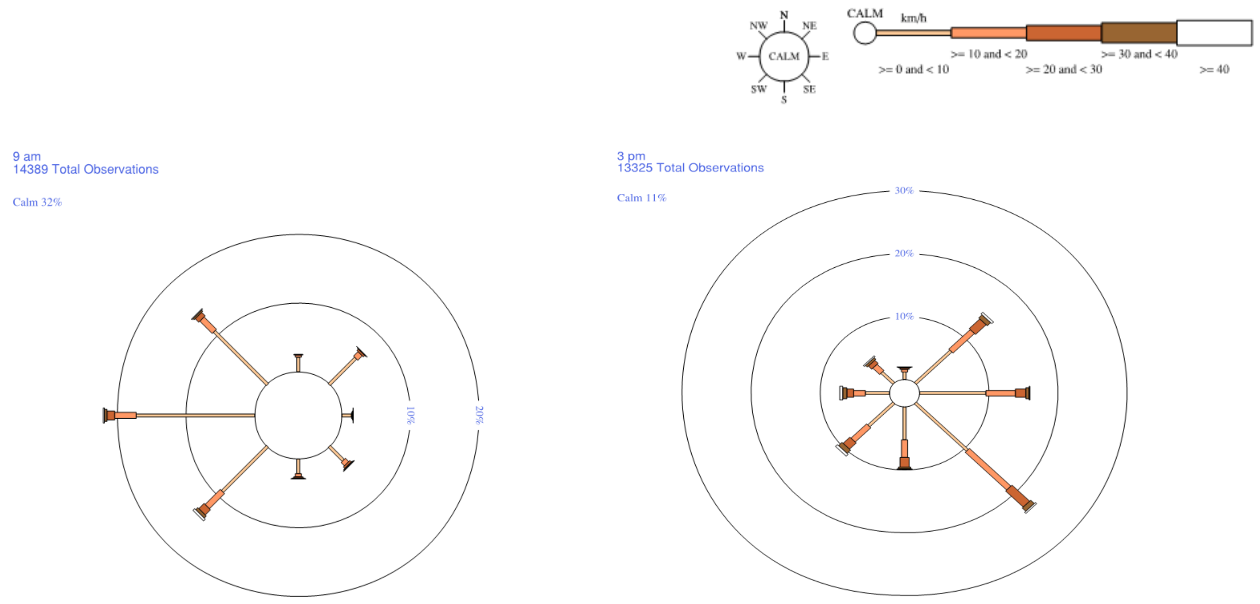
Total annual rainfall in Taree is 1177.2mm. The month with maximum average rainfall is March (153 mm), which has an average of nearly 12 rainfall days. Lowest average rainfall typically occurs in September (60 mm) with average of less than 8 days bringing rainfall.

Wind Direction and Speeds



Average monthly wind speeds for morning and afternoon

Reviewing data on wind speeds in the morning and afternoon informs of the natural ventilation potential of the site. Wind speed of 1.5 m/s provides a cooling sensation of up to 3°C. The Taree climate has the potential to provide wind speed based comfort.



Wind rose for 9am and 3pm

Wind speeds between 0.5 m/s and 1.0 m/s provide a physiological cooling sensation of up to 3°C. The wind speeds in Taree may offer a good possibility for natural ventilation. For summer, allowing outdoor open spaces that are orientated to dominant summer breezes would make that space more comfortable for the majority users.

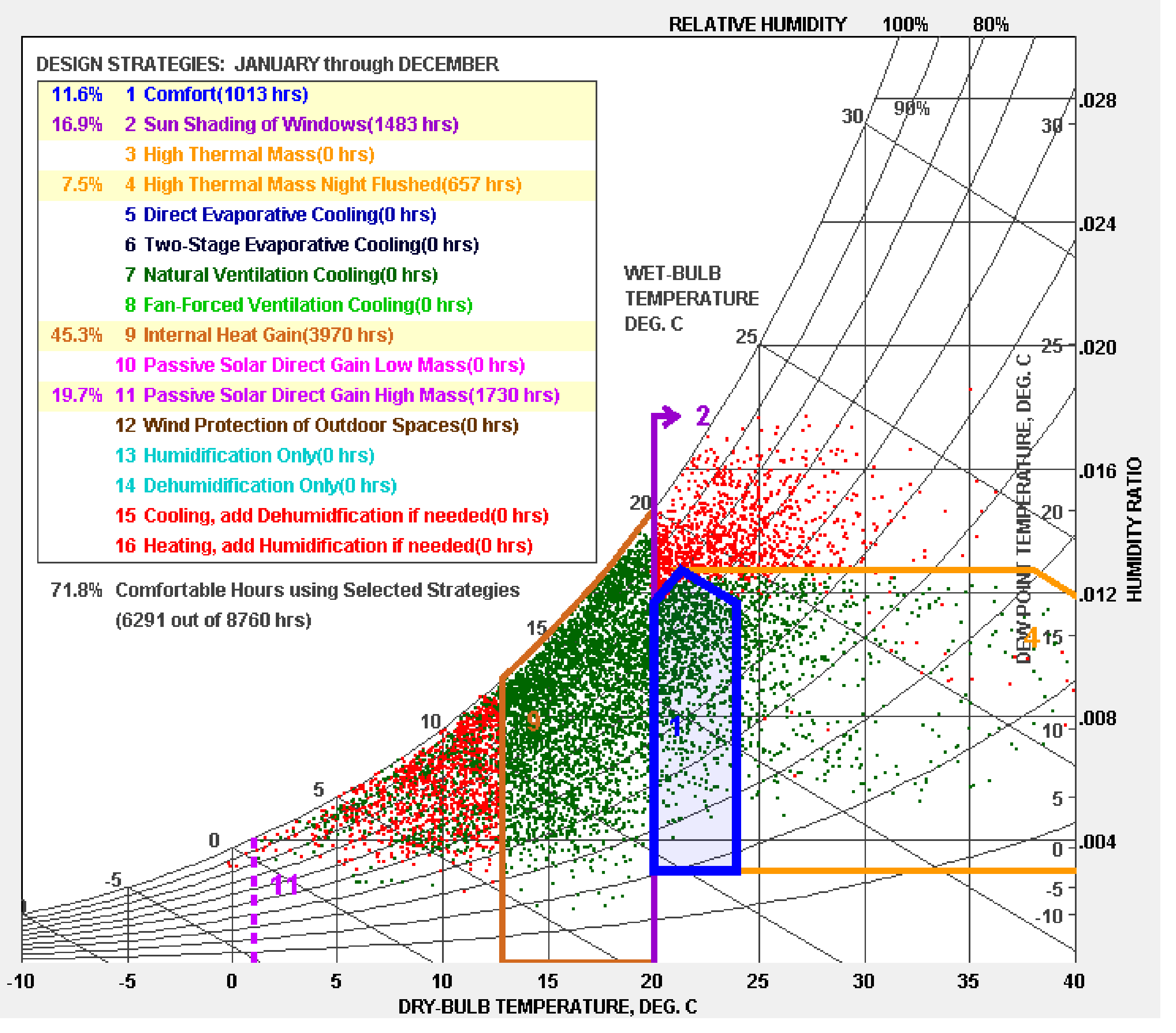
4.1.3 CLIMATE CHANGE SCENARIO PLANNING

Buildings today are simulated using historical weather data. With the uncertainty in the climatic conditions that we are witnessing in recent times, JHA believes that the buildings and developments planned today should not only be simulated/assessed with historical climatic conditions, but they should also be subject to the predicted climate change conditions. For substantial projects where built assets are designed for the next 40+ years, climate change scenario planning can be of paramount importance.

We recommend undertaking climate change scenario planning for 2020, 2050 and 2080 in order to determine strategies required to meet the then comfort conditions, as well as future-proof the development.

4.2 CLIMATE RESPONSIVE BUILDING DESIGN

A NCC Section J report using JV3 verification method is recommended to optimise the thermal specifications of the building fabrics during detailed design.



Psychrometric chart detailing potential of various design techniques to improve thermal comfort

With the implementation of the following strategies, comfortable conditions can be improved for Taree's climate. The following is a very high level analysis to determine balance point temperature, in order to reduce the system size.

- Well shaded windows;
- Design wall with good insulation to minimise temperature loss;
- The building fabric should be air tight to minimise air leakages;
- Potential for passive solar heat gain on north, with good shading to fully cut-off summer sun;
- High performance glazing (low-e) to reduce the amount of solar loads; &
- Specify light coloured roofs and walls, with high emissivity surface properties to reduce the heat absorption.

4.2.1 SITING, ORIENTATION AND BUILDING FORM

Siting is already established within the design of this project. Siting buildings properly, appropriately orientating them and using climatically responsive building form all play a vital role in creating low energy architecture. The siting of the buildings should account for the solar access, prevailing winds, noise consideration and views. Likewise, the orientation of the buildings should aid in minimising the solar heat gain in summer. A long building along the east-west axis has a lower solar heat load as compared to a building that is elongated along the north-south axis. However, a compact floor plate building of the same floor area as compared to a rectangular building has lower floor to wall area ratio, which is effective in reducing the solar heat gain in summer months. In addition, a building with smaller wall area effectively encloses the same floor area with less building façade area, thereby offering a smaller environmental footprint as well as a lower construction cost.

4.2.2 BUILDING ENVELOPE

Building envelope comprises external walls (including glazing), floors and the roofs (including skylights) of the building. There is a constant thermodynamic interaction between the internal space and the external environment through building envelope. The building envelope impact on the heat load of the building and therefore impact the size of the cooling/heating system to maintain thermally comfortable conditions within the building. Whilst the National Construction Code dictates the minimum thermal performance required from the building envelope, it should be noted that the requirements are the bare minimum R-value required for that climate type. These values could be optimised to achieve better thermal performance from all elements of the building envelope. This optimisation of the thermal performance of the building envelope is a key ESD initiative.

4.2.3 GLAZING

Thermal performance wise, glazing and skylights are the weakest elements of the building fabric. For example, an uninsulated brick veneer wall has an R-value of R0.56, which is over 3 times the single glazed window's R-value of 0.17. This means that a single glazed window's rate of heat transfer is over 3 times the quantity per unit area as compared to that of an uninsulated brick veneer wall. The rate of heat transfer for a single glazed window increases to 14 times that of a brick veneer wall after addition of R2 insulation. Specifying IGU (Insulating Glazed Unit, or double glazed windows) with U-value of 3.5 (R-value 0.28) helps to some extent by reducing the rate of heat transfer to around 8-9 times that of an R2 insulated brick veneer wall. Where appropriate, the development team will need to consider using glazing sparingly.

4.2.4 SHADING

Shading is incredibly valuable for all glazed elements (windows and skylights) as it prevents the direct component of solar radiation from impacting on the glazing and thereby minimises the solar load on the building. To minimise solar gain, particular to glazing that is exposed to morning or afternoon summer sun, consideration should be made to providing external shades to the north, east and west façade. The proposed shading design will also assist the building to achieve compliance with Section J requirements.

5. INDOOR ENVIRONMENTAL QUALITY, HEALTH & WELLBEING

5.1 INDOOR AIR

Filtration media and CO2 censors could be utilised to maintain a high quality indoor air environment. In addition to focusing on the amount of fresh air in each space, it is extremely important to specify non-toxic finishes, furniture and flooring for any surface located within the building.

Volatile Organic Compounds (VOCs) and Formaldehyde are known carcinogens. Therefore, it is of utmost importance to specify materials (adhesives, sealants, paints, coatings, flooring) and furniture that does not contain VOCs or Formaldehyde. Typically covering 80% of a building's surfaces, paints are made up of a variety of ingredients, some of which are more benign than others. Possibly the most harmful chemical found in paints are Volatile Organic Compounds (VOCs), which are carbon-containing solvents that vaporise into the air readily as paint dries. These VOCs help make paint easier to spread as well as more durable, but often have negative effects on the health of building occupants. Some exposure to such products can cause headaches, dizziness and nausea, while higher exposure levels can have more serious consequences, such as kidney damage and even cancer. Studies that show that an individual gets 70% of the toxins in the body through absorption from the air inhaled within buildings. Some VOCs also form ground level ozone by releasing odoriferous chemicals that lead to 'urban smog'. This leads to environmental repercussions, with the paint industry responsible for up to 16% of all VOC emissions in Australia. Composite wood such as MDF should be selected on the basis of no urea-formaldehyde content.

5.2 THERMAL COMFORT

The thermal comfort in a space is affected by the surface temperatures of objects. Even when the air temperature is within the comfortable range, radiant heat from a hot object, such as a window that is in direct sun, can cause discomfort.

East and west facing façades that are exposed to direct sunlight for significant periods of the day can increase the mean radiant temperature of the internal space, which is one of the parameters that govern thermal comfort. External shades are one of the most effective methods to reduce mean radiant temperature in perimeter zone next to the glazing.

As discussed in Climate-Responsive Building Design, maximum comfort and functionality is achieved when external shades are provided to complement internal blinds. Selection of internal surface finishes will be important as they will dictate the interaction between the other surfaces as well as the occupants.

5.3 URBAN HEAT ISLAND EFFECT

A known issue in urban areas is the heat island effect. Heat island is caused by developments modifying the land surface and this result in the area retaining unwanted heat more effectively. Hard surfaces, such as asphalt, concrete, paver blocks, stone tiles and ceramic tiles, absorb and store energy from the sun and turn this energy into heat. Heat islands are known to increase summertime peak energy demand, air conditioning costs, and heat-related illness. In addition, due to increased air temperature, the effectiveness of air conditioning system to reject heat to the atmosphere is reduced, thereby reducing the efficiency of the system.

To mitigate this potential issue from reducing the usability of the external spaces, strategies to soften the external areas and the use of light coloured surfaces should be considered.

Shade Sails

Shade sails are easy to install and can be custom-made to suit a specific area. Larger sails may need to be supported by steel posts. Smaller sails can be supported by timber posts. Shade sails can be taken down during the cooler months to allow maximum access to the sun during those periods.

Shade sails used in a school courtyard.

Cool Roofs

A cool roof is one that has been designed to reflect more sunlight and absorb less heat than a standard roof. Cool roofs can be made of a highly reflective type of paint, a sheet covering, or highly reflective tiles or shingles. Nearly any type of building can benefit from a cool roof, but consider the climate and other factors before deciding to install one.

Just as wearing light-colored clothing can help keep you cool on a sunny day, cool roofs material that is designed to reflect more sunlight and absorb less heat than a standard roof. Cool roofs can be made of a highly reflective type of paint, a sheet covering, or highly reflective tiles or shingles. Standard or dark roofs can reach temperatures of +60°C or more in the summer sun. A cool roof under the same conditions could stay more than 10°C cooler and save energy and money by using less air conditioning.

6. ENERGY

The energy performance of the building services will impact on the building's ability to achieve a 4.5 star NABERS rating. Please see NABER Checklist attached as Appendix B for minimum recommendations to achieve the targeted NABERS rating of 4,5 star.

6.1 SOLAR HOT WATER

There are three types of solar collectors for hot water installations:

- Plastic Tubes
- Flat Plate Solar Collectors
- Evacuated Tubes Solar Collectors

Plastic tubes types provide the lowest efficiency but are also the cheapest and come in different colours.

Flat panels and evacuated tubes collectors are more expensive. Evacuated tubes are the most expensive but also provide the highest efficiency. Flat panels usually achieve payback slightly faster than evacuated tubes due to lower upfront costs. However, the orientation and tilt of the flat panels are critical to ensure optimal performance.

One of the issues with using solar preheat is that its contribution will be lowest when heating demand is highest (winter).

6.2 PHOTOVOLTAICS

Onsite generation of renewable energy is an increasingly popular means for buildings to reduce its greenhouse gas emissions. PV solar panels are a popular choice because they are simple to install, operate and maintain.

Of the technologies available, mono- and poly-crystalline silicon panels are the most common; it is a proven technology and provides better efficiency than thin film products. Thin film modules are less efficient at converting sunlight into electricity but they are also less expensive. Thin film modules may be an option when the aim is to clad a large area.

PV Panels should be mounted facing north to maximise yearly output. Mounting the panels directly on a flat roof will reduce electricity output by approximately 10%. When mounted flat, soiling of the module surface may become an issue as velocity of rain runoff becomes insufficient to clean the module surface. Should the proposed roof profile be relatively flat, it is recommended that panels be mounted on tilt frames to maximise power generation and to ensure the slope is sufficient to allow modules to self-clean. Also consideration should be given to the weight of the panels and framing structure on the building's roof structure.

The price of electricity is likely to continue increasing in the future. On the other hand, the cost of installing a PV system has gradually decreased over recent years as the industry expands. If these trends continue, the cost effectiveness of installing a PV system will continue to improve. One of the great advantages of PV is that the solar availability and electricity demand closely correlate.

The payback period of PV can be improved by using the PV modules to replace another building material. For example, the PV modules can form an awning, which can be an architectural feature of the building and replace part of the costs of awning materials.

6.3 LIGHTING & CONTROLS

Lighting accounts for a significant amount of energy usage in a building. Good practice lighting design generally includes for energy efficient fluorescent and LED lighting. LED lighting is becoming a popular choice of light fitting and offers good energy savings.

The use of occupancy sensors to activate lighting and daylight sensing are good ways to further reduce energy consumption associated with lighting.

Lighting design usually allows for occupancy sensors to be installed in rooms/areas used intermittently such as back of house areas, corridors and toilets. The use of occupancy sensors could potentially be expanded to wards and common areas. When selecting occupancy sensors, consider a microwave sensor over an infrared sensor, as a microwave sensor is significantly more effective in picking up the smallest of the movements as against the latter.

Daylight sensors located in communal areas with banks of lighting and/or dimmable ballasts can be used effectively to ensure lighting is only turned on when required.

Occupancy and daylighting sensors to all areas should be considered as this is a low cost and easy to implement item.

6.4 METER MONITORING

In recent years, the cost of installing real time consumption monitoring has decreased and the user interface has improved as the industry matures. In addition to main utilities being metered, benefits can be seen by metering major energy equipment (air conditioning, lighting, hot water etc). Monitoring allows spikes in energy use to be identified quickly and rectified if required.

There are a number of data logging service providers. Currently, the most common strategy is to connect meters to a gateway device that will upload usage data and other information to an online platform. Customers will be provided access to the data via logging in to their online account. There is an annual subscription fee to access the online portal.

The set up and annual fees for monitoring varies between the providers and would range between $5-6k set up and an annual fee of $2-4k. The provision of a real time display is over and above the fees.

Energy monitoring should be considered; the monitoring of water (for example, mains and rainwater) and energy usage (gas / electricity to AC, lighting to different areas etc.) can potentially help facility managers to identify and investigate high energy or water usage in the building.

7. WATER

7.1 WATER EFFICIENT FITTINGS & FIXTURES

One of the most effective ways to minimise the potable water reduction is by specifying low water use fittings and fixtures. The use of 4 Star WELS-rated Taps, Water Closets and Urinals will be considered. The use of 3 Star WELS-rated showers will be considered.

APPENDIX A – SUMMARY OF ESD OPPORTUNITIES

ESD OPPORTUNITIES SUMMARY & PRELIMINARY COST ESTIMATES					
Category	**Item**	**Description**	**Cost**	**Recommendation**	**Relevant Provisions**
Climate Specific Opportunities	4.2.1 Siting, Orientation and Building Form	**Building Form**: A compact floor plate building compared to a rectangular building renders effective reduction of solar heat gain in summer.	*N/A – proper siting, orientation and building form do not increase costs.*	*N/A – already established in the design*	
	4.2.2 Building Envelope	**Cool Roofs:** highly reflective paint. **External Wall:** optimising R-value that would improve thermal performance.	**Cool Roofs:** Approx Cool roof costs **$16.00 per sq.m.** Approx return of investment 2 to 6 years from decreased heat gain, i.e. AC energy use. **External Wall:** *Little to no cost increase.* Only issue is that the thicker walls with greater R values can cause change in room dimensions.	*Opportunity*	**BCA Section J1.3 Roof and ceiling construction** - sets out minimum total R-Value that a roof/ceiling must achieve. **BCA Section J1.5 Walls** - sets out minimum total R-Value that a wall must achieve.
	4.2.3 Glazing	**High thermal performance glazing** to be added to increase the thermal performance where deemed necessary.	*N/A – required.*	*Mandatory minimum glazing compliance*	**BCA Section J2.4 Glazing**
	4.2.4 Shading	**Shading** by means of external window shading devices such as horizontal/vertical fins, fixed canopies, eaves or shading hood.	*N/A – part of current architecturals.*	*N/A – already established in the design*	
Indoor Environmental Quality, Health & Wellbeing	5.1. Indoor Air	**Materials** w/o VOCs or Formaldehyde (adhesives, sealants, paints, coatings and flooring etc.)	*Require little to no cost increase*	*Opportunity; Strongly Recommended*	**BCA** - No specific limitations re VOC and/or Formaldehyde levels. However, **Section F4.5(b)** states that the rooms must be ventilated with mechanical ventilation or AC system complying **AS 1668.2** which states: "This standard sets out design requirements for mechanical air-handling systems...based on the need to control ... VOCs." - necessitating VOC level control.
	5.2 Thermal Comfort	**Internal blinds & surface finishing** (e.g. Glare Control Blinds)	Simple roller blinds approx from **~ $50;** Venetian blinds approx **$70 ~ $150**, etc.	*Opportunity*	N/A
	5.3. Urban Heat Island Effect	**Shade Sails**	Shading Sails: **$2,500** (non-waterproof) **~ $3,500** (waterproof)	*Opportunity*	N/A
Energy	6.1 Solar Preheat	**Solar collectors** (Flat Plate Solar collectors or Evacuated Tubes solar collectors)	N/A – part of current design	*N/A – already established in the design*	N/A
	6.2 Photovoltaic (PV)	Installation of PV Panels	**PV installed**: Approx $2.20/W Payback period is between 5 to 10 years.	*Not selected for project*	N/A
	6.3 Lighting & Controls	LED lights	LED Light Bulbs **$25 ~ $40 per bulb**. *Dependent on electrical layout of the buildings*	*Opportunity; Strongly Recommended*	**BCA Section J6 "Artificial Lighting and Power"** sets out maximum illumination power density to be considered.
	6.4 Meter Monitoring	Installation of real time consumption monitoring system	Meter monitoring hardware & software costs about **$10,000 ~ $15,000** - Wiring the circuits to the meter monitoring softwares would only cost approx **$500**.	*Real-time energy monitoring not selected for project*	**BCA Section J8.3 "Facilities for energy monitoring" (a)** & **(b)**
Water	7.1. Water Efficient Fittings & Fixtures	Installation of low water use fittings and fixtures	4 Star WELS Rated Taps *require little to no cost increase*	*Opportunity*	N/A

APPENDIX B – NABERS CHECKLIST

Architectural	Likely	Not Likely
Site Orientation - Site to be orientated north south where possible, to limit extent of eastern and western façade to minimise summer heat gain. - Consider locating amenities / back of house areas on eastern and western elevations.	☑ (to degree necessary)	
Shading - Horizontal shading to be considered to northern elevations to reduce heat gain in summer, but maximise solar gain in winter months. - Vertical shading to eastern and western façade.	☑	
Glazing - Maximise natural daylight through glazing to southern elevation. - Window to wall ratio of no more than 60%. - Consider higher performing glazing (with low solar heat gain co-efficient) to eastern and western facades. - Consider natural ventilation where security and acoustics are not an issue.	☑	
Fabric Performance - 10% improvement on wall and roof insulation values over minimum Section J requirements. - Light coloured roofing.	☑	
Mechanical		
Air Conditioning - Consider high efficiency air conditioning systems; for example VRV/VRF Heat Recovery. - 100% outdoor air economy cycle if suitable for climate zone. - Ensure appropriate controls are employed to minimise energy consumption e.g. out of hours use or unoccupied spaces system shutdown. - Where areas are unoccupied consider potential to relax internal temperatures / design conditions. - Where natural ventilation is proposed, consider interlocking operation of AC units to shut off when windows are open (security and acoustic issues will need to be considered).	☑	
Ventilation Systems - Consider heat recovery on exhaust systems to precool / preheat outside air. - CO2 sensors for high occupancy spaces; fans with variable speed drives to ramp up and down. - Consider high efficiency filters to reduce outside air rates. - Amenity exhaust systems to be interlocked with lighting PIR to deactivate when unoccupied. - Car parking areas (where natural ventilation cannot be utilised), carbon monoxide (CO) monitoring provided to control the ventilation system.	☑	
Controls - Centralised controller to monitor and control all services (e.g. air conditioning, fans, external lighting, energy consumption etc).	☑	
Metering - Mechanical systems energy consumption to be sub-metered.	☑	
Electrical		
Lighting and Lighting Control - High efficiency LED lighting to be used throughout. - PIR lighting control to amenities and back of house areas.	☑	

- Consider daylight sensing to office areas. - Consider Localised task lighting to work areas to reduce space Lux levels. - External lighting control via photo electric cell and time scheduling (consideration will need to be made with regards to security requirements).		
<u>Energy Generation</u> - Consider the use of photovoltaic systems to power back of house and circulation areas as a minimum. Target 10% electrical energy consumption of the building.	TBC	
<u>Metering (for Base Building Rating)</u> - Energy consumed in supplying building central services to office lettable and common spaces should be separately metered, including: • common-area lighting and power (for example lift lobbies, foyers, plant rooms and common-area toilets) • lifts and escalators • air conditioning and ventilation, including: – base building services to meet normal requirements – centralised supplementary services provided for tenants (such as supplementary tenant condenser water loops) – supplementary services provided to ensure the premises are safe, lit and comfortable for office work, where there is no special tenant requirement • exterior lighting • exterior signage provided by the building owner for the benefit of office tenants • generator fuel where it serves central services • car park ventilation and lighting, where internal or external car parks within the legal boundaries of the site are provided for tenant use. * Note separate metering of base building energy consumption not necessary for single tenant building.	☑	
Hydraulic		
<u>Hot Water Generation</u> - Hot water heaters with solar boost. Solar boost target of 50% of energy consumption for the production of hot water.	☑	
Commissioning		
- All building services systems will require appropriate commissioning, ensuring systems are operating and controlled as required.	☑	