DHA Design Guidelines

Prepared for
Defence Housing Australia
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DHA
Defence Housing Australia

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Introduction

A

DHA
Defence Housing Australia

Introduction

The DHA Design Guidelines were prepared by Tzannes, Arcadia and DHA in 2016. This document is a result of an extensive collaborative process which included a thorough analysis of DHA, Defence and relevant government guidelines, as well as consultative input from expert environmental and construction advisors, landscape architects and quantity surveyors. The fundamental purpose of this document is to create a benchmark for design excellence, innovation, sustainability and whole of life analysis for low and medium density housing projects.

This document is intended to fulfill a number of functions. The first and foremost role of the DHA Design guidelines is to provide DHA tenderers with a concise document that captures all of the current DHA and Defence requirements in relation to design and construction; and provides a national, standardised benchmark for DHA housing that ensures high quality and sustainable design.

The second function of the DHA Design Guidelines is to provide a basis for classification that accounts for varying geographical and climatic conditions across Australia. This document intends to group and classify design and construction requirements based on their relevance to the site's climate with an aim to deliver better performing, high quality housing stock that is region and climate appropriate.

The third function of this document is to provide dwelling design guidance to tenderers by way of typical floor plans for a range of lot and housing typologies, as well as an accompanying set of design principles.

This document also provides tenderers with consolidated construction checklists and typical construction details, and should be read in conjunction with the accompanying specification.

Please note that this document, and the accompanying Property Checklist and specification, is intended as a guide for new constructs only, and should not be utilised for alterations and additions to acquisitions or existing DHA properties.

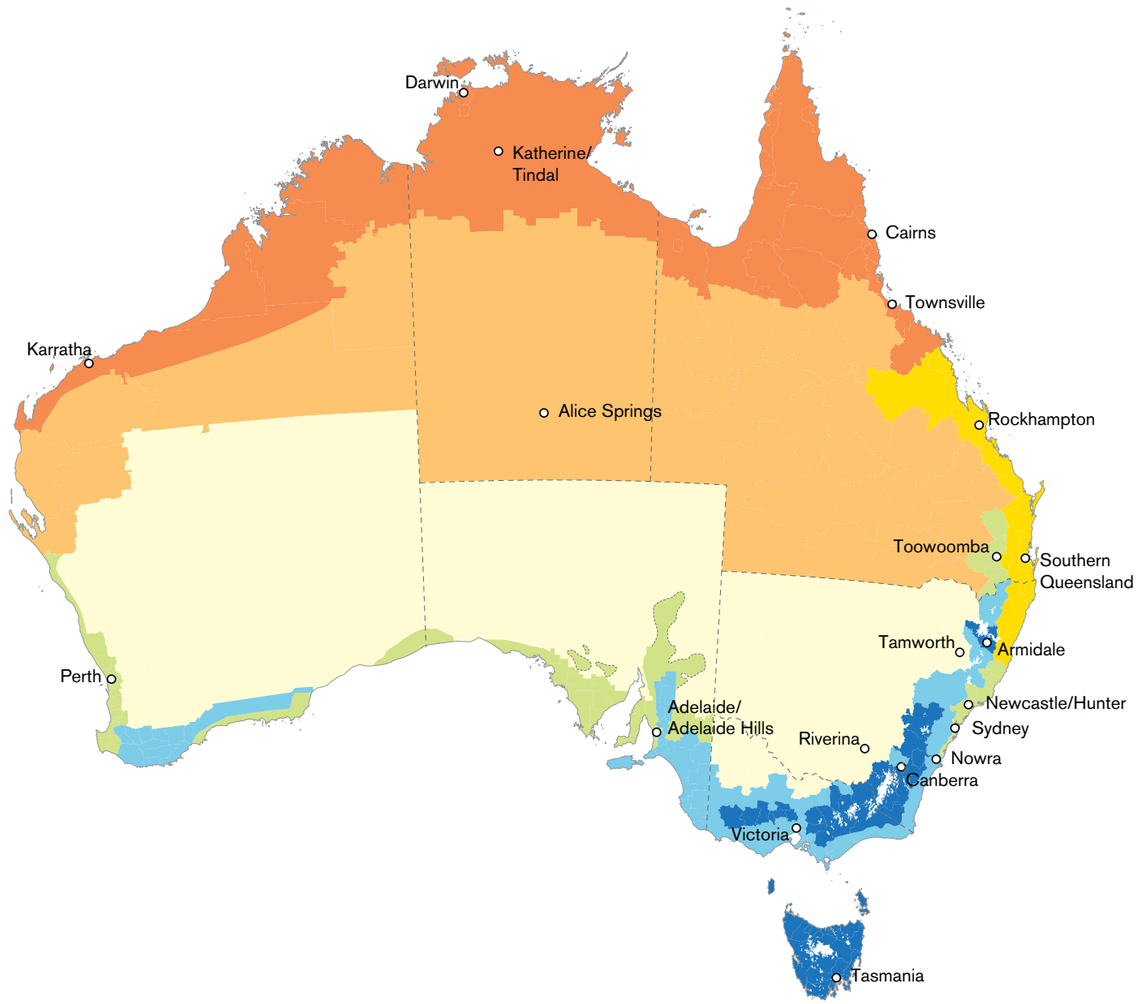
Document Structure

The information contained herein is structured into chapters that cover a specific aspect of design and construction. Each chapter is composed of sections that group content according to their relevance to a particular set of principles and design categories.

This guideline document is to be read in conjunction with the *Property Checklist*, which provides a detailed breakdown of minimum sizes, areas and dimensions.

Location and Climate

B



Climate zone classification for DHA projects.
Source: Australian Building Codes Board, Climate Zone Map: Australia Wide.

B. Location and Climate
DHA Design Guidelines

B.1 Climate Zones

The following guideline classifies the Australian landscape into ‘climate zones’ to capture the unique climate characteristics and identify design strategies and considerations appropriate to that location.

The eight climate zones used in this guideline are defined by the Australian Building Codes Board in the National Construction Code (NCC). Within each main zone are many regional sub-zones determined by local geographic features, including wind patterns and height above sea level. Each climate zone has distinct set of design and construction guidelines.

For the purposes of these Design Guidelines the eight climate zones are:

- Zone 1 - Hot humid summer, warm winter
- Zone 2 - Warm humid summer, mild winter
- Zone 3 - Hot dry summer, warm winter
- Zone 4 - Hot dry summer, cool winter
- Zone 5 - Warm temperate
- Zone 6 - Mild temperate
- Zone 7 - Cool temperate
- Zone 8 - Alpine

It is important to note that climate change is likely to alter the characteristics of each zone during the life span of homes currently being built.

Use throughout the document

The relevance and application of the guidelines outlined in this document have been classified in terms of their suitability to each of the eight climate zones. This is represented graphically through the use of a zone key in each section’s heading.

A heading with a key that displays all of the eight climate zone icons signifies that the information in that section is relevant to all climate zones.

EXAMPLE 1 - Information in this section is relevant to all zones >>> 1 2 3 4 5 6 7 8

When the information is only relevant to some climate zones, only the relevant zone icons are displayed.

EXAMPLE 2 - Information in section is only relevant to zones 1 and 2 1 2

Users of this document must check the climate zone classification of the area in which work is to be carried out.

Zone 01

Hot Humid Summer, Warm Winter

Northern Australia from Exmouth, WA across to midway between Townsville and Mackay, QLD

Main Characteristics

- High humidity with a degree of ‘dry season’
- Moderate to high temperatures year round
- Low to moderate seasonal temperature variation
- Subject to cyclones/hurricanes
- Minimal diurnal (day–night) temperature range
- High rainfall, damp earth and flooding prone

Key Design Objectives

— Houses in these climates use substantially more energy to achieve thermal comfort than houses with the same NatHERS star rating in more benign climates. It is therefore imperative to use design strategies that reduce cooling energy use to achieve similar carbon reductions.

— One of the three distinctly different design approaches should be chosen at the outset of the design process. Each produces a very different solution that is often difficult to change in the future.

  — Free running: These buildings should not be conditioned. Abundant air movement from fans, whirlybird ventilators, stack ventilation and cross-ventilation is essential.

  — Conditioned: These buildings must be well insulated and able to be made airtight while conditioning is running.

  — Hybrid design: These buildings include air conditioned, insulated core rooms in the centre of the house (e.g. a TV room) for peak discomfort periods, surrounded by free running spaces.

Zone 02

Warm Humid Summer, Mild Winter

Coastal Queensland from midway between Townsville and Mackay south to just below Coffs Harbour, NSW

Main Characteristics

- High humidity with a definite ‘dry season’
- Hot to very hot summers with mild winters
- Distinct summer/winter seasons
- Moderate to low diurnal (day–night) temperature range, which can vary significantly between regions (e.g. inland to coastal)

Key Design Objectives

— Eliminate auxiliary heating and substantially reduce cooling with appropriate passive design.

Zone 03

Hot Dry Summer, Warm Winter

Northern central Australia from Carnarvon, WA, encompassing Newman, Alice Springs, Tennant Creek, Charleville to the QLD hinterland down to 28 °S but not the coast.

Main Characteristics

- Low rainfall and low to moderate humidity
- No extreme cold but can be cool in winter
- Hot to very hot summers common
- Significant day–night temperature range
- Distinct wet and dry seasons

Key Design Objectives

— This climate zone has high heating and cooling energy requirements but the task of reducing them through passive design is relatively straightforward and cost effective due to low humidity, high solar incidence and high day–night temperature ranges.

— Use well-insulated thermal mass to even out temperature ranges with night purging in summer and passive solar heating in winter.

— On difficult sites, try to take advantage of clear night skies and high solar incidence.

Zone 04

Hot Dry Summer, Cool Winter

Southern central Australia from the WA hinterland across most of inland SA, inland NSW and inland VIC, encompassing Yalgoo, Warburton, Coober Pedy, Whyalla, Broken Hill, Mildura, Bourke, Tamworth and Albury-Wodonga.

Main Characteristics

- Distinct seasons with low humidity all year
- Cool winters with cold dry winds
- Very hot summers common with hot, dry winds
- High diurnal (day–night) temperature range
- Low rainfall

Key Design Objectives

— Well-designed passive solar heating and cooling are equally important. Application of sound passive design principles can achieve cost effective 8 star or better thermal performance in this climate zone.

— High thermal mass solutions are particularly effective.

— Active solar heating and cooling systems are well suited to sunny winters and clear summer night skies, and will also provide flexible thermal comfort solutions for future climate change.

Zone 05

Warm Temperate

Coastal strip of WA from 27 to 34 ° south encompassing Geraldton, Perth, Bunbury, then a coastal strip encompassing Esperance, a coastal strip encompassing Eucla, then coastal areas of SA encompassing Ceduna and Adelaide and some hinterland areas north of Whyalla and east of Adelaide, then a coastal strip of NSW encompassing Wollongong, Sydney, Newcastle up to 32 ° south, then a hinterland strip west of Brisbane.

Main Characteristics

- Mild winters with low humidity
- Hot to very hot summers with low to moderate humidity
- Four distinct seasons: summer and winter can exceed human comfort range; spring and autumn are ideal for human comfort
- Widely variable solar access and cooling breeze directions and patterns
- Moderate diurnal (day–night) temperature range near coast to high diurnal range inland

Key Design Objectives

— This is an atypical zone in that it includes a more diverse range of climatic conditions than other zones. This diversity is particularly evident in the hours of sunlight, and direction and reliability of cool breezes. For example, the Illawarra escarpment in NSW receives less sunshine than the coastal suburbs of Perth. Newcastle has very different cool breeze patterns and seasonal humidity variations to Adelaide; Perth is distinctly different to both these cities in terms of humidity and breezes. Waterfront properties in Sydney have very different thermal mass requirements to those in SA's wine-growing regions owing to Sydney's oceanic temperature stabilisation, diurnal ranges and cool breezes.

— For this reason, pay careful attention to the 69 sub-zones in NatHERS to decide the best design responses for your site and compare them with those in adjoining zones (4 or 6) that may have more closely matching micro-climate variations

Zone 06

Mild Temperate

A coastal and hinterland strip of southern WA encompassing Albany, then hinterland north of Adelaide, coastal and hinterland area from Kangaroo Island and Adelaide around coastal and hinterland Victoria encompassing Ballarat and Melbourne, then the coastal strip of southern NSW and hinterland NSW west of Sydney as far north as 28 ° south.

Main Characteristics

- Mild to cool winters with low humidity
- Hot to very hot summers, moderate humidity
- Four distinct seasons: summer and winter exceed human comfort range; spring and autumn are ideal for human comfort
- Low day–night temperature range near coast, high range inland

Key Design Objectives

— These climates present cost effective opportunities to achieve carbon zero or positive outcomes because they require relatively simple design adjustments to achieve low or zero heating and cooling energy use (NatHERS ratings of 8−10 star).

— Minimising heating and cooling energy use should be a primary design objective.

Zone 07

Cool Temperate

Sub-alpine areas of Victoria and southern NSW including the south-eastern coast of Victoria and a small area west of Coffs Harbour, most of Tasmania and Bass Strait islands.

Main Characteristics

- Low Humidity
- Cold to very cold winters. Hot dry summers (increasing with climate change)
- High diurnal (day–night) temperature range
- Majority of rainfall (decreasing with climate change)
- Four distinct seasons: summer and winter exceed human comfort range; highly variable spring and autumn conditions (range increasing with climate change)

Key Design Objectives

— Homes in these climates use substantially more energy to achieve thermal comfort than homes with the same NatHERS star rating in more benign climates. An 8-star or better level of thermal performance is required to achieve life cycle carbon reductions equivalent to other zones.

— Designers often include large north-facing windows to maximise solar gains in these climates, which can make double glazing very expensive. However, double glazing is recommended in this climate because on each winter's day there are 19–20 hours of heat loss through glass with a maximum of 4–5 hours of heat gain. The glass to mass ratios in Thermal mass indicate appropriate glazing levels in relation to exposed thermal mass. Exceeding these ratios can lower thermal performance and increase initial and operational costs.

Zone 08

Alpine

Alpine areas of Victoria, NSW and Tasmania

Main Characteristics

- Low humidity
- Warm to hot, dry summers; highly variable spring and autumn conditions. Cold to very cold winters
- Four distinct seasons. Winter exceeds human comfort range and will likely continue to do so under climate change
- High diurnal temperature range
- Winters providing majority of rainfall; some snow

Key Design Objectives

— Homes in these climates have the highest thermal comfort energy use of any climate zone. For example, a NatHERS 6-star house in Cabramurra uses more than double the energy of a 1 star house in Sydney's eastern suburbs and around the same energy as a 3 star house in Canberra.

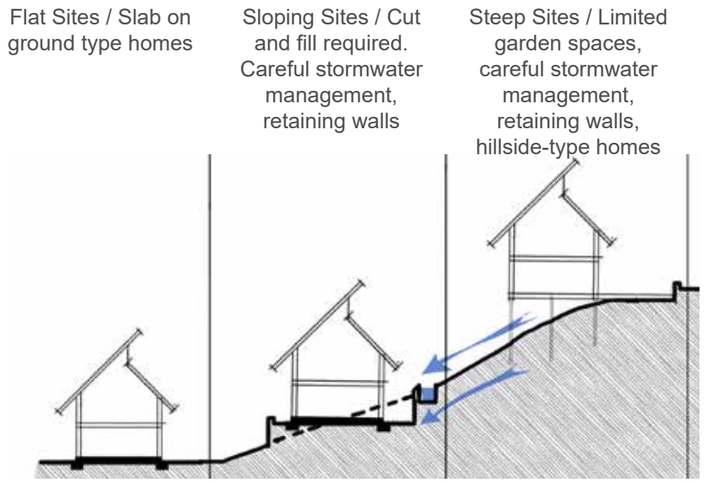
Site Analysis and Streetscape

C

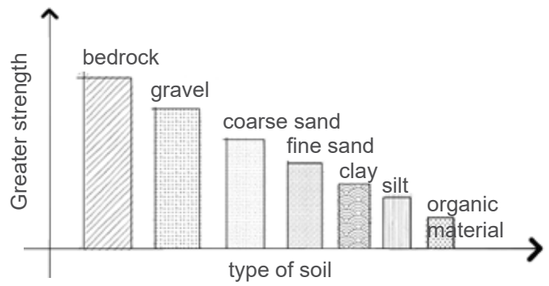
C.1 Topography

Site topography is an important aspect of building design. Challenging land forms can impose stringent constraints resulting in higher environmental impacts and additional costs. On the other hand, they are often conducive to good passive design and, with innovative solutions, they provide for exciting living environments and sustainable homes.

All zones 1 2 3 4 5 6 7 8



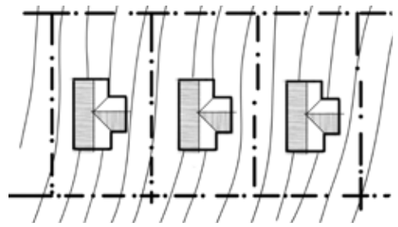
— Consider the impact of the site slope: slab-on-ground house types are good for flat sites; hillside houses (such as pole framed houses) are better suited to steep sloping sites.



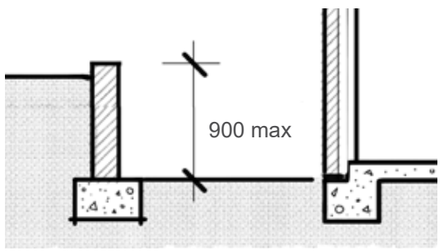
— Consider the existing ground conditions, such as rock, sand, clay or wetlands. Different soil conditions affect the type of foundations and cost of construction. Avoid clay and wetlands due to their inherent instability.

— Rock presents the most stable ground condition but environmental penalties are large for building basements or earth-sheltered structures in these conditions.

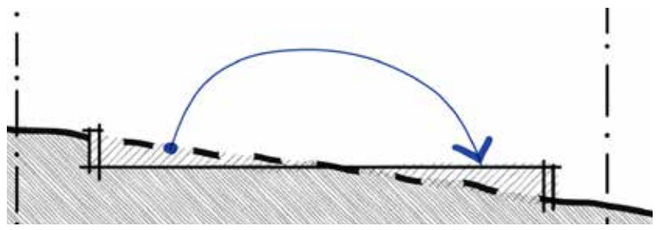
— Steep sites with a gradient exceeding 30° may require extensive cut and fill and may be unstable - construction on these sites can be significantly more expensive.



— Consider building along contour lines, not across them. Site topography may also be irregular with some parts steeper than others, and the fall may lie diagonally across the site; these sites require very site-specific building designs.



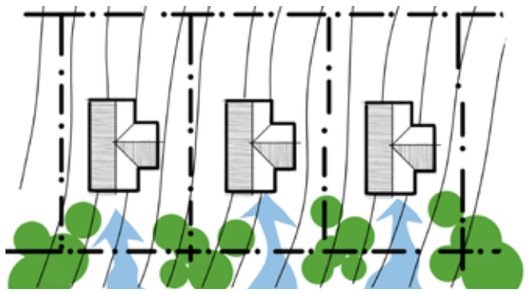
— Avoid retaining walls higher than one metre



— Balance cut and fill to reduce the amount of soil that needs to be removed from site.

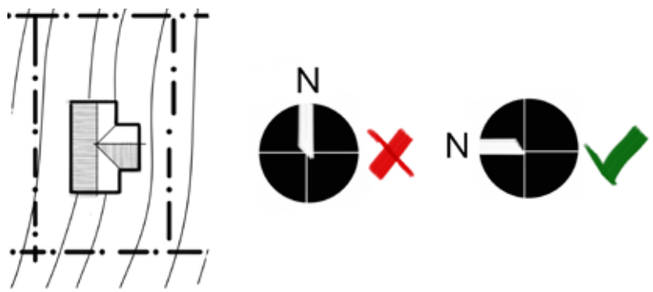
— Consider the site topography in terms of stormwater run-off. Steeply sloping sites increase stormwater runoff above and below the surface.

— Consider the impact of overshadowing through topography. A south-facing slope increases the potential for overshadowing, whereas north-facing slopes increase the potential for solar access



Hot and humid and hot and dry climates

1 2 3 4



— Consider selecting sites with topographies that will minimise heat load on the walls and enable the capture of the prevailing breezes.

— North-facing buildings are still desirable as they are easy to shade through eaves and overhangs

— Try to work with the site topography to avoid west-facing daytime living areas that flow to outdoor spaces with similar orientation.

— Consider the impact of overshadowing neighbouring dwellings due to slope orientation. This can be of benefit in climates with high cooling needs.

Zones requiring winter heating

5 6 7 8

— A north-facing slope increases the potential for access to northern sun and is ideal for higher housing densities.

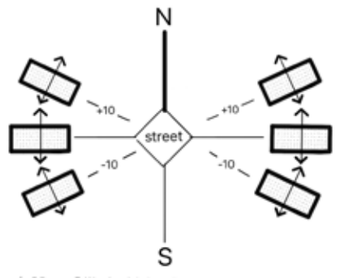
— Where possible, choose a site with a topography that can accommodate north-facing daytime living areas that flow to outdoor spaces with similar orientation.

— Consider the impact of overshadowing on neighbouring dwellings due to slope orientation. This is to be minimised to maximise solar heat gain

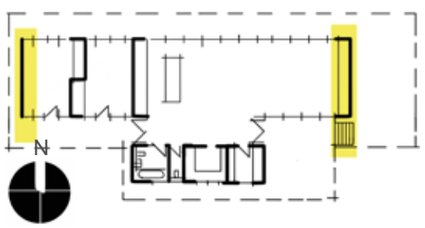
C.2 Solar Orientation

Solar orientation is the positioning of the houses in relation to the seasonal variations in the sun path. Well-oriented buildings can be more energy efficient as they are more comfortable to live in year round and cost less to cool and heat.

Hot and humid and hot and dry climates



— Building on an east-west axis (or within +/- 10˚) minimises the direct sun on external walls and reduces heat gain. It also locates the longest facade facing north, making it easy to shade.



— To prevent low morning and afternoon sun from heating up the house, attempt to minimise the size of east and west facing walls and avoid windows in these walls unless fully shaded.

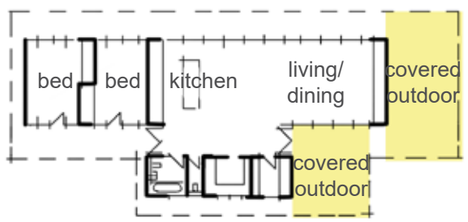
— Building orientation east of north reduces the impact of the western sun and can allow for better capture of cooling breezes.

— Well-oriented buildings will not obstruct the funneling of the cooling breezes.

— Ensure all facades are shaded during the entire year, consider using a fly roof

— Exclude direct sunlight into the dwelling, or provide the ability to fully control it through operable blinds and shutters

— Use appropriate siting to protect dwellings from radiant heat from nearby structures.



— Provide shaded outdoor living areas

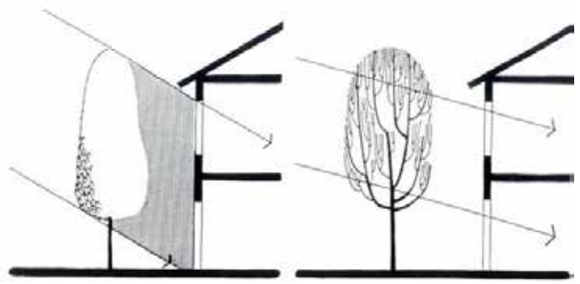
— Look for opportunities to use existing topography and site conditions to provide shade; this includes landscaping and adjoining structures.

Zones requiring winter heating

— A northern orientation is desirable in all climates that require winter heating as it allows for easy shading in summer and solar heat gains in winter

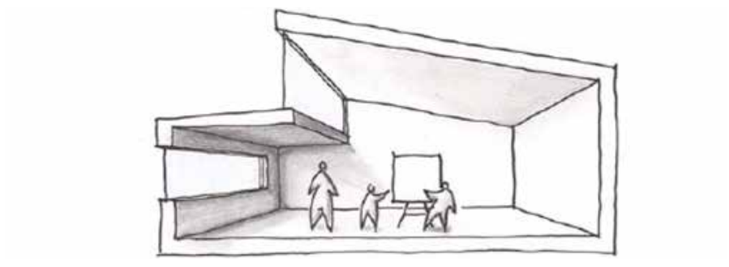
— Consider maximising the length of the north facing walls to minimise exposure to the sun in summer and maximise it in winter.

— In colder climates, solar gains from east-west facades are essential, especially from the west as the sun allows the house to warm up before the cold evening. This is best utilised when coupled with thermal mass on the inside of the dwelling



Consider using deciduous trees to assist with solar shading.
Source: P. Leardini, University of Queensland

— In heating prevailing climates, contemplate the use of deciduous vegetation to provide shade in summer and allow solar gains in winter



Clerestory windows used in conjunction with side windows.
Source: P. Leardini, University of Queensland

— Clerestory (high level) windows can be used to capture winter sun and create stack ventilation (rising hot air) in summer.

— On smaller sites, permanent solar access is more achievable on north–south blocks.

— North–south sites on the north side of the street allow north-facing living areas and gardens to be located at the rear of the house for privacy.

— North–south sites on the south side of the street should be wide enough to accommodate an entry at the front as well as private north-facing living areas.

C.3 Wind Orientation

Cooling through natural ventilation requires a good exposure of the building and its windows to the prevailing cooling breezes. As cooling requirements are dictated by climate, distinctly different approaches to passive design are required for the hot humid climates (Zone 1), where no heating is required; to temperate and warm climates (Zones 2−6) where both heating and cooling are required; and to the cool and cold climates (Zones 7−8) where heating needs are more important. In these climates, the house needs to be protected from prevailing winds by carefully selecting opening orientation and using natural and artificial barriers to block undesirable winds.

All zones

1 2 3 4 5 6 7 8

— Where the local climate provides cooling breezes, aim to maximise their flow through a home when cooling is required

— Unlike cool night air, cooling breezes tend to occur in the late afternoon or early evening, when cooling requirements usually peak.

— Coastal breezes are usually from an onshore direction

— In mountainous or hilly areas, cool breezes often flow down slopes and valleys in late evening and early morning, as heat radiating to clear night skies cools the land mass and creates cool air currents.

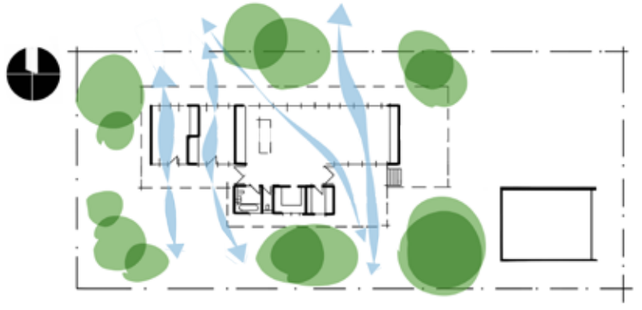
— Thermal currents are common in flatter, inland areas, created by daily heating and cooling. They are often of short duration in early morning and evening but with good design can provide good cooling benefits.

— Wind doesn't blow through a building — it is sucked towards areas of lower air pressure. To draw the breeze through larger openings should be on the leeward (low pressure or downwind) side of the house and smaller openings on the breeze or windward (high pressure or upwind) side.

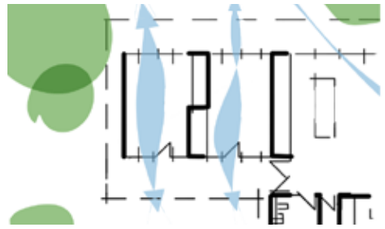
— Consider positioning windows (vertically and horizontally) to direct airflow to the area where occupants spend most time (e.g. dining table, lounge or bed).

Hot and humid and hot and dry climates

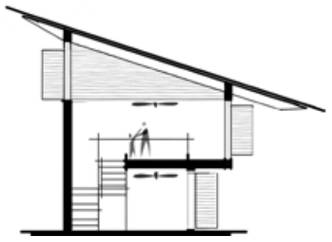
1 2 3 4



— Orientate the building to take full advantage of cooling breezes, and position landscaping and outbuildings to funnel breezes over, under and through the building.

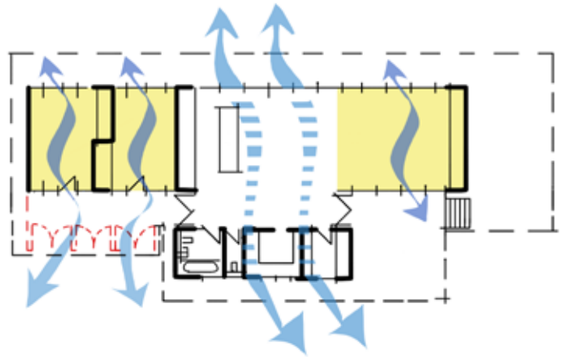


— Attempt to prioritise design for night-time sleeping comfort. Consider sleep-out spaces.



— Install ceiling fans in all rooms (Climate Zone 1 only)

— Maximise external wall areas (plans with one room depth are ideal) to encourage cross-ventilation and, if possible, elevate building to permit air flow beneath floors.



— Design to maximise beneficial cooling breezes by providing multiple flow paths and minimising potential barriers; single depth rooms are ideal.

Zones requiring winter heating

5 6 7 8

— Orientate the building to avoid exposure to prevailing cold winds that affect heat losses and produce uncomfortable draughts

— Consider adopting artificial obstructions to block out wind, using materials with low air permeability

Source: P. Leardini, University of Queensland

— Consider the use vegetation to reduce the negative impact of cold wind in winter

— In temperate climates that require winter heating, look to design to maximise beneficial cooling from breezes in summer, whilst providing a degree of protection from harsh winter winds

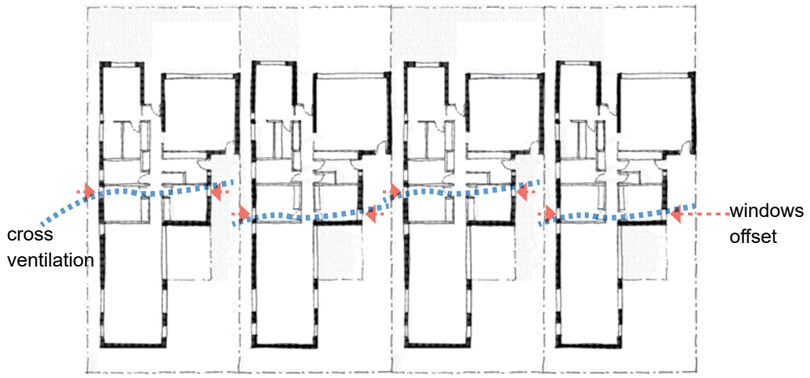
C.4 Building Separation

Considerable design constraints can result from compromised separation between buildings within the block. Building separation is a function of the block subdivision. Residential subdivision in Australia usually generates rectangular blocks of land; non-rectangular geometries of small area, either from subdividing an existing block into two or at corner blocks, can be especially constraining and require a very site specific design.

All zones

1 2 3 4 5 6 7 8

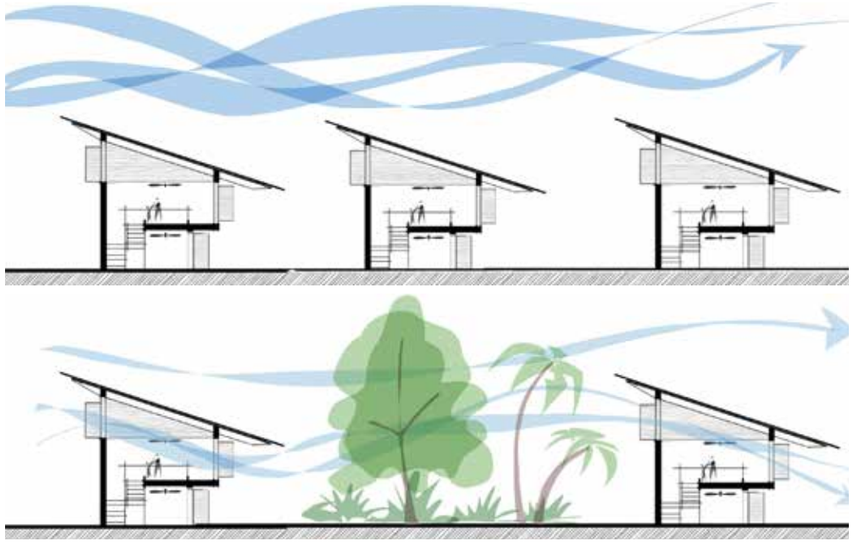
- Careful consideration needs to be given to setbacks - clearances between the site boundary and building walls required by planning rules.
- Setbacks constrain the height and location of the building from the ground and have a profound influence on building volume and spatial configuration.
- Reduced separation due to setbacks will affect the size and orientation of windows, flexibility to locate the private open areas and covered outdoor terraces.
- Building separation on sites with non-rectangular geometries on a block can be further exacerbated by inflexible setbacks and planning controls.
- A ‘tight site’ has little flexibility. The shape of the block, planning constraints and the design brief can lead to only minimum building separation.
- Where building separation is compromised or minimised, design solutions such as reducing the physical building footprint, increasing the number of building levels or consolidating blocks may be necessary.
- Dense urban environments can lead to no separation at all – attached dwellings. In such locations, good design that works from first principles can still achieve very high residential amenity and good passive performance.
- The degree of separation can impact on privacy. Design openings to allow for privacy



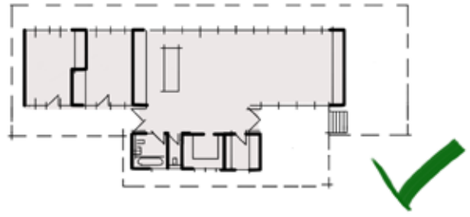
- Offset window alignment between houses to increase privacy
- Maintain window alignment within the dwelling to promote cross ventilation

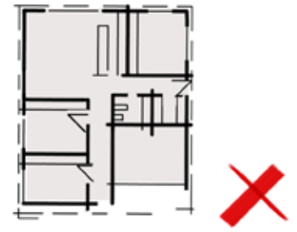
Hot and humid and hot and dry climates

1 2 3 4



- Ensure adequate separation is maintained between adjacent dwellings to allow for cooling breezes to be drawn into living spaces. Avoid “wind shadow” where possible
- The distance between the buildings should allow for landscaping and outbuildings to funnel breezes over, under and through the houses and provide shade on the ground and on the building walls.
- In detached dwellings ensure that building separation is maintained to avoid the transfer of radiant heat between them.
- Wall sharing in semi-detached buildings can lead to higher performance, as one wall is not exposed to the elements.





- Building separation and block sizes must be sufficient to prevent the occurrence of boxy and enclosed floor plans and allow for covered verandahs and open plan layouts

Temperate and cold climates

5 6 7 8

- Ensure adequate separation is maintained between adjacent dwellings to allow for solar access and cross ventilation (indoor air quality) where possible
- Where possible, ensure that the distance between the dwellings allows for landscaping with deciduous trees that provide shade in the summer while allowing solar gains in winter
- In colder climates shared walls (semi-detached houses) could help reduce heat losses and achieve more spacious outdoor areas in small lots

C.5 Pedestrian and Vehicle Access

— Where possible provide separate access for pedestrians adjacent to the vehicle driveway

— Where the parking area forms part of the dwelling access the space should be designed as follows.

- conform with the minimum dimensions set out in the *Property Checklist*
- be constructed as an even, firm and slip-resistant surface;
- be built to a minimum gradient, as stipulated in the *Property Checklist*

— Driveway cross-overs to be clear from street trees. Refer to Property Checklist for minimum clearance

— Minimum width of the driveway must enable safe access to the garage.

— Minimum length of the driveway must accommodate one car parked on the driveway within the block

The driveway at this DHA property at Muirhead allows for a car to be parked outside the garage, within the property boundary.

C.6 Safety and Security

Use of an integrated security screen in front of entry door at a DHA property

— Security screens are to be provided to all ground floor and any upper level windows that are accessible, except for residences within a Defence base.

— Crimsafe or equivalent security screens to be installed to all front facade openings, including doors.

— All external doors are to be security doors. This is not required on internal or external garage doors

— A solid core door must be installed when there is internal access to the garage

— Do not design awning windows to front facade, as these may cause complications with security screens.

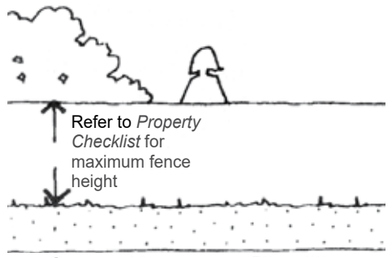
C.7 Streetscape

— Ensure dwellings on corner lots address both streets

— Consider locating habitable rooms to address the street

This DHA property at O'Connell Enogerra addresses the street over two levels, and utilises landscaping to screen the entrance and improve the relationship with the street.

— Consider the location of street bins, water tanks and utilities in relation to street visibility



Source: Your Home, 5th edition

— Front porches and verandahs, as well as landscaped gardens at the front of the dwelling improve the building's relationship with the street and surrounding buildings

— Consider avoiding high fences and hedges along the front boundary to improve connection with the street

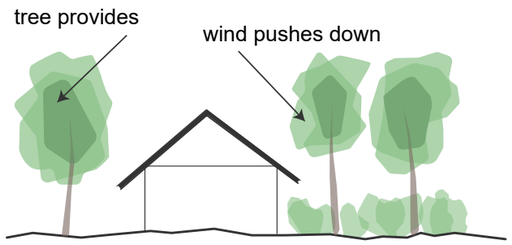
— It is mandatory to cut out all layback kerbs to comply with council's requirements (Brisbane and Ipswich only)

C.8 Landscaping Principles

1 2 3 4 5 6 7 8

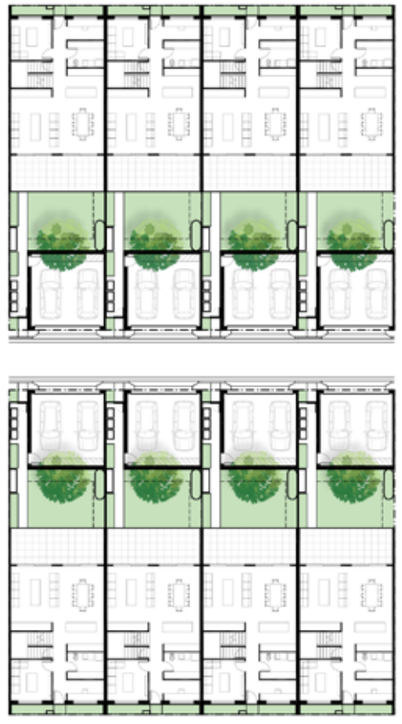
— Consider the use landscaping to provide additional shade to the dwelling

— Consider using deciduous trees in cooler climates



— Planting and landscaping can also be used to channel prevailing breezes into the building, or protecting from cold winds

— The location of tree planting should be considered with regards to the adjacent lots to achieve an adequate distribution of canopies and shading. The diagram above illustrates how to arrange trees in detached dwellings that are mirrored vertically.



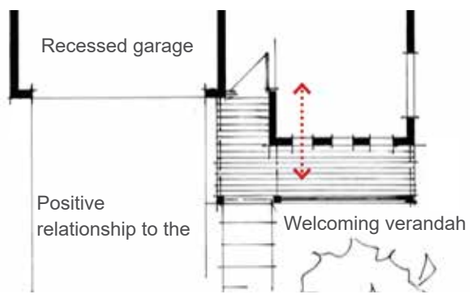
— The diagram above illustrates the ideal tree placement for terrace-type dwellings

Tropical areas

1

— The diagram above illustrates the ideal tree placement for detached dwellings with breezeways

C.9 Patio and Courtyard Principles



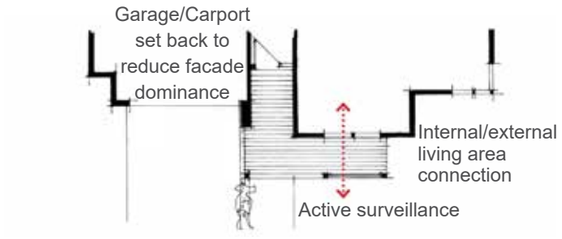
Source: Tropical Housing Design Guidelines,

— In narrow sites, courtyards can be used to provide access to natural light and ventilation. Solutions must be optimised for climate: increasing cross ventilation and shading in hot climates, and increasing winter solar access in colder climates.

Hot humid climates

— Provide shaded and screened patios for indoor-outdoor living and sleep-out spaces

— Outdoor spaces at the front of the dwelling help to create street amenity



Source: Tropical Housing Design Guidelines,

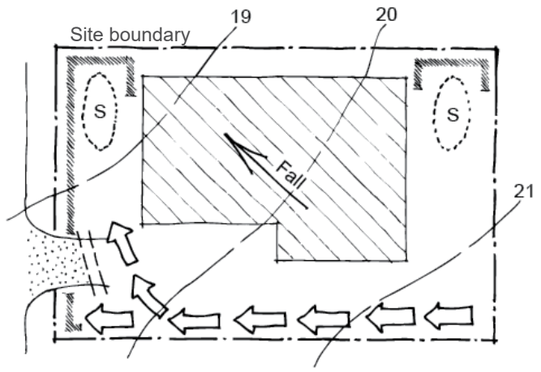
— Consider placing patio elements at the front of the dwelling to reduce the overall bulk of the facade (diagram)

— The depth of patios must be optimised for climate: deep overhangs are ideal in hot climates, but could dramatically reduce natural light in colder climates, especially in winter

C.10 Sediment Control

1 2 3 4 5 6 7 8

- Consider designing to avoid excessive cut and fill and unnecessary clearing of vegetation
- Attempt to maintain existing site drainage patterns during construction
- Avoid carrying out site activities that disturb soil during periods of expected heavy or lengthy rainfall - wet seasons wherever possible
- Divert uncontaminated stormwater away from the work area using flow diversion devices wherever possible
- Use sediment control devices such as the woven sediment fences, vegetated filter strips, inlet traps so as to minimise contaminated water runoff from the site wherever possible
- Protect stockpiles and materials that may erode with waterproof coverings. Divert stormwater runoff away from these and protect with sediment barriers



Source: Your Home, 5th edition.

Building Envelope

D.1 General Design Principles

D.2 Daylight Control

D.3 Ventilation

D.4 Thermal Performance

D.5 Construction

D

D.1.1 Facade Design

1 2 3 4 5 6 7 8

Smith Kearns Residence, *Tzannes*

— The building facade should be of simple, modern design. This architectural language is characterised by the following design strategies:

- The idea that “form follows function”, meaning that the result of design should derive directly from its purpose. In practice, single storey houses, for example, should be designed to look like single storey homes of its time, climate and place.

Materials to be detailed directly without complex detailing

- Building forms should be simple, directly detailed, true to the materials used and without any complex detailing or junctions which have no aim other than to be ornamental.

D. Building Envelope
DHA Design Guidelines
General Design Principles

Material changes. Nursey Residence, *Tzannes*

- Avoid multiple changes of materials within the facade
- Where different materials are required the change should happen at logical points, such as between the first and second storey.
- It is preferable to continue the facade material around the corner and “wrap the volume” rather than to change materials on each face. Avoid cladding individual faces.

Express structure. Kronenberg Residence, *Tzannes*

- Material changes for no purpose other than ornamentation or interest should be avoided.
- Where possible structure is to be given visual expression (as opposed to the hiding of structural elements). This can take place, for example, in exposed underside of roofs externally or internally, on facades, etc.

D. Building Envelope
DHA Design Guidelines
General Design Principles

Truth to materials, brick preferred over render

- Building architecture should seek to express “truth to materials”, meaning that the true nature or natural appearance of a material ought to be *seen* rather than concealed or altered to represent something else.
- Visual emphasis is on horizontal and vertical lines, not on diagonals.
- Use of materials should be functional and rational, with honest and direct detailing, and with an openness to structural innovation and the elimination of ornament.
- The use of pre-finished materials, such as brick and pre-finished aluminium are preferred over post-finished cladding such as render and paint due to ongoing maintenance costs.

DHA Residence at O’Connell Enoggera

- The entry to the dwelling should be visible from the street
- Bathroom or laundry windows should not be on the street facade
- A covered entrance must be provided, refer to E.2 Front Entry for minimum area and dimensions
- The garage and entry line should be recessed from the main facade
- At least one window from a habitable room should face the street to provide passive surveillance

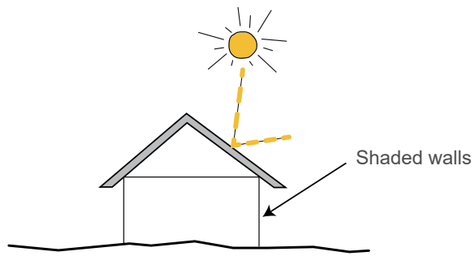
D.1.2 Roof Form and Awning Design

1 2 3 4 5 6 7 8

— Flat, skillion or pitched roofs are permissible

— Refer to Property Checklist for permissible pitched roof angles

— Dark roofing materials should be avoided to lessen the impact of heat loading (zones 1-6 only)



— Roof spaces should be ventilated (zones 1-6 only)

— Thick and insulated roofs with wide eaves should be designed to provide adequate shading as well as protection from solar heat

— Increasing roof insulation over and above NCC requirements is an effective strategy to reduce heat transfer in all climates

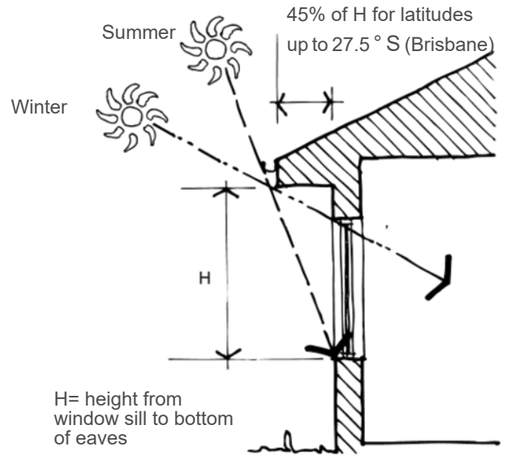
Hot Humid Climates

1

— Eaves are to cover all openings, including south-facing ones. Refer to Property Checklist for minimum eave depth

— Consider shaded skylights to compensate for any resultant loss of natural light

— A fly roof can be used to shade the entire building



Source: Your Home, 5th edition.

Hot Dry, Warm Humid and Warm/Mild Temperate Climates

2 3 4 5 6

— Use deep overhangs to protect walls and openings. Deep overhangs, however, are only partially useful in east-west facades. Combine with vertical screens or louvres for effective shading to openings.

— For latitudes south of and including 27.5 ° S eave depth should be a minimum of 45% of the height from the window sill to the bottom of the eaves. Refer to Property Checklist for minimum eave depth, however consider increasing eave depth in line with the above best practice wherever possible.

Cool and Alpine Climates

7 8

— Refer to Property Checklist for minimum eave depth

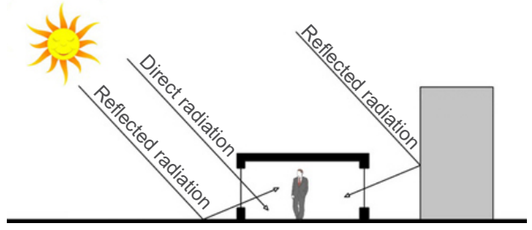
— Avoid creating shade to any portion of north-facing glass in winter where possible

— In regions with heavy rainfall and snow the pitch angle should be increased

— Increase roof insulation for flat and raked rooves, and ceiling insulation for pitched rooves (no ventilated roof cavity) wherever possible

D.2.1 Shading

Providing adequate shading is a fundamental principle in creating well-designed houses. By shading a building and its outdoor spaces we can reduce summer temperatures, improve comfort and save energy.

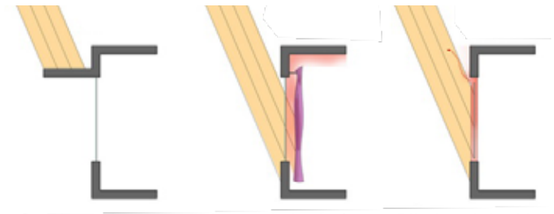


Source: Carbon Neutral Design Project, Terri Meyer Boake

Shading aims to reduce the amount of solar radiation that enters a space, either directly or through reflection. A variety of shading techniques can be utilised depending on orientation, climate and latitude.

All Climate Zones

1 2 3 4 5 6 7 8



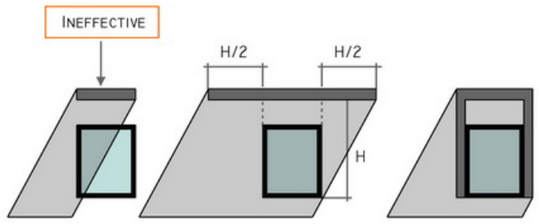
Overhang / no direct sun enters the space

Internal shade / sunlight enters the space, heat builds up between curtain and window

Blind and double glazing / Heat builds up in the window itself and is exhausted to the outside

Source: Carbon Neutral Design Project, Terri Meyer Boake

— Use external shading devices over openings and externally, in front of glass where possible. Internal shading (blinds) does not prevent heat gain. Consider shading with eaves, external shading devices, landscaping or the like



Source: Carbon Neutral Design Project, Terri Meyer Boake

— North-facing openings receive higher angle sun in summer and therefore require narrower overhead shading than east or west openings. Generally fixed horizontal shading above openings is all that is required on north-facing openings

— Minimise east-west glazing where possible. Shading these is more challenging as they must deal with lower sun angles, such as early morning and afternoon sun.

— Deep verandahs or pergolas can be used to shade east-west glazing

— Shade all roof glazing or skylights externally

— All west-facing windows should be shaded. However, solar gains from west-facing windows may be beneficial in colder climates

— Shading east-west openings through overhangs can lead to very large spans. In these cases, external shading devices such as vertical operable blades can be a better solution.

Hot Humid Climates

1

— It is preferrable to shade all external openings, even those facing south

— Consider using covered outdoor areas such as verandahs and deep balconies to shade and cool incoming air

— Use shaded skylights to compensate for any resultant loss of natural light where possible

— Consider positioning suitable landscaping to provide adequate shade without blocking access to cooling breezes

Hot Dry, Warm Humid and Warm/Mild Temperate Climates

2 3 4 5 6

— It is preferrable to shade all external openings and walls, including those facing south

— Avoid shading any portion of the glass in winter when heating is required wherever possible

— Consider using adjustable shade screens or deep overhangs to the east and west

— Consider placing a shaded courtyard next to the main living areas to act as a cool air well

Cool and Alpine Climates

7 8

— Avoid shading north-facing glass in winter where possible

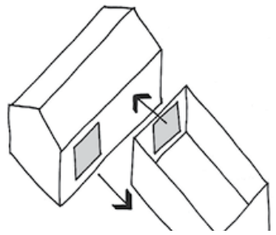
— Consider using deciduous planting to the east and west

— Avoid placing deep covered balconies to the north where possible, as they obstruct winter sun

D.2.2 Privacy

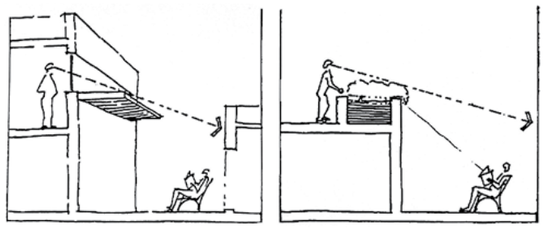
1 2 3 4 5 6 7 8

— Consider using landscaping as natural screening to optimise privacy between dwellings



Source: Your Home, 5th edition.

— Design spaces to avoid overlooking into neigbours' living areas



Source: Your Home, 5th edition.

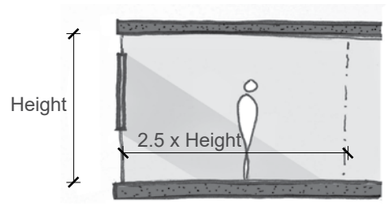
— Offset windows and openings to prevent looking into neighbours' living areas wherever possible

D.2.3 Solar and Daylight Access

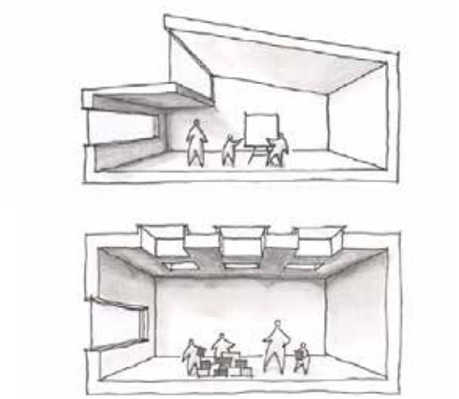
1 2 3 4 5 6 7 8

— North-facing windows introduce sunlight and daylight into the home, particularly in winter when the sun angle is lower. This contributes to the house's lighting and heating

— South-facing windows (below the Tropic of Capricorn) predominantly introduce daylight without any heat gains from sunlight. This makes them suited to houses in warmer climates where cooling is imperative

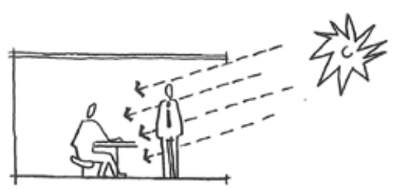


— Good daylighting in an interior space can be achieved using the following rule of thumb: effective daylighting can only cover a space that is 2.5 times the height of the wall with the opening



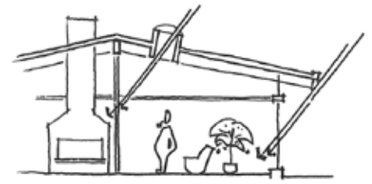
Source: Lighting Design, Werner Osterhaus

— Clerestories or roof monitors can help light deep interiors when oriented and shaded correctly



Source: Lighting Design, Werner Osterhaus

— Aim to keep direct sunlight away from 'task areas' such as kitchens or desks due to the potential for glare and occupant discomfort



Source: Lighting Design, Werner Osterhaus

— Use direct sunlight sparingly in non-critical task areas

— Skylights and solar tubes can light an interior with little heat gains if shaded and, in cold climates, use high performance glass

— Light-coloured interior surfaces reflect more light and reduce the need for artificial light

D.2.4 Artificial Lighting

1 2 3 4 5 6 7 8

— Look to design artificial lighting to complement natural lighting

— Use energy efficient appliances and fittings, including light emitting diodes (LEDs) and compact fluorescent lamps (CFLs) where practical

— Avoid down lights when possible as their installation often compromise the thermal resistance of the envelope (perforation of insulation layer)

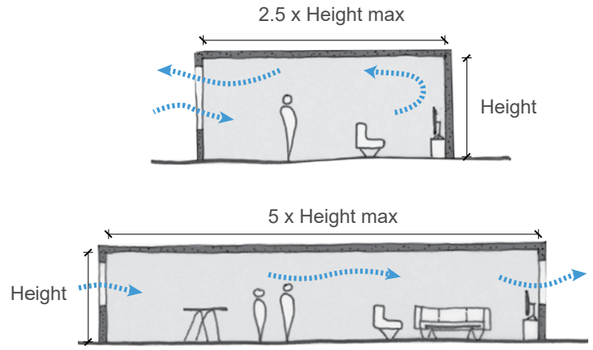
— Use centralised switchers where possible

— Consider using task lighting to reduce overall energy consumption

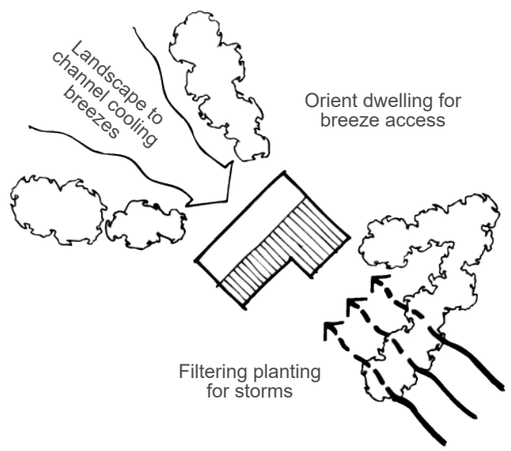
D.3.1 Natural Ventilation

1 2 3 4 5 6 7 8

— Consider designing to maximise beneficial cooling breezes by providing multiple flow paths and minimising potential barriers inside the dwelling



— As a rule of thumb, single sided rooms (ie. Ventilated on only one face) should only be a maximum of 2.5 times the height of the room to be effectively ventilated, whilst double sided rooms can be a maximum of 5 times the height.



Source: Your Home, 5th edition.

— Design and locate planting, fences and outbuildings to funnel breezes into and through the building, filter stronger winds and exclude adverse hot or cold winds wherever possible

— Use passive design strategies to increase air exchange and improve internal air quality where possible

— Consider designing single depth rooms in warmer climates

— Locate openings to direct airflow to the areas where occupants spend most time, such as dining tables, desks, etc. where possible

Hot humid climates requiring cooling only

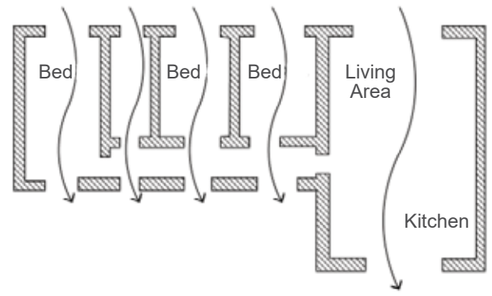
1

— Position well-shaded openings on every facade where possible

— Openings should be located and sized to capture air movement, not sunlight

— Aim to maximise exposure to cooling breezes onto the site and through the building

— Consider using single room depths with well shaded large openings on both sides to enhance cross-ventilation and heat removal



Source: Your Home, 5th edition.

— Aim to design unobstructed cross-ventilation paths

— Consider elevating the building to encourage airflow under floors

— Consider the use of high or raked ceilings to promote convective air movement

— Design landscaping to funnel cooling breezes and filter strong winds where possible

— Consider implementing design solutions to achieve stack ventilation, such as clerestory windows

Warm humid climates

- Design and orientate to capture cooling breezes where possible
- Aim to provide high levels of cross-ventilation via unobstructed pathways
- Consider designing indoor spaces to open to shaded outdoor porches and verandahs

Hot dry climates with warm winter

- Consider using evaporative cooling if mechanical cooling is required

Hot arid climates with cool winter

- Use compact plans with large depths to minimise surface area where possible
- Where possible, include closeable stack ventilation in stairwells and thermal separation between floors in two storey homes.
- Consider using shaded internal courtyards with evaporative cooling features in single storey homes.
- Use smaller window and door openings designed for night-time cooling and cool thermal currents where available.

Temperate climates

- Aim to design for compact forms in cooler zones, extending the east−west axis in warmer zones
- Moderate building depth — two rooms is ideal
- Choose window opening styles and position windows to ensure good cross-ventilation

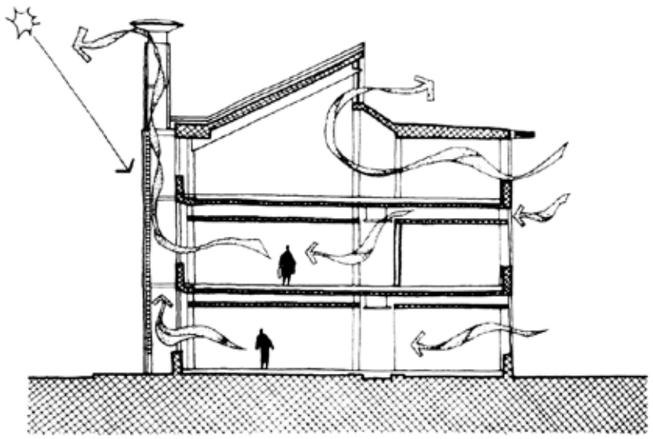
Cool and cold climates where heating dominates

- Consider designing openings for short time ventilation, usually in the morning
- Consider mechanical ventilation with heat recovery for cold climates

D.3.2 Stack Ventilation

1 2 3 4 5 6 7 8

— Stack ventilation uses temperature differences to move air. Lower air pressures at height can passively pull air through a building, causing hot air to rise because it is lower pressure.



Stack Ventilation. *Source: Sun, Wind and Light, G.Z. Brown and M. DeKay*

— In practice, cool air is sucked in through low inlet openings and hotter exhaust air escapes through high outlet openings. The ventilation rate is proportional to the area of the openings.

— Placing openings at the bottom and top of an open space will encourage natural ventilation through stack effect. The warm air will exhaust through the top openings, resulting in cooler air being pulled into the building from the outside through the openings at the bottom.

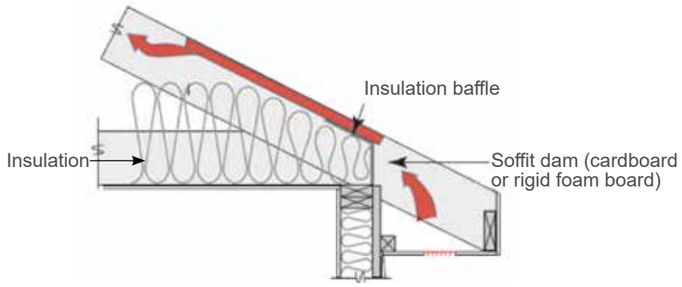
Different types of roof openings that can be used for stack ventilation

— Openings at the top and bottom should be roughly the same size to encourage even air flow through the vertical space.

— The most important design consideration is to have a large difference in height between air inlets and outlets. The bigger the difference, the better.

— Roof exhausts, fans and ventilators can all be used to achieve stack effect ventilation.

— Towers and chimneys can be useful to carry air up and out, or skylights or clerestories in more modest buildings. For these strategies to work, air must be able to flow between levels. Multi-story buildings should have vertical atria or shafts connecting the airflows of different floors.



Standard rafter and top plate with tapered insulation depth

D.3.3 Roof Ventilation

1 2 3 4 5 6 7 8

— Consider using ventilators to cool roof spaces

Extreme climates

— It is critical to insulate rooves and seal the internal space. This can be particularly difficult above the top plate.

Hot climate zones

— Whirlybirds alone are not sufficient to cool the roof space. Consider using power ventilators, light coloured roofs and under-roof insulation

D.3.4 Roof Openings

— Roof openings promote stack effect (air flow from the bottom to top of a building) and bring light in deep plans

— Look to limit roof openings in cold climates, and seal internal spaces well to avoid heat loss

— Roof openings are effective in hot climates as they can exhaust hot, high level air. However, the openings need to be effectively shaded to avoid overheating

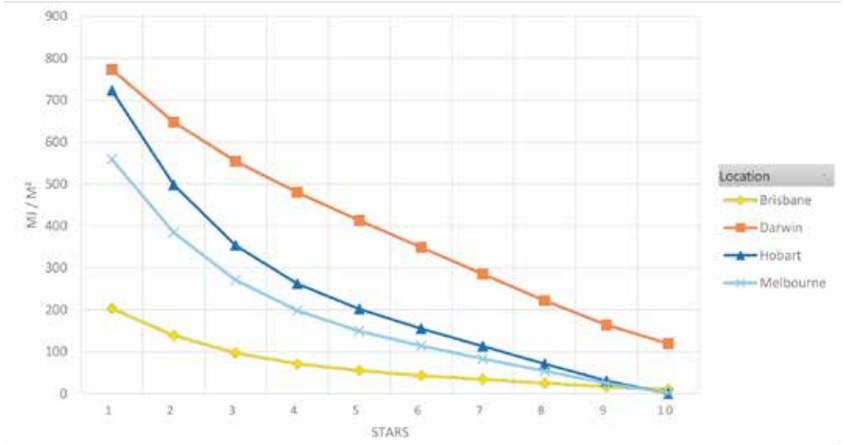
— Consider maintenance requirements to openable elements

D.4.1 Performance Guidelines

1 2 3 4 5 6 7 8

— All houses to be assessed against the Nationwide House Energy Rating Scheme (NatHERS). NatHERS is a star rating system that rates the energy efficiency of a home, based on its design. All DHA dwellings are to achieve a minimum NatHERS rating.

— Refer to Property Checklist for the minimum star level of certification required for each area.



Source: B. Beeson, University of Queensland

— Houses with comparable star ratings perform very differently depending on location. In general, houses in more extreme climates with high heating or cooling requirements have a much higher energy usage of a comparable house of the same star rating in a milder climate. For example, a 6-star NatHERS rated house in Darwin will have an energy consumption of up to 8 times the consumption of a 6-star NatHERS rated house in Brisbane due to the cooling load.

— Dwellings in very mild climates, (climate zones 2, 5, 6) , such as Sydney and Brisbane, have a very low thermal load in a 6-star NatHERS rated house.

— Houses in moderate climates, (climate zones 3,4,7) , such as Hobart, Canberra and Melbourne, have better energy reductions with increasing stars beyond 6-star.

— Houses in extreme climates, (climate zones 1,8), such as Darwin, have very good energy reductions with increasing stars beyond 6-star.

— Where possible, consider increasing the star rating and performance of dwellings to reduce overall energy consumption, especially of those located within Zones 1, 7 and 8.

— Make use of natural ventilation to prevent heat buildup

— Consider the use of energy efficient mechanical ventilation options such as heat recovery ventilation systems, heat pumps, etc.

— Ensure air tightness is achieved in the construction of elements to reduce/avoid uncontrolled air movement through the building envelope

— Air tightness also prevents moisture penetration through the envelope, which could otherwise result in condensation, structural damage and mould growth.

D.4.2 Insulation and Thermal Bridging

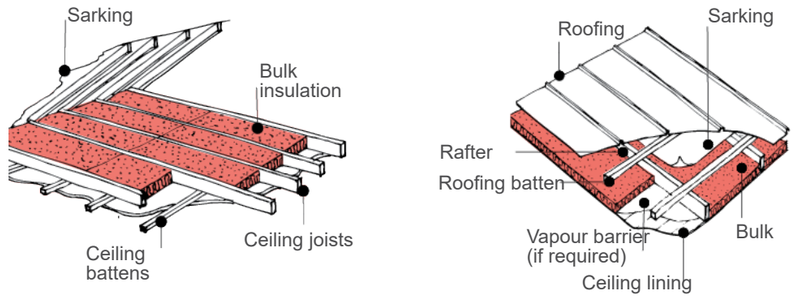
Effective and efficient insulation is an essential component of a dwelling. Climatic conditions influence the insulation strategy - location, seasonal and diurnal variations in temperature require different approaches. A well-insulated house that is fit for the particular climate it is in will make for a more comfortable and sustainable residence.

All insulation is to meet the specification requirements and achieve the required NatHERS star rating.

All Zones

1 2 3 4 5 6 7 8

— Where possible, avoid compressing insulation as this lowers performance. Plan construction details to make space for insulation.



Roof insulation. *Source: Your Home, 5th edition*

— Use the correct type of barrier and terminology:

- Sarking - a layer beneath the roof for thermal insulation, or to prevent water entry
- Vapour barrier - no vapour passes through, and prevents an assembly from getting wet
- Air barrier - no air passes through
- Breathable - air and vapour pass through

— Bulk insulation is not air tight. To work well, bulk insulation needs an air barrier, best placed on the outside face of the insulation.

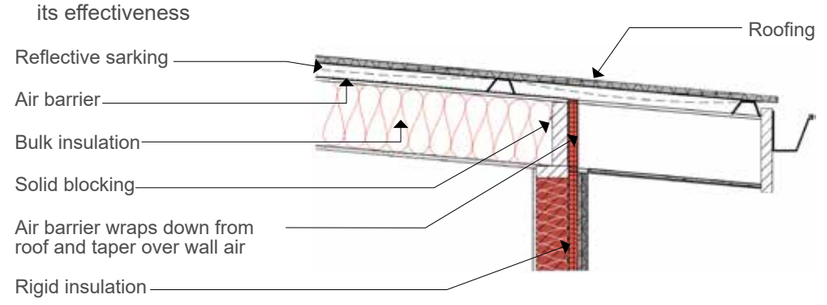
— Generally, locate a vapour barrier on the warm side of the construction. This means the outside for hot climates, and inside for cold climates

— Consider utilising a vapour barrier to garage walls to address moisture buildup

— Vapour barriers, when used incorrectly, can cause condensation and mould. The best method is to build an air-tight, vapour permeable construction; this allows for the controlled escape of vapour from within the building, whilst repelling the ingress of water from the outside. This is characterised by the following strategies:

- Use a vapour permeable, air-tight membrane
- Use water-based (naturally vapour permeable) paints
- Use no vapour barriers

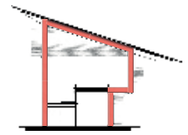
— Air tightness is essential to insulation, as air infiltration into the dwelling will reduce its effectiveness



Skillion roof/wall junction

Zone 1 - Hot Humid Summer, Warm Winter

1



— Although roof insulation is required, avoid bulk insulation to ceilings and walls except in conditioned spaces. Ceiling insulation may be provided if the roof cavity is adequately vented

— Consider protecting insulation from moisture through the installation of a vapour barrier on its warm side where air conditioning is used

— It is recommended to insulate exposed external walls

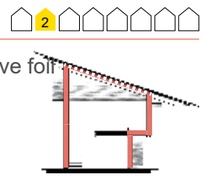
— Consider ventilating roof spaces well with fans or whirlybirds and design for condensation removal

— Consider insulating elevated floors with reflective, closed-cell bulk insulation to keep out heat and condensation, especially in air conditioned dwellings

— It is good practice to leave slabs on ground uninsulated

— Line open ventilated spaces with reflective foil insulation where possible

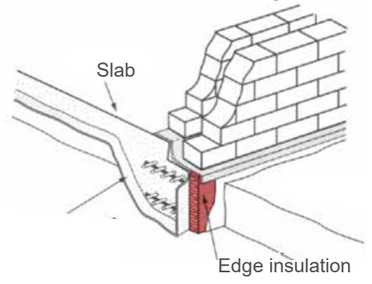
Zone 2 - Warm Humid Summer, Mild Winter



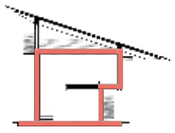
- In areas where no winter heating is required, consider using multiple layers of reflective foil sarking in ceiling/roof to create a one-way valve effect
- Consider insulating internal wall surfaces from any external thermal mass, (e.g. brick veneer)
- Consider using reflective vapour permeable air barriers in walls
- Add bulk insulation to rooms that are air conditioned where possible
- Consider using roof spaces to provide heat loss/gain buffer zones by ventilating them in summer and sealing them in winter with fans or ‘smart’ ventilators
- It is recommended to line open ventilated spaces with reflective foil insulation and design to remove condensation.
- Where possible, avoid installing bulk insulation in ceilings and walls unless winter heating is used.

Zones 3, 4, 5 & 6 - Hot Dry, Warm Temperate and Mild Temperate

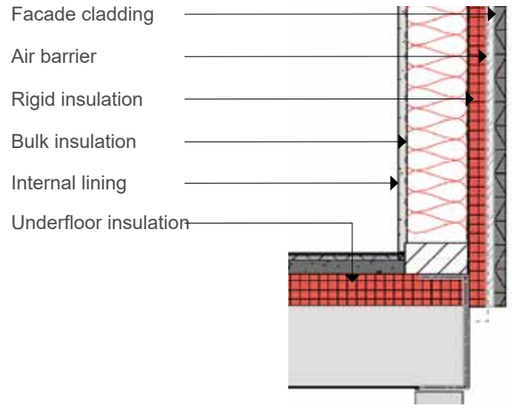
- Consider using bulk and reflective insulation in ceilings, and bulk or reflective insulation in walls.



Slab edge insulation. *Source: Your Home, 5th edition*

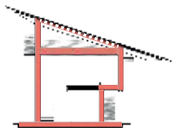


- It is recommended to provide external insulation to all thermal mass.
- Consider insulating under concrete slabs and edges if using in-slab heating. Approximately 80% of slab heat loss happens through the edge
- It is good practice to ensure that all spaces are effectively air sealed.
- It is recommended to insulate elevated floors (concrete and lightweight)



Floor/wall detail showing the continuation of rigid insulation from the wall to the underside of the suspended flooring.

Zones 7 and 8 - Cool Temperate and Alpine



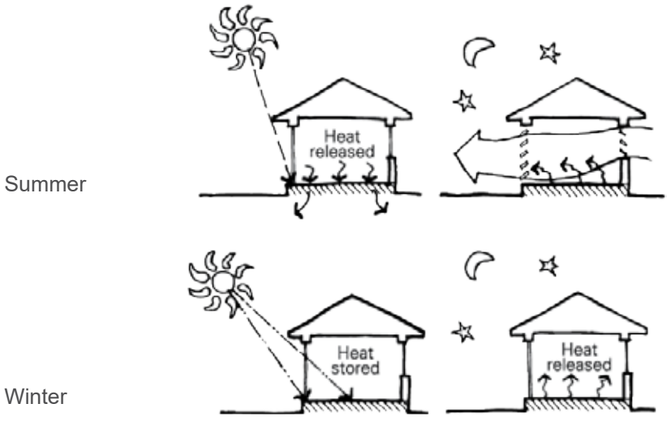
- Bulk insulation should be considered to the whole envelope - in walls, ceilings and floors.
- Consider using double glazing with airtight frames and thermal breaks. Heavy drapes with sealed pelmets can be used, although they are of a lower performance and can cause superficial condensation
- For walls consider bulk insulation with highly breathable sarking or multiple layers of reflective foil insulation, with detailed design to ensure condensation discharge.
- Consider insulating all thermal mass externally and expose to direct sun in winter
- It is good practice to use high levels of bulk insulation in ceilings and line underside of roofing material with downward-facing reflective foil (Zone 7) or downward-facing, closed cell, foil-coated bulk insulation (Zone 8).
- Consider using closed cell reflective insulation in preference to compressed bulk insulation where supplier recommends an anti-condensation layer under roof material.
- It is recommended to insulate all elevated floors, under slab and slab edges
- Provide airlocks to entries wherever possible to avoid loss of heat via drafts
- Consider air seals to all spaces

D.4.3 Thermal Mass

1 2 3 4 5 6 7 8

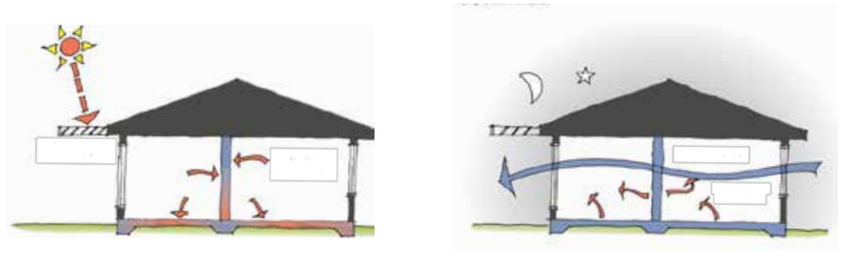
— Thermal mass is not a substitute for insulation. Thermal mass is designed to absorb and release heat, while insulation stops the heat from entering or exiting the building.

— Thermal mass is most appropriate in climates with a large diurnal temperature range. However, it can also be beneficial in cold climates that require internal heating



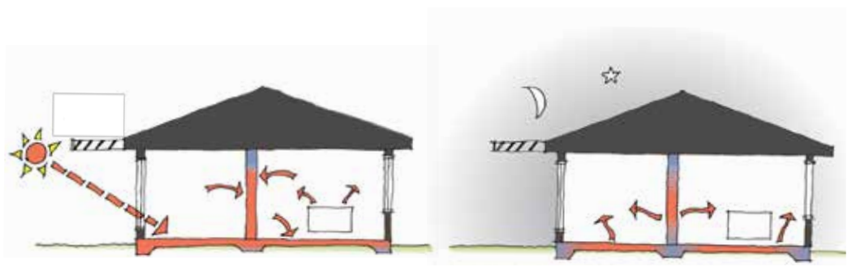
Thermal mass strategies in summer and winter. *Source: Your Home, 5th edition*

— As a general rule, thermal mass should be allowed to absorb heat during the day and re-radiate it at night time.



Diurnal thermal mass summer strategy.
Source: Level NZ, BRANZ

— In summer, thermal mass should be protected from direct sun, and exposed to breezes during the night to draw out the stored energy and re-radiate it



Diurnal thermal mass winter strategy.
Source: Level NZ, BRANZ

— In winter (in climates where heating is required), thermal mass should be exposed to direct sunlight and any other sources of heat (ie. Radiators) during the day, and protected from cool breezes at night to draw out the stored heat and keep it within the dwelling

— If in a climate zone where cooling is primarily needed protect thermal mass from the summer sun and shading and insulation if required; and allow cool night breezes to pass over it and purge the stored heat.

— If in a climate zone where heating is primarily needed locate thermal mass in positions that are exposed to direct sunlight or internal locations where it can absorb radiant heat from heaters

— If in a climate zone that requires both cooling and heating locate thermal mass inside the building on the ground floor for ideal summer and winter efficiency. Locating the mass on the floor is usually the most economical and also benefits from earth coupling for additional thermal stabilisation during both summer and winter.

— If both cooling and heating are required locate thermal mass in north-facing rooms with good solar access and exposure to evening breezes. Additionally, design thermal mass near the core of the dwelling, particularly if a heater or cooler is positioned there

— In climates that require both cooling and heating, thermal mass must be exposed to winter sun but protected from summer sun. This can be achieved through the correct design of eaves and use of shading devices

— Thermal mass may not always be of benefit, it can sometimes be detrimental to the house. In very hot climates, for example, thermal mass that is exposed to the west will store and re-radiate solar heat into the house at night, rendering the space uncomfortable. Similarly, exposed slabs that are in contact with the ground in cold climates, without any winter sun will feel uncomfortably cold for occupants

D.5.1 Materials

1 2 3 4 5 6 7 8

— As a general rule, limit the number of material junctions

— Avoid unnecessary steps in the plan to create elevation articulation

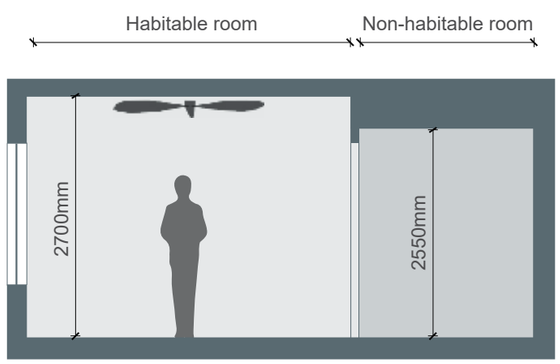
— Minimise the number of material changes on the facade

— If changing materials on the facade, look to establish a consistent datum for this ie. A horizontal reference that makes visual sense, such as window sills. Consider where the material change occurs in two storey houses

— Utilise materials to articulate volumes, not just covering a surface. Apply the same material to the entire volume, not a single side of it

— Use pre-finished materials wherever possible - face brickwork, bare masonry and metal cladding if preferred to minimise maintenance costs, rather than rendering and painting

D.5.2 Walls and Ceilings



Minimum ceiling heights for habitable and non-habitable rooms

- Ceilings to habitable areas (bedrooms, living room, lounge room) are preferred to be a minimum of 2700mm from floor level. This height allows for an adequate clearance for ceiling fans. Refer to the Property Checklist for mandatory minimum ceiling heights.
- Ceilings to non-habitable rooms (bathrooms, ensuites) must be a minimum of 2550mm from floor level

D.5.3 Glazing

Indoor-outdoor connection, Garden House - *Tzannes*

— Consider using glazed sliding doors to enhance the connection between indoor and outdoor spaces

— Where possible, avoid excessively large aluminium frames, as they are very poor insulators

— See WERS (Window Energy Rating Scheme) website for authoritative data on window performance. Windows performance can be specified with a WERS rating

— In extreme climates, consider windows with very low leakage (available on WERS site)

— As a general rule, locate most glazing to the north, with moderate overhangs to protect from harsh summer sun where possible

— In all cases, avoid the excessive use of glazing

— There are many different types of glazing, each with differing cost and performance qualities. Generally, the highest performing glazing will be the most expensive. Starting from the highest performance/cost: low-e double glazing, standard double glazing, low-e single glazing and single glazing

Hot Humid, Warm Humid and Hot Dry zones

— Adequate external shading should always be the primary strategy, as it is more effective and cheaper than high-performance glazing

— Selective glazing is an effective solution for letting light in whilst keeping heat out, although the cost has to be taken into account

— In hot climates consider double glazing or low-e single glazing.

— Aim to use more glazing to the north and south, with moderate overhangs on the north

— Aim to minimise eastern glazing, and omit/minimise western glazing

Warm Temperate and Mild Temperate zones

— Consider low-e glazing or well-shaded standard single glazing

— Carefully size and orientate windows to avoid overheating. Heavily minimise western glazing where possible

— Consider using more glazing to the north, with adequate overhangs

— Modest southern glazing can provide good daylighting without overheating

— Consider double glazing in zones with higher heating requirements ie. Colder winters

Cool Temperate and Alpine zones

— Use standard double-glazing where possible

— Aim to use more glazing to the north with small overhangs on the north.

— Aim to use more glazing to the east for morning warm-up (but refer to fog note below).

— Minimise east-facing glazing in areas where fog limits winter solar gains (Zone 8 only)

— Minimise cold southern glazing where possible

— Minimise western glazing where possible

— Aim to carefully design and size glazing to maximise direct sunlight to thermal mass

D.5.4 Windows and Doors

— Well-insulated buildings use a thermal insulation layer that carefully encloses the whole building without any missed area, which means no “holes” or “thermal bridges” in the insulation. If there are, heat transfers significantly through any “hole”, greatly reducing the whole system of insulation.

— Consider window and door frames with minimal thermal bridging where possible. This means that the metal framing of the glazing system will not be in direct contact with external walls which have high thermal mass.

— Where possible, align doors and windows to promote cross ventilation

— All rooms to have an openable window

— Skylights are permitted to corridors and bathrooms, however a window is preferred

— Consider openings above internal doors to promote cross-ventilation

— Refer to Property Checklist for minimum internal door clearance

Hot Humid and Warm Humid zones

— It is recommended to use only 100% openable windows such as louvre or casement

— Look to maximise external wall openings to encourage cross-ventilation

— Consider louvres or openable highlights above doors to allow for cross ventilation

Hot Dry Summer, Cool Winter zone

— Consider thermally improved or insulated frames, especially in air conditioned dwellings

Mild Temperate zone

— Use tight fitting window coverings with pelmets where possible

— It is recommended to seal thoroughly against draughts and use entry airlocks

Cool Temperate and Alpine zones

— Where possible, specify thermally improved or insulated frames. High performance doors and windows should be used in these climate zones

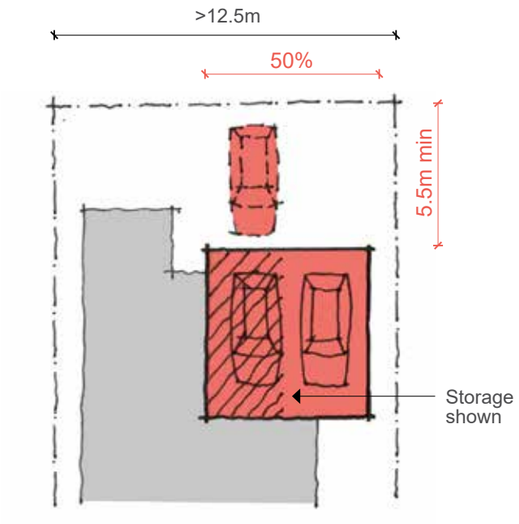
— If high performance doors and windows are not used, look to design and detail for high levels of window condensation

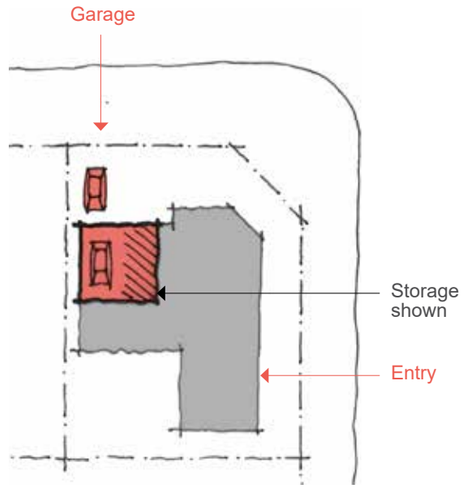
— It is recommended to provide airlocks to entries and seal all interior spaces

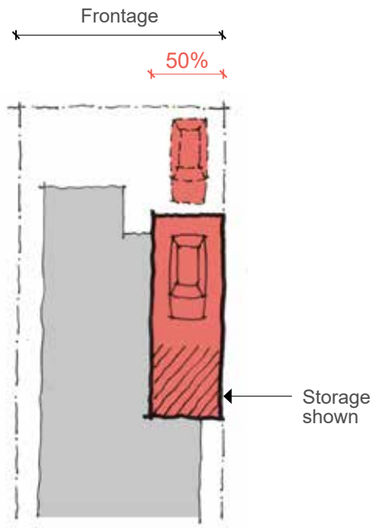
External Areas - Size and Function

E

E. External Areas - Size and Function
DHA Design Guidelines







E.1 Car Parking

1 2 3 4 5 6 7 8

— The minimum provision for a service residence is a single lock up garage

— Width of the garage door is limited to 50% of the front facade. Refer to Property Checklist for minimum dimensions, or developer's/council covenant if applicable

— Garage door should be simple and plain-coloured, and should be in keeping or recessive to the facade palette

— The garage portion of the dwelling is to be set back from the building line. Refer to the Property Checklist for setback

— The garage is to be set back a minimum of 5.5m from the boundary to allow sufficient space for a car to park on the driveway.

Lots >12.5m

— Double car garages are only permitted in lots of 12.5m or wider

— For a double car garage, the area for the second car is considered an acceptable equivalent for the required area of storage

Corner lots

— For corner lots, the garage is preferred to be accessed on the secondary frontage where practicable

Lots <12.5m

— Single fronted tandem garages should be used in narrower lots

— Where the garage can be accessed from a service lane, a double car garage is permissible

— Single garages are to include additional storage in lieu of a storage shed. Refer to the Property Checklist for minimum storage area

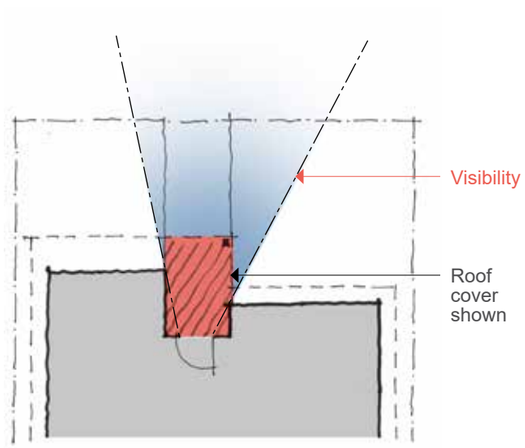
Hot Humid zones

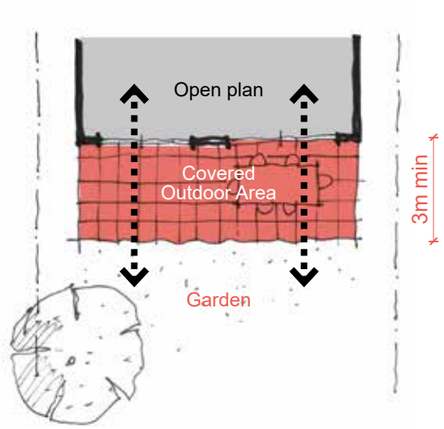
1

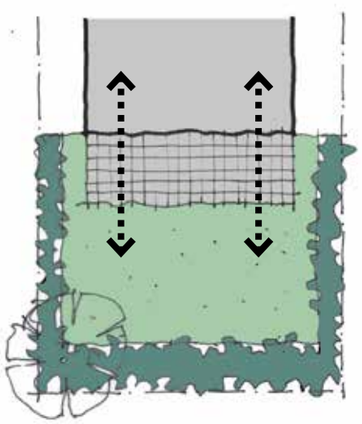
— Non-enclosed carports are permitted in Darwin only

— Provide ventilation to garage doors where enclosed

E. External Areas - Size and Function
DHA Design Guidelines







E.2 Front Entry

- The entry should be clearly visible from the street
- A sheltered porch is to be designed to the front entrance
- Refer to the Property Checklist for minimum areas and dimensions

E.3 Covered Outdoor Area

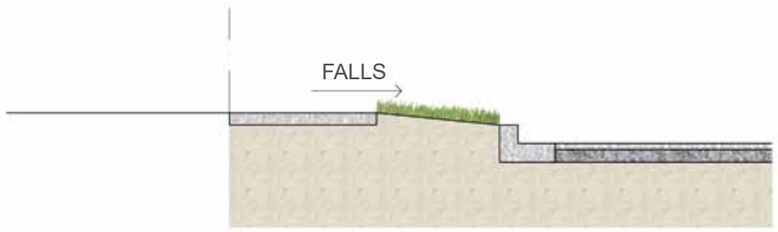
- Covered outdoor area must accommodate a table and chairs for six people as well as space for a BBQ.
- Refer to the Property Checklist for minimum areas and dimensions
- Cover to outdoor area must be solid and water-resistant. Sails are not permitted
- Floor finish is to be a solid, water resistant surface
- The covered outdoor area should be directly accessed from the primary internal living area

Hot Humid zones

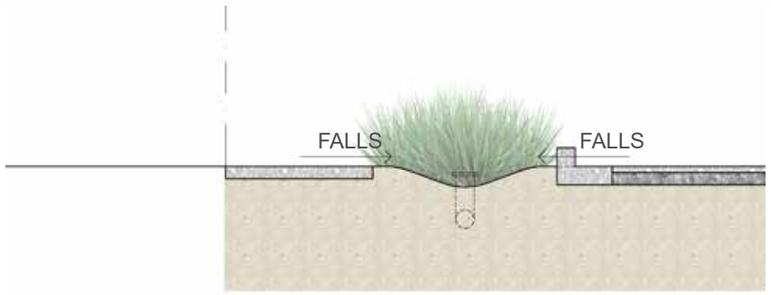
- The eaves must project beyond the minimum area by 900mm for adequate weather protection

E.4 Rear Yard Principles

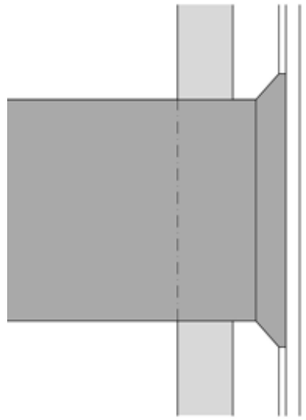
- The minimum fenced yard area should be usable and clear of obstructions
- An area clear of planters and obstructions should be provided
- The primary rear yard should be directly accessed from the covered outdoor area
- The rear yard should be directly assessable from the primary internal living area
- Consider full height glazing to windows and sliding doors to allow views of garden and increase natural light
- Refer to the Property Checklist for minimum areas and dimensions

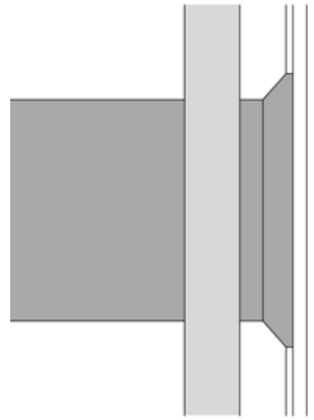


Typical Street Verge



Raingarden Verge





E.5 Streetscape Planting Strategy

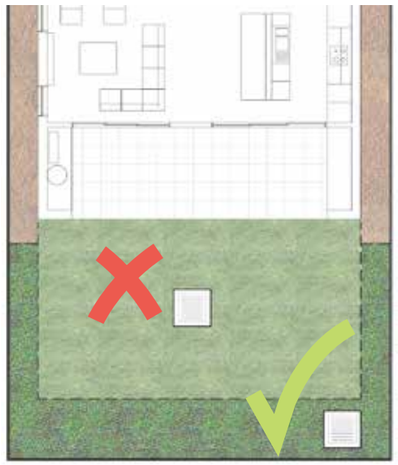
1 2 3 4 5 6 7 8

- Turfed verges to be installed, alternatives to be considered only if local authority conditions require e.g. planted verges, swales, or raingardens
- Raingardens to be designed to receive run-off from adjacent impermeable surfaces, including roads and footpaths - kerbs may be segmented to allow street gutter to flow into raingarden
- Street trees shall be planted to all streets to local government specifications, or in all other cases at 10-15m centres depending on species size
- Tree species to be selected from locally native drought-tolerant varieties with a preference for minimal debris drop, and used to reinforce community / neighbourhood identity

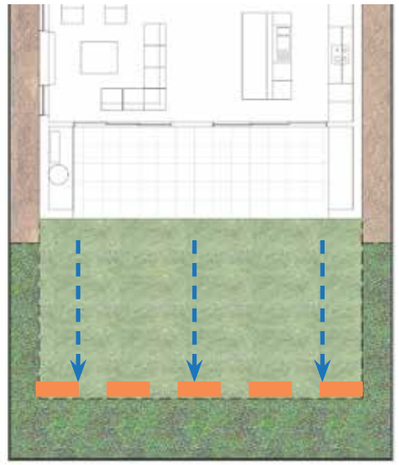
E.6 Public Domain Footpaths

1 2 3 4 5 6 7 8

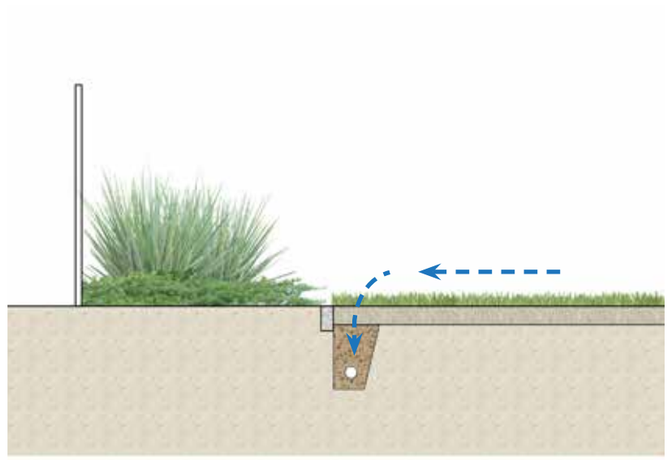
- Public footpaths shall be designed in accordance with local authority specifications
- Should local authority specifications not be available then the minimum standard of public domain footpath shall be broom finished insitu concrete, minimum 1200mm wide
- Driveways over footpaths are preferred over driveways interrupted by public footpaths, unless local authority controls dictate otherwise
- Maximum 1:40 cross-fall, minimum 1:100
- Maximum grade 1:20
- Footpaths shall be installed flush with adjacent surfaces with no raised edges or trip hazards



Pit Locations



Subsurface Agg Line



Subsurface Agg Line

E.7 Lot Drainage

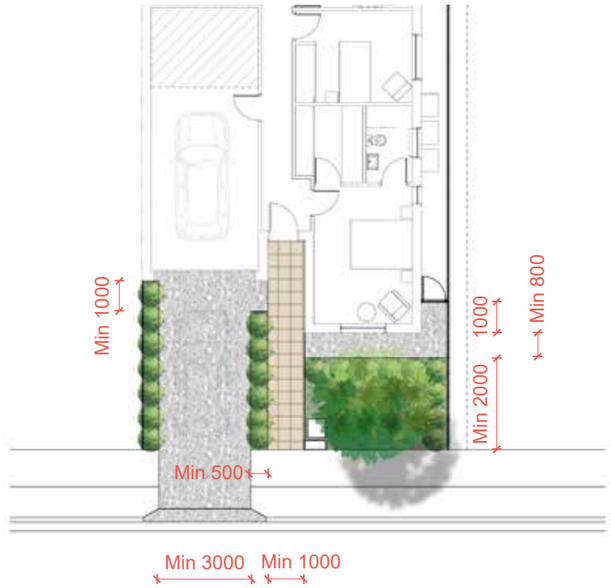
1 2 3 4 5 6 7 8

- All external surfaces to be graded away from dwelling, all drainage to be captured within lot
- All hardstand to be graded to shed surface water towards adjacent lawn and garden beds for passive irrigation
- All external stormwater outlets to be installed flush with adjacent surface finishes and located to perimeter of lots
- No grated drains to be installed within lawn areas, nominally to be located within perimeter garden beds (see above left)
- Subsurface drainage options such as aggregate lines may be utilised to the perimeter of lawn areas in lieu of grated drains (see above centre and above right)
- Drainage system to be engineered to take both roof / downpipe flow in addition to landscape stormwater, or landscape stormwater must be on a separate system to the roof

Zones 1+2 - Hot/Warm Humid Summer, Warm/Mild Winter

1 2

- No subsurface aggregate lines to be used, all drainage to be via grated drain
- Minimum 800mm width unimpeded concrete path to full circumference of dwelling to shed excess water away from dwelling during high rainfall (Darwin Region only)



E.8 Front Yard Character

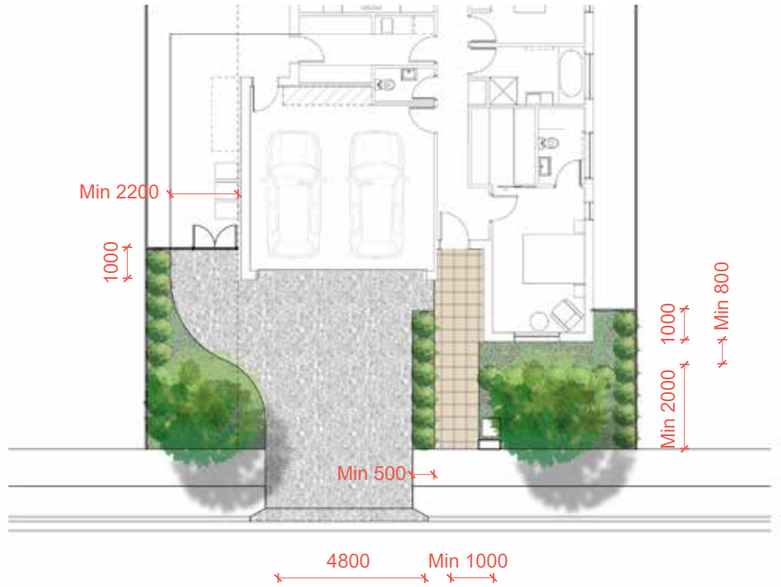
Front yards should be designed to be open and visually accessible, to engage with the street and with neighbours.

All zones

1 2 3 4 5 6 7 8

- Garden beds preferred over lawn
- Garden beds minimum 500mm wide
- Minimum 2 trees (minimum 1 tree for narrow lots <10m wide) to 6m mature height
- Main entry path to be differentiated from driveway surface with higher class finish, continuous pavement not stepping pavers, and separated from driveway by a minimum 500mm width garden bed
- Services, water tanks, hot water units, and rubbish bins to be concealed from public view, preferably located within side setback behind fence
- Paved connection to driveway for bins (no gravel or stepping pavers), driveway to be centred on garage and 4.8m wide (3.0m for narrow lots)
- Stepping pavers may be used for tertiary path connections
- No fences to front boundary
- Fence returns set back minimum 1.0m from dwelling
- Trees to be planted within garden beds, not lawn
- Letterbox to be adjacent main entry path at front boundary, stepping paver or path extension required to rear of letterbox to allow access

E. External Areas - Size and Function
DHA Design Guidelines



All zones - Patio Option

1 2 3 4 5 6 7 8

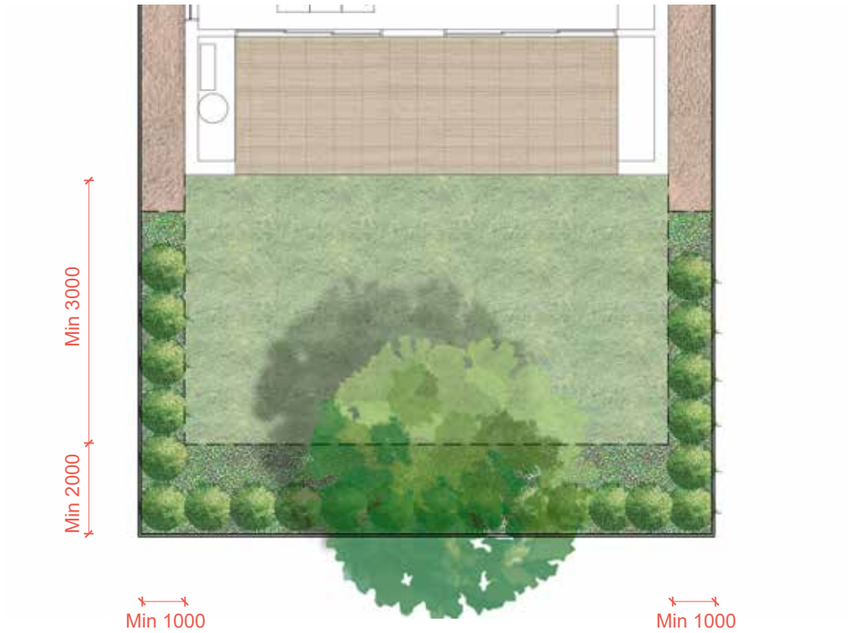
- An uncovered patio may be designed to the front yard if there is sufficient space to accommodate it - patios must be minimum 1.5m wide in addition to a minimum 2m wide garden bed addressing the front boundary
- Patios must be continuous paved surfaces and shall be of a higher quality finish, such as unit paver, than adjacent concrete paths or steppers
- Patio pavement shall be installed on concrete slab basecourse and shall be graded away from the dwelling
- Access to patios shall not be via direct internal entry

All zones - Wider Setbacks

1 2 3 4 5 6 7 8

- Lots with wider setbacks shall incorporate a double gate to the wider fence return to allow access to the side setback for boat trailers or similar
- Driveway connection to side setback to be designed to allow for direct and easy boat trailer access and not reliant on 90 degree angle turns
- Double gates to be located adjacent the dwelling and not towards the neighbouring fenceline

E. External Areas - Size and Function
DHA Design Guidelines



E.9 Rear Yard Character

1 2 3 4 5 6 7 8

— Combination of lawn, screening planting, and trees

— Minimum 1 tree to 10m mature height, shrub planting to 2.0m mature height

— Lawn spaces to be a minimum of 3m wide and as flat as possible (minimum grade 1:100, maximum grade 1:20)

— Planting and trees to be located at boundary to maximise useable space

— Trees to be planted within garden beds, not lawn - design larger garden beds to accommodate trees whilst maintaining useable lawn area

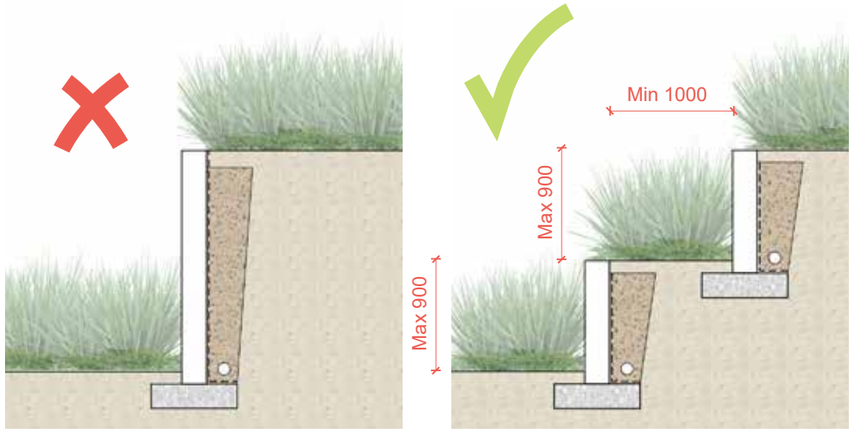
— Paved alfresco entertaining space to be consolidated against dwelling (ideally under roofline) to maximise useable lawn area

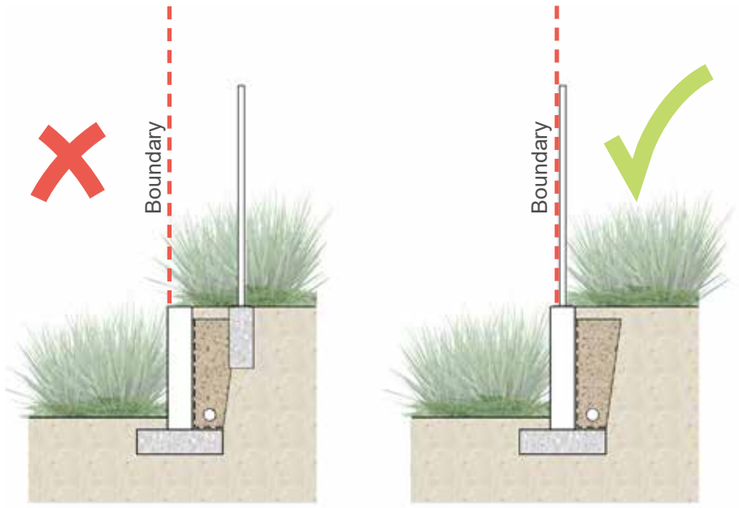
Zones 1+2 - Hot/Warm Humid Summer, Warm/Mild Winter

1 2

— Position trees within backyards to provide the maximum potential shade to habitable spaces (typically to north western elevations)

— Planting design to allow for cross breezes through lots, cluster planting as required and provide additional screening to habitable spaces as required, examples may include angled louvre screens or climbing plants to selected parts of the fenceline



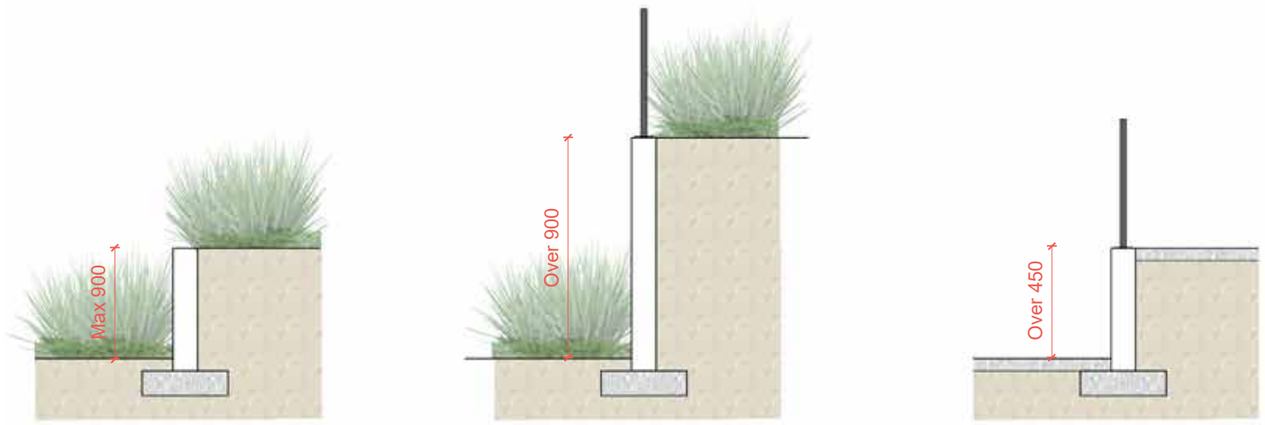


E.10 Retaining Walls

Site grading between lots should be designed so that many walls are used to take up level changes, instead of limited numbers of high walls.

All zones 1 2 3 4 5 6 7 8

- Maximum height 900mm unless absolutely required due to site constraints
- Retaining walls are to have concealed (subsurface) footings in all situations
- Walls over 900mm high must have integrated balustrades, refer Safety in Design Guidelines
- Walls over 450mm high adjacent paths of travel and habitable areas must have a Safety in Design assessment and may also require integrated balustrades
- Avoid retaining walls to front boundary of lots in favour of landscaped batter (maximum grade 1:4)
- Retaining walls to be constructed of masonry - preferred options are split face blockwork or precast concrete sleepers. Natural stone may be used only if appropriate to the site identity, locally available, and cost effective. Wall finish to be selected to complement the character of the dwelling or neighbourhood
- Timber sleeper walls may be considered for cost restrained projects only
- All retaining walls are to be designed with drainage (pipe + agg line) and waterproofing
- Where fences or balustrades are to be constructed in proximity to retaining walls, the fence or balustrade must be installed either on top of or immediately adjacent the wall, not set back from the wall with a planting strip (see above right)



Wall to 900mm, soft landing
- no balustrade

Wall over 900mm
- balustrade

Wall over 450mm, hard landing
- balustrade

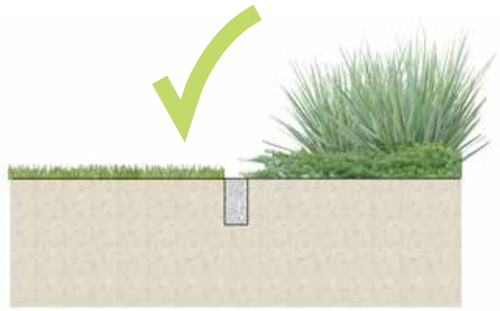
E.11 Safety in Design

All projects shall be assessed with a Safety in Design review to ensure adequate fall protection has been provided where there are changes in level.

All zones 1 2 3 4 5 6 7 8

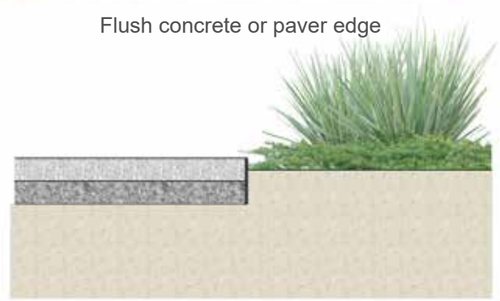
- Balustrades required to all walls over 900mm height
- Balustrades are required to meet BCA and DDA requirements
- Balustrades required to walls over 450mm height if there is a path of travel adjacent the wall
- All projects to have a Safety in Design review to assess if adequate fall protection has been provided
- Balustrades are to be constructed of durable, low maintenance, and cost-effective materials, preference for prefabricated metal palisade

Flush steel or timber edge



Flush concrete or paver edge

No raised edging



Edge protection to pavement as re-quired

E.12 Edging

1 2 3 4 5 6 7 8

— Edge finishes to be selcted from hardwood timber, treated pine, formed concrete, precast concrete, paver, or steel

— Steel edging preferred in all zones

— Edge types to be consistent through lot, avoid using multiple edge types

— All edges to be installed flush with adjacent surfaces (no raised or upstand edges)

— Formed concrete, precast concrete, or paver edge preferred adjacent lawns for mowing edge

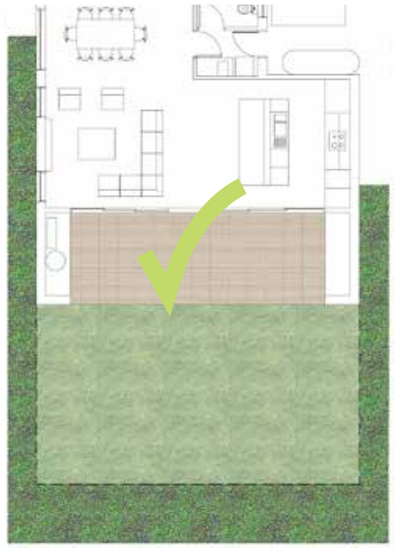
— Steel edging shall be installed to all pavement edges where subsidence of ground levels may occur, to protect the pavement edge from damage

Zones 1+2

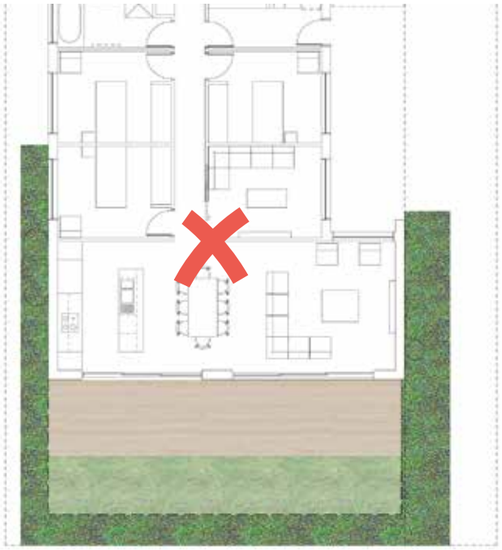
1 2

— Steel, concrete, or paver edges to be installed. Avoid timber due to maintenance and durability issues (rain / damp / termites)

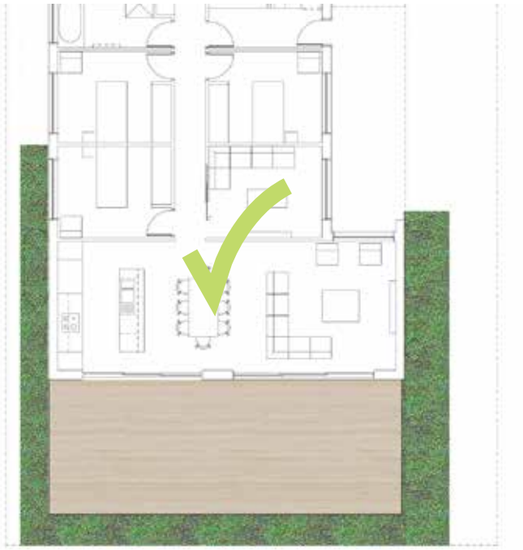
— Lawns to have 300mm mowing strip installed to full perimeter - finish to be concrete or paver



Ideal lawn proportions



Avoid narrow un-useable lawns



Extended patio is better than narrow lawn

E.13 Lawns

1 2 3 4 5 6 7 8

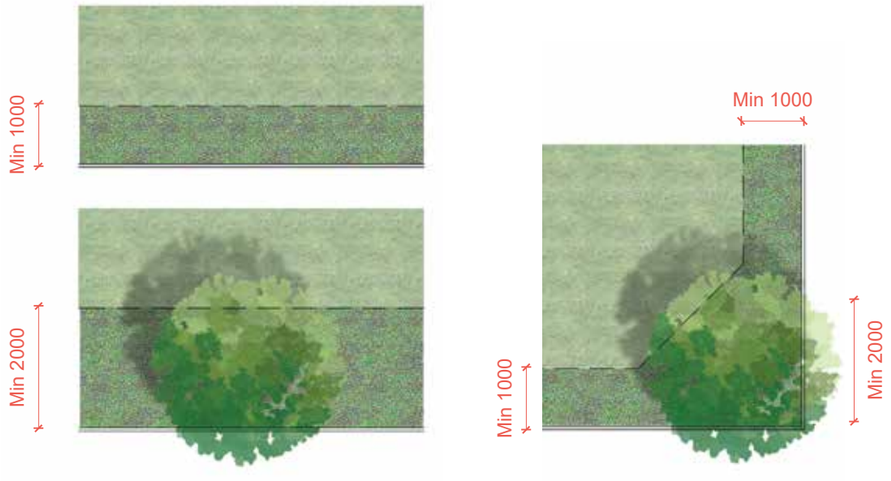
- Minimum area 3m x 3m, avoid installing narrow lawns which offer no useable amenity
- Maximum grade 1:20, minimum grade 1:100
- Preference for level turf areas for useability and maintenance, avoid steep grades if possible
- Locally proven drought-tolerant species to be specified
- All lawns to be edged to garden beds
- Lawn to be designed into spaces with sufficient sunlight exposure to support healthy growth
- No permanent irrigation system unless required by local authorities or developer's covenant

- In cases of constrained backyards where 3m x 3m area of lawn cannot be achieved in addition to the required garden bed, the patio shall be widened to provide a more useable outdoor area.

Zones 1+2

1 2

- Drainage to lawns to be provided via grated drains sited in adjacent garden beds, not subsurface aggregate lines



Ideal garden bed configurations

Steppers to side setback garden beds

E.14 Garden Beds

1 2 3 4 5 6 7 8

- Nominal minimum width 1m unless constrained by narrow lots <10m or side setbacks, where minimum shall be 700mm
- Minimum width 2m for trees, widen garden beds as necessary in a considered way which maximises any adjacent lawn areas
- Garden beds between driveway and entry path minimum 500mm
- Preference for level garden beds, maximum permissable grade 1:4 in extreme circumstances and to front gardens only to avoid stormwater flowing into adjacent lots
- Garden beds to be at grade, not raised planters
- All garden beds to be edged

All zones - Side Setbacks

1 2 3 4 5 6 7 8

- No garden beds shall be installed to narrow side setbacks of less than 1500mm width. Gravel shall be installed instead to allow maintenance access and to prevent damage to planting by pets.
- Concrete pavement shall be installed to service lanes in side setbacks for bins.
- Avoid leaving narrow garden beds adjacent paths in side setbacks - if a setback is 1m and there is a requirement for a concrete path for access to rubbish bins, services, or clotheslines, then the path should be the full width of the setback. Garden beds should only be installed to side setbacks if a minimum width of 700mm can be achieved in addition to the path.

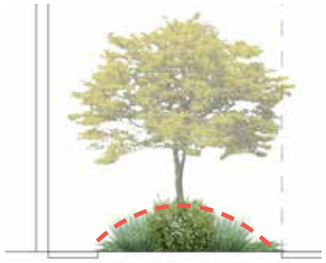
E. External Areas - Size and Function
DHA Design Guidelines

Front Planting to 1.0m height

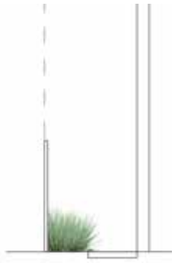
Side Setback:
1m setbacks - gravel or concrete path with no planting

Wide setbacks - planting to 2.0m height

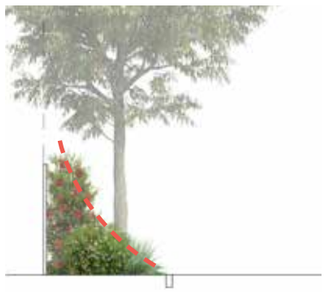
Rear Planting to 2.0m height



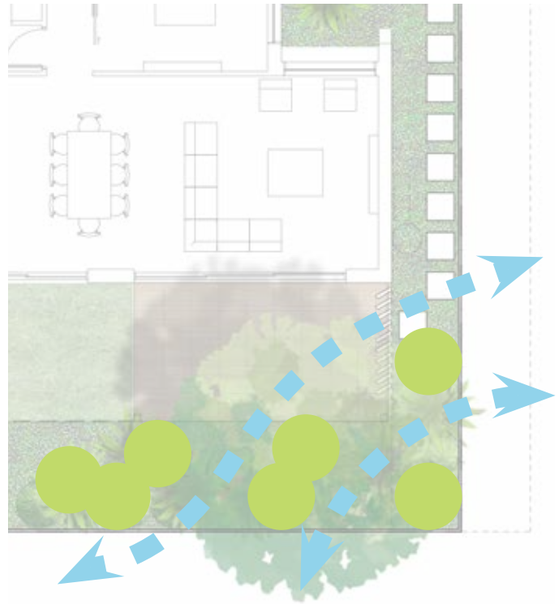
Front



Side



Rear



Cross breezes

E.15 Planting

1 2 3 4 5 6 7 8

- Locally native, easy care, low maintenance, drought-tolerant plant species to be provided
- Plant appropriate species for the specific microclimate of each garden bed (sun vs shade tolerance)
- Maximum mature height 1m to within front yard
- Maximum mature height 3m to side setbacks and back yards
- No climbing plants to walls or fences
- Modern semi-formal to informal (low maintenance) australian garden vernacular preferred
- No plants which will require ongoing trimming or shaping to maintain pathway clearances, use plants with naturally compact growth habits
- Plant larger species to the back of garden beds and adjacent fencelines, not adjacent paths of travel
- Layer plants appropriately within all garden beds (examples above)
- Plant groundcover species to 1m wide side setbacks with steppers
- Plant shrubs and grasses to wider side setbacks with dedicated garden beds but avoid planting large species which will encroach into the path of travel

Zones 1+2

1 2

- Planting to be clustered to permit cross-breezes / natural ventilation through lots, to be coordinated with dwelling layout and orientation

E.16 Trees

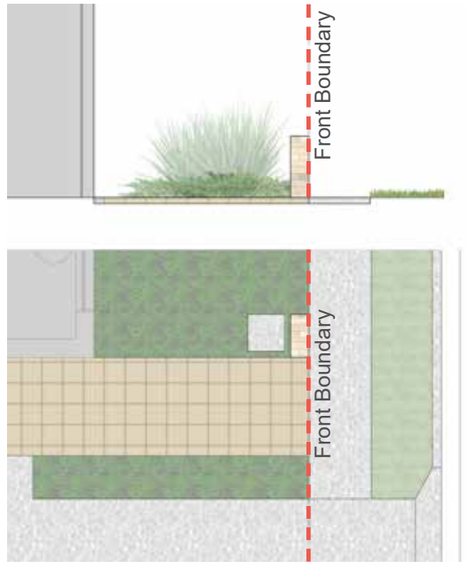
- Maximum mature height 10m to back yards, 6m to front yards
- Non-invasive and low maintenance, with minimal debris drop
- Detached dwellings - minimum 2 trees to front yards, minimum 1 tree to rear yards
- Narrow Lots <10m - minimum 1 tree to front yards, minimum 1 tree to rear yards
- Terrace Lots - minimum 1 tree to rear yards only
- No trees within lawn areas, trees shall be planted within garden beds
- Trees shall not be planted within 1m of boundaries or pavements nor 3m of dwellings
- Garden beds shall be designed to be wider where trees are proposed to ensure the above separation requirements are met
- Trees shall not be planted within 1.5m of underground services
- Preference for species with foliage which permits filtered light as opposed to dense canopies which throw heavy shade

Zones 1+2 - Hot/Warm Humid Summer, Warm/Mild Winter

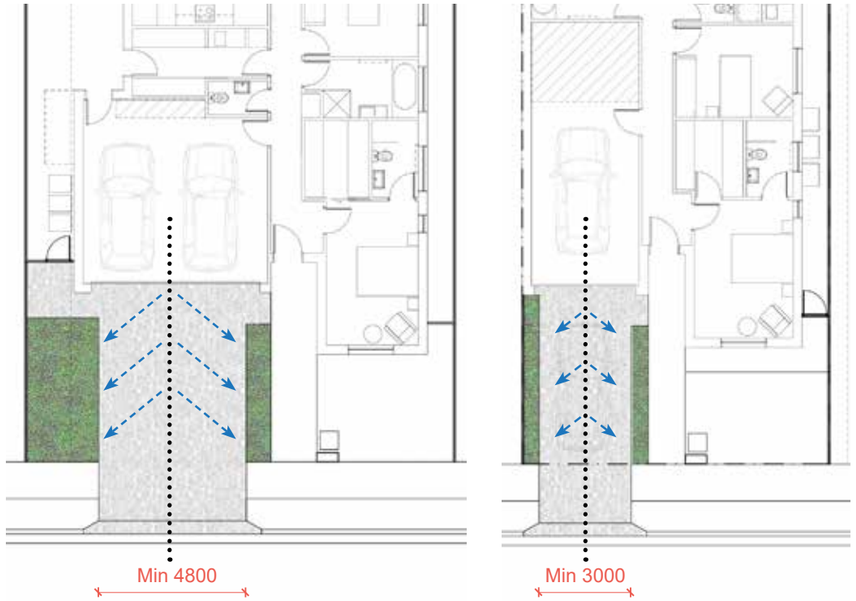
- Trees in backyards should be sited to provide maximum passive cooling potential to the dwelling and habitable spaces

Zones 6,7,8 - Mild Temperate, Cool Temperate, and Alpine

- Deciduous species preferred to back yards for winter sun exposure to habitable spaces



Letterbox adjacent boundary and entry path



Pavements drain to garden beds

E.17 Letterbox

1 2 3 4 5 6 7 8

— Letterbox to be designed to sit adjacent main entry path off street address, at front boundary

— Style and colour to be designed to complement the dwelling and/or community identity

— Provide a stepping paver to the back of the letterbox for access, or extend the pathway min 800x800mm to the back of the letterbox

E.18 Driveway

1 2 3 4 5 6 7 8

— Driveway grades to be considered during initial site works to minimise steep grades where possible, maximum grade 1:6, minimum 1:100

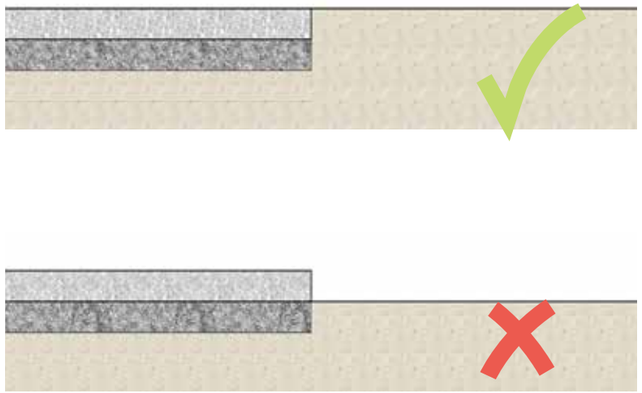
— 4.8m wide minimum for double carparking on driveway, 3.0m wide minimum to narrow lots, driveway widths to meet local Council standards

— Driveways to be centred on garages

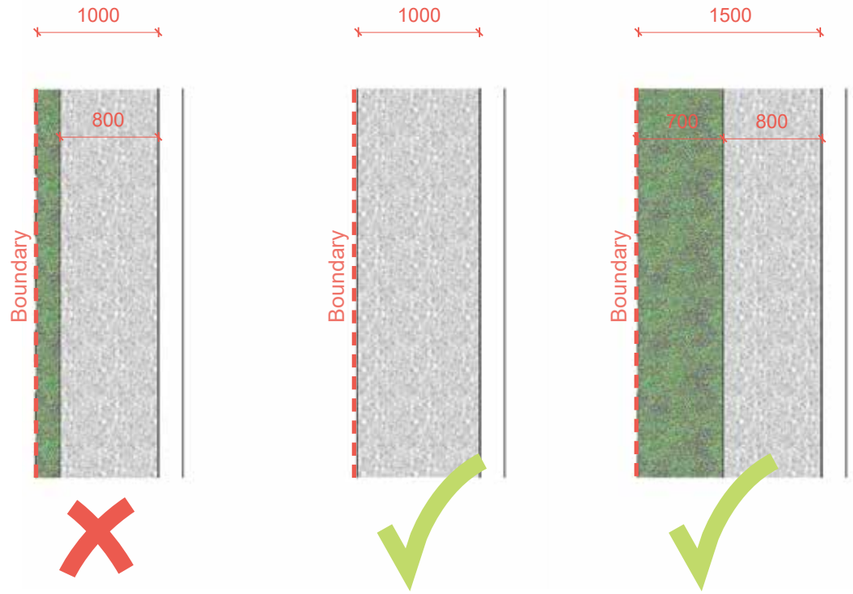
— Driveways to be graded so that surface run-off flows into adjacent garden beds or lawns for passive irrigation, rather than directly into street gutter

— Driveways to have garden beds installed to both sides where possible (except on narrow lots where the driveway is on the boundary), minimum garden bed width 500mm between driveway and entry path

— Driveway finish to be concrete or unit paver (may be permeable), colour and format to complement the dwelling character and differentiated from the main entry path finish



Flush Pavement Transitions



Pathway Width

E.19 Pavement

1 2 3 4 5 6 7 8

— Paths minimum 800mm wide, 1:20 maximum grade

— Landings minimum 1.2m long

— No steps unless required due to grading constraints

— Crossfall 1:40 maximum, 1:100 minimum

— Paths to be graded to adjacent garden beds or lawn for passive irrigation

— Minimum standard to be concrete, with slip resistance to meet Australian Standards

— Main entry paths to dwellings shall be centred on the entrance, be minimum 1m wide, and shall have a higher class finish such as exposed aggregate concrete or unit paver, to differentiate the path from driveways and tertiary pathways - colour and format to complement the dwelling character

— No gravel or pebble based pavements

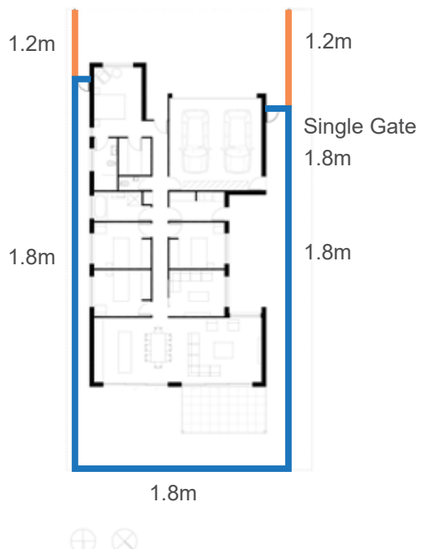
— Continuous paved path of travel to be provided to rubbish bins, services, and clotheslines

— In side setbacks of 1m where concrete paths are required for access to rubbish bins, services, or clotheslines, the width of the pathway shall be 1m, not 800mm - avoid creating garden beds which are less than 700mm width minimum.

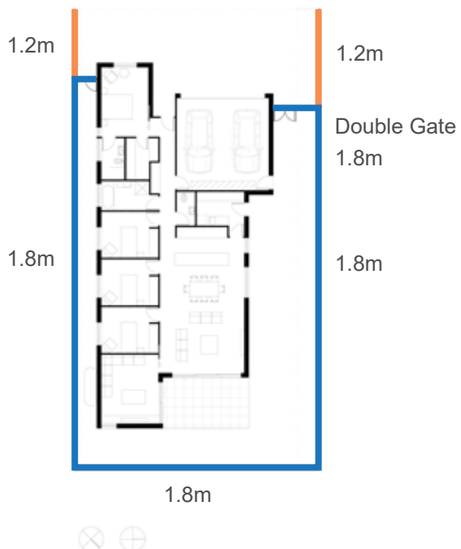
— Stepping pavers are permissable as an alternative within garden beds or lawn where additional access is required, excluding rubbish bin and services storage locations

— In narrow side setbacks of less than 1.5m width, and a concrete path is not required to access rubbish bins, services, or clotheslines, gravel shall be installed to the full width of the setback.

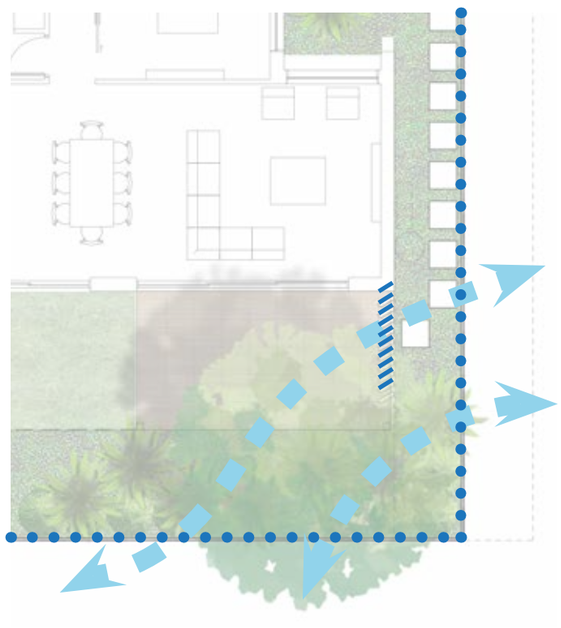
— Pavements should nominally be installed flush with adjacent surfaces. In situations where subsidence is likely then pavements shall have steel edge protection



Standard Setback



Wider Ideal Setback



Cross Breeze

E.20 Fences

1 2 3 4 5 6 7 8

— Maximum height 1.8m to rear and side boundaries

— Maximum height 1.2m between front yards of neighbouring lots (fence may step or taper down from 1.8m), no fences to front boundary

— Side fence return to be setback a minimum of 1m

— Gates to be provided to all side fence returns, gates shall be 1.8m high and designed to match the fence

— Fence finishes: lapped timber (hardwood or treated pine), prefabricated metal, prefabricated palisade, or cyclone - selection to be made according to local availability and cost, type and colour to be designed to complement the character of the dwelling or neighbourhood

— Generally, one gate only required per lot to access bins. An additional gate to the opposite side shall only be provided if necessary to provide access to tanks or services which are otherwise inaccessible

All zones - Lots with Wider Setbacks

1 2 3 4 5 6 7 8

— Lots with wider side setbacks shall have a double gate to allow access for boat trailers

— Double gates shall be 1.8m high and designed to match the fence

— Double gates shall be located adjacent the dwelling and not against the lot boundary as illustrated above

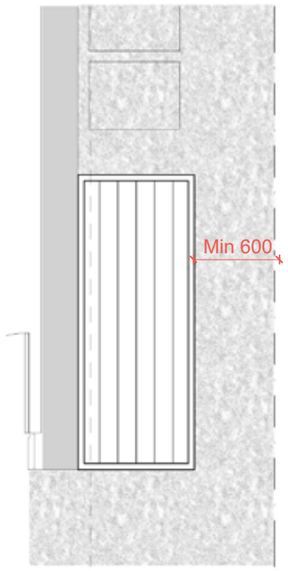
Zones 1+2

1 2

— Porous fencing to be used to mitigate potential wind damage (eg. cyclone or palisade) and permit cross-breezes

— Where visually porous fence options are used to side and rear boundaries, additional privacy shall be provided to habitable areas via screens or planting - screens shall be metal, either prefinished pattern-cut sheet metal or vertical fins

— Timber shall not be used for fencing material



E.21 Clotheslines

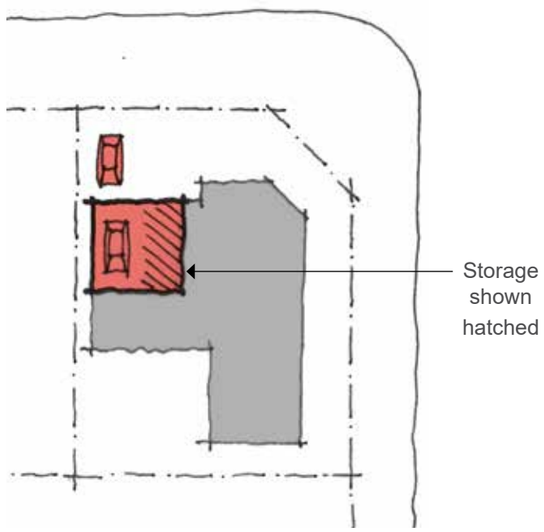
1 2 3 4 5 6 7 8

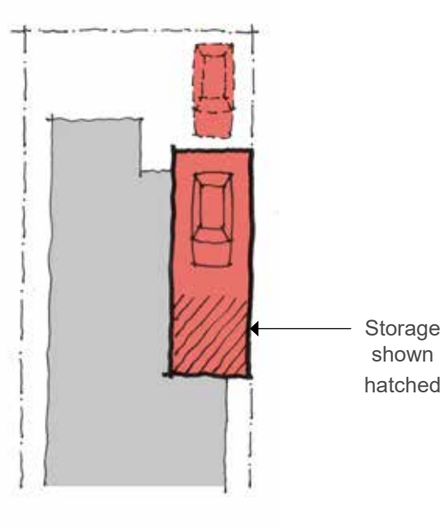
- Clotheslines to be sited for minimal visual impact, ideally in side setbacks
- Site away from useable outdoor amenity i.e lawns or courtyards
- Path to clothesline must be minimum 800mm with no steps, maximum grade 1:20, and must connect from laundry
- Install clotheslines over paved surfaces, minimum standard concrete
- Clotheslines to be designed to be minimum 1m clear of any obstructions
- A minimum path width of 600mm clear must be maintained when clotheslines are deployed

E.22 Utilities

1 2 3 4 5 6 7 8

- Locate hot water units, air conditioning units, and rainwater tanks generally in unobtrusive locations where they will not be visible from windows or covered outdoor areas
- Consider the location of services and utilities so that access around the dwelling, particularly in side setbacks, is not impeded
- Consider screening to services and utilities where they are visible from living spaces or covered outdoor areas





E.23 External Storage

1 2 3 4 5 6 7 8

The minimum provision of external storage for a service residence can be delivered through either:

- A double garage - tandem or side-by-side
- Extended single garage - additional width or length
- A dedicated storage room, or
- An external storage unit - this is only acceptable when storage cannot be provided in the garage or under roof line
- Consider alternative strategies to provide required storage in smaller sites, such as over-bonnet cages

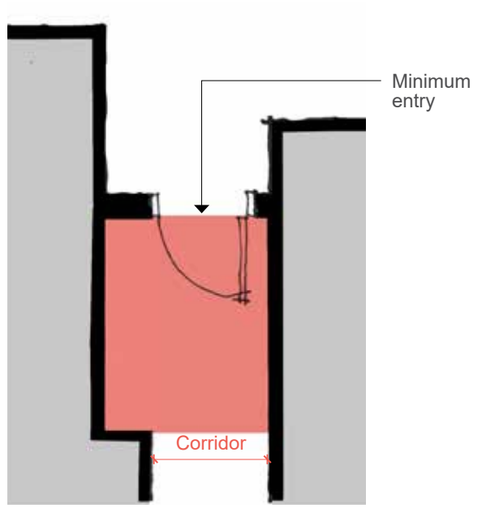
Refer to the *Property Checklist* for minimum external storage requirements

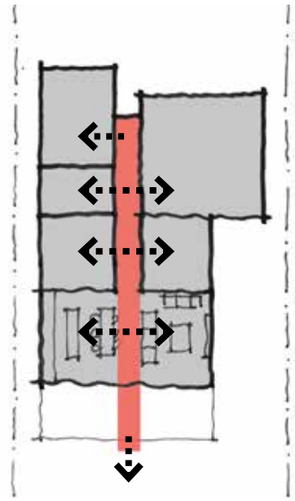
E. External Areas - Size and Function
DHA Design Guidelines

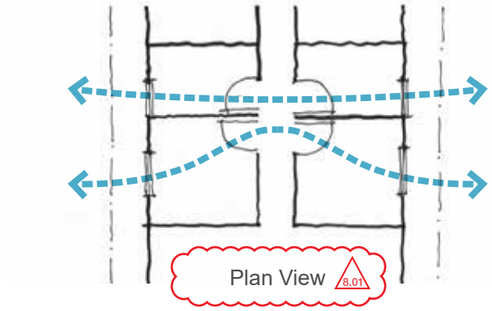
DHA
Defence Housing Australia

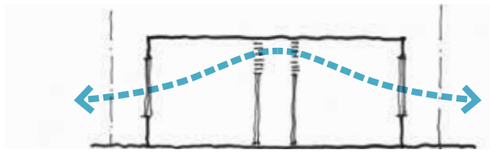
Internal Areas - Size and Function

F









Section View 8.01

F.1 Entry

1 2 3 4 5 6 7 8

— Refer to the Property Checklist for minimum clearance dimensions to be maintained at the dwelling entrance

— Coat / Utility cupboard to be provided, where possible located within proximity of the front entry 8.01

F.2 Circulation and Corridors

1 2 3 4 5 6 7 8

— Look to establish clear circulation spines through the house

— Furniture placement should be considered to allow for clear circulation between spaces

— Avoid stepped corridors where possible

— Corridors are to have a minimum width as specified in the Property Checklist

F.3 Internal Openings

1 2 3 4 5 6 7 8

— Where possible, align doors and windows to promote cross ventilation

— All rooms to have an openable window

— Skylights are permitted to corridors and bathrooms, however a window is preferred

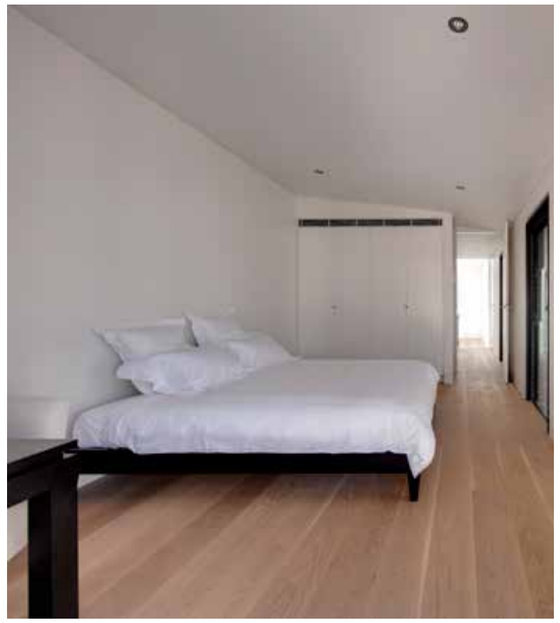
— All internal doorways to have a minimum clear opening width of 820mm and a level threshold. Refer to property checklist 8.01

Hot Humid zones

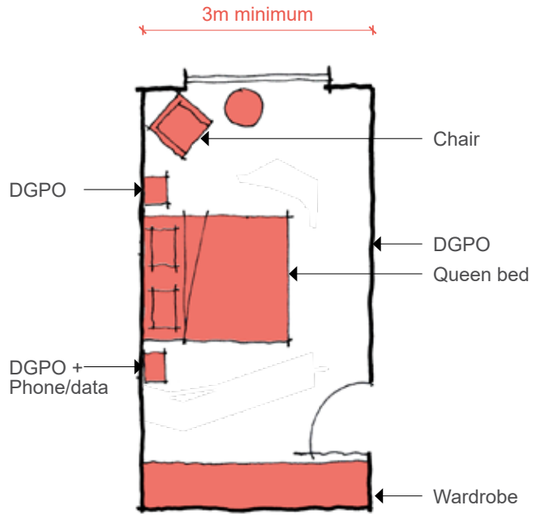
1

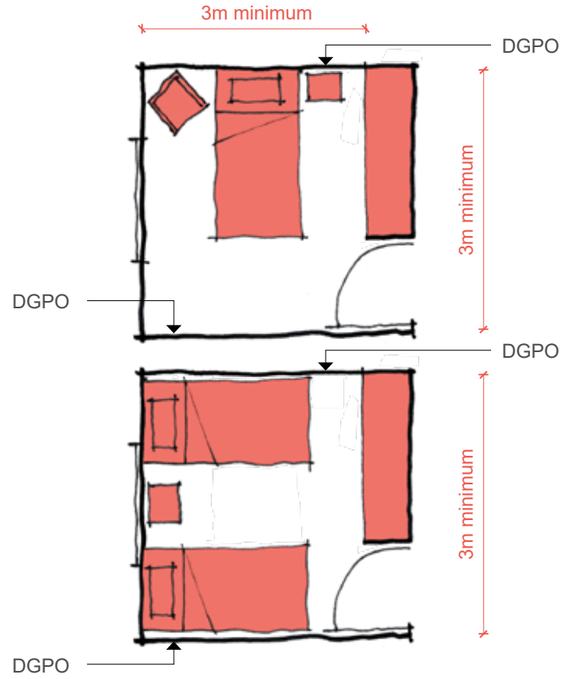
— Consider louvres or openable highlights above doors to allow for cross ventilation

— All rooms, including corridors and bathrooms should have access to an openable window



Bedroom at Paddington terrace.
Tzannes





F.4 Bedrooms

1 2 3 4 5 6 7 8

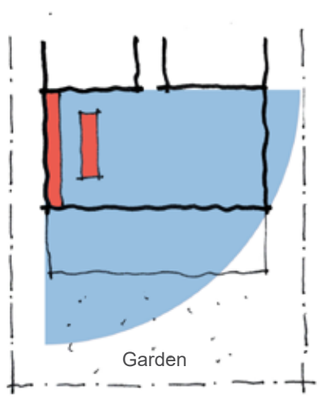
- A minimum of three bedrooms must be provided
- Refer to the Property Checklist for minimum bedroom sizes
- Minimum dimensions are clear of wardrobes
- Built-in wardrobes with shelving must be provided in all bedrooms.
- All bedrooms must have space for either a desk, a chair or a chest of drawers
- Provide double GPOs in logical positions for the future provision of furniture and fixtures

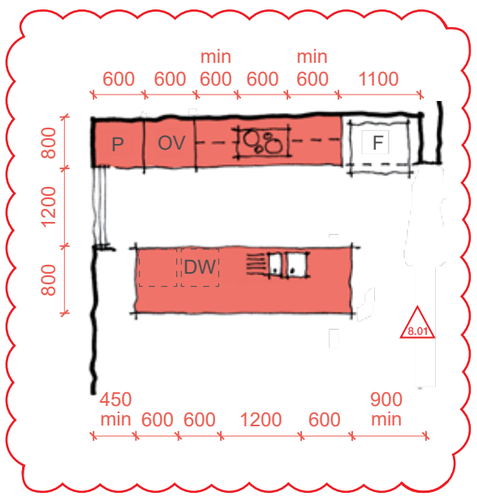
Master Bedroom

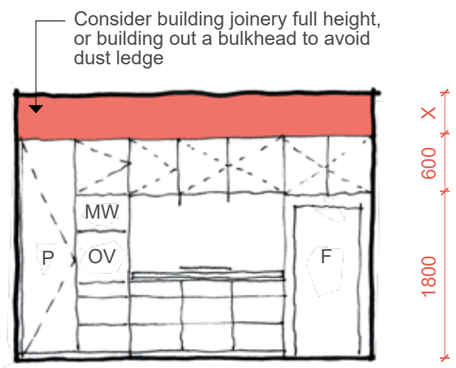
- The master bedroom must have sufficient space for at least a queen bed and side tables
- Refer to the Property Checklist for minimum wardrobe dimensions and requirements for the Master bedroom
- A full-height mirror must be provided in the master bedroom. This can be omitted if the wardrobe doors are sliding mirror finish

Other Bedrooms

- Other bedrooms must accommodate at least a king single bed and side tables
- In 3 bedroom dwellings, at least one of the bedrooms must accommodate at least two singles and a side table
- Refer to the Property Checklist for minimum wardrobe dimensions and requirements for all other bedrooms







F.5 Kitchen

1 2 3 4 5 6 7 8

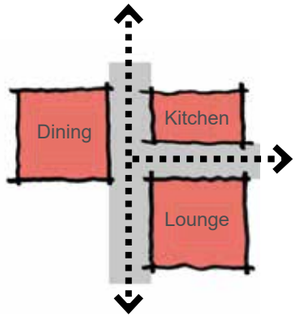
- Where possible, provide a kitchen with a free standing island bench
- “L” and “U” shape kitchens with inaccessible corners should be avoided
- Where possible, kitchens are to have a visual connection to the primary living space
- Kitchens should be located in close proximity to a window. Refer to the Property Checklist for maximum dimensions
- Where possible, kitchens are to have a view to the primary rear yard
- Flooring should be ceramic tiling or other durable finish

Clearances

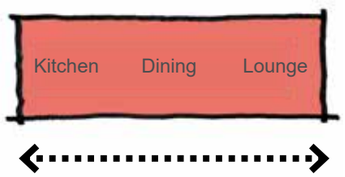
- Refer to the Property Checklist for minimum kitchen dimensions and clearances
- Where possible, the island bench should be free of the wall for improved maintenance
- Sinks should be a minimum of 600mm from side edge of bench

Appliances and Joinery

- Refer to the Property Checklist for minimum requirements
- Ensure fridge door is able to open without obstruction
- A joinery carcass is to be provided above the fridge
- Kitchen exhaust fan must be provided and vented externally
- A full height pantry cupboard must be provided
- A cavity provision for a dishwasher unit must be included
- A cold water provision to the fridge must be included
- Two double GPOs must be provided as a minimum
- A GPO must be provided to the island. Consider mounting the GPO flush with the joinery

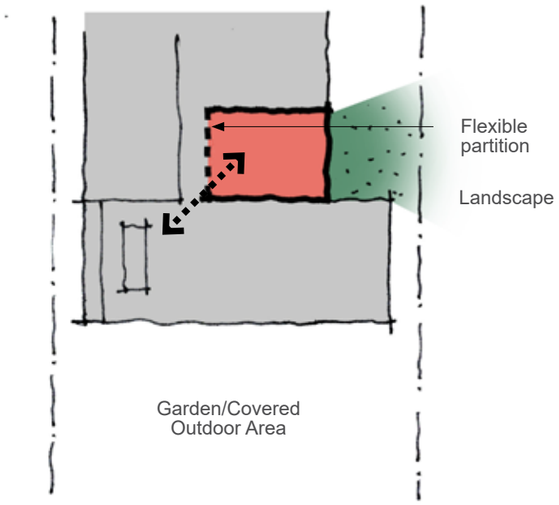


Avoid separating the kitchen, dining and lounge areas



Consider combining areas into an open plan layout

Living area at Paddington terrace.
Tzannes



F.6 Dining Area

1 2 3 4 5 6 7 8

— The dining area must have sufficient space for a six seat dining suite. Refer to the Property Checklist for minimum Dining/Meals Area dimensions and performance requirements

— The dining area should be integrated with the lounge and kitchen in an open plan arrangement wherever possible

— Refer to the Property Checklist for minimum room dimensions

— Flooring should be ceramic tiling or other durable finish. Carpet is not adequate.

F.7 Lounge Area

1 2 3 4 5 6 7 8

— Lounge areas must be large enough to accommodate an entertainment unit, a coffee table and lounge seating for five people. Refer to the Property Checklist for minimum Lounge Area dimensions and performance requirements

— The lounge area may be combined with the dining area, providing they meet the combined dimensions outlined in the Property Checklist

— The lounge area should be integrated with the dining/meals area and kitchen in an open plan arrangement wherever possible

— Consider furniture placement to allow for circulation and placement of a TV

F.8 Family Room

1 2 3 4 5 6 7 8

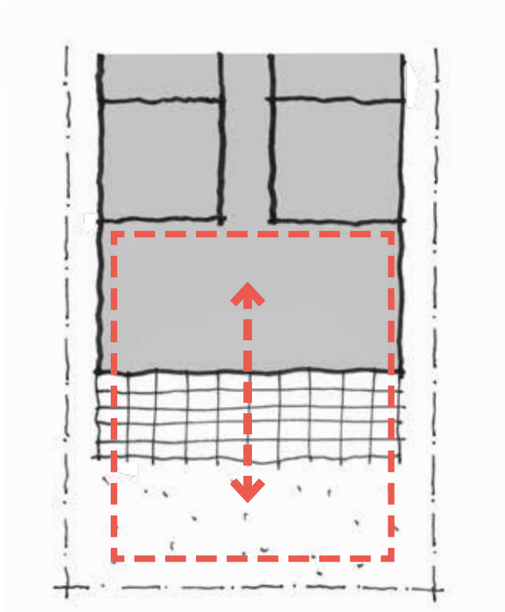
— For residences with 4+ bedrooms consider accommodating a family room

— The location of the family room should allow for visual connection from the primary living area

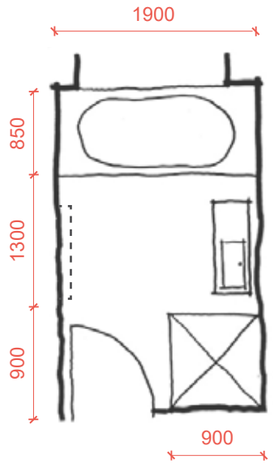
— Where possible, the family room should have visual access to a landscaped space

— Partitions or sliding doors can be provided to allow for the space to be flexible and integrated with the primary living areas

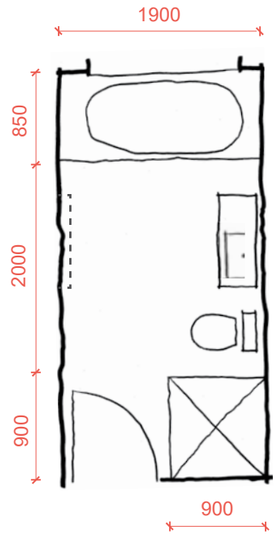
— The room should accommodate a entertainment unit, a coffee table and lounge seating for five people



Bathroom at The Landing, Samford Rd. *DHA*



Bathroom without WC



Bathroom with WC

F.9 Indoor-Outdoor Connection

1 2 3 4 5 6 7 8

— Primary living areas should open up to the outdoor covered area and rear yard

— Where open plan living is achieved, consider orientating the space so both the dining and lounge have either physical or visual access to the outside

F.10 Bathroom and Ensuite Principles

1 2 3 4 5 6 7 8

— Shower recesses must be located in a hobless cubicle with a minimum dimension as stipulated in the Property Checklist and fitted with ventilation or extraction

— Where possible locate plumbing and fixtures on one wall

— If the shower is to be a glass blade, 800 clear is acceptable

— Utilise wall-hung vanities where possible

— Towel rails are to fit a minimum of 2 towels. Refer to the Property Checklist for minimum dimensions

— For privacy, bathroom windows should have obscured glass and fitted with plastic or metal venetian blinds.

— All bathrooms and ensuites are to be mechanically ventilated with extraction fans, vented to the outside

— Consider a skylight where bathrooms, ensuites and powder rooms are unavoidably without access to a window.

Bathroom

— Baths are to be included in the main bathroom. Freestanding baths are not acceptable

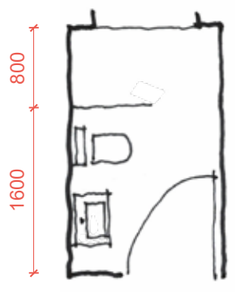
— The bathroom vanity is to have a hand basin and storage cupboards underneath. Refer to the Property Checklist for minimum vanity dimensions

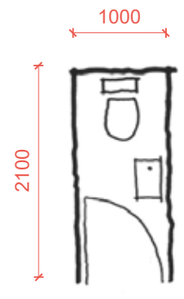
— Refer to the Property Checklist for minimum circulation clearances in bathrooms

— Locate shower cubicles in the corner for future installation of grab rails

— Residences with 4+ bedrooms must have a bathroom on the ground floor

— Shower shelves should be wall-fixed





Ensuite

8.01 — Residences with 3+ bedrooms must have an ensuite

— Ensuite vanities are to have a hand basin and storage cupboards underneath. Refer to the Property Checklist for minimum ensuite vanity dimensions

— Baths are not required in ensuites

Separate toilet

8.01 — All service residence must have a separate toilet

— A separate toilet is to be provided on the ground floor to all two-storey residences

— Where possible a basin is to be provided where there is a separate toilet. If one cannot be provided, ensure adjacent access to a hand basin in a laundry or bathroom.

— Refer to the Property Checklist for minimum toilet clearances and dimensions

Reinforcement of bathroom and toilet walls 8.01

— a. Except for walls constructed of solid masonry or concrete, the walls around the shower, bath (if provided) and toilet should be reinforced to provide a fixing surface for the future provisioning of grabrails.

— b. The fastenings, wall reinforcement and grabrails combined must be able to withstand 1100N of force applied in any position and in any direction.

— c. The walls around the toilet are to be reinforced by installing:

i. noggings with a thickness of at least 25mm in accordance with Typical Details in H.8, Figure 6(a); or

ii. sheeting with a thickness of at least 12mm in accordance with Typical Details in H.8, Figure 6(b).

— d. The walls around the bath are to be reinforced by installing:

i. noggings with a thickness of at least 25mm in accordance with Typical Details in H.9 Figure 7(a); or

ii. sheeting with a thickness of at least 12mm in accordance with Typical Details in H.9 Figure 7(b).

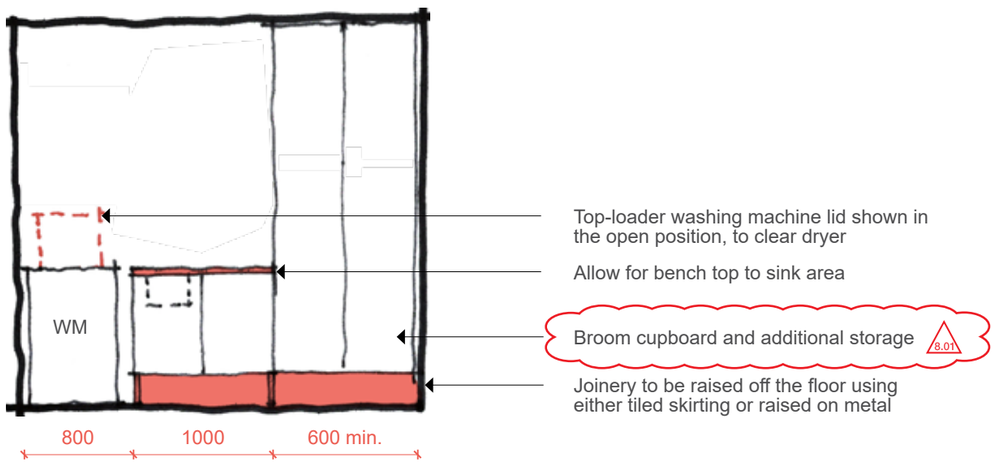
— e. The walls around the hobless (step-free) shower recess are to be reinforced by installing:

i. noggings with a thickness of at least 25mm in accordance with Typical Details in H.10 Figure 8(a); or

ii. sheeting with a thickness of at least 12mm in accordance with Typical Details in H.10 Figure 8(b).

Hot Humid zones 1

— Allow for ceiling fans in bathrooms, in addition to exhaust fan



F.11 Laundry Principles

1 2 3 4 5 6 7 8

- A bench with a sink is preferred 8.01
- The bench is to have a dimension of 600mm x 600 clear of the sink
- Allow for 800 clear width for the washing machine with no bench over
- The laundry is to have direct access to the outside and the drying area
- Allow for extraction fans, vented directly to the outside
- Consider using a glass framed door to the laundry to allow natural light from outside and an openable window where possible

F.12 Internal Storage

1 2 3 4 5 6 7 8

- A linen cupboard is to be provided. Refer to the Property Checklist for minimum dimensions. Note that the lineal metre requirement can be provided across several cupboards.
- A place for the storage of hazardous chemicals and goods must be provided. This must be a secure location that is out of reach for children, such as a high shelf, or a lockable cupboard.
- Consider utilising the space under internal stairs for additional storage
- A Broom cupboard / tall cupboard must be provided. Refer to Property checklist 8.01

Joinery is to be full height and built into walls where possible. *Tzannes*

F.13 Joinery

1 2 3 4 5 6 7 8

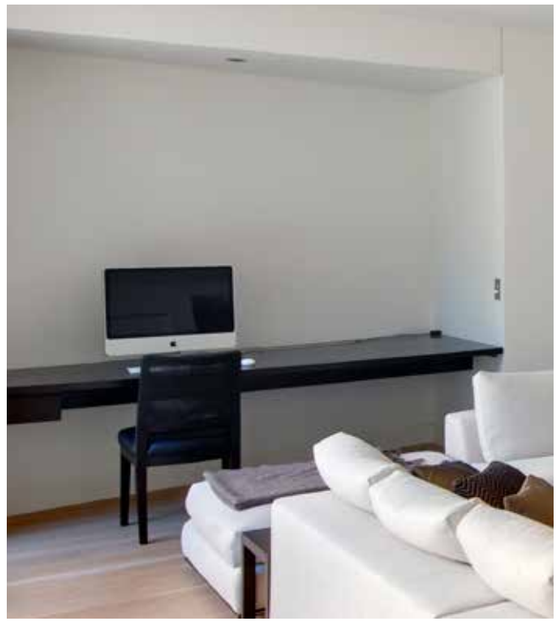
— Consider building joinery flush into the walls wherever possible

— Where possible, consider full-height joinery

— Side edge tracks are to be installed at sliding wardrobe doors to prevent damage to the walls

— Consider adjustable shelves to all cupboards, however maintain the required minimum lineal metres as per the Property Checklist.

— Consider holes for adjustable shelves to allow for provision of hanging rail to be added by tenant



Study nook. Paddington terrace. *Tzannes*

F.14 Study Nook

1 2 3 4 5 6 7 8

— Where possible, provide study nooks

— Where possible, study nooks should have access to a window

— Study nooks are to fit a computer desk, a chair and a shelf as a minimum

— Allow for a minimum 600mm deep x1200mm wide desk with a shelf above

— Study nooks can be located in a designated area or integrated in the family room

F.15 Internal Stairway

1 2 3 4 5 6 7 8

— Internal stairways must feature a continuous handrail on one side where there is a rise of 1 metre or more 8.01

Typical Floorplans

G

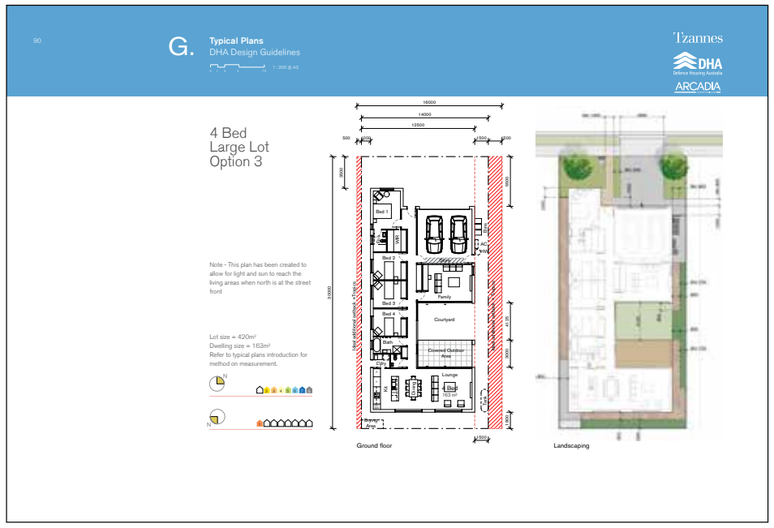
Introduction

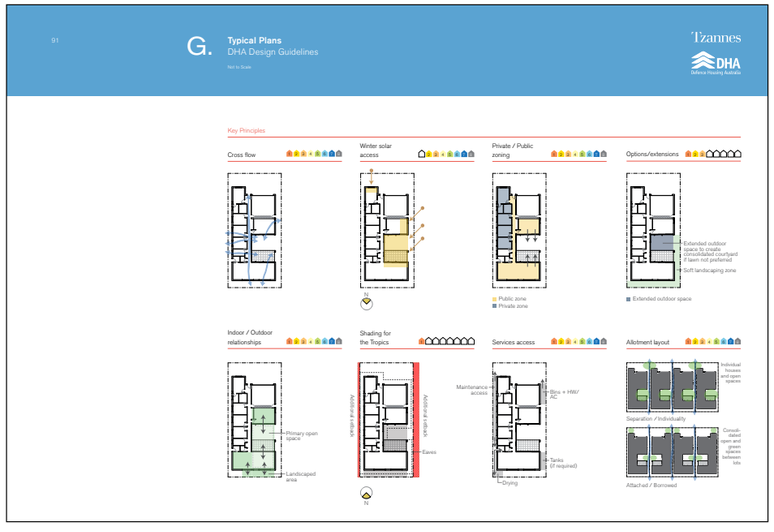
The typical floor plans are provided as examples of acceptable solutions to meet the DHA Design Guidelines. They are only intended as a guide and are not compulsory.

The lots which have been selected in these guidelines represent some of the more challenging lots in DHA's property portfolio. They have been provided, with optional dimensional variations and setbacks to assist in the flexible allocations of certain plan types.

As each site will have its own unique set of conditions, key principles have been included for each plan to communicate the design ideas.

Lot Size	Lot Area	House	Stories	Options
14 x 30	420m²	4 Bed	Single	3
12.5 x 30	375m²	3 Bed	Singe	1
	375m²	4 bed	Double	1
12.4 x 25	310m²	3 Bed	Single	1
10 x 30	300m²	3 Bed	Single	2
	300m²	4 Bed	Double	1
8 x 30	240m²	4 Bed Terrace	Double	1
6.55 x 30	196.5m²	3 Bed Terrace	Double	1
Corner Lot	504m²	4 Bed	Single	1





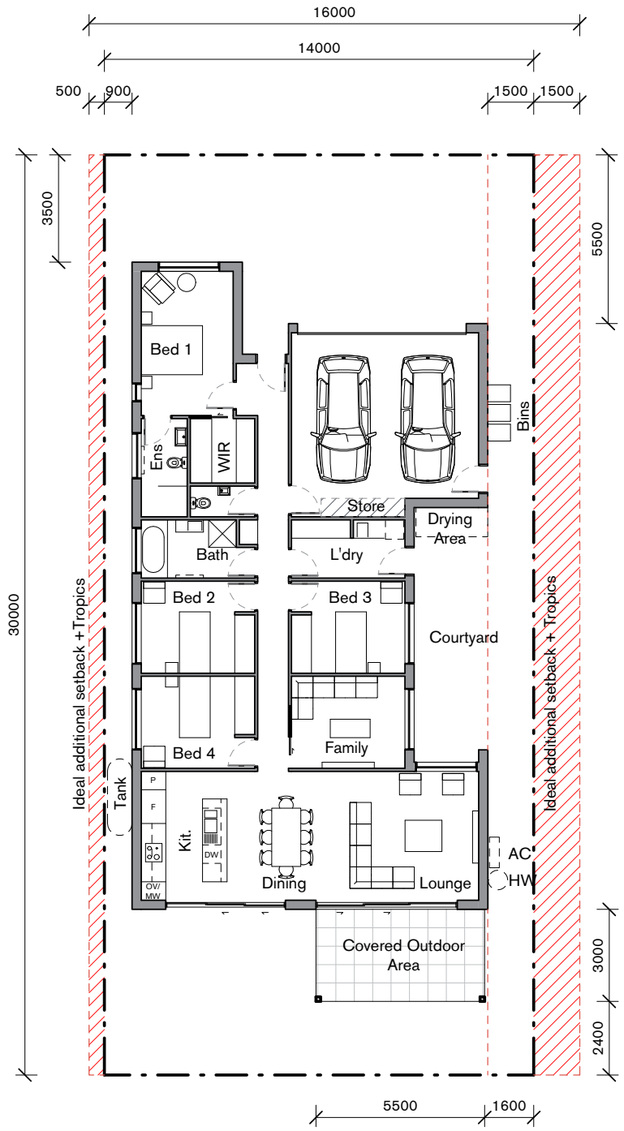
Method of Measurement

The dwelling areas provided have been measured using the following key criteria, as per the highlighted area in the adjacent plan:

- Areas are measured to the inside face of the external walls
- Areas include the fully enclosed covered area
- Stair voids are excluded
- Garage is excluded

4 Bed Large Lot Option 1

Lot size = 420m²
Dwelling size = 150m²
Refer to typical plans introduction for method on measurement.



Ground floor

Landscaping

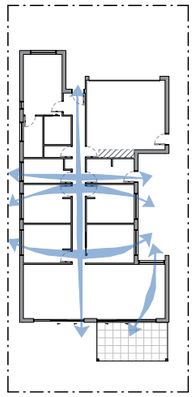
G. Typical Plans
DHA Design Guidelines

Not to Scale

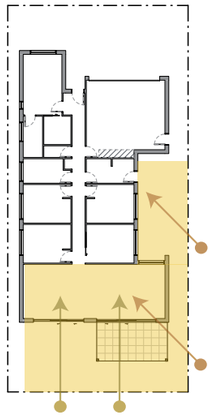
DHA
Defence Housing Australia

Key Principles

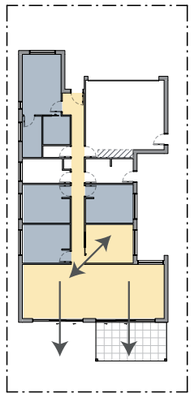
Cross flow



Winter solar access

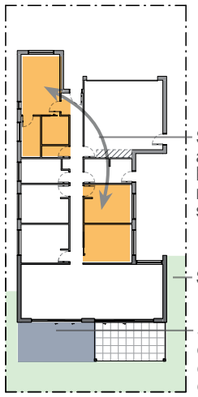


Private / Public zoning



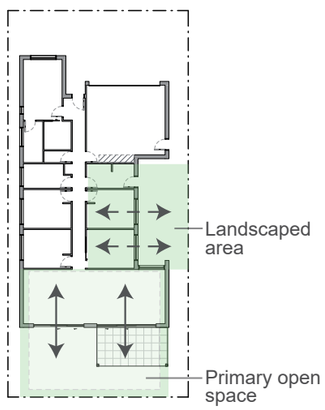
- Public zone
- Private zone

Options/extensions

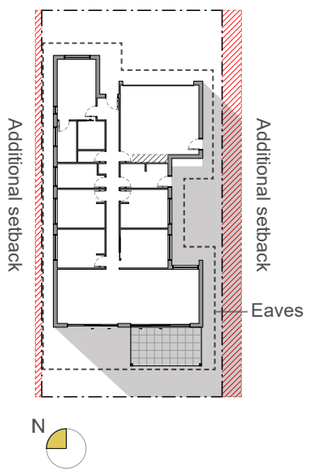


- Relocated or extended outdoor
- Relocated bedrooms / family rooms

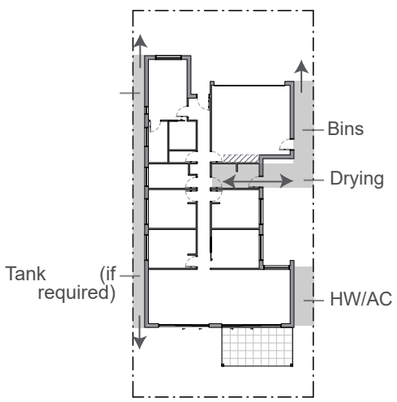
Indoor / Outdoor relationships



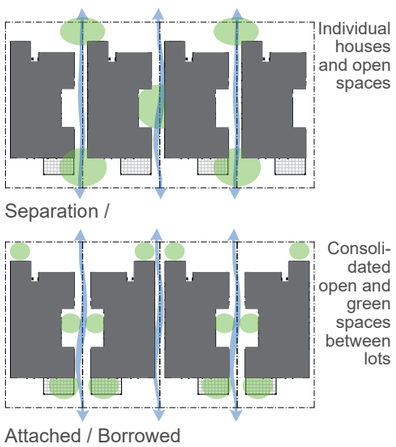
Shading for the Tropics



Services access

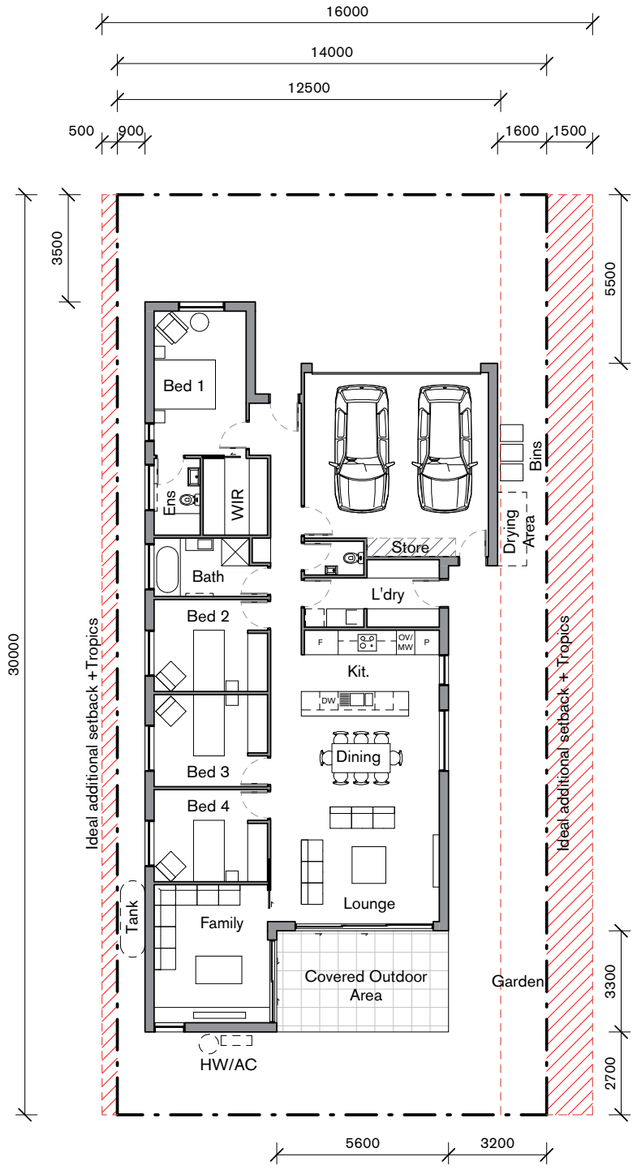


Allotment layout

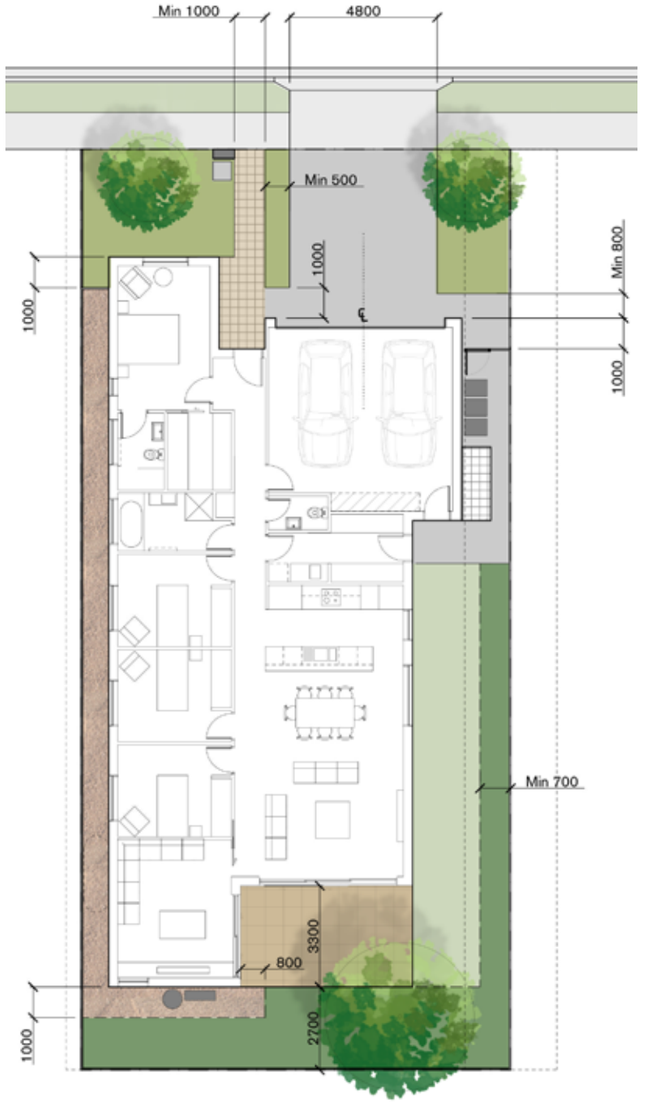


4 Bed Large Lot Option 2

Lot size = 420m²
Dwelling size = 157m²
Refer to typical plans introduction for method on measurement.



Ground floor



Landscaping

G. Typical Plans
DHA Design Guidelines

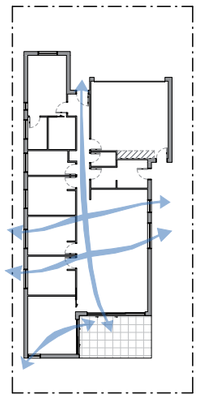
Not to Scale

DHA
Defence Housing Australia

Key Principles

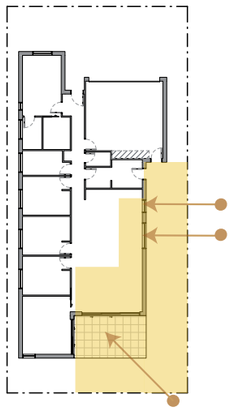
Cross flow

1 2 3 4 5 6 7 8



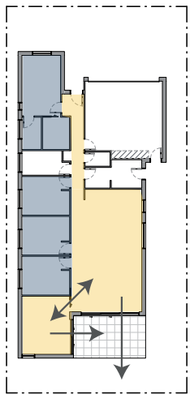
Winter solar access

2 3 4 5 6 7 8



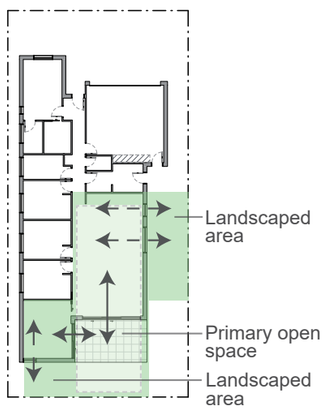
Private / Public zoning

1 2 3 4 5 6 7 8



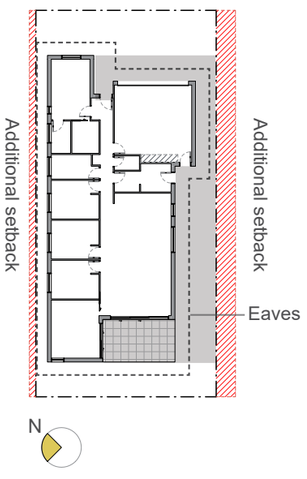
Indoor / Outdoor relationships

1 2 3 4 5 6 7 8



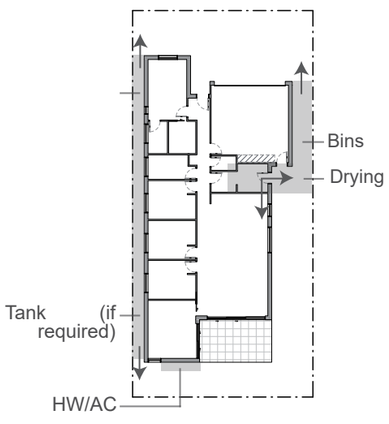
Shading for the Tropics

1



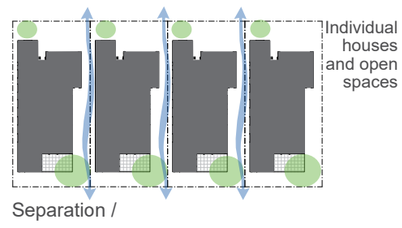
Services access

1 2 3 4 5 6 7 8



Allotment layout

1 2 3 4 5 6 7 8

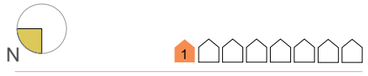


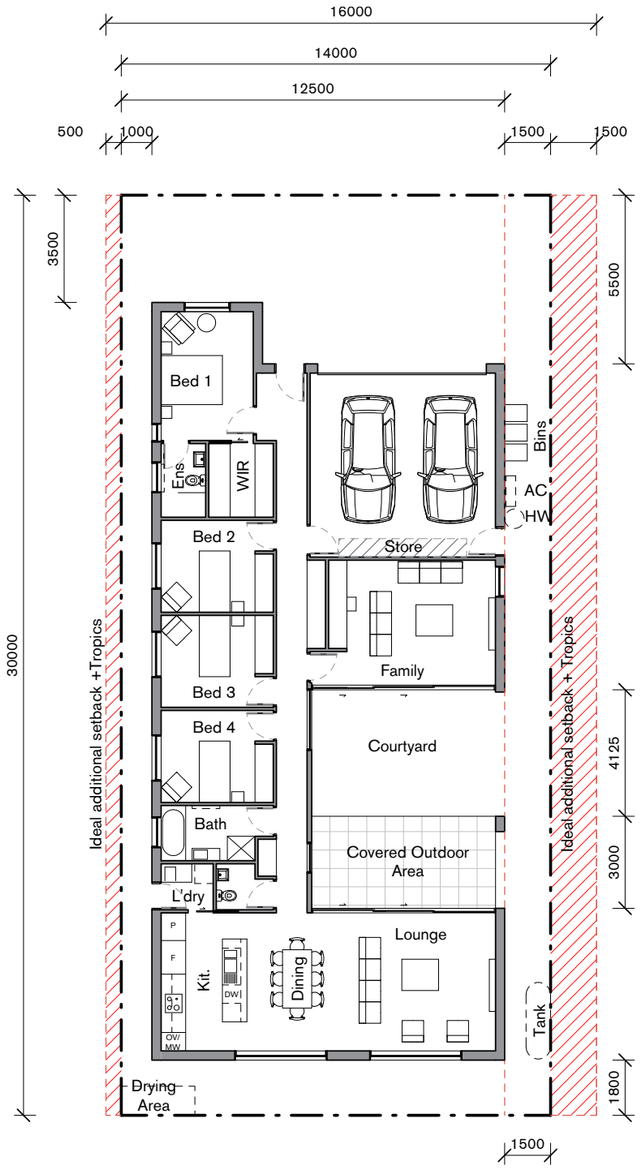
Attached / Borrowed arrangement not recommended for this layout, as mirroring the floorplan would reduce the amount of sunlight reaching the main living areas. Living areas are preferred facing North (Except in Climate Zone 1)

4 Bed Large Lot Option 3

Note - This plan has been created to allow for light and sun to reach the living areas when north is at the street front

Lot size = 420m²
Dwelling size = 163m²
Refer to typical plans introduction for method on measurement.





Ground floor

Landscaping

G. Typical Plans
DHA Design Guidelines

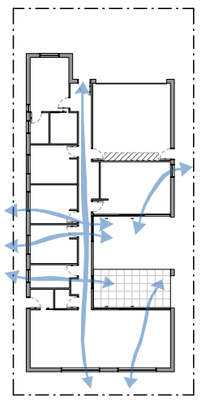
Not to Scale

DHA
Defence Housing Australia

Key Principles

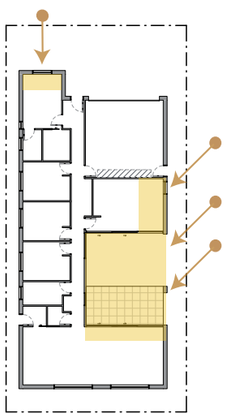
Cross flow

1 2 3 4 5 6 7 8



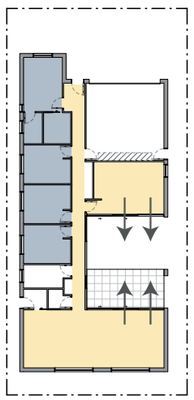
Winter solar access

2 3 4 5 6 7 8



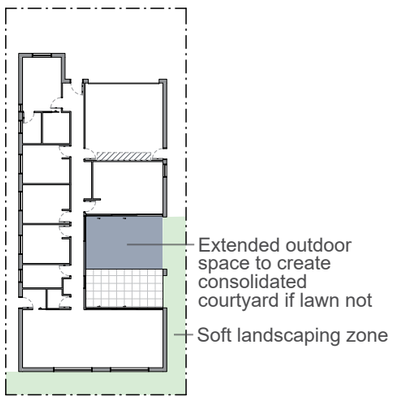
Private / Public zoning

1 2 3 4 5 6 7 8



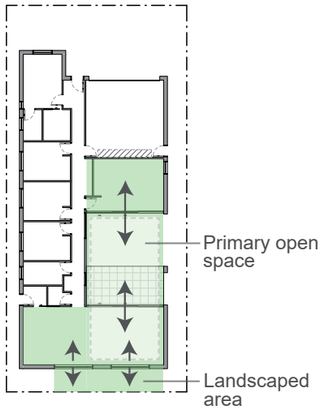
Options/extensions

1 2 3



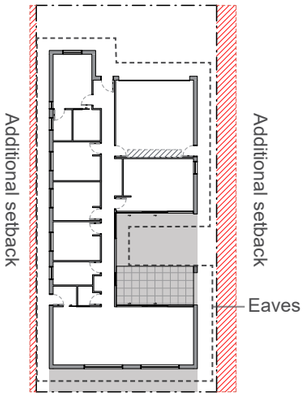
Indoor / Outdoor relationships

1 2 3 4 5 6 7 8



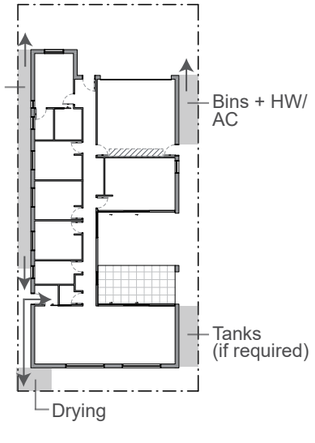
Shading for the Tropics

1



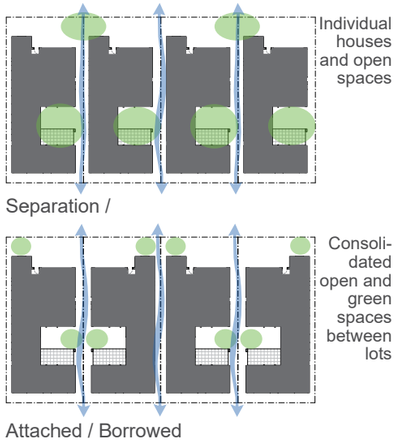
Services access

1 2 3 4 5 6 7 8



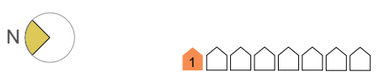
Allotment layout

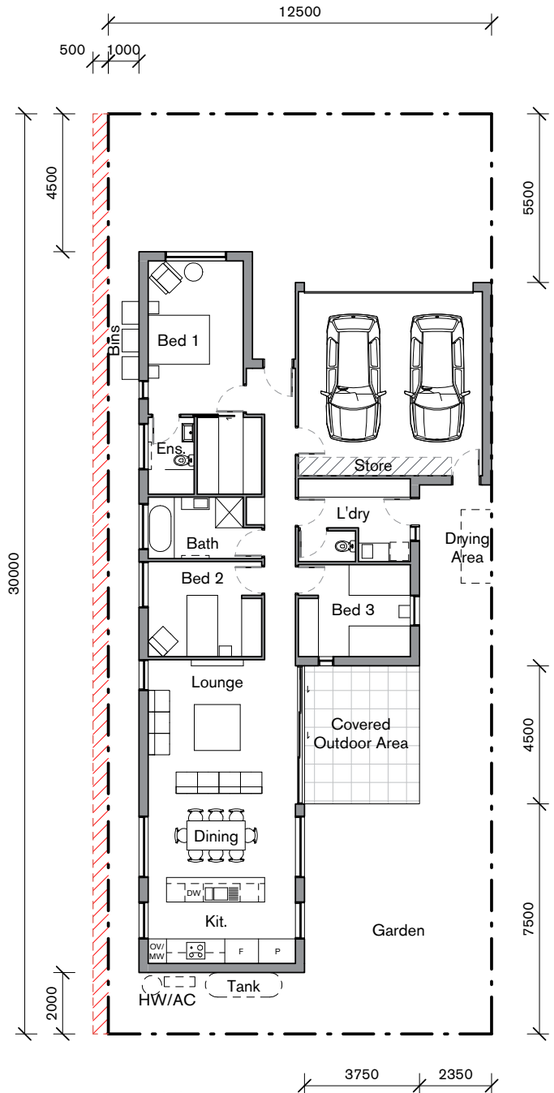
1 2 3 4 5 6 7 8



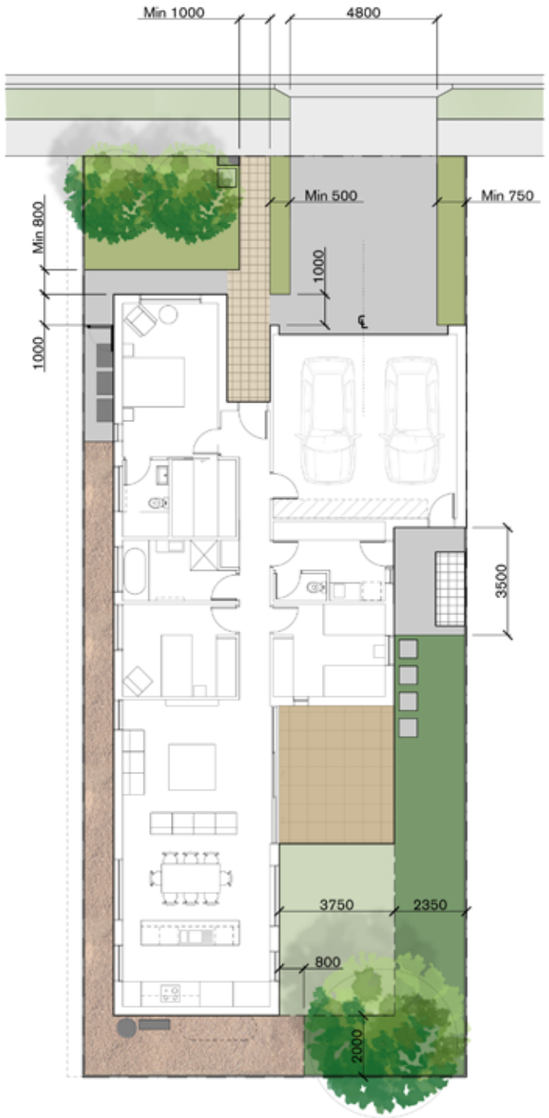
3 Bed Medium Lot

Lot size = 375m²
Dwelling size = 125m² Refer to typical plans introduction for method on measurement.





Ground floor



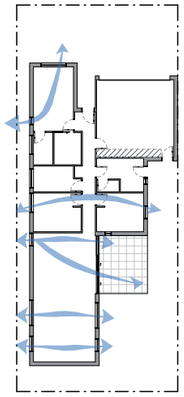
Landscaping

G. Typical Plans
DHA Design Guidelines

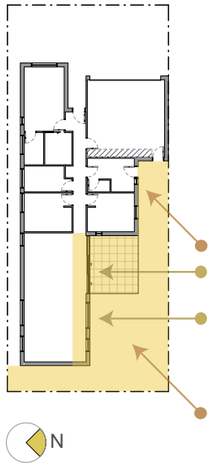
Not to Scale

Key Principles

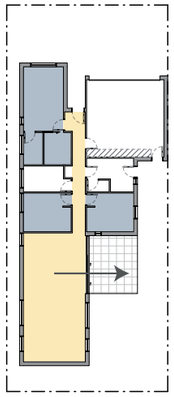
Cross flow



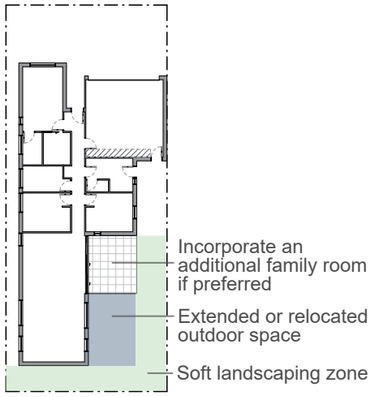
Winter solar access



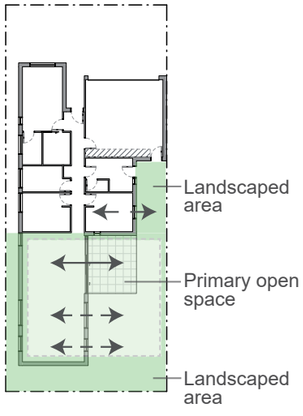
Private / Public zoning



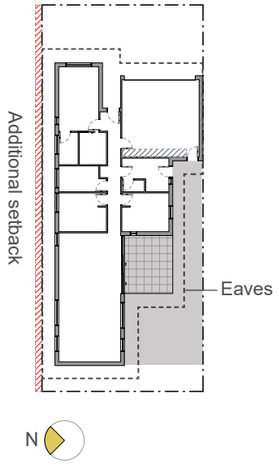
Options/extensions



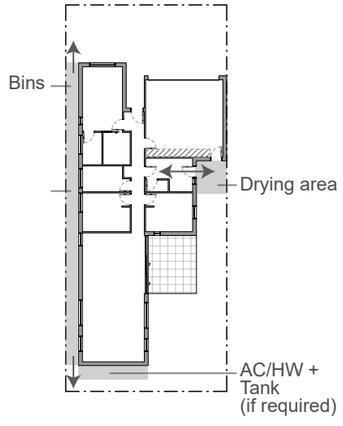
Indoor / Outdoor relationships



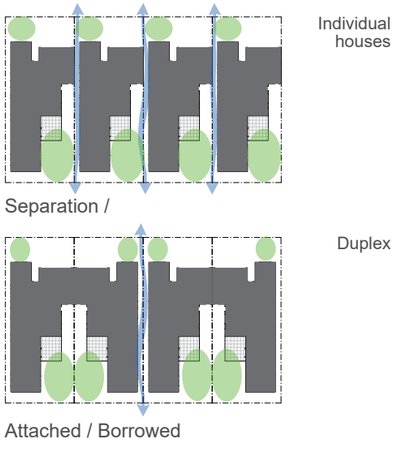
Shading for the Tropics



Services access



Allotment layout



4 Bed, 2 storey Medium Lot

Note - The kitchen shows an option to extend the island bench to allow for double sided storage, shown dotted.

Lot size = 375m²
Dwelling size = 181m² Refer to typical plans introduction for method on measurement.

N

2 3 4 5 6 7 8

Floor plan not suitable for Climate Zone 1

Ground floor First floor

Landscaping

G. Typical Plans
DHA Design Guidelines

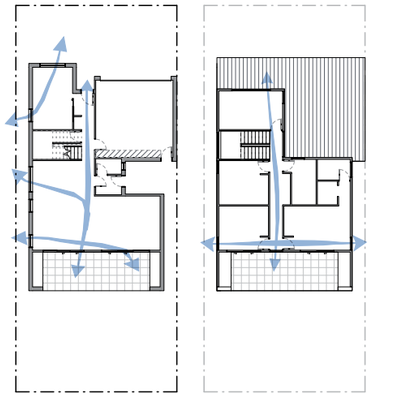
Not to Scale

DHA
Defence Housing Australia

Key Principles

Cross flow

1 2 3 4 5 6 7 8

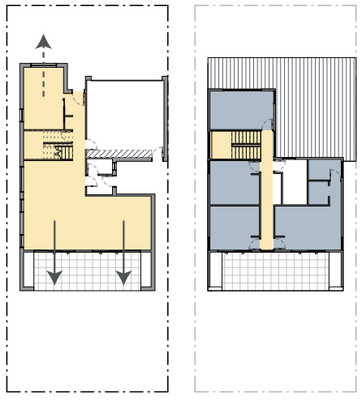


Winter solar access

2 3 4 5 6 7 8

Private / Public zoning

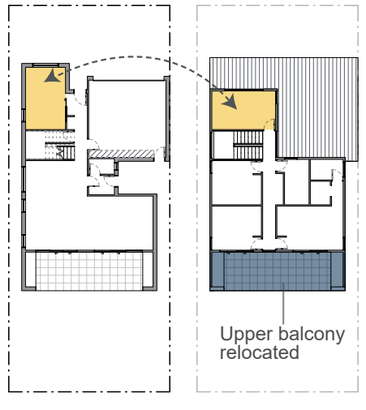
1 2 3 4 5 6 7 8



- Public zone
- Private zone

Options/extensions

1 2 3

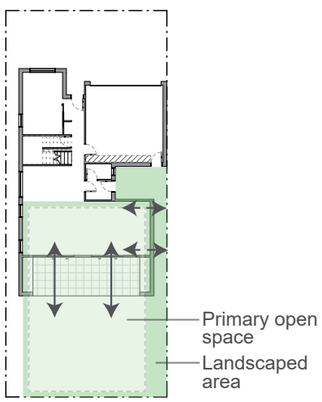


- Option to swap bedroom with family if preferred
- Option to include upper balcony if preferred, or delete and make ground floor terrace double height

N

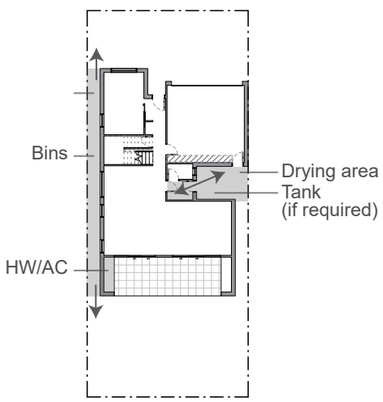
Indoor / Outdoor relationships

1 2 3 4 5 6 7 8



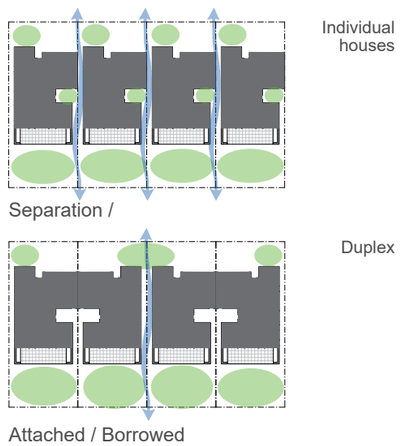
Services access

1 2 3 4 5 6 7 8



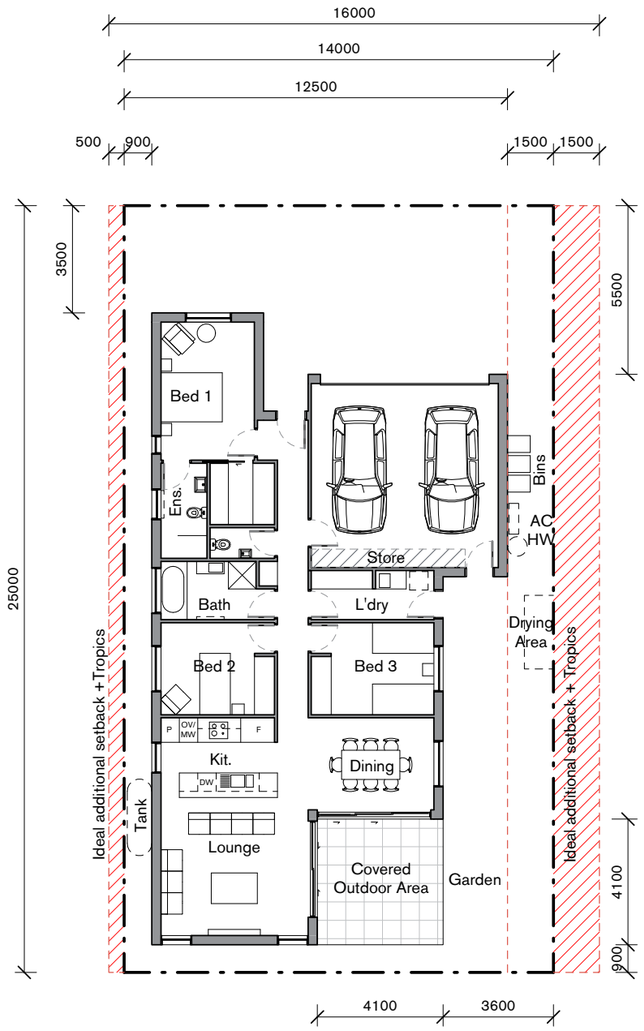
Allotment layout

1 2 3 4 5 6 7 8

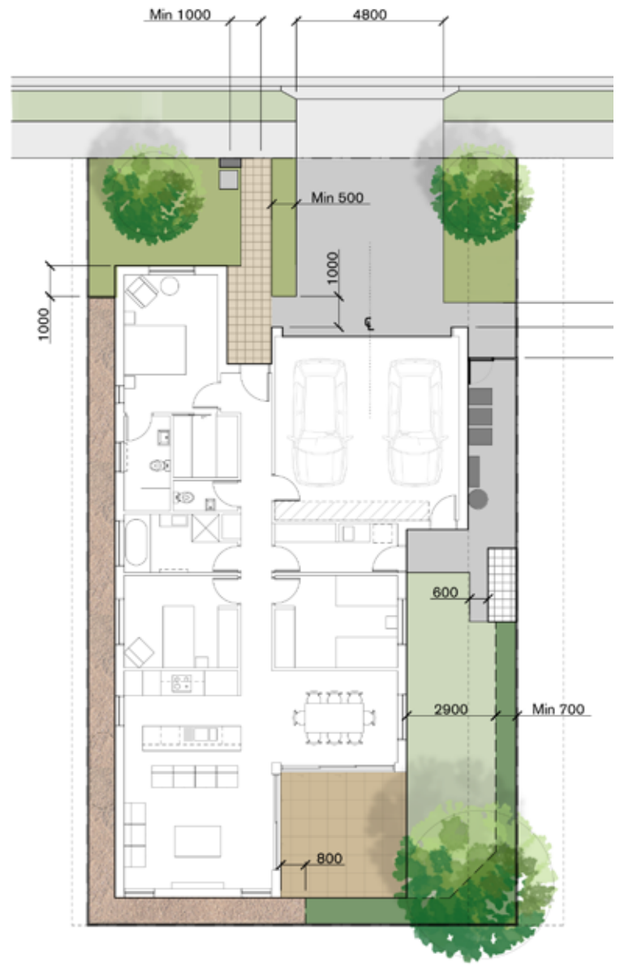


3 Bed Short Lot

Lot size = 310m²
Dwelling size = 122m² Refer to typical plans introduction for method on measurement.



Ground floor



Landscaping

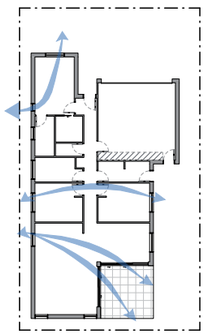
G. Typical Plans
DHA Design Guidelines

Not to Scale

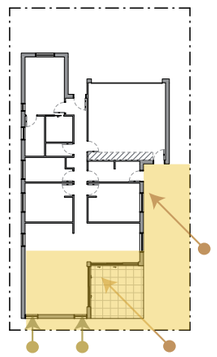
DHA
Defence Housing Australia

Key Principles

Cross flow

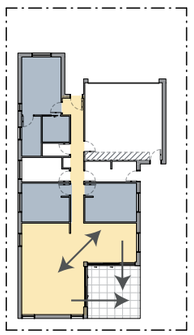


Winter solar access



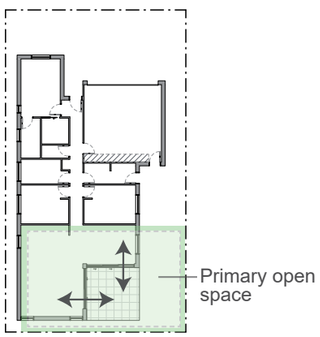
N

Private / Public zoning

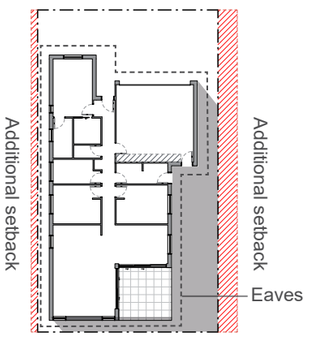


Public zone
Private zone

Indoor / Outdoor relationships

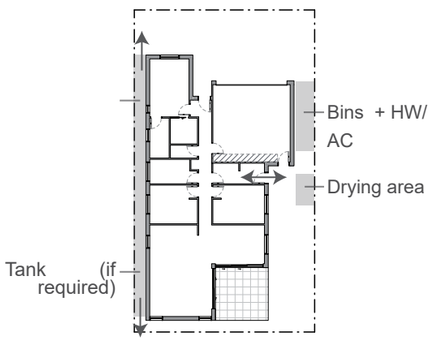


Shading for the Tropics

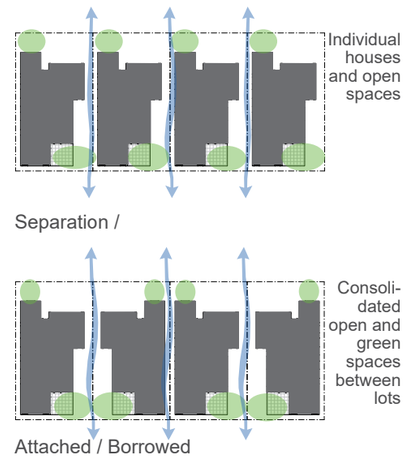


N

Services access



Allotment layout



3 Bed Narrow Lot Option 1

Lot size = 300m²
Dwelling size = 119m² Refer to typical plans introduction for method on measurement.

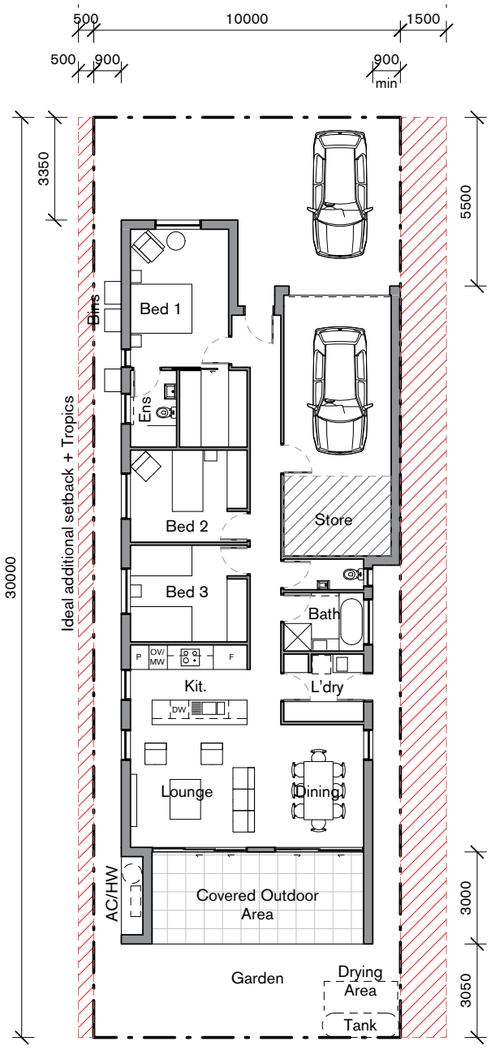
N

2 3 4 5 6 7 8

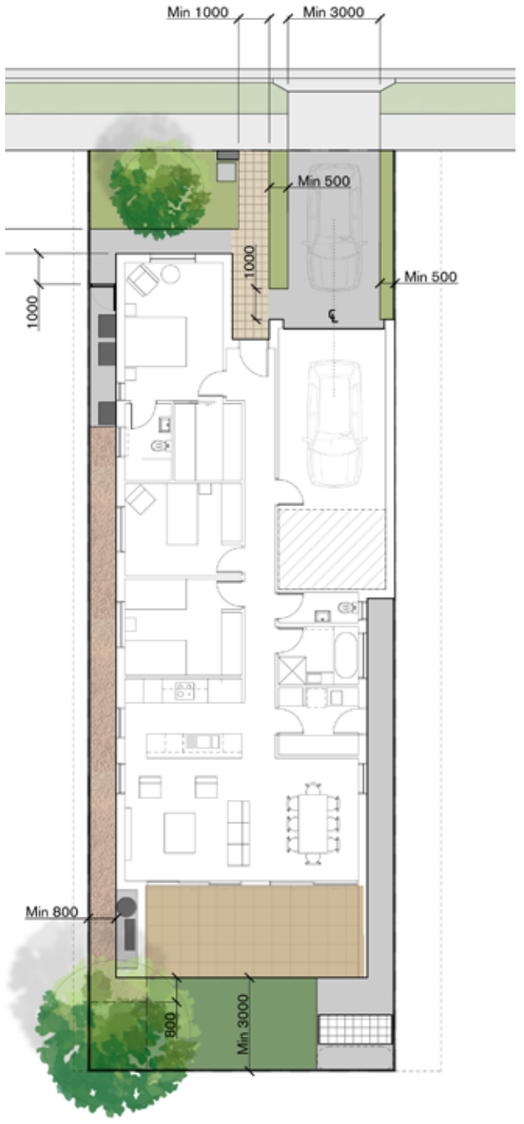
N

1

Note: Floor plan should be mirrored when designing for Climate Zone 1



Ground floor



Landscaping

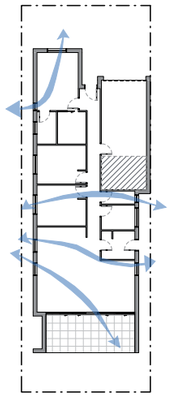
G. Typical Plans
DHA Design Guidelines

Not to Scale

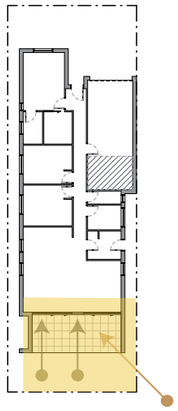
DHA
Defence Housing Australia

Key Principles

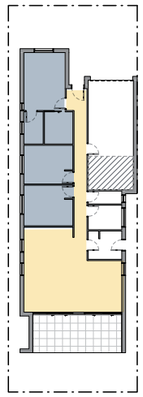
Cross flow



Winter solar access

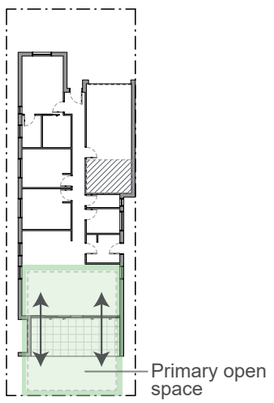


Private / Public zoning

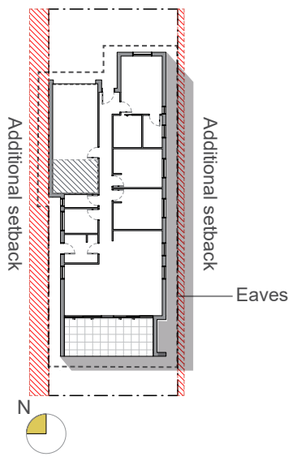


Options/extensions

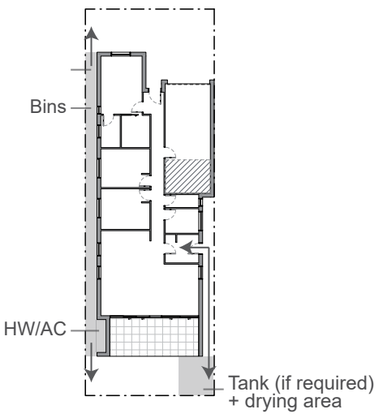
Indoor / Outdoor relationships



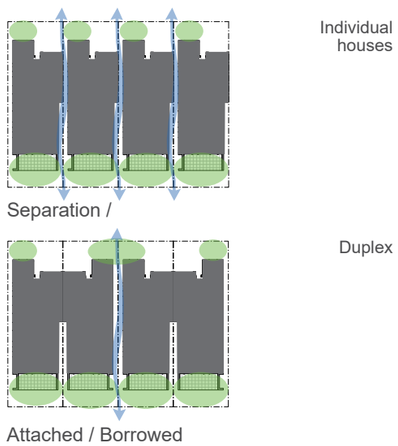
Shading for the Tropics



Services access



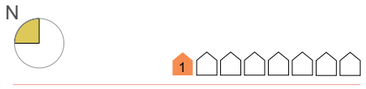
Allotment layout

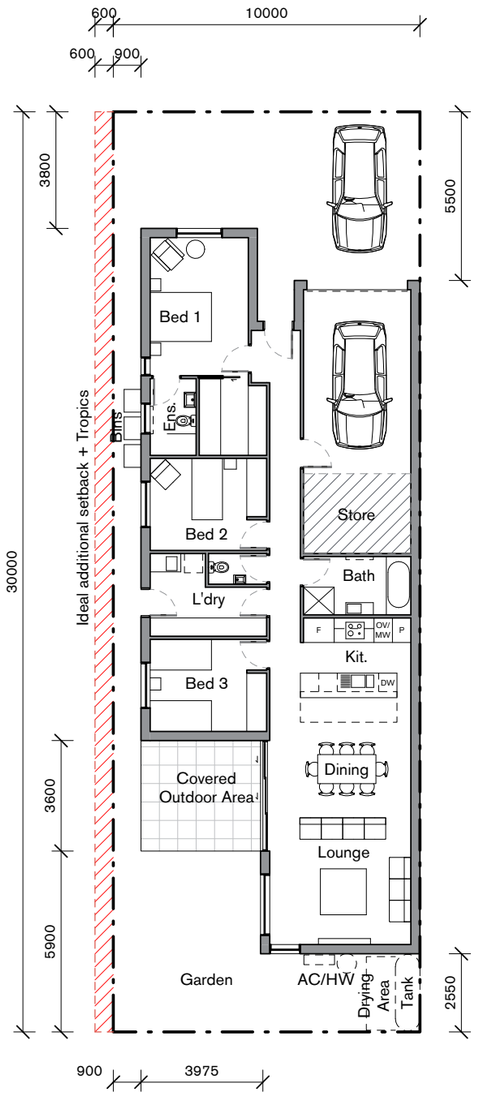


3 Bed Narrow Lot Option 2

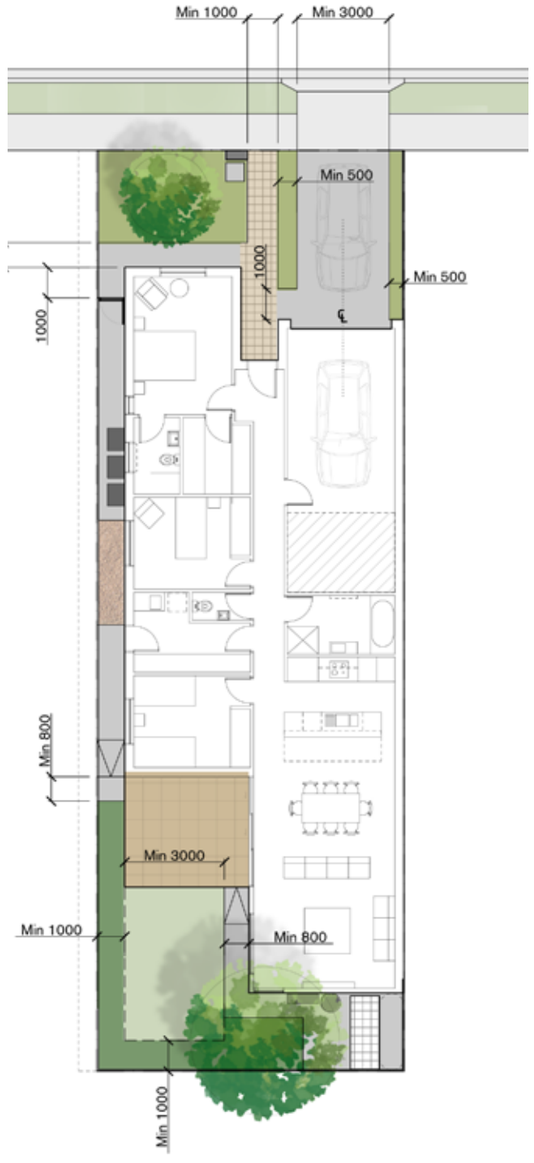
Note - The kitchen shows an option to extend the island bench to allow for double sided storage, shown dotted.

Lot size = 300m²
Dwelling size = 126m² Refer to typical plans introduction for method on measurement.





Ground floor



Landscaping

G. Typical Plans
DHA Design Guidelines

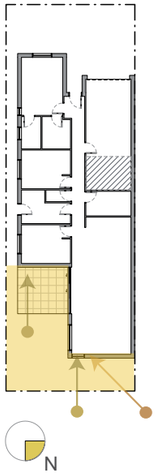
Not to Scale

DHA
Defence Housing Australia

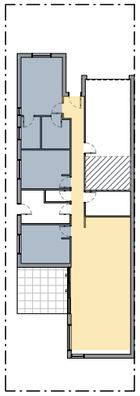
Key Principles

Cross flow

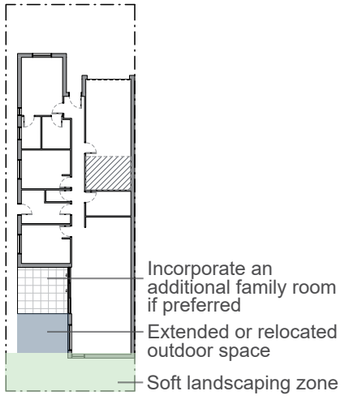
Winter solar access



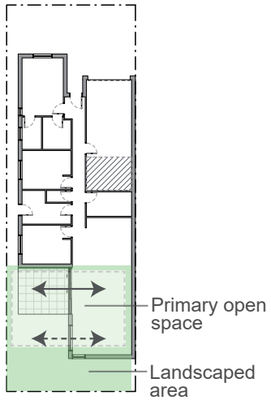
Private / Public zoning



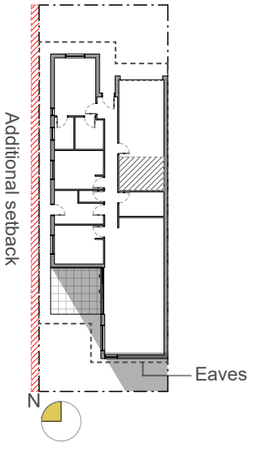
Options/extensions



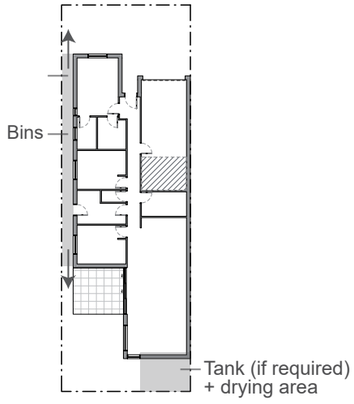
Indoor / Outdoor relationships



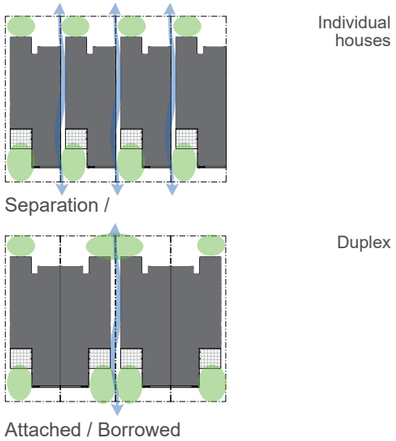
Shading for the Tropics



Services access



Allotment layout



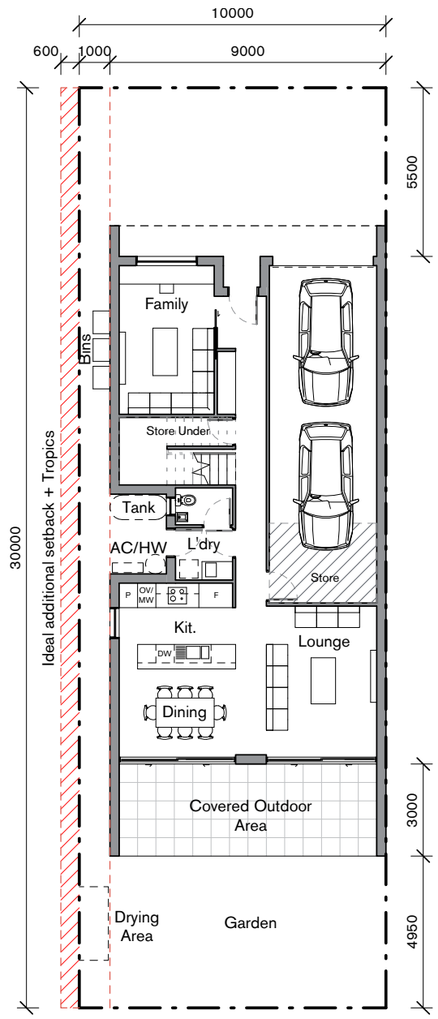
4 Bed, 2 Storey Narrow Lot

Lot size = 300m²
Dwelling size = 169m² Refer to typical plans introduction for method on measurement.

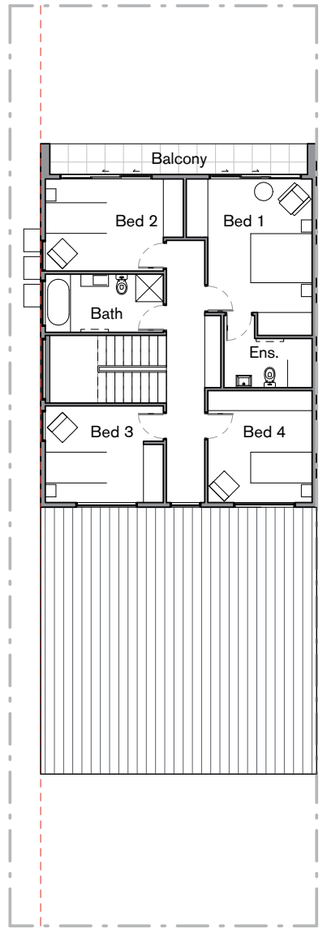
N

2 3 4 5 6 7 8

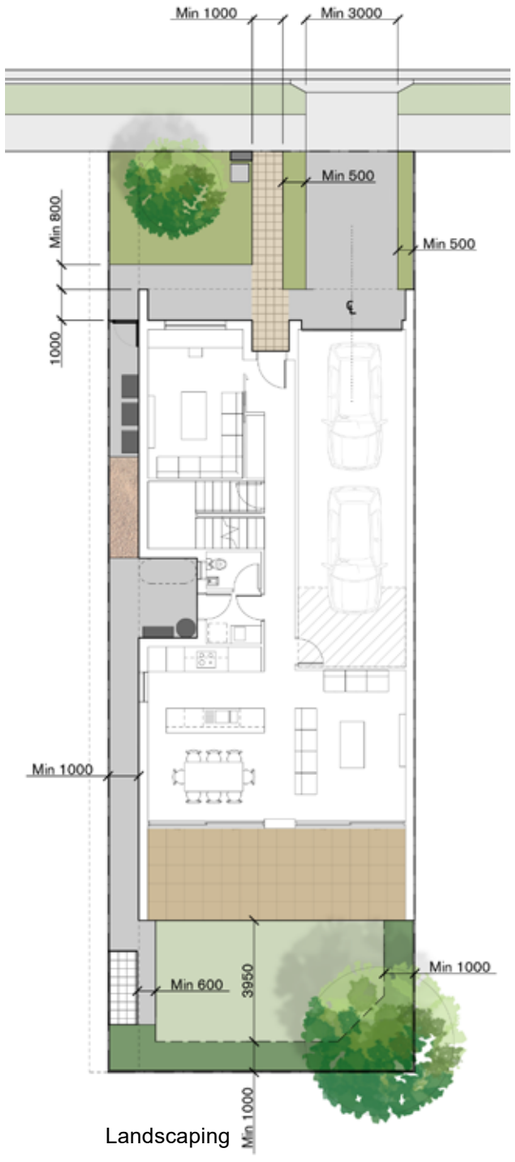
Floor plan not suitable for Climate Zone 1



Ground floor



First floor



Landscaping

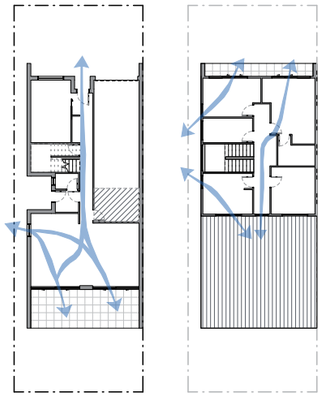
G. Typical Plans
DHA Design Guidelines

Not to Scale

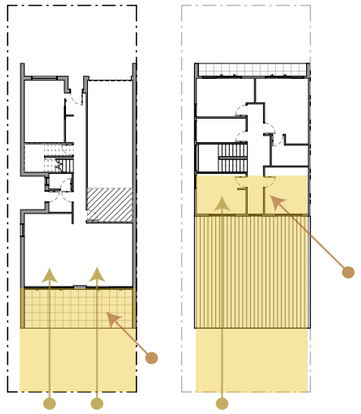
DHA
Defence Housing Australia

Key Principles

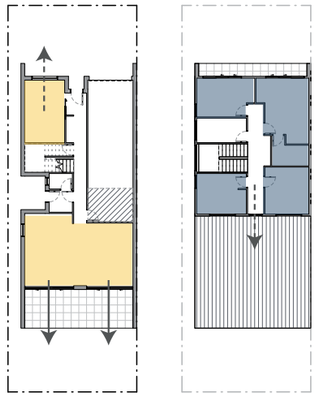
Cross flow



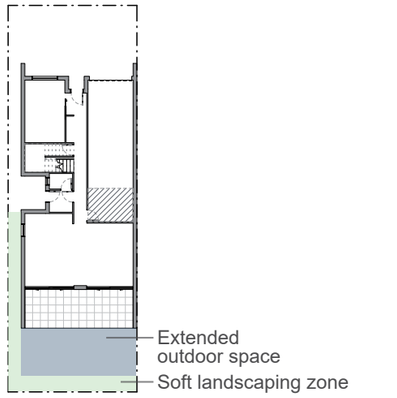
Winter solar access



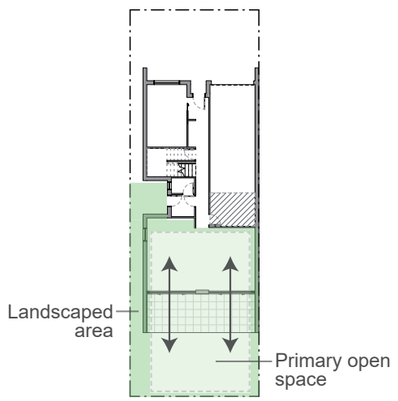
Private / Public zoning



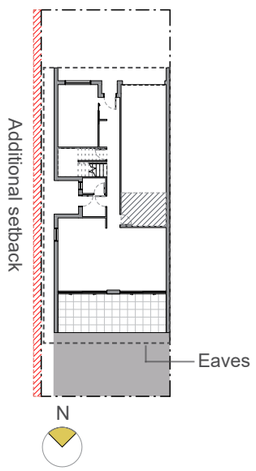
Options/extensions



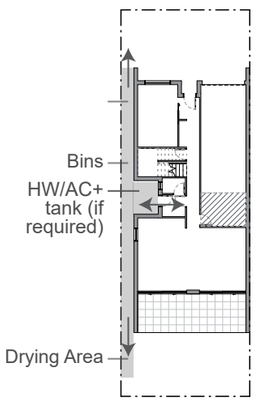
Indoor / Outdoor relationships



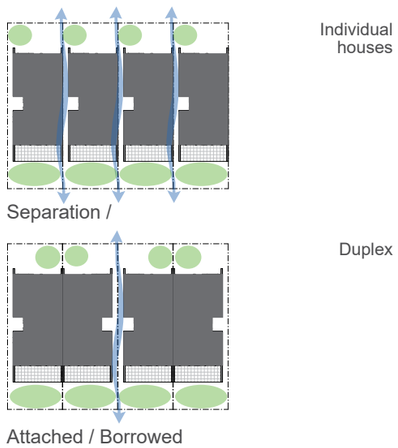
Shading for the Tropics



Services access



Allotment layout



G. Typical Plans
DHA Design Guidelines

0 1 2 5 1 : 200 @ A3

DHA Defence Housing Australia

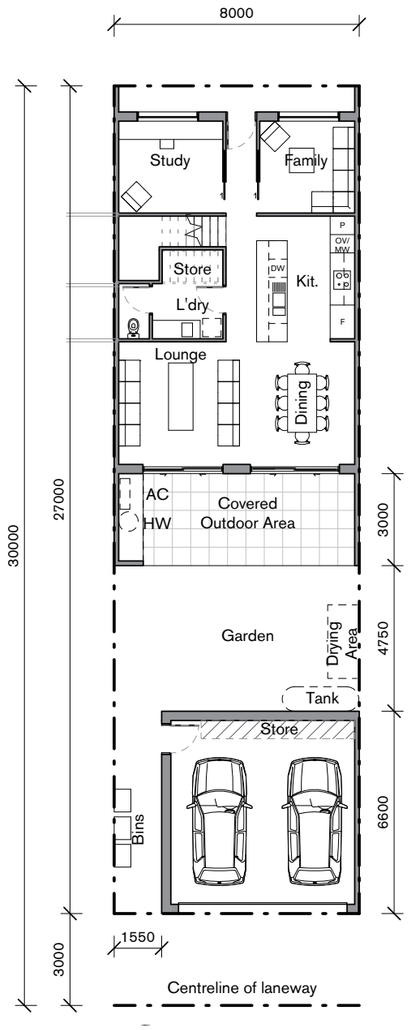
4 Bed Terrace

Note - If compliance with Silver Level is required, the minimum width for the path connecting the garage to the COA should be revised to

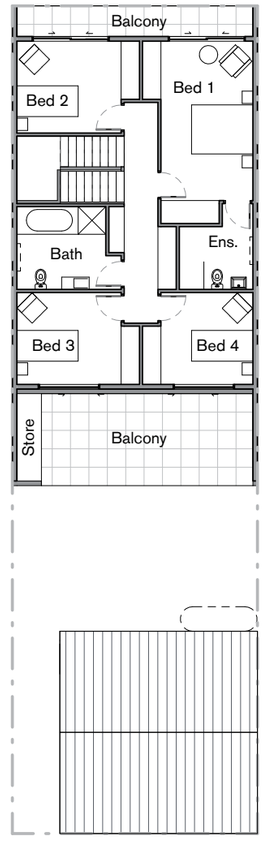
Lot size = 240m²
Dwelling size = 165m² Refer to typical plans introduction for method on measurement.

N 2 3 4 5 6 7 8

Floor plan not suitable for Climate Zone 1



Ground floor



First floor

Landscaping

G. Typical Plans
DHA Design Guidelines

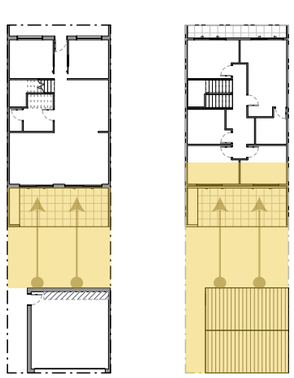
Not to Scale

DHA
Defence Housing Australia

Key Principles

Cross flow

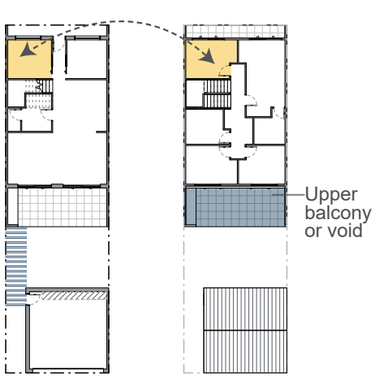
Winter solar access



Private / Public zoning

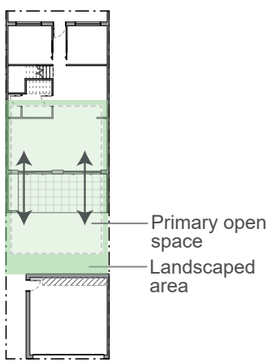
- Public zone
- Private zone

Options/extensions

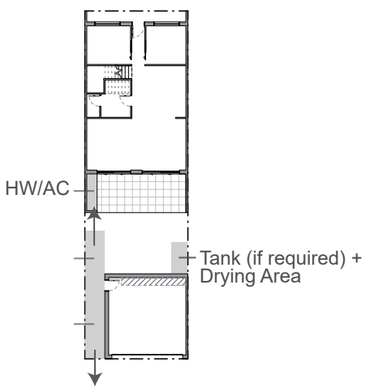


- Option to provide covered walkway to
- Option to swap bedroom with family if preferred
- Option to include upper balcony if preferred, or delete and make ground floor terrace double height

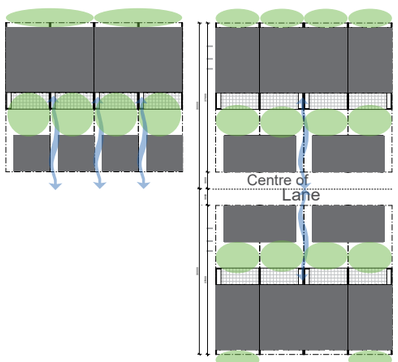
Indoor / Outdoor relationships



Services access



Allotment layout



Separation / Individuality
Individual garage structures

Attached / Borrowed
Joined garage structures

3 Bed Terrace

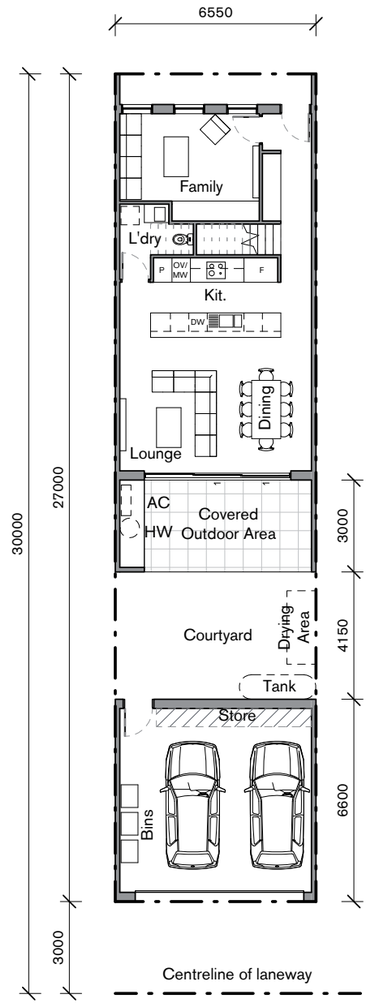
Note - If compliance with Silver Level is required, the minimum width for the path connecting the garage to the COA should be revised to

Lot size = 196.5m²
Dwelling size = 142m² Refer to typical plans introduction for method on measurement.

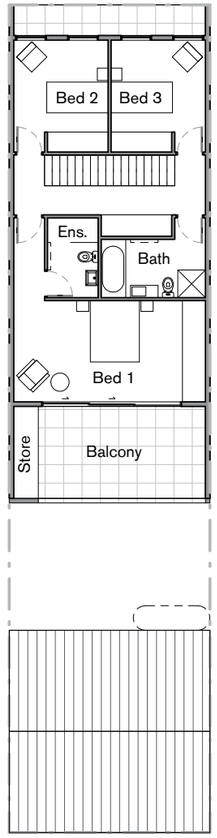
N

2 3 4 5 6 7 8

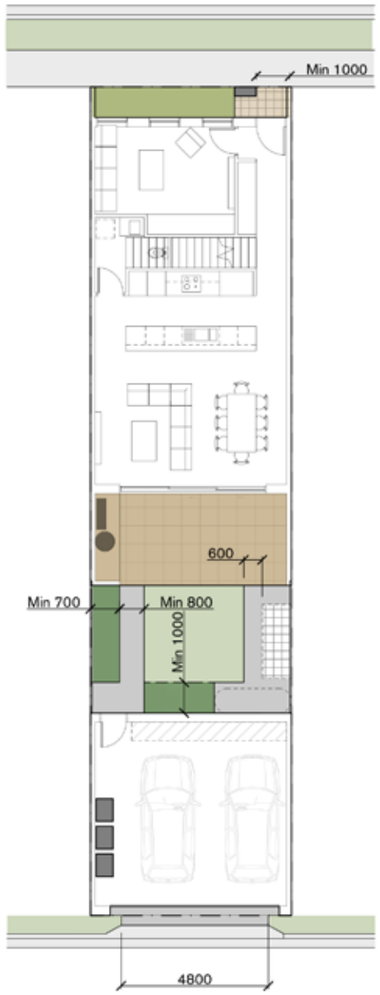
Floor plan not suitable for Climate Zone 1



Ground floor



First floor



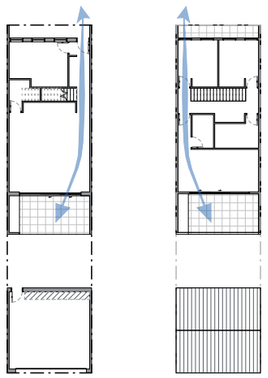
Landscaping

G. Typical Plans
DHA Design Guidelines

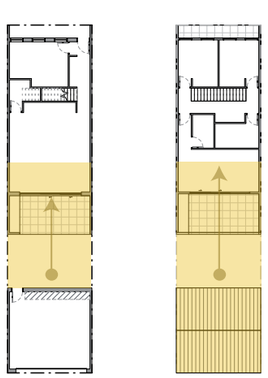
Not to Scale

Key Principles

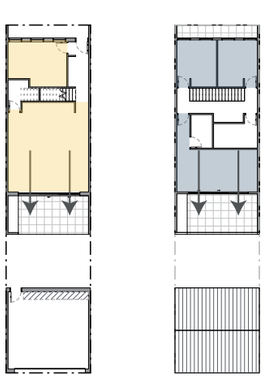
Cross flow



Winter solar access

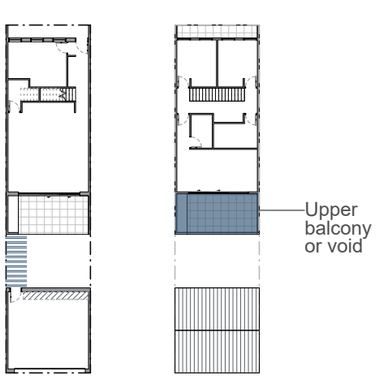


Private / Public zoning



- Public zone
- Private zone

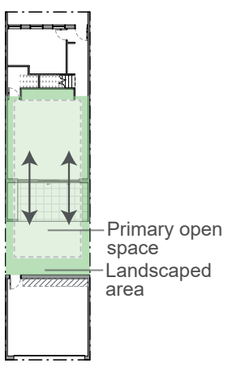
Options/extensions



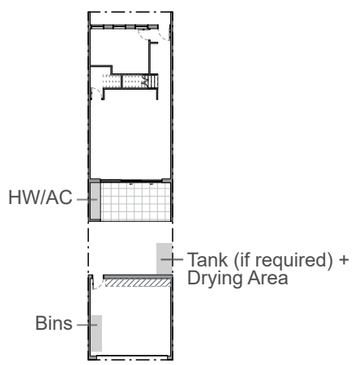
- Option to provide covered walkway to
- Option to include upper balcony if preferred, or delete and make ground floor terrace double height

N

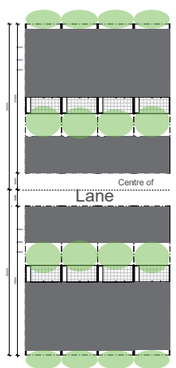
Indoor / Outdoor relationships



Services access



Allotment layout

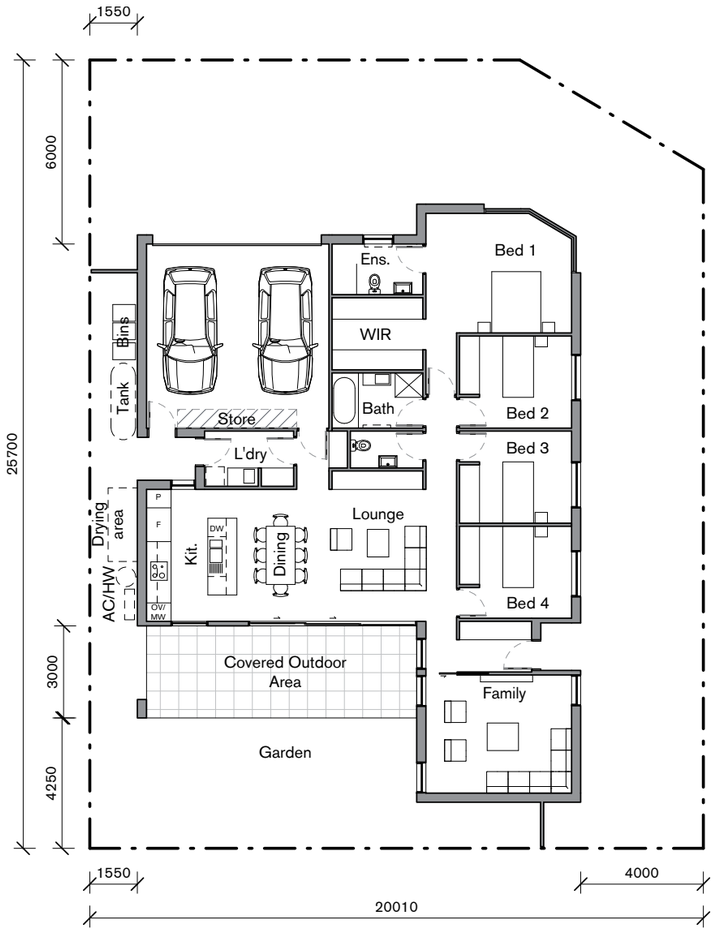


Attached / Borrowed

Joined garage structures

4 Bed Corner Lot

Lot size = 504m²
Dwelling size = 158m² Refer to typical plans introduction for method on measurement.



Ground floor

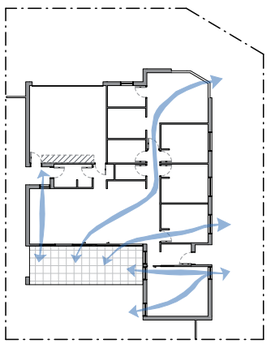
Landscaping

G. Typical Plans
DHA Design Guidelines

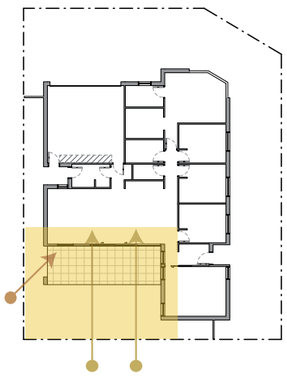
Not to Scale

Key Principles

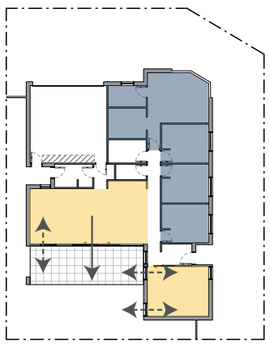
Cross flow



Winter solar access



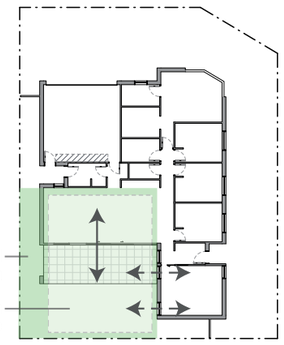
Private / Public zoning



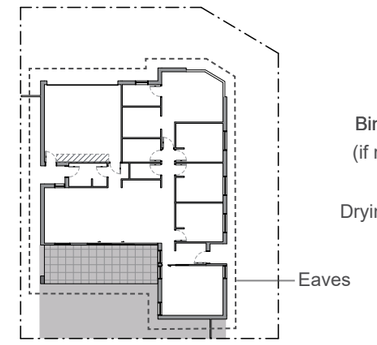
N

Public zone
Private zone

Indoor / Outdoor relationships

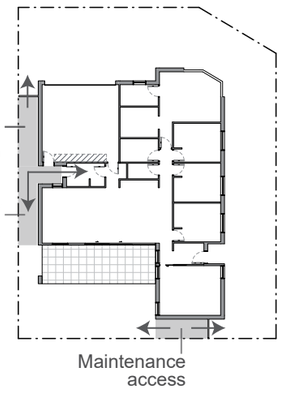


Shading for the Tropics



N

Services access



Typical Details

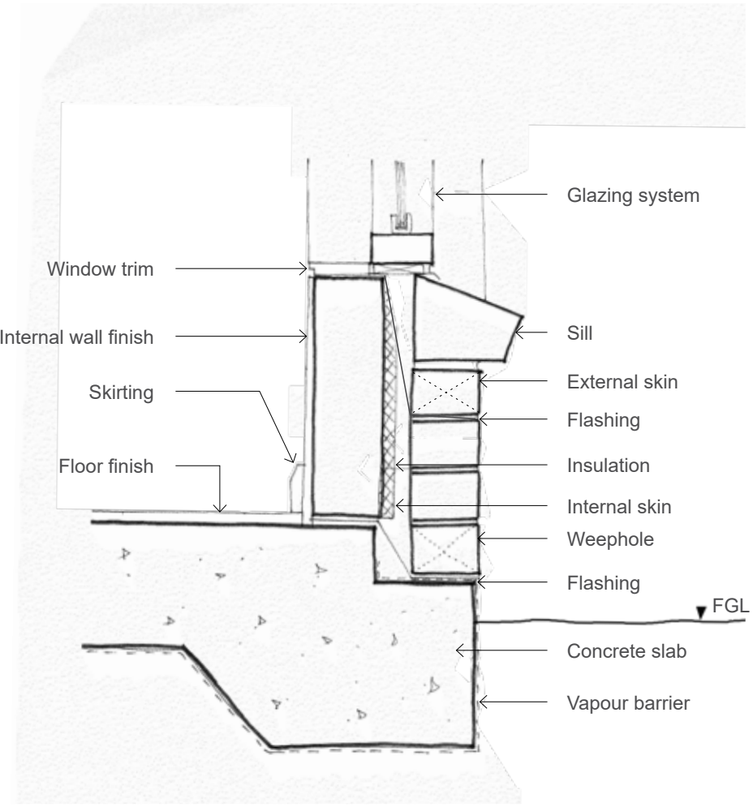
H

H. Typical Details
DHA Design Guidelines

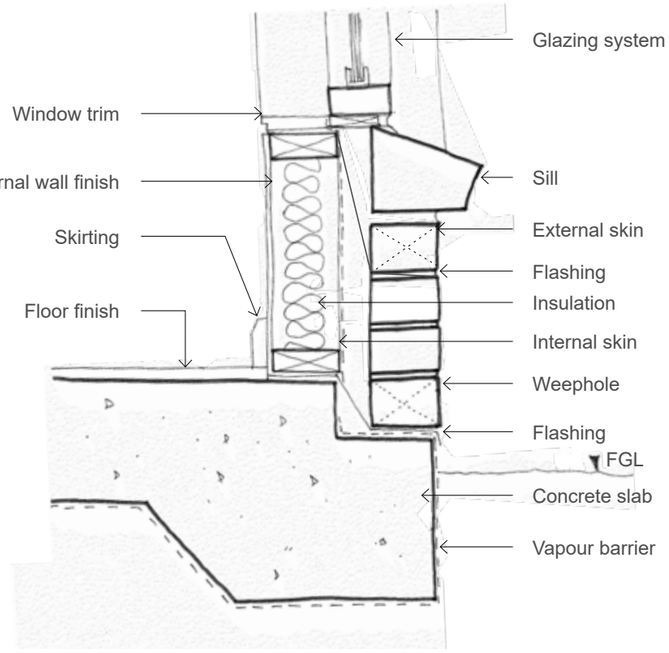
0 0.1 0.2 0.5m 1 : 10 @ A3

DHA Defence Housing Australia

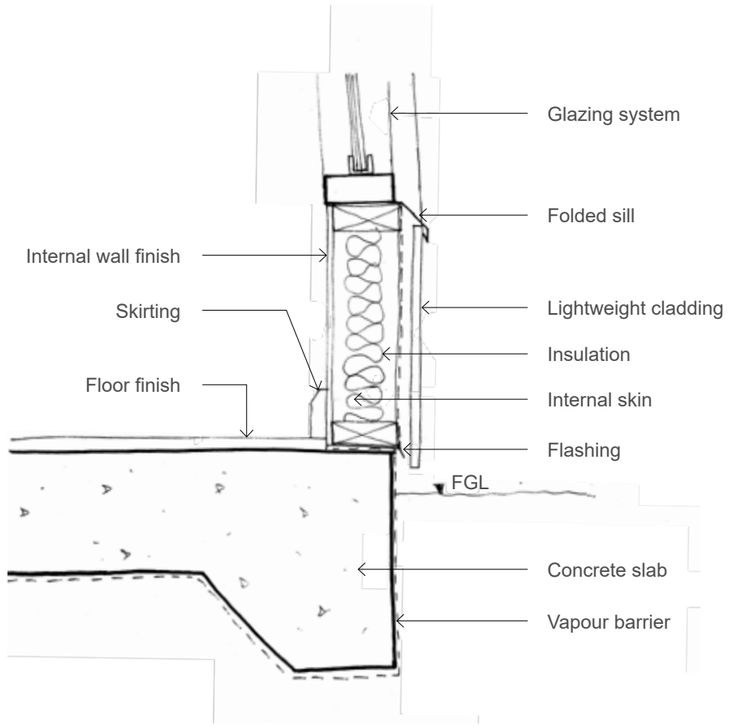
H.1 Cavity Brick Base Detail



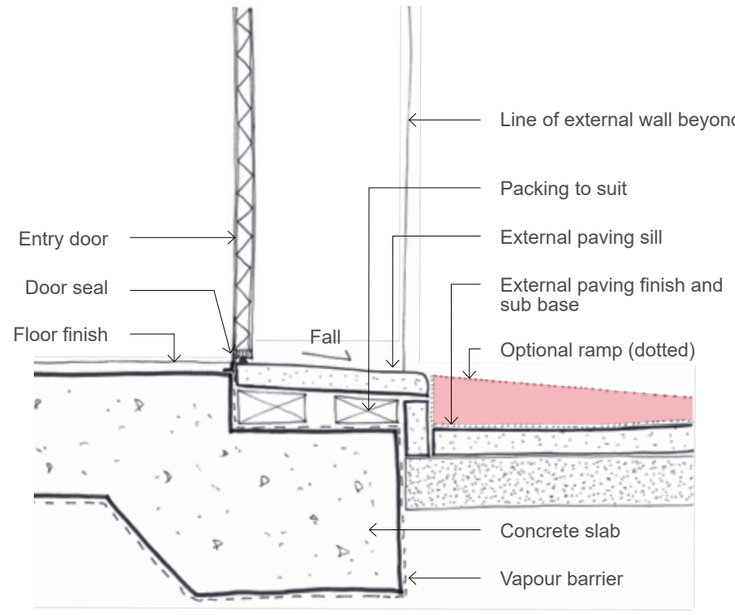
H.2 Brick Veneer Base Detail



H.3 Lightweight Cladding Detail

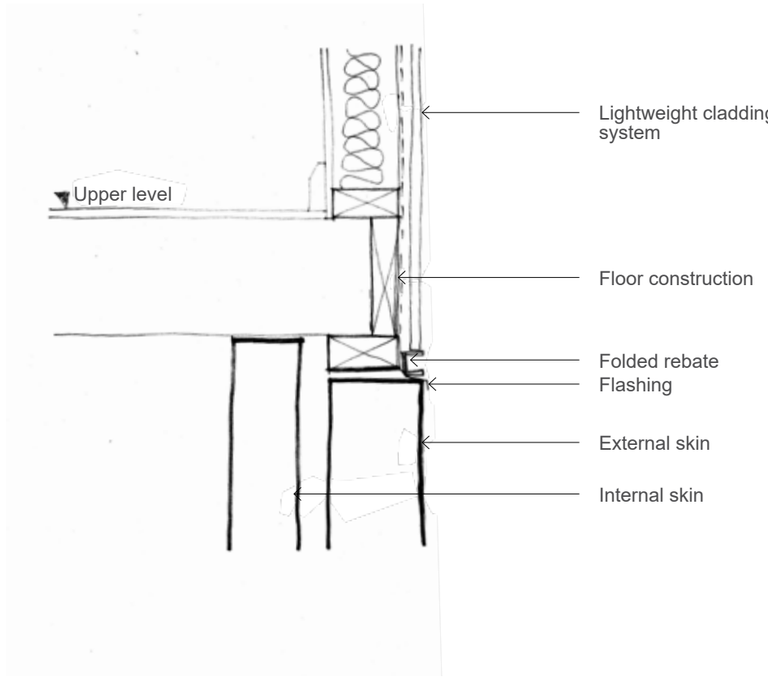


H.4 Entry Door Detail

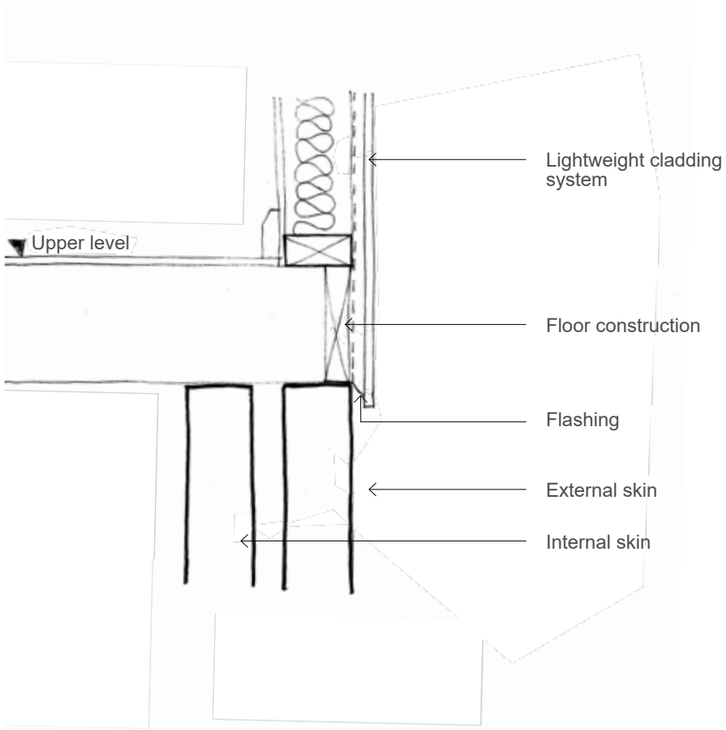


Note: option to incorporate ramp to create flush threshold if Silver Level access is required. Ramp position shown dotted and

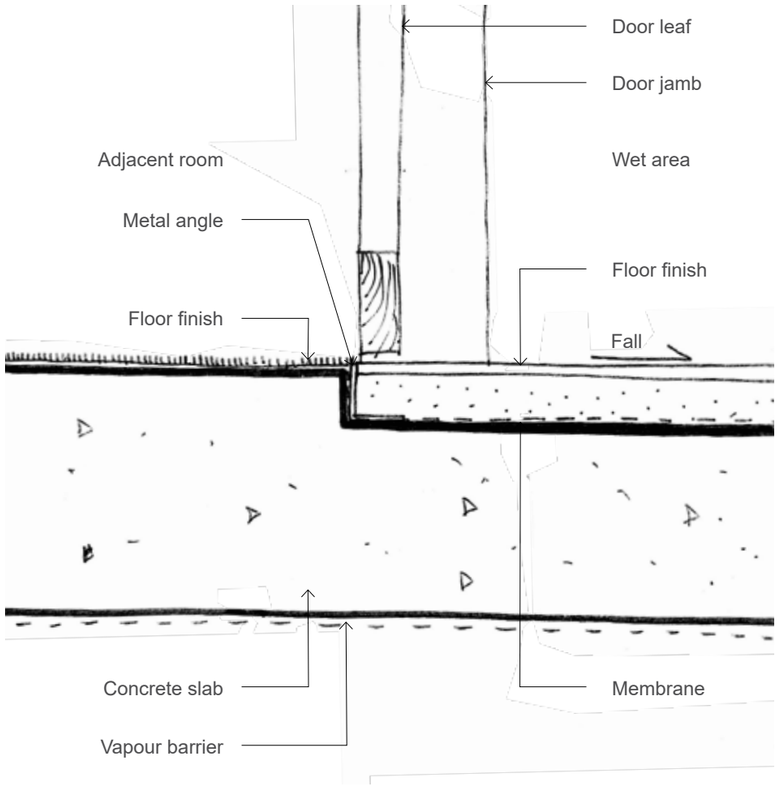
H.5 Facade Material Change - Flush with Rebate



H.6 Facade Material Change - Overlap



H.7 Internal Threshold Detail



H.8 Reinforcement of bathroom and toilet walls

8.01

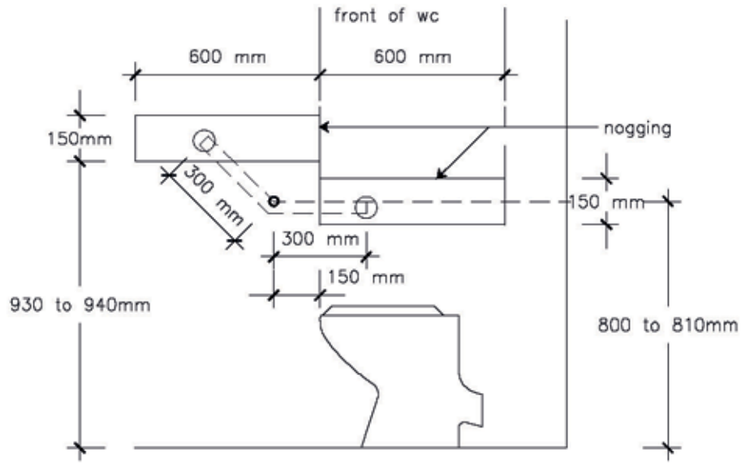


Figure 6(a) Toilet – Location of noggings

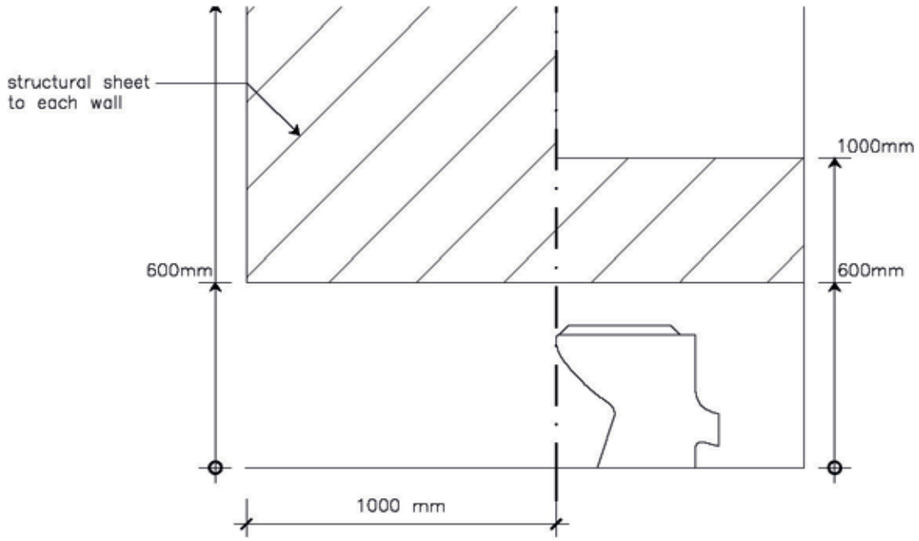


Figure 6(b) Toilet – Location of sheeting

H.9 Reinforcement of bathroom and toilet walls

8.01

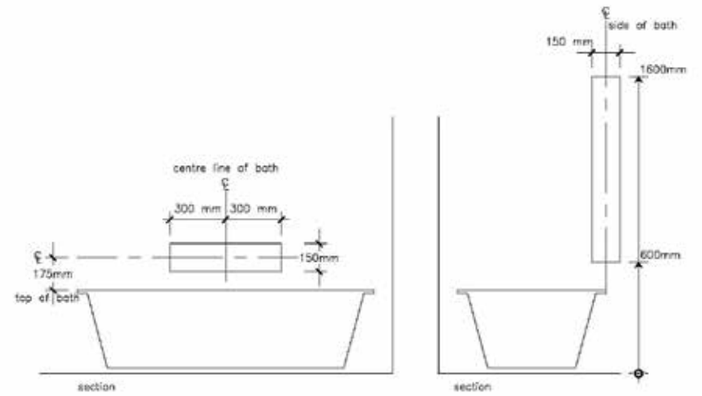
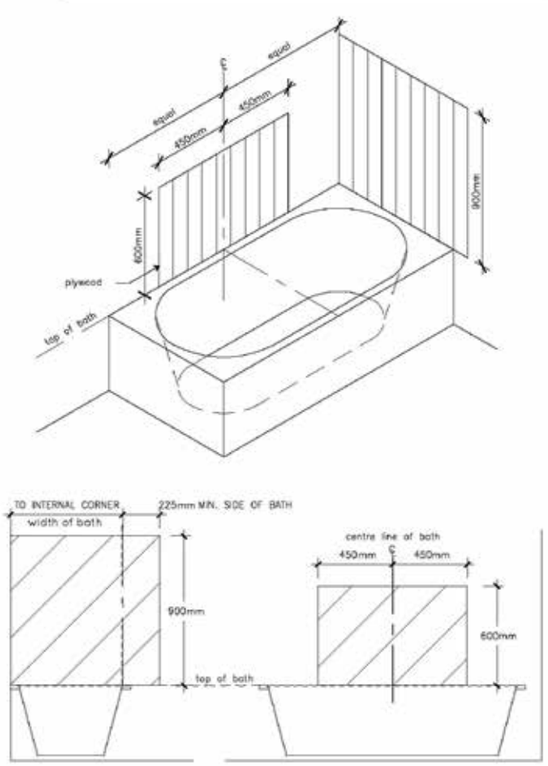


Figure 7(a) Bath – Location of noggings



H.9 Reinforcement of bathroom and toilet walls

8.01

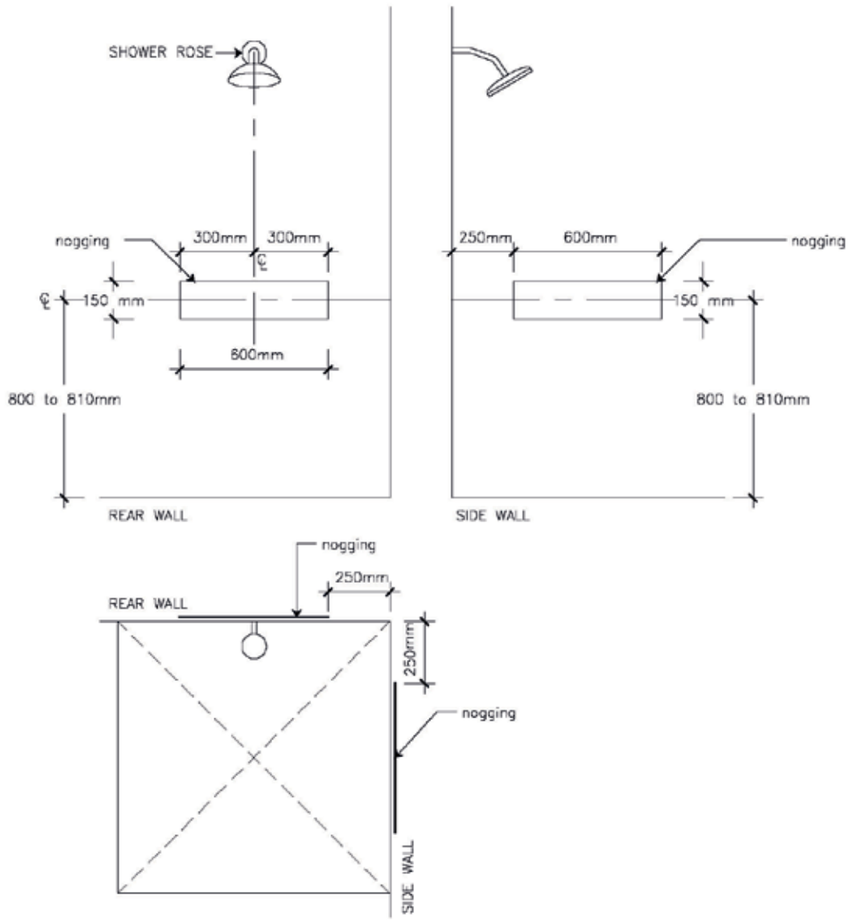


Figure 8(a) Shower recess – Location of noggings

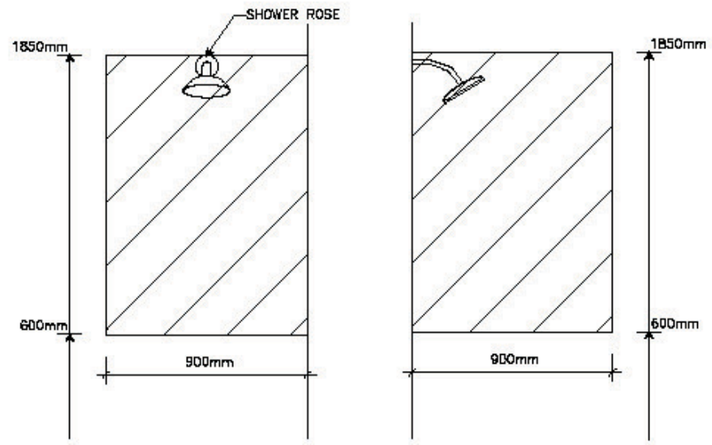


Figure 8 (b) Shower recess – Location of sheeting

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Annexure
Property Checklist

J.1

Annexure Specification

J.2