

Hornsby Public Domain Guidelines

Study Areas

- Asquith
- Beecroft
- Waitara
- Thornleigh
- West Pennant Hills

June 2021

Hornsby Public Domain Guidelines

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Executive Summary

Hornsby Shire has experienced rapid growth and development over the last decade, particularly in key high-density housing strategy precincts.

There are numerous challenges in achieving high quality, consistent public domain outcomes during this period of rapid growth. As such, there is a requirement for additional guidance in the design and delivery of the future public domain in Hornsby's key development areas.

Coupled with this is the recognition that various villages and town centres require upgrades to improve quality, amenities and to better respond to future needs and challenges.

As a result, the following Public Domain Guidelines have been prepared with a focus on five key project areas identified for growth and enhancement over the coming years. To ensure that all future development and upgrades of the Public Domain provide good design quality, consistent solutions should respond to the growing needs of the Shire's community, while also respecting the Bushland Shire character that makes Hornsby what it is. These guidelines describe the minimum standards for the design and Development Assessment of future public domain proposals within the Shire. The Principles and requirements outlined in this document shall be used as guidance for the assessment and preparation of public domain plans related to all areas across Hornsby Shire Council including areas where Key Project plans have not yet been prepared.

In developing these Guidelines, existing planning controls and policies were reviewed to determine their effectiveness in permitting appropriate urban design outcomes and public domain upgrades.

Local community consultation was conducted to understand the current uses, needs and deficiencies of each of the key areas, along with a site analysis of each of the five key project areas. The findings collected provided a good understanding of these areas and their needs, which has driven the proposed design visions and improvements for each of the key project areas.

Proposed improvements including new plazas, dedicated cycleways and shared paths, footpath widening, pedestrian links, shared zones and new trees aim to secure good public domain outcomes for Hornsby Shire

and set the standard for all future improvements. Part F of these guidelines further explores these components.

The preparation of the Public Domain Guidelines also provides an opportunity to address priority actions in the Greater Sydney Commission's North District Plan, the Resilient Sydney Strategy and other associated policies including the State Government's Greener Places - Green Infrastructure Policy and other referenced documents including Council policies.

These guidelines have been developed in close consultation with Hornsby Shire Council, Council stakeholders, and the community via community consultation [PDG engagement yet to occur].

In parallel with the Public Domain Guidelines, a shire-wide Signage Strategy has been developed, providing a hierarchy and palette of outdoor identification, wayfinding / directional and interpretive signage to be used to identify suburbs, community centres, parks and roads. The signage palette accompanied by the palette of public domain elements, provided within this document, create a complete guide to the public domain.



Image 0.1: Hornsby Town Centre, Hornsby

PART A – Introduction

A.1 Purpose

The Hornsby Public Domain Guidelines provide a set of specific objectives and technical information to guide the design and construction of the public domain within the key project areas identified for Hornsby Shire. The guidelines shall also be used in the preparation and assessment of public domain proposals that apply to projects outside of the nominated study areas.

The public domain encompasses all publicly accessible, shared spaces. This includes streets, lanes, squares, parks and pedestrian connections, as well as verges, vegetation, footpaths, cycleways, furniture, lighting and signage. These spaces ensure amenity and safety for the public is maintained, as well as creating an attractive and healthy environment.

The Guidelines provide consistent standards to manage the integration of all public domain components to assist Council's ongoing management and approval of developments, upgrading works and maintenance, ensuring design quality with a vision to achieve a cohesive Hornsby Shire character.

Scope

The key study areas to which these guidelines apply are identified in Figure A.1 and Figure A.3, and noted below:

- Asquith
- Beecroft
- Waitara
- Thornleigh, and
- West Pennant Hills.

These areas, as defined within this document, demonstrate the application of the Guidelines across various town centre typologies within the Shire. The use of the guidelines is not limited to the nominated Study Areas and identified Key Projects. The guidelines shall also inform proposed upgrades to the public domain elsewhere in the Hornsby Shire Council area including areas where site-specific requirements have not been documented.

User

These Guidelines are to be used by all stakeholders involved in the planning, design and approval of public domain works throughout the key project areas nominated in this document including designers, utility providers, other public authorities, private developers and residents to ensure uniformity across the different stages of growth and development.



Image A.2: Peats Ferry Road, Hornsby

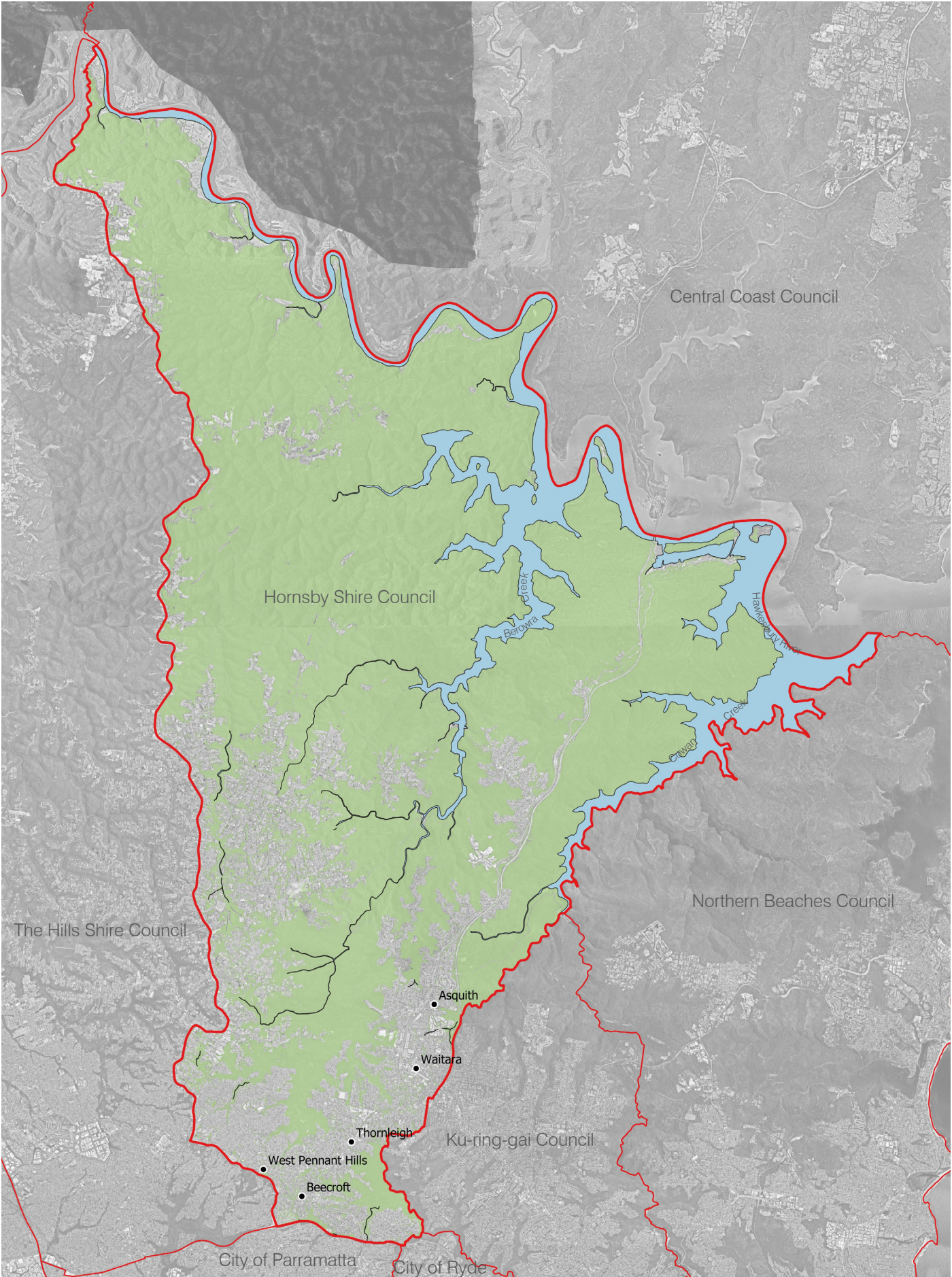


Figure A.1 Project Context



Figure A.3 Study Areas where Key Projects are Located

A.2 How To Use This Document

Document Structure

This document is broken down into sections based on relevant planning conditions and community needs guiding the assessment of street design and local conditions and the application of a coordinated materials palette to specific projects. The guidelines explain the considerations for the public domain at four levels from the macro to the fine grain.

Part A – Introduction

The requirements of the public domain are guided by community needs identified through consultation and collaboration, and statutory planning policy, site conditions and industry best practice. Firstly the document identifies the existing supporting documents and planning framework, secondly it explains the consultation undertaken to identify community needs.

Part B – Approach

Planning and community requirements are distilled into four principle pillars; Biodiversity, Connectivity, Programming and Use, Character and Aesthetics, of the public domain to be implemented by Council.

Part C – Street Design

This section, analyses street design and the composition of elements within the public domain. Street and footpath typologies are examined against the preceding needs providing design objectives and essential considerations for public domain upgrades.

Part D – Materials Palette and Application

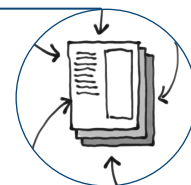
The materials palette defines the materials, street furniture and planting to be used across character areas within the key projects. The Signage and Way-finding Strategy should also be referenced.

Part E – Key Project

Key projects consolidate and demonstrates the application of the previous sections as they apply to five nominated study areas across Hornsby Shire Council Asquith, Waitara, Thornleigh, Beecroft and West Pennant Hills.

STEP 1

With reference to Part A 'Overview' and Part B 'Approach', determine public domain requirements in relation to the subject development



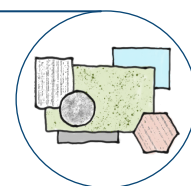
STEP 2

With reference to Part C 'Street Design', undertake a street design assessment in relation to the subject development



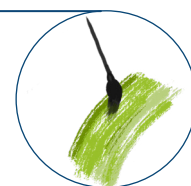
STEP 3

With reference to Part D 'Materials Palette and Application', determine the materials, furniture and planting required for the subject development



STEP 4

With reference to Part E 'Key Projects', understand how the street design and materials palette should be applied to the subject development



A.3 Defining the Character of Hornsby

Hornsby Local Government Area in 2020

The Hornsby Shire Local Government Area is the northernmost municipality of the Greater Sydney metropolitan area. The Hawkesbury River bounds the Shire to the North, Old Northern Road to the West and Ku-ring-gai Chase National Park to the East.

Hornsby Shire is characterised by vast tracts of National Parks and pristine bushland, a range of diverse residential housing each with their own unique local village centres and a large proportion of productive rural properties.

Hornsby Shire represents a unique blend of protected bushland and rapidly developing urban areas typifying the Sydney Basin character. The National and State Parks and Reserves are central to the community's identity and lifestyle.

Major transport infrastructure connects many of these village centres, with the T1 Northern Train line, Pacific Highway and Pennant Hills Road, NorthConnex and M2 delivering vast numbers of people to the various centres and surrounding suburbs.

The Hawkesbury Sandstone geology characterises the land-form of the shire with large ridge-lines falling steeply into gorges and lower river systems. Much of the density of the urban fabric is located along these ridge-lines, adjacent to major transport routes.



Figure A.4 Hornsby Shire Local Government Area



Image A.3: Crosslands Reserve, Hornsby Heights

Environment

Hornsby Shire Council is directly responsible for 2,000 hectares of bushland. Seventy per cent of the Shire is vegetated of which 50 per cent are protected areas (eg, National Parks) and bushland reserves. Council manages policies, strategies and operates programs to ensure that the bushland and waterways, as well as the flora and fauna that live in them, are protected. Regarded as “The Bushland Shire”, the natural environment plays a vital role in the identity of the Hornsby Shire Council Local Government Area.

Lifestyle

Well known for its bushland and waterways along with vibrant commercial centres, many sporting facilities and parks, Hornsby Shire offers a diverse and active lifestyle.

This active lifestyle is supported by major National Parks and more than 180 parks, 135 playgrounds, 40 sports grounds plus 31 community centres and libraries supporting the arts and culture.



Image A.4: Storey Park Community Centre, Asquith



Image A.5: Sunset Sessions, Hornsby Mall

Community

Hornsby Shire is a shire of cultural diversity and strong community. With higher than national average homeownership, and over 30 per cent of households with children and 35 per cent of residents born overseas, Hornsby is a family orientated welcoming community. Between 2019 and 2036, the community is expected to grow by an estimated 21 per cent*.

Business

Hornsby Shire is estimated to contribute 1.22 per cent or \$7.28b in Gross State Product. Hornsby Shire's unemployment is lower than the national average, with 59.5 per cent of the Shire's resident workers having a tertiary qualification.



Image A.6: Westfield, Hornsby

* Population data estimate correct on October 2020 from profile.id.com.au

A.4 Developing the Guidelines

Guidelines Development Process

The development process of the guidelines follows on from an understanding of planning policies, controls and context within which these guidelines sit.

Commencing with a site analysis of each study area and in general, Hornsby Shire, an understanding of the Shire's character and each project area was obtained as well as the current treatment of the public domain areas. Observed primarily within the key project areas was the functionality of the spaces, existing amenities, circulation, connections, zoning, built-form and vegetation to ascertain the needs of each area. Building upon the observations, community consultation was undertaken with the local community in each area, as well as consultation with local community groups and stakeholders. With a strong understanding of how these areas functioned and their needs, the information was distilled down and organised into categories which informed the approach to the design, which are represented by design principles and pillars later described in this document. The principles and pillars stand to guide the designs and to allow a cross-check of the designs as they evolved to ensure that they remain in-line with the needs and objectives of the project.

Concept designs were then developed, followed by these guidelines, which will then go out to further consultation. This process of development and review ensures a high quality document.

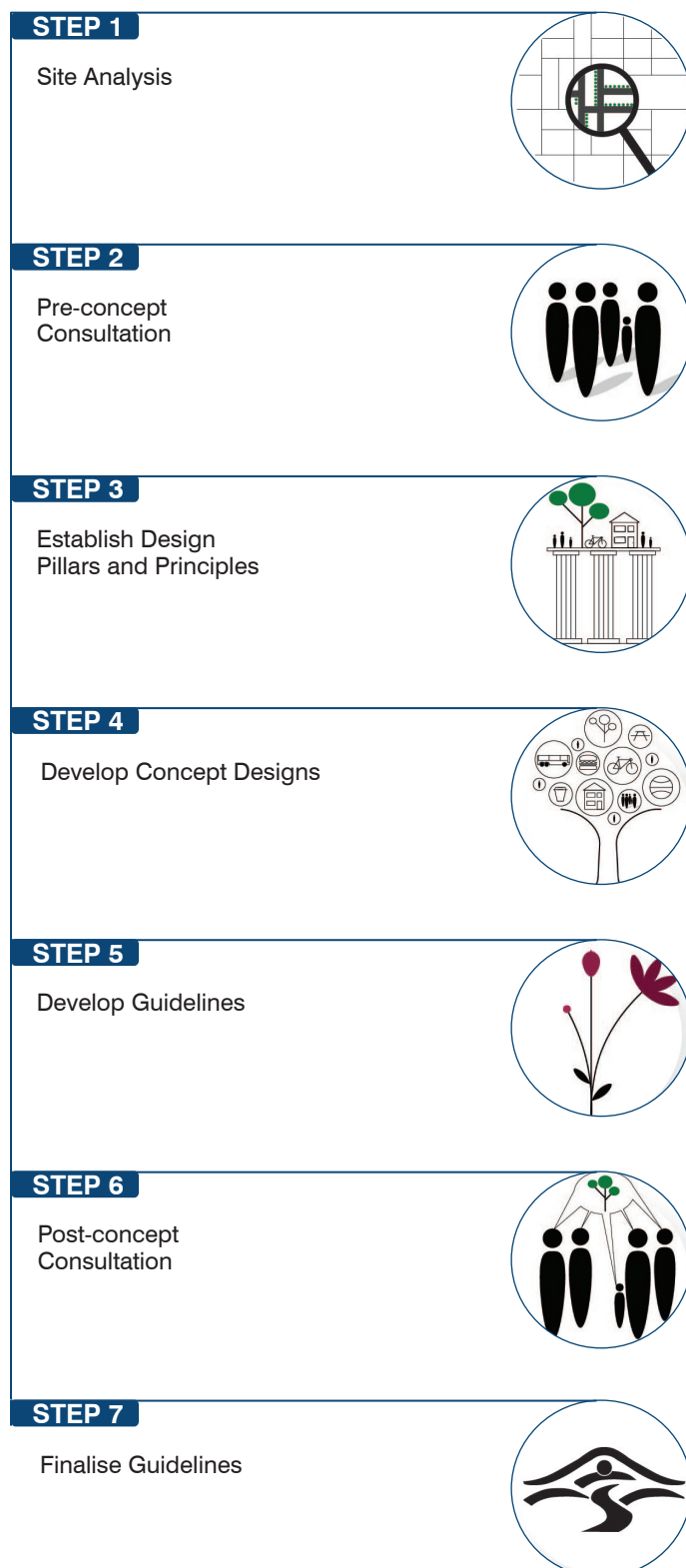


Figure A.5 Guideline development process

Community Consultation

Consultation with the local community has been pivotal in understanding the needs of each project area, as well as highlighting the strengths, opportunities and constraints that exist. More importantly, this process ensured that the community was engaged in the process of developing these guidelines.

The objectives of the consultation process were to:

- Build community awareness of the project and interest in participating in the development of the strategies;
- Provide opportunities for inclusive participation, including diverse ages, cultures and languages;
- Deliver innovative and experiential consultation activities that capture community perceptions and ideas for main street improvements, public domain guidelines and signage; and
- Reach a broad range of community members and stakeholders.

Consultation for the guidelines was undertaken in two phases being; 'pre-concept design' and 'post-concept design' (these draft guidelines). The pre-concept design community consultation was undertaken in March 2019, with the post-concept design consultation going out for exhibition on completion of the current final draft guideline.

Consultation was undertaken by various means to ensure maximum outreach and feedback, including online surveys, workshops and on-street pop-ups and intercept events set up in the key project areas.

Workshops were undertaken with the following community groups:

- Beecroft Cheltenham Civic Trust
- Arcadia Galston Residents Association
- Hornsby Chamber of Commerce
- Hornsby Aboriginal and Torres Strait Islander Committee

Overall, approximately 420 people participated in the initial consultation process.

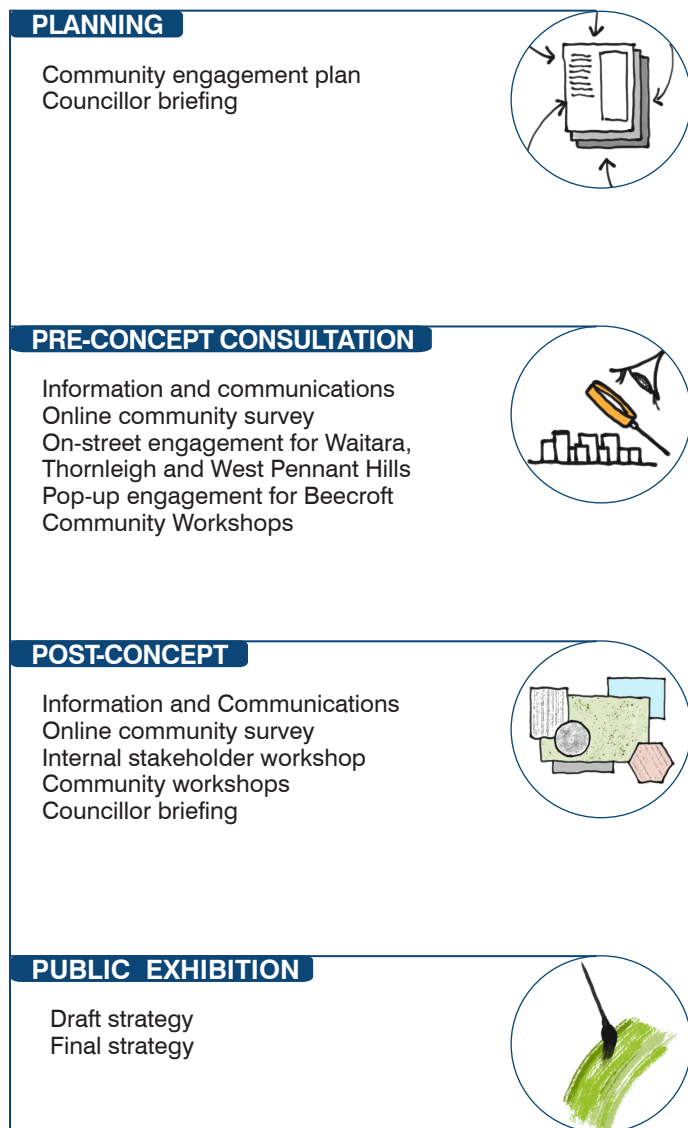


Figure A.6 Consultation approach overview

A.5 Reference Documents

Related Documents and Policies

This document is to be read in conjunction with supporting local and regional planning policies and documents as shown in Figure A.7 and Figure A.8, including:

State and Regional:

- North District Plan, Greater Sydney Commission
- Greener Places, NSW Government Architect
- Better Placed, NSW Government Architect
- Resilient Sydney Strategy, City of Sydney
- Roads and Maritime Services Water Sensitive Urban Design Guideline
- The 2020 Vision Plan

Local – Hornsby Shire Council:

- Draft Bike Plan Review 2019
- Draft Public Art Policy 2015
- Socio Cultural Community Consultation Report 2014
- Active Living Hornsby Strategy 2016
- Water Conservation Policy
- Water Sensitive Urban Design Guidelines 2015
- Walking and Cycling Strategy
- Outdoor Dining Code
- Sustainable Hornsby 2040 Strategy
- Urban Forest Strategy
- Water Sensitive Hornsby Strategy
- Biodiversity Conversation Strategy
- Climate Wise Hornsby Plan
- Integrated Land Use Transport Strategy (ILUTS) 2004
- Draft Hornsby CBD Public Domain Plan
- Draft Hornsby Quarry Masterplan
- Greening the Shire Program
- Employment Lands Study
- Economic Development and Tourism Strategy

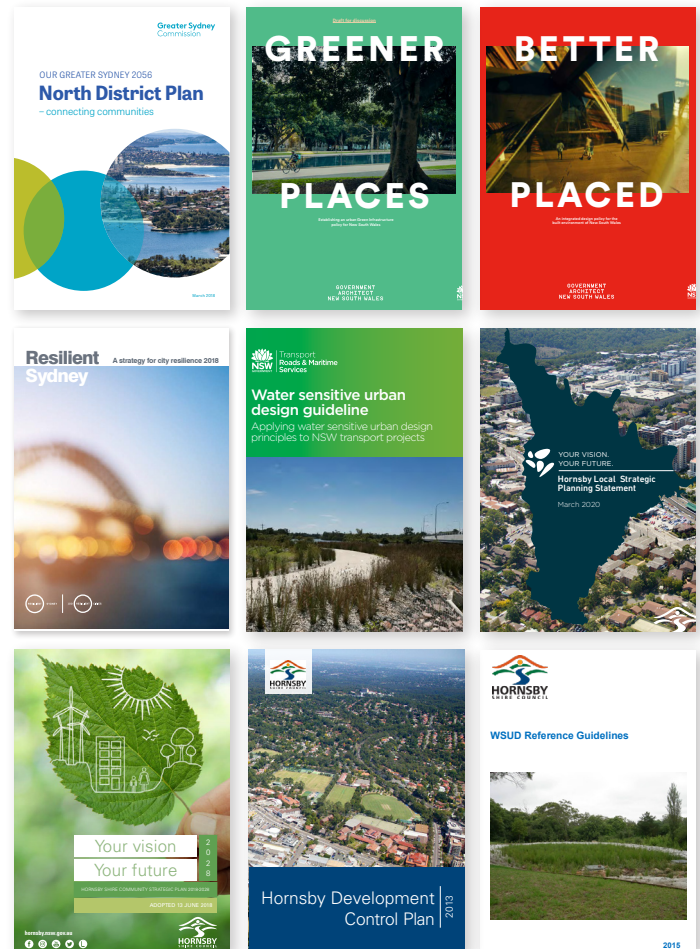


Figure A.7 Reference documents

A.6 The Guidelines in Context

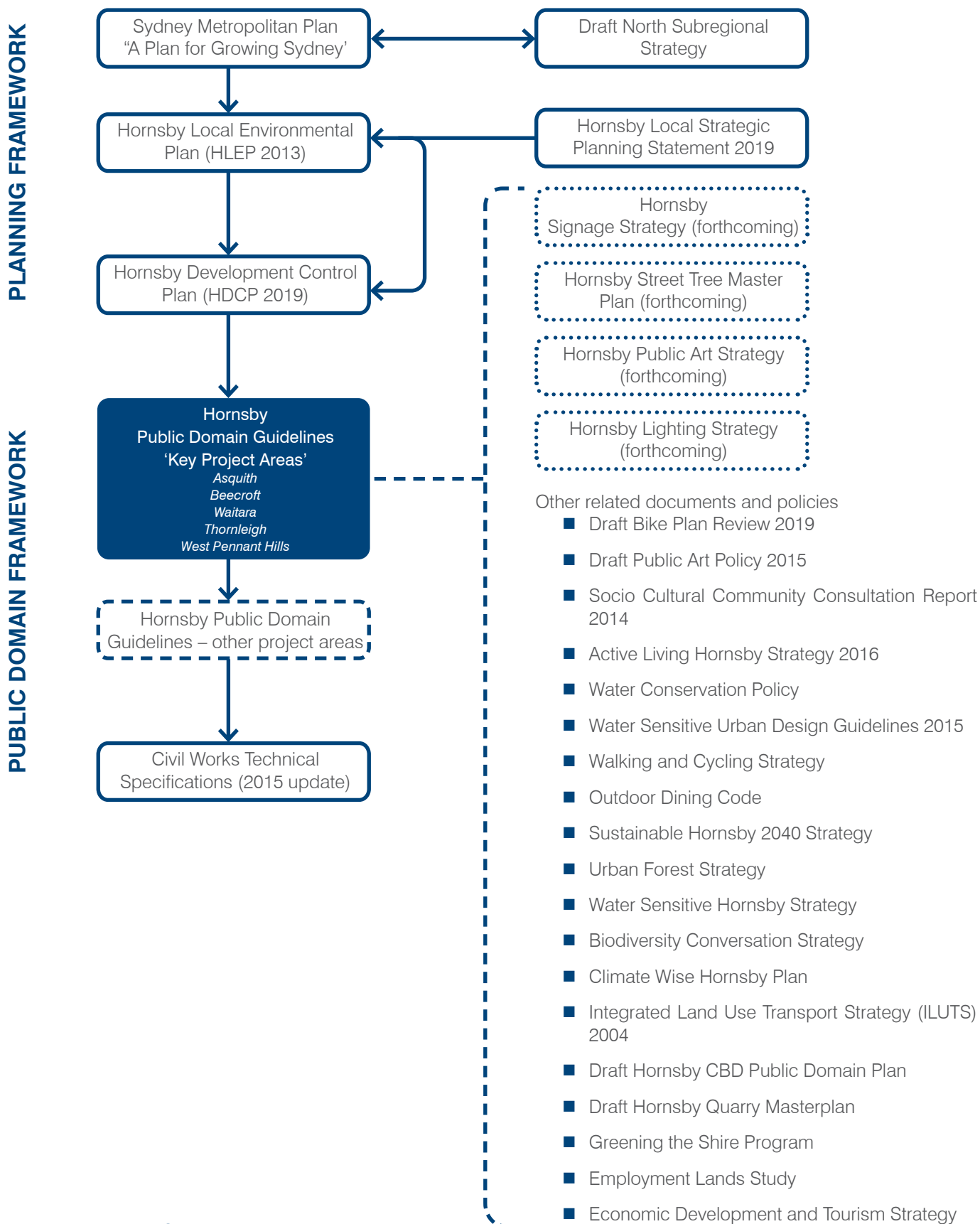


Figure A.8 Document Context Diagram

A.7 Approvals Process

Public Domain Guidelines and Development Control Plan

These Public Domain Guidelines have been formulated as an outcome of the planning policies and controls as noted in Sections A.5 and A.6 whereby they aim to provide a further layer of detail on how to realise the policies in future developments within the public domain.

These guidelines, along with all documents listed, are crucial in aiding Council in providing advice on proposed developments, as well as conducting Development Assessments and providing approvals.

Applications for new development in the study areas to which this guide applies will require an Alignments Plan demonstrating levels, gradients and alignments of new and altered buildings and a Public Domain Plan to be prepared and submitted for approval, reflecting the public domain elements as outlined in the Public Domain Guidelines.

Preliminary advice from Council in relation to requirements for public domain works may be obtained through a DA Pre-Lodgement Application.

Once a DA is lodged, Council will assess the plans and documentation provided to ensure consistency with the Public Domain Guidelines. If the development is approved the development consent will include conditions of consent and there may be inspections throughout construction process to ensure the development occurs in accordance with the Public Domain Guidelines and approved plans.

A.8 Glossary of Terms

Alignment Plan	Plans demonstrating the levels, alignments and gradients of introduced or altered buildings entries, driveways and footpaths in the public domain associated with development
AS1428.1	Australian Standard 1428.1: Design for Access and Mobility Series
Blue Infrastructure	Refers to hydrological (water) systems and, in-particular, the ways urban environments can capture, store, clean, divert and use for irrigation
Council	Hornsby Shire Council
CPTED (Crime Prevention Through Environmental Design)	The design of the environment to discourage criminal activity by ensuring there is more chance for offenders to be seen, challenged or caught
DCP	Hornsby Shire Council's Development Control Plan
Deep Soil	Is an area of natural ground with a relatively natural soil profile. It excludes areas where there is a structure underneath or above, and non-permeable paved areas. However, it can include areas of porous paving and essential accessible paths, up to 1.2m wide, providing there is deep soil area to one side that is level with the footpath or paving
Green Infrastructure	Relates to flora (trees and plants) and open spaces. These include parks, street trees and planting, bushland, rooftop gardens, private back yards, schools
Key Project	Key projects are defined public domain upgrades with clear design controls and outcomes. They are located within Study Areas
Public Domain	Refers to areas of the Shire in which access to and use of is available for any member of the public. Public domain typically includes parks, plazas, footpaths and streets. Public domain elements of the Shire are typically controlled by Hornsby Shire council
Sight Line	Is a line extending from an observer's eye to a viewed object
Study Area	Study areas refer to a defined zone within Hornsby Shire Council local suburbs and determines the extent to which this document applies
TfNSW	Transport for New South Wales
Wayfinding	A term used to describe the ease of navigating through a the public domain with the aim of reaching a pre-selected destination
WSUD	Water Sensitive Urban Design

PART B – Approach

B.1 Pillars and Principles

Defining Pillars and Principles

A set of pillars and principles have been established to help provide an overarching guide for the design and decision making processes for the public domain.

These pillars set out the vision for Hornsby Shire moving forward and have been developed through reviewing existing policies and principles, site investigations, site analysis, community consultation and workshops with various consultants.

Each of these principles are explained and expanded upon in the following pages.



1. Biodiversity

'Stitching the green and blue' by utilising biodiversity to stitch together the public domain remnant vegetation and town centres*.



2. Connectivity

'Linking the Centres' to unite with each other and provide connections for users.



3. Programming and Use

'Activating the Centres' to ensure safer and lively public spaces



4. Character and Aesthetics

'Embracing identity' of the Bushland Shire and individual centres.

*Note: 'Blue' infrastructure refers to hydrological (water) systems and, in-particular, the ways urban environments can capture, store, clean, divert and use stormwater irrigation. These systems are often interconnected with much larger catchment systems (creeks, rivers, lakes etc.)

'Green' infrastructure relates to flora (trees and plants) and open spaces. These include parks, street trees and planting, bushland, rooftop gardens, private back yards, schools. Like blue infrastructure, these pockets are often interconnected with much larger systems like National Parks.

These systems are important parts of our natural environment which support native fauna (animals) and biodiversity, which contribute to a great place to live.



Pillar 1: Biodiversity – *Stitching the Green and Blue* key aims include:

- Build on Hornsby's existing and cherished green and blue assets recognising the interrelationship and co-dependency of green and blue infrastructure
- Enhance the quality and provision of green and blue infrastructure, including bushland and parks
- Enhance the quality and use of blue infrastructure including, rivers and wetlands and their integration with green infrastructure
- Develop the 'green and blue grid' and 'green and blue corridors' to enable connections between places for both people and wildlife
- Infill gaps in vegetation to create new green pockets and ensure a connected green system for both the public and private domain
- Maintain and enhance existing biodiversity through the restoration of disturbed ecosystems to enhance ecological value and function and to create new ecosystems
- Use native plants to provide food and shelter for fauna while contributing to the established local flora communities
- Integrate and enhance the surrounding bushland into the urban and suburban areas to maintain and strengthen Hornsby's "Bushland Shire" character
- Create beautiful places that will continue to evolve through time and for future generations

Note: Refer Council's Biodiversity Conservation Strategy for further information



Image B.1: Hannah Street, Beecroft



Pillar 2: Connectivity – *Linking the Centres* key aims include:

- Create new, and enhance existing connections to and from as well as within and around centres
- Create continuous, safe and legible pedestrian and cycle connections between commercial centres and public transport nodes, as well as within the suburban finer grain
- Enhance signage and way-finding to effectively direct people to, from and within connections and linkages
- Prioritise pedestrian safety by ensuring linkages are well lit and defined, including increasing safe crossings and connections across and over streets, roads and highways
- Create where needed, a hierarchy of movement corridors, prioritised as follows:
 1. Pedestrian
 2. Cycle
 3. Public and Shared Transport
 4. Private Vehicles
- Develop cycleway infrastructure, networks and connections
- Promote active transport to support community health and well-being, as well as reducing traffic congestion & pollution
- Design compliant accessible connections that are comfortable and well maintained



Image B.2: Hunter Street, Hornsby



Pillar 3: Programming and Use – *Activating the Centres* key aims include:

- Program building and public space use to promote continuing community events
- Create spaces in town centres that allow for un-programmed activities, such as everyday community interaction
- Create inviting and safe places and spaces
- Create beautiful spaces and ambient environments
- Ensure that public spaces and amenities are easily maintained
- Enhance and create new amenities to support activation such as toilets, furniture and canopy shade
- Implement signage and way-finding to make public spaces easy to navigate



Pillar 4: Character and Aesthetics – *Embracing identity* key aims include:

- Embrace and build upon the positive aspects of each area's identity rather than impose an identity
- Strengthen expressions of the core identity of the Bushland Shire
- Utilise signage and furniture to express the Bushland Shire identity
- Strengthen a sense of community by creating community hubs and spaces as opportunities for the local community to meet and socialise
- Identify, enhance and create landmarks to establish a sense of place
- Embrace and express the identity and culture of Hornsby through public art



Image B.4: Rouse Hill Town Centre



Image B.3: Peats Ferry Road, Hornsby

PART C – Street Design

C.1 Street Composition

Street Layout

This section looks at the different street typologies across the Shire and their spatial composition. It shows how the allocation of space within a road reserve can create good, accessible design that balances the needs of users with specific social and environmental considerations.

The key considerations for street layout are:

- Creating a safe, accessible and comfortable pedestrian space that promotes public life and vitality;
- Accommodating required paths of travel for all users including pedestrians, cyclists, public transport users and vehicles;
- Providing a clear and direct composition that reinforces the major design elements and reinforces street hierarchy;
- Including components which can be located consistently throughout the public domain to reflect the overall unique character including furniture and lighting;
- Providing additional footpath space for public seating and outdoor dining in streets with high activity and food and beverage uses;
- Providing green and blue infrastructure maximising the provision of street trees and planting to mitigate urban heat island effects, promote connectivity with the natural environment increase biodiversity, cleanse stormwater mitigate flooding and improve aesthetics of the urban environment.

Many competing factors need to be considered when allocating space, including:

- Available pedestrian and vehicle movement through space;
- Anticipated pedestrian volumes;
- Expected traffic volumes and speeds;
- Safety and accessibility for all users;
- Transportation routes and locations of shelters and transfer points;
- The location and layout of existing and proposed underground services e.g. stormwater, electrical, gas and communications;
- Future projections for cycleway users;
- Anticipated shared pedestrian and cycle zones;
- Necessary street infrastructure; and,
- Soil zones for tree planting

All these factors need to be considered when creating a street layout and making space allocation decisions. However, each street will vary depending on its associated functional requirements and will require individual assessment and approval by the Council.

A typical street can be broken down into:

1. Footpath Zone;
2. Carriageway;
3. Building Zone;
4. Overhead Zone;
5. Underground Zone.

Each zone has been allocated a specific function and associated recommended widths.

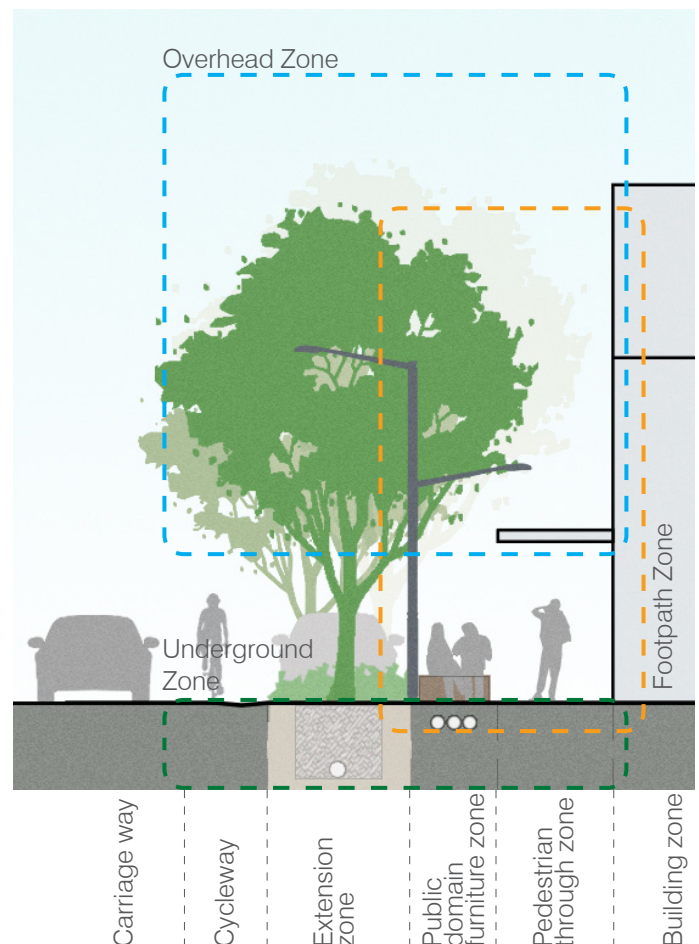


Figure C.1 Typical Street Layout Section

1. The Footpath Zone

The footpath zone extends from the property boundary to the road and can further be broken down into the Pedestrian Through Zone and a Public Domain Furniture Zone.

Pedestrian Through Zone

This zone provides for accessible pedestrian travel and must be clear of obstacles, including street furniture, street trees, outdoor seating and driveway ramping. It should be well lit and meet accessibility standards. To provide the minimum required widths for the Pedestrian Through Zone, the narrowing of parking lanes may be required to accommodate the expanded through zone.

The area provides room for pedestrian movement at building entries and enough space for people to slow down and engage with their immediate environment and each other.

When reconstructing the Pedestrian Zone and relocating utilities, all access points must be located outside of the Pedestrian Zone where possible.

Recommended width:

- All streets require a minimum 1.2m Pedestrian Through Zone
- Provide a minimum of 1.8m to allow for two pairs of people to pass each other comfortably, or a wheelchair and a person to pass each other
- Where high volumes of pedestrians are expected, provide 3m or wider

Public Domain Furniture Zone

The public domain furniture zone acts as a buffer between the street traffic and providing an area for pedestrian respite. Consolidate street trees, landscaping, street lights, site furnishings, traffic and parking poles and equipment, utility poles in this zone. This area also has the potential for outdoor dining.

Recommended width:

- Elements in this zone should be set back a minimum of 600mm from the kerb face. An absolute minimum width of this zone for placement of outdoor seating is 1.2m
- Note: Widening footpaths may require significant changes to the drainage infrastructure as well as the relocation of utilities and must be reviewed on an individual project basis
- Where possible, the widening of footpaths may be achieved by narrowing and/or removing vehicular travel lanes or parking lanes, or establishing setbacks as part of redevelopments
- Council recommends a more comfortable width of at least 1.5m
- If the footpath does not meet the minimum 1.5m in areas of high pedestrian activity then a shared path must be considered
- Where space is restricted, 1.2m is the absolute minimum, with frequent 1.8m wide passing opportunities for people in wheelchairs

STREET TYPES		PUBLIC DOMAIN FURNITURE ZONE	PEDESTRIAN THROUGH ZONE
Arterial Roads		2m	2.5m
Collector Roads Type A (bus route)	(low-mid activity streets)	1.5m	2.5m
Collector Roads Type B	(low-mid activity streets)	1.5m	3.0m
Local Street Type A	(mid-high activity streets)	1.5m	2.0m
Local Street Type B	(low activity streets)	2.3m	1.5
Village Streets	(high activity streets)	2.5m	3.5m
Shared Zones		2.0m	2.8m
Laneways		Shared Zone	Shared Zone 1.5

Note:
Widths are desired Council dimensions for providing better pedestrian comfort and amenity and full inclusion for street trees, verge landscaping and public domain furniture.

*Refer Guide to Road Design Part 6A, Paths for Walking and Cycling.

Table C.1 Public Domain Zone Widths

2. The Carriageway

The carriageway refers to the area used by various forms of movement including motor vehicles, public transport and cyclists. This zone can be two-way, one-way, or become part of a shared environment. The aim for motor vehicle movement is to provide the minimum possible space to support through movement while enticing safe traffic speeds. On-site private parking and loading zones need to be considered in areas for local business, retail and residential.

Recommended width:

Carriageway widths should be appropriate to the particular context and use of the street.

Key factors to take into consideration include:

- The volumes of vehicular traffic and pedestrian activity;
- Traffic composition;
- The demarcation, if any between carriageway and footpath (kerb, street trees or planting and public domain furniture);
- Whether parking will be in the carriageway. If so, consider the distribution, arrangement, frequency of occupation, and the likely level of parking enforcement;
- The design speed;
- The streets curvature is to accommodate the swept path;
- Any intention to include one-way streets, or stretches of single lane in each direction within two-way streets;
- Local linkages and movement patterns; and,
- Allowing for footpath extensions to accommodate outdoor dining areas, landscape treatments and street furniture where appropriate.

Refer to Figure C.2 for preferred vehicle lane and cycleway widths.

In streets with low traffic, carriageways may be narrowed as a traffic calming function. Presence of heavy vehicles is a consideration when using minimum carriageway widths. Wider lane widths are appropriate in locations with high volumes of heavy vehicles. A collaborative judgement between Planners, Designers, and Engineers is necessary to make final determinations regarding lane widths.

Cycleway

A cycleway refers to the area dedicated for cyclists to provide a safe on-street environment for the movement of cyclists. A dedicated cycleway is only considered for streets that are designated for such treatments.

Extension Zone

The extension zone refers to the specific condition where the footpath extends into the parking lane through either permanent kerb extensions or removable bollards, flexible use of parking lanes, bicycle parking, tree planting and WSUD. The extension zone may accommodate landscape treatments, seating, street furniture, play and outdoor dining to free up the footpath for pedestrian through travel.

Where parallel parking is included in this zone, there needs to be an allowance of 1.2m for door swing. The allowance is a minimum of 600mm between the Extension Zone and the kerb face, and 600mm from the kerb face to the Public Domain Furniture Zone.

3. The Building Zone

The building zone forms a transition from public to private. The design of the interface directly influences the public domain experience and requires careful consideration to integrate with the footpath design and form.

In some places buildings are aligned with a zero setback from the property boundary and in other places buildings are set back some distance to provide a landscaped or paved place between the footpath zone and the buildings. Where identified this setback area can perform a number of functions that serve to enhance the public realm that provides a key opportunity in public domain planning.

Consider the arrangement of new and existing utilities, and blue infrastructure elements such as WSUD devices and drainage.

Figure C.1 is an indicative section illustrating the relationship between these zones and their contribution to the quality of the overall public domain.

TfNSW Classification	Primary Traffic lane	Additional Traffic Lanes	Parking	Carriageway Width	Road Reserve Width
ARTERIAL ROADS					
Includes bus/heavy vehicle routes (assumes multiple lanes of traffic in each direction)	3.5m	3.0m	3.0m (existing) 2.8m (proposed)**	13.0m	20-30m
COLLECTOR ROADS					
Type A – One lane of traffic in each direction	3.5m (existing) 3.2m (proposed)	None	3.0m (existing) 2.8m (proposed)**	13.0m (existing) 12.0m (proposed)	20.0m
Type B – One lane of traffic in each direction	3.0m (existing)	None	3.0m (existing) 2.5m (proposed)**	12.0m (existing) 11.0m (proposed)	20.0m
LOCAL STREETS					
Type A & B – One lane of traffic in each direction	3.0m (existing)	None	2.1m	9.0m	16.0m
Single lane, bi-directional streets and lanes (passing bays required in parking zones)	3.2m	None	2.1m ^	Varies	Varies
Single lane, one-way streets and lanes (or adjacent to median)	3.0m	None	2.1m ^	Varies	Varies
VILLAGE STREETS	3.5m	None	3.0m	7.0m	20.0m
SHARED ZONE	2.8m (min.) - 3.2m (buses)	None	Varies	Varies	Varies

Table C.2 Preferred Maximum Vehicle Lane Widths

	Minimum Lane Width	Minimum Kerb Width
SEPARATED BI-DIRECTIONAL CYCLEWAY	2.5m	0.4m
ON-STREET PAINTED CYCLE LANE	1.4m*	n/a
SHARED PATH (cycle and pedestrian)	2.5m	n/a

Table C.3 Preferred Minimum Cycleway Widths

* For mixed traffic in low speed environments, the painted on-street cycle lane should accommodate suitable width to allow for deflection of a parked car door swing.

** Proposed narrowing of parking lane to accommodate expanded Pedestrian Through Zone.

^ Decisions regarding parking lane width when adjacent to bike lanes should consider parking turnover rates and vehicle types.

3. The Overhead Zone

The overhead zone refers to the space above the public domain where various elements compete for space including, tree canopies, building facade and awnings, overhead power lines and lighting. This area plays an important role in the aesthetics of the public domain with local tree species providing shade, adjacent to architectural façades enhancing the streetscape character. Urban heat, air quality, water retention and management systems are also located in this important but often overlooked zone.

As space is limited in this zone, relocating existing elements such as overhead power lines underground should be explored. This zone should be considered throughout the streetscape design.

Key factors to take into consideration include:

- Explore relocation of overhead power lines underground;
- Clearance between elements such as tree branches and foliage to vehicles;
- Tree canopy density, dimensions, and proximity to adjacent buildings or services;
- Location and type of lighting and shadow effect from adjacent elements;
- Extent and articulation of building awnings and façades.

5. The Underground Zone

One of the most restricted zones with a high number of elements competing for a limited amount of space is the underground zone. This zone may contain existing services which may impact the location and inclusion of surface level elements.

Key factors to take into consideration include:

- Existing services which may be managed by other asset owners;
- New services such as overhead powerlines which may increase competition for space;
- Existing geology and soils which may impact WSUD design and plant species selection
- Existing location of manholes and pits and their location in the footpath or cycleways

Street Typology

Street types are generally defined by their major uses and requirements for pedestrian, cycle, transit and vehicle movement. The following street types can be found in the character areas outlined in Part D – Materials Palette and Application and demonstrated in the key projects in Part E – Key Projects:

1. Arterial and Sub-arterial Roads
2. Collector Roads Type A & B
3. Village Streets
4. Local Streets Type A & B
5. Laneways
6. Shared Zones

The following sections outline preferred typical street layouts, showing zones, footpath widths, carriageway widths and arrangement of urban elements for each of the designated street types.

These street designs require adjustments to the existing street arrangement and kerb alignment to be realised. These street types are to be implemented when the Council proposes significant changes to existing streets or in association with major redevelopment on adjacent properties.

Note: Refer to Hornsby DCP for classified and un-classified roads within Hornsby Shire. For further information on roads classification, refer Austroads 'Responsibilities for Local Roads'.

Arterial and Sub-arterial Roads

Arterial and sub-arterial roads are main or major routes through an area that are characterised by high volume vehicular traffic, increased speeds, signalised intersections and wider carriageways. Arterial roads are generally classified roads, and sub-arterial roads can be either classified or unclassified.

Arterial and sub-arterial Roads are State Owned roads, differentiated from other General Street types by having the highest volume of vehicular traffic. The vehicle and pedestrian zones are separated, and the street character and physical appearance vary due to land use context.

The inclusion of shared pedestrian/ cycle footpaths is only relevant in locations proposed by the Council's 'Walking and Cycle Strategy'.

Design Objectives:

- Accommodate relatively high traffic volumes, speeds and public transport, while providing for adequate and safe movement functions for pedestrians and cyclists.
- Promote walkability on street edge footpaths and provide the opportunity for street furniture and outdoor dining where there are a mix of retail, commercial and residential uses.
- Provide cycleways consistent with the Draft Bike Plan Review 2015.

Refer to Street Layout Table – Figure C.1, Figure C.2 and Table C.3 – for recommended footpath and carriageway widths.



Image C.1: Example of Arterial Road Cleveland Street, Redfern



Figure C.2 Arterial and sub-arterial road section and plan

Collector Roads Type A & B

Collector Roads are the primary circulation and access routes through a neighbourhood. They serve as the secondary vehicular through routes/ linkages, connecting the sub arterial roads to the local system in developed areas. Type A collector roads carry more traffic, and/ or form part of a bus route.

The vehicle and pedestrian zones are separated and the street character and physical appearance vary due to land use context.

On-road cycleways may sometimes differentiate a Collector Road. An on-road cycleway is only considered for streets that are designated as such in the Draft Bike Plan Review 2015.

Design Objectives:

- Support a high level of vehicular traffic and public transport, while providing for adequate and safe movement functions for pedestrians and cyclists.
- Promote walkability on street edge footpaths and provide an opportunity for street furniture and outdoor dining where there are a mix of retail, commercial and residential uses.
- Provide cycleways where consistent with the Draft Bike Plan Review 2015.
- Provide visual interest with street landscaping in the Public Domain Furniture Zone, the architectural detail of the residential entryways and building frontages.
- Enhance lower ground level landscaping through under-storey planting and water sensitive urban design, e.g. bioswales and rain gardens.
- Enhance green and blue infrastructure to increase street tree canopy to reduce the heat island effect and supplement biodiversity.

Refer to Street Layout Table – Figure C.1, Figure C.2 and Table C.3 – for recommended footpath and carriageway widths.



Image C.2: Example of a collector road, The Comenarra Parkway



Figure C.3 Collector roads Type A and B including cycleway (medium density residential)

Local Streets Type A (mid-high activity street)

Type A Local Streets, similar to Village Main Streets, support a balanced movement function between traffic and pedestrians. They serve as the tertiary vehicular and primary pedestrian/cycle through routes/ linkages, providing improved access for the medium density residential mixed-use areas with local retail and commercial uses.

When Type A Local streets may are nominated as a cycle route, consider a marked on-street cycleway or shareway. Refer to the Draft Bike Plan Review 2015.

Design Objectives:

- Support a balance of function between pedestrian, cyclists, public transport and vehicular movement.
- Promote walkability on street edge footpaths to provide for safe and legible connections from public transport to residential dwellings.
- Provide cycleways where consistent with the Draft Bike Plan Review 2015;
- Provide visual interest with street landscaping in the Public Domain Furniture Zone, the architectural detail of the residential entryways and building frontages.
- Enhance lower ground level landscaping through under-storey planting and water sensitive urban design, e.g. bioswales and rain gardens.
- Provide planting to soften the streetscape, informal plaza spaces and building entries.
- Enhance green and blue infrastructure to increase street tree canopy to reduce the heat island effect and supplement biodiversity.

Refer to Street Layout Table – Figure C.1, Figure C.2 and Table C.3 – for recommended footpath and carriageway widths.



Image C.3: Example of a local street type A, George Street, Redfern

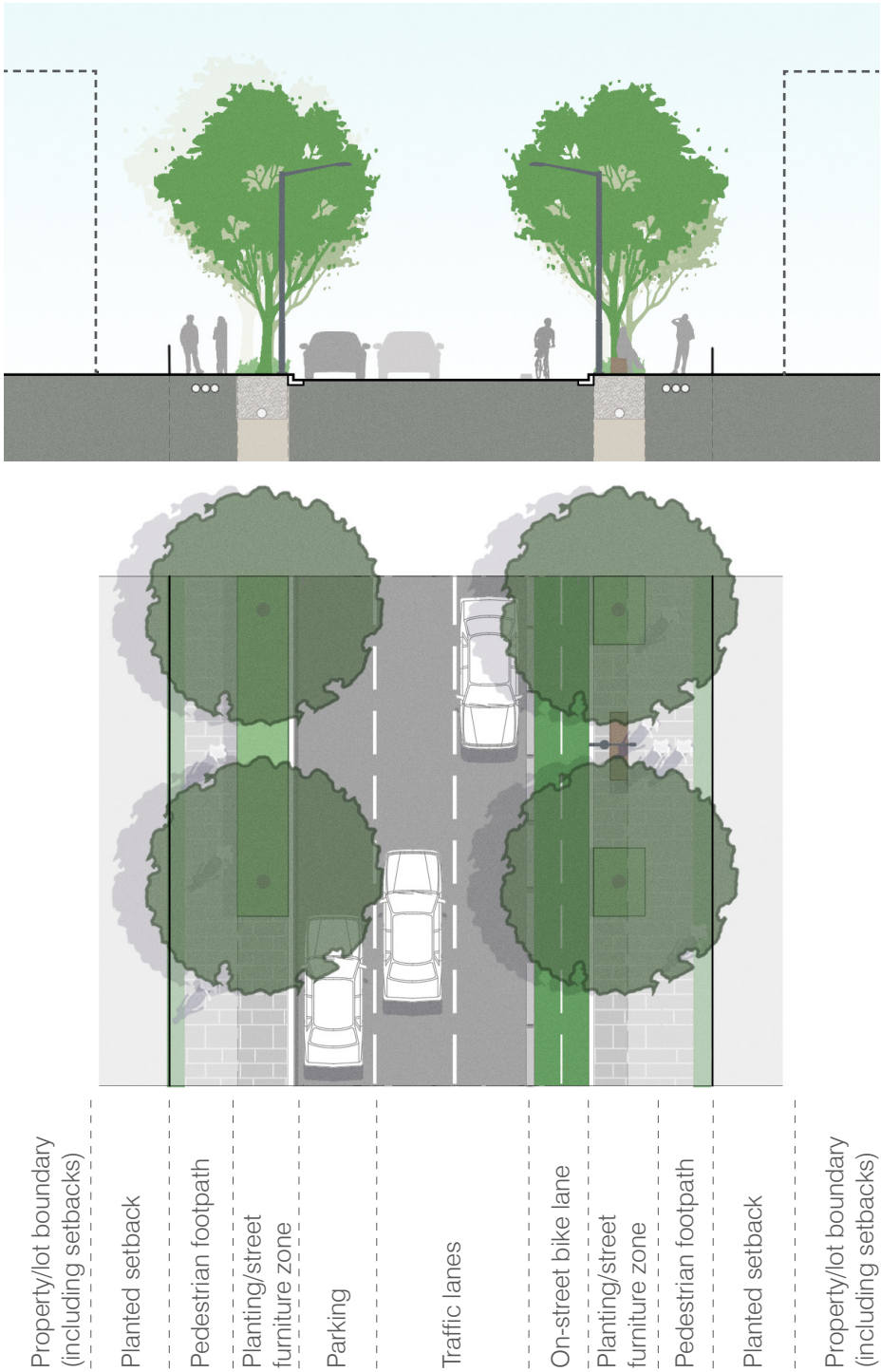


Figure C.4 Local streets type A (mid-high activity streets)

Local Streets Type B (low-mid activity street)

Type B Local Streets support a balanced movement function between traffic and pedestrians. Traffic volumes are generally lower than a Type A Local street and primarily provide access to low-density residential areas.

Visual interest is provided by street landscaping within the Public Domain Furniture Zone. Lower ground-level landscaping can be enhanced through under-storey planting and water sensitive urban design e.g. bioswales and rain gardens.

When Type B Local streets are nominated to include a cycle route, a marked on-street cycleway may be considered. Refer to the Draft Bike Plan Review 2015.

Design Objectives:

- Support a balance of function between pedestrian, cyclists and vehicular movement.
- Promote walkability on street edge footpaths to provide for safe and legible connections from public transport to residential dwellings.
- Provide cycleways where consistent with the Draft Bike Plan Review 2019
- Provide visual interest with street landscaping in the Public Domain Furniture Zone, the architectural detail of the residential entryways and building frontages.
- Enhance lower ground level landscaping through under-storey planting and water sensitive urban design, e.g. bioswales and rain gardens.
- Provide planting to soften the streetscape, informal plaza spaces and building entries.

Refer to Street Layout Table – Figure C.1, Figure C.2 and Table C.3 – for recommended footpath and carriageway widths.



Image C.4: Example of a local street Type B, Thornleigh Street, Thornleigh

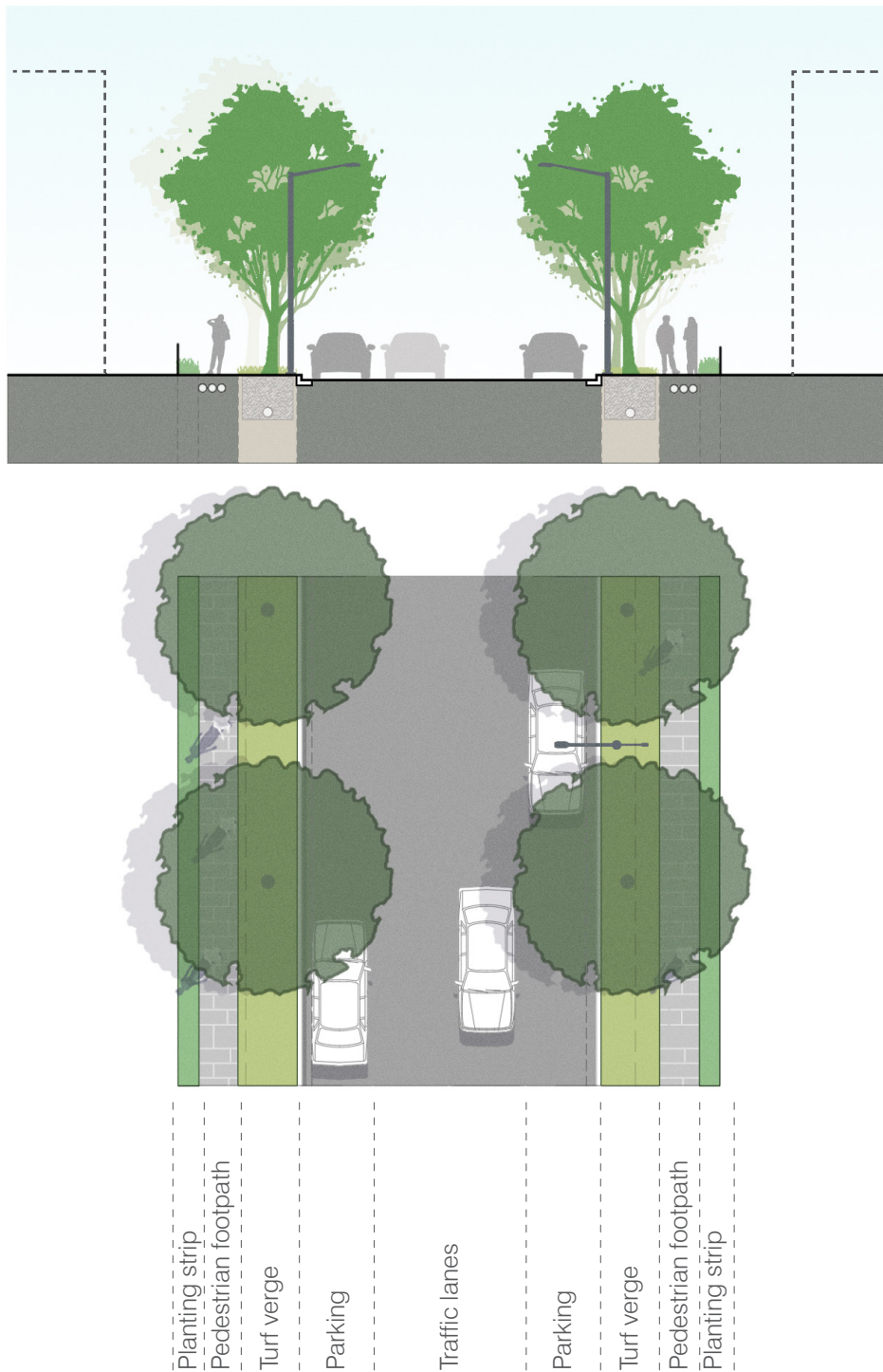


Figure C.5 Local streets Type B (low-mid activity streets)

Village Streets

Village Streets utilise extensive traffic calming measures with reduced speed limit signage to discourage vehicular through-traffic and encourage slower vehicular speeds. These measures allow for increased green landscape opportunities to create a comfortable environment for pedestrian and bicycle movement.

High levels of pedestrians characterise Village Streets, requiring the provision of a wide Pedestrian Zone. The vehicle and pedestrian zones are separated, and the street character and physical appearance respond to varying land use with a high volume of active retail and commercial frontages.

Widened footpath areas into the Extension Zone can be utilised as an extended Public Domain Furniture Zone, including removable cafe tables and chairs, permanent seating, the opportunity for bicycle parking and planted areas creating meeting places for locals.

Design Objectives:

- Support a balance of function between pedestrian, cyclists, public transport and vehicular movement.
- Promote walkability through the widening of footpath zones and provide the opportunity for street furniture, planting and outdoor dining.
- Inclusion for traffic-calming measures and reduced speed limits to 40km/hr.
- Promote through traffic to bypass village streets in order to reduce congestion and prioritise pedestrian activity.

Refer to Street Layout Table – Figure C.1, Figure C.2 and Table C.3 – for recommended footpath and carriageway widths.



Image C.5: Example of a village street, Rouse Hill Town Centre



Figure C.6 Village street

Laneways

Laneways are small scale streets that typically carry low numbers of vehicles and are mostly for local access only. Laneways can be used solely for service functions or they may have a partial, or full closure to vehicular traffic and/ or low-speed restrictions in a dedicated shared zone environment.

Typically Pedestrian Zones are narrower in pathway width between the property boundary and kerb-line, however, when upgrades occur, provision for a wider Pedestrian Zone should be considered where possible. Laneways can also serve as a valuable public space and should be designed with street furniture and lighting to maximise comfort and experience.

Design Objectives:

- Use seating, landscaping, and pedestrian lighting to create safe, attractive and usable spaces.

Refer to Street Layout Table – Figure C.1, Figure C.2 and Table C.3 – for recommended footpath and carriageway widths.

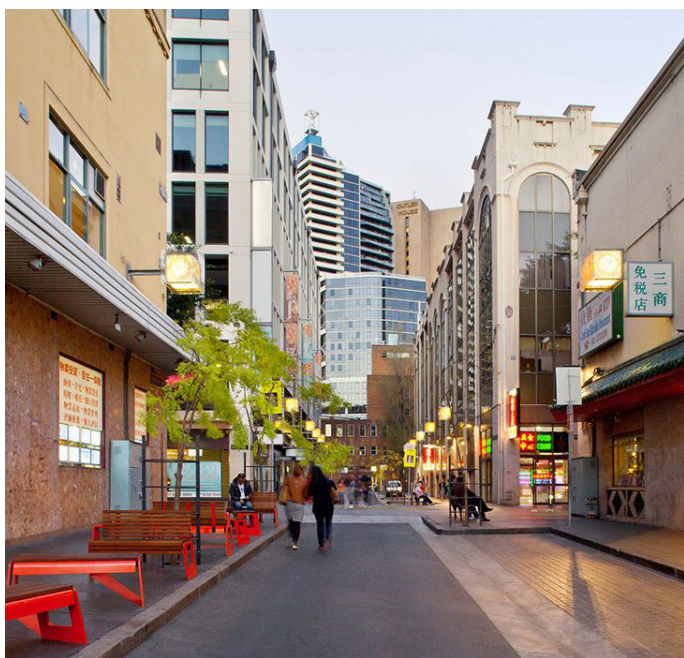


Image C.6: Example of a laneway, Factory Street, Haymarket

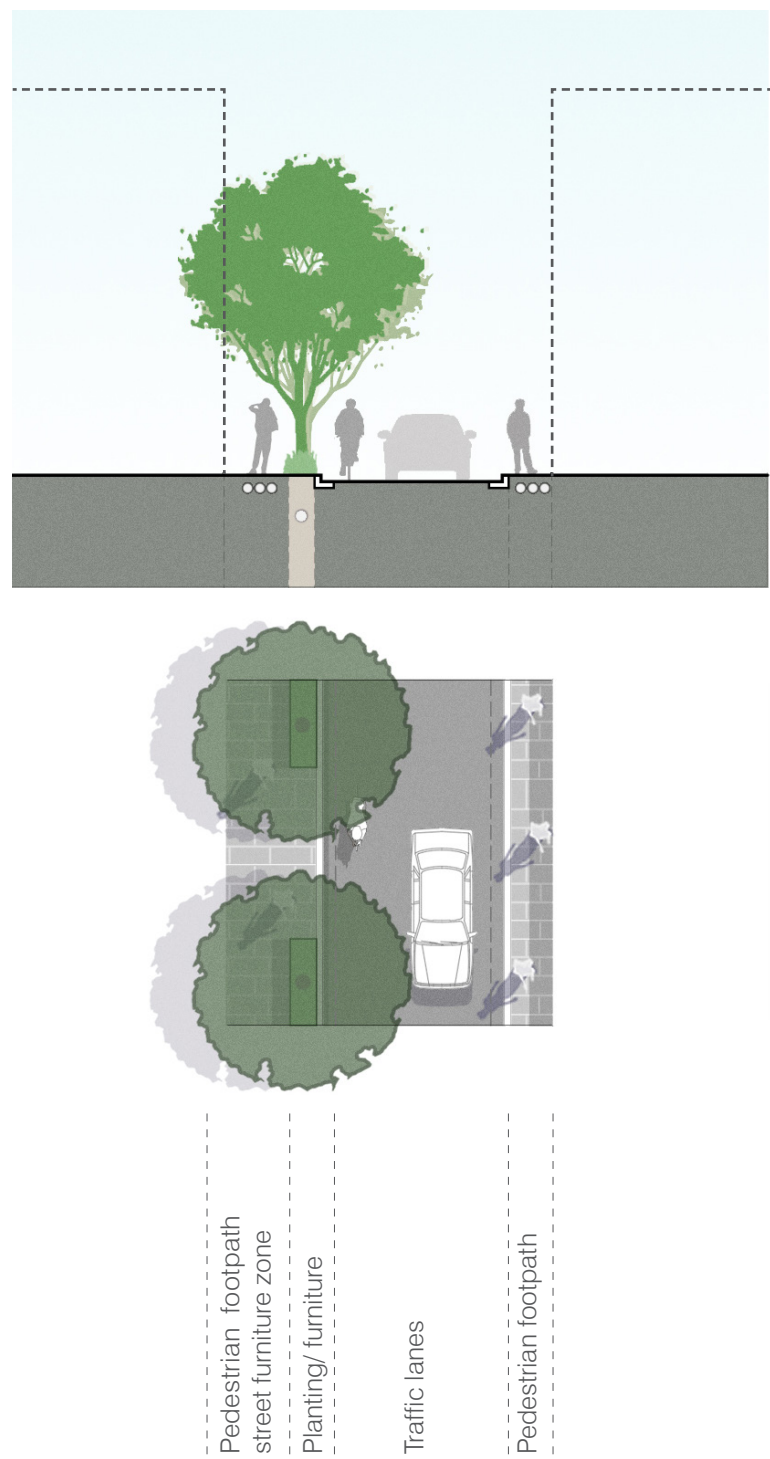


Figure C.7 Laneway

Shared Zones

A Shared Zone is a street shared safely by vehicles and pedestrians. It has a low-speed limit of 10km/hr and is design to support pedestrian and public life. The use of alternative paving materials, removal of raised kerbs, footpath extensions and thresholds, seating, landscape treatments, and pedestrian lighting together, differentiate shared zones from traditional vehicle priority streets. These differences remind drivers that they should proceed cautiously and slowly, refer TfNSW Technical Direction for shared zones.

Shared Zones are often kerb-less, providing a flush environment for pedestrians, cyclists, and low-speed vehicles to share the same space. Depending on the width of the street, public transport and local vehicular movements can still be accommodated within a high quality paved pedestrian/cycle zone. Special consideration needs to be given to the provision of adequate tactile indicators or other aid devices for visually impaired people including options for 'safe' spaces (normally along the building line) if a traditional kerb line is not provided.

Design Objectives:

- Promote safe primary access for pedestrians and cyclists in a shared environment.
- Provide inclusive access requirements as a priority to ensure safe navigation of the street.
- Coordinate street elements through movement zones to reduce clutter and improve legibility.



Image C.7: Example of a shared zone, Greville Street, Prahran

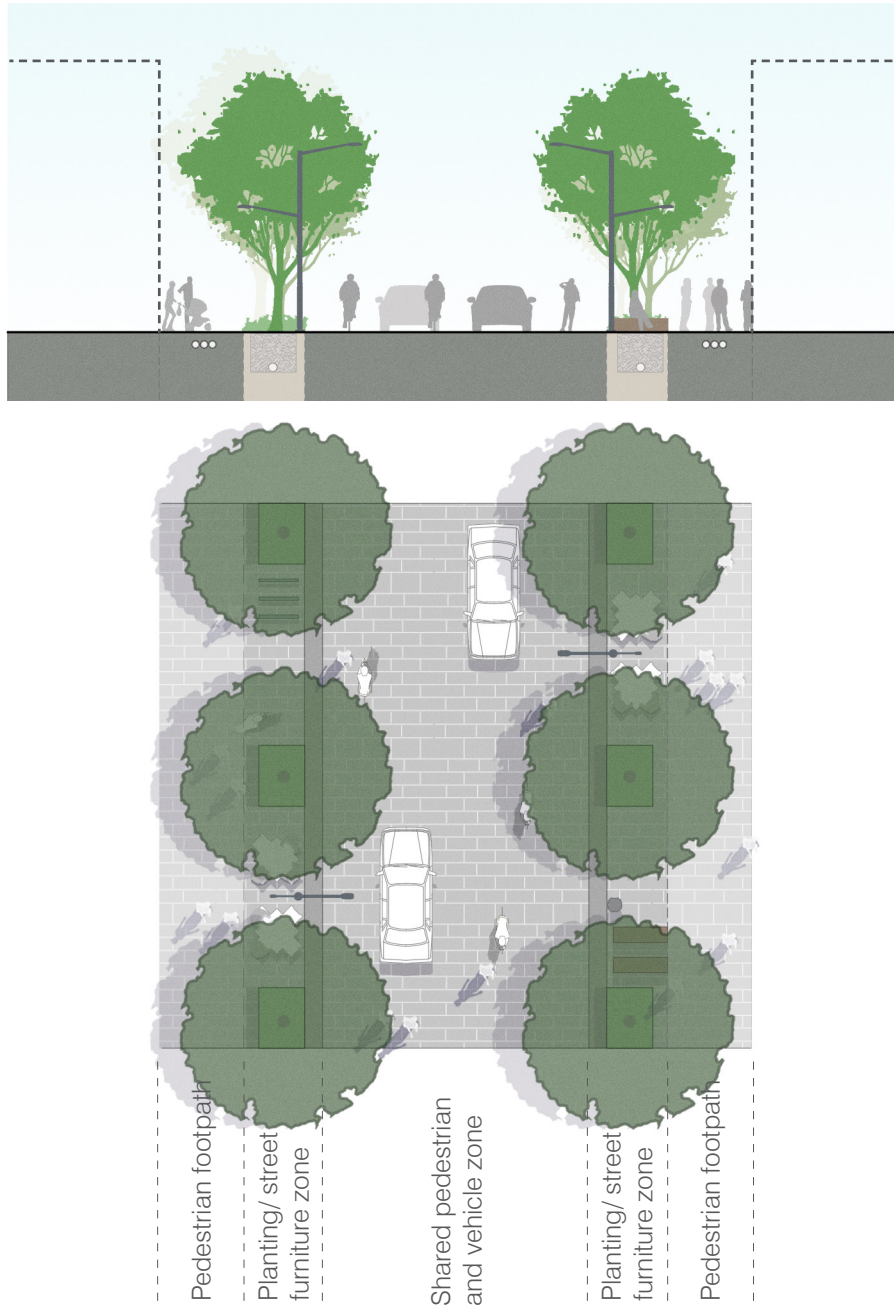


Figure C.8 Shared Zones

Footpath and Cycleway Typology

Footpaths and cycleways are generally defined by the adjacent road type, requirements for pedestrian and cycle movement and the space available. The following footpath and cycleway types can be found in the character areas outlined in Part D - Materials Palette and Application and demonstrated in the key projects in Part E – Key Projects:

1. Urban footpath
2. Shared footpath
3. Minor footpath
4. Separated cycleway

The following section outlines preferred typical footpath zone layouts as identified in the streetscape typologies.

To implement the following footpath and cycleway designs requires adjustments to the existing street arrangement and kerb alignment. These footpath types are to be implemented when the Council proposes changes to existing streets or in association with major redevelopment on adjacent properties.

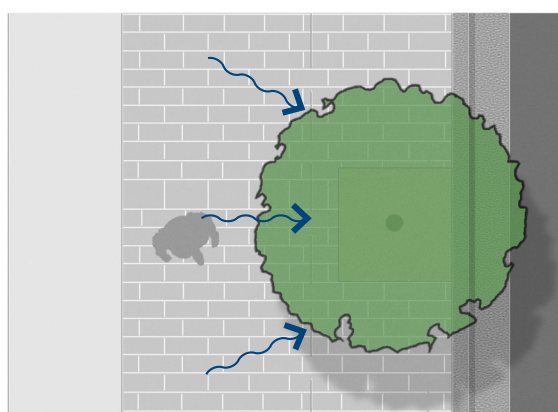
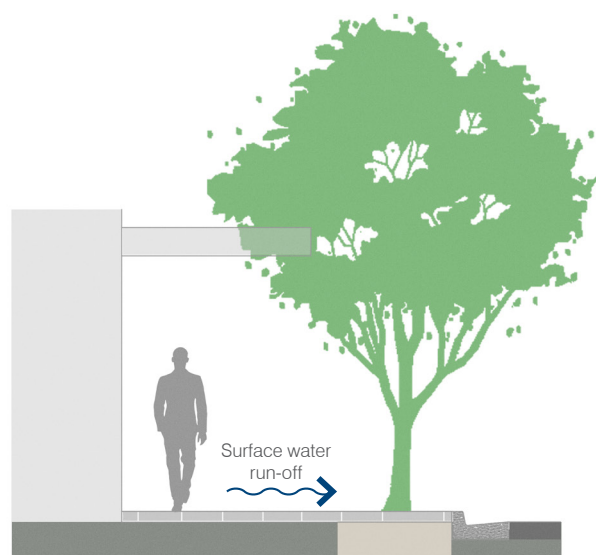
Urban Footpaths

Urban footpaths are typically located in town centres or sections of road or street which have higher volumes of pedestrian and/or cycle traffic. This is due to their proximity to public transport such as train stations or are adjacent to active commercial frontages.

Two types are available; those with street tree plantings sited to avoid any awnings with a solid grate tree pit (refer Figure C.9), and, those with similarly sited trees with understorey mass planting (refer Figure C.10). The decision to include mass planting should consider outdoor dining and spacings with street furniture.

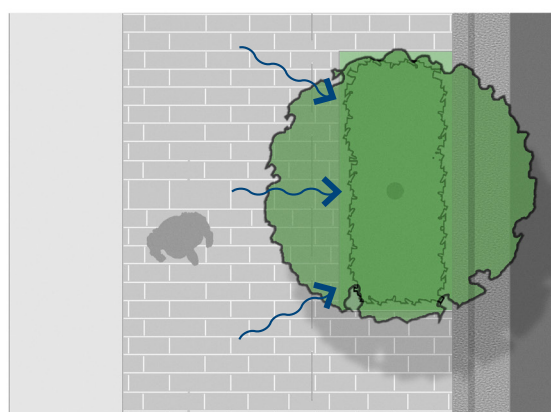
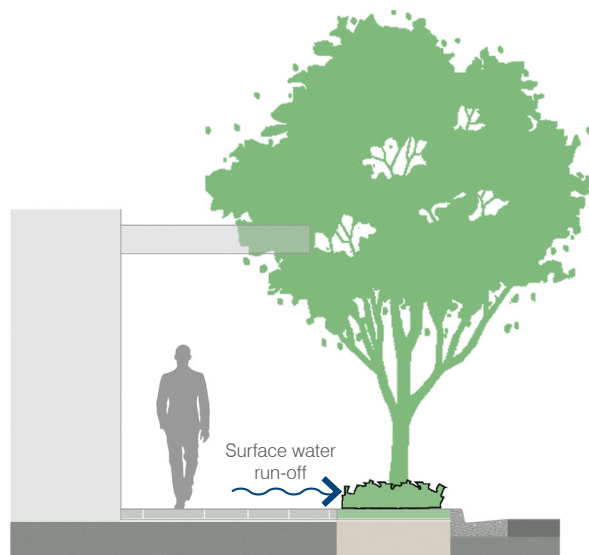
Design Objectives:

- Provide a wide and generous footpath to maximise pedestrian comfort and circulation.
- Improve street aesthetics with street trees and mass planting.
- Create a high-quality landmark quality footpath with high-quality materials and finishes.



Retail Unit paver footpath Tree in pit (min. 1m) Kerb/Road

Figure C.9 Fully paved footpath (back of kerb to boundary) with tree pit



Retail Unit paver footpath Tree in mass planting (min. 1m) Kerb/Road

Figure C.10 Fully paved footpath (back of kerb to boundary) with mass planting to base of tree

Shared Footpaths

Shared paths appear as widened footpaths with a minimum width of 2.5m. They provide enough space for both pedestrians and cyclists to travel in both directions on the street verge separated from vehicle traffic. Typically these occur where a separated cycle lane on the road may not be viable. Shared paths will typically include a grass verge with street trees from back of kerb to the footpath (refer Figure C.11) or a planted verge with street trees (refer Figure C.12).

Shared footpaths form part of the Hornsby Shire-wide cycle network and are a vital footpath type when implementing the network.

Design Objectives:

- Promote cycling in local areas through a connected, shared path and cycleway network.
- Provide a generous footpath to maximise pedestrian comfort and circulation and reduce conflict with cyclists.
- Improve street aesthetics with street trees and mass planting.

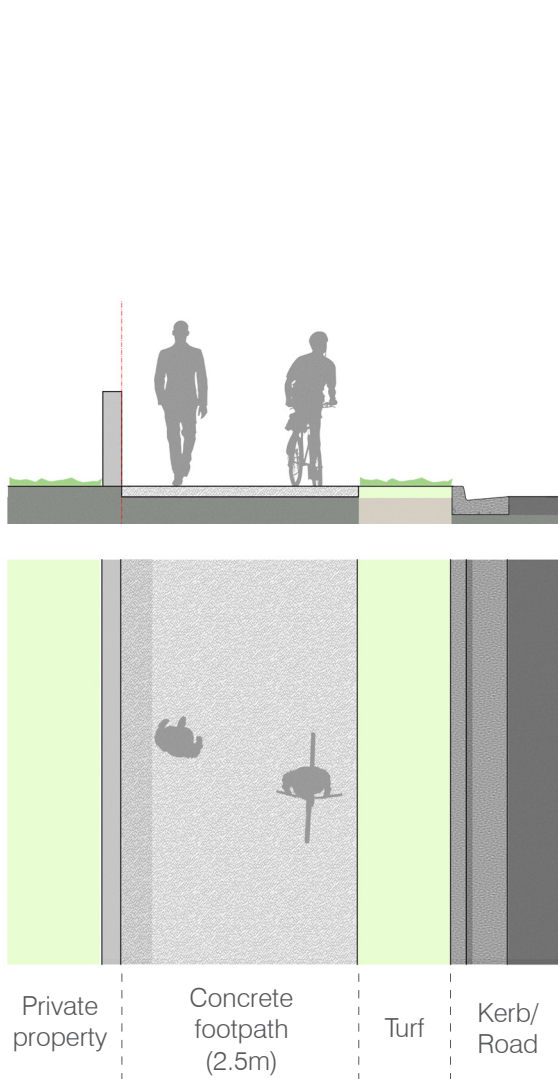


Figure C.11 Shared path with grass verge

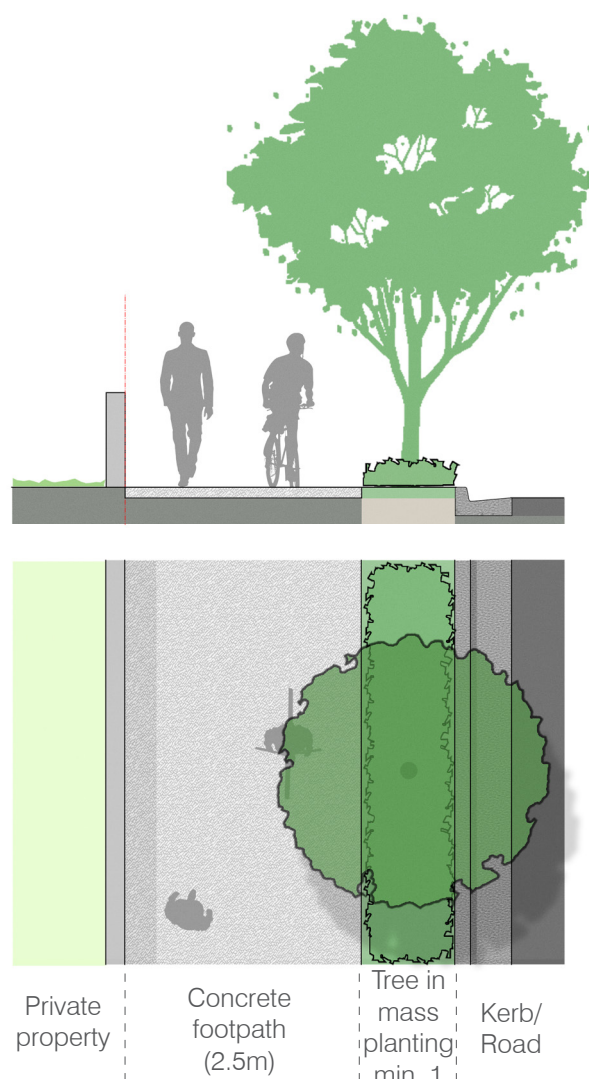


Figure C.12 Shared path with planted verge

Note: Where width allows, provide 600mm turf or planted edge between footpath and property boundary. Refer to Table C.3 for preferred minimum cycleway widths.

Minor Footpaths (Local Streets)

Minor footpaths are located on local streets which do not form part of the cycle network but form part of the Hornsby Shire's footpath network. The path is offset from both kerb and private boundary to allow for turf or mass planting against private properties with either street tree planting and turf (refer Figure C.13), or street tree planting and mass planting (refer Figure C.14).

Design Objectives:

- Provide clear, connected links of pedestrian links applying kerb ramps and tactiles to ensure the safety of all users.
- Clearly define connections with the shared path cycle network through signage which promote cooperation of users.
- Maximise street tree and mass plantings where possible.
- Provide consistent alignments without abrupt changes in direction.

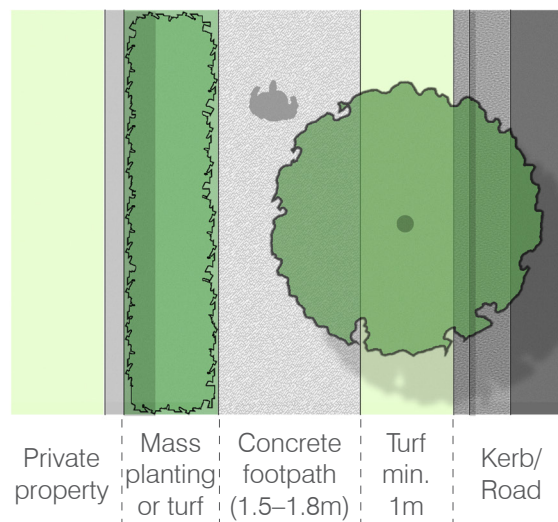
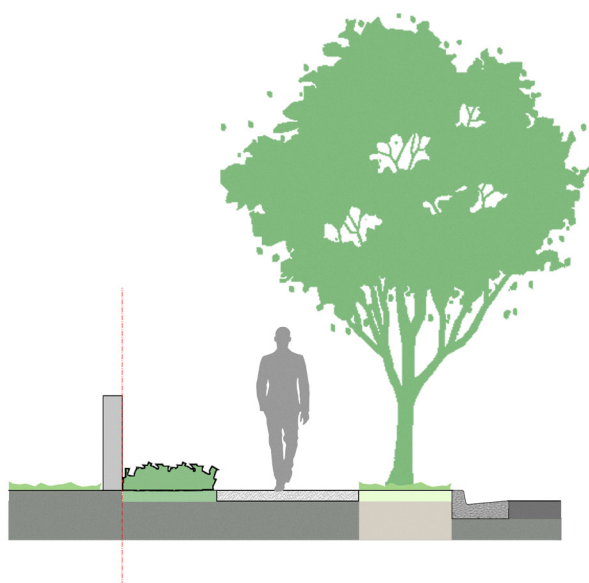


Figure C.13 Minor footpath with grass verge

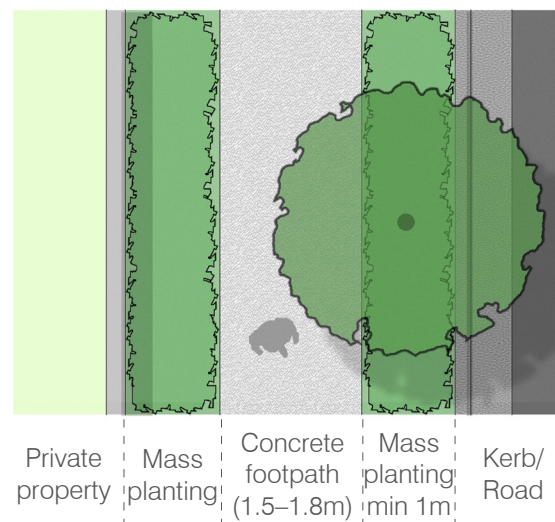
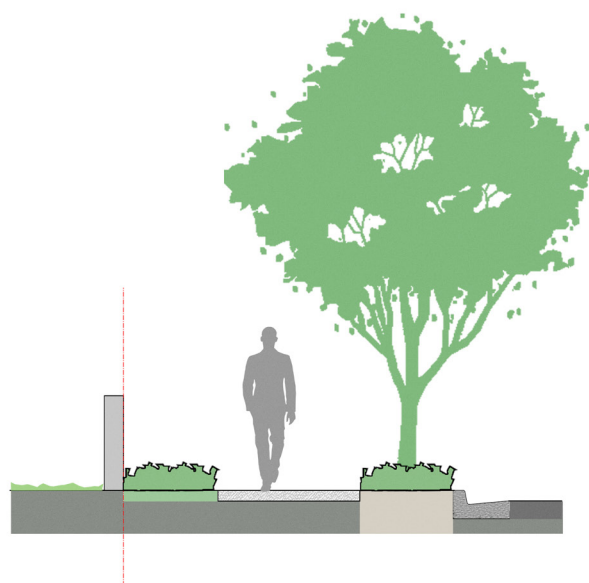


Figure C.14 Minor footpath with planted verge

Note: Refer to Table C.3 for preferred minimum cycleway widths

Separated Cycle Lane

Separated cycle lanes can occur on both arterial and collector road types. They provide clear and safe paths of travel for cyclists with a high pedestrian, cyclist and vehicular flow. Cycle paths can be either single lane located either side of the vehicle carriageway (refer Figure C.15) or as a dual cycle lane located on one side only of the vehicle carriageway (refer Figure C.16). The type used is dependant on the road reserve dimensions and edge conditions, refer Austroads Guidelines for cycleways.

TfNSW provide design options for separated cycle lanes at intersections. Consider the use of the shared environment intersection without (refer Figure C.17) or with (refer Figure C.18) a continuous footpath. Refer TfNSW Technical Direction TTD 2020/03 'Shared environment intersection treatment'.

Design Objectives:

- Provide broken median strip kerb to allow for road drainage.
- Ensure cycle lanes are consistent, reduce unnecessary changes in cycleway conditions such as crossing to the other side of the road or using multiple cycleway types.
- Clearly define entries to cycle lanes from pedestrian footpaths and vehicle carriageways, with signage, lane painting and markings.

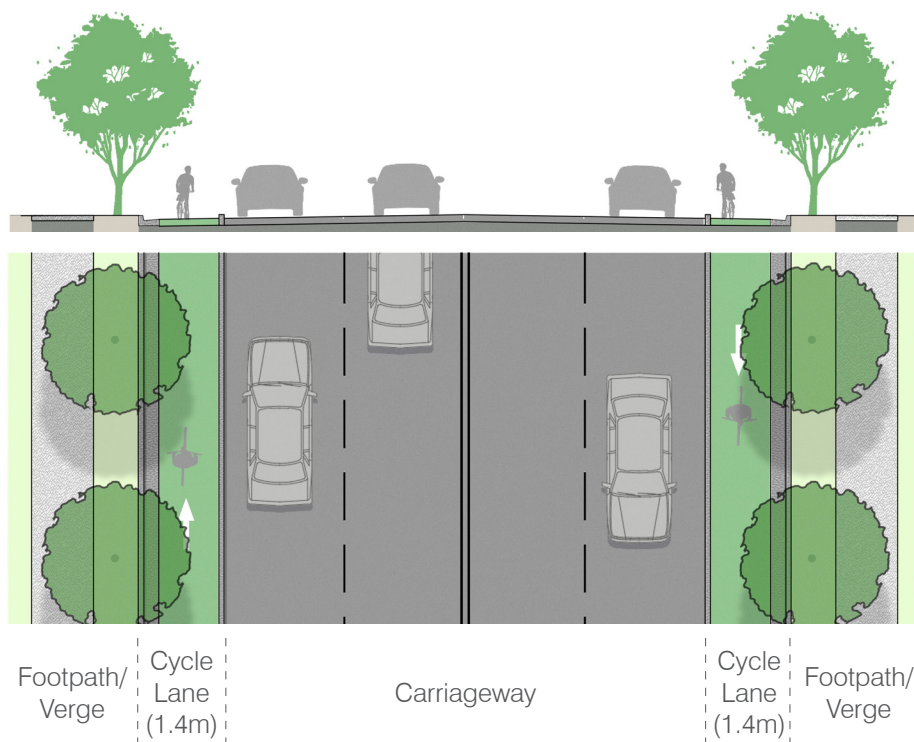


Figure C.15 Single lane on-road separated cycle lane

Dedicated single separated cycle lane with concrete barrier kerb. For use in urban areas with high pedestrian/cycle flow paths.

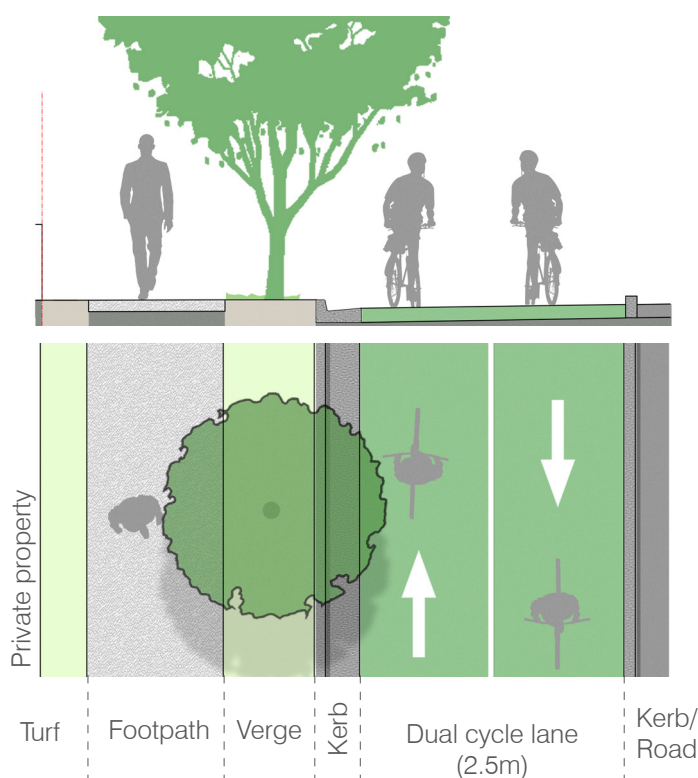


Figure C.16 Dual lane on-road separated cycle lane

Dedicated separated cycle lane with concrete barrier kerb. For use in urban areas with high pedestrian/cycle flows.

Note: Refer to Table C.3 for preferred minimum cycleway widths

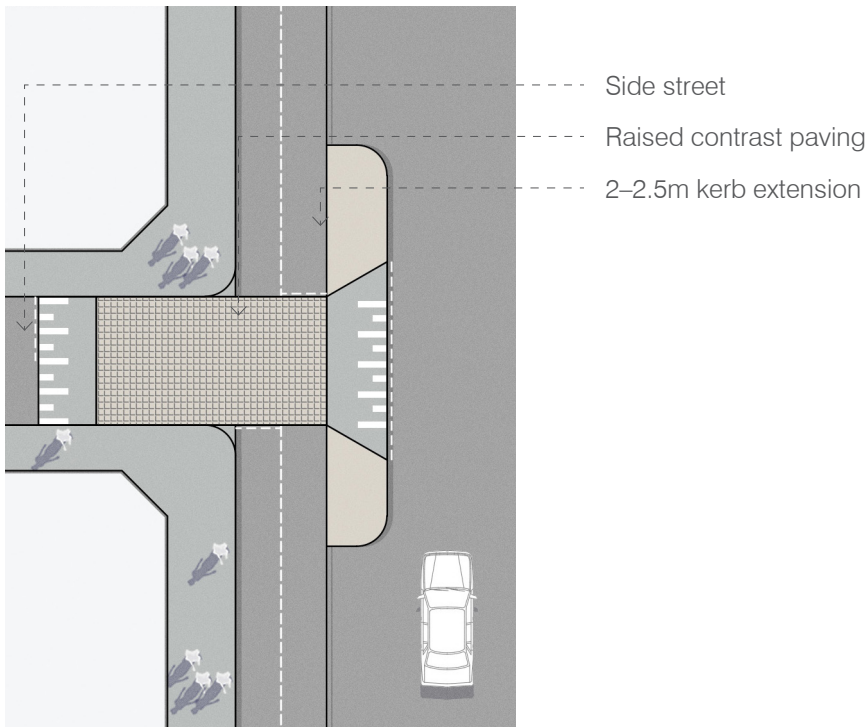


Figure C.17 Shared environment intersection treatment

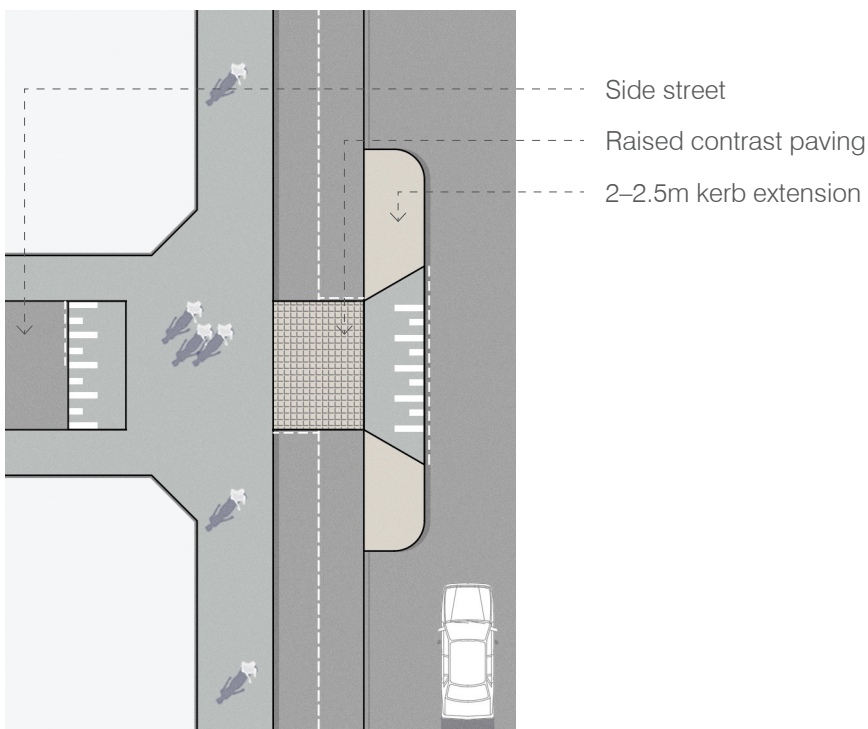


Figure C.18 Shared environment treatment with continuous footpath

Refer TfNSW Technical Direction TTD 2020/03
'Shared environment intersection treatment'.

C.2 Streetscape Elements

Key Design Principles

The physical components and elements within the street such as street trees, furniture, outdoor seating, lighting, paving, kerbs, corner junctions, kerb extensions, driveways, pedestrian ramps, crossings and share ways all require a carefully coordinated design approach to maintain a consistent, legible and safe pathway for pedestrians.

Urban elements contribute significantly to the character and appearance of a place as well as providing a safe and comfortable public domain. A well-designed street will encourage people to use the footpath.

Footpath Components



Footpaths and Kerbs

Footpaths and kerbs delineate the areas of pedestrian priority and define space for passive activities such as eating, sitting and socialising.

The character and width of footpaths can vary widely depending on local context and accommodate different movement functions and various degrees of prominence in each Street Type. Refer to Figure C.1 for footpath widths in relation to street types.

Key Considerations:

- Retain and consolidate existing kerbs in-situ and match adjacent kerbs to create continuous sections of kerb material.

Corner Treatments



The design of a footpath junction and where the change in pavement material occurs emphasizes the hierarchy within street types.

Pavement material of the priority street is to continue around the corner of a block to strengthen the connection across the roadway. Logical termination of paving types can be the radius transition point or building property line. See diagrams below: (Refer to technical specifications).

Footpath and Kerb Extensions

Kerb extensions are the expansion of the footpath and kerb line into the adjacent road lane (typically a parking lane) for a portion of a block either at the corner or mid-block. (Refer to Figure C.19)

Key Considerations:

- Generous kerb extensions may allow opportunities for landscaping, seating, outdoor dining, bicycle parking and stormwater management as well as enhance pedestrian safety by increasing pedestrian visibility, slowing turning vehicles and visually narrowing the roadway.
- Must be constructed according to an overall street plan that takes into account the relevant urban design, heritage, and traffic issues.
- Materials should form a seamless whole matching existing features and materials of the footpath environment. The length of the footpath extensions vary and depend on the different conditions of the intersection and must be assessed on a project by project basis.
- Widening footpaths may require significant changes to drainage infrastructure as well as the relocation of utilities. Where possible the widening of footpaths should be achieved by the narrowing or removal of vehicular travel lanes or parking lanes or establishing setbacks as part of redevelopments.

(Refer to technical specifications).

Kerb Radii

Minimise kerb radii while accommodating the turning movements of vehicles anticipated to shorten crossing distances, increase pedestrian visibility and slow turning traffic.

Key Considerations:

- Corner design must balance the needs of the pedestrians and vehicular movement.
- Assess the specific kerb radii on a site-specific basis due to different vehicle access requirements.
- Use swept paths to determine minimum dimensions.

(Refer to technical specifications).

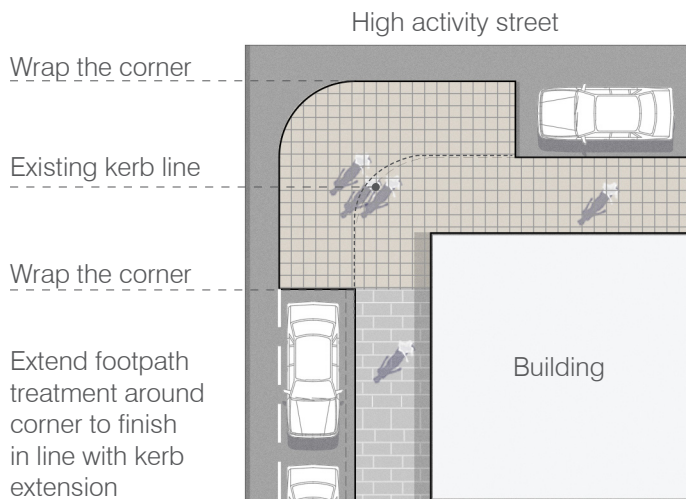


Figure C.19 Footpath material junction with kerb extension

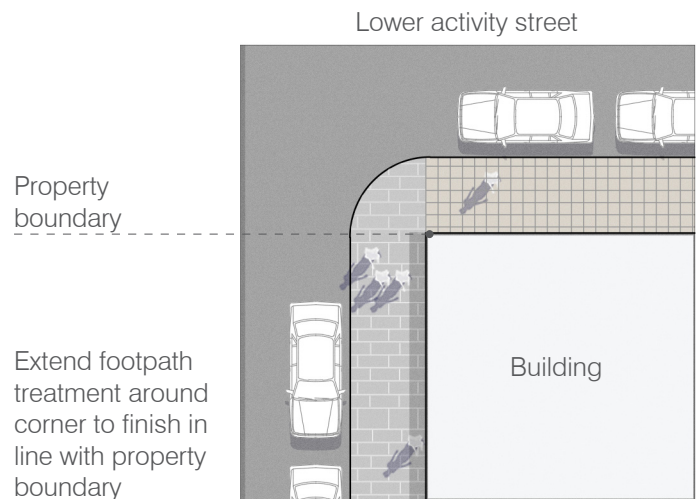


Figure C.20 Footpath material junction without kerb extension

Driveways

Minimise the location and widths of driveways along pedestrian priority streets to maintain footpath continuity and avoid impacts on existing or potential streetscape elements such as street trees.

Key Considerations:

- Driveways should not interrupt the footpath so that ease of pedestrian movement and visual continuity is maintained.
- Footpath pavements should be continuous across the driveway rather than emphasise vehicle priority, refer Figure C.21

(Refer to technical specifications).

Kerb Ramps

Install pedestrian ramps must in the direct line of travel at all intersections and mid-block locations where pedestrian crossings exist. The orientation of ramps must meet AS1428 accessibility standards to ensure the safe passage of persons with visual or physical impairments across the street.

Key Considerations:

- At intersections, locate kerb ramps within the corner area of the footpath, aligned with the street wall and set at a straight angle to the street alignment.
- Minimise the depth of the kerb ramp to reduce insertion into the footpath environment. Where a conflict occurs between the direct line of travel and existing physical elements such as a stormwater pit, the pit must be relocated clear of the crossing point.

(Refer to technical specifications and the application of tactile finishes to guide visually impaired in accordance with Australian Standards).

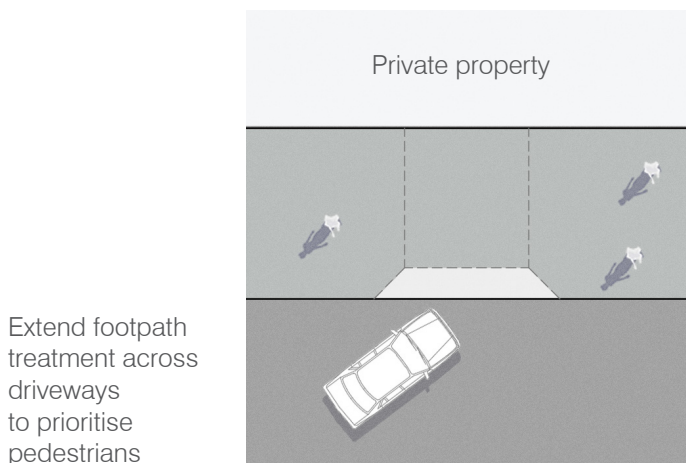


Figure C.21 Footpath driveways crossings

Raised Pedestrian Crossings



Raised pedestrian crossings make crossing easier and safer for pedestrians by increasing the visibility of the crossing for drivers and requiring vehicles to slow down. When used in combination with kerb extensions, the crossing width is also reduced, refer Figure C.22.

Key Considerations:

- Utilise raised crossings at unsignaled mid-block locations as gateway treatments in Village centres and slow zone areas.
- A change in paving unit and/or colour should be used to enhance the contrast between the carriageway and raised crossing.
- Paving applications must be consistent with the Character Area palettes (Refer to Part D – Materials Palette and Application).
- The design must comply with current TfNSW design guidelines.
- The design of raised threshold crossings should accommodate storm water drainage with prioritising a smooth and accessible pedestrian movements over vehicle movements.
- WSUD planting and elements to be used wherever possible

New extended
kerb line

Existing kerb line

Extend footpath
treatment at
intersections
and provide a
tighter kerb radius
to narrow the
roadway and slow
traffic movement

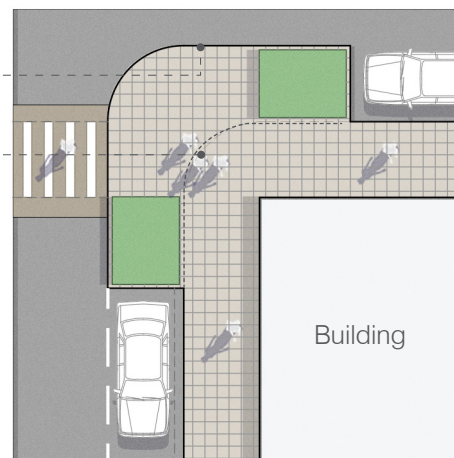


Figure C.22 Raised Pedestrian Crossing and Kerb Extensions



Image C.8: Example of raised pedestrian crossing, Bourke Street, Redfern

Shared Zones



The Shared Zone is a dedicated shared traffic environment for pedestrian, cyclists and vehicle movement. When there are low volumes of traffic assessed and a lack of space separation for balance between pedestrian and vehicle movement, a change in street type can be considered, refer TfNSW Technical Direction for shared zones.

Key Considerations:

- Remove kerbs and gutters in shared zones where possible to remove any ambiguity as to where a pedestrian should walk.
- Carefully consider the sighting and location of elements, pavements and material changes.
- If retaining kerbs and gutters require an entrance treatment (at the start of the zone) to ensure motorists are aware that they are in a significantly different road environment. (Refer to technical specifications).
- Create a self-enforcing road environment to support the implementation of the shared zone and reinforce that pedestrians have the right of way.
- To ensure that the safety of pedestrians and their priority is maintained, traffic flows must be below the designated volume as stated in the TfNSW policy.



Image C.9: Example of shared zone, The Levee, Maitland

Street Trees and Planting



Trees and planting add vibrancy and diversity to the street. Street tree canopies provide shade improving pedestrian comfort and reduce the heat island effect. Varied species selection and mass planting improve the public domain aesthetics and increase biodiversity.

Key Considerations:

- Provide permanent planting within the street furniture zone.
- Provide street trees to provide environmental quality, enhance visual continuity and unity, and reinforce local identity and character.
- Provide tree planting in roadways to increase the tree canopy, particularly in situations where awnings or overhead wires constrain the establishment of medium to tall trees on the footpaths.
- Design special applications to passively irrigate urban landscapes using water sensitive urban design to accommodate rain gardens or bio-filtration swales to collect and treat stormwater from surrounding roads and footpaths for re-use or discharge to promote growth and a comfortable microclimate.

For further information regarding street trees and planting, refer to Section 2, Part E and Hornsby's Urban Forest Strategy.

Siting and Spacing

The siting and spacing of street trees and planting is a combination of street composition and planting factors required by plant species selected.

Key Considerations:

- Locate street tree planting to create a continuous tree canopy along the corridor to provide a visually attractive setting. Spacing will vary depending on tree species selection, adjacent land use, proximity to active street entries, parking zones and distance from other streetscape elements such as lighting (Refer to technical specifications).
- Setout street trees to maximise canopy cover and allow for the maximum growth potential of the species to meet or exceed the Greater Sydney Commission's target of 40 per cent canopy cover and to meet targets outlined in Hornsby's Urban Forest Strategy.
- Trees planted in co-ordination with parallel parking bays, the size of the tree pit and the location of the central planting must consider car overhangs and allow for enough space not to disturb the tree (Refer to technical specifications).
- Street trees to be located within the Public Domain Furniture Zone and the Extensions Zones of the street and located a minimum of 600mm from the kerb edge.



Image C.10: Example of Street tree planting, Abercrombie Street, Chippendale



Image C.11: Example of street furniture siting and spacing, Kent Street, Sydney

Street Tree Selection

Appropriate tree selection, location and installation treatment will ensure healthy growth and long term benefits for the streetscape.

Key Considerations:

- Environmental conditions, physical constraints and functional requirements.
- Based on aesthetic criteria consider include flowering and deciduous tree species to bring life and vitality to the street.

Trees should be:

- Low maintenance and robust;
- An appropriate scale for their location;
- Not susceptible to pests and diseases;
- Tolerant of Paving over the root zone (where applicable);
- Suitable to the local microclimate, soils and drainage conditions;
- Quick growing with a long life;
- Visually interesting and reflective of local character;
- Suitable for fauna and flora linkages; and
- Not likely to damage drainage utilities and pavements.

Tree Base Treatments

Tree base treatments will vary according to location and context of the surrounding footpath material palette. Tree base treatments should be optimised to ensure tree health, minimise root interference and consider providing trafficable area around tree base through the use of porous pavements and grills to capture stormwater. (Refer to Technical Specifications)

Key Considerations:

- Standard tree base treatments include tree grates (for Town Centre and Activity Strips Areas), porous pavements, decomposed granite, mass planting or turf (for Local Areas). For tree base material palette selection refer to the Part D – Materials Palette and Application.
- Tree guards are to be used only in situations where the protection of the tree is necessary and is a temporary measure only until the tree is established.
- Use mass planted tree base options where possible to increase vegetation in the streetscape.
- Implement Water Sensitive Urban Design bio-retention tree pits (infiltration) where appropriate levels and drainage fall occurs to receive water runoff from surrounding roads, properties and footpaths and to treat stormwater for reuse and/ or discharge to receiving waters.
- Use Water Sensitive Urban Design passive irrigation street tree pits wherever possible.



Image C.12: Example of street tree selection for colour and canopy, McDougall Street, Kirribilli



Image C.13: Installed bioretention tree grate in brick paving, Coronation Street, Hornsby

Verge Planting

Planted verges reduce the extent of the paved surfaces and provide separation between the footpath and the roadway—verge planting design to be approved by Council before installation.

Key Considerations:

- The location of planted verges needs consideration to ensure access to parked cars and utilities is maintained. Where in association with parallel parking it must be long stay parking.
- Prioritise permanent in-ground planting over containerised planting.
- Containerised treatments should be limited to Town Centres and Activity Strips. The placement of planter boxes must not obstruct pedestrian access and flow.
- The position of planter boxes must be in the Public Domain Furniture Zone.
- Implement WSUD treatments where appropriate

Refer to Technical Specifications and Council's Urban Forest Strategy for further information.

Water Sensitive Urban Design

WSUD not only addresses the issue of discharging stormwater pollutants into our waterways but also provides the benefits of contributing to cooler microclimates and biodiversity of plant species. Several devices and means can be used to achieve water sensitive design objectives. Examples of such devices include:

- Permeable pavers;
- Verge gardens and nature strips;
- Rain gardens (bio-retention units and filtration); and
- Bio-retention tree pits.

Key Considerations:

- Preference rain gardens (also known as bio-retention devices) when using WSUD streetscape devices. They are practical to integrate into the streetscape but also facilitate the physical, chemical and biological breakdown of pollutants.
- Use WSUD tree pits where design levels and drainage permit to receive water runoff from surrounding roads, properties and footpaths and to treat stormwater for reuse or discharge to receiving waters.

Refer to Technical Specifications and Hornsby Shire WSUD Guidelines for further information.



Image C.14: Example of verge planting, Gerard Street, Alexandria

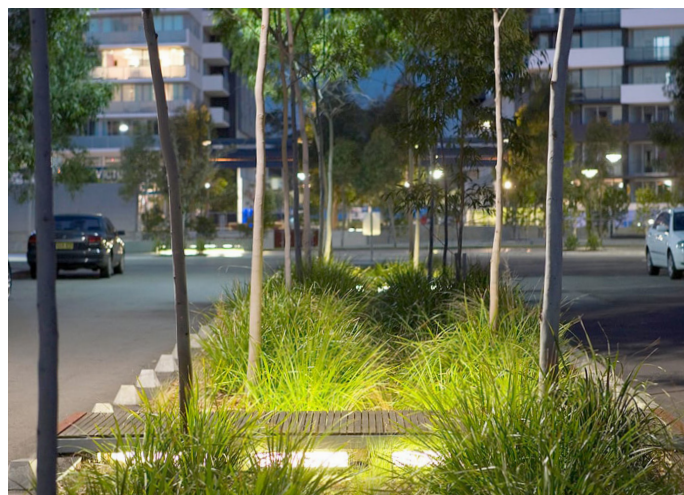


Image C.15: Example of water sensitive urban design, Wolseley Grove, Zetland

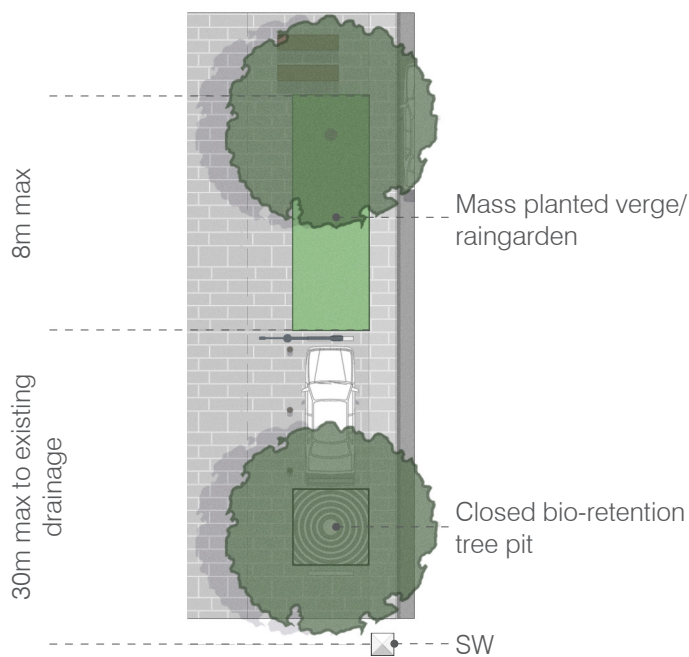


Figure C.23 Village streets

Note: Developers are to provide raingardens/bio-retention tree pits where the edge of the property boundary is >30m from any existing stormwater drainage. New developments which satisfy this criterion should provide WSUD devices to treat all stormwater discharge from the site and link devices to existing stormwater infrastructure.

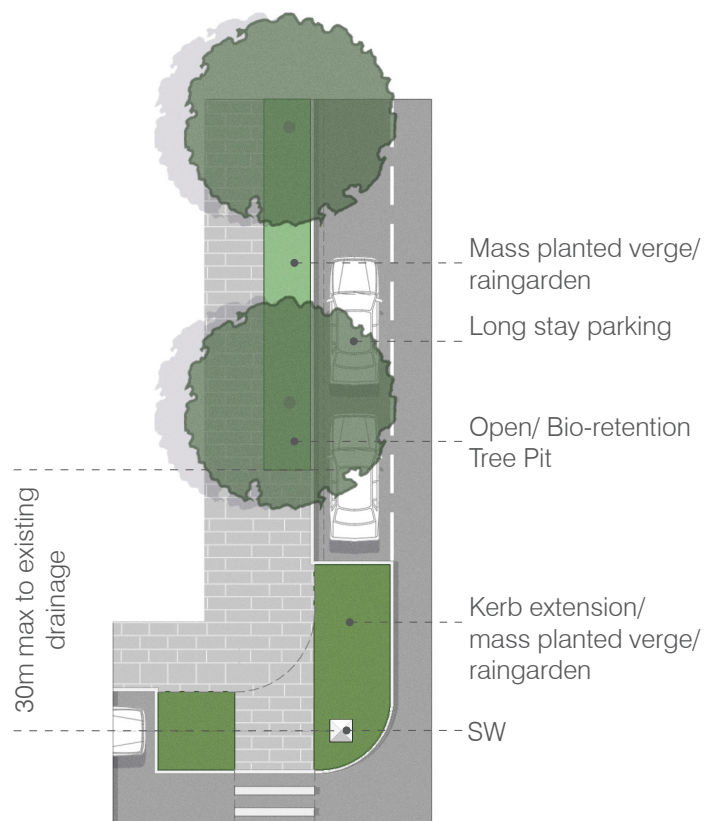


Figure C.24 Local street type A/ collector roads

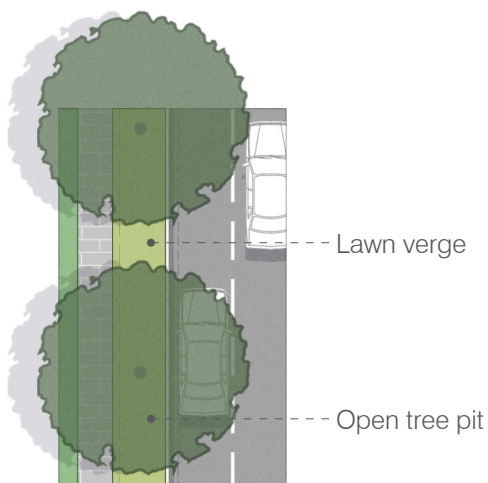


Figure C.25 Local streets type B

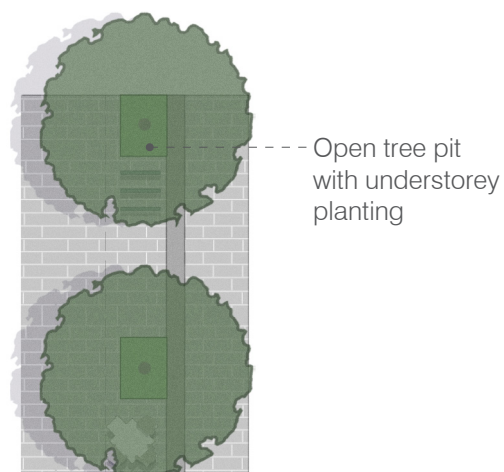


Figure C.26 Shared zone

Planted Medians

A central planted median can increase the streets aesthetics as well as narrow the carriageway, to reduce vehicle speeds and improve the pedestrian amenity. They provide an opportunity to further enhance the streetscape by introducing green elements and provide additional stormwater control and treatment. Where suitable, planted medians can be designed as WSUD devices.

Key Considerations:

- Median widths must meet minimum dimensions to enable appropriate planting objectives, depending on street tree type and size, root control and drainage. Carefully consider maintenance requirements and regimes.
- Footpaths should not be reduced in width to provide space or additional width for medians.
- Wherever safe and feasible, use permeable surfaces, street trees, understorey plantings and drought-tolerant plants.

Refer to Technical Specifications.



Image C.16: Example of planted median, Gipps Street, East Melbourne

Cycleways



Hornsby Shire Council is developing a bicycle network to provide facilities for cyclists of all abilities. The range of bicycle infrastructure to be rolled out, which has implications on street layout, and design includes:

- Separated bi-directional bicycle lanes;
- Shared paths;
- Marked lanes on roads;
- Bicycle parking; and,
- Future hire schemes.

Key Considerations:

- The selection of appropriate treatment types for routes is a function of several parameters including carriageway width, anticipated bicycle volumes, vehicle traffic volume and local conditions.

Only consider a dedicated cycleway for streets designated for such treatments. Refer to the Draft Bike Plan Review 2019.

Refer to Technical Specifications and Austroads Cycleway Guidelines.



Image C.18: Example of separated cycle path, Bourke Street, Surry Hills.



Image C.17: Merri Creek Trail shared path, Victoria.

Public Domain Furniture



Street furniture forms an integral part of the public domain identity, reinforce the public domain character, provide essential amenities for pedestrians and add functionality and vitality to the public realm. They include seats, bubblers, bicycle racks, bollards, kiosks, rubbish bins, parking meters, public art, streetscape signage, traffic and parking signs, among other elements.

The public domain furniture needs to use a consistent design language including colour, form and detailing to read as a coordinated family of elements and achieve a coherent streetscape character.

For furniture, palette refer to Part D – Materials Palette and Application.

For all detailing, fixing and technical specifications, refer to the Technical Specifications.

Key Considerations:

- Consider the siting and Spacing of street furniture.
- Consider the robustness, durability and maintenance of street furniture when selecting for use.
- Design seats and benches for comfortability, allowing for a range of settings.

Locate custom furniture elements may at key points in the street to define existing garden beds, help direct pedestrian movement as well as providing opportunities for social gathering.



Image C.19: Example of custom furniture, Darling Quarter



Image C.20: Example of public domain seating suite Lonsdale Street, Dandenong

Siting and Spacing

All elements of public domain furniture must be sited within the Public Domain Furniture Zone.

Key Considerations:

- All furniture must be located a minimum of 600mm from the street kerb face; seating is preferable to be located 1m from the kerb face for safety.
- Typical distances between elements are; Seating located every 100-250m with max. 30-50m spacing along main Village Streets; bubblers should be located every 500-800m on Village Streets.
- Light poles should not impede into the Pedestrian Zone. Maintain appropriate clearances between all other street elements, including street trees and public domain furniture.
- Locate seating as units or as singular elements where possible near street trees for public amenity.
- Bollards must be limited in use to minimise visual clutter on the street and should be used only where necessary and must comply with access and safety requirements; provide a minimum of 1000mm clear opening with 1.8m clear preferred.
- Use adjacent public spaces, including street closures, parks, and urban spaces to extend the use of public furniture.
- Co-locate pedestrian facilities at gathering and resting places rather than haphazardly spread along a street.
- Siting and spacing of elements near car parking must be compliant and not impede the provision of parking requirements as outlined in AS2890.
- Provide minimum bicycle parking facilities as outlined in AS2890.3.
- Location of bus stops and rubbish bins to bicycle parking to be as per AS2890.
- CPTED principles which create public spaces that are safe and inviting, enabling passive surveillance, access control, territorial reinforcement and space management



Image C.21: Example of well spaced public domain elements Wulugul Walk, Barangaroo

Signage and Wayfinding



A coordinated suite of signage is an essential component of achieving a legible and quality public domain. There are three types of public domain signage;

1. Wayfinding information displays that map key locations within the city;
2. Regulatory signage; and,
3. Street and place name signs.

Key Considerations:

- Locate all signage within the street furniture zone, with consideration for facilitating pedestrian movement around all sides.
- Attach signage where possible to existing poles and structures to reduce clutter;
- Site wayfinding signage in areas of high pedestrian traffic and usage such as gateways, entry points, traffic junctions or similar.

Council is in the process of developing a Shire-wide Signage and Wayfinding Strategy.

Street Lighting



Street Lighting works in conjunction with street trees as an organising element to establish the rhythm of the streetscape. Street lighting includes roadway, pedestrian and cycleway lighting and helps define a positive urban character and supports night time activities.

Key Considerations:

- Improve pedestrian amenity through lighting footpaths and cycleways.
- Choose energy-efficient light fittings such as LED.
- Select light fittings that minimise light spill and glare.
- Reduce visual clutter in streets by locating on existing poles.
- Consider the use of standard lighting fixtures as used by electricity service authorities, provided they are evaluated as meeting aesthetic design objectives
- Choose a light fitting that is an appropriate scale for pedestrian areas.
- Comply with Australian Standards for footpath lighting.

Developments should facilitate the placement of powerlines underground on the road reserve at the front of the site as well as within the site boundaries.

Refer Sections 3.2.10, 3.3.10, 3.4.10 and 3.5.10 of the HDCP.

Refer to Part D – Materials Palette and Applications and Technical Specifications for proposed light fitting and lighting levels and technical applications for lighting luminaries and required lighting levels.



Image C.22: Example of public signage and wayfinding Dandenong, Victoria

Public Art



Public Art is an essential aspect of major streetscape design projects. On a large scale, Public Art can unify a district with a theme or identify a neighbourhood gateway. At a pedestrian scale, it can assist in wayfinding and provide visual interest to passers-by.

Public Art can imbue beauty and symbolic meaning as both independent installations or as functional objects such as seats, bus shelters, grates and railings to create a sense of place and identity.

Interactive Public Art also has the potential to bring together members of the community to participate actively and engage with each other within the public realm.

The Government Architects NSW Designing with Country discussion paper highlights the importance of cultural ingetration in public spaces and projects. Public Art can provide one of many avenues to integrate Indigenous story telling and cultural interpretation.

Key Consideration:

- Public Art proposals shall respond to the Public Art Masterplan (currently being developed) and comply with the Public Art Policy.
- Consultation and collaboration with local indigenous groups, artists and leaders

Utilities



Utilities in the streetscape consist of utility poles, overhead wires, surface pits and electricity kiosks.

Key Considerations:

- Efficiently locate utilities to minimise the impact on other existing or potential streetscape elements, maintain necessary access and maintenance requirements.
- Under-grounding of overhead services should be carried out where feasible to main streets to reduce visual intrusion and provide optimum conditions for street trees to reduce the impact on the tree canopy.
- Pit lids should consist of paving inserts consistent with the paved footpath finish in the Town Centre and on all main streets.
- Realign pits to match with pavers where possible.
- Above ground utilities such as traffic signal boxes, electrical MSB's and communications pillars should be coordinated and consolidated to reduce visual intrusion and maintain paths of travel.

Refer to Technical Specifications.



Image C.23: Example of public art, Huntley Street, Alexandria



Image C.24: Pitt Street Mall, Sydney

Outdoor Dining and Barriers



Council encourages outdoor dining as a key component of delivering a lively and engaging city. The design of outdoor spaces and environmental conditions can positively contribute or negatively detract from the dining experience. Smoking policies such as Council's Smoke-Free Policy and Smoke Free Environment Act 2000 should be considered when designing outdoor dining areas.

Key Considerations:

- Carefully design barriers to provide inclusive access and high design quality.
- Locating all outdoor dining furniture in the Street Furniture Zones or as directed by the Council.
- Maintain a clear, unobstructed footpath zone for pedestrian through movement.
- Hornsby Council's Smoke-Free Policy
- NSW Government Smoke Free Environment Act 2000 and Smoke-Free Environment Regulation 2016

Refer to Technical Specifications.

Inclusive Access Applications



Inclusive access applications are required in compliance with the relevant legislation and Australian Standards 1428.1.

Key Considerations:

- Provide clear and legible paths of travel in accordance with AS 1428.
- The provision of luminance contrast at stairs and falls.
- The provision of bollards and safety railing.
- The provision of tactile paving treatments.
- Tactile Ground Surface Indicators (TGSIs) where appropriate.
- The provision of pram ramps.
- The Alignment of path of travel and pram ramps.
- Removed kerb edges to shared traffic zone treatments require a change in the surface pavement.
- Slip resistance.

Refer to Technical Specifications.



Image C.25: Example of outdoor dining, Barangaroo Avenue, Barangaroo



Image C.26: Example of Braille street sign, Wynyard Park, Sydney

Dementia Friendly Design



The public domain is to be designed for the widest range of users possible. Dementia friendly design goes beyond the application of inclusive access applications and Australian Standards to provide functional, legible and safe environments for all abilities.

Key Design Considerations:

- Provide acoustic barriers to reduce background noise, such as planting and fencing.
- Use clear large signage with clear colour contrast for wayfinding to toilets and destinations.
- Provide obvious and easy access to shaded areas, with adequate seating.
- Provide seating design which is clearly a seat, avoid abstract furniture design.
- Provide sufficient parking and easy access to parks, shops and public facilities.
- Ensure changes in ground levels are clearly marked and well-lit, with compliant handrails, tactile, and appropriate contrast and non-glare surfaces.
- Ensure clear visibility from top step to bottom step.
- Provide sensory stimulation in gardens and parks using varied colours, scents, textures and sounds.
- Ensure main paths of travel are enough for two users to walk side-by-side or use wheelchairs.
- Ensure entry and exit signs are clear and obvious.
- Avoid structures, such as pergolas, or lighting which cast complex contrasting shadows, these may be interpreted as depth changes.
- Ensure undercover areas are provided in parklands for access in all weather conditions.
- Utilise visual landmarks to assist with wayfinding such as water features or murals.
- Ensure bus shelters are enclosed and have adequate seating.

Maintenance of the public domain is equally as important as its design. The public domain infrastructure must be actively monitored and rectification of issue sought as soon as possible.

Key Maintenance Considerations:

- Repair trip hazards caused by cracks, tree root up-heaving, unstable pavers, potholes and other depressions.
- Repair or replace damaged infrastructure.
- Repainting of surfaces, and line marking to maintain compliant luminance contrast.
- Cleaning of surfaces to removing debris and spills which may cause slip hazards.
- Tree and plant pruning and maintenance to prevent obstructions to a continuous path of travel, restricting of lighting or access to building entries and exits.

Refer to Alzheimer's Australia's "Guidelines for the Development of Friendly Communities" and Local Government Toolkit.

PART D – Materials Palette and Application

D.1 Character Areas

This section defines different character areas that make up the urban realm of Hornsby Shire. The zones are defined by location and function and form the basis of the material palette selections.

Town Centre and Activity Strips

Town centres and activity strips are typically areas of high daily visitation focused around commercial and retail business activity. These areas often have high pedestrian activity with direct access to public transport.

These areas are comprised of public spaces offering a civic place for play, learning and cultural events with direct links to public transport modes. Surrounding the civic space is an area of retail and restaurants.

Heritage Town Centre and Activity Strips

Similar to Town Centres and Activity Strips, Heritage Town Centres retain and celebrate historical urban design elements. They exemplify the heritage of Hornsby villages through materiality, architecture and scale. The distinct features of Heritage Town Centres enrich and define the local community's identity and lifestyle.

Local Areas

Local areas include a variety of street types, comprised of medium and low density suburban areas with the primary land use being residential. Within the study areas covered by these guidelines they form part of the local pedestrian network that links local amenities and destinations such as schools, parks, community centres, retail and commercial services, and public transport services.

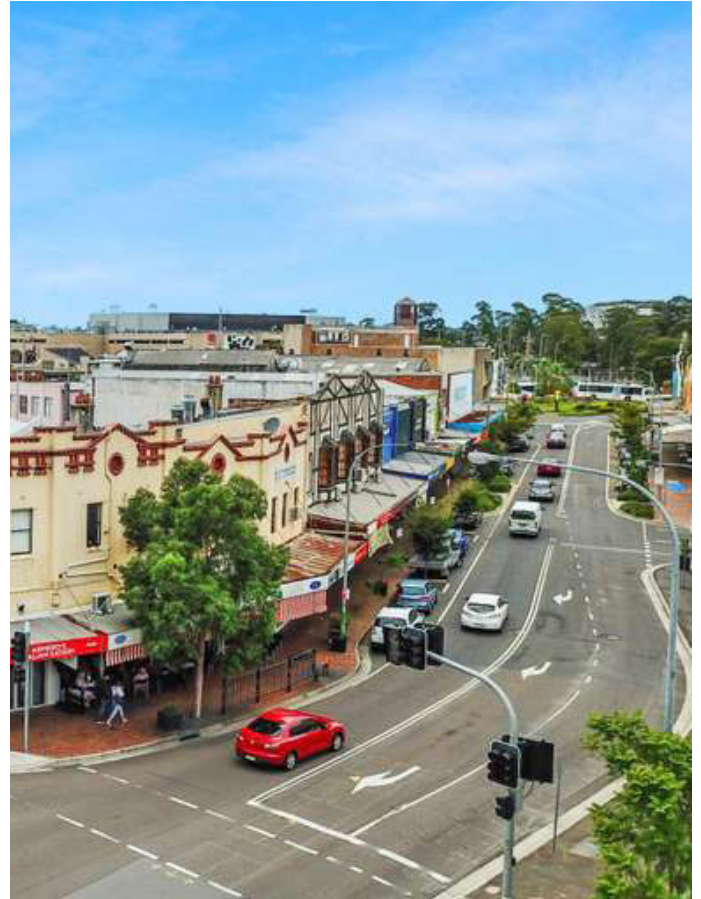


Image D.1: Peats Ferry Road, Hornsby

Town Centre and Activity Strips

These centres provide a focus around which daily community life is organised. A high quality and robust materials palette and street furniture selection are used in the streetscape and public space areas to respond to high pedestrian use, and amenity associated with local commercial, retail and business activity and public transport uses throughout Hornsby Shire.

A distinct palette of streetscape elements is used along the activity strips leading away from and towards Railway Stations to acknowledge its significance both as a local transport hub and gateway into Town Centres.

Streetscape elements within the existing streetscape including bus stops, telephones, bins, seats, dining barriers, pedestrian lighting, cycle racks, bubblers and tree guards provide the tools for demonstrating these as visually distinct places in the local government area.

These occur in Asquith, Waitara, Thornleigh, West Pennant Hills.



Image D.2: Example of retail activity strip, Scotch Row, Barangaroo



Image D.3: Example of high quality public domain in town centres, Rouse Hill Town Centre, Rouse Hill

Heritage Town Centres and Activity Strips

Heritage town centres maintain, protect and celebrate their history and character through architecture and materiality. A distinct palette of heritage streetscape elements are chosen to be used along the heritage activity strips leading away from and towards Railway Stations in order to acknowledge its significance both as a local transport hub and gateway into Town Centres.

These centres function similar to other town centres providing a focus around which daily community life is organised. A high quality and robust palette of materials and street furniture is used in the streetscape and public space areas. The palette responds to high pedestrian use and amenity associated with local commercial, retail and business activity and public transport uses throughout Hornsby Shire.

Streetscape elements within the existing streetscape including bus stops, telephones, bins, seats, dining barriers, pedestrian lighting, cycle racks, bubblers and tree guards are to be updated so as to respond to the local heritage. Heritage materials such as brick, are to be used as paving specific to the street types. Areas such as Beecroft, have a fine grain heritage architecture and urban form, these should inform the streetscape design and layout.



Image D.4: Example of retained fine grain heritage architecture, Argyle Street, Camden

Local Areas

Local areas consist primarily of low-medium density residential areas. They require a simple, durable and robust palette of materials that responds to the existing fabric and offers an opportunity for expression of individual neighbourhood character.

Within the local area network, some areas accommodate a higher level of pedestrian activity associated with retail, commerce and transportation links between destinations. In contrast, some residential areas have lower levels of pedestrian activity.

The street network within the Local Areas provides pedestrian connections to local amenities and destination such as schools, parks, community facilities, retail and commercial services, and the public transport network.

The streets with the higher level of pedestrian activity provide the opportunity to use a higher standard of materials and street furniture to enhance legibility and identity within the streetscape. These elements include bus stops, telephones, pedestrian lighting, bins, seats, cycle racks and tree guards.

The paving palette for the Local Areas currently includes in situ concrete as the primary material for footpaths. However, consideration of local context, fabric and potential heritage value may provide an opportunity to highlight main pedestrian links and local hubs with brick paving/ granite setts. There is an opportunity for these footpaths to be widened that link key places.



Image D.5: Station Street, Thornleigh



Image D.6: Peats Ferry Road, Asquith

D.2 Public Domain Palette

Materials Palette

A consistent palette of paving and kerb materials creates a clear, coherent public domain structure and unified, recognisable character as well as accentuates the visual continuity of the street. Complimentary to these ground materials are elements such as street furniture and lighting. This section provides reference tables for the materials palette and their application. Key considerations include materials selection, excellent attention to detailing and quality installation: these components work together to form robust, slip-resistant, stable and durable public spaces.

The aims of the materials and furniture palette are to:

- Provide a simple, durable, manageable and consistent palette that is appropriate to different character zones and street types;
- Consider sustainability objectives in material selections including embodied energy, life cycle costing and provenance; and
- Use this palette to design a public domain that unifies street types, while allowing variations in some elements to distinguish the different character zones and reinforce local identity.

The design principles for the choice of materials and street furniture include:

- Sustainable, high durability, low embodied energy;
- Flexible and easy to remove and re-lay;
- Create a high-quality pedestrian environment with materials that are robust, durable and easy to maintain;
- Reinforce streetscape hierarchy and character;
- Reduce the use of asphalt;
- Relate to streetscape context and existing pavement type; and
- Consider the use of temporary materials in street design for low-cost variations, such as paint and planter boxes.

Use a combination of the above design principles to ensure the use of the most appropriate materials to maximise accessibility, ease of maintenance, are aesthetically appropriate, economically beneficial, sustainable in choice and durable.

Design feature paving to unite and provide a continuous and identifiable element in the Town Centre.

For further information the Technical Specification and Materials Performance Specification.

Paving


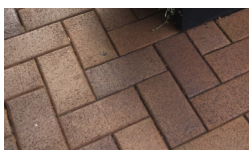






Type	Description					Application	Image
	Product	Colour	Finish	Dimensions	Setout		
In-situ concrete	In-situ concrete	Natural Portland Grey	Broom finished, no trowel edge	Widths varies, refer path network diagram	Control and expansion joints to engineers design	Local streets	
Brick Paving	Claypave or equivalent	Monarch Tan	N/A	230 x 115 x 50mm	Herringbone, laid 45 degrees to street	Heritage Town Centres and Activity Strips	
Granite Setts	Granite cobbles	Adelaide Black	Flame exfoliated	105 x 105 x 80mm	Stack bond	Town Centres and Activity Strips, Local Areas	
Granite paver	Granite Flagstone	Raven Black, Adelaide Black	Flame exfoliated	Type A: 900 x 450mm Type B: 600 x 450mm	Stack bond Stretcher bond, perpendicular to path of travel*	Town Centres and Activity Strips	
Granite (Special Application)	Special applications of granite flagstone paving including inlays of different paving materials.					Town Centres and Activity Strips	
Permeable paver (road)	Ecotrihex	Charcoal	N/A	188 x 92 x 60mm	As per manufactures specification	WSUD roads/ parking	
Permeable paver (shared)	Ecopave80	Charcoal	N/A	226 x 111 x 80mm	Herringbone	WSUD shared zones	
Permeable Paving (Special Application)	Porous Asphalt, Concrete & Aggregate with Epoxy. Future use is subject to Council approval based on further research on availability and application.					Town Centres and Activity Strips and Local Areas	
Asphalt	Roadway asphalt use to be determined and approved by Council, and to meet TfNSW Technical Guides and Standards, and RMS guidelines, including the use of recycled glass materials.					Roads and footpaths where approved.	

Table D.1 Paving type materials palette

Note: Concrete must comply with the technical specification for sustainability, Special consideration is to be given regarding the inclusion of recycled glass components in concrete and asphaltic pavements in line with Council MOU with SSROC.

Refer to Technical Specification and Materials Performance Specification

Seating

The intent of the site furnishings is a palette of considered design elements that use a consistent aesthetic design with individual elements relating to each other in form, appearance and materials.

Note: The furniture selections are subject to further aesthetic and asset management investigations and subject to change.



Type	Description				Application	Image
	Product	Material	Dimensions	Supplier		
Contemporary Seat Suite	Oxley Furniture Suite: seat, bench, corner bench, platform	Powdercoated steel and hardwood timber	Seat: 1800L x 755W x 620D mm Bench: 1800L x 420H x 530D mm Corner bench: 1200W x 430H x 1200D mm Platform: 1800W x 430H x 1800D	MOS Urban	Town centre streetscape upgrades, parks and plazas	
Custom Seating	Comprised of low walls and back rests to be used in parks and plaza upgrades. Custom furniture should be high quality with hardwood timber battens and steel frames.*				Town centre, plazas, parks, malls and shared zones	

Table D.2 Seating type palette

*Refer to Technical Specification

** Refer Materials Performance Specification

Bike Parking



Type	Description				Application	Image
	Product	Colour	Dimensions	Supplier		
Retro-fit Bike Hoop	Cycla Pole Mounted Retro-fit	Galvanised steel	650 x 650mm	Civiq	Town centres and local areas where bike parking required to affix to existing poles	
Local Bike Hoop	Semi Hoop	Galvanised Steel	845L x 120W x 850H mm	Street Furniture Australia	Local areas	
Urban Bike Hoop	Semi Hoop	316 Stainless steel	845L x 120W x 850H mm	Street Furniture Australia	Town Centres and Activity Strips	

Table D.3 Bike parking type palette

Waste Collection



Type	Description				Application	Image
	Product	Colour	Dimensions	Supplier		
Co-mingle Bin	National Park Range	304 Stainless steel frame, roof, chutes and panels. Panels feature full colour UV digital printed educational material	240L	Source Separation Systems	Streetscape upgrades, parks and plazas.	
Separated Waste	National Park Range	304 Stainless steel frame, roof, chutes and panels. Panels feature full colour UV digital printed educational material	2 x 240L, 3 x 240L	Source Separation Systems	Streetscape upgrades, parks and plazas.	

Table D.4 Waste collection type palette

*Refer to Technical Specification

** Refer Materials Performance Specification

Bollards


Type	Description				Application	Image
	Product	Colour	Dimensions	Supplier		
Existing Bollard	Slimline 150NB removable (SSP150RB)	304 Stainless steel	168.3mm	LEDA	Town Centres, Parks, Plazas, Malls	

Table D.5 Bollard type palette

Bubblers




Type	Description				Application	Image
	Product	Colour	Dimensions	Supplier		
Bubbler/re-fill	Aquafil, 1500/2100 high Refill Station with Drinking Fountain, Type C	316 Stainless steel	1500mm, 2100mm	Aquafil	Town Centres, Parks, Plazas, Malls	
Bubbler	Aquafil Bold	316 Stainless Steel	850(h)	Civiq	Streetscape upgrades, parks and plazas.	
Bubbler with dog bowl	Aquafil Bold with dog bowl	316 Stainless steel	850(h)	Civiq	Streetscape upgrades, parks and plazas.	

Table D.6 Bubbler type palette

*Refer to Technical Specification

** Refer Materials Performance Specification

Tree Base Treatments







Type	Description					Application	Image
	Type	Materials	Supplier	Dimensions	Notes		
Turf	Spade cut edge in turf with mulch	N/a	N/a	N/a	N/a	Local street verge planting	
Decomposed Granite	Cement Stabilised Decomposed Granite	Decomposed Granite decomposed granite	N/a	N/a	N/a	General Streets with in-situ concrete footpaths	
Mass Planting	Hardwood timber edge to turf. Steel edge to paving	Mass planting	N/a	N/a	Understorey planting at base of tree subject to council approval	Town Centre and Activity Strips Local Areas	
Raingraden	Broken kerb with planting and filtration media	Rain gardens with stormwater run-off directed to infiltrate through planting media and treat stormwater before it drains to stormwater infrastructure.				Town Centre and Activity Strips Local Areas	
Roadway / Bioretention	Resin-bound aggregate (e.g. terrabond)	Epoxy bound aggregate (no-fines), and concrete wheel stops (type 1)	n/a	1985 x 1490mm	Ensure aggregate is no-fines to allow water per permeation	Village Streets and Laneways Tree protection measures such as wheel stops to be considered	
Tree grate	Laser-Cut Slotted Steel Grate with support frame	Painted mild steel	Furphy Foundry	1985 x 1490mm	Grate in frame set flush with road surface to encourage infiltration	Village Streets and Laneways	

Table D.7 Tree base treatment type palette

Refer to Technical Specification and Material Performance Specification. Refer to best practice tree placement guidelines: <https://watersensitivecities.org.au/content/trees-cool-city-guidelines-optimised-tree-placement/>

Barriers

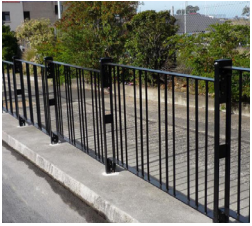
Type	Description				Supplier	Application	Image
	Product	Materials	Finish	Dimensions			
TfNSW Barrier	TfNSW Pedestrian Fencing – Type 1	Painted Mild Steel	Painted steel	Varies	ENCAT	As required by TfNSW ^	

Table D.8 Barrier type palette

Refer to Technical Specification
Refer Materials Performance Specification
^ Where possible planting should be prioritised in place of a barrier

Lighting

Note: The lighting selections are subject to further aesthetic, asset management and electrical service authority lighting standards/ fixture investigations and are subject to change. All electrical cabling to be underground. All existing and new street lighting to be LED, refer Ausgrid LED roll out program. Refer Ausgrid network standard, Public Lighting Design and Construction document.





Type	Description				Application	Image
	Product	Height	Supplier	Description		
EA Pole – Replace with LED as per Ausgrid	Energy Australia Timber or Steel pole	N/a	Energy Australia	Hardwood Timber / Galvanised Steel	Retain where existing in streetscape	
Smart Pole Series	Smart Pole	13.7m	HUB	Stainless Steel	Streetscape upgrades, parks, and plazas in civic heart sites and associated main streets	
Pedestrian Street Lighting on Stand-alone pole	Pole-top luminaire with asymmetrical flat beam light	4.5m	BEGA / Zumtobel Group	Graphite	New pedestrian pole where stand alone light is required, streets, malls and laneways	
Contemporary Lighting	Pole-top luminaire with symmetrical flat beam light	4.5m	BEGA / Zumtobel Group	Graphite	New pedestrian pole where stand alone light is required, streets, malls and laneways	
Other lighting fixtures (special applications)	Lighting technology and fixtures available on the market are constantly changing. Alternative lighting design elements for street poles, wall mounted fixtures and other applications will be subject to City assessment and approval.					

Table D.9 Lighting type palette

Refer to Technical Specification
Refer Materials Performance Specification

Kerbs

Type	Description		Application	Standard
	Material	Dimensions		
Dish Crossing	Concrete ^	900 x 190mm	Vehicle crossing	Refer to Technical Specification Generally, continue use of predominant kerb material and type of street ^ Sandstone to be used in place of concrete in Heritage Town Centres
Mountable Kerb	Concrete ^	210 x 260mm	Local areas	
Roll-kerb	Concrete ^	760 x 250mm	Local areas	
Barrier Kerb	Concrete ^	600 x 150mm	Town Centres and Activity Strips	
Broken Kerb	Concrete ^	Varies	Town Centres, Local Areas, WSUD	
Wheel stop Type 1	Concrete	90-100H x Min. 2000L mm	Local Areas, Town Centres and Activity Strips	Refer to Technical Specification

Table D.10 Kerb type palette

TGSI



Type	Description			Application	Standard	Image
	Material	Description	Supplier			
Warning	316 Stainless Steel	316 Stainless steel tactile with slip resistant engraved sides and mill top finish	DTAC or similar	As required by standards	TGSI to be tested for LRV prior to installation at each application.	
Directional	316 Stainless Steel	316 Stainless steel tactile with slip resistant engraved sides and mill top finish	DTAC or similar	As required by standards		

Table D.11 TGSI type palette

*Refer to Technical Specification

** Refer Materials Performance Specification

Shelter and Kiosk Types




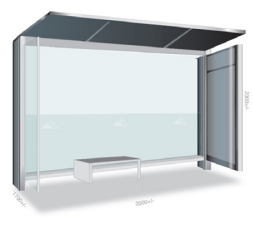
Type	Description					Application	Image
	Product	Materials	Finish	Dimensions	Supplier		
Telephone	TELSTRA	To be installed within ‘Street Furniture Zone’ on streets where required (determined in conjunction with Council)				Town Centre and Activity Strips Local Areas	
Kiosks	New Kiosk to future specification subject to EOI. To be installed where required (determined in conjunction with the Council)					Town Centre and Activity Strips Local Areas	
Existing Bus Shelter	To be retained where existing in streetscape				Adshel	Town Centre and Activity Strips Local Areas	
Contemporary Bus Shelter	Metro Bus Shelter	Shatter Resistant Glass and Painted steel	3500L x 1700W x 2300H		Polite	Town Centre and Activity Strips Local Areas	

Table D.12 Shelter and Kiosk type palette

*Refer to Technical Specification

** Refer Materials Performance Specification

Character Areas Material Palette Application Summary Table

Street Type	Village Streets			Shared Zones			Laneways		
Example Street Name	Pacific Hwy	Pennant Hills Rd	Waitara Ave, Waitara		Railway Ave, Thornleigh	Park Ln, Waitara		Park Ln, Waitara	Wattle St, Asquith

FOOTPATHS

Paving Type	Granite Flagstone (Raven Black, Adelaide Black)	Special Applications – Granite Flagstones	Granite Stone Sett Paving, Permeable Ecopave (Asphalt where approved)
Kerb / Gutter	Concrete	Concrete	Concrete
Dish Drain	Concrete	Granite Paving Segments	N/A
Parking Bays / Threshold	Granite Stone Sett Paving (Asphalt where approved)	Special Applications – Granite Stone Sett, Permeable Ecotrihex	N/A
Wheel stops	Concrete		
Kerb Ramps	Concrete		
Driveway	To match footpath/shared way/ laneway material		
TGSIs (Tactiles)	Type 316 Stainless Steel tactiles		
Service Pit Lids	Infill to match paving		

STREET TREES

Pot Size	400L
Min. Soil size per tree	Small tree 9m³ (<5m Mature Canopy)
	Medium tree 35m³ (<10m Mature Canopy)
	Large tree 150m³ (>10m Mature Canopy)

TREE BASE TREATMENTS

Tree Pits	Tree Grate, WSUD	Mass Planting, WSUD	Tree Grate, WSUD
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STREET FURNITURE

Seat	Contemporary Seat and Bench 1 & 2, Custom Designed Seating		
Bollard	Existing Bollard – LEDA, Contemporary Bollard		
Bubbler	Contemporary Bubbler		N/A
Re-fill Station	Aquafil Re-fill Station		N/A
Rubbish Bin	Contemporary Rubbish Bin		
Bike Rack	Contemporary Cycle rack, 'O' Ring attached to pole		
Barrier	TfNSW Barrier	N/A	N/A
Telephone	TELSTRA		
Kiosk	New Kiosk to future specification subject to EOI		N/A
Bus Shelter	Contemporary Bus Shelter		

LIGHTING

Street Lighting	Smart Pole Series	N/A
Pedestrian Lighting	Pedestrian Street Light on Stand-alone Pole	
Plaza Lighting	Contemporary Lighting	N/A

Table D.13 Town Centres and Activity Strip materials application table

Street Type	Village Streets			Shared Zones		Laneways	
Example Street Name	Hannah St, Beecroft	Beecroft Rd, Beecroft	Wongala Cres, Beecroft	Hannah St, Beecroft		Future Laneways	

FOOTPATHS

Paving Type	Brick Paving	Brick Paving, Permeable Ecopave	Brick Paving, Permeable Ecopave
Kerb / Gutter	Sandstone		
Dish Drain	Concrete	Concrete	N/A
Parking Bays / Threshold	Brick Paving (Asphalt where approved)	Special Applications – Granite Stone Sett	N/A
Wheel stops	Sandstone		
Kerb Ramps	Brick Paving		
Driveway	To match footpath/shared way/ laneway material		
TGSIs (Tactiles)	Type 316 Stainless Steel tactiles		
Service Pit Lids	Infill to match paving		

STREET TREES

Pot Size	400L
Min. Soil size per tree	Small tree 9m³ (<5m Mature Canopy)
	Medium tree 35m³ (<10m Mature Canopy)
	Large tree 150m³ (>10m Mature Canopy)

TREE BASE TREATMENTS

Tree Pits	Tree Grate, WSUD	Mass Planting, WSUD	Tree Grate, WSUD
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STREET FURNITURE

Seat	Existing seating, Custom Designed Seating		
Bollard	Existing Bollard – LEDA, Contemporary Bollard		
Bubbler	Contemporary Bubbler		N/A
Re-fill Station	Aquafil Re-fill Station		N/A
Rubbish Bin	Contemporary Rubbish Bin		
Bike Rack	Contemporary Cycle rack, 'O' Ring attached to pole		
Barrier	TfNSW Barrier	N/A	N/A
Telephone	TELSTRA		
Bus Shelter	Contemporary Bus Shelter		

LIGHTING

Street Lighting	Smart Pole Series	N/A
Pedestrian Lighting	Pedestrian Street Light on Stand-alone Pole	
Plaza Lighting	Contemporary Lighting	N/A

Table D.14 Heritage Centres and Activity Strips material application table

Street Type	Arterial Roads				Collector Roads - Type A & B				Local Streets Type A				Local Streets Type B				
Example Street Name	Pacific Hwy	Pennant Hills Rd	Beecroft Rd	Cumberland Hwy		Peats Ferry Rd, Asquith	Wongala Crs, Beecroft	The Comenarra Pky, Waitara		Bouvardia St, Waitara	Kirkham St, Beecroft	Station St, Thornleigh		Gardenia St, Asquith	Chapman Ave, Beecroft	Orara St, Waitara	Wood St, Thornleigh

FOOTPATHS

Paving Type	In-situ Concrete	In-situ concrete, Granite, Flagstone Setts (Raven Black, Adelaide Black)	In-situ concrete, Granite, Flagstone Setts (Raven Black, Adelaide Black)	In-situ Concrete
Kerb	Concrete			
Gutter	Concrete			
Dish Drain	N/A			
Kerb Ramps	Concrete			
Driveway	To match footpath material			
Service Pit Lids	Concrete			

STREET TREES

Pot Size	400L
Min. Soil size per tree	Small tree 9m ³ (<5m Mature Canopy)
	Medium tree 35m ³ (<10m Mature Canopy)
	Large tree 150m ³ (>10m Mature Canopy)

TREE BASE TREATMENTS

Tree Pits	Decomposed granite, Mass Planting, WSUD
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STREET FURNITURE

Seat	Contemporary Seat and Bench 1 & 2, Custom Designed Seating		N/A
Bubbler	N/A	Contemporary Bubbler	N/A
Rubbish Bin	N/A	Contemporary Rubbish Bin	N/A
Bike Rack	N/A	Contemporary Cycle rack, 'O' Ring attached to pole	N/A
Barrier	TfNSW Barrier	TfNSW Barrier	N/A
Telephone	TELSTRA		
Bus Shelter	Existing Bus Shelter	Contemporary Bus Shelter	Existing Bus Shelter

LIGHTING

Street Lighting	Ausgrid Lighting		
Pedestrian Lighting	N/A	Pedestrian Street Light on Stand-alone Pole	N/A

Table D.15 Local area material application table

D.3 Materials for a Sustainable Public Domain

Performance Specification

This section outlines best practice guidelines for the design, procurement, construction and maintenance of public domain elements. The following performance specifications form the basis of using sustainable practices and materials and assist throughout the life-cycle of the public domain.

Practices for Sustainable Sites

The following are key best practices, which where possible should be incorporated into the design, construction and maintenance of a sustainable public domain:

Materials or Products That Reduce Resource Use

- Use no new materials, don't rebuild;
- Reuse existing structures in place;
- Reduce materials use;
- Use durable materials;
- Reclaim and reuse materials or products in the whole form;
- Use reclaimed material from other sources;
- Reprocess existing structures and materials for use on-site;
- Use reprocessed materials from other sites;
- Specify materials and products with reuse potential and design for disassembly;
- Specify recycled-content materials and products;
- Use materials and products with recycling potential;
- Specify materials and products made from renewable resources; and
- Specify materials or products from manufactures with product take-back programs.

Materials or Products That Minimise Environmental Impacts

- Use sustainably harvested or mined materials;
- Use certified wood;
- Use minimally processed materials;
- Specify low embodied energy materials;
- Specify materials produced with energy from renewable sources;
- Use local materials;
- Specify low-polluting materials; and
- Specify low-water-use and low-water-polluting materials.

Materials or Products That Assist with Sustainable Site Design Strategies

- Products that promote a site's hydrological health;
- Materials and products that sequester carbon;
- Products that reduce the urban heat island effect;
- Products that reduce the energy consumption of site operation;
- Products that reduce the water consumption of site operations.

Sustainable Material Performance

Concrete

As the world's most frequently used construction material, concrete also rates as one of the worst contributors to greenhouse gas emissions. Sustainable use of concrete in construction should consider:

- Efficient structure design to reduce material volume
- The mix of fly ash and other alternatives
- Substituting natural aggregate with recycled materials
- Efficient reinforcing and alternative materials

Earthen Materials

Often easy to source locally and flexible use cases across a project, including reusing existing site materials, earthen materials are sustainable construction materials and should be considered for structural use. Construction methods include adobe bricks, compressed earth blocks, rammed earth, cob, and earth-bags. Additionally, consider the technical performance of earthen structure finishes and waterproofing.

Masonry

Traditionally, clay bricks materials have a high embodied energy. However, a considered approach to the life cycle of bricks can improve the sustainability of the material. With the potential to be used in more than one project. When using bricks, consider the following:

- Efficient wall design to reduce quantities
- Cement mortar efficiency and cement mix
- Possible second life of brick after the current project
- Using recycled bricks

Asphalt

Asphalt, an impermeable co-product of petroleum production and comprised of heavy hydrocarbons, can negatively impact both environmental and human health. Considerations to reduce the environmental impacts of asphalt include:

- Using warm or cold-mix asphalt
- Using recycled aggregates and/or reclaimed asphalt
- Using high-albedo paving materials and/or surfaces

Alternatives to asphalt as a surface vary, including other materials in this section, or permeations of their use such as porous asphalt or permeable paving.

Wood and Wood Products

Although inherently a natural renewable resource, wood as a sustainable material is only as good as its supply chain and processing. Consider the following when using wood:

- Use the lowest grade of wood for application
- Build smaller and more efficiently
- Build for disassembly
- Use of recycled wood or engineered wood products
- Use FSC certified wood
- Use natural low-volatile organic compound finishes

Metals

Due to the multiple stages of raw materials acquisition and processing, metals have a generally high level of embodied energy. However, it can be an efficient structural material which can be reused or recycled. The various properties of metals and alloys impact not only their sustainability but their weathering and durability performance. Sustainable finishes practices should be used, such as factory finishing and specifying powder coating over solvent-based coatings.

Plastics and Rubber

Plastics fill a unique role construction, with potential uses as both a construction material such as pipe, or secondary product such as plastic packaging of other materials. A holistic approach to sustainable site management is essential to a truly sustainable project. Projects should reduce plastic use in construction and where possible reuse and recycle. When using plastics, consider the type of plastic to have the lowest environmental and human health impacts as possible, and their ease of recycling.

Biobased Materials

Produced from organically based renewable animal and plant parts, biobased materials are a more sustainable alternative than petroleum-based materials. Common biobased materials include jute, coir, straw and recycled organic fibres for erosion control, revegetation and mulching. Another is bamboo and bamboo-based products which have various structural and non-structural applications. Biobased materials have applications in other materials mentioned in this part as sustainable substitutes in part or whole.

D.4 Public Domain Water Sensitive Urban Design

The Water Cycle of Hornsby

Dominated by the Hawkesbury River catchment, Hornsby Shire displays common characteristics of shires within the Sydney Basin and Metropolitan Region, refer Figure D.1. Such characteristics include hydrological influences from both natural inputs; rainfall, rivers, and aquifers, and human inputs; piped potable water, urban and industrial run-off, treated and untreated sewage. Water within Hornsby drains into either the Hawkesbury River catchment or Lane Cove River catchment. The topography of Hornsby Shire has been carved throughout its geological history resulting, in the deposition of alluvial soils to most of the Shire, refer Figure D.9. The combination of topography, soil types and development within the Shire has resulted in the vegetation communities remaining in most difficult to develop areas refer Figure D.10.

Hornsby's water uses are diverse, combining urban, suburban and agricultural. This diverse use of water requires a considered approach to water treatment to reduce negative impacts on the environment and damage to property. The peri-urban waterways are strongly valued by the community and contributing to the outdoor lifestyle and environmental identity. With an average rainfall of 1229mm, Water Sensitive Urban Design is crucial to supporting a sustainable environment and protecting land and marine flora and fauna.

Hawkesbury River Catchment

The Hawkesbury River catchment is a dominantly tidal drowned valley estuary with an open entrance at Broken Bay. The majority of the Hornsby Shire resides within the catchment to the exception of the lower portion south of Pennant Hills Road draining into the Lane Cove River catchment. The catchment shares Hornsby Shire's boundary along Castle Hills Road, which borders the Parramatta River catchment located within The Hills Shire Council local government area. Of the key projects addressed in this document, Asquith, Waitara and West Pennant Hills are entirely located within the Hawkesbury River Catchment, including the northwestern half of the Thornleigh project area, refer Figure D.1.

Lane Cove River Catchment

The Lane Cove River catchment is a dominantly tidal drowned valley estuary with an open entrance connecting into the Parramatta River and Upper Sydney Harbour. The catchment area totals 95.4 km², of which approximately the upper third is located within Hornsby Shire Council. Within Hornsby Shire Council the catchment is bounded by the Cumberland Highway/ Pennant Hills Road to the north-west, M2 Motorway to the south-west, and the Pacific Highway to the northeast. Of the key project areas addressed in this document, Beecroft is located wholly within the catchment, including the southeastern half of the Thornleigh project area, refer Figure D.1.



Image D.7: Berowra Creek, Berowra National Park, a tributary of the Hawkesbury River

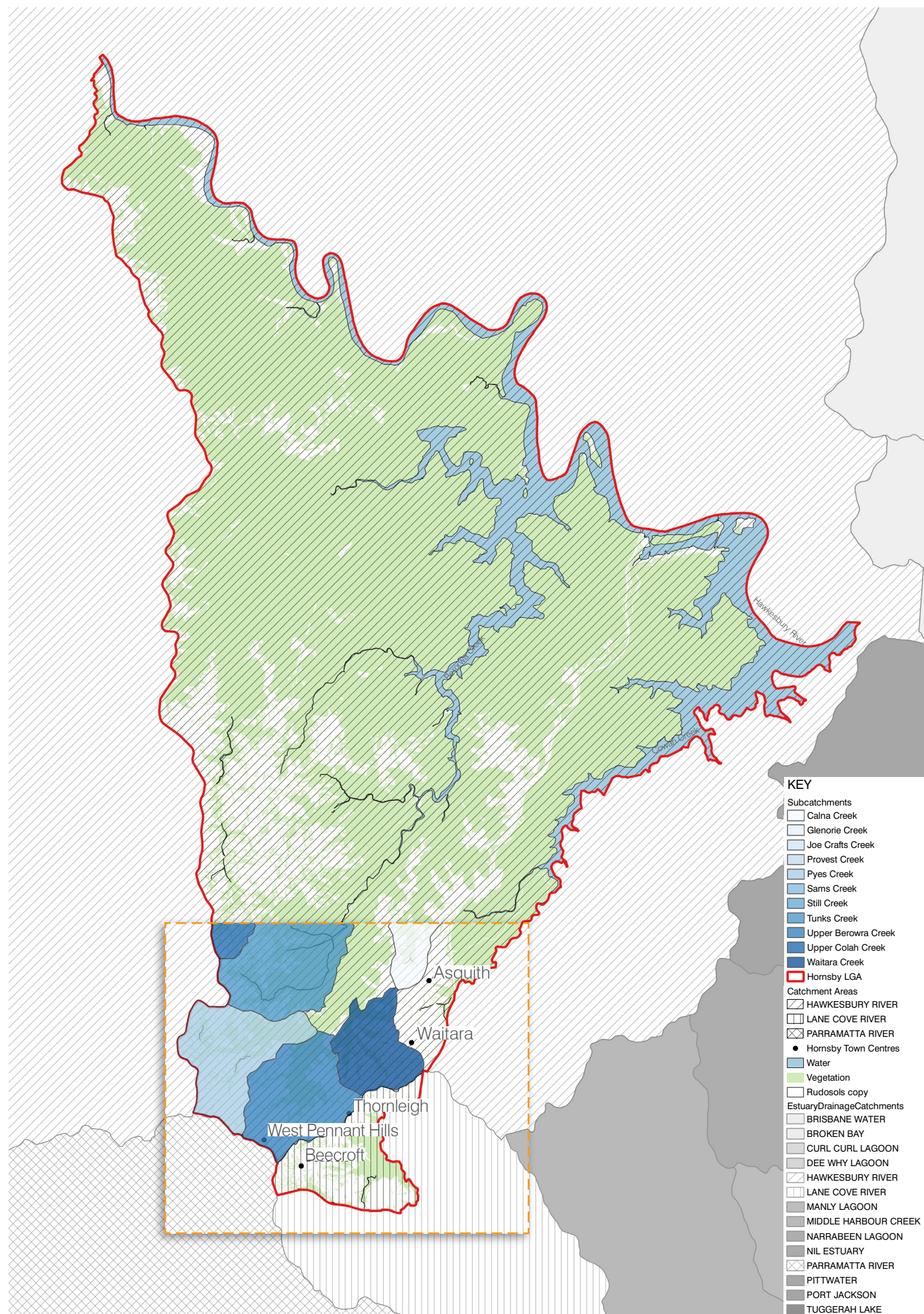


Figure D.1 Hornsby Catchments

Water Sensitive Urban Design

The increasing proportion of hard surfaces in urban areas has increased rainwater runoff, putting pressure on stormwater networks while transporting chemicals and toxic materials directly into natural water systems.

Water Sensitive Urban Design (WSUD) is an essential tool in urban design which serves the purpose of capturing, treating and reusing stormwater before it has the chance to pollute and degrade our creeks and rivers.

The following section provides design guidance during the upgrading of existing infrastructure as well as the introduction of new infrastructure, as well as the application of different WSUD devices. Read this conjunction with the Hornsby Shire Council WSUD Guidelines.

Key benefits of WSUD include:

- Reducing the volume of stormwater runoff;
- Improving the quality of stormwater runoff;
- Assisting the restoration and protection of creeks and rivers;
- Improving biodiversity;
- Improving the appearance of streets and parks; and
- Reducing the urban heat island effect through the increased tree canopy and reduced hard surfaces.

Types of WSUD applicable to the Hornsby public domain areas include:

- Tree pits;
- Tree pit with storage;
- Street tree with storage;
- Bio-retention systems (raingarden);
- Permeable pavers;
- Passive irrigation;
- Gross Pollutant Trap (GPT);
- Rainwater harvesting; and
- Stormwater harvesting.



Image D.8: Example of WSUD device Dyuralya Square, Waterloo

WSUD Elements and Scenarios in the Public Domain

The following section acts a supplementary guide to the WSUD elements and scenarios to which they apply further those in the Hornsby Shire WSUD Reference Guidelines, as relevant to the public domain areas covered in these guidelines.

The proposed scenarios and elements identified across the following pages include rooftop water and general runoff collection for use in passive irrigation of public domain trees and planting. While these scenarios are provided as guidance each situation will have site specific design requirements.

Scenario # 1: No adjustment to existing roadway or footpath:

Tree pits or street trees with passive irrigation typically require means for drainage (to avoid waterlogging the tree) such as a subsoil outlet connection to the stormwater pit and pipe network. Thus it may be preferable for trees to be planted in the existing verge or in small areas of 'cut' in the roadway (noting use of street trees rather than tree pits). In these instances, consider how to improve plant health through passive irrigation which is dependant on in situ soil type such as:

- Sandy or high infiltration (top 100mm has infiltration rate of >20mm/hr) = no need for subsoil drainage/outlet
- Clayey or low infiltration: either subsoil drainage outlet pipe OR plant tree ball above the extended detention zone.

Refer Figure D.2 for typical detail.

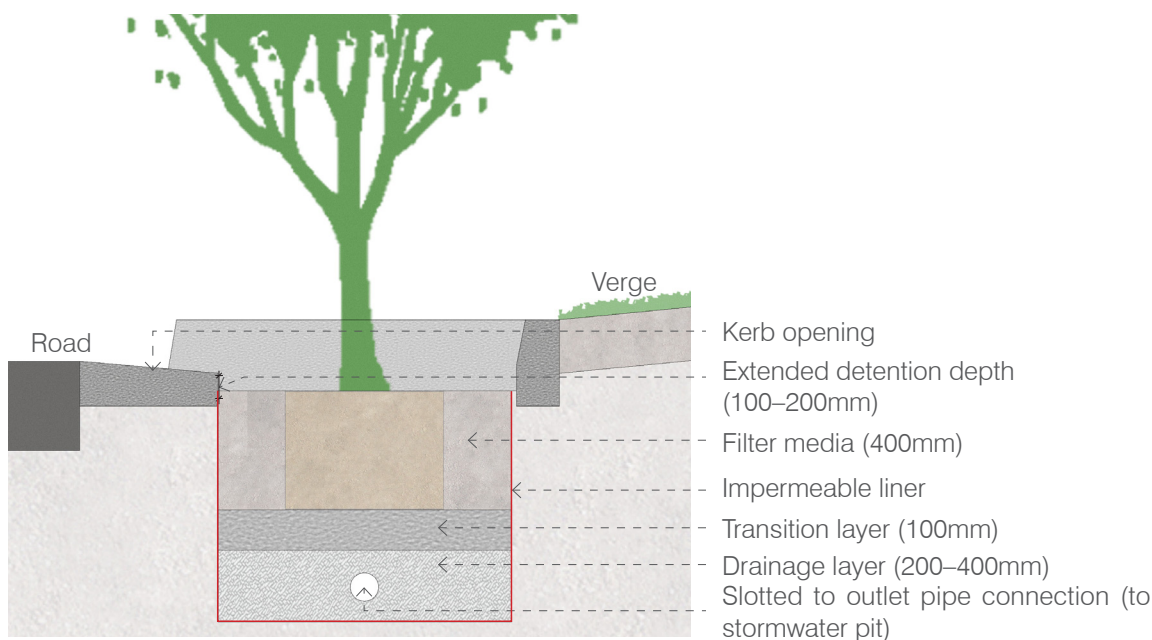


Figure D.2 Scenario 1 – Tree pit with kerb opening – Section

Scenario # 2: New or adjusted roadway or footpath:

New or adjusted roadways or footpaths are an ideal opportunity to construct more comprehensive street tree systems with well developed passive irrigation as there is a corresponding disturbance to surrounding surfaces and likely earthworks involved. In this instance, there are more options with regards to WSUD elements that can be installed, with some more appropriate depending on particular site and catchment characteristics, as follows:

- The first preference is to construct a streetscape bio-retention system (providing the greatest improvement to water quality) either a standalone vegetated bio-retention system for catchments >500m² (e.g. blister or set back in verge) or a tree pit for smaller road catchments.
- Street trees with structural soil storage (primarily if poor drainage in natural soils) this provides enhanced passive irrigation through the inclusion of a storage cell adjacent or below the tree planting. Various configurations depend on street composition but are most appropriate in locations where there are significant changes to the roadway or footpath due to earthworks. There is greater ease in installing drainage of these systems, which improves their performance. Refer Figure D.3 and Figure D.4 for typical detail and plan.

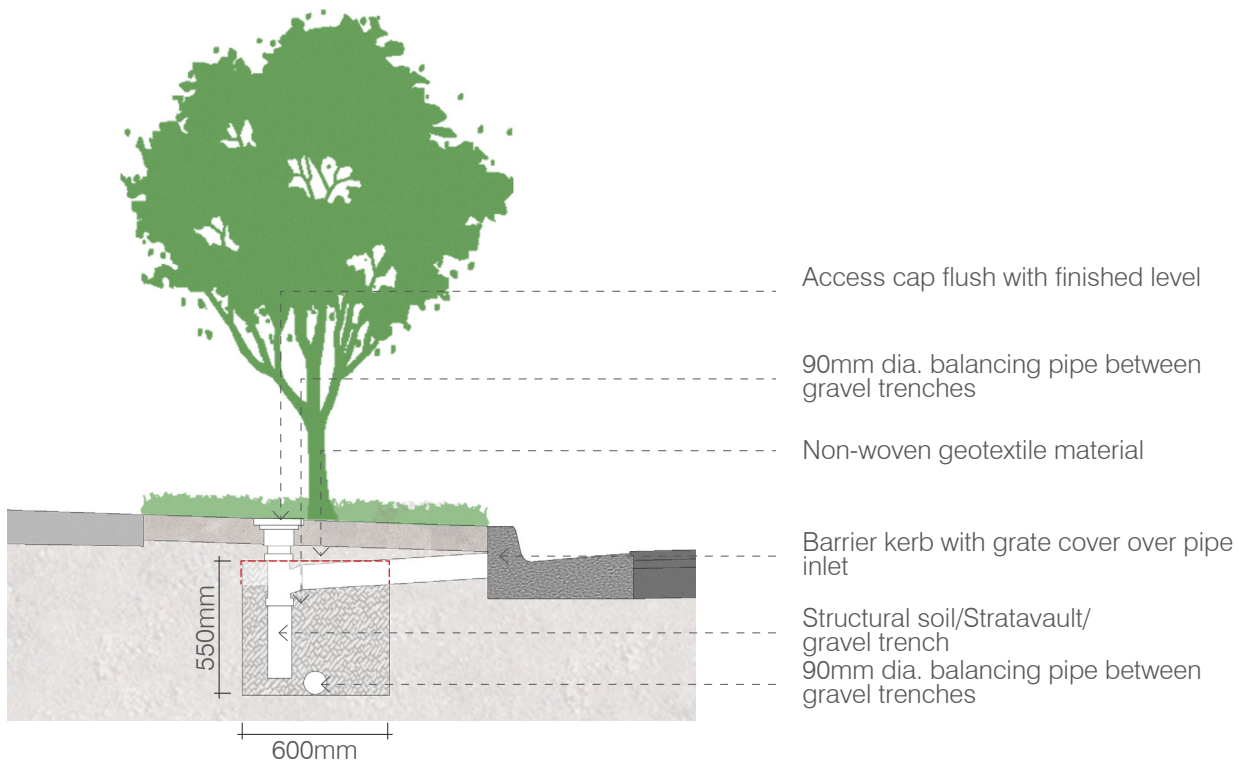


Figure D.3 Scenario 2 – Gravel trench (kerb inlet diversion)
– Section

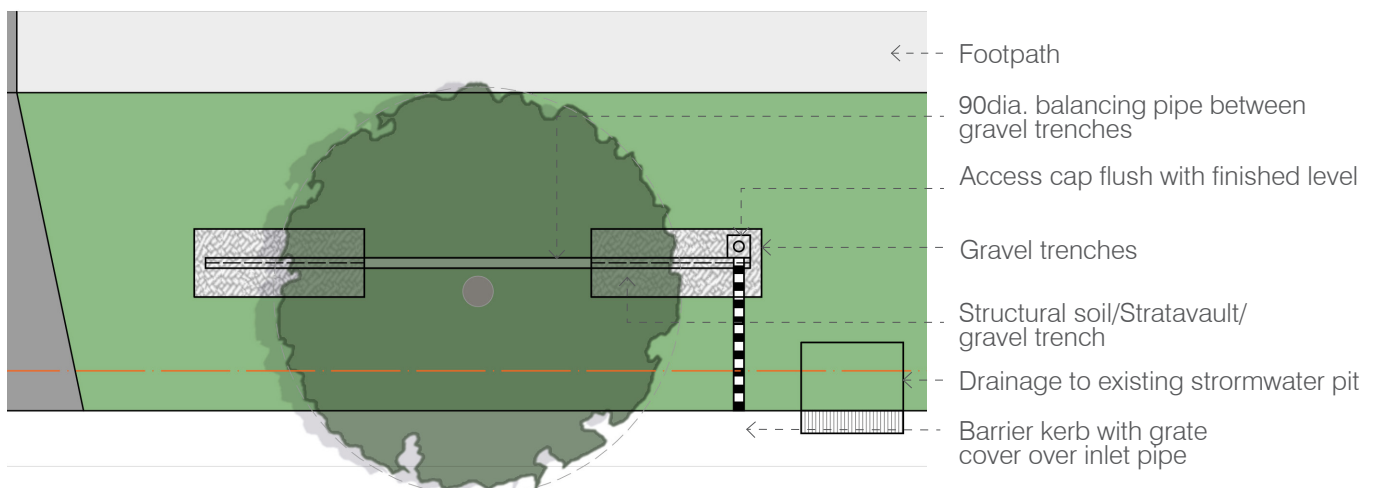


Figure D.4 Scenario 2 – Soil storage (downpipe diversion) – Plan

Scenario # 3: Building runoff and permeable paving in civic centres:

Permeable paving can be used to both improve infiltration of a site and also serves as a visual marker for a changed surface and use (e.g. pedestrian zone in the plaza). However, it may not be the preferred finished surface for all sites and does impose a higher maintenance demand, but it is the most effective in the form of pavement infiltration. Thus, the following guides on how to incorporate permeable paving and how its use influences other WSUD elements.

- Permeable paving increases infiltration to the subsurface, especially in areas of higher infiltration capacity (locations with sandy soils are most appropriate to incorporate permeable paving). When installing permeable paving in locations of high infiltration, tree plantings do not require additional grading of the surface to direct runoff to them, or additional subsurface storage or drainage, for passive irrigation. Refer Figure D.5.

- When not using permeable paving, and concrete paving are installed, there should be consideration of design options to create passive irrigation of trees, significant planted areas and turf. As an alternative, consider the following options should:
- Grading of surrounding surfaces to direct runoff to green spaces.
- Installation of structural soil for water storage.
- Connection of nearby building roof drainage to a subsoil drainage connection to tree plantings (with allowance for design of diversion of low flows only or inclusion of high flow bypass) refer Figure D.6 and Figure D.7.

Note the above options may require an outlet subsoil drainage connection to the stormwater infrastructure to allow drainage and prevention of waterlogging most notably in poor drainage soils such as clays (typical of the Hornsby Local Government Area).

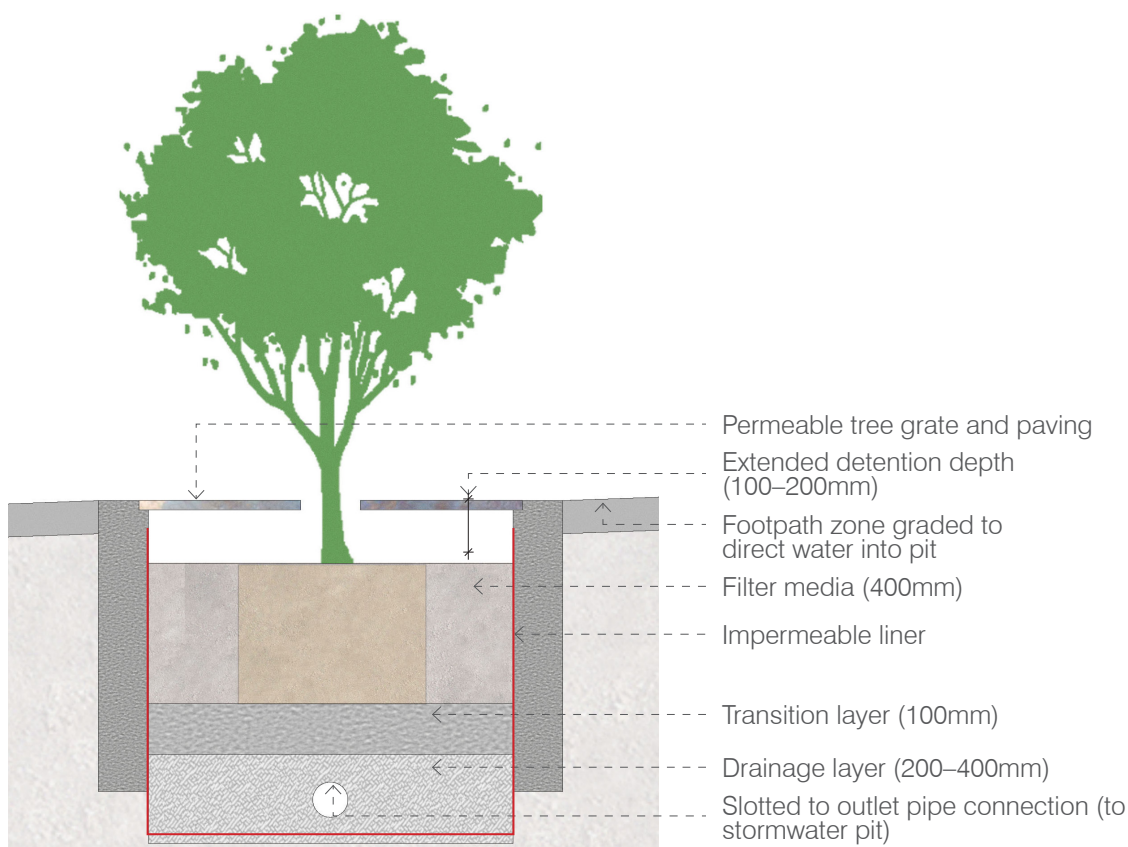


Figure D.5 Scenario 3 – Tree pit in footpath zone – Section

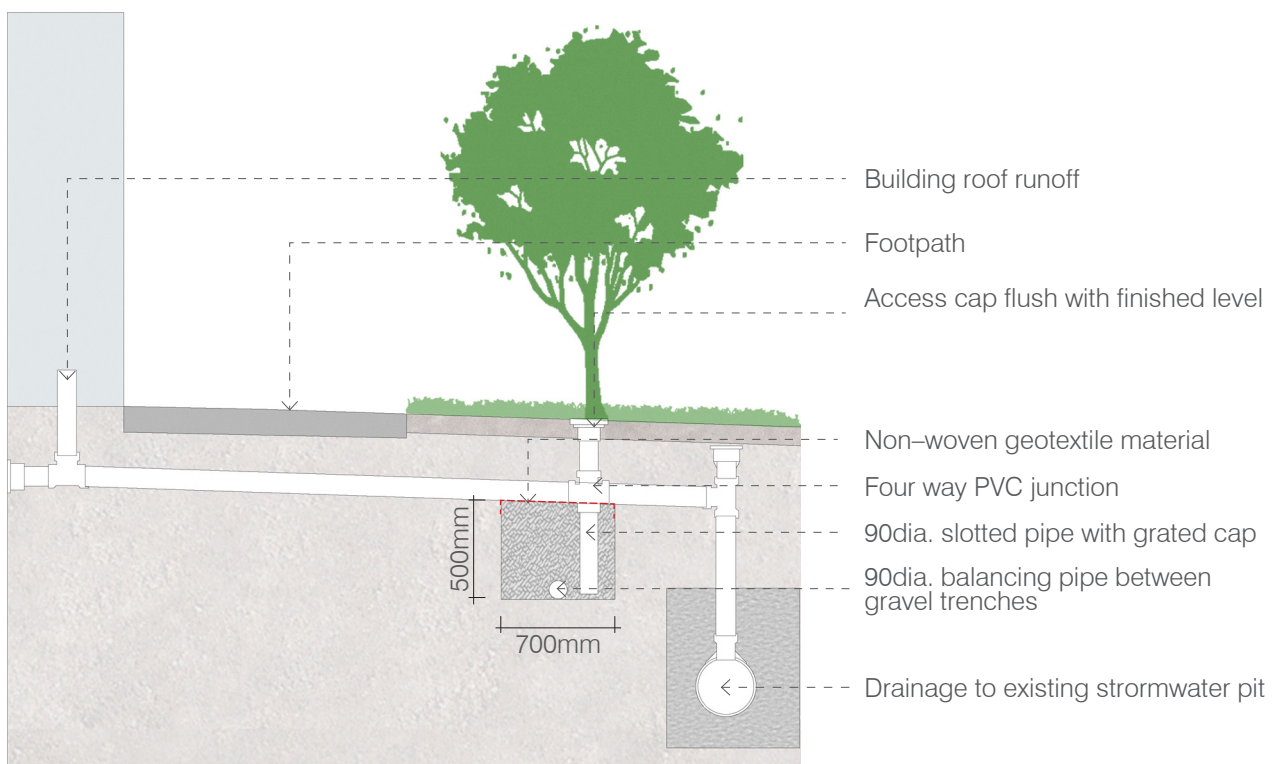


Figure D.6 Scenario 3 – Soil storage (downpipe diversion) – Section

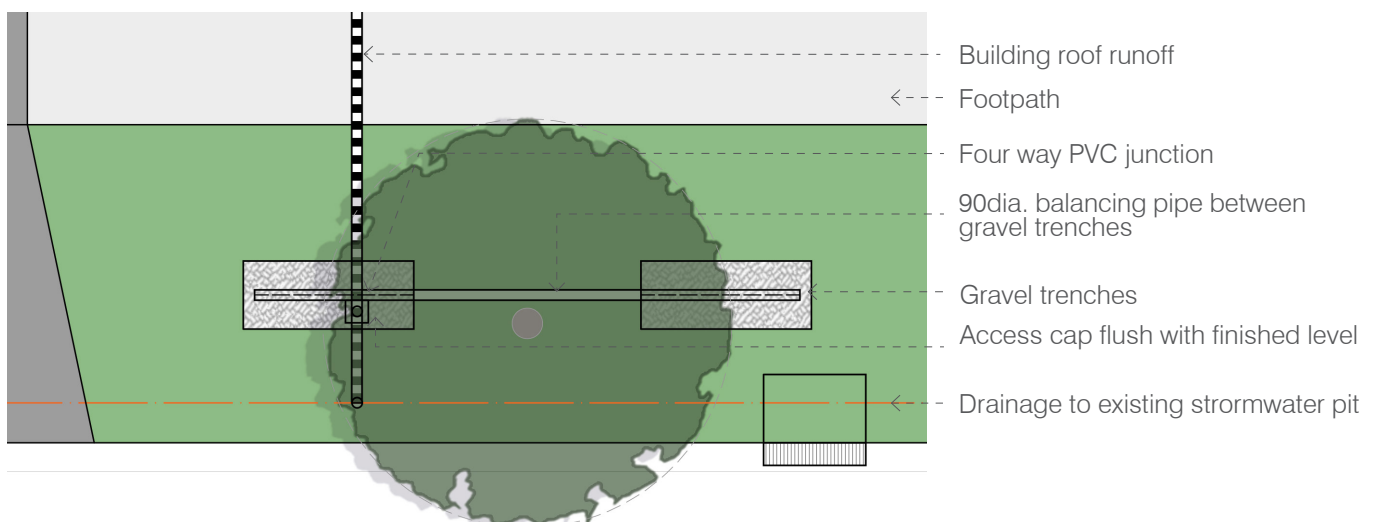


Figure D.7 Scenario – Soil storage (downpipe diversion) – Plan

WSUD Element Selection

The following decision tree and table aim to guide the process of selecting an appropriate selection of WSUD elements within the different public domain areas.

The decision tree, refer Figure D.8 below, shows the parameters of selecting and use of either street trees or bio-retention cells for existing, new and upgraded footpaths.

In addition to this, a matrix is provided, refer Table D.16, to guide the application of the WSUD elements, identifying the nine applicable WSUD elements and their use across eight public domain and streetscape situations.

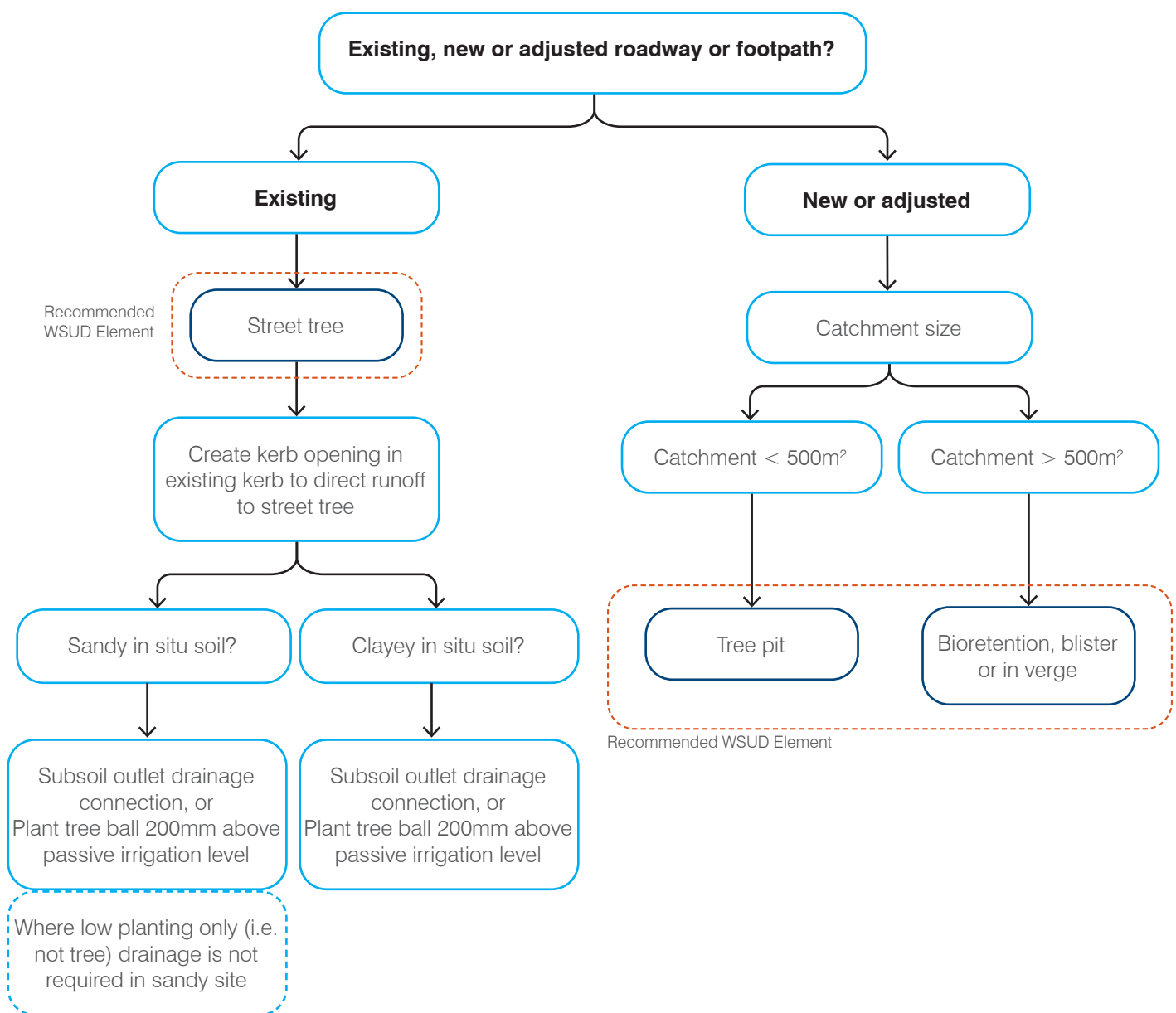


Figure D.8 Street tree bioretention decision tree

WSUD Element Application

	Footpath/ verge new	Footpath/ verge existing	Carpark	Street parking
Tree pit	Ideal to incorporate	Ideal to incorporate	Ideal in buffer zones between rows of car spaces	Ideal as breaks between car spaces
Tree pit with storage	Combine with passive irrigation	Combine with passive irrigation	Combine with passive irrigation	Combine with passive irrigation
Street tree with storage	Combine with passive irrigation	Combine with passive irrigation	Combine with passive irrigation	Combine with passive irrigation
Bio-retention system (raingarden)	Streetscape blisters or set back in verges	Streetscape blisters or set back in verges	Linear bio-retention, blisters	Streetscape blisters
Permeable pavers	Use in pedestrian zones. Combined with tree pits or facilitate passive irrigation	-	Use mitigation measures to reduce pollution loads and main permeability	Use mitigation measures to reduce pollution loads and main permeability
Passive irrigation	Kerb openings for vegetated median strips. Combine with tree pits with storage	Kerb openings for vegetated median strips	Kerb openings for vegetated median strips	Kerb openings for vegetated median strips
GPT	Use as required	Use as required	Use as required	Use as required
Rainwater harvesting	-	-	-	-
Stormwater harvesting	-	-	Ideal for use at car park perimeter	-

Table D.16 WSUD Element application

	Roadway (centre)	Plaza	Park/ open space	Buildings	Recommended location
Tree pit	Linear systems (with trees) where road is being regraded direct road grade to centre	Use of formal grated 'lid' to minimise land take. Combine with passive irrigation	-	-	Asquith Beecroft Waitara Thornleigh
Tree pit with storage	-	Combine with passive irrigation	Combine with passive irrigation if nearby source of runoff	-	Asquith Beecroft Waitara Thornleigh
Street tree with storage	-	Combine with passive irrigation	-	-	West Pennant Hills
Bio-retention system (raingarden)	Linear systems where road is being regraded direct road grade to centre	Larger systems (>10m ²) ideal in parks and open spaces	Larger systems (>10m ²) ideal in parks and open spaces	-	Asquith Beecroft Waitara Thornleigh West Pennant Hills
Permeable pavers	-	Use in pedestrian zones. Pavers also create visual separation in zoning/use.	-	-	Asquith Beecroft Thornleigh West Pennant Hills
Passive irrigation	Kerb openings for vegetated median strips	Surfaces can be graded to feed adjacent green spaces or 'formal' tree pits	-	Roof drainage to passive irrigation of trees and veg plantings.	Asquith Beecroft Thornleigh West Pennant Hills
GPT	Good location for GPT maintenance access	-	Good location for GPT maintenance access with formal track	-	Waitara
Rainwater harvesting	-	-	-	Rainwater tank to collect runoff -Internal reuse (toilet flushing) -Irrigation of planted areas	Thornleigh West Pennant Hills
Stormwater harvesting	-	-	-	-	Waitara

*Refer Hornsby Shire Council Water Sensitive Reference Guidelines

D.5 Public Domain Green Infrastructure

Hornsby Shire Biodiversity

Spanning more than 7,500,000 square kilometres the Australian continent possesses a unique biological diversity (referred to hereafter as 'biodiversity') distributed across thirty-three degrees of latitude from the tropics in the north to Tasmania in the south. Across the breadth of this island continent Steffen estimates that Australia comprises between seven and ten per cent of the world's total species, including approximately 200,000 terrestrial species, many unknown to science and significantly endemic. This means that in ecological terms Australia is globally important.

The Hornsby LGA possesses a high degree of biodiversity. This can be attributed to the diversity of habitats within the LGA, as well as the high percentage of vegetation cover – or bushland – within large and representative protected areas, council reserves on lands managed by other agencies (i.e. RMS) and private properties. This biodiversity is a significant and defining feature of the 'Bushland Shire' and one that requires safeguarding for future generations. It also offers an enduring connection and is of continued significant place to the area's Indigenous people to practice their culture.

Indeed, the Hornsby Shire's bushland provides life-sustaining benefits to humans through the transformations of resources (or environmental assets, including land, water, vegetation and atmosphere) into a flow of essential goods and services (e.g. clean air, water, and food). These ecosystem services are therefore critical for maintaining the health and wellbeing of Hornsby citizens.

Importance of Bushland Across Our Shire

The role of bushland and waterways in making our urban areas more liveable and supporting biodiversity cannot be overstated. Urban habitat that is well-preserved, maintained, and connected contributes to making NSW a healthier, more enjoyable, and prosperous place to live. Biodiversity loss is one of the greatest threats worldwide and needs attention. Despite the pressures of urbanisation on biodiversity, green places in urban areas can be home to a significant number of species, offering biodiversity protection and nature experience for people.

Green infrastructure planning and design seeks to contribute to biodiversity conservation by providing habitats or establishing connections between habitats and populations. It is imperative that we support biodiversity networks from large areas such as national parks and forests to networks within more built-up urban systems. Urban biodiversity is more than just threatened species – it is all the plants, animals, and microorganisms that live in our cities. Biodiversity can exist in our streets, in our gardens, in brownfield sites, and in other unexpected places.

Rethinking infrastructure

Green infrastructure offers a broad range of ecosystem services and benefits, has a variety of types and operates over a range of spatial scales. Types of Green infrastructure may include designs at the continental scale; planning at the regional scale such as National Parks and large urban parks; and local scale including public places and waterfronts; down to the domestic, such as gardens, green roofs and other smaller scale green spaces. Increasing size and complexity Green infrastructure also offers a new approach to address environmental challenges and threats.

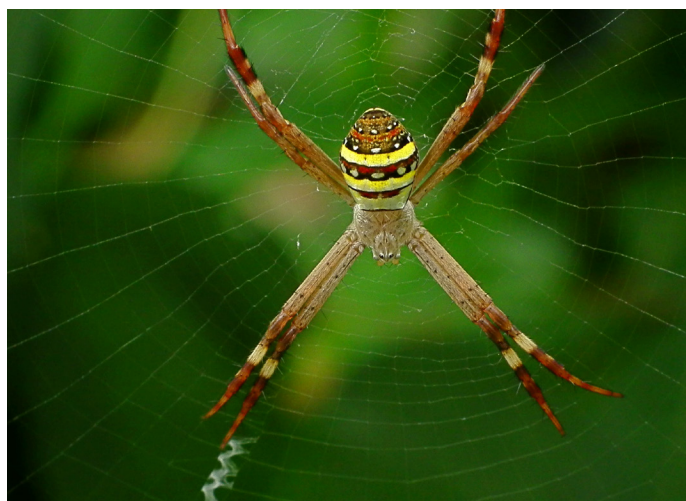


Image D.9: St. George's Cross spider



Image D.10: Australian Brush Turkey

Strategies for urban bushland

Council's (draft) Biodiversity Strategy promotes five key strategies to connect, protect, restore, enhance, and create urban habitat as an integral part of how urban areas are planned, constructed, and maintained. The strategies apply to remnant, transition, and urban environments that provide connections between core habitat. This approach recognises the important role of integrating nature into urban areas and the lives of people, not just protecting selected sites and landscapes.

1. Protect and conserve ecological values

The protection and conservation of existing remnant ecosystems is crucial to the prevention of further habitat and biodiversity loss and the viability of green infrastructure. Remnant ecosystems provide important habitat resources for urban biodiversity, and community access to natural landscapes.

2. Restore disturbed ecosystems to enhance ecological value and function

Where ecosystems have been disturbed, restoration is the preferred option to improve habitat structure and function and support biodiversity. Restoration not only includes bush regeneration and weed management in the reserve system, which is statutorily required, but also refers to urban habitat corridors where the built form as well as gardens, street verges, parks, and large institutional properties etc. can all play a role in improving habitat through the way they are designed and managed. Specific actions will vary depending on location; condition; identified values; past, current, and anticipated pressures; and what is feasible and practical.

3. Create new ecosystems

Where habitat linkages are needed within a corridor in areas devoid of habitat, new ecosystems can be created. Green infrastructure and water-sensitive urban design elements, such as green roofs, wetlands, and bioswales, can provide habitats and ecosystem services. More effective urban green spaces can be created when the improvement of the space considers multiple benefits at the design stage including improved economic, social, and environmental outcomes.

4. Connect people to nature

People connect with nature through sport, recreation, education, bushwalking, volunteer activities, and health-related activities. Daily exposure to nature can be improved using urban design features such as biodiverse green walls or street trees, and by providing infrastructure to facilitate access such as walking tracks, picnic areas, and lookouts. These connections are fundamental to benefit people but also the environment. Improving people's connection to nature may support longer term land management as people are motivated to care for and enhance their natural spaces.

5. Connect urban habitats

Species diversity and genetic health relies on the total area of habitat, proximity of habitats, and the capacity of species to move between habitats. Corridors allow plants and animals to recolonise areas where they have become locally extinct, so they can be enjoyed by future generations and have long-term viability. They also allow species to find alternative habitat in times of major disasters such as fire or flood and escape major threats such as clearing or disease. It is important to understand the existing network of green and blue habitats and their links. Where links between existing habitats are incomplete, approaches are needed that help to restore both corridor and steppingstone habitat connections. Urban green and blue grid corridors and networks can also provide a range of social benefits including improved recreation opportunities and neighbourhood destinations.

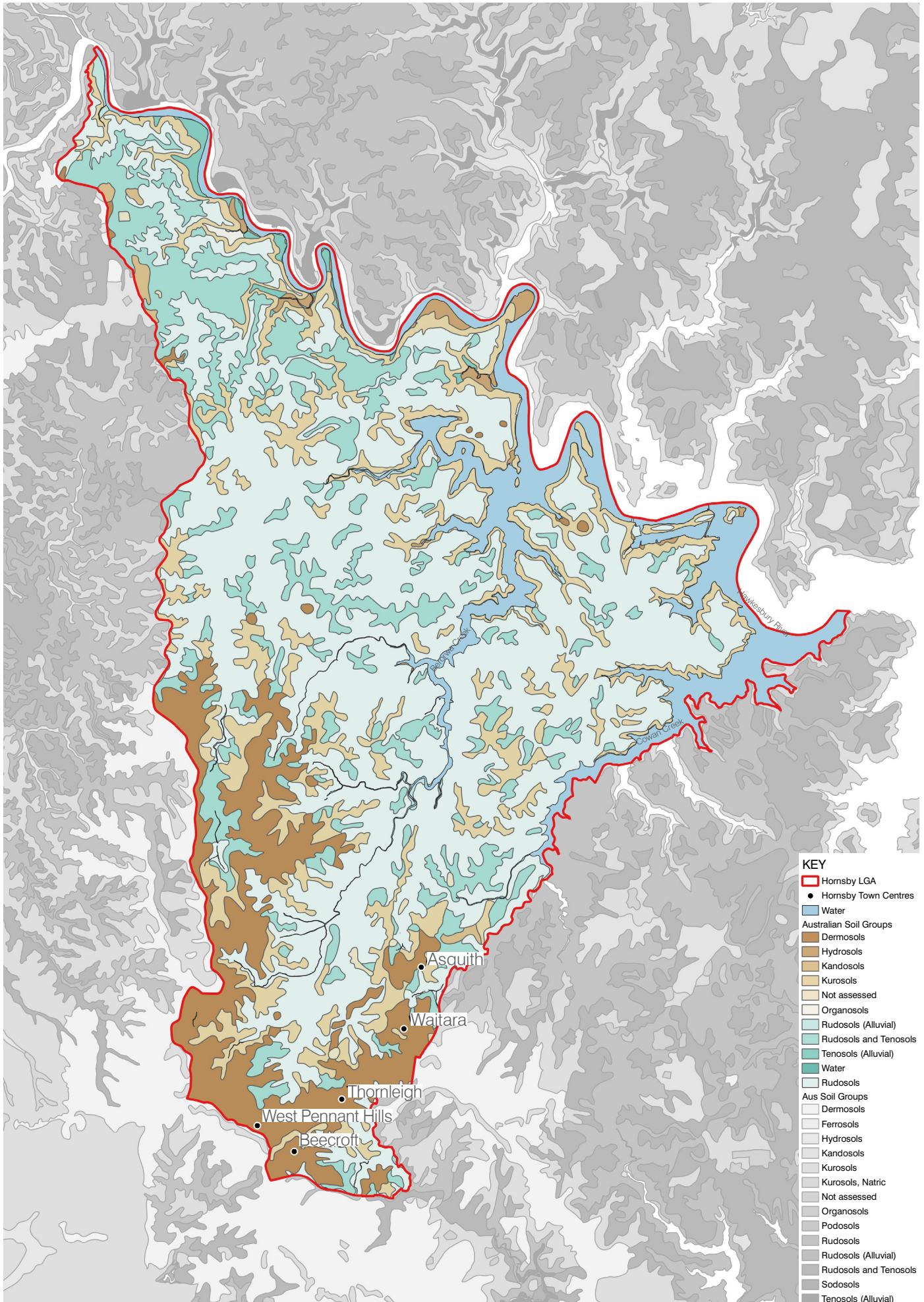


Figure D.9 Hornby soils typologies

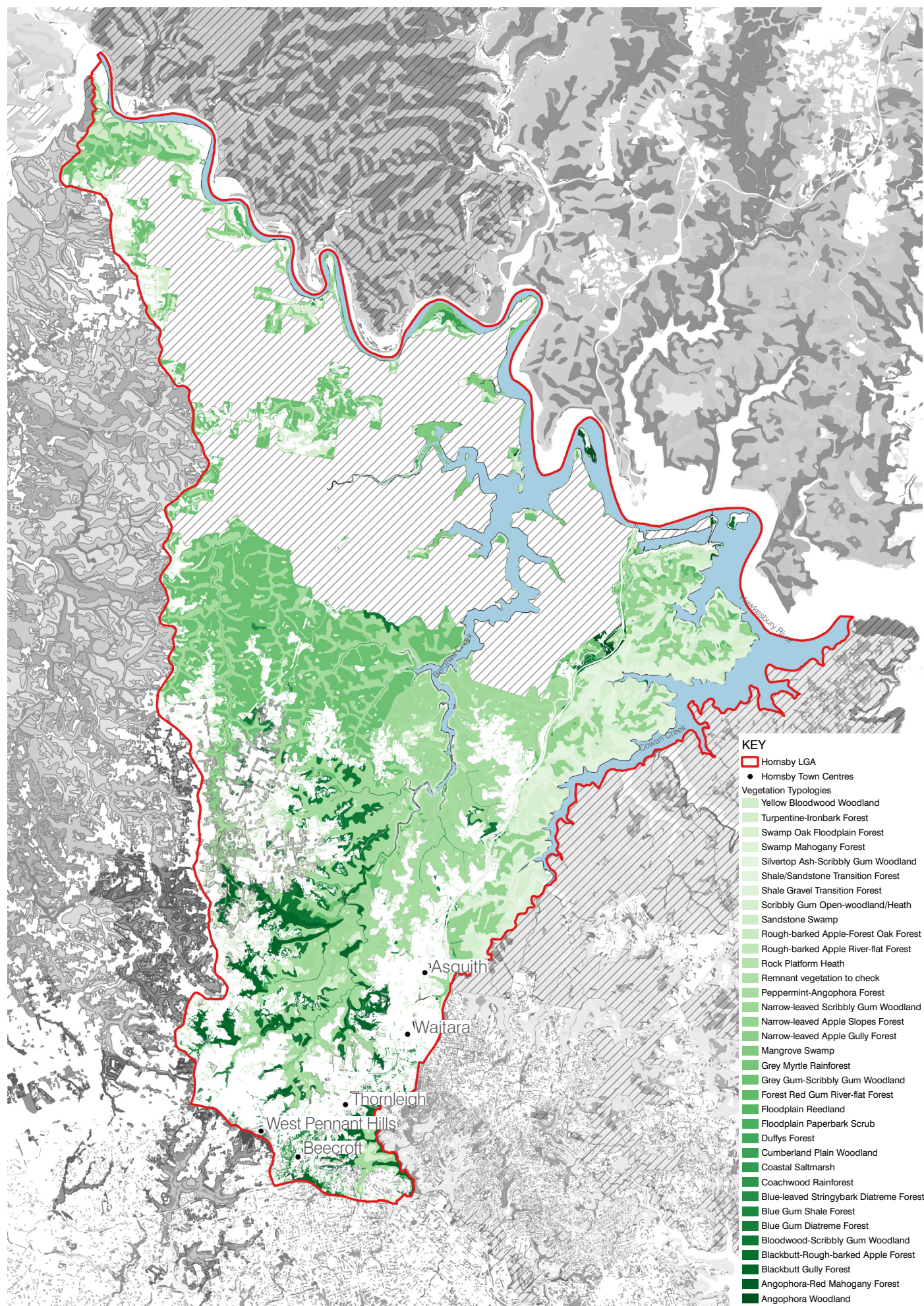


Figure D.10 Hornsby vegetation typologies

Tree species and plant selection

Street trees play an important role in the public domain at a micro scale on the street individual level up to the macro scale as an urban forest. The species selection of street trees should be informed by the existing conditions of the street and local area. However, the installation of trees can change and improve the quality and character of the street. A long-term vision is essential to realising an effective street tree program.

Key considerations when selecting a street tree species:

- Mature growth height and width of the canopy and trunk
- Minimum spacings between plantings based on canopy width
- Canopy cover and density and adjacent street elements such as building façades lighting and powerlines
- Frangibility of branches when planted directly adjacent carriageways
- Available soil volume base on mature tree size and ensuring there is adequate volume for the species selected
- Soil type and hydraulic conditions, and whether additional green or blue infrastructure can be installed to improve existing conditions

Botanical Name

Syncarpia glomulifera
Eucalyptus paniculata
Eucalyptus haemastoma
Corymbia gummifera
Acmena smithii
Banksia serrata
Ceratopetalum gummifera
Acacia floribunda
Allocasuarina torulosa
Elaeocarpus reticulatus

Common Name

Turpentine
 Grey Ironbark
 Scribbly Gum
 Red Bloodwood
 Lillypilly
 Old Man Banksia
 NSW Christmas Bush
 White Sallow Wattle
 Forest Oak
 Blueberry Ash

Note: All species are indicative only and subject to coordination with Council

PART E – Key Projects

E.1 Study Area Guideline Application

Study Areas

The following section demonstrates the application of the guidelines across five study areas. It provides overarching guidance to achieve a cohesive and high-quality public domain. Typologies and treatments are applied to specific areas to inform the implementation of future public works projects and public domain upgrades.

The following areas, as shown in Figure E.1, have been identified by Hornsby Shire Council to be study areas:

- Asquith (Town Centre, Mount Colah and Peats Ferry Road), refer Figure E.2
- Beecroft, refer Figure E.3
- Waitara, refer Figure E.4
- Thornleigh, refer Figure E.5
- West Pennant Hills, refer Figure E.6

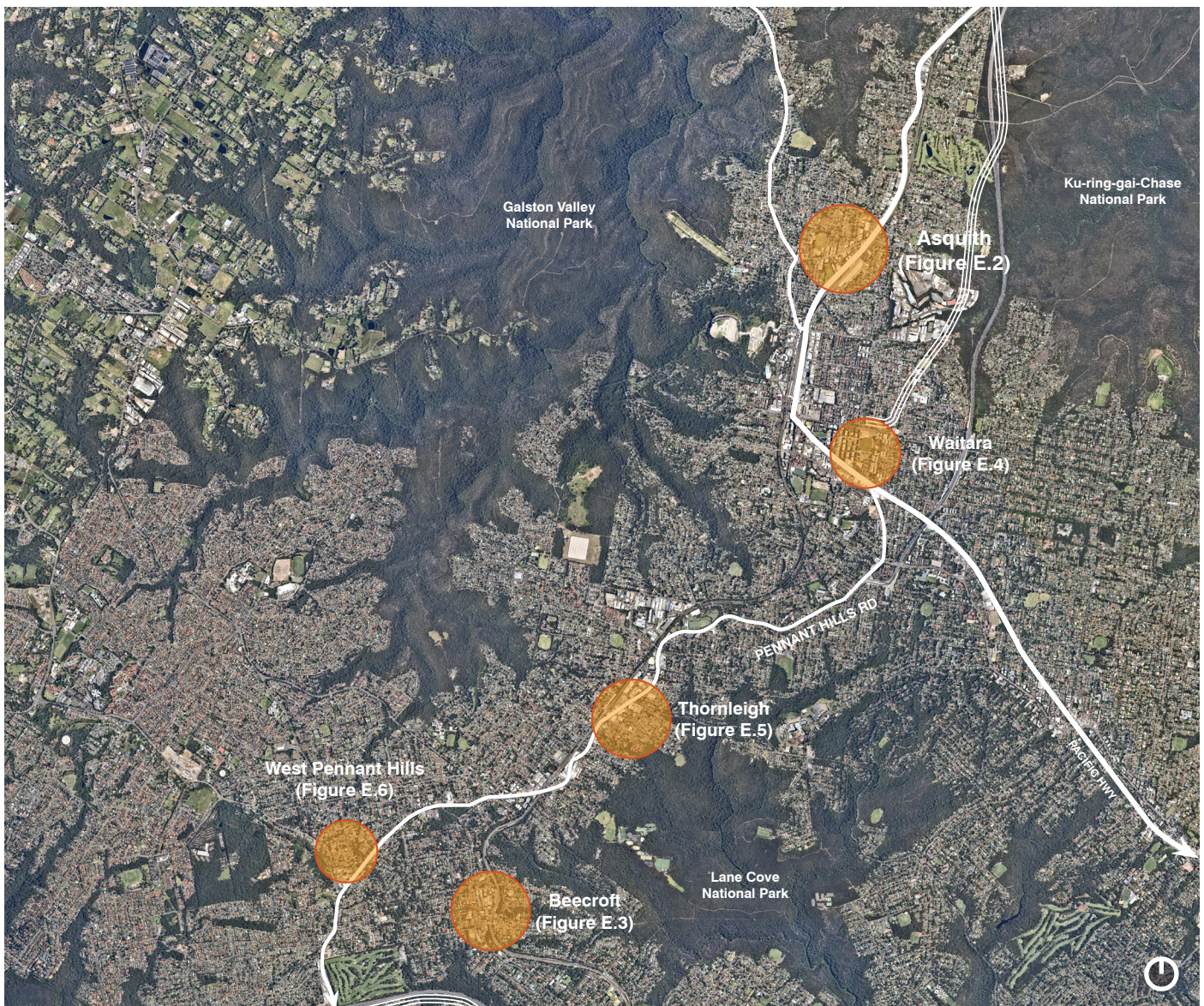


Figure E.1 Project locations across Hornsby

Legend ● Study Areas

Suburb Study Areas



Figure E.2 Asquith Study Area



Figure E.4 Waitara Study Area

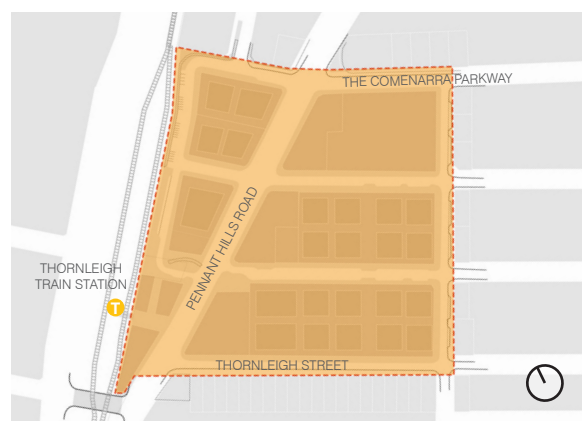


Figure E.5 Thornleigh Study Area

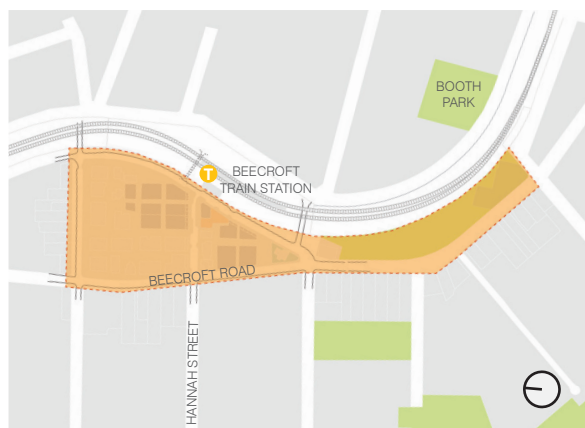


Figure E.3 Beecroft Study Area

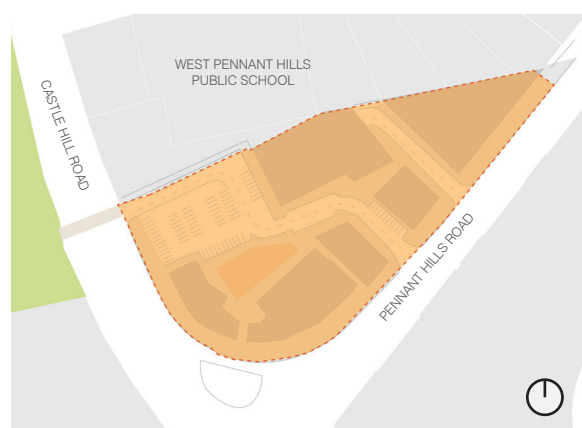
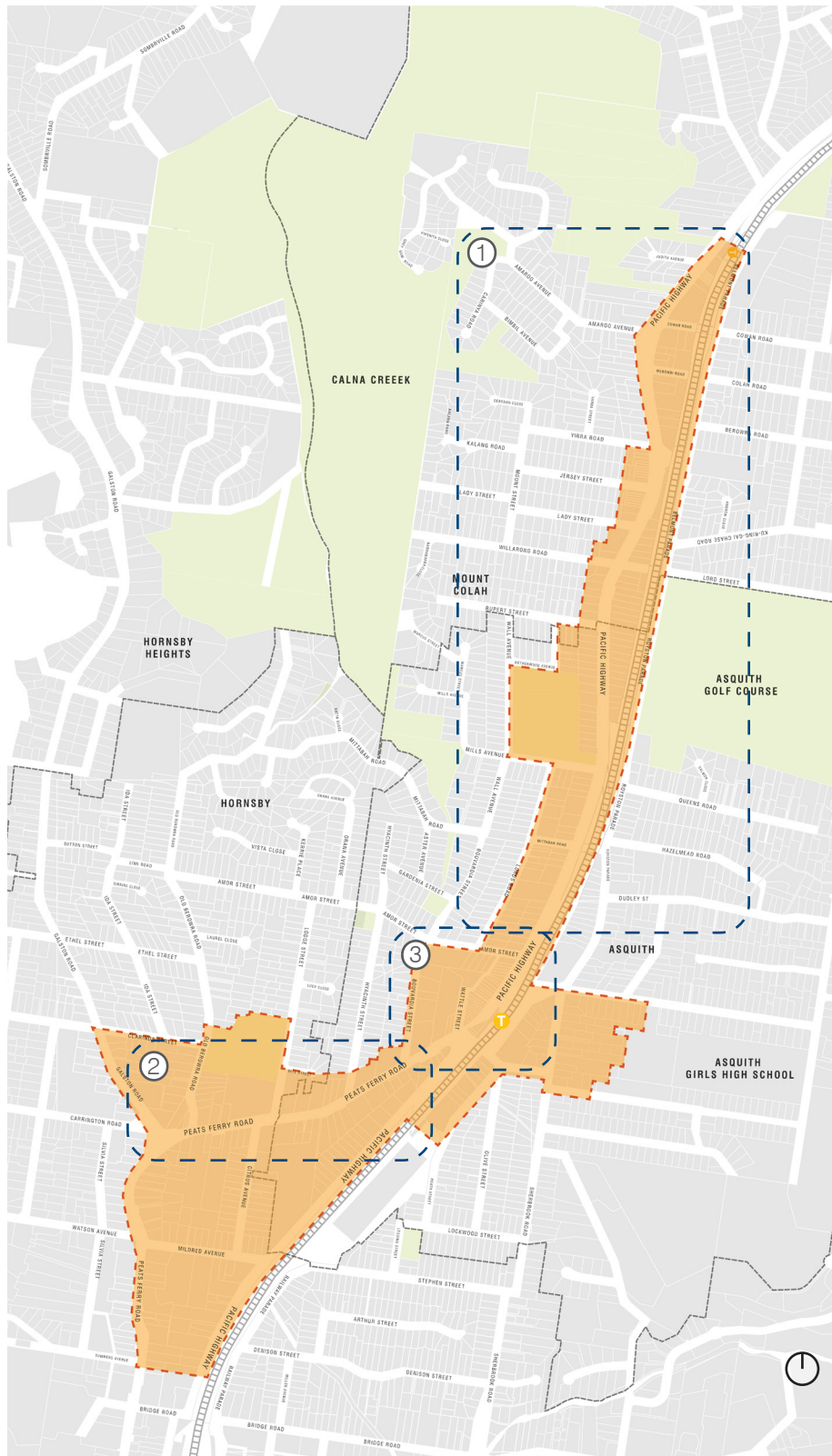


Figure E.6 West Pennant Hills Study Area

Legend ● Study Areas

Asquith

Study Areas



Within the Asquith study area are three smaller study areas, these are Mount Colah, Peats Ferry Road and Asquith Town Centre. These three study areas together create a revitalised pedestrian, cyclist, vegetation and commercial corridor from Hookhams Corner to Mount Colah train station.

The Mount Colah study area (1) focuses on upgrading the Pacific Highway from Amor Street to the Mount Colah train station. The upgrade improves the existing and new cycleway and footpath network, new street tree plantings and incorporated WSUD.

Similar to Mount Colah, the Peats Ferry Road study area (2) upgrade provides increased street tree canopy and WSUD. Additionally, new cycleway and pedestrian connections, upgraded footpaths and lighting create an enhanced and safe experience.

The Asquith town centre study area (3) provides a new public domain responsive to its future urban design creating a revitalised commercial and community hub. Four key projects provide upgrades to the public domain. The upgrades focus on a pedestrian-focused civic heart with greater pedestrian permeability and connections to the local footpath network and public transport. Commercial active frontages and outdoor dining are prioritised to create a vibrant public interface.

Study Areas:

- ① Mount Colah
- ② Peats Ferry Road
- ③ Asquith Town Centre

Legend

- Study Area
- Suburb Boundary
- Train Line
- Train Station

Figure E.7 Project locations across Asquith

Footpath Network

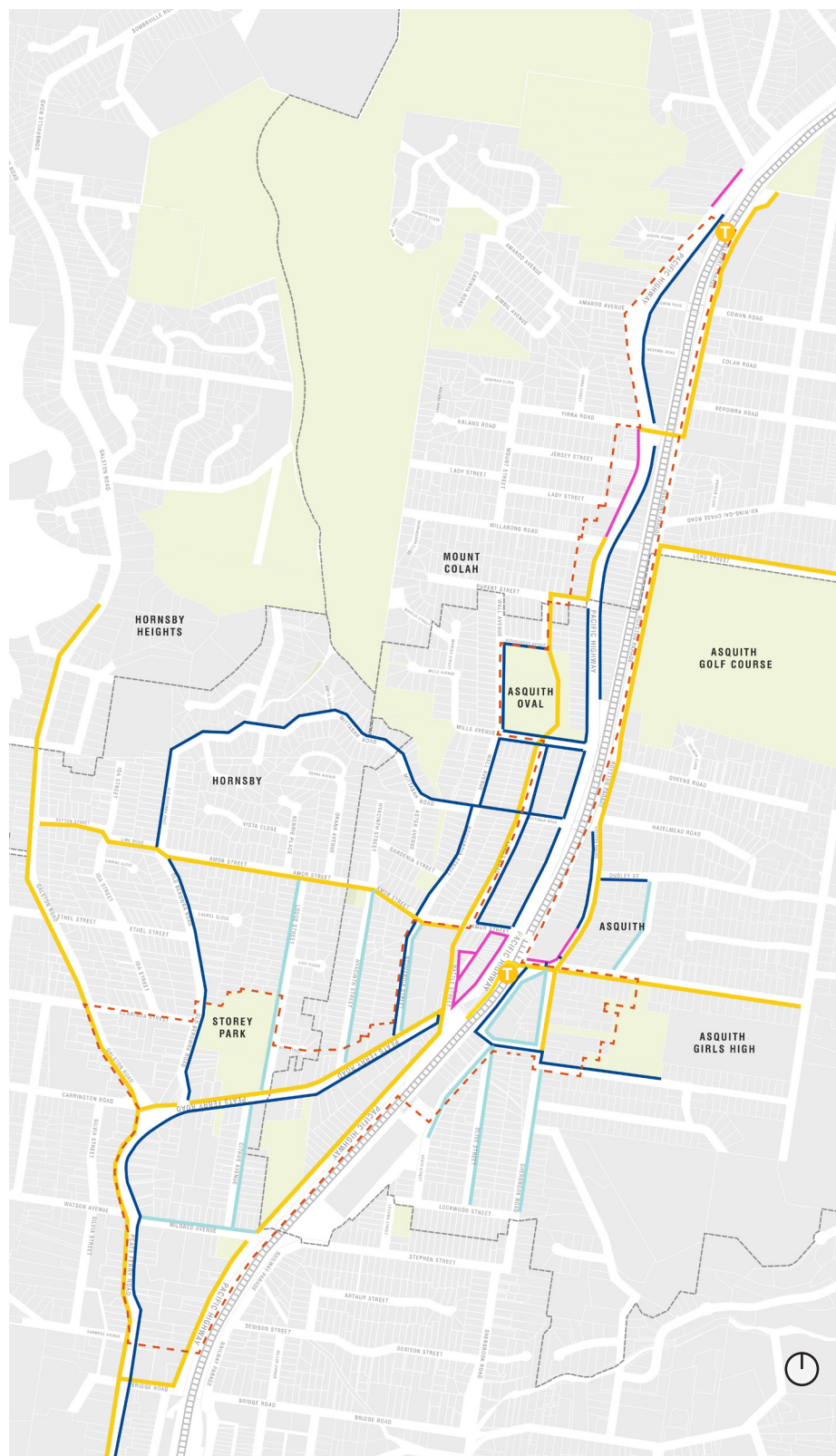


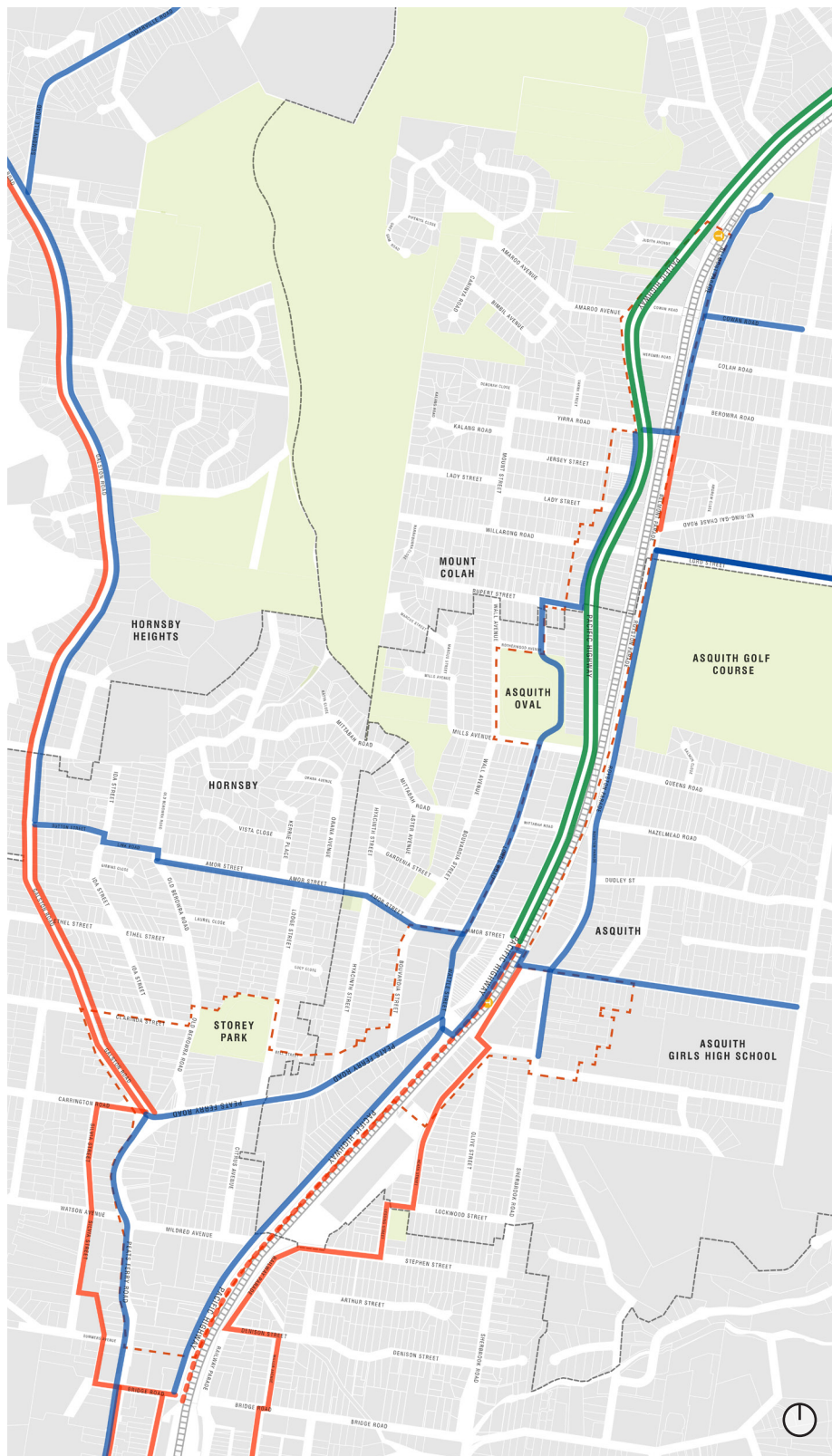
Figure E.8 Asquith and Mount Colah footpath network

The footpath network upgrades will provide important new extensions of the existing network with new paths and links. New footpaths are to be provided along high activity routes and connect key locations in the local area. To provide safe alternative routes off high traffic volume roads such as Pacific Highway.

For example, the upgrading of existing footpaths to shared paths along Lords Avenue creates a safe and comfortable pedestrian connection from the Asquith town centre to Asquith Oval. Additionally, the proposed new 1.8m wide footpath to Old Berowra Road and Mittabah Road service Hornsby North Public School and the local community.

For further information on the footpath network, refer to Council's Walking and Cycle Strategy.

Cycle Network



Upgrading the cycle network throughout Asquith, Mount Colah and surrounding local area aims to encourage safe active transport and provide a cohesive cycling network.

New and upgraded shared paths will encourage safe local travel whilst, dedicated on-road cycle lanes provide protection from the high traffic volumes for the growth in recreational cyclists.

For further information on the cycle network, refer to Council's Walking and Cycle Strategy.

Reallocate space from the third southbound lane of the Pacific Highway to a new cycleway and link it with the existing cycleway on Pacific Highway north of Amor street (subject to design and consultation with TfNSW).

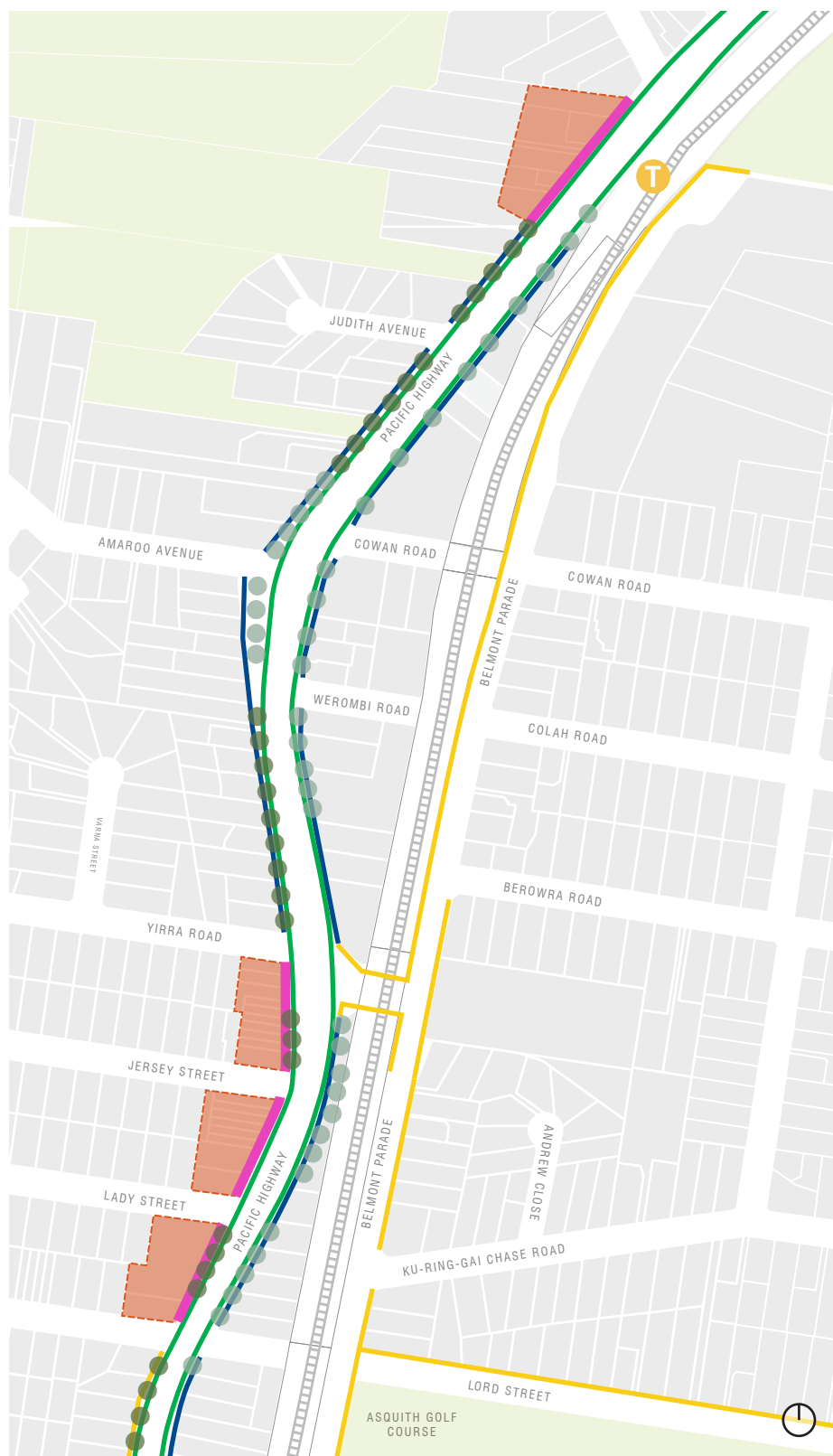
Legend

- Single lane 1.4m wide separated on-road cycle lane (regional proposed)
- 2.5m wide shared path in verge (local)
- On-road shared with vehicles, linemarking only (regional existing)
- - - Unregulated on-road shared with vehicles (regional existing)
- - - Study Area
- - - Suburb Boundary
- Train Line
- T Train Station

Figure E.9 Asquith and Mount Colah cycleway network

Asquith Study Area #1 – Mt Colah Town Centre

Public Domain Upgrades



Key Moves

- Provide on-road separated single lane cycle way with integrated WSUD
- Use WSUD with road and cycle way upgrade to treat verge level changes whilst treating road run-off
- Increase street tree canopy along Pacific Highway in grass verges and WSUD raingardens
- Provide new footpath connections to existing residential areas extending the network
- Work with TfNSW to upgrade commuter car parking at Mt Colah train station

Legend

- Existing street tree to remain
- Proposed street tree
- 1.2m wide footpath
- 1.5m or 1.8m wide footpath
- 2.5m wide shared footpath
- Fully paved, urban footpath
- On-road separated single lane cycle way
- Mount Colah commercial centre
- Study Area
- Train Line
- Train Station

Figure E.10 Asquith to Mount Colah public domain upgrade plan

Asquith Study Area #2 – Peats Ferry Road

Public Domain Upgrades

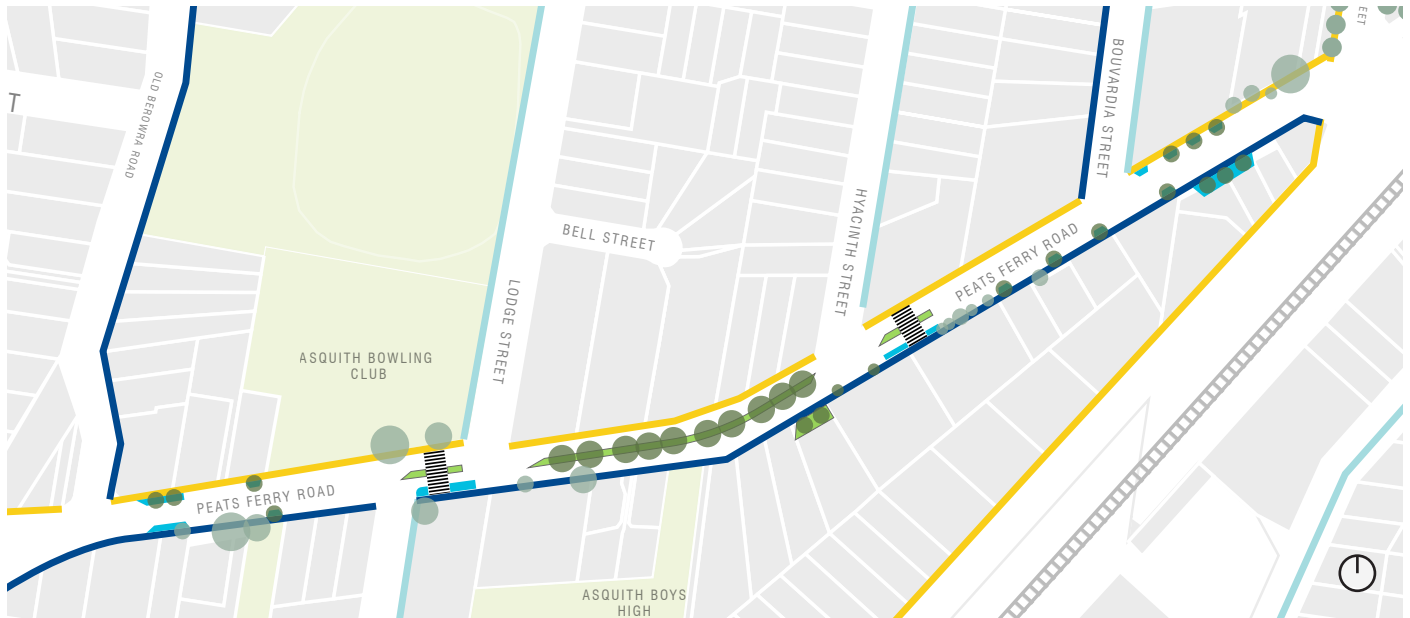


Figure E.11 Peats Ferry Road public domain upgrade plan

Key Moves

- 39 new trees (19 in central median and 20 street trees)
- Retain existing trees where possible
- New 2.5m wide shared pathway to northern side of Peats Ferry Road
- New 1.8m wide footpath to southern side
- Raingardens to capture and clean road run-off
- Speed limit reduced to 50km/hr
- Undergrounding of existing powerlines and installation of replacement Ausgrid street lighting being investigated
- Provide min. 58 parallel parking to both sides of Peats Ferry Road subject to TfNSW approval

Legend

- Existing street tree to remain
- Proposed street tree
- 1.2m wide footpath
- 1.5m or 1.8m wide footpath
- 2.5m wide shared footpath
- WSUD rain garden
- Street mass planting

Asquith Study Area #3 – Asquith Town Centre

Asquith Town Centre Public Domain Upgrades



Figure E.12 Asquith town centre public domain upgrades plan

Key Moves

- Two-way vehicle connection extending from Wattle Street north connecting to Amor St with a new roundabout
- A civic heart with open green passive space, play and public art
- Active retail frontages focused westward
- Re-alignment and pacification of Wattle Street, dual carriage to new Wattle Lane
- Pedestrian overpass connection from station to Asquith town centre
- Active retail frontages and through site link connecting overpass to civic heart
- Improved pedestrian connection from commuter carpark to station
- Blister footpaths at key pedestrian crossings
- Integrate broken kerbs and bio-retention capture elements
- WSUD Roof run-off capture and re-use

The Asquith Town Centre is a gateway town centre linking northern suburbs along the Pacific Highway to Hornsby Town Centre. Pedestrian connections to the community and station to the east are limited. Additionally, the shop fronts face outwards towards the Highway, and there is a lack of a civic heart. There are opportunities to re-focus the commercial shop fronts inwards and create a safe and pedestrian-friendly community centre along Wattle Street.

Legend

- Shared zone paving
- Town Centre Plaza Paving
- Ammenities Kiosk
- Custom Seating
- Passive Open Space
- WSUD
- Existing Trees
- Proposed Trees
- Active Frontages
- ★ Public Art
- T Train Station
- Key Projects
- Study Areas
- On-road separated single lane cycle way
- Future Development

Key Projects

- ① Wattle St. extension to Amor St.
- ② Asquith town centre civic plaza
- ③ New pedestrian overpass
- ④ New gateway park
- ⑤ Asquith to Mount Colah public domain upgrade, refer Figure E.10
- ⑥ Peats Ferry Road public domain upgrade, refer Figure E.11

Public Space and Vehicle Network

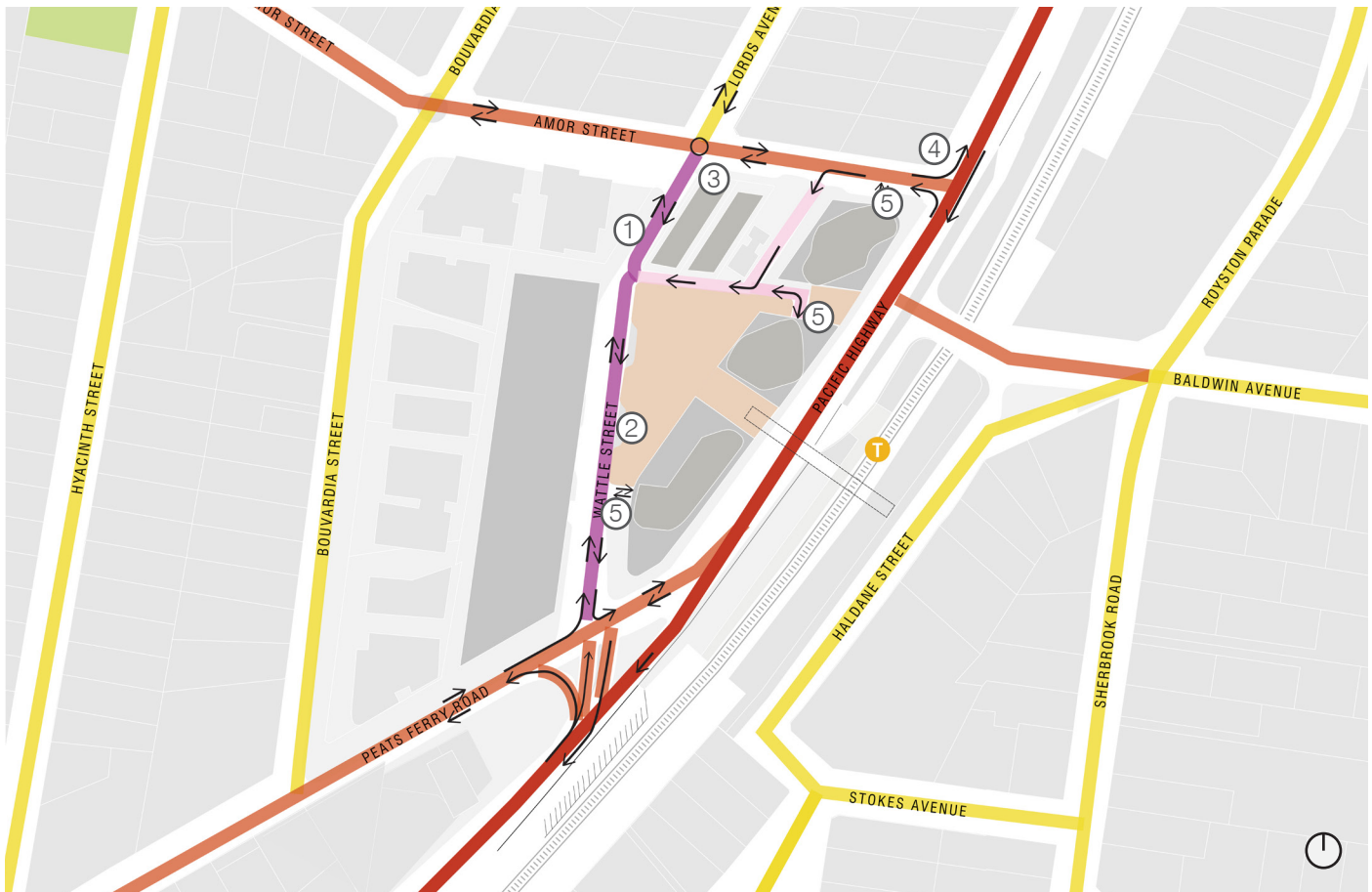


Figure E.13 Asquith public space and vehicle network plan

Key Elements and Design Controls

- ① Wattle St. extension proposed as two-way connection to Amor St.
- ② Provide traffic calming and prioritise pedestrian activity along Wattle Street
- ③ Lords Avenue, Amor Street and Wattle Street intersection to become roundabout intersection
- ④ Pacific Highway and Amor Street to be left in, left out only to reduce conflict by right hand turns
- ⑤ Vehicular entry to future development basements and services to occur on Wattle Street and Amor Street only

Legend

- Arterial/Sub-arterial Road
- Collector Road
- Local Road
- Village Street
- Shared zone
- Plaza
- Future Development
- Traffic Direction
- T Train Station

Verge Treatments, Tree planting and WSUD



Figure E.14 Asquith verge treatments, planting and WSUD

Key WSUD Elements:

- ① Bioretention system to Wattle St catchment connecting to the existing stormwater network;
- ② Tree pits: kerb opening with set down planting to allow larger off-take of gutter runoff.
- ③ Install storage for passive irrigation with new road upgrade;
- ④ Roof runoff to passively irrigate trees;
- ⑤ Permeable paving and grading to direct local runoff to green spaces;
- ⑥ Bioretention system upstream of the existing pit;
- ⑦ Kerb openings along Wattle St to provide passive irrigation for trees, consider soil water storage for passive irrigation

Notes:

- Refer Hornsby Shire Council Water Sensitive Reference Guidelines for technical specifications.
- Refer Street Tree Masterplan for trees species.
- Mass planting design and species to be approved by Hornsby Shire Council prior to installation.

Legend

- Urban Footpath
- 1.2m Footpath
- 1.8m Footpath
- 2.5m Shared path
- Existing Trees
- Proposed Trees
- Open Space
- WSUD
- Shared zone paving
- Plaza
- Future Development
- T Train Station

Asquith WSUD Study Area Analysis

Asquith Town Centre straddles the catchments of Calna and Cockle Creeks. The majority of runoff drains north-west of the precinct to Calna Creek, through the existing stormwater network on local streets. Due to its large traffic volumes, the Pacific Highway will produce relatively large loads of pollutants in its runoff, and drains east off the precinct boundary.

A well-developed catchment, Asquith Town Centre will benefit greatly from WSUD interventions that target the higher pollutant loads of the Pacific Highway for water quality treatment, and contribute to the health and vitality of the civic heart open space with infiltration measures.

Topography of the precinct provides ideal grade to daylight stormwater pipes for above ground treatment in bioretention systems. The development of the open space centre of the precinct and Wattle Street extension will provide an opportunity to daylight the existing stormwater infrastructure and treat the 0.8 ha upstream catchment in a bioretention system (1).

Development on the eastern portion of the precinct will have drainage connections to the adjacent open green space, providing sub-surface passive irrigation to the street trees in this plaza. Roof runoff will feed these subsurface drainage points, improving plant health, cooling the local environs and reducing peak flow volumes into Calna Creek.

The limited drainage infrastructure on the Pacific Highway provides an opportunity to intercept and direct road surface runoff to the new commuter park, on the eastern side of the highway. A bioretention system, set back from the roadway will target treatment of the polluted road runoff and integrate with the proposed green link from the carpark. Potentially, a high foot-traffic zone, interpretative signage in this location may maximise the impact of education.

Amor Street's verges provide the ideal location for tree pits due to their greater width and limited number of constraining overhead electrical cables. Lining Amor Street with a number of tree pits amongst street trees will provide passive irrigation opportunities of surrounding street trees with the use of subsurface drains. Connecting new street trees with subsurface drainage will increase the impact of the tree pits as they capture road runoff that can then drain downstream and be taken up by regular street trees.

Wherever possible, kerb openings are to be created on the road edges with the installation of new street trees, to provide passive irrigation.

Key Project #1 – Wattle Street Extension to Amor Street

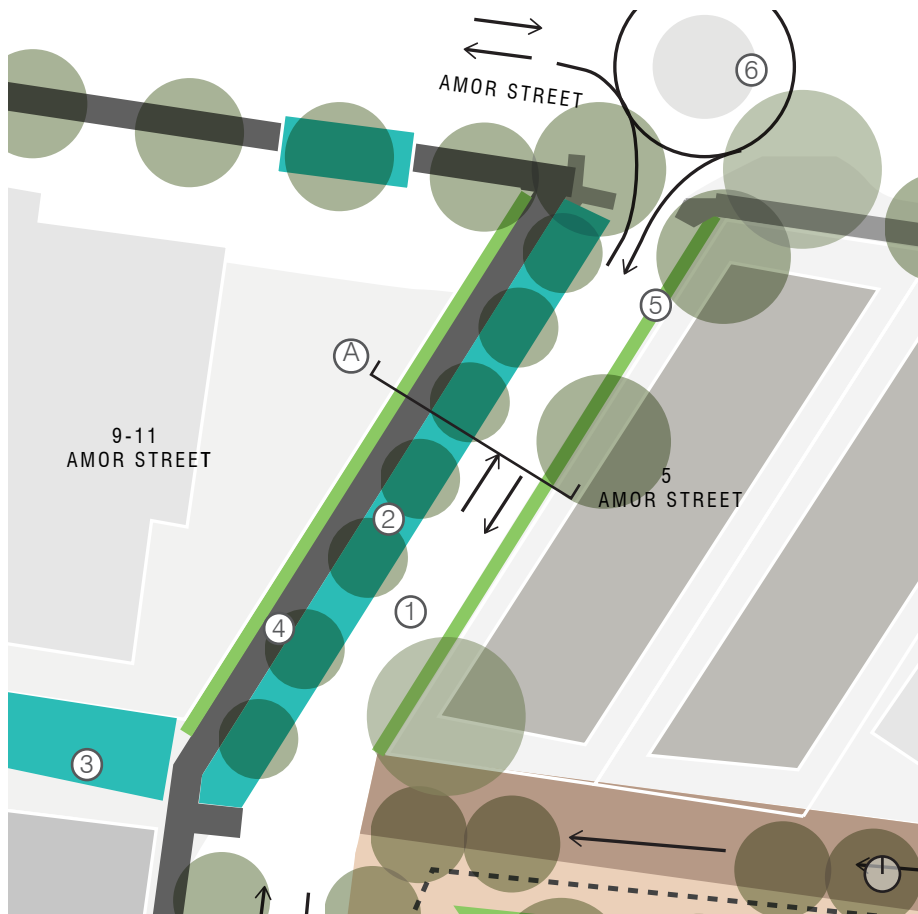
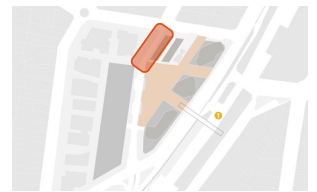


Figure E.15 Wattle Street extension concept plan

Key Plan



The Wattle Street extension will be a two-way important local connection off the busy Pacific Highway. This link prioritises pedestrian and cyclist movement to the greater Asquith network, particularly to Asquith Oval. It also provides direct access into the town centre for traffic from the north.

Blue green infrastructure is also prioritised using new street trees and WSUD rain gardens to reduce and treat local run-off. The WSUD extends west on the Council owned land behind Coles to the treat run-off from the town centre.

Legend

- 2.5m Shared Path
- 1.8m Footpath
- Turf Verge
- WSUD
- Existing Trees
- Proposed Trees
- Shared zone paving
- Traffic Direction

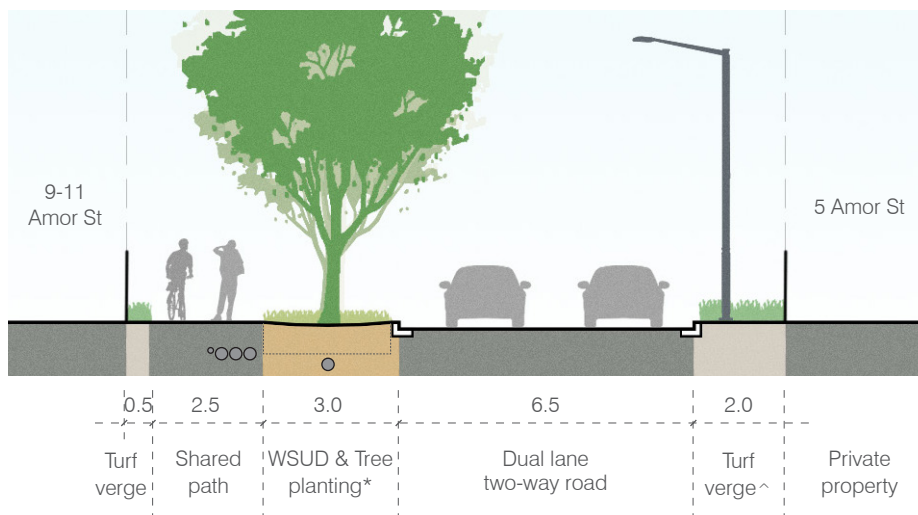


Figure E.16 Wattle Street extension – Section A

Key Elements and Design Controls

- ① Two-way lane southward off Amor St
- ② WSUD planted rain garden capturing local road run-off
- ③ WSUD planted rain garden capturing run-off from town centre plaza, roads and footpaths
- ④ 2.5m wide shared path connecting off-street cycling from Peats Ferry Rd to Lords Avenue
- ⑤ Turf verge
- ⑥ Lords Avenue / Amor Street intersection to become roundabout

*Consider passive irrigation to trees from road, refer kerb inlet

^ Limited planting opportunity

Key Project #2 – Asquith Town Centre Civic Plaza

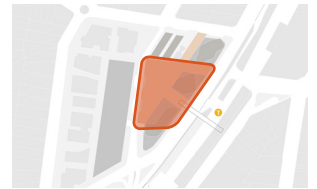


Figure E.17 Asquith town centre plaza concept plan

Legend

- | | |
|------------------------------|--------------------|
| Town Centre Plaza Paving | Shared zone paving |
| Amenities Kiosk | 2.5m Shared Path |
| Custom Seating | 1.8m Footpath |
| Passive Open Space | Urban Footpath |
| WSUD | |
| Existing Trees | |
| Proposed Trees | |
| 2.5m Clear Path of Travel | |
| 3m Outdoor Dining Space | |
| Active Frontages | |
| Public Art | |
| Traffic Direction | |
| Preferred Overpass Alignment | |

Key Plan



The town centre civic plaza is a new green passive open space and active urban heart for Asquith. It provides a central community space linking the future developments on Wattle Street and Pacific Highway.

High quality materials and planting will provide continuity between the highly permeable public domain. The civic plaza provides active commercial and retail opportunities whilst providing a key open space for community events.

The calming of Wattle Street prioritises pedestrians and active transport. The plaza and through-site link form an extension to the future pedestrian overpass inviting residents and visitors into the community.

Key Elements and Design Controls

- ① 850-950m² passive open space turf or paved area
- ② Perimeter seating
- ③ Pedestrian connection to Amor St and Lord Ave
- ④ Street tree planting
- ⑤ WSUD corridor on Council lot connecting to Bouvardia Street
- ⑥ Amenities kiosk
- ⑦ Public art opportunity to provide visual anchor to proposed through-site link
- ⑧ 2.5m wide clear path of travel
- ⑨ Min. 3m wide outdoor dining area
- ⑩ Timed parking
- ⑪ One-way shared zone Wattle Ln.
- ⑫ 12m wide through-site link to Pacific Highway and train station overpass connection
- ⑬ Vehicle access to future development basement

Key Project #3 – Asquith Train Station Pedestrian Overpass

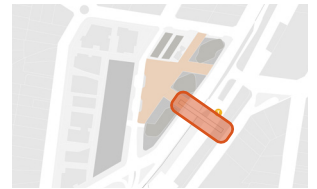


Figure E.18 Asquith train station pedestrian overpass concept plan

Legend

- Pedestrian Overpass
- Town centre plaza paving
- Lift Access
- Stair Access
- Passive open space
- WSUD
- Existing Trees
- Proposed Trees
- Active Frontages
- 3m Outdoor Dining Space
- Traffic Direction
- Limited Parking/Active Lane
- Park Seating
- 1.8m Wide Footpath
- Train Station Entry

Key Plan



The pedestrian overpass connecting Asquith train station and the town centre provides a vital community link. The overpass will create a safe and direct connection for existing and future residents.

Landing in the town centres 12m wide through site link, active frontages provide increased social and commercial opportunities. Outdoor dining, public seating, trees and planting should emphasise the green link to the Civic Plaza.

The pedestrian overpass will be high quality, wide, well lit, covered with clear sight lines to enhance the pedestrian comfort.

Key Elements and Design Controls

- ① 3.5 - 4.5m wide high quality covered pedestrian overpass to incorporate CPTED
- ② Stair access from town centre to overpass
- ③ Lift access from town centre to overpass
- ④ Lift access from platforms to overpass
- ⑤ Provide lighting on overpass for access and wayfinding
- ⑥ Level pedestrian access from street to platforms to remain
- ⑦ 12m wide through-site link to Pacific Highway and train station overpass connection
- ⑧ Active frontages to through-site link
- ⑨ Stair access from Haldane St to overpass

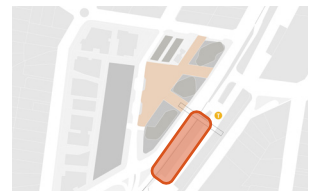
Key Project #4 – Asquith Gateway Park



Figure E.19 New Asquith gateway park concept plan

Note: This project is on TfNSW land and subject to endorsement and coordination.

Key Plan



The new Asquith gateway park creates a valuable pocket park with safer access to Asquith train station and future pedestrian overpass. Enhanced blue green infrastructure will treat road and park run-off while increasing the tree canopy area.

Legend

- Passive open space
- WSUD
- Existing Trees
- Proposed Trees
- Park Seating
- 2.5m Wide Footpath
- Pedestrian Overpass
- Lift Access to Overpass
- Train Station Entry
- Traffic Direction

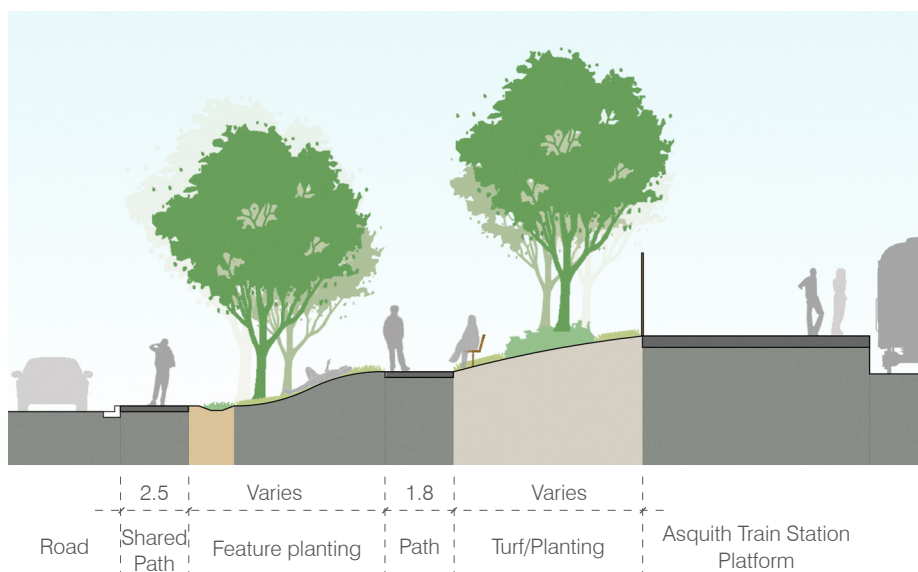


Figure E.20 New Asquith gateway park – Section A

Key Elements and Design Controls

- ① Min. 1300m² new linear park to rail corridor
- ② Min. 1.8m wide secondary footpath through park
- ③ New tree and mass planting to create landmark gateway and provide shade
- ④ Level park seating for short term park use
- ⑤ WSUD bioretention basin treating park and road run-off
- ⑥ Lighting, circulation and sight lines to meet CPTED guidelines
- ⑦ Consider secondary southern platform entry/exit to commuter carpark
- ⑧ Retain existing concrete path
- ⑨ Bike locker and casual bike parking
- ⑩ Retain existing high quality trees

Beecroft

Study Area

Located between Beecroft Station and Beecroft Road, Beecroft town centre is an excellent example of Hornsby's heritage. Anchored to the north by its main street of Hannah Street, the heritage town centre is an example of Sydney North Shore style villages with fine-grain architecture and a strong community feel. These distinct heritage qualities need to be retained and celebrated. There is an opportunity to create a vibrant pedestrian focused heritage town centre which prioritises pedestrian movement over vehicular, and provides an urban civic heart which allows for the expression of the local cultural heritage through public art, and space for community gatherings. Beyond the Hannah Street precinct, pedestrian and bike routes are to connect to the greater Hornsby network.

Copeland Road splits the precinct running between the heritage urban town centre to the north and Beecroft Village Green to the south. The Village Green is a vital community green open space, offering areas and infrastructure for large gatherings, family barbecues and play. It is a visually prominent corridor of open space running alongside Beecroft Road. It offers a green space that is important to setting the character of the suburb but is constrained by limited safe access from the north and south and the barrier of the railway to the east and a busy road to the west. Upgrading the park aims to make this parkland more attractive to visit and improve accessibility.

Key projects to be undertaken to achieve the vision of Beecroft include:

- ① Upgrading of Hannah Street to partial share zone;
- ② Development of Beecroft civic heart plaza on private land;
- ③ Wongala Crescent upgrade;
- ④ Upgrading of Beecroft Village Green.

Considerations

- Consideration of existing heritage elements/ items needs to be taken in any future development
- Consider precinct wide through site pedestrian connections in village centre
- Consideration of traffic management elements and pedestrian flows to prioritise pedestrian movement on Hannah Street
- Consider community needs of open space facilities in Beecroft Village Green
- Consider the relationship between tree canopy and open space in the Village Green to optimise solar access and understorey plant growth
- Integration of WSUD elements

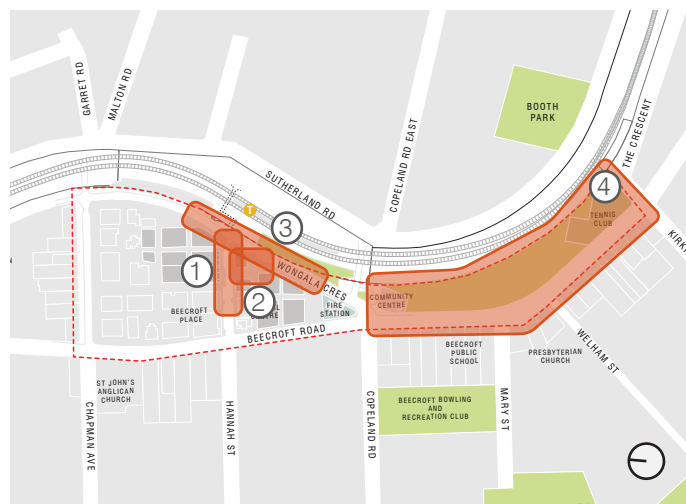


Figure E.21 Beecroft Heritage Town Centre

Objectives

- Protect and celebrate the heritage character of the Town Centre and retain community identity
- Pacify Hannah Street to prioritise pedestrian movement over vehicles
- Public domain frontages should maximise activity facing all streets, walkways and piazzas by siting lower storeys with minimal setback from boundaries
- Provide a central public plaza or square for public use
- Encourage new mid-block pedestrian connections with active frontages, solar access and protection from traffic noise
- Encourage community use of Beecroft Village Green and Beecroft Station Gardens for organised and impromptu events

Design Controls

- An absolute minimum central civic plaza of 500m² (excluding setback areas around the primary building envelope) is required. This shall include; a high quality soft landscape area, public seating and street furniture and public art.
- Plaza to comprise of minimum 50% softscape of turf and mass planting
- Hardscape to provide 2.5m clear accessible path of travel to active frontages and entry points to plaza
- 3m wide outdoor dining seat to comply with Council's Outdoor dining code

Verge Treatments, Tree planting and WSUD



Figure E.22 Beecroft verge treatments, tree planting and WSUD

Key WSUD Elements:

- ① Bioretention system or bio-tree pit upstream of existing stormwater pit;
- ② Daylight existing stormwater pipe to new bioretention system;
- ③ New trees to Hannah St to be in pits to capture street runoff;
- ④ Bioretention system to treat Beecroft Rd catchment. Outlet to connect into existing stormwater pit near Copeland St/Wongala Cres intersection;
- ⑤ Permeable paving and regrading to green spaces and tree pits with subsoil drainage;
- ⑥ Planted beds to reduce overland flow/runoff;

- ⑦ Planted area set down with sandy loam planting media and formal drainage connection to existing stormwater network.

Notes:

- Refer Hornsby Shire Council Water Sensitive Reference Guidelines for technical specifications.
- Refer Street Tree Masterplan for trees species.
- Mass planting design and species to be approved by Hornsby Shire Council prior to installation.

Legend

- Urban Footpath
- 1.2m Footpath
- 1.8m Footpath
- 2.5m Shared path
- Existing Trees
- Proposed Trees
- Open Space
- WSUD
- Plaza
- Future Development
- Existing Building
- Train Station
- Heritage Building

Beecroft WSUD Study Area Analysis

Integration of WSUD into the Beecroft precinct is opportunistic due to the limited availability of space for installation of stormwater treatment assets in the commercial domain. The strategy for this precinct seeks to support the development of the heritage portion of the site with streetscape bioretention systems and tree pits that will enhance Hannah Street with well supported vegetation and street trees. Fewer WSUD interventions are planned for the Village Green which has well established canopy cover – management of overland flows and local drainage within the green space are the focus in this portion of the precinct.

A section of Beecroft Road catchment is targeted for treatment in a single bioretention system (4) positioned near the junction of Copeland Road, and will utilise the fall in grade to drain to the existing stormwater drainage network. This location has the potential to drain and treat runoff from the adjacent carpark in addition to road runoff.

Development of land to the west of Hannah Street provides the opportunity to daylight the existing stormwater pipe that drains the upper portion of the precinct's catchment of Chapman Avenue. This 1 ha catchment would drain to a bioretention system located adjacent to Wongala Crescent (2).

Adjustments to the roadway of Hannah Street are to incorporate passive irrigation modifications to the kerb and gutter where possible. Street trees that line Hannah Street can receive runoff through a combination of road grading and kerb openings to direct stormwater flows into tree/planter beds for irrigation. Constructed tree pits with stratavault storage have the capacity to capture, store and make use of larger volumes of runoff and should be installed in locations that maximise the catchment area (i.e. upstream of existing stormwater pits).

Beecroft Village Green is a well-established green space with great coverage of tree canopy. Construction of large WSUD assets are not recommended in this location to avoid tree loss or impact on their root zone (with construction of stormwater diversion pipes). Addressing local park drainage is a part of the overall stormwater management strategy for Beecroft that will encourage infiltration and reduce the impact of ponding that can reduce utility and enjoyment of open, green spaces. A planted, infiltration bed is proposed at the low point of the park, parallel to the adjacent train line (7 on Figure E.22). The infiltration bed is to be set down and sandy loam planting media will assist in draining the local area. This infiltration bed would connect to the existing stormwater infrastructure to ensure discharge from the site.

Study Areas



Figure E.23

Beecroft Study Areas

- ① Beecroft Heritage Commercial Area
- ② Beecroft Village Green

Legend

- Heritage Brick Paving
- Town Centre Plaza Paving
- Passive Open Space
- Existing Trees
- Proposed Trees
- Existing Playground
- Study Area
- Future Development
- Existing Building
- Train Station
- Heritage Building

Beecroft Study Area #1 – Beecroft Town Centre

Beecroft Town Centre Heritage Commercial Area Public Domain Upgrades



Figure E.24 Beecroft Heritage Commercial Area plan

The two key projects identified within the Beecroft heritage commercial area aim to provide a high quality community heart. Upgrades to Hannah Street prioritise pedestrian movement north south activating the public domain with outdoor dining. A new civic plaza creates a key community passive space.

Key Moves

- Expand pedestrian circulation opportunities
- Use of heritage herringbone brick paving along activity strips
- Green plaza to Wongala Avenue to celebrate heritage setbacks
- Integration of regional shared path network
- New civic heart and through site link to Wongala Crescent

- Extend pedestrian links from the northern precinct developments through built form into the southern precinct
- Increase street tree canopy cover on Hannah Street
- Blister footpaths at key pedestrian crossings
- Integrate broken kerbs and bio-retention capture elements where possible
- WSUD Roof run-off capture and re-use

Key Projects

- ① Hannah Street upgrade
- ② Beecroft Civic plaza
- ③ Wongala Crescent upgrade
- Ⓐ Ⓑ Refer next page for sections

Legend

- Heritage Brick Paving
- Town Centre Plaza Paving
- Custom Seating
- Passive Open Space
- Existing Trees
- Proposed Trees
- Active Frontages
- WSUD
- Traffic Direction
- Key Projects
- Future Development
- Existing Building
- Ⓣ Train Station
- Heritage Building

Public Domain Street Upgrades



Figure E.25 Chapman Avenue public domain upgrade – Section A

Public domain upgrades to Chapman Avenue are to include the planting of street trees in turf and implement the upgraded footpath network to include 1.8m wide footpaths.



Figure E.26 Wongala Crescent public domain upgrade – Section B

Wongala Crescent is a vital vehicle and active transport road. Upgrades to the public domain include the 2.5m wide shared path from Chapman Avenue to Copeland Road using the heritage brick paving to highlight the Beecroft Town Centre. Footpaths on the southern side outside of the urban-footpath area to be 1.8m wide brick paving with new street tree plantings.

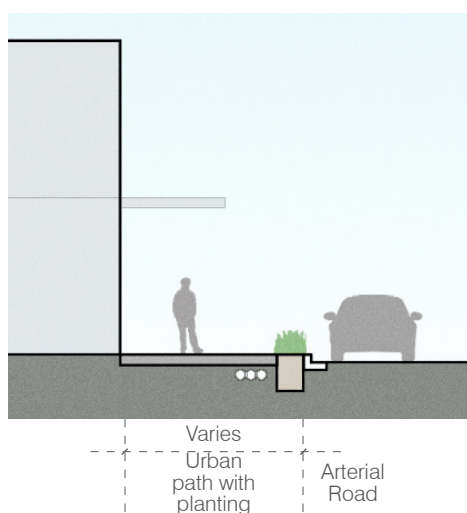


Figure E.27 Beecroft Road public domain upgrade – Section C

As an arterial TfNSW-route Beecroft Road experiences high vehicular traffic volumes whilst forming the western boundary to the Beecroft heritage-precinct. As a prominent urban interface the public domain should be upgraded to promote the heritage nature of the area and provide a high quality pedestrian experience.

Future developments are to underground powerlines. The footpath is to be heritage brick paving from kerb to boundary or from planting to boundary were possible. Mass planting should be provided where possible to act as a soft barrier between vehicles and pedestrians.

Key Project #1 – Hannah Street Upgrade



Figure E.29 Hannah Street upgrade plan

Centrally located in the heritage precinct, Hannah Street is a landmark connector between the train station and key community destinations. The upgrades require the exploration of a shareway, reducing speed and frequency of vehicular movements and encouraging outdoor dining in the adjacent plaza spaces. Future developments should explore opportunities for outdoor dining. Future detailed design shall investigate the direction of one-way traffic on Hannah Street, implications of the Hannah Street development on local bus routes and the inclusion of a scatter crossing pedestrian management device at the intersection of Hannah Street and Wongala Crescent.

Legend

- Heritage Brick Paving
- Town Centre Plaza Paving
- Custom Seating
- Passive Open Space
- WSUD
- Existing Trees
- Proposed Trees
- Existing Playground
- Upgraded Planted Blister
- New Planted Blister
- 3m Outdoor Dining Space
- Active Frontages
- Public Art
- Traffic Direction

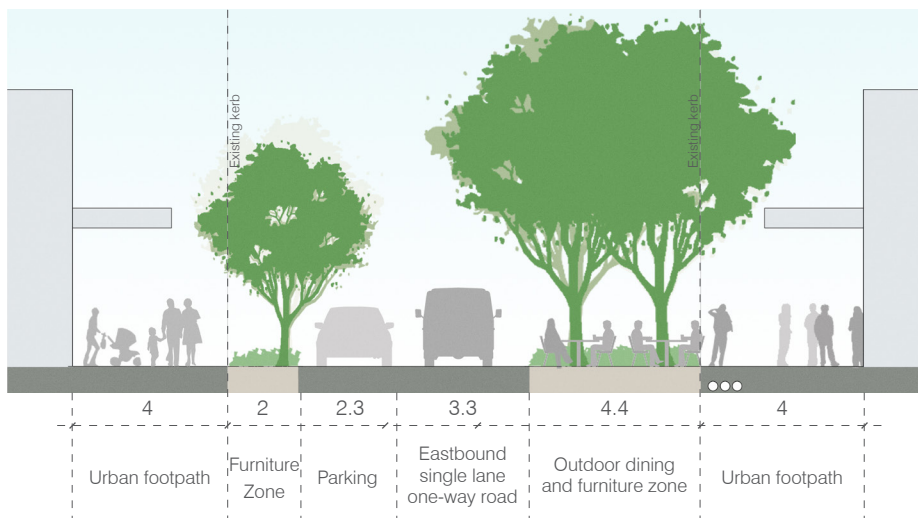


Figure E.28 Hannah Street upgrade – Section A

*Refer Council's Outdoor Dining Code

Key Elements and Design Controls

- ① Min. 2.5m clear path of pedestrian travel*
- ② Outdoor dining min. 600mm offset from kerb*
- ③ New street trees in extension zone, refer Fig C.1 maintaining clear path of travel
- ④ Narrow Hannah Street to prioritise pedestrians, reduce traffic volume and slow vehicular movement
- ⑤ Enhance existing active frontages to Hannah Street
- ⑥ Re-locate taxi rank to Wongala Crescent
- ⑦ Timed parallel parking
- ⑧ Beecroft Civic Plaza key project, refer Figure E.31
- ⑨ Station entry upgrade by TfNSW
- ⑩ Attenuate cross falls to create level areas for outdoor dining

Key Project #2 – Beecroft Civic Plaza

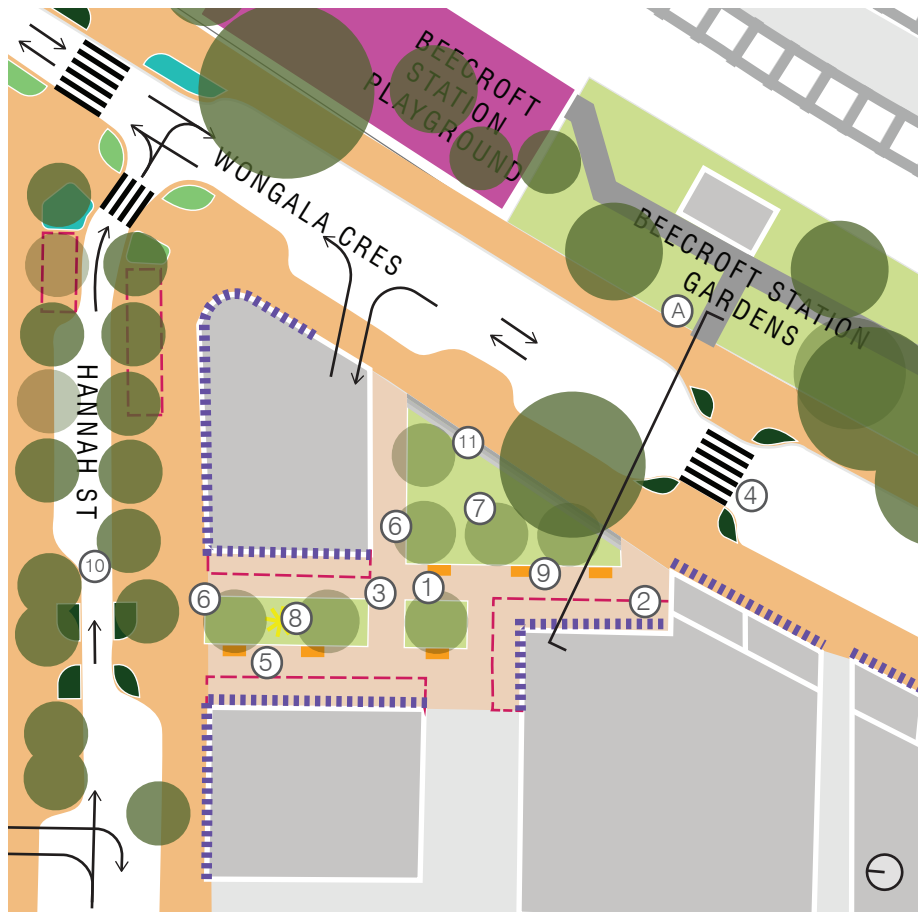


Figure E.31 Beecroft Civic Plaza concept plan

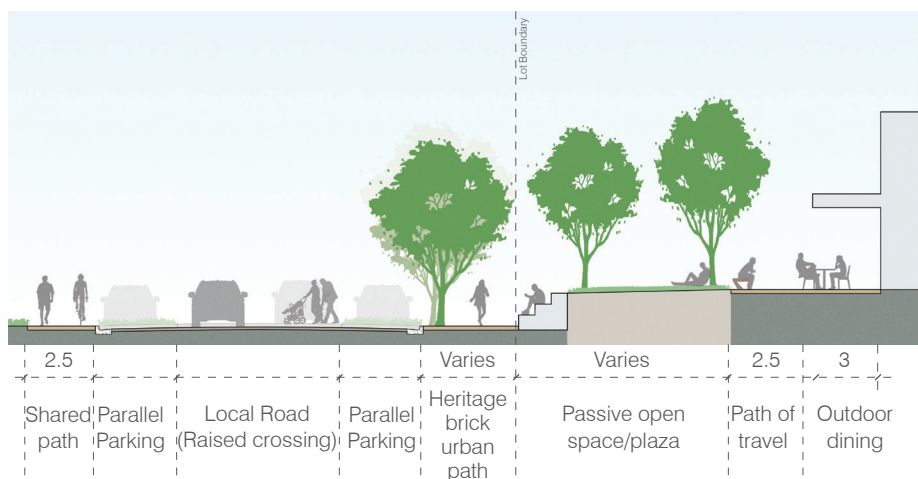


Figure E.30 Wongala Crescent and Civic Plaza – Section A

Beecroft Civic Plaza is a new plaza area currently occupied by on-grade parking. This project is an opportunity to work with future developments providing a urban retail and community space. A new passive green heart with new trees, active frontages and public art respecting the heritage of the town centre.

Legend

- Heritage Brick Paving
- Town Centre Plaza Paving
- Custom Seating
- Passive Open Space
- WSUD
- Existing Trees
- Proposed Trees
- 2.5m Clear Path of Travel
- 3m Outdoor Dining Space
- Active Frontages
- Public Art
- Traffic Direction

Key Elements and Design Controls

- Civic Plaza min. total area to be 500m²
- Min. 3m wide outdoor dining area to active retail frontages
- Provide clear path of travel from Hannah Street to Wongala Crescent pedestrian crossing
- Explore options for pedestrian crossing or refuge island
- High quality town centre plaza paving
- Trees species to provide shade protection and visual interest
- Provide passive green open space
- Landmark public art
- Custom public seating
- Hannah Street pacification upgrade, refer Figure E.29
- Terracing/bleacher transition down to Wongala crescent grade

Key Project #3 – Wongala Crescent Upgrade

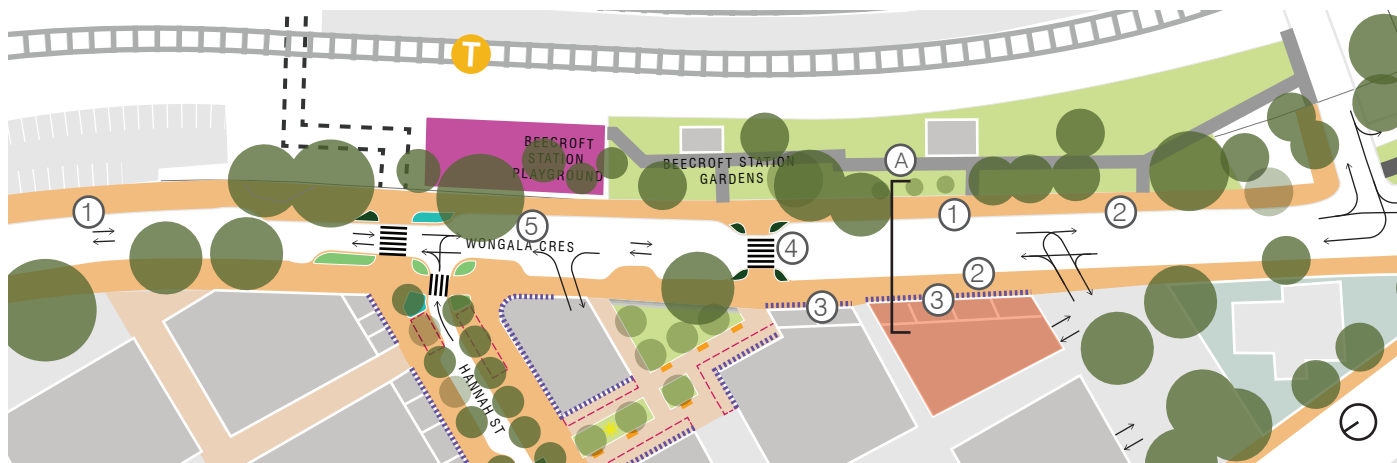


Figure E.32 Wongala Crescent Upgrade

Wongala Crescent plays an important role in Beecroft acting as a key pedestrian link between the heritage town centre and Beecroft Village Green. Upgrades to Crescent are to reinforce it as an active transport connector linking into the regional cycle path network.

Pedestrian comfort is to be prioritised, adjustment to kerb alignment and height are required to ensure sufficient path widths and compliant path crossfalls.

Key Elements and Design Controls

- ① Min. 2.5m wide shared path to provide sufficient path of travel for cyclists and pedestrians connecting to the wider cycle path network, consider kerb adjustments to ensure sufficient widths
- ② Parallel parking to remain
- ③ Zero setback shop frontages
- ④ Explore options for pedestrian crossing or refuge island
- ⑤ Provide sufficient space for bus stop as required by TfNSW

Legend

- Heritage Brick Paving
- Town Centre Plaza Paving
- 1.8m Footpath
- Custom Seating
- Passive Open Space
- WSUD
- Existing Playground
- Existing Trees
- Proposed Trees
- Upgraded Planted Blister
- New Planted Blister
- 2.5m Clear Path of Travel
- 3m Outdoor Dining Space
- Active Frontages
- Public Art
- Traffic Direction
- Heritage Building

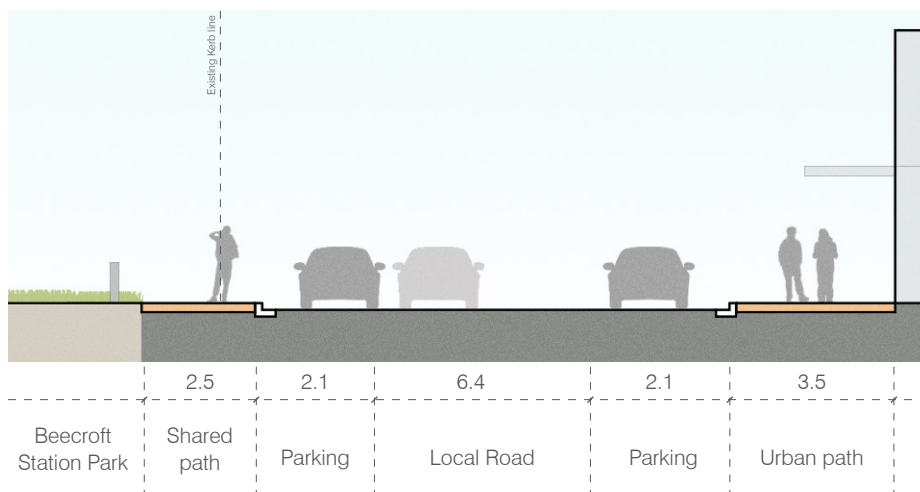


Figure E.33 Wongala Crescent Upgrade – Section A

Beecroft Study Area #2 – Beecroft Village Green

Beecroft Village Green – Key Project #1 – Park Upgrades



Figure E.34 Beecroft Village Green plan

Beecroft Village Green is a linear green link and community open space bookended by the Community Centre and tennis club providing a strong visual reference for the suburb and for people driving past. Upgrades to the Green's infrastructure are required including the internal footpath network, playground, shelters and toilets block.

Improvements to the Green's blue green infrastructure should focus on WSUD and tree quality. The tree canopy density should be managed to increase solar access and promote the growth of turf.

Key Elements and Design Controls

- ① Upgrade existing north south footpath to 2.5m wide shared path connecting to walking and cycle network
- ② Mass planting to enhance Village Green Environmental performance and visual character
- ③ Beecroft Rd footpath widened to min. 1.8m
- ④ Provide formal WSUD sub-surface drainage connecting to existing stormwater network to improve drainage in park low point, consider WSUD raingarden planting
- ⑤ Arborist review of existing tree canopy for opportunities to increase solar access into park

- ⑥ Planted beds to reduce overland flow/runoff
- ⑦ New tree planting to screen rail infrastructure

Legend

- 1.8m Footpath
- 3m Shared Path
- Passive Open Space
- WSUD
- Proposed Mass Planting
- Existing Trees
- Proposed Trees
- Traffic Direction
- Existing Playground

Waitara

Study Area

The scope of these guidelines for the Waitara study area focuses on the residential area bounded to the north by Edgeworth David Avenue and the south by the rail line. Waitara has recently seen significant development and has become the most densely populated area in Hornsby Shire with much of this occurring west of Mark Taylor Oval. This increase in density requires an upgraded and high-quality public domain to support the growing community.

Future development opportunities exist in the eastern half of the precinct which provides opportunities to coordinate public domain upgrades. As this precinct increases its density the role of high quality and high-performance public domain is key to a sustainable community.

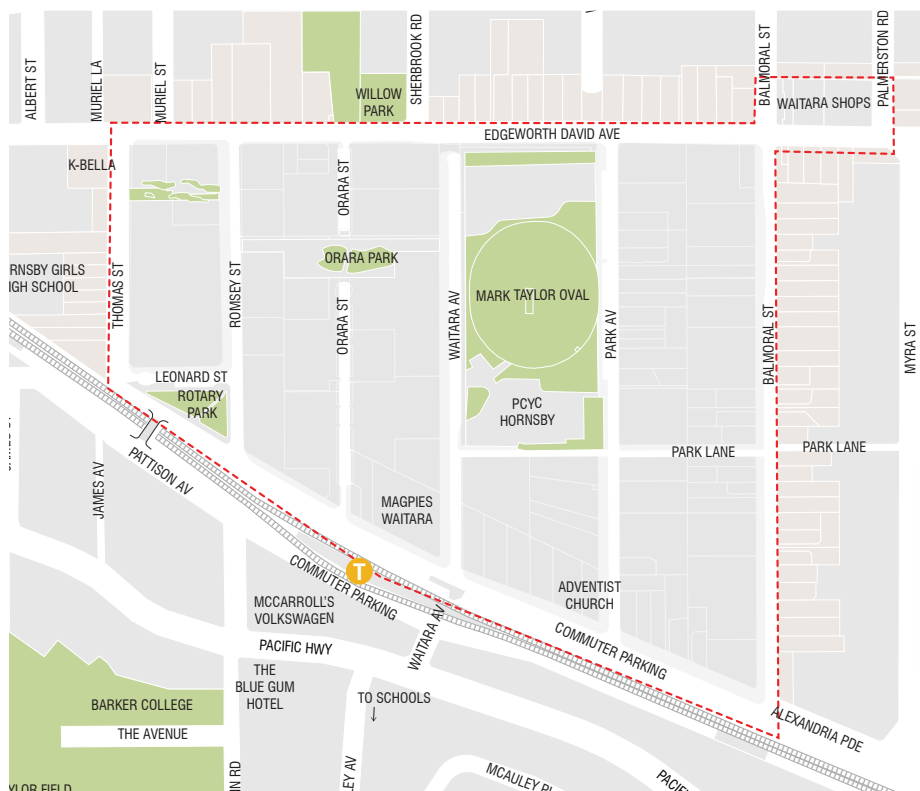


Figure E.35 Waitara Study Area

 Study Area

Objectives

- Create a pedestrian and cycle friendly precinct by providing wider paths and additional tree planting
- Improve the retail offering to cater to the increased density
- Maximise street tree plantings where possible
- Underground powerlines

Considerations

- Consideration of existing heritage elements/ items needs to be taken in any future development
- Encourage ground level active frontages in the Alexandria Parade and Waitara Avenue area opposite the station entry
- Integration of WSUD elements

Waitara Public Domain Upgrades



Figure E.36 Waitara Public Domain Upgrades Plan

Key Moves

- Create a new urban gateway precinct at Alexandria Parade and Waitara Avenue
- Prioritise pedestrians along Park Lane and reinforce as a key link
- Continue share path connections along Park Lane, Waitara Avenue, Romsey Street to Edgeworth David Avenue
- Retain and enhance existing tree planting along Edgeworth David Avenue
- Improve pedestrian connections from commuter car parks to train station
- Blister footpaths at key pedestrian crossings
- Integrate broken kerbs and bio-retention capture elements where possible
- WSUD Roof run-off capture and re-use

Four key projects have been identified within Waitara. The projects focus on enhancing the public domain by encouraging active transport, prioritising pedestrian movement throughout the local community and adding to the existing network of street trees.

Legend

- Town Centre Plaza Paving
- Existing Street Trees
- Proposed Street Trees
- Open Space
- Future Development
- Existing Building
- WSUD
- Train Station
- Key Projects

Key Projects

- ① Waitara Retail Gateway
- ② Waitara Avenue street upgrade
- ③ Edgeworth David Avenue verge upgrade
- ④ Park Lane shareway

Public Space and Vehicle Network



Figure E.37 Waitara public space and vehicle network plan

Key Elements and Design Controls

- ① Treat Park Lane with paint finish, graphic or coloured asphalt to highlight shared zone
- ② In-road blisters to calm traffic and provide better pedestrian connectivity with raised thresholds at intersections.

Legend

- Arterial/Sub-arterial Road
- Collector Road
- Local Road
- Shared zone
- Open Space
- Future Development
- Existing Building
- Traffic Direction
- T Train Station

Cycle Network

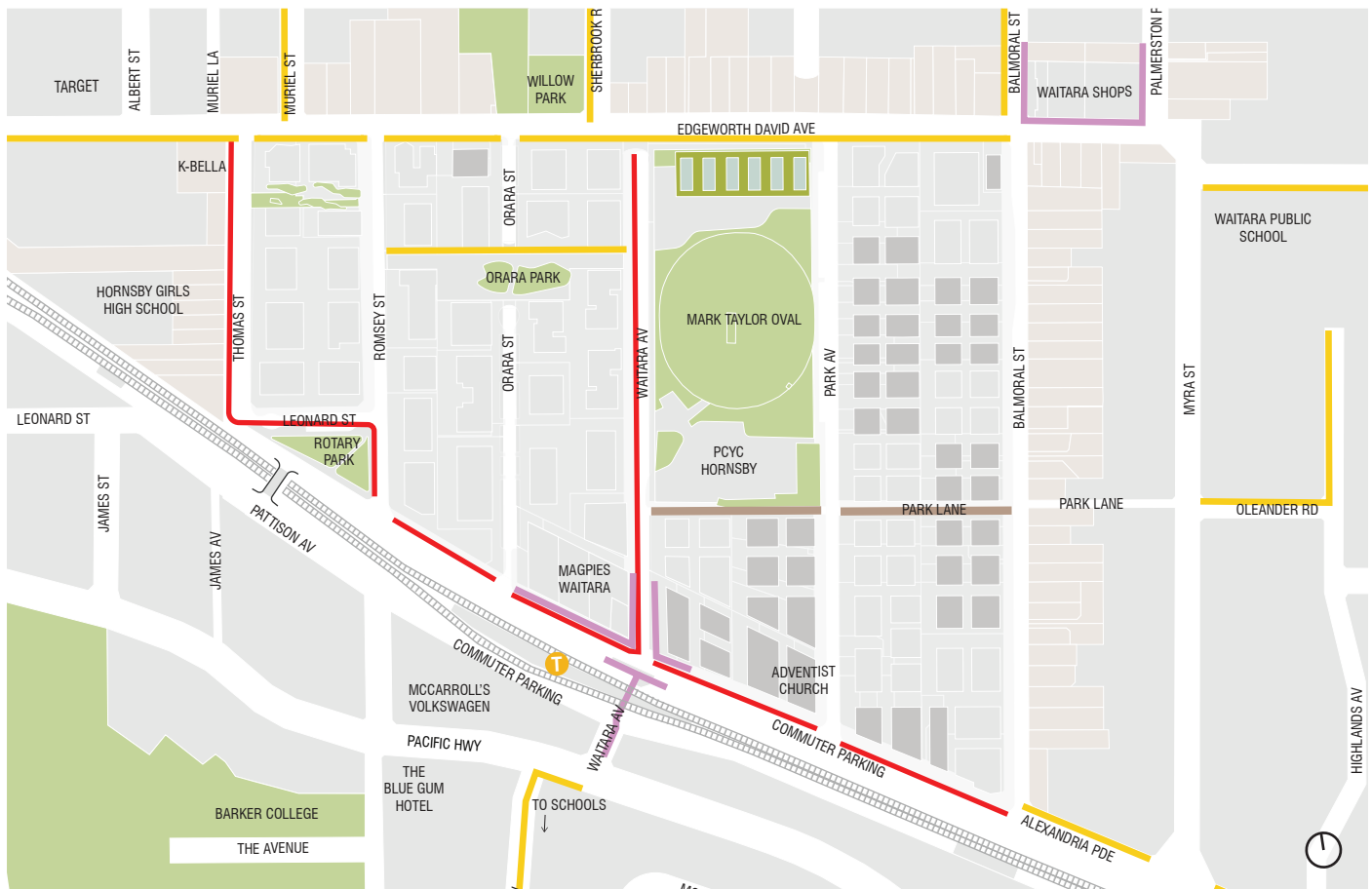


Figure E.38 Waitara cycle network plan

Legend

- Urban Footpath
- 2.5m Shared path
- Shared zone
- On-road shared with vehicles, linemarking only
- Open Space
- Future Development
- Existing Building
- T Train Station

Verge Treatments, Tree planting and WSUD



Figure E.39 Waitara verge treatment, tree planting and WSUD plan

Key WSUD Elements:

- ① Off-take for stormwater harvesting and reuse for irrigating of Orara Park;
- ② Existing Gross Pollutant Trap and basin;
- ③ Additional street trees to include kerb openings, and structural soil for passive irrigation;
- ④ Bioretention system setback in verge or blister into street. Tree pits to be upstream of existing pits;
- ⑤ Bioretention system blister upstream of existing pit;
- ⑥ Kerb openings with structural soil for street trees. Subsoil drainage along Balmoral St and Park Ave.

Legend

- Urban Footpath
- 1.2m Footpath
- 1.8m Footpath
- 2.5m Shared path
- Existing Street Trees
- Proposed Street Trees
- WSUD
- Future Development
- Existing Building
- Train Station

Notes:

- Refer Hornsby Shire Council Water Sensitive Reference Guidelines for technical specifications.
- Refer Street Tree Masterplan for trees species.

Waitara WSUD Study Area Analysis

The Waitara precinct WSUD strategy focuses on passive irrigation of the tree-lined residential streets, delivering significant urban cooling benefits, and proposes a stormwater harvesting scheme – possible at this precinct due to its topography and the size of the upstream catchment.

Passive irrigation of street trees and treatment of road runoff with bioretention systems and tree pits are recommended wherever possible on each of the residential streets. Prioritising increased urban tree canopy in the Waitara precinct will benefit a large number of residents due to the medium density residential development within the precinct.

There is existing WSUD infrastructure in this precinct, in Orara Park (2 – GPT, basin and storage tank). A stormwater harvesting scheme in Waitara Park could supplement this infrastructure to provide additional storage and reuse capacity. In total, there is an upstream catchment of approximately 32 ha that drains to the northern end of Waitara Park, at Edgeworth David Avenue. This sized catchment, with an offtake and underground storage at Waitara Park, would provide increased water security for irrigation of the oval and reuse for internal use at the PCYC and tennis facilities (e.g. toilet flushing) located at either end of the park. The scheme's eastern 20 ha catchment that drains to Park Street can be pre-treated with the construction of a GPT within the reserve area, upstream of an offtake at the junction of the two stormwater mains.

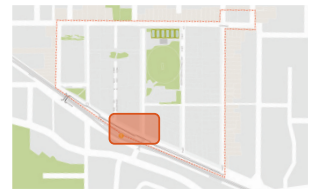
Treatment of the large 20 ha eastern catchment with a GPT will provide one of the more substantial water quality improvements across Hornsby due the catchment size being treated, and is recommended as a standalone measure that can later be incorporated in a harvesting scheme, if staging is preferred.

Key Project #1 – Waitara Retail Gateway



Figure E.40 Waitara retail gateway plan

Key Plan



The Waitara retail gateway creates an enhanced landmark entry with new retail opportunities opposite Waitara train station. The retail gateway responds to Waitara's increasing population density, providing the opportunity for an activated and diverse retail centre. New high quality urban footpaths and street trees prioritise pedestrian comfort and circulation. A 2.5m clear path of travel is to be provided to all active frontages.

Legend

- Town Centre Plaza Paving
- Existing Street Trees
- Proposed Street Trees
- Future Development
- 2.5m Clear Path of Travel
- Active Frontages
- 2.5m Shared Path
- Turf Verge
- Traffic Direction
- Train Station

Key Elements and Design Controls

- ① High quality kerb to boundary urban footpath
- ② Contemporary public furniture seating suite
- ③ Setback to be determined pending outcomes of Employment Land Study, potentially zero setback
- ④ New street trees with tree grates
- ⑤ Active frontages
- ⑥ Parallel short stay timed parking
- ⑦ Upgrade pedestrian underpass and remove stairs to Pacific Hwy
- ⑧ Improve train station entry paving
- ⑨ Heritage listed building

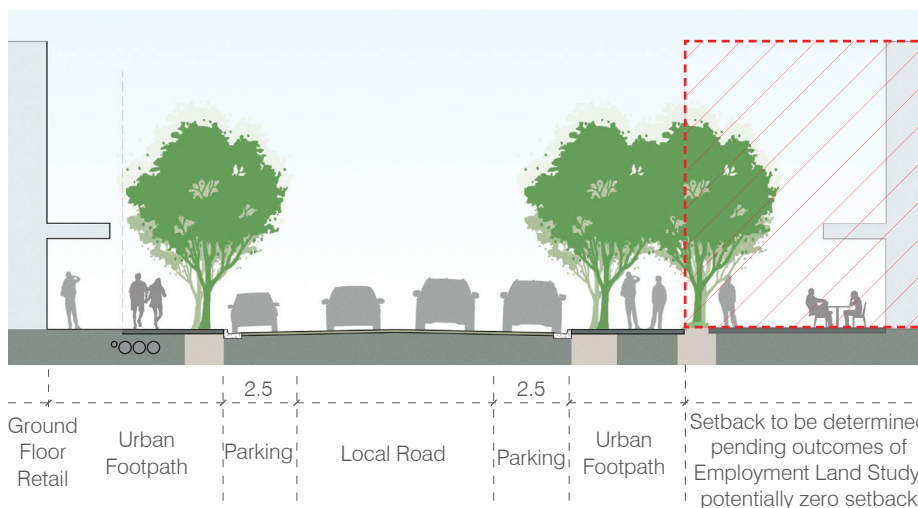


Figure E.41 Waitara retail gateway – Section A

Key Project #2 - Waitara Avenue Upgrade

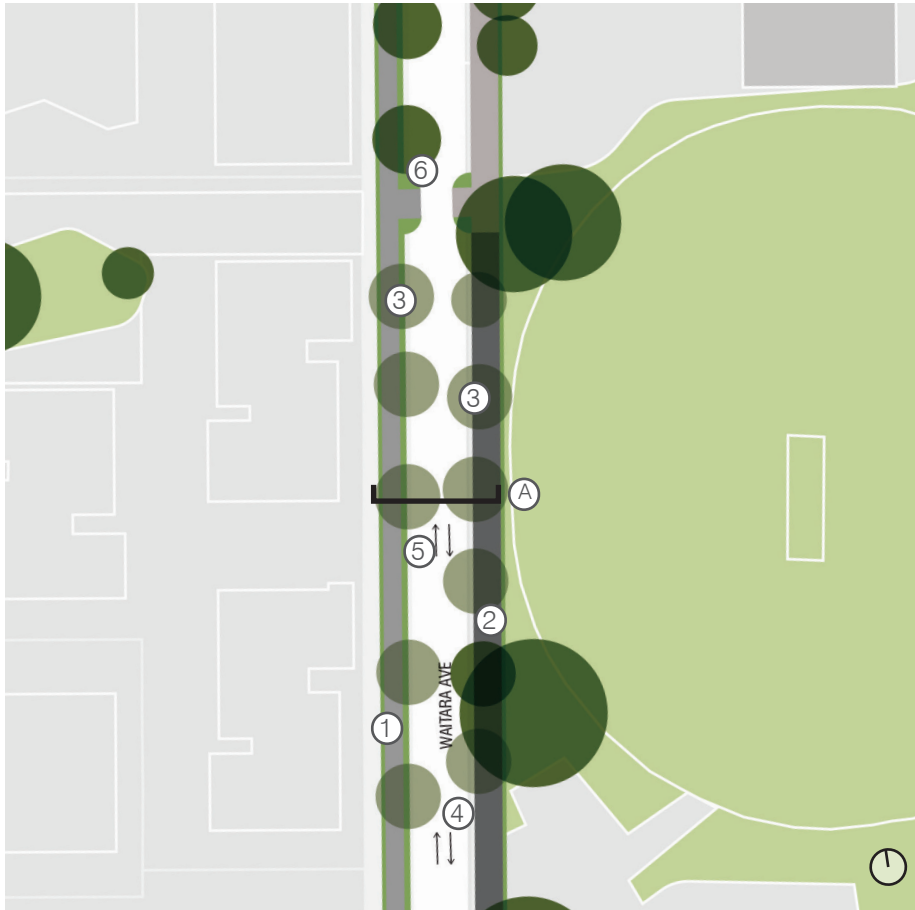
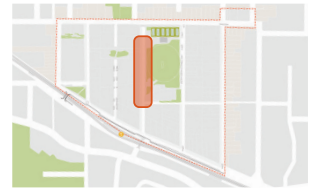


Figure E.42 Waitara Avenue upgrade plan

Key Plan



Waitara Avenue forms the central spine of Waitara linking key community infrastructure such as Waitara Oval and PCYC, train station, football club and retail. Upgrading the avenue reinforces the active transport network and increases the urban tree canopy.

Wide concrete urban footpaths are provided to the eastern side of Waitara Ave, with existing trees to remain and new trees proposed to infill between. A 1.8m wide concrete path with new trees to infill existing are to the western side. Existing parking is to remain, while east west pedestrian connections are to be explored.

Legend

- 2.5m Shared Path
- 1.8m Footpath
- Street Tree in Planting
- Traffic Direction

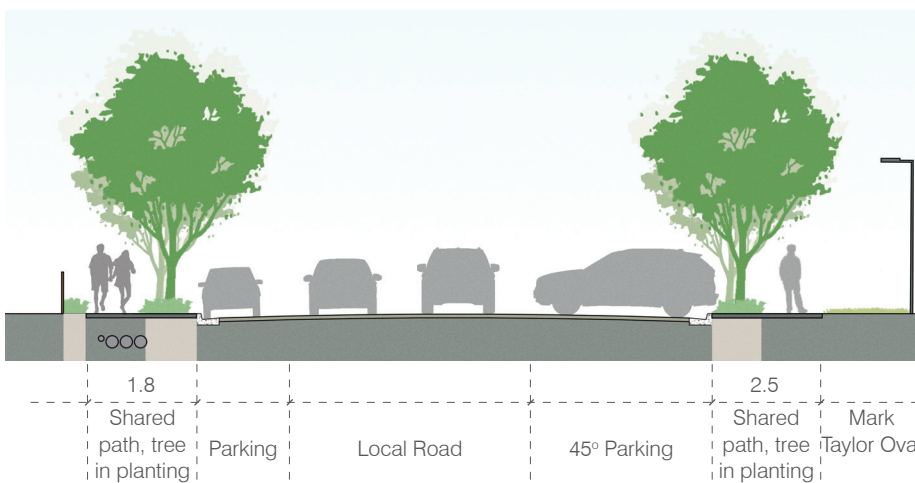


Figure E.43 Waitara Avenue upgrade – Section A

Key Elements and Design Controls

- ① 1.8m wide concrete footpath, with turf to back of kerb, planting to base of trees and boundary edge
- ② Concrete urban footpath, with turf to back of kerb, planting to base of trees
- ③ New street trees to be planted in mass planting to back of kerb beyond extent of vehicle overhang
- ④ Retain existing 45° angled parking
- ⑤ Retain existing parallel parking
- ⑥ Existing pedestrian blisters to remain
- ⑦ New urban path to match into existing urban path

Key Project #3 – Edgeworth David Avenue Shared Path

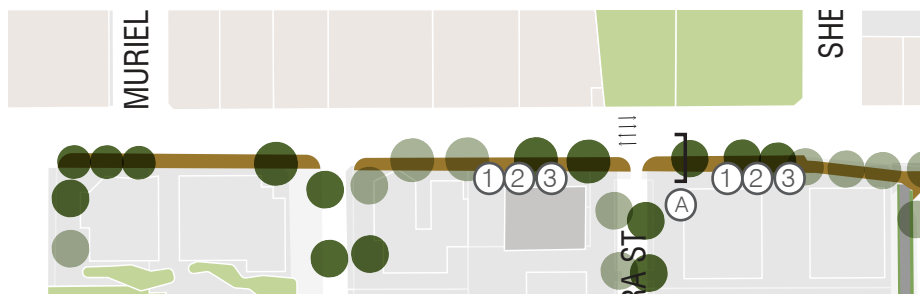


Figure E.47 Edgeworth David Avenue west shared path plan

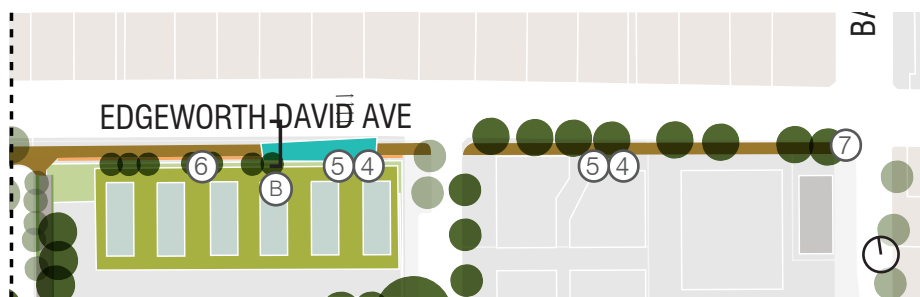


Figure E.44 Edgeworth David Avenue east shared path plan

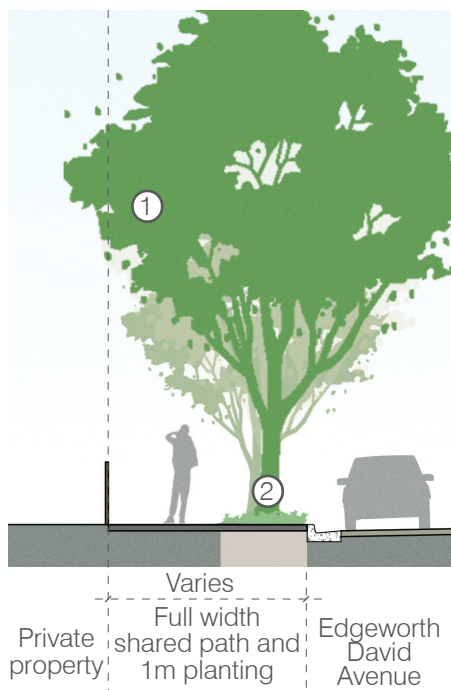


Figure E.45 Edgeworth David Avenue – Section A

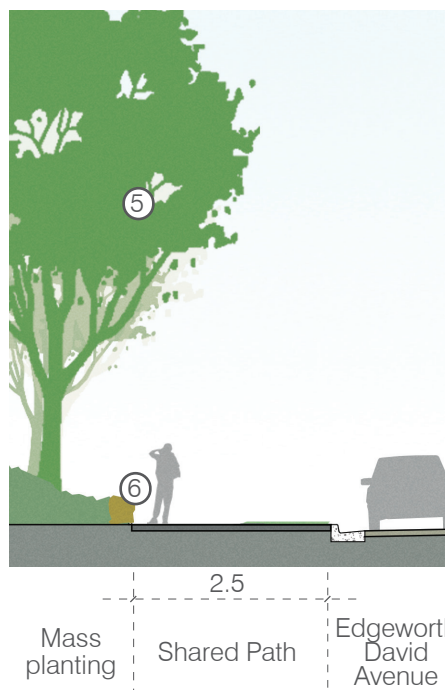
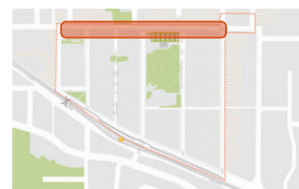


Figure E.46 Edgeworth David Avenue – Section B

Key Plan



The Edgeworth David Avenue shared path is an important connection in the cycle network connecting to Palmerston Rd and the Hornsby Hospital.

This section of the shared path references the heritage brick paving outside Hornsby Girls High. Existing street trees are to be retained and prioritised with new street trees infilling the existing canopy.

Legend

- 2.5m Shared Path (Brick)
- Sandstone Retaining Wall
- Existing Street Trees
- Proposed Street Trees
- Traffic Direction

Key Elements and Design Controls

- ① Retain existing street trees
- ② Narrow new shared path at existing trees and supplement with planting at base, as per treatment outside of Hornsby Girls High
- ③ Full width kerb to boundary shared path in heritage brick paving
- ④ 2.5m wide shared path in heritage brick paving
- ⑤ New street trees
- ⑥ Sandstone log retaining wall to existing planting
- ⑦ Upgrade traffic signals to include bike lanterns for crossing

Key Project #4 – Park Lane Shareway

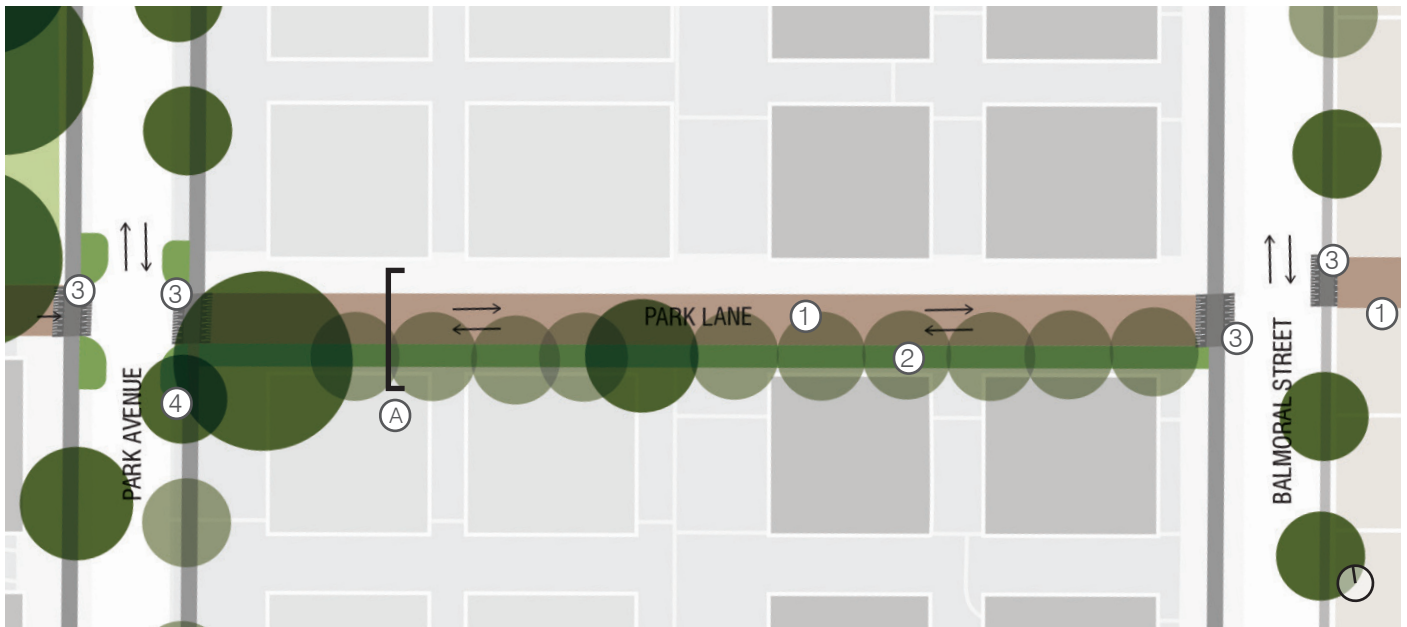
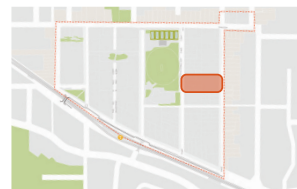


Figure E.48 Park Lane shareway plan

Key Plan



The Park Lane shareway forms a critical mid-block link. The shareway is a continuation from Waitara Avenue and should be extended to Myra Street as a critical connection to Waitara Public School.

Use of the painted surface highlights the low speed and shared environment of the lane, with raised crossings at either end.

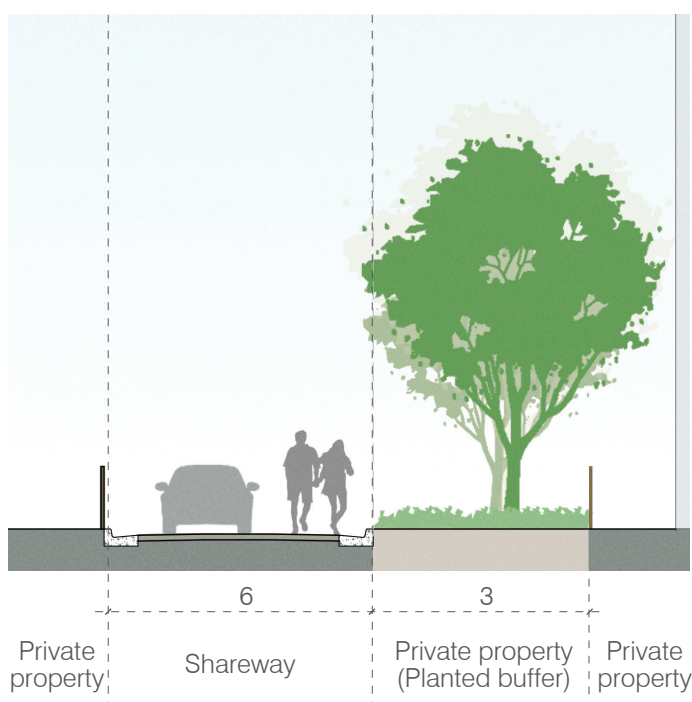


Figure E.49 Park Lane shareway – Section A

Key Elements and Design Controls

- ① Vehicular shareway paved with permeable paver (shared)
- ② Continue planted buffer to south side
- ③ Continuous raised footpath treatment
- ④ WSUD Blistered planting

Legend

- Shared zone paving
- Raised Crossing
- 1.2m Footpath
- Existing Street Trees
- Proposed Street Trees
- Future Development
- Existing Building
- Traffic Direction

Thornleigh

Study Area

Thornleigh straddles Pennant Hills Road, splitting a mix of commercial, existing single dwelling residential houses and new medium density residential developments. Unlike Waitara, Thornleigh is in an earlier stage of development. Similarly, though, the current and future increase in population density requires a public domain which meets the needs of the community. There is an opportunity to create a new retail and pedestrian-focused precinct adjacent to the rail line and Pennant Hills Road. Protection from traffic noise should be prioritised along active frontages to existing roads and new laneways. The proposed key project incorporates an upgraded pedestrian overpass in to future mixed-use developments, train station upgrade and public domain upgrades.

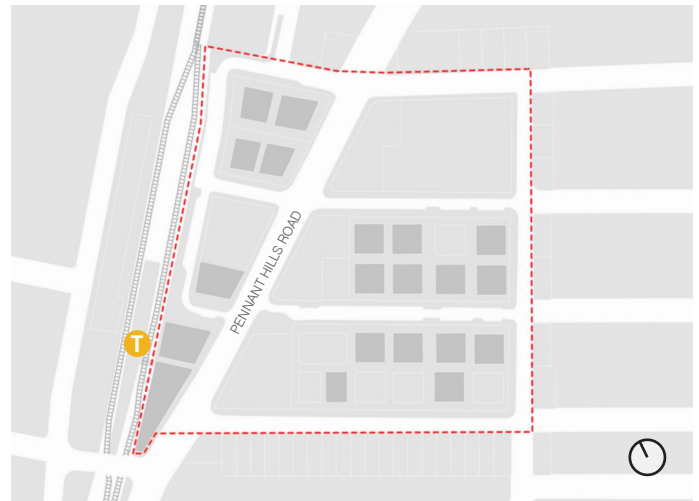


Figure E.50 Thornleigh Town Centre

 Study Area

Objectives

- Provide a central civic plaza connecting train station to retail and pedestrian linkages
- Maintain fine grain shop frontages
- Increase street tree planting for shade canopy cover
- Slow down traffic to Railway Parade through traffic calming measures
- Public frontages should maximise activity facing all streets, walkways and piazzas by siting lower storeys with minimal setback from boundaries
- Provide a central public plaza or square for public use
- Encourage new pedestrian prioritised shareway to the train station with active frontages with solar access and protection from traffic noise
- Encourage mid-block pedestrian connections to improve north-south links (through private land)

Considerations

- Consider high volumes traffic along Pennant Hills Road and opportunities for planting and safety measures to improve pedestrian comfort
- Consider creating a central gathering space and consolidating users to a civic heart
- Promote undergrounding of powerlines to improve visual landscape and opportunities for street tree planting
- Consider highlighting the Great North Walk connection
- Breaking up built form of new developments with architectural breaks and pedestrian links
- Integration of WSUD elements into new street plantings, surfaces and stormwater network
- Opportunities to introduce time limited on-street parking at kerb side to encourage on-street activity

Public Space and Vehicle Network

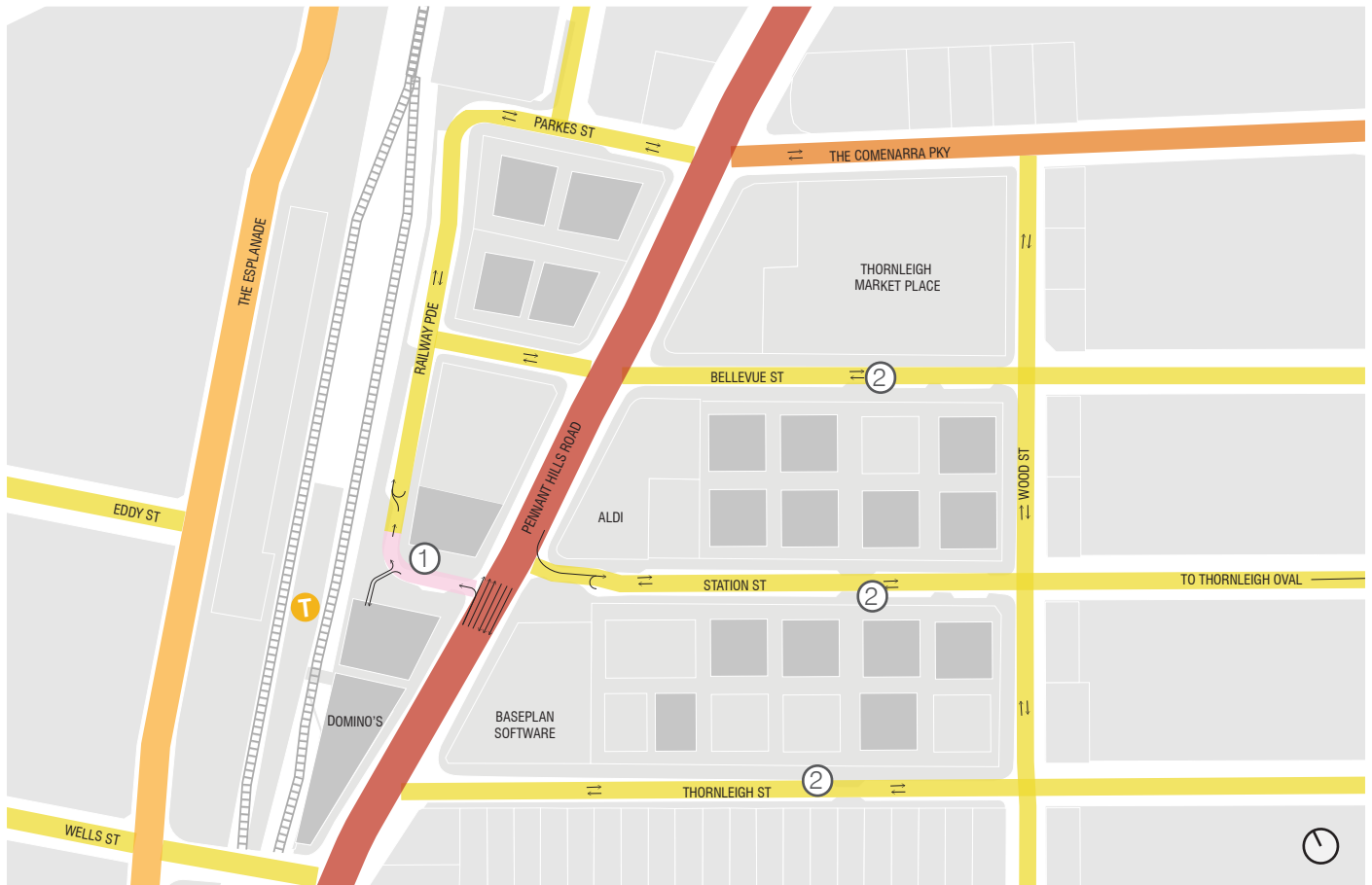


Figure E.51

Key Elements and Design Controls

- ① Re-surface Railway Parade with permeable trafficable shareway paving
- ② In-road blisters to calm traffic and provide better pedestrian connectivity

Legend

- Arterial/Sub-arterial Road
- Collector Road
- Local Road
- Shared zone
- Existing Building
- Future Development
- Traffic Direction
- T Train Station

Verge Treatments, Tree planting and WSUD

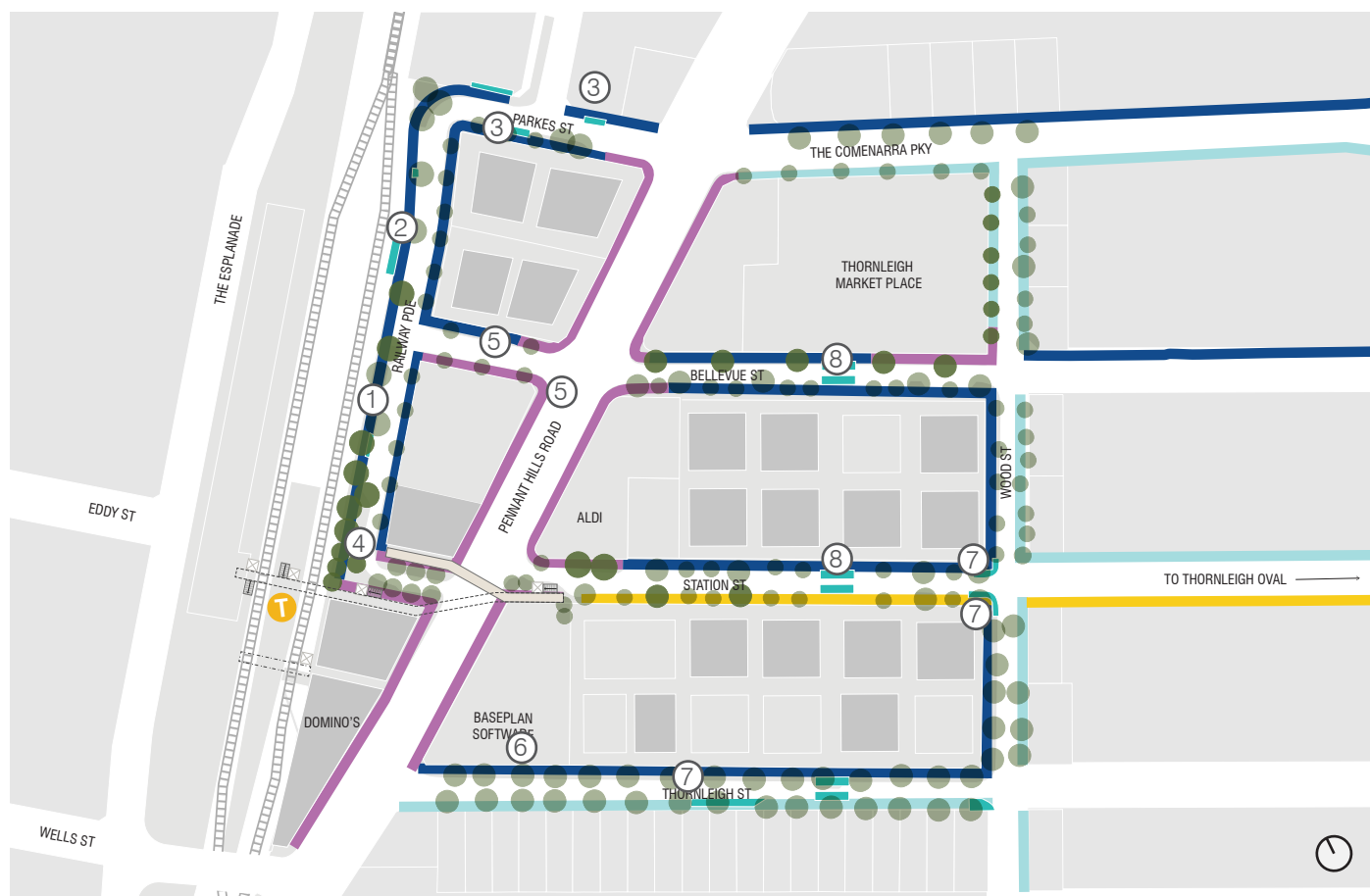


Figure E.52

Key WSUD Elements:

- ① Trees with kerb openings and subsoil drainage to existing pit;
- ② Provide tree in blister upstream of existing pit;
- ③ Bioretention systems in verge or blisters;
- ④ Permeable paving and grading to direct local runoff to green spaces, install tree pits with subsoil drainage;
- ⑤ Install water storage with structural soil under new verge edge to passively irrigate trees;
- ⑥ Kerb openings to trees for passive irrigation to be installed during street or verge upgrades;
- ⑦ Bioretention system upstream of existing pit;
- ⑧ Blistered wombat crossing to be bioretention system or bio-tree pits;
- ⑨ Shopping centre and car park rainwater/runoff harvesting to be considered to grey water use.

Legend

- Urban Footpath
- 1.2m Footpath
- 1.8m Footpath
- 2.5m Shared path
- Existing Street Trees
- Proposed Street Trees
- WSUD
- Train Station

Notes:

- Refer Hornsby Shire Council Water Sensitive Reference Guidelines for technical specifications.
- Refer Street Tree Masterplan for trees species.

Thornleigh WSUD Study Area Analysis

The topography of the Thornleigh precinct drives the WSUD strategy. Pennant Hills Road divides the precinct and is the boundary of the two catchments which receives flows from the mixed residential-commercial area. The predominantly residential eastern side of Pennant Hills Road drains to Lane Cove River, whilst the more built up, commercial western side drains to Berowra Creek. However, this precinct's location, at the headwaters for both these significant rivers, provides a great opportunity to minimise the impact of densification in urban environments that has the potential to deteriorate the natural drainage links of headwater streams.

A combination of kerb openings for street tree passive irrigation (6) and targeted bioretention systems located upstream of stormwater pits (7) on Thornleigh, Station and Bellvue Streets will reduce peak runoff volumes to the headwater stream of Scout Creek, treat stormwater and support growth and health of the street trees. As Scout Creek is relatively well buffered by a small area of development it is essential to maintain or decrease runoff volumes from this precinct's catchment.

Permeable paving will assist in reducing runoff from the Town Centre Plaza which is at a high elevation, at the top of the precinct and has a limited the ability to capture, treat and use runoff for passive irrigation. The grading of Railway Parade however provides an opportunity direct stormwater into the street trees for treatment and storage with kerb openings and dedicated tree pits and bioretention systems.

The constrained nature of Pennant Hills Road, with no space for verges limits the capacity for installing WSUD stormwater treatment assets. Opportunities for stormwater treatment are thus targeted on the adjacent side street of Parkes Street where two small bioretention systems will treat road runoff. They are to be positioned upstream of the existing stormwater pits to maximise the road catchment area for treatment.

Thornleigh Study Area – Thornleigh Town Centre

Thornleigh Town Centre Public Domain Upgrades

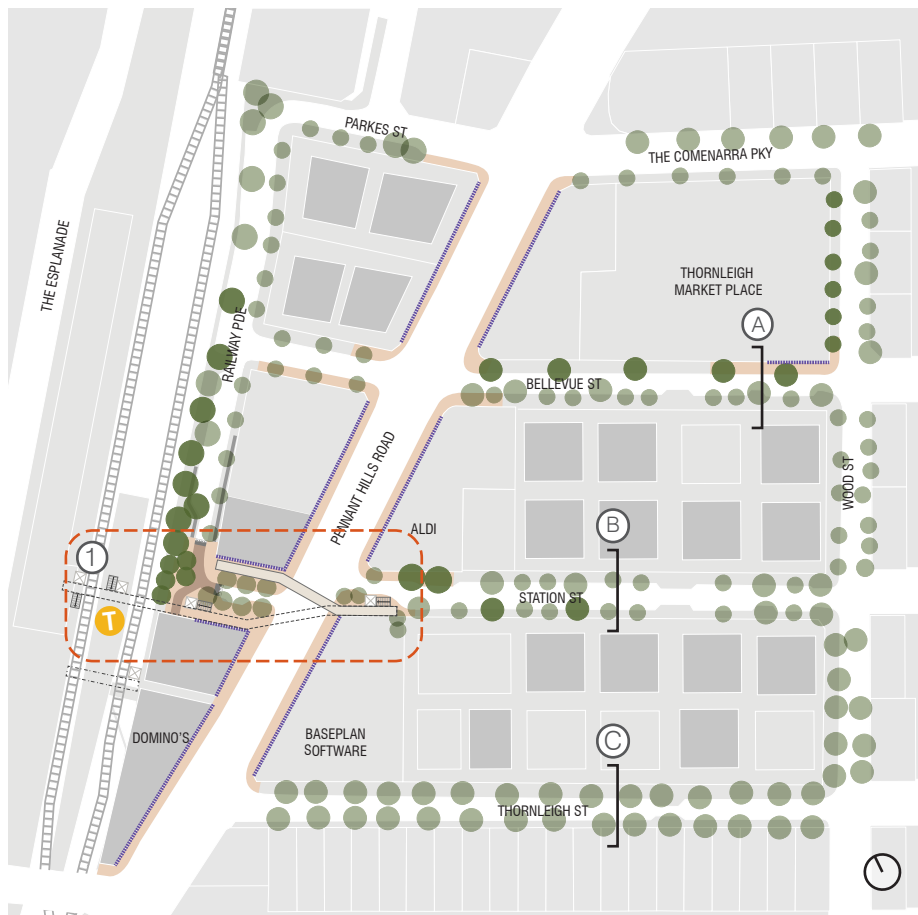


Figure E.53

Key Moves

- New civic heart with plaza and activated façades to enable increased permeability and safety
- Preferred option to upgrade pedestrian overpasses to train station and over highway to be DDA compliant
- Reduce road widths to increase footpath width and increase planting
- Provide cycleway connection along Station Street
- Preferred option to improve pedestrian connection from commuter carpark to station
- Blister footpaths with planting at key pedestrian crossings
- Integrate broken kerbs and bio-retention capture elements where possible
- Additional street trees and new footpath to southern side of Wood Street
- WSUD roof run-off capture and re-use

One key project has been identified within Thornleigh, with public domain upgrades required across the study area. The train station entry key project will create a landmark civic pedestrian prioritised space anchoring the new pedestrian overpass to street level.

Public domain upgrades to street tree planting and the footpath network will promote active transport whilst servicing the future increased density.

Legend

- Town Centre Plaza Paving
- Shared zone paving
- Active Frontages
- Existing Street Trees
- Proposed Street Trees
- Future Development
- Existing Building
- Train Station
- Key Projects

Key Project

- ① Station Street Plaza

Public Domain Upgrades – Sections

- Ⓐ Bellevue Street, refer Figure E.56
- Ⓑ Station Street, Figure E.55
- Ⓒ Thornleigh Street, Figure E.54

Public Domain Street Upgrades

Outside of the key project area, three streets have been prioritised for verge upgrades, Bellevue Street, Station Street, and Thornleigh Street. In particular footpaths, street planting and WSUD elements form the public domain upgrades to enhance the pedestrian experience. Additionally road blisters should be implemented to slow traffic and form part of the WSUD strategy.

Other streets within the study area are to be upgraded as per the previous street and public domain network diagrams.

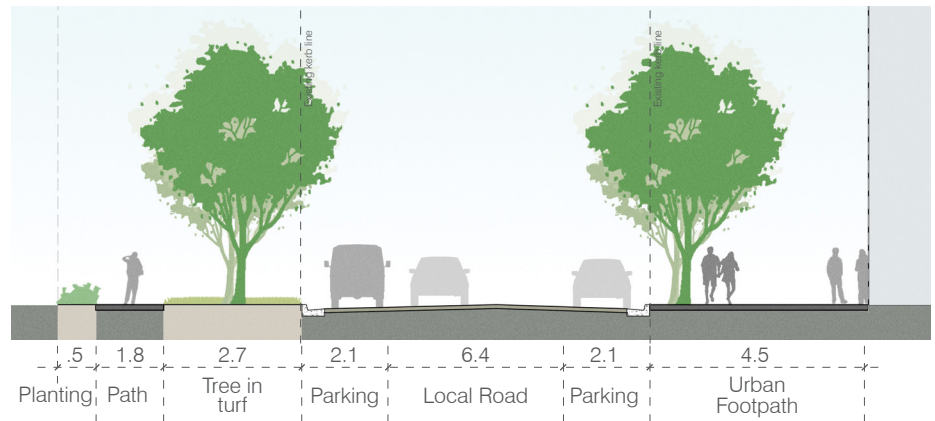


Figure E.56 Bellevue Street – Section A

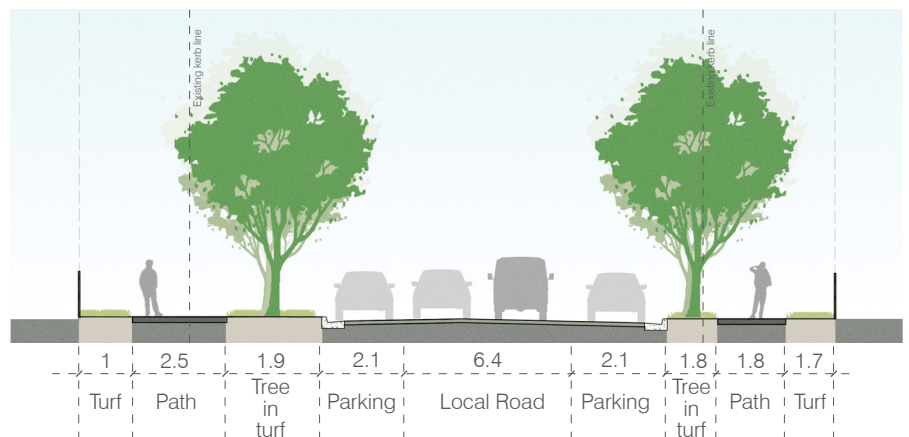


Figure E.55 Station Street – Section B

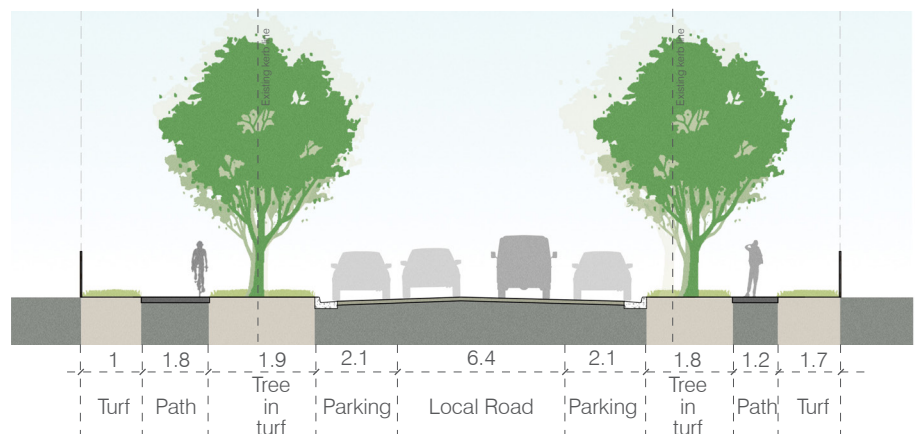


Figure E.54 Thornleigh Street – Section C

Key Project – Thornleigh Train Station Plaza

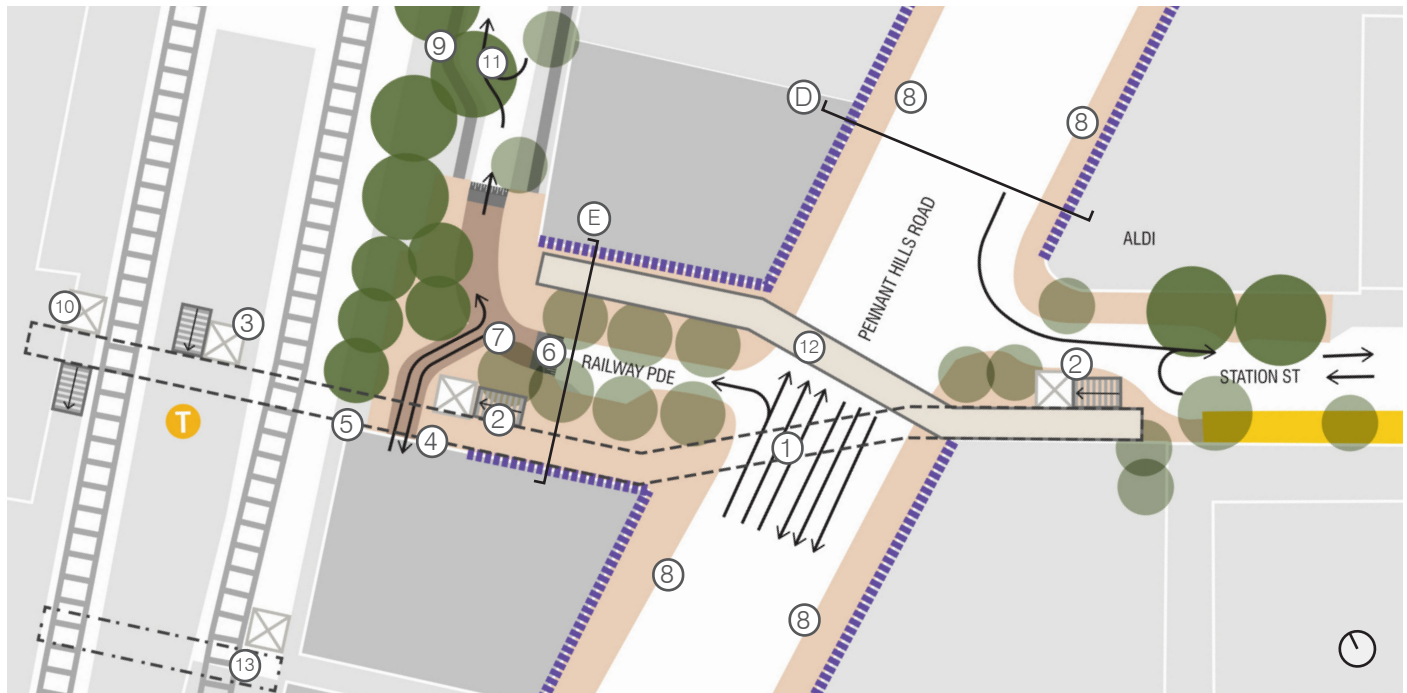


Figure E.57 Thornleigh Train Station Plaza

The new train station plaza on Railway Parade will create a landmark urban entry for Thornleigh. The Preferred Option for an upgraded pedestrian overpass is a key component of the project and with opportunities to integrate the project delivery with the future developments of private lots and Thornleigh Station upgrade. The preferred option requires the realignment and extension of the pedestrian overpass to provide a linear single level connection from Station Street to The Esplanade.

Prior to arrival at a suitable development arrangement for this Preferred Option the existing pedestrian bridge is to be accommodated within the Train Station Plaza. At the street level, Railway Parade is to become a more passive pedestrian experience. Permeable paving and a narrowing of the road will calm traffic. New retail opportunities are to be provided along active frontages.

Coordination of various authorities and stakeholders is required at the planning level to deliver a coordinated outcome.

Key Elements and Design Controls

- ① Preferred Option to provide new 3.5 - 4.5m wide covered pedestrian overpass incorporating CPTED principles and universal access
- ② Stair and lift access from Station Street and Railway Parade to overpass as part of Preferred Option
- ③ Stairs and lift access from train station platforms to overpass as part of station upgrade
- ④ Active frontages to Railway Parade vehicle basement access to future development
- ⑤ Future development facade to integrate preferred option of pedestrian overpass, may be structurally separated
- ⑥ Permeable shared zone paving
- ⑦ Upgraded overpass landing area with trees and planting on Station St.
- ⑧ Timed parking to Pennant Hills Road
- ⑨ 1.8m wide footpath from commuter parking
- ⑩ Lift and stair access to car park and The Esplanade as part of overpass and train station upgrade
- ⑪ 12m diameter turning circle to suit B99 vehicle
- ⑫ Existing bridge to be retained prior to future 'preferred option' subject to future exploration
- ⑬ TfNSW transport access program

- ⑪ 12m diameter turning circle to suit B99 vehicle
- ⑫ Existing bridge to be retained prior to future 'preferred option' subject to future exploration
- ⑬ TfNSW transport access program

Legend

- Town Centre Plaza Paving
- Shared zone paving
- Raised Crossing
- Street Tree
- 2.5m Shared path
- 1.8m Wide Footpath
- Existing Overpass
- Preferred Overpass Alignment
- Lift Access to Overpass
- Future Development
- Existing Building
- Traffic Direction
- Train Station

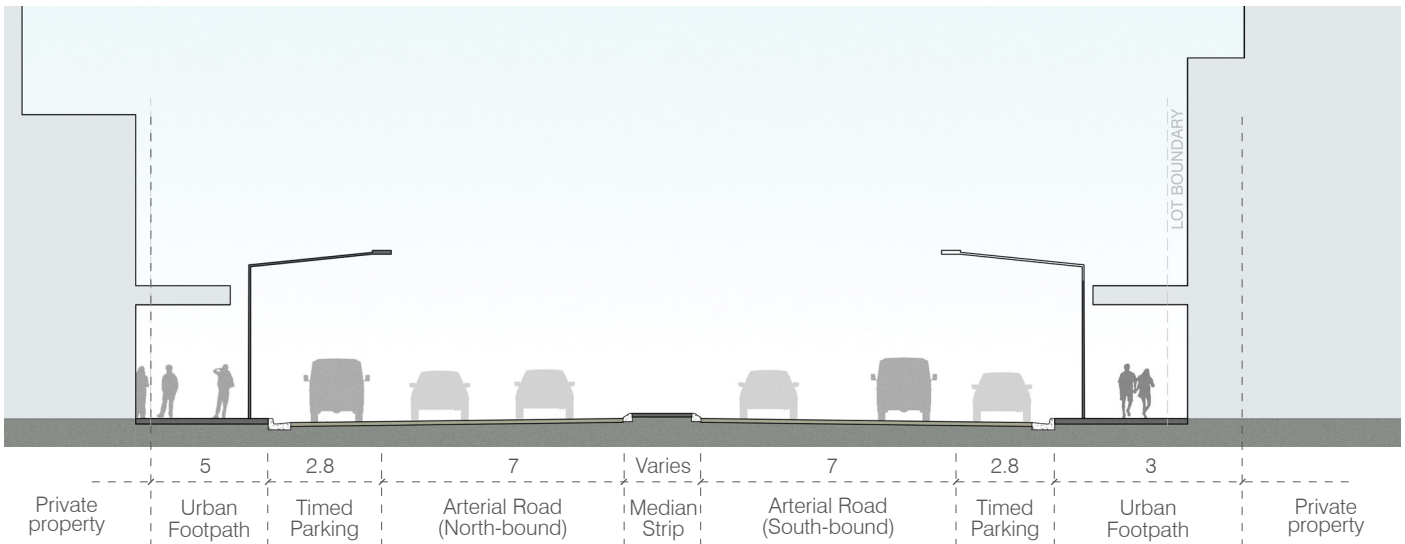


Figure E.59 Pennant Hills Road – Section D

Lighting to be located within designated furniture zone (refer Fig C.2) to create clear path of travel along building line

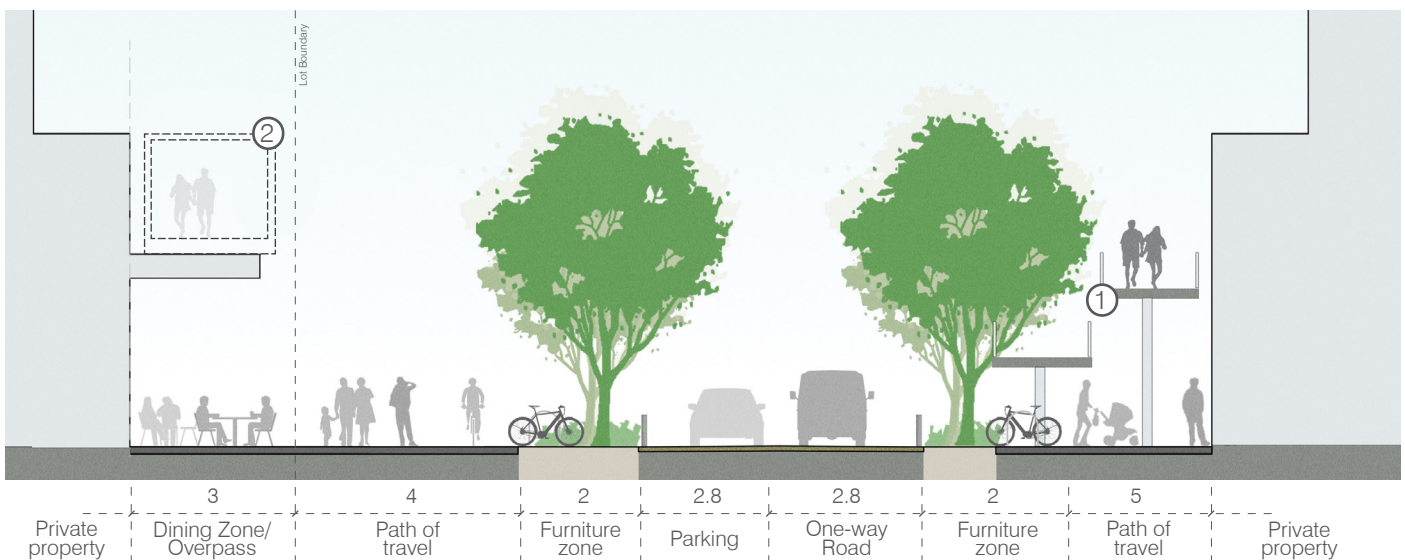


Figure E.58 Railway Street – Section E

The new pedestrian overpass Preferred Option may be delivered together or separately from the building development. However, the design of both must be coordinated to deliver a building facade and overpass which acknowledge each other. The coordinated response to the future development incorporating the

pedestrian overpass should remove overpass structure from the public domain decreasing street clutter and improving sight lines. Additionally, this encourages a coherent architectural and urban design outcome.

Overpass

- ① Existing pedestrian overpass
- ② Pedestrian overpass Preferred Option, subject to future exploration

West Pennant Hills

Study Area

The West Pennant Hills town centre is located on the landmark Thompson's Corner and acts as the south western gateway to the Hornsby Shire. There is an opportunity to create a unique and iconic entry into the Bushland Shire. Bounded by Pennant Hills Road to the south and West Pennant Hills Public School to the north, the town centre has restricted pedestrian connections.

The West Pennant Hills town centre local shopping village is vehicle dominated. Active frontages are focused outwards towards Pennant Hills Rd while pedestrian connections have been insufficient to encourage walking or social lingering. Increased traffic to Pennant Hills Rd has made the pedestrian experience uncomfortable.

At an urban design scale, the village is to be re-orientated inwards towards a central (north facing) civic plaza prioritising pedestrians and planting. Increased active frontages and widened through-site links increase permeability and activation. The existing central car park is to be upgraded re-organising vehicular movement and parking while incorporating WSUD elements.

The existing planting to Thompson's Corner is to be expanded to provide planted barriers to Castle Hill and Pennant Hills Road

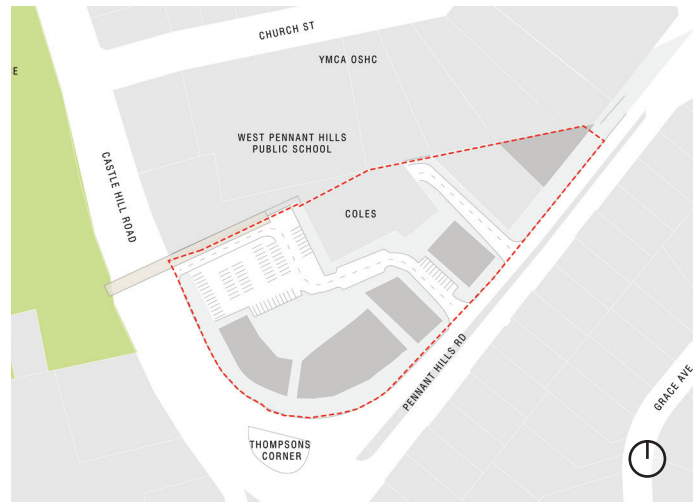


Figure E.60 West Pennant Hills Town Centre

Considerations

- Consider options to integrate and expand the pedestrian and cycle connections to the greater surrounding suburb network
- Consider under-grounding car parks under new developments where possible
- Consider opportunities to include public art
- Integrate WSUD elements into new street tree planting and green open spaces

Objectives

- Re-organise existing buildings to create a landmark destination with arcades, laneways and through-site links to plaza and greater connectivity
- Relocate existing carpark underground
- Establish an internal landscaped street
- Rearrange shopping façades to face civic heart
- Encourage new mid-block pedestrian connections with active frontages with sunlight and protection from traffic noise
- Develop new civic heart as focal point for the community on council land

Design Controls

- An absolute minimum central civic plaza of 1100m² (excluding setback areas around the primary building envelope) is required. This shall include; a high quality hard and soft landscape area, public seating and street furniture and public art.
- Plaza to comprise of minimum 70% deep soil softscape of turf and mass planting
- Hardscape to provide 2.5m clear accessible path of travel to active frontages and entry points to plaza
- 3m wide outdoor dining seat to comply with Councils Outdoor dining code

Public Space and Vehicle Network



Figure E.61

Key Elements and Design Controls

- ① Re-surface service road with permeable trafficable shareway paving and limit access to service vehicles only
- ② Reconfigured carpark to increase space efficiency
- ③ Vehicle access to future development basement

Legend

- Arterial/Sub-arterial Road
- Local Road
- Shared zone
- Pedestrian Overpass
- Existing Building
- Future Development
- Traffic Direction

Verge Treatments, Tree planting and WSUD



Figure E.62

Key WSUD Elements:

- ① Rainwater harvesting and reuse in grey water system in new developments;
- ② Tree pits with passive irrigation (assumed clay surface subsurface) subsoil drainage to existing stormwater network;
- ③ Bioretention system collecting runoff from car park connecting to existing stormwater network;
- ④ Roof runoff to subsoil passive irrigation of new proposed trees;
- ⑤ Permeable paving in pedestrian shareway;
- ⑥ Grade central plaza to achieve local runoff to turf and planted areas;
- ⑦ Enlarge existing planter's and create bioretention system connected to existing stormwater network;
- ⑧ Mass planting barrier to road.

Legend

- Urban Footpath
- 1.2m Footpath
- 1.8m Footpath
- 2.5m Shared path
- Existing Street Trees
- Proposed Street Trees
- WSUD
- Street Planting
- Shared zone paving

Notes:

- Refer Hornsby Shire Council Water Sensitive Reference Guidelines for technical specifications.
- Refer Street Tree Masterplan for trees species.

West Pennant Hills WSUD Study Area Analysis

The West Pennant Hills precinct is a part of both the Darling Mills Creek and Devlins Creek catchments, and is located at a high point on this boundary. Due to the developed nature of these catchments surrounding both waterways (especially Devlins Creek) the WSUD priority at this precinct is to utilise runoff for beneficial outcomes on site (through passive irrigation). Whilst this approach will help reduce peak runoff volumes, it is not a priority outcome given the limited ability to impact headwater stream health due to the existing developed nature of Devlins Creek catchment.

Despite its small size West Pennant Hills precinct has a number of effective WSUD interventions that will deliver water quality improvements, reduction in peak flows and contribute to improved vegetation outcomes from passive irrigation.

The large proportion of impervious surfaces in the carpark provide an opportunity to integrate bioretention systems (3) and tree pits (2) in a linear configuration with the design of the carpark, to both intercept and treat sheetflow from the carpark and to provide the physical buffer between car spaces. Subsoil drainage from these WSUD assets can easily connect back to the existing stormwater network on Castle Hills Road.

The size of the verges of Pennant Hills Road limit opportunities for treatment of road run off from this road that would have higher pollutant loads due to large traffic volumes. Development of this side of Pennant Hills Road should incorporate blisters in the verge wherever possible to capture and treat road runoff – having a greater impact on water quality due to the degraded catchment characteristics.

Areas of new development are to incorporate rainwater harvesting where possible (1). The open space of the Town Plaza will be enhanced through passive irrigation of the surrounding street trees. Large areas of development in the Town Centre can direct their roof runoff to the green space centre and to subsoil drains that passively irrigate the street trees, providing local cooling and facilitating improved tree health.

The planted edge of Castle Hill and Pennant Hills Roads further support the WSUD objectives at this precinct, by intercepting runoff in the vegetated perimeter, reducing runoff volumes from this site.

West Pennant Hills Town Centre Public Domain Upgrades



Figure E.63

Key Moves

- Reconfigure existing surface parking with new median island planting integrating WSUD
- Future Coles upgrades to include frontages along south elevation
- Re-alignment and pacification of two-way internal road
- New civic heart with open green passive space, with activated frontages
- Ground level car parking to be reduced and located underground where possible
- Active retail frontages focused northward to engage with new civic heart
- Provide barriers to Pennant Hills Road with either mass planting or engineered barrier
- Architectural breaks to align with pedestrian links
- Thompson's Corner to be retained and celebrated
- Integrate broken kerbs and bio-retention capture elements where possible
- WSUD Roof run-off capture and re-use

Legend

- Town Centre Plaza Paving
- Shared zone paving
- Active Frontages
- Existing Street Trees
- Proposed Street Trees
- Street Planting
- Future Development
- Existing Building
- Key Projects

Key Project

- ① Town Centre Plaza

Key Project – West Pennant Hills Town Centre Plaza



Figure E.64 West Pennant Hills Town Centre Plaza plan

The West Pennant Hills key project reorientates the commercial centre to focus on a new civic heart. Future developments will facilitate the reorientation with new active frontages and pedestrian through-site links. New kerbs and carpark configuration clearly delineate vehicle traffic, efficiently creating an active urban heart.

Legend

- Town Centre Plaza Paving
- Shared zone paving
- Existing Street Trees
- Proposed Street Trees
- 3m Outdoor Dining Space
- Active Frontages
- Public Art
- Custom Seating
- Street Planting
- Pedestrian Overpass
- Future Development
- Existing Building
- Traffic Direction

Key Elements and Design Controls

- ① New deep soil passive open space to make up min. 70% of plaza
- ② Site specific landmark public art to be visual centre piece
- ③ Active frontages to new civic heart, Pennant Hills Road and Castle Hill Road
- ④ Future developments to maintain existing through site links
- ⑤ Basement vehicle entry to future residential and commercial developments for parking and loading dock access
- ⑥ Permeable paved shareway with restricted vehicle access, service vehicles to Coles
- ⑦ New WSUD mass planting beds to car park
- ⑧ Reconfigure carpark
- ⑨ Pedestrian overpass to remain
- ⑩ Mass planting barrier to road
- ⑪ 2.5m clear path of travel
- ⑫ 3m outdoor dining space

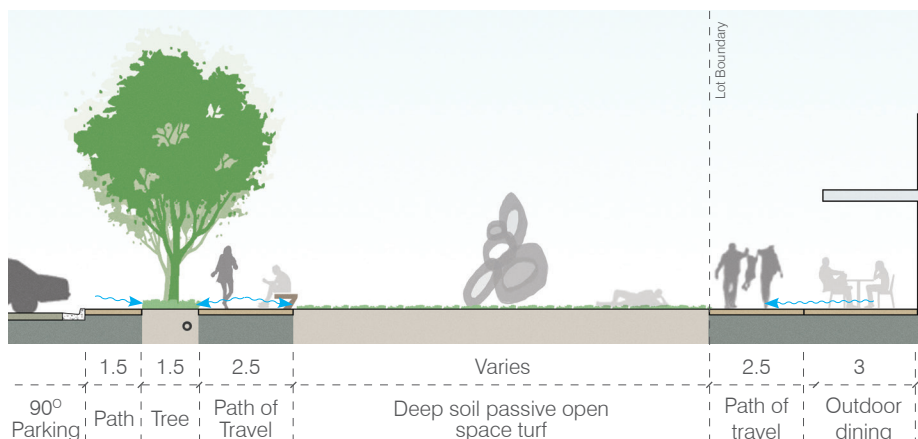


Figure E.65 West Pennant Hills Town Centre Civic Plaza – Section A

Public Domain Street Upgrades

The existing mass kerbside mass planting at Thompson's Corner is to be extended along Castle Hill and Pennant Hills Road. The planting is to act as a barrier between vehicles and pedestrians whilst softening the street scape through the reduction of hardscape.

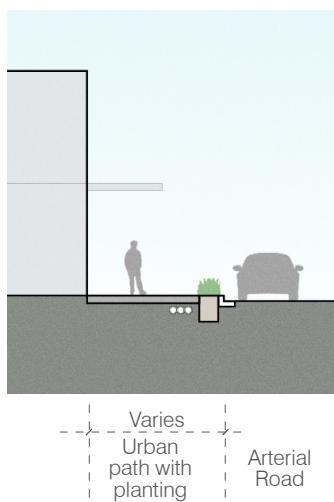


Figure E.66 Castle Hill Road – Section B

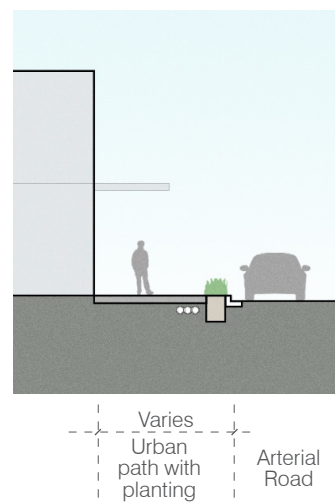


Figure E.67 Pennant Hills Road – Section C

References

References

Image Credit

B.1	Photo by Hornsby Shire Council
A.1	Photo by OCULUS 18.12.18
A.2	Crossland Reserve. Photo by Hornsby Shire Council
A.3	Storey Park Commnity Centre. Photo by Hornsby Shire Council
A.4	Photo by Hornsby Shire Council
A.5	Westfield Hornsby. Photo by Urban Apostles
B.1	Photo by OCULUS 21.01.19
B.2	Photo by OCULUS 18.06.08
B.3	Rouse Hill Town Centre. Photo by OCULUS 18.06.19
B.4	Photo By Hornsby Shire Council
C.1	Photo By Google Street View
C.2	Photo By Google Street View
C.3	City of Sydney, "5 Tips for Riding Sydney's Cycleways", Web, 3 July 2020, < https://news.cityofsydney.nsw.gov.au/articles/5-tips-for-riding-sydneys-cycleways?utm_medium=email&utm_campaign=14+July+2020&utm_content=14+July+2020+CID_a028207e3fe3b40c5961d03b69aa1816&utm_source=Email+marketing&utm_term=5+tips+for+riding+Sydneys+cycleways >
C.4	Photo by OCULUS 21.01.19
C.5	Rouse Hill. Photography by Brett Boardman
C.6	Factory St, Haymarket. Photopgraphy By Simon Wood
C.7	Greville 7. Photo by Ace Constructions
C.8	SydneyCycleways Facebook Group, < https://www.facebook.com/sydneycycleways/posts/work-at-the-crossing-on-bourke-street-redfern-near-zamia-street-has-been-complet/2436578603036587/ >
C.9	Maitland Levee, Photo by McGregor Coxall
C.10	Abercrombie St
C.11	Photo by OCULUS 12.10.006
C.12	Sydney Street Furniture. Photo by Tzannes
C.13	Alex Harmon, "Where To See Sydney's Jacaranda Trees In Full Bloom", 20 September 2020, < https://www.ellaslist.com.au/articles/where-to-see-sydney-s-jacaranda-trees-in-full-bloom >
C.14	Photo by OCULUS 29.04.20

C.15	Wolseley Grove, Zetland. Photo by Hassell
C.16	Gipps Street Median. Photo by The City of Melbourne
C.17	Seba via Visit Victoria, "The Best Bike Rides In and Around Melbourne", 14 March 2019, < https://concreteplayground.com/melbourne/travel-leisure/leisure/ten-best-bike-rides-in-melbourne >
C.18	City of Sydney. Photopgraphy by Simon Woods
C.19	Darling Quarter, Hassell. Photo by StraBe
C.20	Lonsdale Street, Taylor Cullity Lethlean Landscape and Urban Design. Photography by John Gollings
C.21	Barangaroo South, OCULUS. Photography by Simon Wood
C.22	Revitalising Central Dandenong, Vic Urban. Photography by Daniel Colombo
C.23	18 Huntley St, Arkadia, OCULUS. Photography by Tom Ross
C.24	Pitt Street Mall Paver Infill Access Covers, Durham. Photo by Durham
C.25	Barangaroo, Aspect. Photography by Florian Groehn
C.26	Outdoor Design Source, "Tactile Signs Make Navigation Easier", 20 July 16, < https://www.outdoordesign.com.au/news-info/tactile-signs-make-navigation-easier/4586.htm >
D.1	282-288 Peats Ferry Road Hornsby. Photo by LJ Hooker Commercial
D.2	Barangaroo, Lendlease. Photography by Brett Boardman
D.3	Photo By OCULUS 02.10.17
D.4	Argyle Street, Camden < https://www.camden.nsw.gov.au/whats-on/visit-camden/place/camdentowncentre >
D.5	Photo by OCULUS 21.01.19
D.6	Photo by OCULUS 21.01.19
D.7	Barnetts Road Reserve, Berowra National Park. Photograph by NSW NPWS
D.8	Photo by OCULUS 28.02.20
D.9	Wkipedia, "Argiope keyserlingi", 4 May 2021, < https://en.wikipedia.org/wiki/Argiope_keyserlingi >
D.10	Lexis English, "Byron Bay – Bush Turkey", 13.01.20, < https://www.lexisenglish.com/byron-bay-bush-turkey/ >